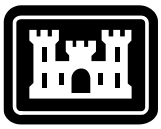
SANTA ANA RIVER MAINSTEM PROJECT: REACH 9
PHASES 4, 5A, 5B, & BNSF BRIDGE

Counties of Orange and Riverside, California

FINAL
SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT
AND
ENVIRONMENTAL IMPACT REPORT ADDENDUM

Prepared for:



US Army Corps of Engineers®

Los Angeles District

With Technical Assistance Provided by:

AECOM
Orange, California

July 2015

SANTA ANA RIVER MAINSTEM PROJECT: REACH 9
PHASES 4, 5A, 5B, & BNSF BRIDGE
Counties of Orange and Riverside, California

FINAL
SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT
AND
ENVIRONMENTAL IMPACT REPORT ADDENDUM

Prepared for:

U.S. Army Corps of Engineers
Los Angeles District

With Technical Assistance Provided by:

AECOM
Orange, California

July 2015

FINDING OF NO SIGNIFICANT IMPACT

SANTA ANA RIVER MAINSTEM PROJECT: REACH 9
PHASES 4, 5A, 5B, & BNSF BRIDGE
Counties of Orange and Riverside, California

I have reviewed the Supplemental Environmental Assessment (SEA) and Environmental Impact Report (EIR) Addendum that has been prepared for the Santa Ana River Mainstem Project (SARMP): Reach 9 Phases 4, 5A, 5B, & BNSF Bridge protection in the Counties of Orange and Riverside, California. This final SEA/EIR Addendum supplements the Survey Report and Environmental Impact Statement (1975 EIS), the Prado Basin and Vicinity, Including Reach 9 and Stabilization of the Bluff toe at Norco Bluffs SEIS/EIR, (2001 EIS/EIR), and other SARMP SEIS/SEIRs, that have been prepared for the SARMP, a flood risk management project located in San Bernardino, Riverside and Orange Counties, California. This final SEA/EIR Addendum evaluates the environmental impacts that may result from the implementation of the recommendations described in the draft Engineering Documentation Report for the Santa Ana River Mainstem Project Lower Santa Ana River Channel – Reach 9 Orange and Riverside Counties, California, June 2015 (EDR), incorporated here by reference.

The U.S. Army Corps of Engineers (Corps) and the SARMP's non-Federal sponsors (Orange County Flood Control District, Riverside County Flood Control and Water Conservation District, and San Bernardino County Flood Control District) identified that authorized SARMP operations could result in the potential for undercutting, erosion or scour of embankments and bridge piers along and within the Santa Ana River in Reach 9. The purpose of this federal action is to address the potential for instability along the Santa Ana River banks and at the BNSF bridge in Reach 9 by extending the currently authorized Reach 9 bank protection measures and fortifying bridge piers and abutments at the BNSF Bridge.

This SEA/EIR Addendum addresses the additional Reach 9 bank and bridge protection measures, including impacts to environmental resources related to both implementation and future maintenance, not previously addressed under existing SARMP documents. Alternatives for each measure (i.e. Phase 4, 5A, 5B and the BNSF Bridge protection) are described in Chapter 4 of the SEA/EIR addendum, which is incorporated here by reference. The preferred alternative for each measure is recommended for implementation and is summarized below:

Phase 4: Soil Cement Alternative - Phase 4 is located along the south bank of the Santa Ana River, beginning approximately 3.5 miles downstream of the outlet from Prado Dam, in the vicinity of Coal Canyon Road, and extending 3,150 feet (0.59 mile) downstream tying into Reach 9, Phase 3, at the downstream limit. An approximate 3,150-foot-long soil cement structure (approximately 30 feet in height and 10 feet in width, placed at a 1H:1V slope) would be constructed along an established alignment. In coordination with the U.S. Fish and Wildlife Service (USFWS), the Corps reduced the linear length of this alternative by approximately 450 feet to further minimize impacts to wildlife movement. With this reduction, approximately 135,000 cubic yards (cy) of alluvial substrate (25,000 cy less than originally proposed) would be excavated. The volume of the soil cement structure would be approximately 40,000 cy. Phase 4 also includes the construction of permanent bike path, removal of temporary bike path, and hydroseeding and replanting. Construction is expected to take place in September 2015 and continue to approximately December 2017.

Additional Work to Be Conducted under Phase 4 - State Parks, Phase 2B Gully Erosion Repair: Repair of the two gully erosion areas will cover about 0.35 acre and will include: stabilizing the gully areas; grading areas to 2:1 slopes or flatter; revegetating with native vegetation; establishing vegetation; monitoring; and removing non-natives for a total of 5 years.

Phase 5A: Grouted Stone and Sheet Pile Alternative - Phase 5A is located along the north bank of the SAR, extending from the completed Reach 9, Phase 1 at the Mercado Del Rio Plaza, 4,083 feet (0.77 mile) upstream to the vicinity of Via Lomas De Yorba-West Road. This Phase includes a 90-degree bend in the SAR currently protected by ungrouted riprap revetment of the Lomas De Yorba-Sur (LDY-S) Levee. An existing 4,083-foot section of the LDY-S Levee consisting of ungrouted stone bank protection would be replaced by 980 feet of a grouted stone structure and 3,273 feet of steel sheet pile wall. The grouted stone structure would be 24 inches thick and have a 2:1 horizontal-to-vertical slope (H:V). Approximately 34,000 cubic yards of alluvial substrate would be excavated. The estimated amounts of 24-inch grouted stone, salvaged riprap, and compacted backfill to be used during construction are 11,100 tons, 3,500 tons, and 32,000 cubic yards, respectively. In addition to alluvial excavation, an estimated 3,500 tons of existing riprap stone would be removed and salvaged for reuse to the greatest extent possible. The sheet pile would be a 2-foot-wide "Z"-shaped steel wall with tiebacks; height of the sheet pile varies from 45 to 50.5 feet. A retaining wall with height ranges from 2.5 to 4.5-ft would be constructed on top of the terrace slope of the proposed bank, along the grouted stone and sheet pile reaches, to accommodate a 24-ft wide section of riding/hiking trail and bikeway. Construction of the retaining wall requires excavation of the existing terrace slope and removal of about sixteen (16) trees. Construction of Phase 5A is expected to take 24 months to complete beginning in fall 2015.

Phase 5B: Grouted Stone and Sheet Pile Alternative - Phase 5B extends from the upstream terminus of Phase 5A, in the vicinity of Via Lomas De Yorba-West Road, upstream for approximately 19,700 feet (3.73 miles) to existing sheet pile protection along the BNSF rail line. Grouted stone (24 inches thick and have a 2H:1V slope) and sheet pile would replace existing riprap of the LDY-S Levee and be installed on the river bank upstream of the levee where the river bank is currently unprotected. The grouted stone structure would range in height from 30 to 45 feet, with the buried portion of the grouted stone slope approximately 25 feet deep. A total of approximately 1,116,000 cubic yards of alluvial substrate would be excavated. The estimated amounts of grouted stone and compacted backfill to be used during construction are 80,000 to 94,000 cubic yards (or 166,000 tons) of stone and 1,116,000 cubic yards, respectively. Construction for Phase 5B is expected to take approximately 24 months to complete beginning in August 2016.

BNSF Railroad Bridge Alternative - The BNSF railroad bridge is located at the transition between Reach 9, Phases 2A and 2B channel improvements. The components consist of reinforced concrete walls, sheet pile and reinforced concrete diaphragm walls, and grouted stone protection would be constructed to provide additional scour protection to bridge piers and abutments, and tie into previously constructed bank protection along the east bank of the channel into the existing eastern bridge abutment. Reinforced concrete enclosure walls would be installed around Pier Nos. 2 through 5 and reinforced concrete pier nose extension walls would be constructed immediately upstream of these piers. The BNSF Bridge project also provides for construction of the sheet pile and reinforced concrete diaphragm walls with tieback anchors parallel to existing Pier Nos. 1 and 6 to guide the design flow safely under the bridge. Additionally, 24-inch grouted stone bank protection would be installed to tie the existing bridge abutment along the east bank of the river channel (Pier No. 1) into bank protection installed upstream (Phase 2A) and downstream (Phase 2B) of the BNSF bridge. The amount and types of "fill material" associated with this alternative includes 6,175 cy of grouted stone, 637 cy of bedding

material under the grouted stone, 4,000 cy of concrete for the pier nose extension walls (1,000 cy each), 1,360 linear feet of H-Piles under each of the pier nose extensions (total of 5,440 linear feet), and 15,200 cy of concrete for the reinforced concrete diaphragm walls. Construction is expected to take approximately 3 years to complete. Construction is proposed to begin in 2016.

Funding constraints, weather delays, and other issues could potentially move the construction timeline beyond the expected completion date for each phase. Jointly, the recommended actions above are referred to hereinafter as the "Reach 9 Improvements."

This SEA/EIR Addendum was prepared to comply with the National Environmental Policy Act (NEPA) and applicable laws and regulations. The draft SEA/EIR Addendum was made available for public review and comment from January 23, 2015 until March 6, 2015. Comments on the draft SEA/EIR Addendum have been taken into consideration and substantive comments have been addressed in the text of the final SEA/EIR Addendum as described in Appendix F and are incorporated here by reference.

Implementation of the Reach 9 Improvements would result in short term impacts to environmental resources including, but not limited to, biological resources, water quality and air quality. Construction impacts will include the temporary removal of approximately 28.53 acres of riparian, 34.29 acres of upland, and 0.94 acres of perennial stream habitat. Approximately 9.63 acres of riparian, 9.79 acres of upland and 0.28 acres of perennial stream habitat would be permanently affected. Environmental commitments, best management practices, and mitigation measures, as identified in this SEA/EIR Addendum, 2001 SEIS/EIR and SARMP Biological Opinions(BO) are incorporated here by reference and would be implemented to avoid, minimize or offset environmental impacts during construction and future maintenance. Adherence to identified mitigation measures and environmental commitments would reduce environmental impacts to less than significant levels.

The SARMP remains in compliance with all applicable federal and state laws and statutes. The Corps initiated formal consultation under Section 7 of the ESA with the U. S. Fish and Wildlife Service (USFWS) on January 23, 2015 for least Bell's vireo, Santa Ana sucker, and coastal California gnatcatcher. The USFWS issued a final biological opinion (BO) to the Corps on July 23, 2015 concluding that the proposed action is not likely to jeopardize the continued existence of the least Bell's vireo or Santa Ana sucker, and would not adversely affect gnatcatcher with implementation of the conservation measures identified in the SEA/EIR Addendum. The SARMP non-Federal sponsors are coordinating with the California Department of Fish and Wildlife to obtain a 1601 Streambed Alteration Agreement for the Reach 9 Improvements.

Reach 9 Improvements have been evaluated pursuant to Section 404(b)(1) of the Clean Water Act. The Preferred Alternative for each phase and the BNSF Bridge protection is the Least Environmentally Damaging Practicable Alternative (LEDPA). Additionally, the Corps also applied for a Section 401 Certification under the Clean Water Act on January 23, 2015. Because the Regional Water Quality Control Board (RWQCB) has not responded, pursuant to 33 CFR 325.2(b)(1)(ii) the Corps has deemed the requirement for certification waived.

Reach 9 Improvements would also comply with Section 106 of the National Historic Preservation Act. A programmatic agreement (PA) was executed for the SARP in 1993 by the Advisory Council on Historic Preservation to which the State Historic Preservation Office (SHPO) and the Corps are parties. The PA detailed the procedures and stipulations that must be followed, which will be implemented for construction and future maintenance of the Reach 9 Improvements. No additional coordination with the SHPO is required unless an unanticipated discovery is made during construction in which case the Corps would comply with the procedures in 36 CFR 800.13.

Based on the analyses in the SEA/EIR Addendum, no new significant impacts were identified for the Reach 9 Phases 4, 5A, 5B, and BNSF bridge protection measures. I have considered the available information contained in the SEA/EIR Addendum and determined that the proposed Reach 9 improvements will not have a significant impact upon the existing environment or the quality of the human environment. Therefore, preparation of a Supplemental EIS is not required.

7/30/15
DATE

Kimberly M. Colloton, PMP
Colonel, US Army
Commander and District Engineer

TABLE OF CONTENTS

1.0 INTRODUCTION 1-1

1.1 SARMP Background 1-1
1.2 Proposed Action: Reach 9 Measures 1-2
1.3 SARMP Authority and Background 1-2
1.4 Previously Prepared Documents 1-3
1.5 Preparation of Final SEA/EIR Addendum 1-4
1.6 Summary of Changes from the Draft SEA/EIR Addendum: 1-4

2.0 PROJECT LOCATION 2-1

2.1 Phase 5A 2-1
2.2 Phase 5B 2-1
2.3 Phase 4 2-1
2.4 BNSF Bridge 2-2

3.0 PURPOSE AND NEED 3-1

3.1 Statement of Need 3-1
3.1.1 Phase 5A 3-1
3.1.2 Phase 5B 3-2
3.1.3 Phase 4 3-2
3.1.4 BNSF Bridge 3-2
3.2 Statement of Purpose 3-3

4.0 ALTERNATIVES 4-1

4.1 Description of Phase 5A Alternatives 4-1
4.1.1 Phase 5A: Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1) 4-1
4.1.2 Phase 5A: Soil Cement and Sheet Pile Alternative (Alternative 2) 4-10
4.1.3 No Federal Action Alternative (Alternative 3) 4-12
4.1.4 Alternatives Eliminated from Further Consideration 4-13
4.2 Description of Phase 5B Alternatives 4-14
4.2.1 Phase 5B: Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1) 4-14
4.2.2 Phase 5B: Soil Cement Alternative (Alternative 2) 4-22
4.2.3 No Federal Action Alternative (Alternative 3) 4-24
4.2.4 Alternative Eliminated from Further Consideration 4-25
4.3 Description of Phase 4 Alternatives 4-26
4.3.1 Phase 4: Soil Cement Alternative (Alternative 1, Preferred Alternative) 4-26
4.3.2 Phase 4: Grouted Stone Alternative (Alternative 2) 4-37
4.3.3 No Federal Action Alternative (Alternative 3) 4-44
4.3.4 Alternative Eliminated from Further Consideration 4-46
4.4 Description of BNSF Railroad Bridge Alternatives 4-46
4.4.1 Pier and Abutment Protection Alternative (Alternative 1, Preferred Alternative) 4-46
4.4.2 No Federal Action Alternative (Alternative 2) 4-53
4.4.3 Alternatives Eliminated from Further Consideration 4-53
4.5 Description of Additional Work 4-55
4.6 Continuing Investigations 4-56

5.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES 5-1

5.1 EARTH RESOURCES 5-1
5.1.1 Affected Environment 5-1
5.1.1.1 Geology 5-1
5.1.1.2 Seismicity and Faulting 5-1
5.1.1.3 Soils 5-2
5.1.2 Environmental Consequences 5-6
5.1.2.1 Phase 5A 5-6
5.1.2.2 Phase 5B 5-8
5.1.2.3 Phase 4 5-10
5.1.2.4 BNSF Bridge 5-13
5.1.3 Summary of Significance Thresholds Related to Proposed Alternatives 5-15
5.2 HYDROLOGY 5-16
5.2.1 Affected Environment 5-16
5.2.2 Environmental Consequences 5-16
5.2.2.1 Phase 5A 5-16
5.2.2.2 Phase 5B 5-18
5.2.2.3 Phase 4 5-19
5.2.2.4 BNSF Bridge 5-20
5.2.3 Summary of Significance Thresholds Related to Proposed Alternatives 5-21
5.3 GROUNDWATER 5-22
5.3.1 Affected Environment 5-22
5.3.2 Environmental Consequences 5-22
5.3.2.1 Phase 5A 5-23
5.3.2.2 Phase 5B 5-24
5.3.2.3 Phase 4 5-25
5.3.2.4 BNSF Bridge 5-27
5.3.3 Environmental Commitments 5-28
5.3.4 Summary of Significance Thresholds Related to Proposed Alternatives 5-28
5.4 SURFACE WATER QUALITY 5-29
5.4.1 Affected Environment 5-29
5.4.2 Environmental Consequences 5-30
5.4.2.1 Phase 5A 5-30
5.4.2.2 Phase 5B 5-31
5.4.2.3 Phase 4 5-32
5.4.2.4 BNSF Bridge 5-33
5.4.3 Environmental Commitments 5-34
5.4.4 Summary of Significance Thresholds Related to Proposed Alternatives 5-35
5.5 BIOLOGICAL RESOURCES 5-37
5.5.1 Affected Environment 5-37
5.5.2 Environmental Consequences 5-113
5.5.2.1 Phase 5A 5-114
5.5.2.2 Phase 5B 5-129
5.5.2.3 Phase 4 5-138
5.5.2.4 BNSF Bridge 5-152
5.5.2.5 Summary Impact and Mitigation Tables 5-166
5.5.3 Environmental Commitments 5-168
5.5.4 Summary of Significance Thresholds Related to Proposed Alternatives 5-178
5.6 AIR QUALITY 5-179

5.6.1 Affected Environment *5-179*
5.6.2 Environmental Consequences *5-184*
5.6.2.1 Phase 5A 5-186
5.6.2.2 Phase 5B 5-193
5.6.2.3 Phase 4 5-199
5.6.2.4 BNSF Bridge 5-205
5.6.3 Environmental Commitments *5-210*
5.6.4 Summary of Significance Thresholds Related to Proposed Alternatives *5-213*
5.7 NOISE 5-214
5.7.1 Affected Environment *5-214*
5.7.1.1 Phase 5A, Phase 5B, and Phase 4 5-214
5.7.1.2 BNSF Bridge 5-215
5.7.2 Environmental Consequences *5-217*
5.7.2.1 Phase 5A 5-217
5.7.2.2 Phase 5B 5-221
5.7.2.3 Phase 4 5-223
5.7.2.4 BNSF Bridge 5-225
5.7.3 Environmental Commitments *5-227*
5.7.4 Summary of Significance Thresholds Related to Proposed Alternatives *5-227*
5.8 CULTURAL RESOURCES 5-228
5.8.1 Affected Environment *5-228*
A Sacred Lands file check will be requested of the Native American Heritage Commission. 5-228
5.8.2 Environmental Consequences *5-228*
5.8.2.1 Phase 5A 5-228
5.8.2.2 Phase 5B 5-229
5.8.2.3 Phase 4 5-229
5.8.2.4 BNSF Bridge 5-230
5.8.3 Environmental Commitments *5-230*
5.8.4 Summary of Significance Thresholds Related to Proposed Alternatives *5-230*
5.9 LAND USE 5-231
5.9.1 Affected Environment *5-231*
5.9.1.1 Phases 5A and 5B 5-231
5.9.1.2 Phase 4 5-231
5.9.1.3 BNSF Bridge 5-231
5.9.2 Environmental Consequences *5-232*
5.9.2.1 Phase 5A 5-233
5.9.2.2 Phase 5B 5-234
5.9.2.3 Phase 4 5-236
5.9.2.4 BNSF Bridge 5-238
5.9.3 Summary of Significance Thresholds Related to Proposed Alternatives *5-239*
5.10 RECREATION 5-240
5.10.1 Affected Environment *5-240*
5.10.1.1 Phases 5A and 5B 5-241
5.10.1.2 Phase 4 5-241
5.10.1.3 BNSF Bridge 5-241
5.10.2 Environmental Consequences *5-241*
5.10.2.1 Phase 5A 5-242
5.10.2.2 Phase 5B 5-243

5.10.2.3 Phase 4 5-244
5.10.2.4 BNSF Bridge 5-246
5.10.3 Environmental Commitments 5-247
5.10.4 Summary of Significance Thresholds Related to Proposed Alternatives 5-247
5.11 TRANSPORTATION 5-248
5.11.1 Affected Environment 5-248
5.11.2 Environmental Consequences 5-249
5.11.2.1 Phase 5A 5-249
5.11.2.2 Phase 5B 5-250
5.11.2.3 Phase 4 5-252
5.11.2.4 BNSF Bridge 5-253
5.11.3 Environmental Commitment 5-254
5.11.4 Summary of Significance Thresholds Related to Proposed Alternatives 5-255
5.12 AESTHETICS 5-256
5.12.1 Affected Environment 5-256
5.12.2 Environmental Consequences 5-256
5.12.2.1 Phase 5A 5-257
5.12.2.2 Phase 5B 5-258
5.12.2.3 Phase 4 5-260
5.12.2.4 BNSF Bridge 5-261
5.12.3 Summary of Significance Thresholds Related to Proposed Alternatives 5-262
5.13 PUBLIC UTILITIES AND SERVICES 5-263
5.13.1 Affected Environment 5-263
5.13.1.1 Phases 5A, 5B and 4 5-263
5.13.1.2 BNSF Bridge 5-263
5.13.2 Environmental Consequences 5-264
5.13.2.1 Phase 5A 5-264
5.13.2.2 Phase 5B 5-266
5.13.2.3 Phase 4 5-267
5.13.2.4 BNSF Bridge 5-268
5.13.3 Summary of Significance Thresholds Related to Proposed Alternatives 5-269
5.14 HAZARDOUS MATERIALS 5-271
5.14.1 Affected Environment 5-271
5.14.2 Environmental Consequences 5-271
5.14.2.1Phase 5A 5-271
5.14.2.2 Phase 5B 5-273
5.14.2.3 Phase 4 5-275
5.14.2.4 BNSF Bridge 5-277
5.14.3 Summary of Significance Thresholds Related to Proposed Alternatives 5-279
5.15 SOCIOECONOMICS 5-280
5.15.1 Affected Environment 5-280
5.15.2 Environmental Consequences 5-280
5.15.2.1 Phase 5A 5-281
5.15.2.2 Phase 5B 5-282
5.15.2.3 Phase 4 5-283
5.15.2.4 BNSF Bridge 5-284
5.15.3 Summary of Significance Thresholds Related to Proposed Alternatives 5-285
5.16 ENVIRONMENTAL JUSTICE 5-286

5.16.1 Affected Environment *5-286*
5.16.2 Environmental Consequences *5-287*
5.16.2.1 Phase 5A 5-287
5.16.2.2 Phase 5B 5-288
5.16.2.3 Phase 4 5-289
5.16.2.4 BNSF Bridge 5-290
5.16.3 Summary of Significance Thresholds Related to Proposed Alternatives *5-290*
5.17 CUMULATIVE IMPACTS 5-291

6.0 ENVIRONMENTAL COMMITMENTS 6-1

6.1 ENVIRONMENTAL COMMITMENTS 6-1

7.0 ENVIRONMENTAL COMPLIANCE 7-1

7.1 RELEVANT FEDERAL, STATE, AND LOCAL STATUTES, LAWS, AND GUIDELINES 7-1

8.0 COORDINATION 8-1

9.0 LIST OF PREPARERS AND REVIEWERS 9-1

10.0 CONCLUSION 10-1

11.0 LIST OF ACRONYMS AND ABBREVIATIONS 11-1

12.0 REFERENCES 12-1

APPENDICES

A. Memorandum for Record. Hydraulic Engineering Basis of Design for Reach 9 of the Lower Santa Ana River, Santa Ana River Mainstem, CA.
B. 2012 & 2015 Biological Opinions
C. Air Quality Calculations
    1. Air Quality Addendum
D. U.S. Army Corps of Engineers, Regulatory 404(b)(1) Evaluation
E. Distribution Mailing List
F. Correspondence, Public Comments and Responses

LIST OF TABLES

Table **Page**

2-1 Approximate Reach 9 Project Locations (from west to east) 2-1
5.1-1 Major Faults and Associated Seismic Risk 5-5
5.5-1 Regional Special-Status Plant Species[1] 5-64
5.5-2 Bird Species Observed during April 2014 Surveys 5-76
5.5-3 Regional Special-Status Animal Species[1] 5-82
5.5-4 Phase 5A-Grouted Stone and Sheet Pile Alternative: Permanent and Temporary Impacts 5-115
5.5-5 Phase 5A-Grouted Stone and Sheet Pile Alternative (Preferred Alternative) Mitigation Requirements 5-116
5.5-6 Least Bell's Vireo Territories Occurring Within the Area of Potential Effect 5-124
5.5-7 Phase 5B-Grouted Stone Alternative: Permanent and Temporary Impacts 5-131
5.5-8 Phase 5B-Grouted Stone (Preferred Alternative) Mitigation Requirements 5-132
5.5-9 Phase 4-Soil Cement Alternative: Permanent and Temporary Impacts 5-140
5.5-10 Phase 4-Soil Cement (Preferred Alternative) Mitigation Requirements 5-141
5.5-11 Phase 4-Grouted Stone Alternative: Permanent and Temporary Impacts 5-148
5.5-12 Phase 4-Grouted Stone (Alternative 2) Mitigation Requirements 5-149
5.5-13 BNSF Bridge Pier and Abutment Protection Alternative: Permanent and Temporary Impacts 5-153
5.5-14 BNSF Bridge Pier and Abutment Protection Alternative (Preferred Alternative) Mitigation Requirements 5-155
5.5-15 BNSF Bridge-Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP) Analysis 5-162
5.5-16 Reach 9 Measures: Permanent Impacts to Vegetation Communities in Acres 5-166
5.5-17 Reach 9 Measures: Temporary Impacts to Vegetation Communities in Acres 5-166
5.5-18 Reach 9 Measures: Total Mitigation Acreages 5-167
5.6-1 National and California Ambient Air Quality Standards 5-179
5.6-2 Summary of Ambient Air Quality Concentrations 5-182
5.6-3 Attainment Status of the South Coast Air Basin 5-182
5.6-4 Applicable General Conformity/NEPA Significance Thresholds 5-185
5.6-5 Phase 5A – Grouted Stone and Sheet Pile Alternative – General Conformity Applicability Analysis 5-187
5.6-6 Phase 5A – Grouted Stone and Sheet Pile Alternative – Daily Construction Emissions 5-188
5.6-7 Phase 5A – Soil Cement and Sheet Pile Alternative – General Conformity Analysis 5-191
5.6-8 Phase 5A Soil Cement and Sheet Pile Alternative – Daily Construction Emissions 5-192
5.6-9 Phase 5B – Grouted Stone Alternative – General Conformity Analysis 5-194
5.6-10 Phase 5B - Grouted Stone Alternative – Daily Construction Emissions 5-195
5.6-11 Phase 5B – Soil Cement Alternative – General Conformity Analysis 5-197
5.6-12 Phase 5B – Soil Cement Alternative – Daily Construction Emissions 5-198
5.6-13 Phase 4 – Soil Cement Alternative – General Conformity Analysis 5-200
5.6-14 Phase 4 – Soil Cement Alternative – Daily Construction Emissions 5-201
5.6-15 Phase 4 – Grouted Stone Alternative – General Conformity Analysis 5-204
5.6-16 Phase 4 – Grouted Stone Alternative - Daily Construction Emissions 5-204

5.6-17 BNSF Bridge - General Conformity Analysis....5-206
5.6-18 BNSF Bridge – Pier and Abutment Protection Alternative – Daily Construction Emissions....5-207
5.7-1 City of Corona Stationary Noise Source Standards....5-216
5.7-2 City of Corona Transportation Noise Source Standards....5-216
5.7-3 Ambient Noise Levels within Proximity of BNSF Bridge....5-217
5.7-4 Potential Noise Levels at Various Distances....5-219
5.10-1 Parks and Recreation Facilities within Approximately 1.5 Mile of the Reach 9 Measures....5-240
5.11-1 Current Traffic Volumes....5-248
5.13-1 Utility and Service Providers for the Phases 5A, 5B, and 4 Areas....5-263
5.13-2 Utility and Service Providers for the BNSF Bridge Area....5-263
5.15-1 Population, Housing, and Employment....5-280
5.16-1 Ethnicity and Low Income....5-286
5.17-1 Cumulative Projects in the Reach 9 Measures Activity Area (within 2-mile radius)....5-291

LIST OF FIGURES

Figure **Page**

2.1 Area/Regional Map.... 2-3
2.2 Watershed Map.... 2-4
2.3 Vicinity Map.... 2-5
4.1-1 Reach 9 Phase 5A: Project Features.... 4-5
4.1-2 Phase 5A – Typical Grouted Stone Section.... 4-7
4.1-3 Phase 5A – Typical Sheet Pile Section.... 4-8
4.2-1 Reach 9 Phase 5B: Project Features.... 4-17
4.2-2 Phase 5B – Typical Grouted Stone Section.... 4-19
4.3-1 Phase 4 Soil Cement – Project Features.... 4-29
4.3-2 Phase 4 Soil Cement – Project Features.... 4-31
4.3-3 Phase 4 – Typical Soil Cement Section.... 4-33
4.3-4 Phase 4 Grouted Stone – Project Features.... 4-39
4.3-5 Phase 4 Grouted Stone – Project Features.... 4-41
4.4-1 Reach 9 Phase 5B: Project Features.... 4-51
5.1-1 Geologic Faults.... 5-3
5.1-2 Phase 5B Project Features - Farmland.... 5-11
5.5-1 Reach 9 Phase 5A: Plant Communities.... 5-41
5.5-2 Reach 9 Phase 5B: Vegetation Communities.... 5-43
5.5-3a Phase 4 Impact Overlap with SARI Line and Phase 3: Plant Communities-Plate 1.... 5-45
5.5-3b Phase 4 Impact Overlap with SARI Line and Phase 3: Plant Communities-Plate 2.... 5-47
5.5-3c Phase 4 Impact Overlap with SARI Line and Phase 3: Plant Communities-Plate 3.... 5-49
5.5-3d Phase 4 Impact Overlap with SARI Line and Phase 3: Plant Communities-Plate 4.... 5-51
5.5-3e Phase 4 Alternative 2 (Grouted Stone) - Vegetation Communities.... 5-53
5.5-3f Phase 4 Alternative 2 (Grouted Stone) - Vegetation Communities.... 5-55
5.5-4 BNSF: Overlap Analysis-Impact Durations and Habitat Types.... 5-57

5.5-5 SR-91 Undercrossings 5-79
5.5-6a Reach 9 Phase 5A: Critical Habitat 5-93
5.5-6b Reach 9 Phase 5B: Critical Habitat 5-95
5.5-6c BNSF: Overlap Analysis-Impact Durations, Habitat Types, and Critical Habitat 5-97
5.5-6d Reach 9 Phase 4: Critical Habitat 5-99
5.5-7a 2014 Least Bell's Vireo Occurrences (Tile 1-R9P5A) 5-105
5.5-7b 2014 Least Bell's Vireo Occurrences (Tile 2-R9P5B) 5-107
5.5-7c 2014 Least Bell's Vireo Occurrences (Tile 3-R9P5B & R9P4) 5-109
5.5-7d 2014 Least Bell's Vireo Occurrences (Tile 4-R9P5B, R9P4 & BNSF) 5-111

1.0 INTRODUCTION

This final Supplemental Environmental Assessment (SEA) and Environmental Impact Report (EIR) Addendum has been prepared by the U.S. Army Corps of Engineers (Corps) and the Orange County Flood Control District (OCFCD), as a supplement to the Final Supplemental Environmental Impact Statement (SEIS) and EIR for Prado Basin and Vicinity, Including Reach 9 and Stabilization of the Bluff Toe at Norco Bluffs, dated November 2001 (2001 SEIS/EIR) (Corps 2001a). The 2001 SEIS/EIR identified six distinct locations on the south and north banks of the Santa Ana River in Reach 9 that required protection. Technical studies completed since the 2001 SEIS/EIR indicate that the potential for bed degradation in the Reach 9 area is more severe than originally contemplated. An Engineering Document Report (EDR) for the Santa Ana River Mainstem Project Lower Santa Ana River Channel – Reach 9 Orange and Riverside Counties, CA (Reach 9 EDR) has been prepared to evaluate technical solutions for reducing the risk of additional bed degradation in Reach 9. One such site, Reach 9, Phase 3, was evaluated in 2013 (Corps 2013a) and is currently under construction. This SEA/EIR Addendum evaluates the environmental impacts that would arise from implementing structural measures in Reach 9 as described in the EDR as well as other alternatives.

This final SEA/EIR Addendum has been prepared pursuant to the National Environmental Policy Act (NEPA) (42 United States Code 4321 et seq.), Council on Environmental Quality regulations published at 40 Code of Federal Regulations (CFR) Part 1500, et seq., other environmental laws, Executive Orders, Corps regulations, the California Environmental Quality Act (CEQA) (Public Resources Code Section 21000, et seq.) and the State of California CEQA Guidelines (California Code of Regulations [CCR], Title 14, Section 15000, et seq.).

1.1 SARMP Background

The Corps and non-Federal sponsors: OCFCD, Riverside County Flood Control and Water Conservation District (RCFC&WCD), and San Bernardino County Flood Control District, entered into a local cooperation agreement (LCA) on December 13, 1989, to implement the Santa Ana River Mainstem Flood Control Project (SARMP) and provide flood damage reduction along the Santa Ana River (SAR). The Corps is the lead agency under NEPA and the OCFCD is the lead agency under CEQA. RCFC&WCD will be primarily responsible for maintenance of the Burlington Northern and Santa Fe (BNSF) Bridge project and will also take subsequent discretionary actions including, but not limited to: utility relocation, property acquisition, obtaining easements, issuing encroachment permits and entering into cooperative agreements. Therefore, RCFC&WCD will be a responsible agency for CEQA compliance for the BNSF Bridge project. Other agencies (i.e., cooperating, responsible, and trustee agencies) that may use this SEA/EIR Addendum in the decision making or permit process will consider the information in this document along with other information that may be presented during the NEPA/CEQA process. It is anticipated that cooperating, responsible, and trustee agencies identified in the 2001 SEIS/EIR will rely in

the same capacity on this final SEA/EIR Addendum. Potential cooperating, responsible and trustee agencies would include:

- California Department of Fish and Wildlife (CDFW, formerly California Department of Fish and Game)
- California Regional Water Quality Control Board (RWQCB)
- U.S. Fish and Wildlife Service (USFWS)
- California Department of Transportation (Caltrans)
- Orange County Water District (OCWD)
- Orange County Parks (OC Parks)
- City of Corona
- City of Yorba Linda

1.2 Proposed Action: Reach 9 Measures

Reach 9 extends approximately 8.3 miles from Prado Dam in Riverside County, California, downstream to the Weir Canyon Road/Yorba Linda Boulevard Bridge, in the City of Yorba Linda, Orange County (see Chapter 2 for detailed project location information). Under existing SARMP documents, the Corps has constructed or is completing construction on Reach 9, Phases I, 2A, 2B, and 3. In 2012, a study evaluating the hydrology, hydraulics, and sedimentation in Reach 9 identified that planned Reach 9 improvements were not sufficient to withstand a release of 30,000 cubic feet per second (cfs) from Prado Dam. The Corps determined that local flood risk management measures composed largely of soil cement and riprap within Reach 9 did not provide the sufficient fortifications necessary to withstand the potential 30,000 cfs releases from Prado Dam.

The Corps proposes to extend bank protection measures within Reach 9 by constructing three additional bank and infrastructure measures, Phases 4, 5A, and 5B, and fortifying the BNSF Bridge. The purpose of the additional phases is to prevent undercutting or erosion of SAR embankments caused by high-velocity flows and associated scour in the adjacent cities of Yorba Linda and Anaheim. Structural improvements within the BNSF Bridge right-of-way (R/W) would address potential deficiencies in protection and susceptibility to scour at the bridge piers and abutments that would be at risk during high velocity releases from Prado Dam.

1.3 SARMP Authority and Background

The SARMP is located along a 75-mile reach of the Santa Ana River in Orange, Riverside, and San Bernardino Counties, California. The SARMP is a comprehensive flood risk management system that was authorized for construction by Section 401(a) of the Water Resources Development Act (WRDA) of 1986.

The recommended plan for the SARMP is contained in the Phase I General Design Memorandum (GDM) for the SARMP (Corps 1980) and included eight elements, which were subsequently reevaluated in the Phase II GDM (Corps 1988). The Phase II GDM modified the SARMP by redefining the authorized SARMP

features and clarifying that the Standard Project Flood term referred in most cases to the 190-year flood event. Construction of the SARMP commenced in fiscal year 1989.

In 2001, the Corps submitted a Limited Reevaluation Report (LRR) entitled Prado Dam Separable Element, Prado Basin, & Vicinity, including Stabilization of Bluff Toe at Norco Bluffs Santa Ana River Basin, California, dated September 2001 pursuant to Section 309(a) of WRDA of 1996, which required the Corps to "review" the Prado Dam feature, a component feature of the SARMP. The LRR was approved by the Director of Civil Works on August 16, 2002. The LRR recognized, consistent with the Phase I GDM and Phase II GDM, that the purpose of the proposed Prado Dam improvements was to increase the reservoir storage capacity from 217,000 acre-feet to 362,000 acre-feet and to be able to release 30,000 cfs flows from Prado Dam into the downstream channels. In accordance with the determination in the LRR to construct Prado Dam as a separable element, the Prado Dam component was removed from the definition of the project in the LCA by a second modification to the LCA dated February 24, 2003. A Project Cooperation Agreement for the Prado Dam feature as a separable element was signed on February 11, 2003, with OCFCD as the non-Federal sponsor.

The specific feature of the SARMP addressed by this SEA/EIR Addendum is Reach 9, which is located immediately downstream of Prado Dam, extending approximately 8.3 miles to Weir Canyon Road in the City of Anaheim and from station 1607+50 to the SAR Canyon at station 1218+20. Reach 9 is partially located in Riverside County, California, with the majority of Reach 9 located in Orange County, California. Reach 9 is a soft bottom portion of the Santa Ana River, which at the time of WRDA 1986 was bounded by undeveloped land with the Riverside Freeway, or State Route (SR) 91, to the south and low elevation mountains to the north. Since that time, residential, commercial, and industrial developments, as well utilities and facilities, have been constructed on the floodplain, which required local flood risk management measures to be put in place. The 2002 LRR analyzed site conditions in Reach 9 to assess whether Reach 9 measures constructed as part of the SARMP together with local improvements provided sufficient flood risk management measures. The Corps determined in the 2002 LRR that additional measures were necessary to support the authorized level of releases from Prado Dam. Accordingly, the Corps constructed Reach 9, Phases 1, 2A, and 2B. Subsequent evaluations indicated that additional bank protection is warranted, beginning with Reach 9, Phase 3 (currently under construction).

Since the original authorization, the SARMP has subsequently been modified by the Energy and Water Appropriation Act of 1988 (which included the San Timoteo feature), WRDA 1990 (Santa Ana Trails), WRDA 1996 (Prado Dam, SR-71), and WRDA 2007 (Santa Ana River Interceptor Line protection/relocation).

1.4 Previously Prepared Documents

The environmental impacts of the SARMP have been evaluated in several documents since initial study of the SARMP commenced in the 1970s. Below is a partial list of environmental documents that have

been completed for the SARMP and for Reach 9 in particular, which may be referenced throughout this SEA/EIR Addendum.

- Survey Report and Environmental Impact Statement (EIS), United States Army Corps of Engineers, Los Angeles District, 1975.
- Phase I General Design Memorandum and Supplemental Environmental Impact Statement (SEIS), United States Army Corps of Engineers, Los Angeles District, 1980.
- Upstream Dam Alternatives SEIS, United States Army Corps of Engineers, Los Angeles District, 1985.
- Santa Ana River Mainstem including Santiago Creek. Phase II General Design Memorandum and Supplemental Environmental Impact Statement (GDM/SEIS), United States Army Corps of Engineers, Los Angeles District, 1988.
- Prado Basin and Vicinity, Including Reach 9 and Stabilization of the Bluff Toe at Norco Bluffs Supplemental Environmental Impact Statement/Environmental Impact Report, United States Army Corps of Engineers, Los Angeles District, 2001.
- Santa Ana River Reach 9 Phase II Green River Mobile Home Park Embankment Supplemental Environmental Assessment (SEA)/Addendum to EIR 583, United States Army Corps of Engineers, Los Angeles District, 2008.
- Santa Ana River Reach 9 Phase II Green River Golf Club SEA/Addendum to EIR 583, United States Army Corps of Engineers, Los Angeles District, 2009 Santa Ana River Interceptor Line (SARI) Protection/Relocation Project SEIS/EIR, United States Army Corps of Engineers, Los Angeles District, 2009.
- Santa Ana River Interceptor Line (SARI) Protection/Relocation Project SEA/Addendum to EIR IP 03-26, Orange County Public Works and United States Army Corps of Engineers, Los Angeles District, 2010.
- Santa Ana River Flood Control Project Reach 9 Phase 2A Embankment SEA/Addendum to EIR 583, United States Army Corps of Engineers, Los Angeles District, 2011.
- Santa Ana River Flood Control Project Reach 9 Phase 3 Embankment SEA/Addendum to EIR 583, United States Army Corps of Engineers, Los Angeles District, 2013.

1.5 Preparation of Final SEA/EIR Addendum

This final SEA/EIR Addendum has been prepared by the Corps and OCFCD. The draft report had been prepared by AECOM for and in coordination with Corps and OCFCD staff. The scope of the document, methods of analysis, and conclusions represent the independent judgment of the Corps and OCFCD. Staff members from the Corps, OCFCD, and AECOM who helped prepare the draft and final SEA/EIR Addendum are identified in Chapter 9, List of Preparers and Contributors.

1.6 Summary of Changes from the Draft SEA/EIR Addendum:

- The Draft SEA/EIR Addendum had identified potential adverse effects to the coastal California gnatcatcher. Based on further coordination with U.S. Fish and Wildlife Service (USFWS) and

2015 gnatcatcher surveys, the determination has been changed to "may affect, not likely to adversely affect" this species. This is also consistent with the finding in the final Biological Opinion dated 23 July 2015.

- Some of the environmental commitments/conservation measures have been modified in coordination with USFWS to further avoid and minimize impacts to the Santa Ana sucker, least Bell's vireo, and coastal California gnatcatcher.
- Deletion of approximately 450 feet of embankment protection from the upstream end of Phase 4. The Corps will be reassessing the need for this protection and may propose the same or an alternative alignment at a later date, under separate environmental documentation.
- The Phase 5A project description was modified to include construction of a retaining wall, riding/hiking trail, and bikeway along the top of the embankment.
- Some staging areas were relocated further from the active stream channel to minimize environmental impacts.
- Modification of the upstream end of Phase 5B from grouted stone to sheet pile, to avoid potential impacts to perennial stream habitat.
- Previous documentation for the Mobile Home Park protection had identified a temporary access road from Green River Road. This final SEA/EIR Addendum includes a permanent access for maintenance purposes, although the existing access will likely be abandoned and a new road may be constructed approximately 200 feet to the east, to minimize impacts to B Canyon wildlife corridor.
- The number of least Bell's vireo territories expected to be impacted was updated. Estimates of acres of impact to habitat and associated mitigation for each of the project components were updated.

This page intentionally left blank.

2.0 PROJECT LOCATION

Reach 9 is located in the SAR watershed within Orange County and Riverside County, California. It is approximately 8.3 miles long, ranges in width between approximately 400 and 2,000 feet, and parallels SR-91 beginning at the Prado Dam outlet in Riverside County, California, downstream to the vicinity of the South Weir Canyon Road/Yorba Linda Boulevard bridge in the City of Yorba Linda, Orange County, California. At that point, the SAR transitions from a relatively natural channel to an engineered channel that conveys flows to the Pacific Ocean. A regional overview and watershed map depicting the location of Reach 9 is provided in Figures 2.1 and 2.2. Location information for Phases 4, 5A, 5B, and BNSF Bridge, hereafter referred to as Reach 9 measures, are presented below and depicted in Figure 2.3.

Table 2-1. Approximate Reach 9 Project Locations (from west to east)

Project Feature	City, County	Latitude/Longitude
Phase 5A	Yorba Linda, Orange County	Upstream limit: 33°52'37.38"N; 117°43'54.62"W Downstream limit: 33°52'47.60"N; 117°44'36.24"W
Phase 5B	Yorba Linda, Orange County	Upstream limit: 33°52'35.38"N; 117°41'14.42"W Downstream limit: 33°52'41.33"N; 117°43'56.88"W
Phase 4	Yorba Linda, Orange County	Upstream limit: 33°52'31.52"N; 117°41'20.05"W Downstream limited: 33°52'19.42"N; 117°42'1.76"W
BNSF Bridge	Corona, Riverside County	33°52'36.44"N; 117°40'3.67"W

2.1 Phase 5A

Phase 5A is proposed to be located along the north bank of the SAR, parallel to East La Palma Avenue, and extending from the completed Reach 9, Phase 1 at the Mercado Del Rio Plaza, 4,083 feet (0.77 mile) upstream to the vicinity of Via Lomas De Yorba-West Road (Figure 2.3). This Phase includes a 90-degree bend in the SAR currently protected by ungrouted riprap revetment of the Lomas De Yorba-Sur (LDY-S) Levee.

2.2 Phase 5B

Phase 5B, as proposed, would extend from Phase 5A upstream approximately 3.7 miles to a locally constructed existing sheet pile wall that functions to protect the BNSF rail line (Figures 2.3). Phase 5B would extend nearly 3,000 feet upstream of the limit of the LDY-S Levee, which terminates near the Sycamore Park Orange Grove.

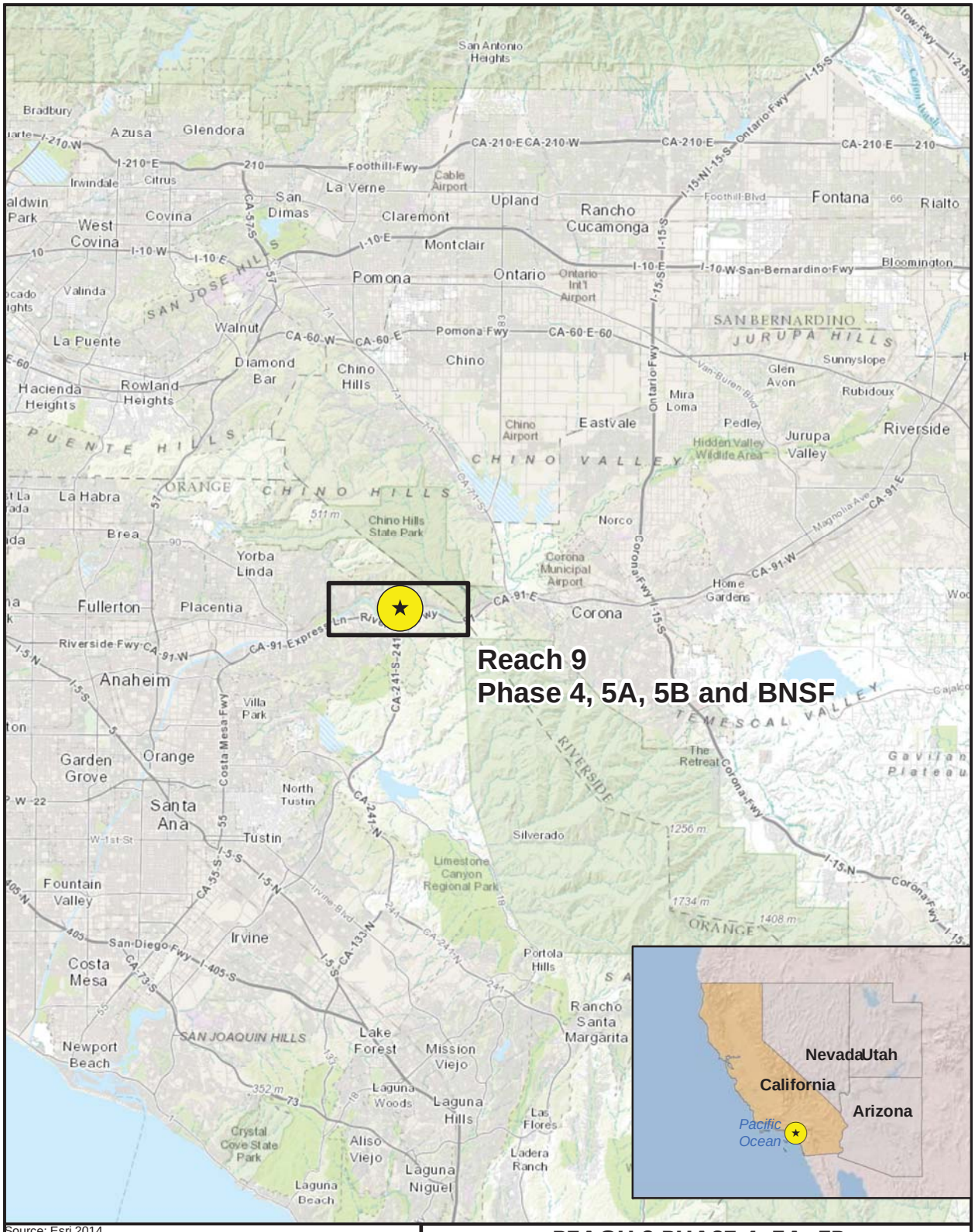
2.3 Phase 4

Phase 4 is proposed to be located along the south bank of the Santa Ana River, beginning approximately 3.5 miles downstream of the outlet from Prado Dam, in the vicinity of Coal Canyon Road, and extending 3,150 feet (0.59 mile) downstream (Figure 2.3). At its downstream limit, Phase 4 ties into Reach 9, Phase 3, which is currently under construction, and at its upstream limit will tie into State of California, Department of Parks and Recreation (State Parks) land downstream of Reach 9, Phase 2B.

2.4 BNSF Bridge

The BNSF Bridge lies approximately 2.25 river miles downstream of the outlet from Prado Dam (Figure 2.3). It was constructed in 1938 as part of relocation efforts for construction of Prado Dam. Two additional bridges, each carrying a set of tracks, were constructed south of the original bridge in 1995. Bridge structures located at this location are referred to throughout this document as the "BNSF Bridge." BNSF Bridge improvements are necessary at piers and abutments of the railroad bridges. Reach 9, Phase 2A is upstream of the BNSF Bridge, and the completed Green River Mobile Home Park Embankment Protection and Phase 2B (Green River Golf Course) lie downstream.

When completed, Reach 9 along the south bank, including (from upstream to downstream) Phase 2A, BNSF, Green River Mobile Home Park, Phase 2B, Phase 4, and Phase 3, will provide nearly continuous bank protection from the Prado Dam outlet works, downstream for approximately 4.5 miles to the vicinity of Gypsum Canyon Road. Phases 5A and 5B constructed along the north bank would provide continuous protection from the existing sheet pile wall protection along the BNSF rail line, downstream for approximately 4.5 miles to the Mercado Del Rio Plaza, where Phase 5A would be contiguous with the "Car Wash Strip Mall" at Reach 9, Phase 1 (Figure 2-3).



Source: Esri 2014

0 10,000 20,000 40,000 Feet

Scale: 1:360,000 1 inch = 30,000 feet

REACH 9 PHASE 4, 5A, 5B & BNSF SEA/EIR ADDENDUM

FIGURE 2.1
Reach 9 Regional

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Path: P:\2014\60279208-Reach_9_SEA\900-CAD-GIS\920 GIS-Graphics\925_Docs\Figure2_1_Reach9Regional.mxd, 11/6/2014, wallacerj

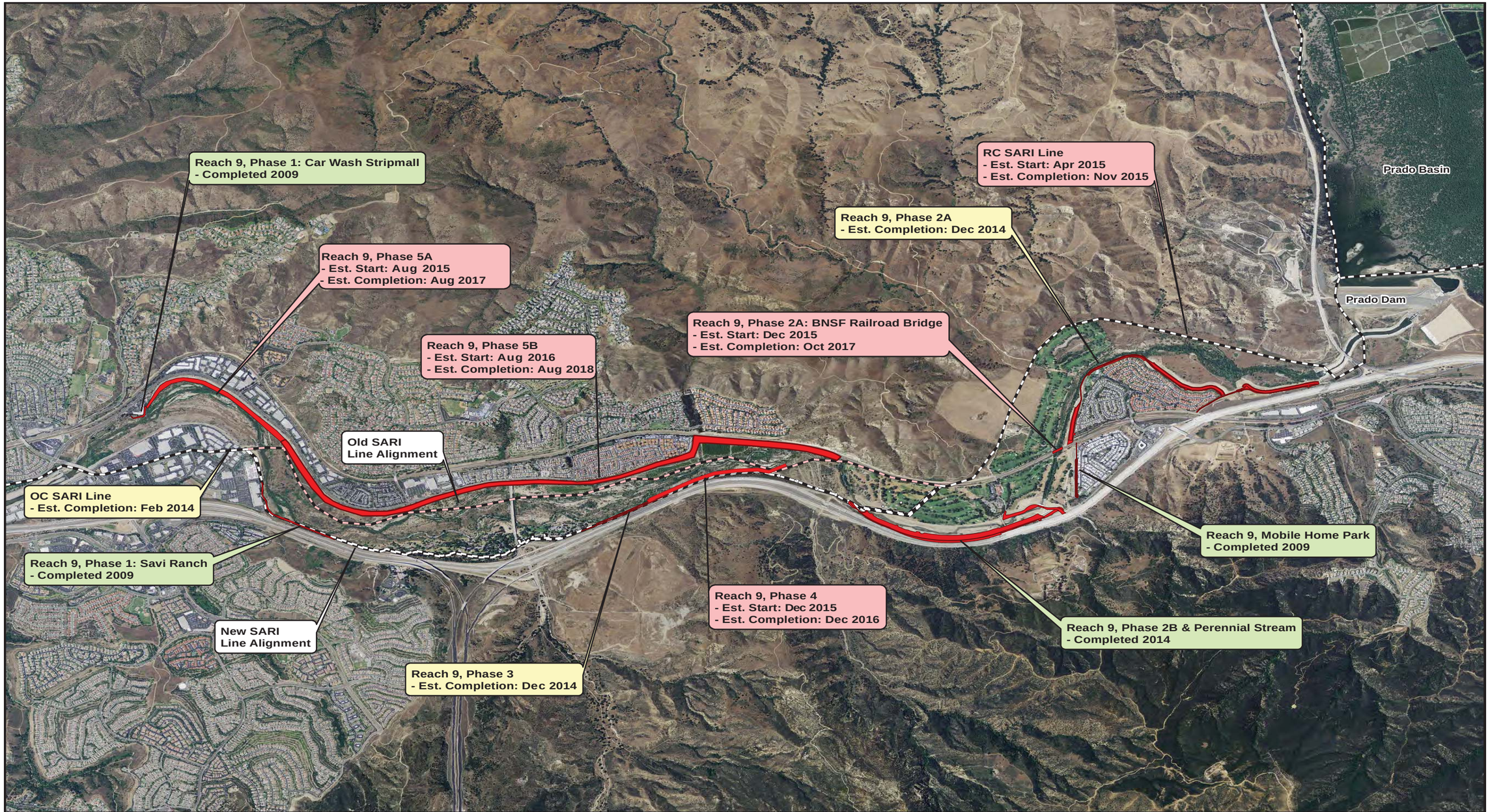


REACH 9 PHASE 4, 5A, 5B & BNSF SEA/EIR ADDENDUM

FIGURE 2.2
Santa Ana River Watershed Map

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Path: P:\2014\60279208-Reach_9_SEA\900-CAD-GIS\920 GIS-Graphics\925_Docs\Figure2_2_SantaAnaWatershed.mxd, 11/14/2014, wallacerj



N

0 0.25 0.5 1 Mile

Reach 9 Features and Estimated Implementation Schedule

REACH 9 PHASE 4, 5A, 5B
& BNSF SEA/EIR ADDENDUM

FIGURE 2.3
Reach 9 Vicinity Map

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Path: P:\2014\60279208-Reach_9_SEA\900-CAD-GIS\920 GIS-Graphics\925_Docs\Aerial_Base_5B_ver2.mxd, 11/6/2014, wallacerj

This page intentionally left blank.

3.0 PURPOSE AND NEED

In accordance with 40 CFR 1502.13, this section provides an explanation of the "underlying purpose and need to which the [Corps] is responding in proposing the alternatives including the proposed action."

3.1 Statement of Need

Although portions of the existing SAR channel in Reach 9 could convey flows ranging from 30,000 to 40,000 cfs without adversely impacting the surrounding areas, there are areas within Reach 9 where channel erosion could potentially occur if more than 5,000 cfs is released from Prado Dam. High-velocity discharges from Prado Dam could undermine the toe of existing channel embankments in certain locations, and could erode foundation materials underneath the BNSF bridge piers. To operate the SARMP as authorized by Congress, it is necessary to be able to release 30,000 cfs from Prado Dam to provide a 190-year level of flood risk management. The February 2014 design memorandum (Corps 2014a), provided with this SEA/EIR Addendum as Appendix A, presents the engineering basis for proposed bank protection under the Phase 5A, Phase 5B, Phase 4, and BNSF Bridge projects. Protection is needed in areas where existing bank armoring does not exist (i.e., portions of Phase 4 and Phase 5B), or where it has been determined that the buried toe of existing bank protection does not extend deep enough (i.e., Phases 5A and 5B and portions of Phase 4). At the BNSF Bridge, the pier does not extend deep enough to provide sufficient protection against the design flood event. The basis of need for the four projects is provided below, as presented in the 2014 design memorandum (see Appendix A).

3.1.1 Phase 5A

In 1981, the Corps prepared a memorandum for record (MFR) documenting a review of the LDY-S Levee (Corps 1981) existing riprap revetment that extends the entire length of Phase 5A. The MFR recommended that where the setback is greater than 400 feet, the revetment should be extended to at least the lowest adjacent streambed elevation; where the setback is less than 400 feet, the revetment should be extended to at least 5 feet below the adjacent streambed. The Corps recommendation was based on the engineering judgment in 1981. However, given that the alignment of the low-flow channel has historically migrated laterally in this location, the existing levee condition was later deemed deficient. The current condition of the ungrouted riprap revetment of the LDY-S Levee on the north bank has been reevaluated by the Corps and results of the riprap analysis indicate that the toe of the revetment is not deep enough to protect from long-term scour. An estimated maximum scour depth of 16 feet below the current river thalweg was provided for a design flood event (Corps 2014a). Additionally, scour studies in Reach 9 have shown that the riverbed is degrading at a faster rate than previously estimated (Chang 2003; OCFCD 2010). As a result, a fortification and deepening of the existing bank protection to withstand 30,000 cfs flows is recommended to prevent future lateral erosion into the north bank and protect adjacent infrastructure consisting of East La Palma Road, the SAR Trail, industrial facilities, and commercial and residential development.

3.1.2 Phase 5B

In Phase 5B, bank protection is necessary to prevent future lateral erosion into the bank line and protect infrastructure consisting of East La Palma Avenue; the SAR Trail; industrial, commercial, and residential development; and the BNSF rail line during a 30,000 cfs flow event. In some places in the Phase 5B reach, the invert of the thalweg (the bottom surface of the active river channel) is already equal to or below the toe elevation of the levee (Corps 2012a), which extends from Phase 5A upstream through nearly the entire Phase 5B reach. Maximum scour in this area is anticipated to reach a depth of 14 feet below the current thalweg (Corps 2014a). Bank protection in Phase 5B is necessary to replace the LDY-S Levee through Phase 5B and extend approximately 3,000 feet beyond the current upstream limit of the LDY-S Levee, to an existing BNSF sheet pile wall protecting the BNSF rail line.

3.1.3 Phase 4

To protect the Riverside Freeway (SR-91) from sustained impinging flows from the SAR, Caltrans constructed and upgraded four sections of bank protection along the south bank of the SAR. The most downstream (fourth) section occurs along the current Phase 3 and proposed Phase 4 areas, where soil cement bank protection is in place where the river is close, and an earth-compacted bank where the river bank is set back from the SAR. The structural integrity of the bank protection for locations where there is no setback between the low flow riverbank and the freeway itself is unknown because the toe is submerged by the low flow adjacent to the freeway embankment. Therefore, the adequacy of the existing toe depth and structural soundness of the Caltrans constructed measures against maximum scour from a 30,000 cfs release from Prado Dam, estimated at a maximum of 16 feet below the current thalweg, could not be verified. Additional bank protection is necessary to replace the Caltrans bank protection (Corps 2012a).

3.1.4 BNSF Bridge

Previous Corps investigations have also focused on the BNSF Bridge piers, which may be susceptible to scour during a 30,000 cfs flow/release (Corps 2013b). Scour at a bridge pier occurs when a vortex forms—flow hits the bridge pier and moves downward toward the riverbed. When flow reaches the riverbed, it moves in a direction opposite to its original flow direction before hitting the bridge pier. This movement of flow upstream of the bridge pier results in the formation of a vortex, where material is continuously removed so that holes are formed in the riverbed, lowering the riverbed level and ultimately exposing the foundations of the bridge pier. Each bridge is supported by abutments on the east and west ends and six intermediate piers (designated Pier Nos. 1 through 6, numbered from east to west). Each abutment and pier is supported by a group of driven H piles, with pile caps at various levels. The BNSF Bridge is designed for a scour depth of 14 feet. An existing tieback sheet pile wall encloses the abutments and Pier Nos. 1 and 6 to protect those foundations from that level of scour. However, a 30,000 cfs release from Prado Dam could cause deeper scour levels that exceed the BNSF bridge design condition. It is foreseeable that the level of scour could be up to 18 feet below the existing thalweg. Scour at this depth would expose piles supporting the intermediate piers. Additional scour protection measures are required to maintain bridge stability and avoid catastrophic collapse of the BNSF bridge during a 30,000 cfs release.

3.2 Statement of Purpose

The purpose of the proposed Reach 9 measures is to provide river bank and bridge protection from predicted future scour associated with 30,000 cfs releases from Prado Dam associated with the operation of the SARMP. Specifically, in the areas of Phases 5A and 5B improvements would reduce or prevent flood damage to roadways, the SAR Trail, industrial and commercial development, and residential housing in the City of Yorba Linda by providing new bank protection structures that will extend in depth beyond existing protection. In Phase 5A improvements would provide protection from a minimum elevation equal to the lowest adjacent streambed elevation, to at least 5 feet below the adjacent streambed. Phase 4 would protect SR-91, the SAR Trail, and the SARI Line by providing a new bank protection structure that would extend deeper to protect from meandering and impinging flood flows that could cause maximum scour, approximately 7 feet below the current thalweg. The BNSF Bridge protection would provide new bridge pier and bank protection features to reduce or prevent flood damage to piers and abutments of the BNSF railroad bridge. No protection features are currently in place at the bridge piers or along the river bank at the BNSF railroad bridge, and degradation is estimated at 18 feet below the existing thalweg. As a result, the existing bridge piers may be deficient in protection and susceptible to scour.

This page intentionally left blank.

4.0 ALTERNATIVES

The alternatives described in this section are presented by phase. A modular approach is necessary to develop reasonable alternatives given differing site conditions at each location, but also because construction would occur close in time and geographic location. A final recommended plan will be composed of a selected alternative from each phase.

4.1 Description of Phase 5A Alternatives

Phase 5A is located along the north bank of the Santa Ana River, parallel to East La Palma Avenue, and extending from the Mercado Del Rio Plaza, 4,083 feet (0.77 mile) upstream to the vicinity of Via Lomas De Yorba-West Road, in the City of Yorba Linda. It would provide erosion protection for the north bank of the SAR and flood damage protection for portions of East La Palma Avenue, the SAR Trail, industrial facilities, commercial buildings, and residential development.

4.1.1 Phase 5A: Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

Under this alternative, an existing 4,083-foot section of the Lomas De Yorba-Sur (LDY-S) Levee consisting of ungrouted stone bank protection would be replaced by 980 feet of a grouted stone structure and 3,273 feet of steel sheet pile wall. The new bank protection would have an adequate foundation depth to minimize scour and provide erosion control and support the conveyance capacity required by SARMP operations. The following paragraphs provide details for various features and tasks associated with this alternative. Figures 4.1-1 and 4.1-2 show the overall Reach 9 location and features. The R/W on the north (land) side for the grouted stone section of Alternative 1 is located outside the OCFCD R/W. The R/W on the north (land) side for the sheet pile wall reach is proposed to have an offset of 75 feet measured horizontally from the sheet pile control line. R/Ws on the south (river) side for the grouted stone and sheet pile reaches are set at 92 and 36.5 feet, respectively, from the grouted stone and sheet pile control lines. A temporary construction easement (TCE) on the south side for grouted stone is offset 30 feet from the R/W line. The excavation footprint for grouted stone protection would be approximately 80 feet wide along the 980-foot reach. Figure 4.1-2 depicts a typical grouted stone section and Figure 4.1-3 a typical sheet pile section proposed under this alternative.

Construction Phasing

It is anticipated that bank protection in Phase 5A would be constructed in three phases; one to construct the grouted stone structure, one for installation of sheet pile protection, and the final phase to construct the retaining wall, riding/hiking trail and bikeway. Construction sequencing will be determined after contract award.

Construction of interior drainages would occur concurrently with grouted stone and sheet pile installation. Construction would be initiated with removal of existing ungrouted stone and vegetation within the TCE of the proposed grouted stone reach.

Grouted Stone

The grouted stone structure, which would be placed against the existing bank, would be 24 inches thick and have a 2:1 horizontal-to-vertical slope (H:V); a 2H:1V slope is required to provide slope stability. The grouted stone structure would be approximately 37.5 feet tall, measured vertically from 1 foot below the scour line to top of the structure, and would be buried approximately 18 to 20 feet below the channel invert. In addition, a minimum 3-foot-thick riprap stone would be installed at the toe of the 24-inch-thick stone for additional scour protection. Riprap stone along the existing bank would be used. Construction of riprap stone and 24-inch grouted stone revetment would require excavation of a trapezoidal trench approximately 80 feet wide by 980 feet long. Approximately 34,000 cubic yards of alluvial substrate would be excavated. The estimated amounts of 24-inch grouted stone, salvaged riprap, and compacted backfill to be used during construction are 11,100 tons, 3,500 tons, and 32,000 cubic yards, respectively. In addition to alluvial excavation, an estimated 3,500 tons of existing riprap stone would be removed and salvaged for reuse to the greatest extent possible. Stone would be transported to the site from a quarry site near Prado Dam; 16 daily truck trips are anticipated. Excess excavated material would be hauled to appropriate disposal sites, most likely to an Orange County landfill site approximately 20 miles from Phase 5A.

Sheet Pile

The sheet pile wall would be situated along the top edge of the existing north bank to minimize excavation for installation of tiebacks and minimize environmental impacts. Installation of tiebacks requires an approximate 8-foot vertical excavation of the existing bank, from the top of the existing bank. The sheet pile would be a 2-foot-wide “Z”-shaped steel wall with tiebacks, and would be driven vertically down into the existing bank to a design elevation; height of the sheet pile varies from 45 to 50.5 feet. Figure 4-1.4 depicts the configuration of the Z-shaped sheet pile wall.

Removal and reuse of the existing riprap stone and compacted earth fill would be required and needed for sheet pile tieback installation. An estimated 3,500 tons of riprap stone and 10,000 cubic yards of earth fill would be removed and reused. Backfill to restore the compacted earth fill embankment would be required after completion of sheet pile tieback installation. The final configuration of backfill would match the original embankment configuration. It is anticipated that most, if not all, excavated material would be used for construction of Phase 5A. The finished surface of the restored embankment would be hydroseeded and planted with native vegetation.

Retaining Wall, Riding/Hiking Trail and Bikeway

To accommodate a 24-ft wide section consisting of a 10-ft wide DG (Decomposed Granite) riding/hiking trail and a 14-ft wide AC (Asphalt Concrete) bikeway, a retaining wall is needed on top of the terrace slope of the proposed bank, along the grouted stone and sheet pile reaches. The retaining wall height ranges from 2.5 to 4.5-ft. Construction of the retaining wall requires excavation of the existing terrace slope and removal of about sixteen (16) trees. Figures 4.1-2 and 4.1.4 present typical grouted stone and sheet pile sections respectively including the proposed retaining wall, riding/hiking trail and bikeway.

Interior Drainage

There are six existing interior side drains belonging to City of Yorba Linda and ranging from 27-inch- to 84-inch-diameter reinforced concrete pipes (RCP) that need to be modified to accommodate the proposed bank protection. Three RCPs are located in the grouted stone portion and three in the sheet pile reach. Modification includes demolition of the existing outlet structures and flap gates, and reconstruction of the outlet structures and flap gates as well as extension of the RCPs.

Water Diversion and Dewatering

No diversion or control of water in the active channel of the SAR would be required during construction. Dewatering of groundwater would occur for grouted stone construction. The dewatering means and methods would be determined by the contractor; however, a common method is to construct dewatering wells near the excavation daylight and use sump pumps to lower groundwater levels until levels are below the bottom of the excavation. No dewatering is anticipated for sheet pile construction. Discharge at RCP outflows would occur via existing flow paths during construction.

Staging Areas

Staging areas are located at the upstream and downstream ends of Phase 5A as shown in Figures 4.1-1 and 4.1-2, and occupy areas of 1.4 and 1.38 acres, respectively. Staging areas would be used for storage of construction equipment and materials and as turnaround areas. Clearing and grubbing would be required to prepare the staging areas, which would be restored with appropriate native vegetation upon completion of the project.

Access

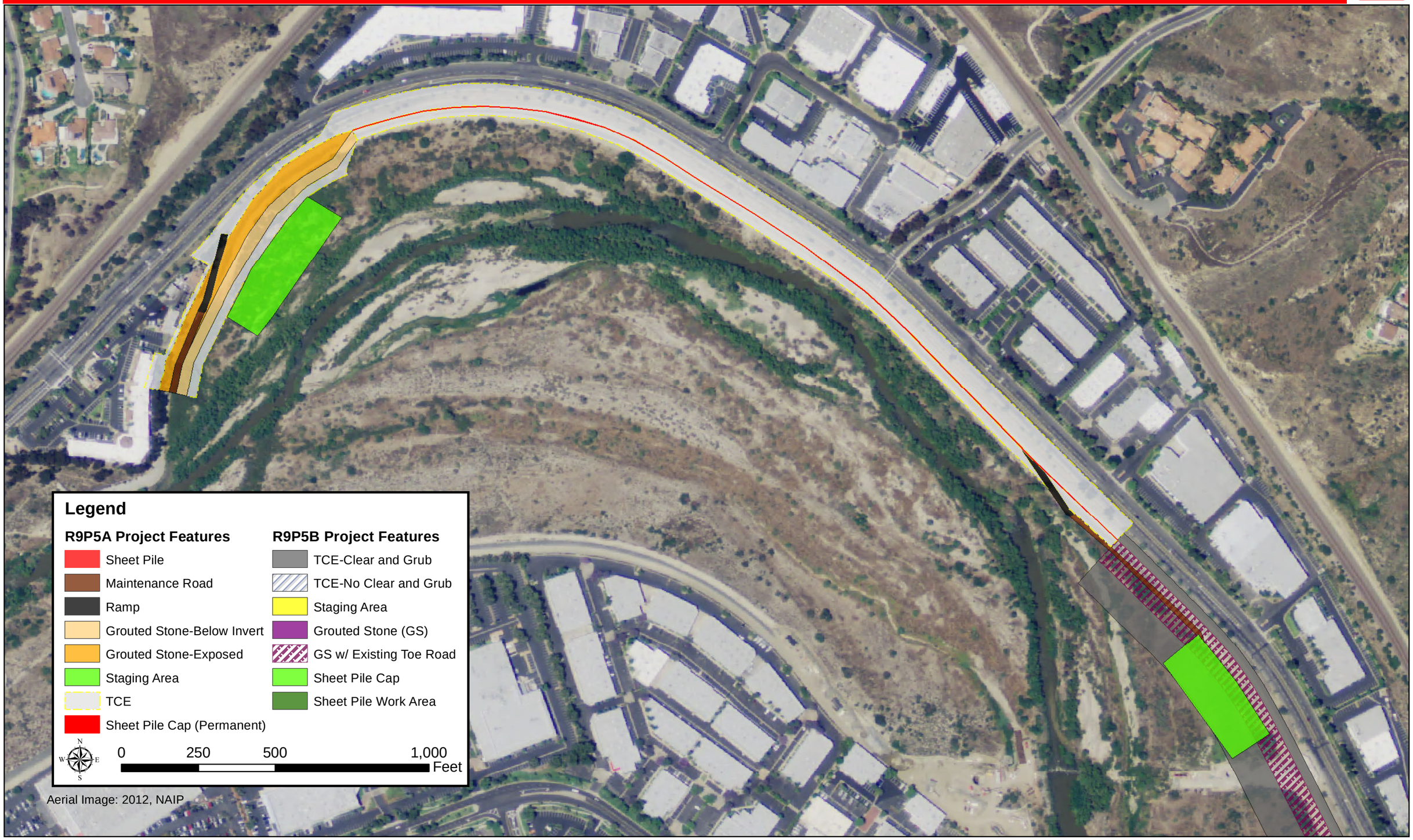
Access to the Phase 5A area would occur via East La Palma Avenue, the Santa Ana River Trail along the top of the LDY-S Levee, and an existing dirt access road at the base of the levee. These access routes occur within the TCE and no new haul roads are anticipated for construction.

Roads

The existing Santa Ana River Trail at the top of the north bank would be used for routine inspection and operation and maintenance (O&M) work. A temporary trail detour would be provided by placing k-rails within a portion of the eastbound (south) driving lane on East La Palma Avenue. The existing dirt access road along the base of the levee would remain upon construction completion and would be used for O&M work on the new grouted stone and sheet pile structures. This road will also be extended from its terminus at the downstream (west) end of the project, for approximately 300 feet to the west (see Figure 4.1-1). The road extension would be installed on top of the buried toe of the grouted stone structure.

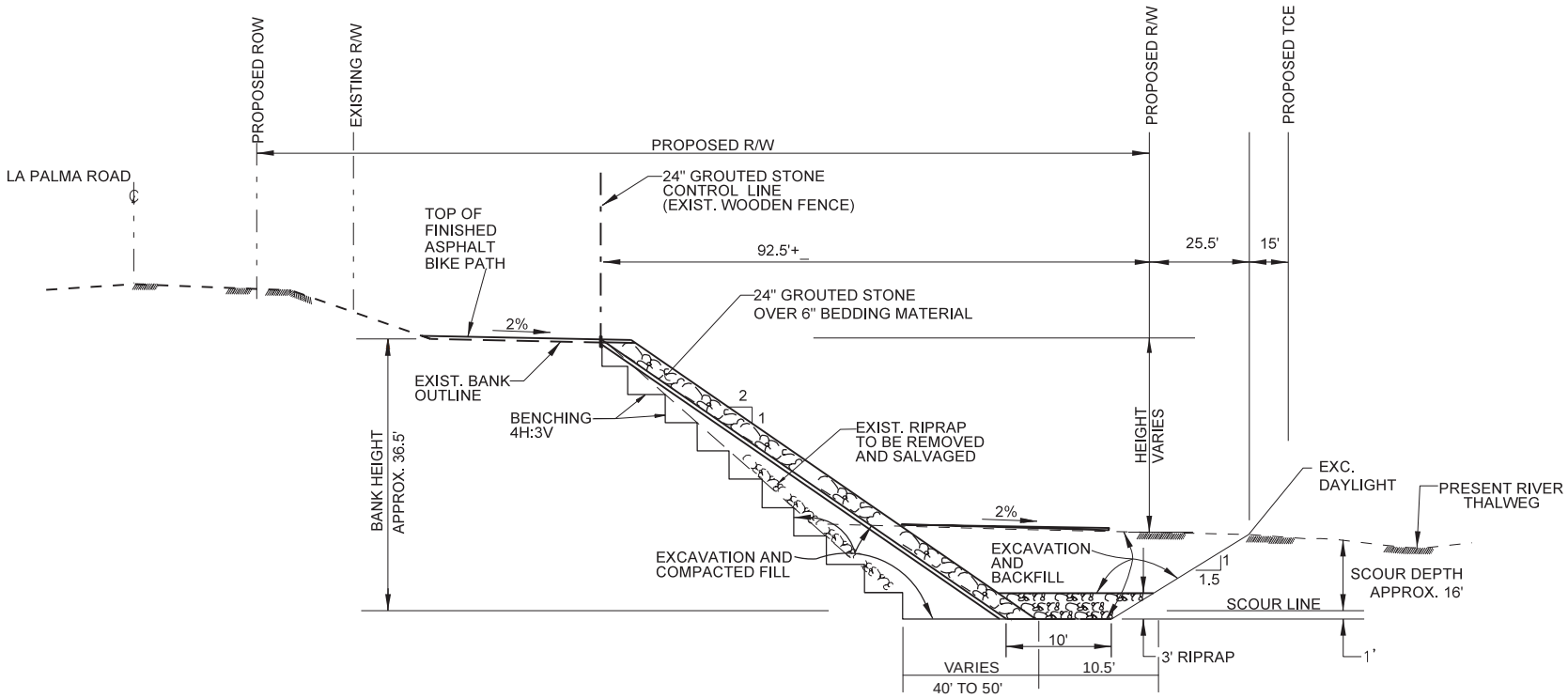
This page intentionally left blank.

Reach 9 Phase 5A: Project Features



Aerial Image: 2012, NAIP

This page intentionally left blank.



TYPICAL GROUTED STONE SECTION
LOOKING UPSTREAM
N.T.S.

Source: ACOE 2014

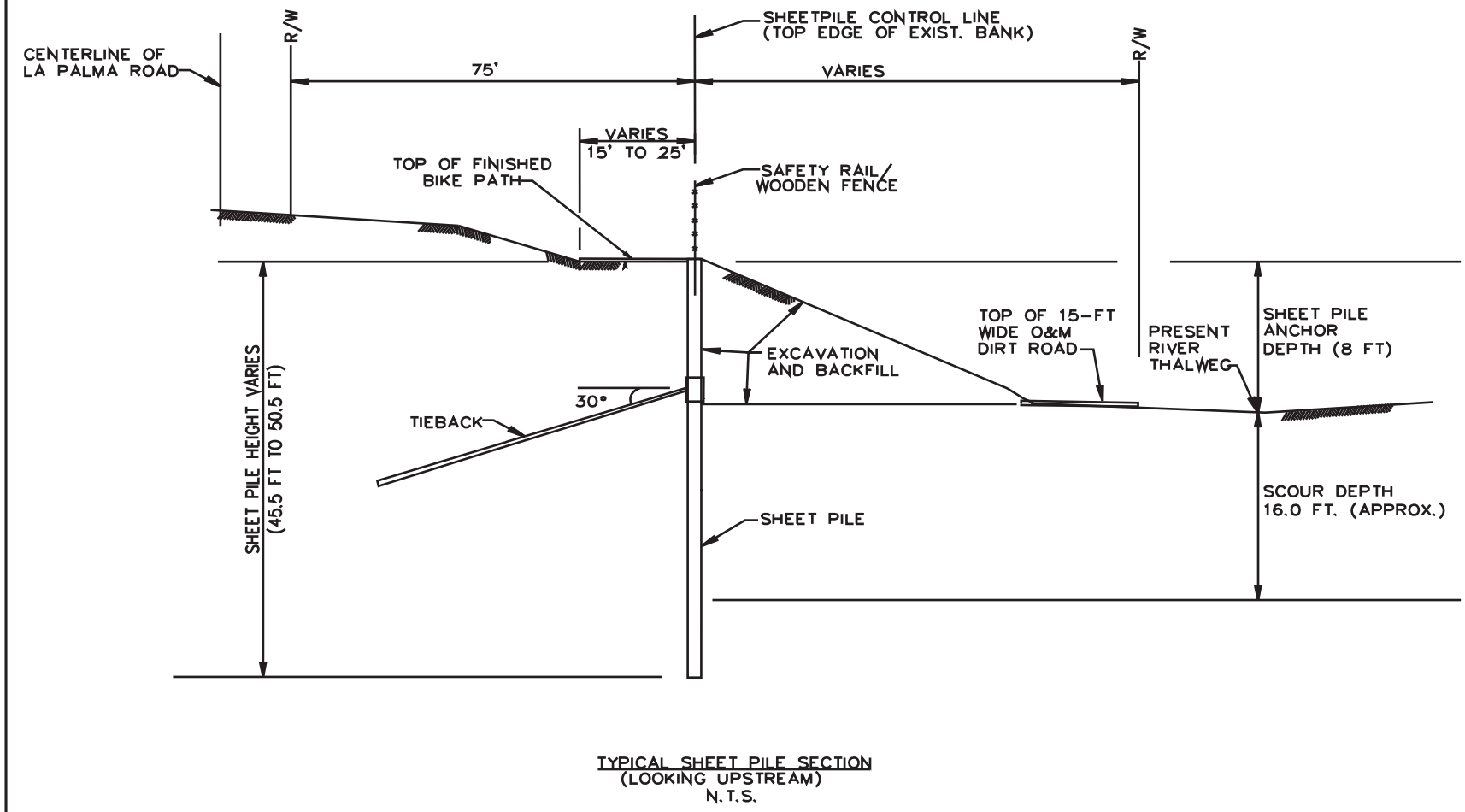
;

REACH 9 PHASE 4, 5A, 5B
& BNSF SEA/EIR ADDENDUM

FIGURE 4.1-2
Phase 5A - Typical Grouted Stone Section

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Path: P:\2014\60279208-Reach_9_SEA\900-CAD-GIS\920 GIS-Graphics\925_Docs\5A_Sections.mxd, 11/24/2014, WallaceRJ



TYPICAL SHEET PILE SECTION
(LOOKING UPSTREAM)
N.T.S.

Source: ACOE 2014

;

REACH 9 PHASE 4, 5A, 5B
& BNSF SEA/EIR ADDENDUM

FIGURE 4.1-3
Phase 5A - Typical Sheet Pile Section

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Path: P:\2014\60279208-Reach_9_SEA\900-CAD-GIS\920 GIS-Graphics\925_Docs\5A_Sections.mxd, 11/24/2014, WallaceRJ

Connstruction Equipment

Equipment to be used for construction of the grouted stone structure would include, but is not limited to, excavators, front-end loaders, bulldozers, dump trucks, a grader, concrete pump trucks, and water trucks. Additionally, delivery trucks would be associated with imported materials. Equipment to be used for construction of the sheet pile protection would include a hydraulic hammer and heavy-duty cranes.

Construction Schedule

Construction is expected to take 24 months to complete. Clearing and grubbing is proposed to begin in fall 2015 and would be initiated and completed outside of the bird breeding season (which in this area is February 15 through August 15) to avoid impacts to nesting birds. Sound walls, if needed, would be constructed prior to March 1 of each year. Construction is expected to continue to approximately fall 2017. Funding constraints, weather delays, and other issues could potentially move the construction timeline into 2018. Daily construction would occur between 8:00 a.m. and 5:00 p.m., Monday through Friday.

Site Preparation

As stated above, site preparation activities would be completed outside of the bird breeding season to minimize impacts to nesting birds. Areas to be cleared and grubbed include the construction footprint and staging areas; no new haul roads are anticipated.

Temporary closure of the SAR Trail would be required during construction. A temporary detour/bike path would be provided along the eastbound (south) lane of East La Palma Avenue.

Future Operations and Maintenance

Future O&M activities would entail structural and nonstructural repairs, and inspections. Maintenance of the structures would be required per the O&M manual and as determined by the SARMP Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) Manual. It is anticipated that major structural repairs would be needed infrequently, if at all, during the life of the project. Minor repairs of discreet areas, most likely on the exposed embankment, may be required following larger flow events.

- ***Structural Repairs:*** If repairs require excavation to the toe-down and also work within the watercourse, the minimum amount of vegetation would be removed to undertake the repair. The work area would be dewatered with portable dewatering structures such as k-rails or coffer dams. Upon completion of work, the dewatering structures would be removed, and the area would be allowed to revegetate via natural recruitment or replanted. The non-Federal sponsor would be required to obtain necessary permits for any work that requires river diversion, major excavation, and vegetation removal outside of routine maintenance areas.

  O&M activities associated with the SAR Trail and interior side drains may also occur.

- ***Non-Structural Repairs:*** Non-structural repairs would entail removal of vegetation and debris that may accumulate on and around the grouted stone and sheet piling structures, or the removal of small mammal burrows from the earthen embankment that supports the grouted stone structure. Use of herbicides or rodenticides, if needed, would be applied in a manner to avoid impacts to non-target species.

- ***Equipment***: Equipment that would be utilized during routine O&M activities includes pickup trucks, ½- and ¾-ton trucks, spray rigs, fence trucks, bobcats, bulldozers, loaders, backhoes, tractors, transports, motor graders, cranes, water trucks, 5- and 10-yard dump trucks, and excavators.

- ***Inspections:*** A semi-annual inspection and inspections after each major storm event of sheet pile tiebacks, interior drainage structures, and the Santa Ana River Trail would be required.

4.1.2 Phase 5A: Soil Cement and Sheet Pile Alternative (Alternative 2)

Under this alternative, a soil cement structure would be installed with sheet piling, instead of grouted stone with sheet piling. This alternative contemplates replacement of existing riprap slope protection with a 10-foot-thick soil cement structure at the 1,100-foot downstream end of the proposed Phase 5A. The soil cement structure would resemble a vertical parallelogram with a 2H:1V slope and be placed against the existing bank. The soil cement would be approximately 35 feet tall measured vertically from the scour line to top of the structure, and would be buried approximately 20 to 25 feet below the channel invert to minimize scour and provide erosion control and subsequent flood protection. Due to slope stability concerns, construction of soil cement would require a trapezoidal-shaped trench excavated at a 1.5H:1V slope, with a footprint approximately 80 feet wide.

Approximately 20,000 cubic yards of alluvial substrate would be excavated for soil cement placement. Suitable excavated material would be used for soil cement construction and to backfill the trench. Unsuitable and excessive material would be hauled to appropriate disposal sites. If additional material is needed for backfill or soil cement creation, it would be imported from an outside source (e.g., Prado Dam borrow site). In addition to alluvial excavation, an estimated amount of 850 cubic yards of riprap would be removed and hauled to appropriate disposal sites. The following paragraphs provide details for various features and tasks associated with Alternative 2. Figures 4.1-1 and 4.1-2, which depict the footprint of the Preferred Alternative, are also representative of the footprint of Alternative 2 features (TCE, permanent footprint, staging areas, etc.).

Interior Drainage

Similar to the Preferred Alternative (Grouted Stone and Sheet Pile Alternative), modification of the six RCPs in Phase 5A would include demolition of existing outlet structures and flap gates, reconstruction of the outlet structures and flap gates, and extension of the RCPs.

Water Diversion and Dewatering

Similar to the Preferred Alternative, no diversion or control of water in the active channel of the SAR would be required to construct a soil cement and sheet pile structure under Alternative 2. Dewatering of groundwater would occur for soil cement construction as well, with the means and methods of dewatering to be determined by the contractor. It is anticipated that dewatering wells would be constructed near the excavation daylight and sump pumps would be used to lower groundwater levels until levels are below the bottom of the excavation.

Staging Areas

The same staging areas utilized under the Preferred Alternative would be used to construct soil cement and sheet pile structures under Alternative 2. Staging areas would be used for storage of construction equipment and materials and as turnaround areas. Under this alternative, a batch plant would also be sited in a staging area.

Access

Access to the Phase 5A area under Alternative 2 would also occur via East La Palma Avenue, the SAR Trail along the top of the LDY-S Levee, and an existing dirt access road at the base of the levee. Like the Grouted Stone and Sheet Pile Alternative, no new access roads would be required.

Roads

Similar to the Preferred Alternative, the existing SAR Trail at the top of the north bank would be used for routine inspection and O&M work. A temporary trail detour would be provided by placing k-rails within a portion of the eastbound (south) driving lane on East La Palma Avenue. The existing dirt access road along the base of the levee would remain upon construction completion and would also be used for OMRR&R activities on the new soil cement and sheet pile structures. This road will also be extended from its terminus at the downstream (west) end of the project, for approximately 300 feet to the west (see Figure 4.1.1). The road extension would be installed on top of the buried toe of the soil cement structure.

Construction Equipment

Equipment to be used for construction of a soil cement structure under Alternative 2 would include, but is not limited to, excavators, front-end loaders, bulldozers, dump trucks, soil cement compactors (i.e., sheep-foot and smooth-wheel rollers), a grader, concrete pump trucks, water trucks, and a soil cement batch plant. Similar to the Preferred Alternative, equipment anticipated to be used for construction of the sheet pile structure would include heavy-duty cranes and hydraulic hammers.

Construction Schedule

Construction of Alternative 2 would require at least an additional 2 months over the Preferred Alternative, and would be expected to take 26 months to complete. Clearing and grubbing would commence in fall 2015 and would be initiated and completed outside of the bird breeding season (which

in this area is February 15 through August 15) to avoid impacts to nesting birds. Sound walls, if needed, would also be constructed prior to March 1 of each year. Construction is expected to continue to approximately late fall 2017. Funding constraints, weather delays, and other issues could potentially move the construction timeline into 2018. Daily construction would occur between 8:00 a.m. and 5:00 p.m., Monday through Friday.

Site Preparation

As stated under the Preferred Alternative, site preparation activities would be completed outside of the bird breeding season to minimize impacts to nesting birds. Areas to be cleared and grubbed include the construction footprint and staging areas; no new haul roads are anticipated.

Temporary closure of the SAR Trail would also be required during construction of Alternative 2, with a temporary detour/bike path provided along the eastbound (south) lane of East La Palma Avenue.

4.1.3 No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, no improvements of the existing bank would occur, including associated features such as interior drainage. Without adequate bank protection, the lower Santa Ana River may not be able to safely convey large controlled releases. The No Federal Action Alternative would leave the existing bank at high risk of erosion since the lower half of the slope of the existing bank uses ungrouted riprap and the upper half utilizes compacted earth fill. In addition to erosion, the most important aspect contributing to slope/bank failure is the inadequate toe-down depth to prevent scour associated with high flow events. High flow conditions through the project reach could undermine the structure and threaten portions of East La Palma Avenue; the SAR Trail; and industrial facilities, commercial buildings, and newly developed residential housing along the north bank of the Santa Ana River. Periodic emergency repairs of the existing bank protection could be required. It is likely that any emergency repair would be limited in scope and duration and would likely entail the discharge of rocks to stabilize the embankment, and would not prevent against eminent bank failure.

Short Comparison of Alternatives 1, 2, and 3

The estimation of construction costs was calculated for the Preferred Alternative (Grouted Stone and Sheet Pile) and Alternative 2 (Soil Cement and Sheet Pile) to determine which alternative would yield the most feasible and economic benefit. Results indicate that implementation of the Preferred Alternative would save about $1.8 million. In addition to cost saving, the Preferred Alternative would require an approximately 2-month shorter construction duration compared to Alternative 2.

Both the Preferred Alternative and Alternative 2 would provide the same level of protection with respect to hydraulic aspects of the project, while having similar environmental impacts. Under both alternatives, the grouted stone and soil cement bank protection structures would be constructed at a 2H:1V slope, resulting in similar permanent and temporary impacts. Implementation of either alternative would result in a minor increase in the permanent footprint of the structure along the

deepest portion of the buried toe; however, it is likely that most or all of this structure would remain buried and therefore have little or no impact on the amount or function of floodplain habitat in which the alternatives would be constructed. As a result, the Grouted Stone and Sheet Pile Alternative (Preferred Alternative) and the Soil Cement and Sheet Pile Alternative (Alternative 2) are both equally the Least Environmentally Damaging Practicable Alternative (LEDPA). Under the No Federal Action Alternative, there would be no cost to construct new bank protection and permanent and temporary impacts resulting from implementation of either the Grouted Stone and Sheet Pile Alternative or the Soil Cement and Sheet Pile Alternative would not occur. As a result, protection from future scour associated with 30,000 cfs releases from Prado Dam would not be constructed, leading to the potential for high flow conditions through the project reach to undermine existing bank protection and threaten infrastructure along the north bank of the SAR.

Differences in O&M

No differences would occur in OMRR&R activities required for the Grouted Stone and Sheet Pile Alternative and the Soil Cement and Sheet Pile Alternative. Both alternatives utilize hard material (i.e., grouted stone and soil cement) and their protection level against erosion and scouring would be the same; therefore, O&M would be similar.

4.1.4 Alternatives Eliminated from Further Consideration

Complete Grouted Stone and/or Soil Cement Alternative

This alternative would entail construction of a grouted stone or a soil cement structure along the entire reach, with no sheet pile. Since the active river channel is located close to the bank in the upstream reach of Phase 5A, soil cement would likely be considered for implementation in the upstream portion rather than grouted stone, which requires a wider footprint. As with the Preferred Alternative, grouted stone would still be more appropriate for the downstream portion because the active river channel is located away from the bank. Regardless of location of the grouted stone and soil cement, this alternative would potentially require mitigation for impacts to at least 12 additional acres of riparian vegetation and diversion of the active river channel during construction in the upstream reach. This alternative would result in more substantial environmental impacts and is not as cost effective; therefore, it is not recommended for implementation and will not be analyzed further.

Complete Sheet Pile Alternative

Under this alternative, existing revetted embankment within the Phase 5A work area would be left intact and sheet pile walls would be constructed in uplands immediately behind the existing embankments throughout the entire Phase 5A project reach, rather than just the 3,273-foot stretch proposed under the Preferred Alternative. Individual panels, approximately 2 feet wide, would be driven from the top of the embankment approximately 10 to 15 feet past the projected scour depth (approximately 10 feet below the invert). The panels would be held in place by horizontal rods (tiebacks) that would be driven into the soil.

Installation of a sheet pile wall at the top of the existing bank would not require clearing and grubbing of riparian vegetation, and mitigation associated with such activities, and would not require work in the Santa Ana River. Noise control during sheet pile construction would be required to minimize impacts to adjacent habitat where special-status species have been documented. While this alternative offers less environmental impact, the construction cost estimate for installation of a sheet pile wall would be 2.5 times more than that of the grouted stone structure proposed for a 1,100-foot reach under the project alternatives, while mitigation savings would be minimal (3.8 acres of temporary and 4.4 acres of permanent impact [consisting of buried toe extension] would be avoided). As a result, this alternative is not considered practicable, is not recommended for implementation, and will not be analyzed further in this document.

4.2 Description of Phase 5B Alternatives

Phase 5B is located along the north (right) bank of the SAR, parallel to East La Palma Avenue in the City of Yorba Linda. It extends from the upstream terminus of Phase 5A, in the vicinity of Via Lomas De Yorba-West Road, upstream for approximately 19,700 feet (3.73 miles) to existing sheet pile protection along the BNSF rail line. It would provide erosion protection for the north bank of the SAR and flood damage protection to portions of East La Palma Avenue, the SAR Trail, the BNSF rail line, industrial facilities, commercial development, and residential housing.

4.2.1 Phase 5B: Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

Under this alternative, grouted stone and sheet pile would replace existing riprap of the LDY-S Levee and be installed on the river bank upstream of the levee where the river bank is currently unprotected. Grouted stone would be used for the majority of protection, transitioning to sheet pile only at the upstream-most extent where needed to avoid direct impacts to flowing water. New bank protection would have an adequate foundation depth to minimize scour and provide erosion control and subsequent flood protection. The grouted stone structure would be 24 inches thick and have a 2H:1V slope, which is required to provide slope stability. The grouted stone structure would range in height from 30 to 45 feet, with the buried portion of the grouted stone slope approximately 25 feet deep. Construction of grouted stone revetment would require excavation of a trapezoidal trench approximately 80 feet wide by the length of the proposed protection (approximately 19,700 feet long). A total of approximately 1,116,000 cubic yards of alluvial substrate would be excavated. The estimated amounts of grouted stone and compacted backfill to be used during construction are 80,000-94,000 cubic yards (or 166,000 tons) and 1,116,000 cubic yards, respectively. In addition to alluvial excavation, an estimated amount of 65,000 cubic yards of existing stone would be removed and salvaged for reuse to the greatest extent possible. Excess excavated material and unsuitable stone would be hauled to appropriate disposal sites.

The following paragraphs provide details for various features and tasks associated with the Grouted Stone Alternative and Figures 4.2-1 through 4.2-3 show the location of SARMP features. The TCE on the

north (land) side of the SAR coincides with the existing R/W and the TCE on the south (river) side is offset 30 feet from the river side of the trapezoidal trench. Figure 4.2-2 depicts a typical grouted stone section proposed under this alternative.

Construction Phasing

Construction would be initiated with the removal of existing ungrouted riprap and vegetation within the TCE of the proposed Phase 5B limits, followed by installation of the dewatering system and excavation of the trench for construction of the grouted stone structure. It is then anticipated that construction of the grouted stone structure would take place in incremental phases in which the contractor would excavate and place grouted stone and backfill for a few hundred feet for each increment due to limited stockpile areas and to minimize environmental impacts. Then, the contractor would repeat the process on the next increment. This way excavation and backfill hauling distances are shortened. Finally, the side drains would be extended, dewatering system removed, SAR Trail restored, and hydroseeding and replanting done.

Water Diversion and Dewatering

No diversion or control of water in the active channel of the SAR would be required during construction. Dewatering of groundwater would occur for grouted stone construction. The dewatering means and methods would be determined by the contractor; however, a common method is to construct dewatering wells near the excavation daylight and use sump pumps to lower groundwater levels until levels are below the bottom of the excavation. Discharge at RCP outflows would occur via existing flow paths during construction.

Staging Areas

Three staging areas are required; two along the main Phase 5B construction area (as shown in Figures 4.2-1 and 4.2-2), and a third location for the extension area near the BNSF rail line is at the upstream end of the Phase 5B segment (as shown in Figure 4.2-3). Precise locations of the staging areas have not yet been determined, although each would be approximately 1 acre in size. Staging areas would be placed out of the way of higher flows, and disturbance to habitats would primarily be limited to communities composed of non-native plant species.

Access

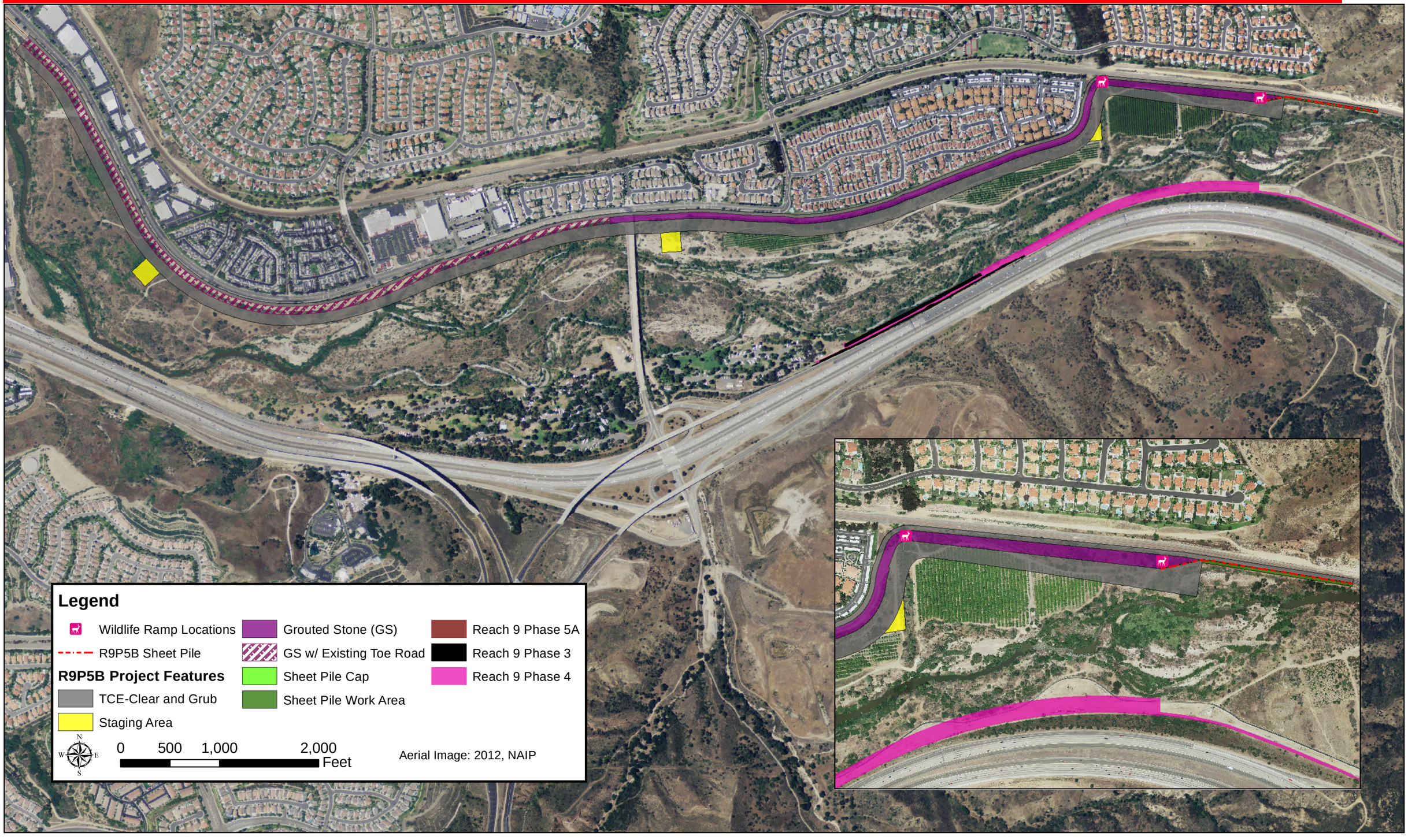
Access to the Phase 5B construction area would occur via East La Palma Avenue and the SAR Trail along the top of the LDY-S Levee. Existing ramps off East La Palma would provide access to an existing dirt access road at the base of the levee. No new access roads would be required.

Existing Levee Maintenance Road

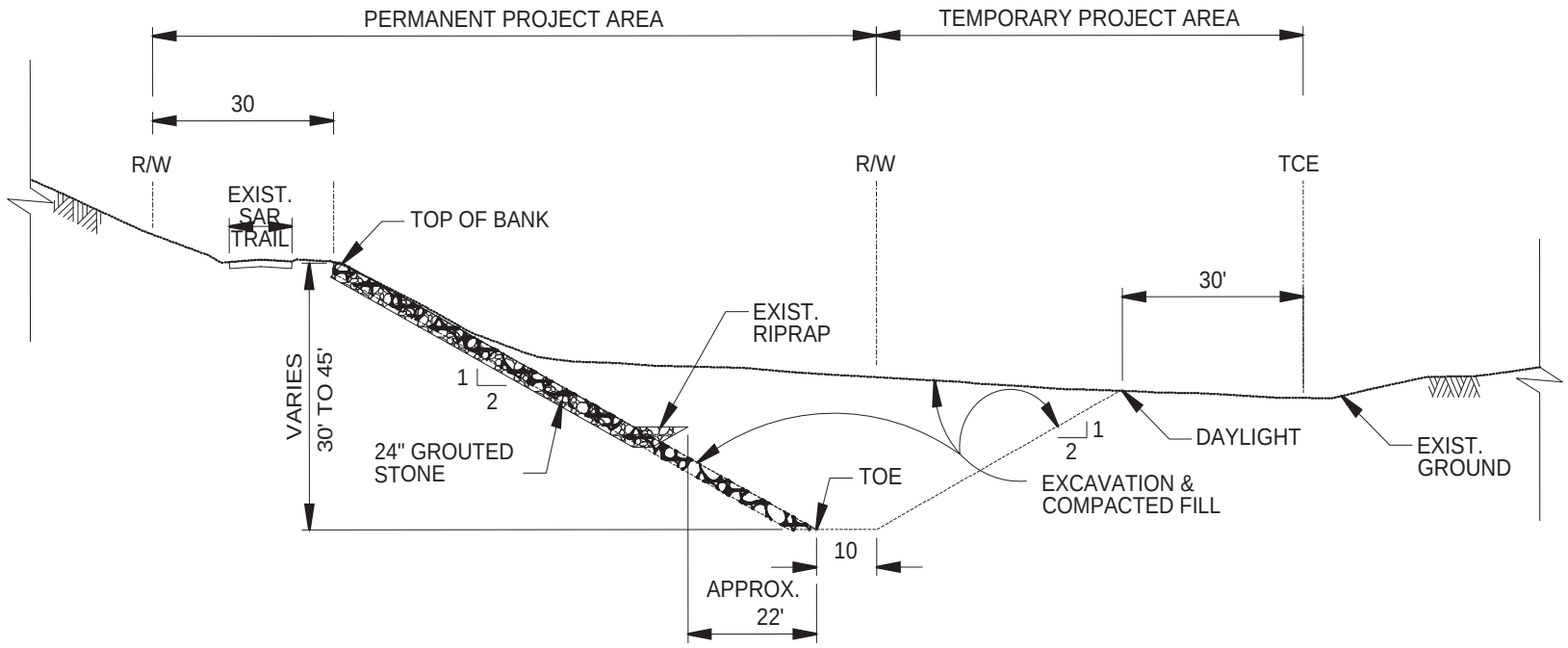
The existing 15-foot-wide dirt access road along the base of the levee would be restored upon completion of construction and used for subsequent OMRR&R activities.

This page intentionally left blank.

Reach 9 Phase 5B: Project Features



This page intentionally left blank.



TYPICAL SECTION GROUTED STONE
N.T.S.

Source: ACOE 2014

;

REACH 9 PHASE 4, 5A, 5B & BNSF SEA/EIR ADDENDUM

FIGURE 4.2-2
Phase 5B - Typical Grouted Stone Section

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Path: P:\2014\60279208-Reach_9_SEA\900-CAD-GIS\920 GIS-Graphics\925_Docs\5B_Sections.mxd, 11/25/2014, WallaceRJ

This page intentionally left blank.

Storm Drain Outlets

Modification to existing drains would be required but would not result in permanent impacts. Modification includes demolition of the existing outlet structures and flap gates, and reconstruction of the outlet structures and flap gates as well as extension of the RCPs.

Construction Equipment

Equipment to be used for construction of the grouted stone structure would include, but is not limited to, excavators, front-end loaders, bulldozers, dump trucks, a grader, concrete pump trucks, and water trucks. Additionally, delivery trucks would be associated with imported stone; 20-40 daily truck trips are anticipated.

Construction Schedule

Construction is expected to take approximately 24 months to complete. Clearing and grubbing is proposed to begin in August 2016 and would be completed outside of the bird breeding season (which in this area is February 15 through August 15) to avoid impacts to nesting birds. Sound walls, if needed, would be constructed prior to March 1 of each year. Construction is expected to continue to approximately August 2018. Funding constraints, weather delays, and other issues could potentially delay the construction completion. Daily construction would occur between 8:00 a.m. and 5:00 p.m., Monday through Friday.

Site Preparation

As stated above, site preparation activities would be completed outside of the bird breeding season (August 15 through February 15) to minimize impacts to nesting birds. Areas to be cleared and grubbed under this project include the construction footprint and staging areas; new haul roads would be located with the TCE. Complete clearing of vegetation would be avoided where possible, or vegetation would be trimmed to within less than 2 feet of the ground to minimize direct and indirect effects of construction to birds that may attempt to nest in riparian vegetation adjacent to the project. Roots and stumps would be left in place where possible to maintain the integrity of the north bank of the river and to facilitate faster restoration of the site upon completion of construction.

Temporary closure of the SAR Trail would be required during construction. It is anticipated that a temporary detour/bike path would be provided along the eastbound lane of East La Palma Avenue.

Future Operations and Maintenance

Future O&M activities would entail structural and non-structural repairs, and inspections. Maintenance of the structures would be required per the SARMP OMRR&R manual and as determined by the field superintendent. It is anticipated that major structural repairs would be needed infrequently, if at all,

during the life of the project. Minor repairs of discreet areas, most likely on the exposed embankment, may be required following larger flow events.

- ***Structural Repairs***: If repairs require excavation to the toe-down and also work within the watercourse, the minimum amount of vegetation would be removed that is required to undertake the repair. If necessary, the work area would be dewatered with portable dewatering structures such as k-rails or coffer dams. Upon completion of work, the dewatering structures would be removed, and the area would be allowed to revegetate via natural recruitment or would be replanted. The non-federal sponsor would be required to obtain necessary permits for any work that requires river diversion, major excavation, and vegetation removal outside of routine maintenance areas.

  O&M activities associated with the SAR Trail and interior side drains may also occur.

- ***Non-Structural Repairs***: Non-structural repairs would entail removal of vegetation and debris that may accumulate on and around the grouted stone and sheet piling structures, or the removal of small mammal burrows from the earthen embankment that supports the grouted stone structure. Use of herbicides or rodenticides, if needed, would be applied in a manner to avoid impacts to non-target species.

- ***Equipment:*** Equipment utilized during OMRR&R activities would include pickup trucks, ½- and ¾-ton trucks, spray rigs, fence trucks, bobcats, bulldozers, loaders, backhoes, tractors, transports, motor graders, cranes, water trucks, 5- and 10-yard dump trucks, and excavators.

- ***Inspections:*** Inspections of all project features after each major storm event would be required.

4.2.2 Phase 5B: Soil Cement Alternative (Alternative 2)

Under this alternative, a 10-foot-thick soil cement structure would be installed instead of grouted stone. The soil cement structure would resemble a vertical parallelogram with a 2H:1V slope and would be placed against the existing bank. Soil cement would range from 30 to 45 feet in height and be buried approximately 25 feet deep, to minimize scour and provide erosion control and subsequence flood protection. Due to slope stability concerns, construction of soil cement would require a trapezoidal-shaped trench excavated at a2H:1V slope, with a footprint approximately 80 feet wide. Additional geotechnical investigations are being conducted to determine if a 1.5H:1V or 1H:1V slope for the soil cement structure may be acceptable. If it is determined that a steeper slope is practicable, and that associated environmental impacts would be reduced, the Corps may opt to pursue soil cement rather than grouted stone as the Preferred Alternative.

Approximately 959,000 cubic yards of alluvial substrate would be excavated for soil cement placement. Suitable excavated material would be used for soil cement construction and to backfill the trench. Unsuitable and excessive material would be hauled to appropriate disposal sites. If additional material is

needed for backfill or soil cement creation, it would be imported from an outside source (e.g., Prado Dam borrow site). In addition to alluvial excavation, an estimated 65,000 cubic yards of riprap would be removed and hauled to appropriate disposal sites or blended in with backfill.

The following paragraphs provide details for various features and tasks associated with the Soil Cement Alternative. Figures 4.2-1 through 4.2-3, which depict the footprint of the Preferred Alternative, are also representative of the footprint of Alternative 2 features (TCE, permanent footprint, staging areas, etc.).

Construction Phasing

Similar to the Preferred Alternative (Grouted Stone and Sheet Pile Alternative), construction would be initiated with the removal of existing ungrouted riprap and vegetation within the TCE, followed by installation of the dewatering system and excavation of the trench for construction of the soil cement structure. It is then anticipated that construction of the soil cement structure would take place in incremental phases in which the contractor would excavate and place soil cement and backfill for a few hundred feet. Then, the contractor would repeat the process on the next increment. This way excavation and backfill hauling distances are shortened. Finally, the side drains would be extended, dewatering system removed, SAR Trail restored, and temporarily impacted areas hydroseeding and replanted.

Water Diversion and Dewatering

Similar to the Preferred Alternative, no diversion or control of water in the active channel of the SAR would be required during construction. Dewatering would occur for soil cement construction, with the means and methods determined by the contractor. A common method is to construct dewatering wells near the excavation daylight and use sump pumps to lower groundwater levels until levels are below the bottom of the excavation.

Staging Areas

The same staging areas utilized under the Preferred Alternative would be used to construct the soil cement structure under Alternative 2. Two staging areas would be required along the main portion of the soil cement structure (Figures 4.1-1 and 4.1-2), with a third at a location to be determined, in the extension area near the BNSF rail line. Staging areas would be used for storage of construction equipment and materials and as turnaround areas. Under this alternative, a batch plant would also be sited in a staging area.

Access

Access to the Phase 5B area under Alternative 2 would also occur via East La Palma Avenue, the SAR Trail along the top of the LDY-S Levee, and the existing ramps off East La Palma to access an existing dirt access road at the base of the levee. Like the Preferred Alternative, no new access roads would be required.

Existing Levee Maintenance Road

Similar to the Preferred Alternative, the existing dirt access road along the base of the levee would be restored upon completion of construction, and would be used for subsequent O&M work.

Storm Drain Outlets

Modification to existing drains would also be required under the soil cement alternative. Similar to the Preferred Alternative, modification includes demolition of the existing outlet structures and flap gates, and reconstruction of the outlet structures and flap gates as well as extension of the RCPs.

Construction Equipment

Equipment to be used for construction of a soil cement structure under Alternative 2 would include, but is not limited to, excavators, front-end loaders, bulldozers, dump trucks, soil cement compactors (i.e., sheep-foot and smooth-wheel rollers), a grader, concrete pump trucks, water trucks, and a soil cement batch plant.

Construction Schedule

Construction of Alternative 2 would require at least an additional 2 months over the Preferred Alternative, and would be expected to take 26 to 28 months to complete. Clearing and grubbing would commence in August 2016 and would be initiated and completed outside of the bird breeding season (which in this area is February 15 through August 15) to avoid impacts to nesting birds. Sound walls, if needed, would also be constructed prior to March 1 of each year. Construction is expected to continue to approximately October 2018. Funding constraints, weather delays, and other issues could potentially move the construction timeline into 2019. Daily construction would occur between 8:00 a.m. and 5:00 p.m., Monday through Friday.

Site Preparation

As stated under the Preferred Alternative, site preparation activities would be completed outside of the bird breeding season to minimize impacts to nesting birds. Areas to be cleared and grubbed include the construction footprint and staging areas; no new haul roads are anticipated.

Temporary closure of the SAR Trail would also be required during construction of Alternative 2, with a temporary detour/bike path provided along the eastbound (south) lane of East La Palma Avenue.

4.2.3 No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, reconstruction of the existing bank protection structure to provide additional protection against bank failure from scour would not occur. Without adequate bank protection, the lower Santa Ana River may not be able to safely convey large controlled releases. Since the toe of the existing bank protection structure is not deep enough to protect against scour, embankment failure would be eminent and damage costs would far exceed the project costs. High flow

conditions through the project reach could undermine the structure and threaten portions of East La Palma Avenue, the Santa Ana River Trail, the BNSF rail line, commercial and industrial buildings and residential housing along the north bank of the SAR, the bridge abutment along the north bank of Gypsum Canyon Road, and utilities. Therefore, under the No Federal Action Alternative, East La Palma Avenue and infrastructure along it would periodically be threatened during high flow conditions, requiring emergency repairs of the existing bank protection. It is likely that any emergency repair would be limited in scope and duration and would likely entail the discharge of rocks to stabilize the embankment, and would not prevent against eminent bank failure.

Short Comparison of Alternatives 1, 2, and 3

An estimation of construction costs was calculated for the Preferred Alternative (Grouted Stone) and Alternative 2 (Soil Cement) to determine which alternative would yield the most feasible and economic benefit. Based on prior bids for grouted stone versus soil cement, the cost differential is approximately $500 higher per linear foot of construction for soil cement. This indicates that implementation of the Preferred Alternative would save about $10 million. In addition to cost saving, based on previous construction along Reach 9, the Preferred Alternative of grouted stone would require an approximate 6-month shorter construction duration compared to Alternative 2.

Both the Preferred Alternative and Alternative 2 would provide the same level of protection with respect to hydraulic aspects of the project, while having similar environmental impacts. Under both alternatives, the grouted stone and soil cement bank protection structures would be constructed at a 2H:1V slope, resulting in similar permanent and temporary impacts. Implementation of either alternative would result in a minor increase in the permanent footprint of the structure along the deepest portion of the buried toe; however, it is likely that most or all of this structure would remain buried and therefore have little or no impact on the amount or function of floodplain habitat in which the alternatives would be constructed. As a result, the Preferred Alternative and Alternative 2 are both equally the LEDPA. Under the No Federal Action Alternative, there would be no cost to construct new bank protection and permanent and temporary impacts resulting from implementation of the Grouted Stone Alternative or the Soil Cement Alternative would not occur. As a result, protection from future scour associated with 30,000 cfs releases from Prado Dam would not be constructed, leading to the potential for high flow conditions through the project reach to undermine existing bank protection and threaten infrastructure along the north bank of the SAR.

Differences in O&M

No differences would occur in OMRR&R activities required for the Grouted Stone Alternative and Soil Cement Alternative. Both utilize hard material (i.e., grouted stone and soil cement) and their protection level against erosion and scouring would be the same; therefore, OMRR&R would be similar.

4.2.4 Alternative Eliminated from Further Consideration

Sheet Pile

Under this alternative, existing revetted embankment within the Phase 5B work area would be left intact and sheet pile walls would be constructed in uplands immediately behind the existing embankments. Individual panels, approximately 2 feet wide, would be driven from the top of the embankment approximately 10 to 15 feet past the projected scour depth (approximately 10 feet below the invert). The panels would be held in place by horizontal rods (tiebacks) that would be driven into the soil.

Installation of a sheet pile wall at the top of the existing bank would not require clearing and grubbing of riparian vegetation and mitigation associated with such activities; and would not require work in the SAR. Noise control during sheet pile construction would be required to minimize impacts to adjacent habitat where special-status species have been documented. While this alternative offers less environmental impact (the temporary impact area would be reduced), the construction cost estimate for installation of a sheet pile wall would be 3.5 and 2.5 times more than that of grouted stone (Preferred Alternative) and soil cement (Alternative 2), respectively. This is not considered practicable considering that the "permanent" impact area associated with the extended toe (7.76 acres) is likely to remain buried far beneath a vegetated backfill along most, if not all, of the project length. As a result, this alternative is not recommended for implementation and will not be analyzed further in this document.

4.3 Description of Phase 4 Alternatives

Phase 4 is located along the south (left) bank of the SAR, parallel to SR-91. It extends from approximately 1,750 feet downstream (west) of the Coal Canyon exit, and continues downstream to tie directly into the Phase 3 soil cement bank protection structure (Figure 2-3). The existing bank in the Phase 4 area includes soil cement; however, the soil cement is not strong enough or deep enough to provide adequate protection to the embankment of heavily transited SR-91 against scour, erosion, and impingement forces. The proposed project would provide protection to the embankment of SR-91; to the newly relocated SARI Line; and to the Santa Ana River Trail, which lies between the Santa Ana River and SR-91.

4.3.1 Phase 4: Soil Cement Alternative (Alternative 1, Preferred Alternative)

Under this alternative, an approximate 3,150-foot-long soil cement structure would be constructed along an established alignment. If existing soil cement is encountered during excavation it will be demolished. The new structure would be approximately 30 feet in height and 10 feet in width, and placed at a 1H:1V slope. Approximately 10 feet would be exposed above-ground, with the remaining structure buried. The areas of the exposed and buried portions of the soil cement structure are approximately equal at 1.5 acres each.

A trapezoidal cut is required to place the soil cement structure. The excavation footprint would be approximately 100 feet wide along the 3,150-foot span. Approximately 135,000 cubic yards of alluvial

substrate would be excavated. The volume of the soil cement structure would be approximately 40,000 cubic yards.

Existing soil cement may be encountered during excavation. If encountered, soil cement would be demolished with the option to dispose off-site or process it for reuse as backfill, if it is deemed suitable for construction. Any excavated material not suitable for the soil cement mix or for backfill would be disposed of off-site. The following paragraphs provide details for various features and tasks associated with this alternative. Figures 4.3-1 and 4.3-2 show the location of features associated with this alternative. The TCE is approximately 35 acres and would include the soil cement structure, haul roads, staging areas, stockpile areas, location of batch plant, the temporary bike path during construction, and the restored bike path. Width of the TCE varies, with the limit of the TCE on the land side and river side of the project varying from approximately 35 to 110 feet and 120 to 170 feet, respectively, from the control line. Figure 4.3-3 depicts a representative section of the soil cement bank protection proposed under this alternative.

A 16-foot wide road of decomposed granite will be installed immediately along the south side of the soil cement structure. The road will serve dual purposes – it will be used for future operations and maintenance (O&M) and as a pedestrian trail. The road will traverse both Phase 4 and Phase 3, which was completed just west of Phase 4. Installation of the road through both of these phases will occur under the Phase 4 construction contract. Additionally, a 12-foot wide paved bike trail will be installed adjacent and south of the new road. This permanent trail will replace the temporary bike trail that currently passes through Phases 3 and 4. Installation of the new road and trail will occur within the temporary construction easement of Phase 4. No maintenance road or future vegetation clear zone is proposed south of the base (river flow side) of the proposed bank protection.

Construction Phasing

The anticipated construction sequence is as follows: clear and grub, placement of sound wall, installation of dewatering system, excavation of toe, stockpile material, placement of soil cement, backfill, extension of side drains, removal of dewatering system, construction of permanent bike path, removal of temporary bike path, and hydroseeding and replanting.

Clearing and grubbing is expected to be completed prior to the beginning of the 2016 bird breeding season. The bird breeding season in this area is between February 15 and August 15. Sound walls, where needed, would be erect at all times when construction activities are on-going during the bird breeding season. The sound wall can only be installed or removed outside of the bird breeding season and remain erect at all times when construction activities are on-going during the bird breeding season. The installation of the dewatering system and excavation will begin mid-April 2016, or later. Due to the length of the project and safety concerns, the soil cement revetment will be constructed in segments. The total excavation and stockpiling would require approximately 3 months and the placement of soil cement would require approximately 5 months. Backfilling and compaction of the toe would require approximately 2 months. Construction of the restored permanent bike path and demolition of the

temporary bike path would have an expected duration of 3 months, followed by approximately 4 months of hydroseeding and replanting.

Water Diversion and Dewatering

The low flow channel of the SAR meanders adjacent to Phase 4. The distance between the project alignment and low flow is sufficient that diversion of the low flow is not anticipated as part of the project. In general, the minimum distance between the project alignment and the low flow is approximately 200 feet. Drainage from existing outlet structures would occur via existing flow paths during construction. In addition, the project would require dewatering of groundwater during excavation, placement of soil cement, and backfilling. The dewatering means and methods would be determined by the contractor; however, a common method is to construct dewatering wells near the excavation daylight and use sump pumps to lower groundwater levels until levels are below the bottom of the excavation.

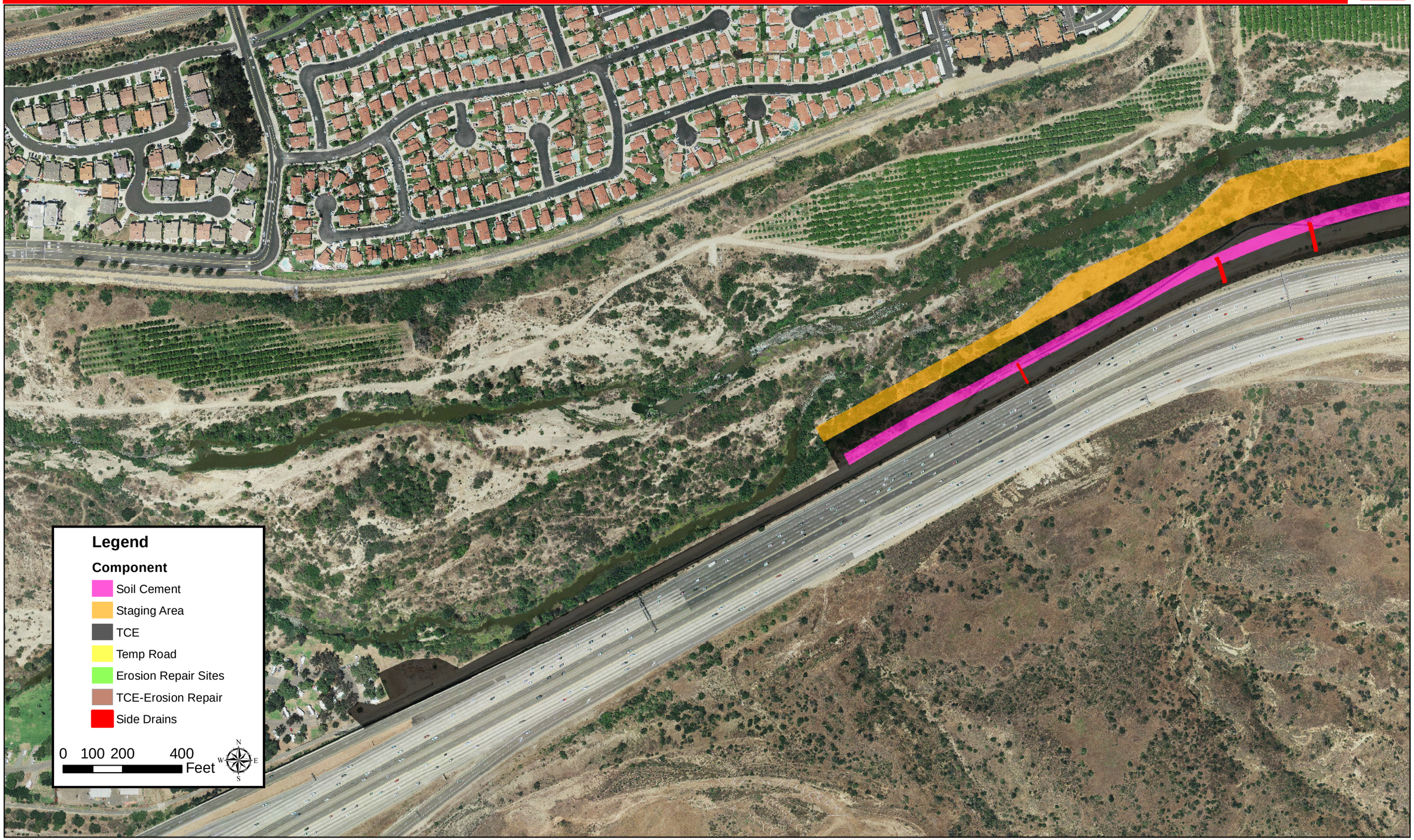
Staging Areas

Approximately 5.7 acres of land would be used for staging, stockpiling, and the soil cement batch plant. Available land is located parallel to the proposed soil cement alignment, on the river side of the project, as depicted in Figures 4.3-1 and 4.3-2 below. The specific location of the stockpile area and batch plant within the staging area would be determined by the contractor during coordination with the Construction Officer's Representative.

Access

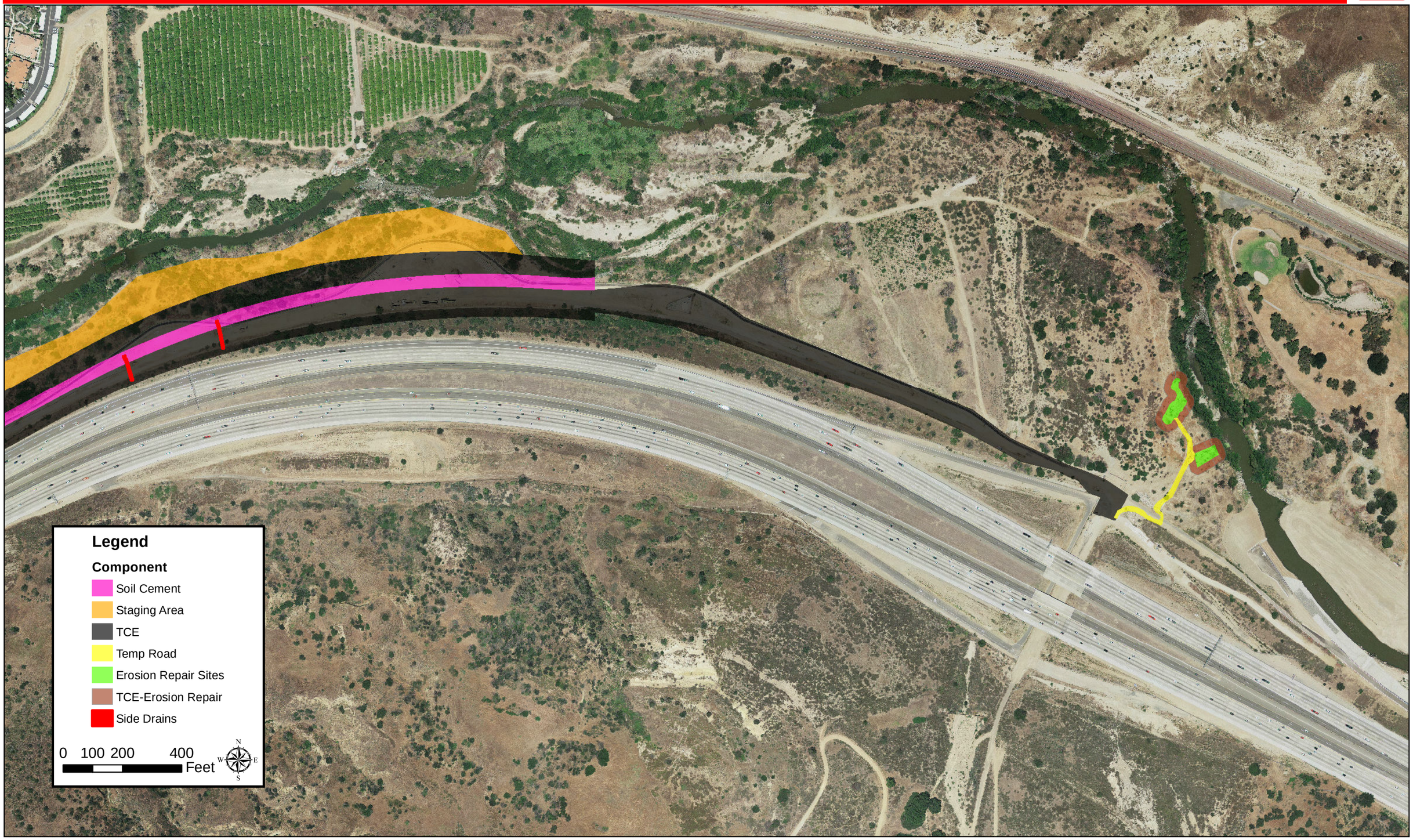
Access to Phase 4 would occur via Coal Canyon Road off-ramps from SR-91. Once equipment and workers exit at Coal Canyon, they would be able to immediately access Phase 4 via existing access roads that run west (downstream) of Coal Canyon, parallel to SR-91. This route is currently used to access the Phase 3 bank protection project, which lies downstream of Phase 4. Access roads would remain upon completion of Phase 3 for use during Phase 4 construction. No new haul roads are anticipated for project construction.

Figure 4.3-1 Phase 4 Soil Cement-Project Features



This page intentionally left blank.

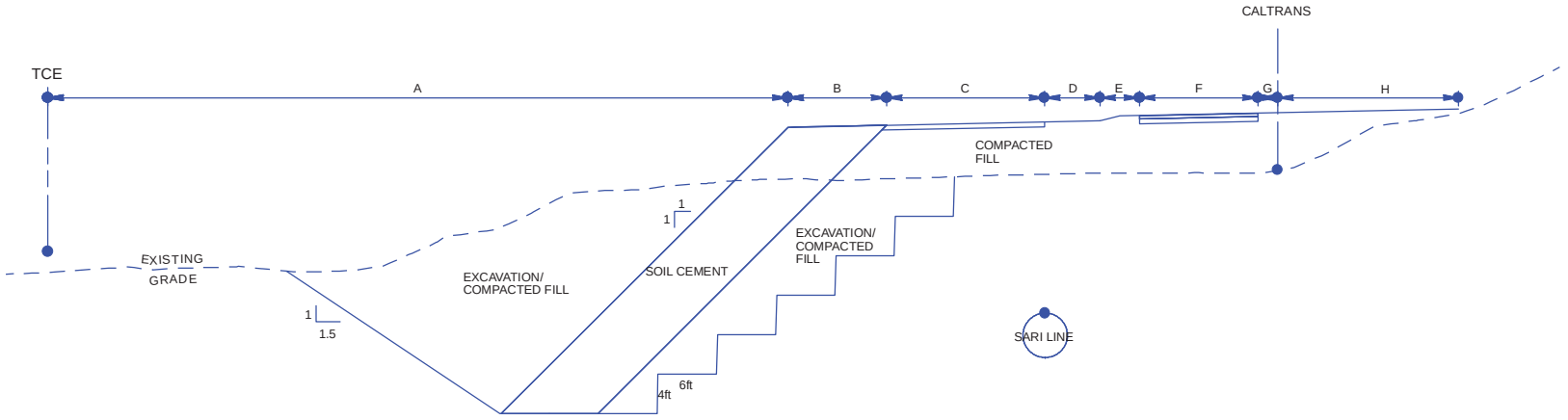
Figure 4.3-2 Phase 4 Soil Cement-Project Features



This page intentionally left blank.

LSAR R9 - PHASE 4 - TYPICAL CROSS-SECTION

A - DISTANCE BETWEEN TCE (RIVER-SIDE) AND EDGE OF SOIL CEMENT = VARIES
B - WIDTH OF SOIL CEMENT = 10 FT
C - WIDTH OF DG ROAD = 16 FT
D - WIDTH OF UPLAND AREA MIX = VARIES
E - WIDTH OF BIKE PATH SHOULDER = 2 FT
F - WIDTH OF PERMANENT BIKE PATH = 12 FT
G - WIDTH OF BIKE PATH SHOULDER = 2 FT
H - WIDTH OF FILL WITHIN CALTRANS RW = VARIES



Source: ACOE 2014

;

REACH 9 PHASE 4, 5A, 5B & BNSF SEA/EIR ADDENDUM

FIGURE 4.3-3
Phase 4 - Typical Soil Cement Section

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Path: P:\2014\60279208-Reach_9_SEA\900-CAD-GIS\920 GIS-Graphics\925_Docs\Phase4_Sections.mxd, 11/10/2014, wallacerj

This page intentionally left blank.

Roads

A 16-foot wide road of decomposed granite would be installed immediately along the south side of the soil cement structure, as shown on the Phase 4 cross section (Figure 4.3-3). The road would serve a dual purpose—utilized for O&M and as a future pedestrian trail. The road will traverse both Phase 4 and Phase 3, which is nearing completion just west of Phase 4. Installation of the road through both of these phases will occur under the Phase 4 construction contract. Additionally, a 12-foot wide paved bike trail will be installed adjacent and south of the new road (see Figure 4.3-3). This permanent trail will replace the temporary bike trail that currently passes through Phases 3 and 4. Installation of the new road and trail will occur within the TCE of Phase 4.

Storm Drain Outlets

There are four existing interior side drains within the limits of the project. Three of the side drains will be extended through the designed soil cement structure. The side drains to be extended include one 24-inch RCP, and two 5-foot by 5-foot reinforced concrete boxes (RCBs). The modification includes demolition of the existing outlet structures, extension of the RCP and the RCBs, then reconstruction of the outlet structures. A drop inlet structure and a 48-in RCP, located near the upstream end of the project, will be constructed and will penetrate through the soil cement. The purpose of this side drain is to capture flows from a nearby 3-foot by 3-foot reinforced concrete box and to capture surface flows from the surrounding area.

Construction Equipment

Equipment anticipated to be used for construction of the soil cement structure under this alternative would include, but is not limited to, excavators, front-end loaders, bulldozers, dump trucks, soil cement compactors (i.e., sheep-foot and smooth-wheel rollers), a grader, concrete pump trucks, water trucks, and a soil cement batch plant. The project will require approximately 60,000 cy of fill material. The designated borrow site is within Prado Basin. One-way trip from the borrow site to the project site is approximately 15 miles. It is assumed that the fill material will be imported using double-belly dump trucks. Each truck can carry approximately 15 cy of material; therefore, a total of approximately 4,000 truck trips will be required. The number of truck trips per day depends on the Contractor's productivity and available resources. A high productivity rate could result in as many as 100 truck trips per day. .

Construction Schedule

It is expected that Phase 4 would be awarded in September 2015 with a Notice to Proceed issued shortly thereafter. Construction is expected to continue to approximately December 2017. Funding constraints, weather delays, and other issues could potentially delay the construction completion date. Daily construction would occur between 8:00 a.m. and 5:00 p.m., Monday through Friday.

Site Preparation

Site preparation activities would be completed outside of the bird breeding season to minimize impacts to nesting birds. Areas to be cleared and grubbed under this project include the staging area, the construction footprint, and the location for the soil cement batch plant; no new haul roads are anticipated. A temporary detour of the SAR Trail around the construction site would also be established within the TCE.

Future Operations and Maintenance

Future O&M activities would entail structural and non-structural repairs, and inspections. Maintenance of the structures would be required per the SARMP OMRR&R manual and as determined by the field superintendent. It is anticipated that major structural repairs would be needed infrequently, if at all, during the life of the project. Minor repairs of discreet areas, most likely on the exposed embankment, may be required following larger flow events.

- ***Structural Repairs:*** Damaged sections would be removed by a hoe ram or by cutting with a concrete saw. The exposed cut surface would be power-washed using clean (potable) water and broom cleaned to remove all loose or friable pieces or fragments of the soil cement. The exposed cut surface would then be pre-moistened before placing new soil cement or other acceptable repair material.

  Repair work in small or confined areas may utilize concrete mix instead of soil cement since it is typically difficult to place and properly compact soil cement in a confined space. The concrete mix would be poured in place, vibrated to remove voids, and allowed to cure without compacting.

  The repaired sections would be anchored to the soil cement embankment with reinforcing bar dowels. These dowels would be approximately 3 feet in length and would typically be installed on 18-inch centers in a grid pattern over the cut face of the soil cement. Dowels would extend approximately 18 inches into the existing soil cement embankment, using a 1.25-inch-diameter drilled hole, and would be secured using a two-part epoxy specifically designed for rebar embedment.

  Repair of large sections would utilize soil cement, which would be compacted into place. Large sections would not typically require anchors.

  If repairs require excavation to the toe-down and work within the watercourse, the minimum amount of vegetation required to undertake the repair would be removed. The work area would be dewatered with portable dewatering structures such as k-rails or coffer dams. Upon completion of work, the dewatering structures would be removed, and the area would be allowed to revegetate via natural recruitment or replanted. The non-federal sponsor would be

required to obtain necessary permits for any work that requires river diversion, major excavation and vegetation removal outside of routine maintenance areas.

O&M activities associated with the SAR Trail and interior side drains may also occur.

- ***Non-Structural Repairs:*** Non-structural repairs would entail removal of vegetation that may grow on the soil cement structure, debris, and small mammal burrows from the earthen embankment that supports the soil cement structure. Use of herbicides or rodenticides, if needed, would be applied in a manner to avoid impacts to non-target species.

- ***Equipment***: Equipment utilized during routine O&M activities would include pickup trucks, ½- and ¾-ton trucks, spray rigs, fence trucks, bobcats, bulldozers, loaders, backhoes, tractors, transports, motor graders, cranes, water trucks, 5- and 10-yard dump trucks, and excavators.

- ***Inspections:*** Inspections of all project features after each major storm event would be required.

Additional Work to Be Conducted under Phase 4: State Parks, Phase 2B Gully Erosion Repair

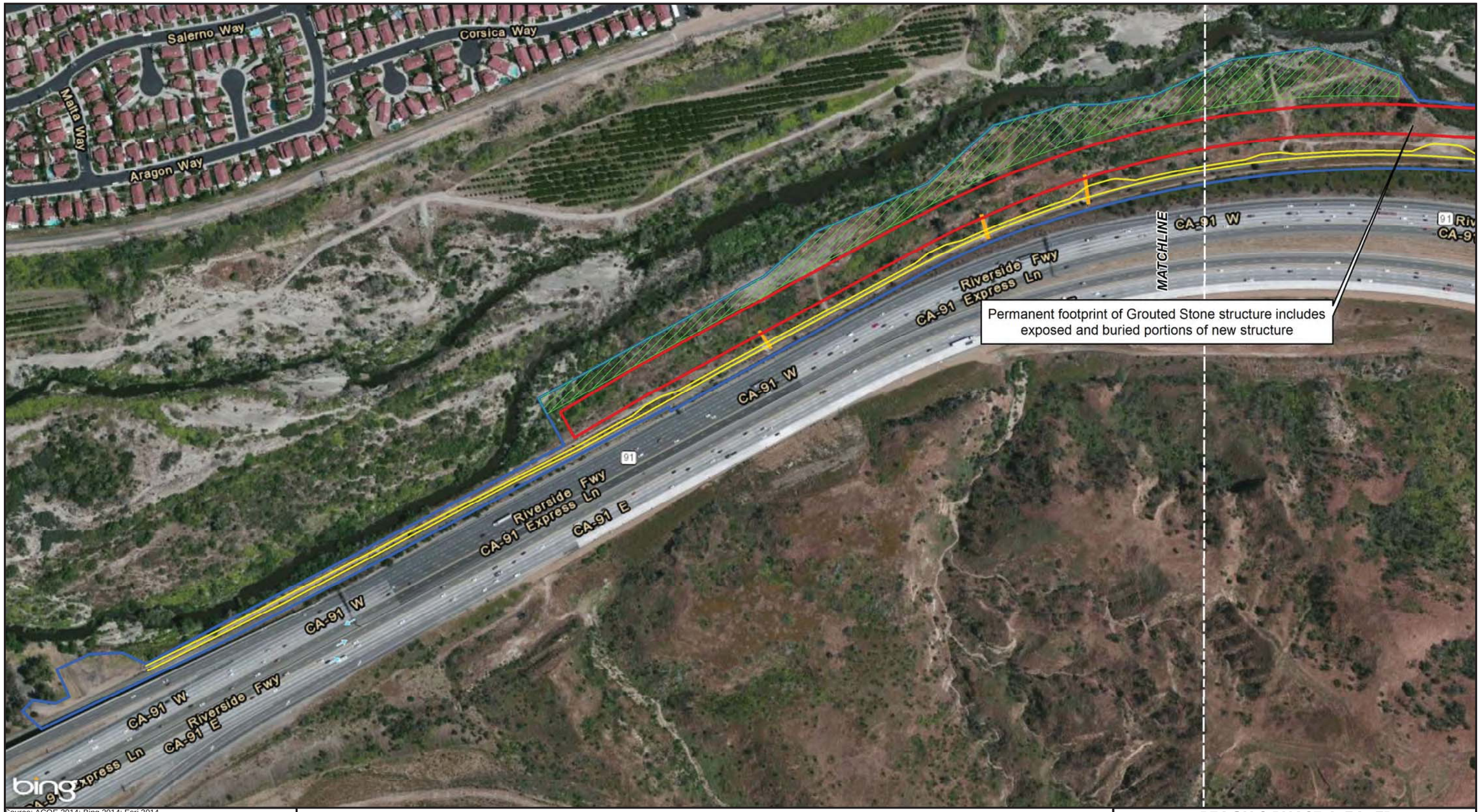
During Reach 9, Phase 2B construction, the construction contractor encroached upon State Parks property on or around January 2011 in the vicinity of Coal Canyon. As reparation for the encroachment, OCFCD, State Parks, and the Corps agreed that the Corps will repair two off-site gully erosion areas just east of Phase 4, as shown in Figure 4.3-2. This repair will take place as part of the Phase 4 construction contract.

Repair of the two gully erosion areas will cover a total of approximately 0.35 acre and will include stabilizing; grading areas to 2H:1V slopes or flatter; revegetating; establishing vegetation; monitoring; and removing non-natives for a total of 5years.

4.3.2 Phase 4: Grouted Stone Alternative (Alternative 2)

Under this alternative, the existing soil cement embankment would be removed, and an 80-foot-wide, trapezoidal-shaped trench would be excavated along the 3,970-foot-long embankment. A compacted earthen embankment would be constructed at a 2H:1V slope. The slope would be protected by a 2-foot-thick concrete layer embedded with stones. Launchable derrick stone would be placed at the toe of the structure to provide further protection. The structure would be approximately 28 feet high. Approximately 18 feet of the structure would be buried beneath the channel invert in a typical cross section, while the upper 10 feet would remain exposed above the channel invert. A combined total of approximately 100 cubic yards of alluvial substrate would be excavated. The excavated material would be used to backfill the trench. The following paragraphs provide details for various features and tasks associated with Alternative 2. Figures 4.3-4 through 4.3-5 depict the footprint of Alternative 2.

This page intentionally left blank.



Source: ACOE 2014; Bing 2014; Esri 2014

0 75 150 300 Feet

Scale: 1:3,600 ; 1 inch = 300 feet

Legend

- Staging Area
- Permanent Grouted Stone
- Temporary Construction Easement
- Side Drains
- Maintenance Road

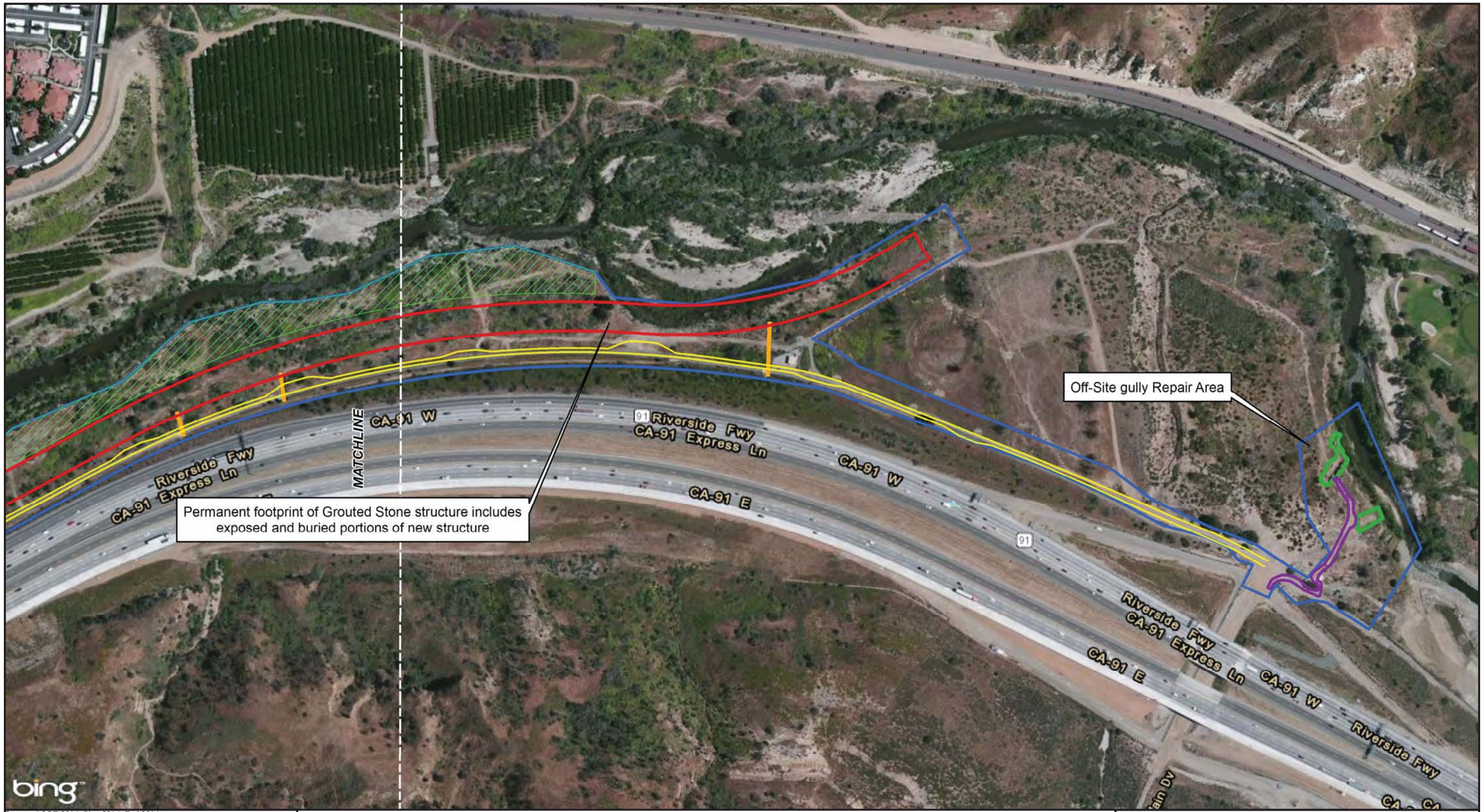
REACH 9 PHASE 4, 5A, 5B & BNSF SEA/EIR ADDENDUM

FIGURE 4.3-4
PHASE 4 Grouted Stone - Project Features

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Path: P:\2014\60279208-Reach_9_SEA\900-CAD-GIS\920 GIS-Graphics\925_Docs\Aerial_Base_Phase4_ver2_Alt2.mxd, 1/22/2015, wallacerj

This page intentionally left blank.



Source: ACOE 2014; Bing 2014; Esri 2014

0 75 150 300 Feet

Scale: 1:3,600 ; 1 inch = 300 feet

Legend

- Staging Area
- Permanent Grouted Stone
- Temporary Construction Easement
- Side Drains
- Maintenance Road
- Access Road
- Erosion Repair Sites

REACH 9 PHASE 4, 5A, 5B & BNSF SEA/EIR ADDENDUM

FIGURE 4.3-5
PHASE 4 Grouted Stone - Project Features

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Path: P:\2014\60279208-Reach_9_SEA\900-CAD-GIS\920 GIS-Graphics\925_Docs\Aerial_Base_Phase4_ver2_Alt2.mxd, 1/23/2015, wallacerj

This page intentionally left blank.

Construction Phasing

Similar to the Preferred Alternative (Soil Cement Alternative), the anticipated construction sequence would be as follows: clear and grub, placement of sound wall, installation of dewatering system, excavation of toe, stockpile material, placement of grouted stone, backfill, extension of side drains, removal of dewatering system, construction of permanent bike path, removal of temporary bike path, and hydroseeding and replanting.

Clearing and grubbing is expected to be completed prior to the beginning of the 2016 bird breeding season. The bird breeding season is February 15 through August 15. Sound walls, where needed, would be erect at all time when construction activities are on-going during the bird breeding season. The sound wall can only be installed or removed outside of the of the bird breeding season. The installation of the dewatering system and excavation would begin no earlier than mid-April 2016. Due to the length of the project and safety concerns, the grouted stone revetment will be constructed in segments. The total excavation and stockpiling would require approximately 3 months and the placement of grouted stone would require approximately 3 to 4 months. Backfilling and compaction of the toe would require approximately 2 months. Construction of the restored permanent bike path and demolition of the temporary bike path would have an expected duration of 3 months, followed by approximately 4 months of hydroseeding and replanting.

Water Diversion and Dewatering

The low flow channel of the SAR meanders adjacent to Phase 4; however, the distance between the alignment of Alternative 2 would be sufficient so that diversion of the low flow under Alternative 2 would also not be anticipated as part of the project. Similar to the Preferred Alternative, the project would require dewatering during excavation, placement of grouted stone, and backfilling. The dewatering means and methods would be determined by the contractor; however, a common method is to construct dewatering wells near the excavation daylight and use sump pumps to lower groundwater levels until levels are below the bottom of the excavation.

Staging Areas

The same approximately 5.7-acre area of land would be used for staging and stockpiling under Alternative 2. This land is located parallel to the proposed grouted stone alignment, on the river side of the project, as depicted in Figures 4.3-1 and 4.3-2. The specific location of the stockpile area within the staging area would be determined by the contractor during coordination with the Construction Officer's Representative.

Access

Access under Alternative 2 to the Phase 4 project would also occur via Coal Canyon Road off-ramps from SR-91 and existing access roads that run west (downstream) of Coal Canyon, parallel to SR-91. New haul roads are also not anticipated for project construction under Alternative 2.

Roads

Similar to the Preferred Alternative, a road of decomposed granite would be installed along the south (SR-91) side of the grouted stone structure, which would serve a dual purpose—utilized for O&M and as a future pedestrian trail.

Storm Drain Outlets

Similar to the Preferred Alternative, four side drains would be extended through the grouted stone structure. Modification would include demolition of the existing outlet structures, extension of the RCP and the RCBs, and reconstruction of the outlet structures.

Construction Equipment

Equipment anticipated to be used for construction of Alternative 2 would include, but is not limited to, excavators, front-end loaders, bulldozers, dump trucks, a grader, concrete pump trucks, and water trucks.

Construction Schedule

It is expected that Phase 4 would be awarded in September 2015 with a Notice to Proceed issued shortly thereafter. Construction of Alternative 2 would be expected to be of similar duration to the Preferred Alternative. Clearing and grubbing would need to be completed outside of the bird breeding season (which in this area is February 15 through August 15). Sound walls, if needed, would be constructed prior to March 1 of each year. Construction is expected to continue to approximately December 2017. Funding constraints, weather delays, and other issues could potentially delay the construction completion date. Daily construction would occur between 8:00 a.m. and 5:00 p.m., Monday through Friday.

Site Preparation

Similar to the Preferred Alternative, site preparation activities would be completed outside of the bird breeding season to minimize impacts to nesting birds. Areas to be cleared and grubbed under this project include the staging area and construction footprint. A temporary detour of the SAR Trail around the construction site would also be established within the TCE.

4.3.3 No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, reconstruction of the existing bank protection structure to provide additional protection against bank failure from high flows and scour would not occur. Without adequate bank protection, the lower Santa Ana River may not be able to safely convey large controlled releases. Since the toe of the existing bank protection structure is not deep enough to protect against scour associated with high flow events, future high flow conditions through the project reach could undermine the structure and threaten portions of SR-91 along the south bank of the Santa Ana River. Periodic emergency repairs of the existing bank protection could be required. It is likely that any

emergency repair would be limited in scope and duration and would likely entail the discharge of rocks to stabilize the embankment, and would not prevent against eminent bank failure.

Short Comparison of Alternatives 1, 2, and 3

An estimation of construction costs was calculated for the Preferred Alternative (Soil Cement) and Alternative 2 (Grouted Stone) to determine which alternative would yield the most feasible and economic benefit. Based on prior bids for grouted stone versus soil cement, the cost differential is approximately $500 higher per linear foot of construction for the preferred soil cement alternative. This indicates that implementation Alternative 2 would save about $1,985,000. In addition to cost saving, based on previous construction along Reach 9, the grouted stone alternative would require an approximately 2-month shorter construction duration compared to the Preferred Alternative.

Both the Preferred Alternative and Alternative 2 would provide the same level of protection with respect to hydraulic aspects of the project. The Preferred Alternative, however, would result in less permanent and temporary impacts during construction. Construction of the Preferred Alternative (Soil Cement) would result in 3.38 and 25.22 acres of permanent and temporary impacts, respectively. Alternative 2 (Grouted Stone) would result in 4.35 and 24.22 acres of permanent and temporary impacts, respectively. Although the TCE of both alternatives is similar, permanent impacts under the Preferred Alternative would be less than half of Alternative 2. Either alternative's permanent footprint would occur along the deepest portion of the buried toe, where it is likely that most or all of this structure would remain buried and therefore have little or no impact on the amount or function of floodplain habitat in which the alternatives would be constructed. However, since impacts would be less under the Preferred Alternative, it would be carried forward as the LEDPA. Under the No Federal Action Alternative, there would be no cost to construct new bank protection, and permanent and temporary impacts resulting from implementation of either the Preferred Alternative or Alternative 2 would not occur. As a result, protection from future scour associated with 30,000 cfs releases from Prado Dam would not be constructed, leading to the potential for high flow conditions through the project reach to undermine existing bank protection and threaten infrastructure along the south bank of the SAR.

Differences in O&M

There would be no differences in OMRR&R activities between the Preferred Alternative and Alternative 2, because both alternatives implement hard material (i.e., soil cement and grouted stone), which, when finished, provide the same level of protection against erosion and scouring. Therefore O&M would generally be the same.

Other aspects of the alternative, such as dewatering structures, staging areas, storm drains, construction equipment, and construction window, would in general be similar to the Soil Cement Alternative.

4.3.4 Alternative Eliminated from Further Consideration

Sheet Pile

Under this alternative, existing revetted embankment within the Phase 4 work area would be left intact and sheet pile walls would be constructed in uplands immediately behind the existing embankments. Individual panels, approximately 2 feet wide, would be driven from the top of the embankment approximately 10 to 15 feet past the projected scour depth (approximately 10 feet below the invert). The panels would be held in place by horizontal rods (tiebacks) that would be driven into the soil.

Installation of a sheet pile wall at the top of the existing bank would not require clearing and grubbing of riparian vegetation, and mitigation associated with such activities; and would not require work in the SAR. However, due to the presence of the SARI Line behind the existing soil cement structure, only a narrow area is available to install sheet pile behind existing protection. Additionally, noise control during sheet pile construction would be required to minimize impacts to adjacent habitat where special-status species have been documented. While this alternative offers better control of environmental aspects, the construction cost estimate for installation of a sheet pile wall would be 3.5 and 2.5 times more than that of grouted stone (Preferred Alternative) and soil cement (Alternative 2), respectively. As a result, this alternative is not recommended for implementation and will not be analyzed further in this document.

4.4 Description of BNSF Railroad Bridge Alternatives

The BNSF railroad bridge is located at the transition between Reach 9, Phases 2A and 2B channel improvements. There are three separate bridges, each with one track. The upstream (north) track bridge was constructed in 1938. Bridge piers are constructed of reinforced concrete and are supported on steel H-piles, and the bridge superstructure consists of steel plate girders and truss. In 1995, Atchison Topeka & Santa Fe Railway (AT&SF), owners of the railroad, designed and constructed two parallel track bridges downstream of the 1938 bridge. The 1995 bridge piers and superstructures are constructed of reinforced concrete and also supported on steel H-piles. The abutments of the 1938 and 1995 bridges are protected with a sheet pile and tieback wall. The east abutment sheet pile wall also protects Pier No. 1 of the 1938 bridge, and the west abutment sheet pile wall also protects Pier No. 6 of both the 1938 and 1995 bridges. Under the BNSF project, additional scour protection for the piers and abutments of the existing bridges would be constructed to protect from scour caused by a controlled flood event from Prado Dam (up to 30,000 cfs), including long-term scour of the riverbed and local scour of the piers. It is anticipated that BNSF Bridge work would be awarded in fiscal year (FY) 2015 and that construction would begin in FY 2016 and require approximately 3 years.

4.4.1 Pier and Abutment Protection Alternative (Alternative 1, Preferred Alternative)

Under this alternative, reinforced concrete walls, sheet pile and reinforced concrete diaphragm walls, and grouted stone protection would be constructed to provide additional scour protection to bridge piers and abutments, and tie previously constructed bank protection along the east bank of the channel

into the existing eastern bridge abutment. Reinforced concrete enclosure walls would be installed around Pier Nos. 2 through 5 and reinforced concrete pier nose extension walls would be constructed immediately upstream of these piers. This alternative provides for construction of the sheet pile and reinforced concrete diaphragm walls with tieback anchors parallel to existing Pier Nos. 1 and 6 to guide the design flow safely under the bridge. Additionally, 24-inch grouted stone bank protection would be installed to tie the existing bridge abutment along the east bank of the river channel (Pier No. 1) into bank protection installed upstream (Phase 2A) and downstream (Phase 2B) of the BNSF bridge. The toe of the bank protection will match the existing toe depths for Phase 2A (el. 401) and mobile home park (el. 398) bank protection. The grouted stone on the river side of the sheet pile wall will be mostly buried. Figure 4.4-1 depicts the locations of permanent bridge and bank protection features and the temporary construction easement associated with this alternative.

The amount and types of "fill material" associated with this alternative includes 6,175 cy of grouted stone, 637 cy of bedding material under the grouted stone, 4,000 cy of concrete for the pier nose extension walls (1,000 cy each), 1,360 linear feet of H-Piles under each of the pier nose extensions (total of 5,440 linear feet), and 15,200 cy of concrete for the reinforced concrete diaphragm walls.

Construction Phasing

Construction of BNSF Bridge and river bank protection features would be initiated with clearing and grubbing of vegetation inside the project's permanent footprint and other areas required for construction outside of the nesting season (which in this area is February 15 through August 15). If necessary, sound barriers would be installed prior to March 1 of each year. The installation of dewatering wells, pumps, discharges, and collection systems needed to provide dry excavations for construction of project features would occur simultaneously, and/or follow clearing and grubbing. Sheet piles may also be installed to help slow down water percolation into the work sites. A diversion of the active river channel would also be necessary during structural excavation. The timing and methods of this diversion will be coordinated with USFWS to minimize impacts to native fish.

The construction of in-river bridge protection features would occur first. Activities would begin with the construction of below-grade diaphragm walls to protect the bridge abutments. These walls would require tieback tendons. Pier wall extensions would then be constructed on H-piles, and excavation and installation of four flat web sheet pile walls to protect the existing bridge piers would follow.

Following the completion of in-stream features, a 24-inch layer of grouted stone would be placed on 6-inch bedding material along the slope on the east side of the river. Derrick stone would be placed at the toe of the grouted stone protection.

Project activities would be completed by extending side drain through the grouted stone, installing 3.5-foot-high concrete masonry unit wall, replacing a portion of the concrete golf cart path along the west bank, grading and paving of ramps on the east side of the SAR to tie into existing roads and trails, and incidental work.

Water Diversion and Dewatering

An active river channel and high groundwater table occur in the BNSF Bridge measure, which would require dewatering to install bridge protection features. The active channel of the SAR currently flows between Pier Nos. 4 and 5 and a water diversion would be required to dewater the active channel for installation of bridge pier nose walls and enclosure walls at these piers. The specific method and location of the river diversion will be proposed by the contractor.

Staging Areas

Staging would occur within and throughout the TCE as needed to construct the project.

Access

Access to the BNSF Bridge area would occur via SR-91 and Green River Road, and on temporary access/haul roads on the golf course adjacent to the Green River Mobile Home Park levee.

Project design has provided for continued emergency ingress and egress for the Green River Home Owner's Association under the railroad bridge during and after construction.

Roads

The existing Green River Mobile Home Park bank protection maintenance road would be utilized for permanent access to the project from the south and the Phase 2A bank protection maintenance road for permanent access from the north. The emergency ingress and egress access road under the bridge would remain after project construction. Access roads on the east abutment will either be composed of dirt, aggregate base or DG, except for the ramp and landing area (concrete) and the HOA emergency access road (AC). The existing access from Green River Road that had been identified as a temporary access for Mobile Home Park construction will be relocated approximately 200 feet to the east (or an alternative location as coordinated with FWS) to minimize potential impacts to the adjacent B Canyon wildlife corridor, and will become a permanent access road.

Storm Drain Outlets

Existing side drains belonging to OCFCD would be extended through new bank protection on the east side of the SAR. New outlet drains would be constructed where the bank protection embankment crosses existing drainage paths.

Construction Equipment

Equipment to be used for construction of bridge and bank protection features under this alternative would include, but is not limited to, cranes, bulldozers, excavators, compactors, dump trucks, rollers, pickup trucks, earth augers, vacuum trucks, pile drivers, low overhead drill rigs, and low headroom hydromill. Additionally, delivery trucks would be associated with imported materials; 20 daily truck trips are anticipated on average.

Construction Schedule

Construction is expected to take approximately 3 years to complete. Clearing and grubbing is proposed to begin in 2016 and would need to be completed outside of the bird breeding season (which in this area is February 15 through August 15). Construction is expected to continue to approximately 2018. Funding constraints, weather delays, and other issues could potentially move the construction timeline beyond 2019. Daily construction would occur between 7:00 a.m. and 4:00 p.m., Monday through Friday.

Site Preparation

Site preparation activities would be completed outside of the bird breeding season to minimize impacts to nesting birds. Areas to be cleared and grubbed under this project include the staging area and construction footprint; no new haul roads are anticipated outside the footprint of the TCE. Initial site work would also include protecting utilities in place or relocating them.

Future Operations and Maintenance

Future O&M activities would entail structural and non-structural repairs, and inspections. Maintenance of the structures would be required per the SARMP OMRR&R manual and as determined by the field superintendent. It is anticipated that major structural repairs would be needed infrequently, if at all, during the life of the project. Minor repairs of discreet areas, most likely on the exposed embankment, may be required following larger flow events.

- ***Structural Repairs:*** Damaged sections would be removed by a hoe ram or by cutting with a concrete saw. The exposed cut surface would be power-washed using clean (potable) water and broom cleaned to remove all loose or friable pieces or fragments of the soil cement. The exposed cut surface would then be pre-moistened before placing new soil cement or other acceptable repair material.

  Repair work in small or confined areas may utilize concrete mix instead of grouted stone since it is typically difficult to place and properly compact soil cement in a confined space. The concrete mix would be poured in place, vibrated to remove voids, and allowed to cure without compacting.

  The repaired sections would be anchored to the soil cement embankment with reinforcing bar dowels. These dowels would be approximately 3 feet in length and would typically be installed on 18-inch centers in a grid pattern over the cut face of the soil cement. Dowels would extend approximately 18 inches into the existing soil cement embankment, using a 1.25-inch-diameter drilled hole, and would be secured using a two-part epoxy specifically designed for rebar embedment.

  Repair of large sections would utilize soil cement, which would be compacted into place. Large sections would not typically require anchors.

This page intentionally left blank.

BNSF: Project Features

Legend

BNSF Project Features

- Sheet Pile
- Concrete Wall
- Pier Nose Extension
- Pier
- Drain
- Drainage Feature
- Cart Path
- GRMHP Maintenance Road
- Emergency Dirt Road
- Road Slope
- Paved Road
- Grouted Stone
- TCE

GRMHP Project Features

- Option A-Grouted Stone
- Grouted Stone

R9P2A Project Features

- Derrick Stone
- Grouted Stone

N W E S

0 50 100 200 Feet

* Note: The aerial image shown is from 2014 (Eagle Aerial).

This page intentionally left blank.

If repairs require excavation to the toe-down and work within the watercourse, the minimum amount of vegetation required to undertake the repair would be removed. The work area would be dewatered with portable dewatering structures such as k-rails or coffer dams. Upon completion of work, the dewatering structures would be removed, and the area would be allowed to revegetate via natural recruitment or replanted. The non-federal sponsor would be required to obtain necessary permits for any work that requires river diversion, major excavation and vegetation removal outside of routine maintenance areas.

- ***Non-Structural Repairs:*** Non-structural repairs would entail removal of vegetation that may grow on the soil cement structure, debris, and small mammal burrows from the earthen embankment that supports the soil cement structure. Use of herbicides or rodenticides, if needed, would be applied in a manner to avoid impacts to non-target species.

- ***Equipment***: Equipment utilized during routine O&M activities would include pickup trucks, ½- and ¾-ton trucks, spray rigs, fence trucks, bobcats, bulldozers, loaders, backhoes, tractors, transports, motor graders, cranes, water trucks, 5- and 10-yard dump trucks, and excavators.

- ***Inspections:*** Inspections of all project features after each major storm event would be required.

Maintenance may include debris removal, inspections and monitoring of performance, maintenance of the road providing access below the BNSF Bridge connecting roads on top of Phase 2A and the Green River Mobile Home Park, side drain maintenance, vegetation maintenance, corrosion protection, and maintenance of exposed anchors and sheet piles.

RCFC&WCD will primarily be responsible for maintenance of the BNSF Railroad Bridge project and will also take subsequent discretionary actions including, but not limited to: utility relocation, property acquisition, obtaining easements, issuing encroachment permits and entering into cooperative agreements.

4.4.2 No Federal Action Alternative (Alternative 2)

Under the No Federal Action Alternative, no new bridge and bank protection structures that would provide protection against high flows and scour would be constructed. Since bridge piers and existing bank protection are not deep enough to protect against scour associated with high flow events, future high flow conditions through the project reach could undermine and threaten stability of the bridge piers and existing protection. Therefore, under the No Federal Action Alternative, the bridge piers and existing protection would periodically be threatened during high flow conditions, requiring emergency repairs of the existing bridge and bank protection.

4.4.3 Alternatives Eliminated from Further Consideration

The requirement for Reach 9 to remain a soft (earthen) bottom channel for wildlife use and native habitat preservation created environmental constraints in the design of bridge protection measures. Reach 9 is designated as critical habitat for the endangered Santa Ana sucker (*Catostomus santaanae*).

Preliminary coordination with environmental resource agencies indicates a strong desire for flood protection alternatives to satisfy the following constraints, which were considered during design of BNSF alternatives:

1) No adverse impact to hydraulic continuity. The flood protection measure should not create a vertical barrier in the river that would impede potential upstream migration of Santa Ana sucker. Vertical barriers to be avoided would include drop structures, crosswalls, stabilizers, and rock armoring that functions as a grade stabilizer across the entire river channel.

2) No significant increase in velocity of low flows between piers. Any significant increase in low flow velocity between the piers could adversely affect the ability of Santa Ana sucker to migrate upstream.

3) No impediment to the natural meandering of the river. Protection measures should not create a horizontal barrier and restrict natural meandering of the river.

The following alternatives were considered during design of the BNSF Bridge project.

Diaphragm Wall Enclosure and Continuous Rock Apron

After a presentation to BNSF Railway in early 2012, the Corps re-evaluated the scour protection design at the BNSF railroad bridge and determined that the proposed structural diaphragm wall enclosure to the pier foundations and abutments could be shortened and would only need to protect against the long-term general scour estimated at 18 feet deep. Protection for the local pier scour effects would be provided with a derrick stone armor blanket buried 18 feet below existing ground at the estimated maximum long-term scour elevation. Both derrick stone and articulated concrete armor blocks were considered for armor blanket. Derrick stone was ultimately selected due to ease of constructability compared to the articulated concrete armor blocks alternative because the stones could be placed without excavating the entire foundation area under the bridge.

Flared Slurry Wall with Slot

Flared slurry walls would be constructed upstream and downstream of the bridge, flaring from a slurry wall "slot" under one of the middle spans outward past the ends of the bridge. This alternative would require an articulated mat to cap the entire surface areas within the boundaries of the slurry wall. Due to BNSF concern regarding the lack of a method of validating the integrity of the slurry wall, a pressure grout curtain wall behind the slurry wall was also proposed. However, this alternative does not satisfy the environmental constraints as the confined low flow channel would accelerate flood flows through its opening and increase scour potential for that location. It would also not allow for natural meandering of the river. In addition, the flared slurry walls would act as a grade stabilizer upstream of the railroad, but, as the river degrades over time, could promote drop scour condition downstream of the walls during flood flows.

Isolated Rock Apron

Alternatives evaluated also included the use of a rock apron buried below the ground surface around each set of bridge piers. Thickness of the derrick stone would be approximately 10 feet. Variations on the configuration of the apron included asymmetrical, symmetrical, and overlapping patterns around the pier groups. Overlapping, however, would create a continuous rock barrier across the river near the existing ground surface and would not satisfy the environmental constraint to avoid formation of a vertical barrier across the river channel. The rock apron alternatives would require vigilant monitoring, maintenance, and reconstruction of the apron after storm events due to the anticipated displacement of rock from larger flood flows.

4.5 Description of Additional Work

A portion or all of the following activities may be conducted at the same time as construction of the above-listed features, and small portions may be included in Corps construction contracts (where work limits overlap), but this SEA/EIR Addendum assumes that any environmental documentation or permits have been or would be prepared/obtained by other entities (namely, OCFCD and/or Orange County Sanitation District [OCSD]). This information is provided herein for purposes of full disclosure and to assist with cumulative impacts analysis.

Santa Ana River Interceptor (SARI) Line Abandonment/Severing and Yorba Linda Spur Protection

SARI Line relocation is complete and the old SARI pipeline was abandoned by cleaning and flushing the system, filling the pipeline and manholes with cellular concrete, and removing manhole cones. Due to concerns associated with potential impacts on river flow by leaving the old abandoned pipeline intact, the Corps has required that this pipeline be severed at five locations where it crosses the low flow channel as part of the abandonment plan. The severing process would likely employ steel piles driven into the pipeline to fracture the concrete. Additionally, the Corps has requested that OC Public Works ensure that portions of the Yorba Linda Spur, constructed south of the north bank of the Santa Ana River, are protected from erosion.

SARI Line Emergency Rock Removal

For many years, the potential for erosion-related damage to the existing SARI Line has been a cause of concern for the California RWQCB and for OCSD, the owner of the SARI Line. In 2005, rock riprap was placed in the river by OCSD initially as an emergency measure to protect the SARI Line from riverbed erosion. Over the ensuing years, OCSD has added more rock to the river as a maintenance activity to protect the SARI Line. OCSD has placed about 30,000 tons of rock in the river at five major locations between Weir Canyon Road and the Green River Golf Course. The Corps' Regulatory Branch issued a 404 Permit to OCSD for the emergency and maintenance work, which included a condition that requires the removal of all rock after the completion of the SARI Line Project. OCSD is continuing to coordinate the details and timing of rock removal with the Regulatory Branch and other agencies.

It is anticipated that one of the emergency rock piles located inside the footprint of the Phase 4 project would be removed by the Corps as part of construction site preparation.

4.6 Continuing Investigations

Geotechnical

Geotechnical investigations and structural analyses are being conducted to verify the assumed limits of bank protection, and to verify that the Gypsum Canyon Road bridge and abutments would not require additional protection at this time.

Sediment Movement/Geomorphology

The Corps is developing a Plan of Action to conduct additional investigations on sediment movement, hydrology, and geomorphological changes in the SAR watershed. The primary purpose is to assess long-term impacts of Prado Dam operations on listed species (particularly Santa Ana sucker and least Bell's vireo), and to verify that existing mitigation strategies within Reach 9 would continue to be viable even as the riverbed continues to degrade.

The Plan of Action will likely include a review and re-evaluation of previous hydraulic and hydrologic modeling efforts with a focus on detecting and predicting changes in geomorphology and species habitat, and may include additional data collection and expanded modeling. The Plan of Action will be coordinated with USFWS, as it will be used to inform a continuing informal consultation on potential effects to Santa Ana sucker critical habitat. The Corps anticipates initiating formal consultation on effects related to Prado Dam operations during preparation of an updated Water Control Manual for that project.

A preliminary draft Plan of Action has been prepared and is being reviewed by the Corps.

The proposed Reach 9 features would not result in a permanent, substantial reduction in floodplain or loss of aquatic habitat. Therefore, moving forward with construction of additional bank and bridge protection features would have no effect on study results or conclusions, would not change sediment degradation patterns, would not permanently degrade Santa Ana sucker or vireo habitat within Reach 9, and would not constrain or eliminate any potential mitigation or enhancement measures that may be proposed in the future.

Sediment Bypass/Regional Sediment Management

Sediment bypass, which would involve the dredging or excavation of sediment deposited behind Prado Dam with re-entrainment below the dam, is being evaluated by OCWD as a pilot study, and also by the Corps and OCWD as part of the ongoing Prado Ecosystem Restoration and Water Conservation Feasibility Study. The pilot study is proposed to be initiated first and, if successful, would result in the bypass of approximately 200,000 cy of sediment over a 3- to 5-year period. The feasibility study, if authorized, would greatly expand the dredge limits, the amount of material bypassed, and the project

duration. Various alternatives are being developed and analyzed. It is anticipated that sediment bypass would improve habitat conditions both upstream and downstream of the dredge area by restoring a more natural gradient and floodplain condition, and could also improve water conservation.

The proposed Reach 9 features would not affect the ability of the Corps or OCWD to pursue sediment bypass, and would not affect the results of those efforts.

This page intentionally left blank.

5.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

5.1 Earth Resources

5.1.1 Affected Environment

5.1.1.1 Geology

This section provides information on the affected environment for Earth Resources, including geology, seismicity and faulting, and soils, as relevant to the Phases 5A, 5B, 4, and BNSF Bridge Reach 9 measures. This discussion is based on information provided in the 1988 Phase II GDM/SEIS and the 2001 SEIS/EIR, as well as other relevant agency materials.

The Corps has conducted numerous geotechnical and field investigations in the Prado Basin since the 1930s, including mapping of the various geologic formations and exploring the subsurface to determine the nature and extent of soil and bedrock materials, and the character of local faults. Reach 9 occurs in the lower SAR, which extends from Prado Dam downstream to the Pacific Ocean. Reach 9 is situated within the SAR floodplain in an area known as Santa Ana Canyon. It is bounded by Chino Hills to the northwest and by the Santa Ana Mountains to the south.

The SAR is incised into a variety of different bedrock materials and has subsequently been backfilled by Holocene- and late Pleistocene-age alluvial deposits. Within Reach 9, the bedrock is characterized as undifferentiated Sespe and Vaqueros Formations; sedimentary deposits that may range in age from early Miocene to late Eocene.

5.1.1.2 Seismicity and Faulting

Faults are plane-like surfaces on which movement of the earth's rock formations and soils can occur. The San Andreas Fault can be considered a boundary in southern California, west of which land is drifting north, relative to the east. This drift builds stresses throughout the region, which are eventually relieved by movement along the San Andreas and other southern California faults. The regional stress accumulated is not equally distributed among faults, as some move more frequently than others. Other major northwest-southeast-trending faults in the vicinity of Reach 9 are the San Jacinto, Whittier-Elsinore, and Newport-Inglewood. Many smaller and considerably less active or apparently inactive faults exist among the aforementioned larger faults. The seismic environment relevant to the Reach 9 projects is dominated by two fault zones, the San Andreas and the Whittier-Elsinore. Based on results of the 1980 Chino Fault study conducted for the Los Angeles District-Corps, the area is located within a zone of potential surface fault offsets and ground cracking that could be triggered by an event along the Whittier-Elsinore fault zone (Corps 1988 [Appendix B, p. B-IV-2, 4]).

Faults generally cut through multiple stratigraphic formations at angles, as is the case in Reach 9. When movement occurs on fault planes, propagation of seismic waves occurs, resulting in an event with seismic characteristics and a risk of damage due to earthquakes that are caused by the fault movements. Geologic faults in the vicinity of the Reach 9 projects are shown in Figure 5.1-1. The

Whittier Fault is the most important fault in the vicinity of Reach 9 because it is active and has been the source of earthquakes. It intersects Phase 5B, crossing under the BNSF railway and under East La Palma Avenue near the intersection with Brush Canyon Road, at an orientation of N. 65º to 70º W., with a dip angle on the fault plane of 85º NE. It is a right-lateral strike-slip fault, meaning that the motion on the fault plane is horizontal much more than vertical, and that lands on the south side of the fault are moving westward relative to lands on the north side of the fault. The fault has juxtaposed Puente Formation rocks on the north side to the older Topanga Formation on the south side.

Research into earthquake probabilities by the Corps determined the following seismic characteristics of the Whittier fault zone:

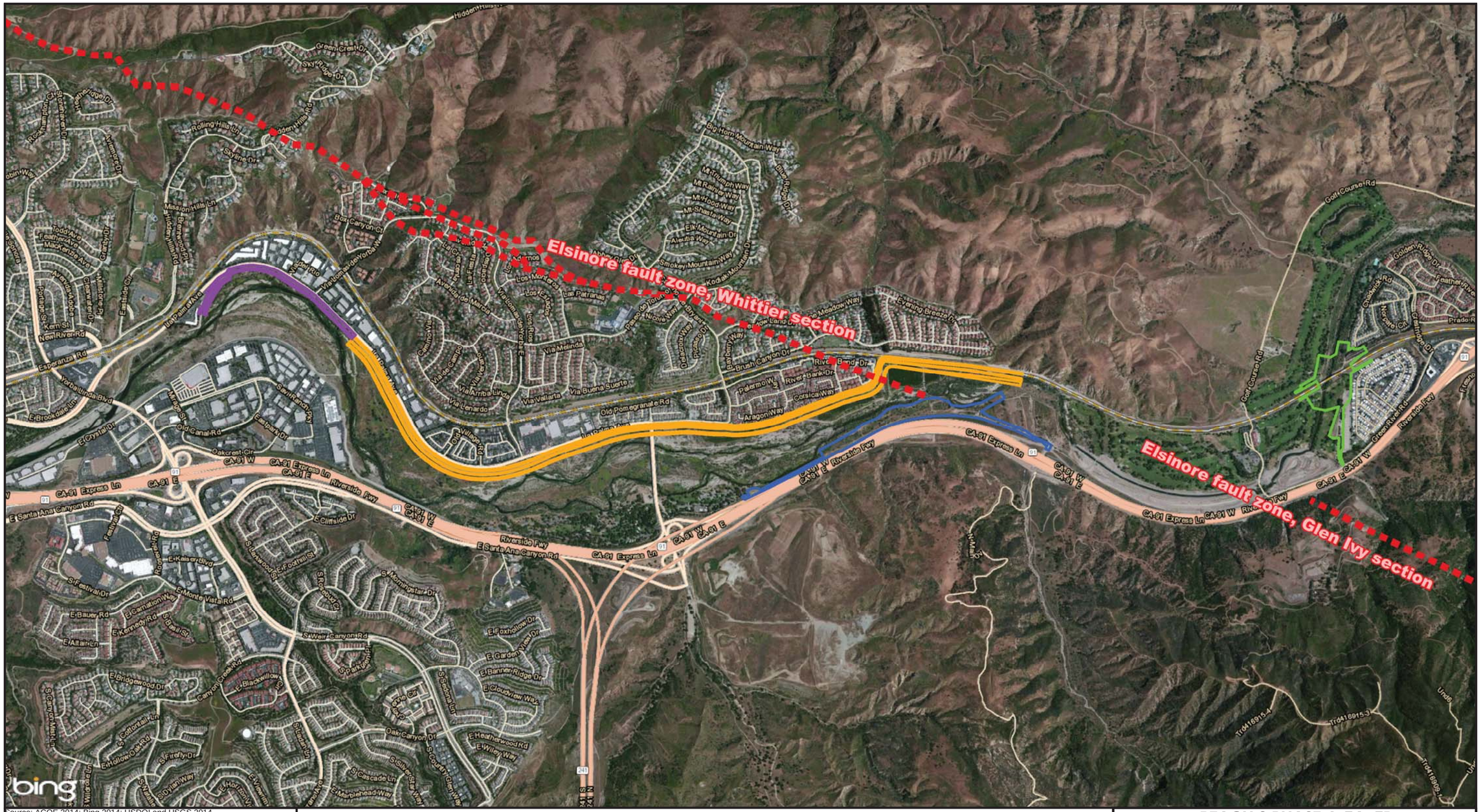
- Maximum probable earthquake (MPE) is 6.9 M (earthquake magnitude);
- Could cause up to 19 feet of horizontal offset;
- Maximum site acceleration from an earthquake estimated is 0.55 *g*; (*g* is the force of gravity. An acceleration of 1 *g* is equal to a force of 32 feet/second/second.)
- Maximum measured site acceleration was 0.08 *g.*[1]

Overall, the Reach 9 vicinity has a 10 percent probability in 50 years of an earthquake event of *M* 6.8 (Converse Consultants 2000). Such an event most likely would occur on either the Whittier or Chino-Central Avenue Faults**.**

Additional seismic risk exists from other faults in the region, as shown in Table 5.1-1. However, the Phase II GDM/SEIS indicates that the river channel in Reach 9 has been analyzed and is considered stable, even during periods of maximum seismic events.

5.1.1.3 Soils

In general, the composition of the SAR's streambed developed and is influenced by river meandering and floodplain functions. From upper through middle and into lower portions of the SAR, the streambed is generally rocky with fine sands and silts. Soils of the coastal plain are similar to those of the middle and lower portions of the SAR. Soils in the Reach 9 measures are generally derived from alluvial materials that dominate the valley floor and slopes. The two most prevalent soil types across all Reach 9 measures are Metz series soils, and Riverwash. Metz soils are typically light, sandy, and highly permeable. These soils are found on floodplains and alluvial fans throughout southern California (NRCS 2014). Riverwash is considered a barren alluvial area. Riverwash is usually coarse textured, exposed along streams at low water and subject to shifting during normal high water. Less dominant soil types present within Phases 5A, 5B, 4, and BNSF Bridge are provided below.



Source: ACOE 2014; Bing 2014; USDOI and USGS 2014

0 500 1,000 2,000 Feet

Scale: 1:24,000;1 inch = 2,000 feet

Legend

- Faults
- Phase 5A Temporary Construction Easement
- Phase 5B Temporary Construction Easement
- BNSF Bridge Temporary Construction Easement
- Phase 4 Temporary Construction Easement

REACH 9 PHASE 4, 5A, 5B & BNSF SEA/EIR ADDENDUM

FIGURE 5.1-1
Geologic Faults

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Path: P:\2014\60279208-Reach_9_SEA\900-CAD-GIS\920 GIS-Graphics\925_Docs\Aerial_Base_Faults.mxd, 12/22/2014, wallacerj

This page intentionally left blank.

Table 5.1-1: Major Faults and Associated Seismic Risk

Fault	Approximate distance from project (miles)	Fault length (miles)	Fault dip angle (degrees)[1]	Slip rate (mm/yr)	Type of slip[2]	Maximum magnitude (Mw)	Peak site acceleration (*g*)[3]	MCE & MPE[4]
Whittier	1.9	23.1	70 NE	3.0	ss	6.8	0.48	7.1 & 6.0
Chino-Central Ave	3.7	17.5	70 NE	1.0	ds	6.7	0.55	7.0 & 5.4
Elsinore-Glen Ivy	4.5	23.8	90	5	ss	6.8	0.36	7.5 & 6.6
Elysian Park Thrust	12.7	21.2	22 NE	1.7	bt	6.7	0.22	7.1 & 5.8
San Jose	14.7	11.2	75 W	0.5	ss	6.5	0.17	6.7 & 5.0
Compton Thrust	17.8	24.4	23 NE	1.4	bt	6.8	0.17	7.2 & 5.8
Sierra Madre	18.7	35.6	50 N	4.0	ds	7.0	0.18	6.9 & 6.3
Cucamonga	18.9	18.8	50 N	5.0	ds	7.0	0.18	6.9 & 6.1
Newport-Inglewood (L.A. Basin)	22.5	15.6	74 NE	0.1	ss	6.9	0.10	6.7 & 4.2
Newport-Inglewood (Offshore)	23.5	31.3	90	1.2	ss	6.9	0.10	7.1 & 5.9
Taken from *EQFault* program (Blake 2000). Major faults within a 25-mile radius of the SARI Line project area.								

[1] Degrees of dip are measured from the horizontal.
[2] ss = strike slip, ds = dip slip, bt = blind thrust.
[3] Horizontal acceleration given as a percentage of gravity, expressed in decimal form.
[4] *g* = force of gravity; mm/yr = millimeters per year; MCE = maximum credible earthquake; MPE = maximum probable earthquake.

Phase 5A

Dominant soil types within Phase 5A are Riverwash (74 percent), Hueneme fine sandy loam (16 percent), and Yorba cobbly sandy loam (9 percent). Hueneme series soils typically consist of grayish brown, loamy fine sand, and light sandy loam. A-horizons are moderately alkaline, while C-horizons are stratified sandy loam with thin silt layers, are mottled, and contain segregated gypsum. Yorba series soils are deep, well-drained soils formed in mixed alluvium and are found on terraces in the coastal plains of southern California.

Phase 5B

Dominant soil types within Phase 5B are Mocho sandy loam (60 percent), Riverwash (16 percent), and Mocho loam (12 percent). Mocho series soils are well-drained soils that formed in alluvium derived

mostly from sandstone and shale rock sources. These soil types are found on alluvial fans with slopes of 0 to 9 percent.

Phase 4

Dominant soil types within Phase 4 are Riverwash (95 percent) and Metz loamy sand (5 percent).

BNSF Bridge

Dominant soil types within BNSF Bridge are Metz loamy sand (48 percent), Riverwash (19 percent), San Emigdio fine loamy sand (18 percent), and Soper gravelly loam (11 percent). Soper soils are well-drained soils that formed in material weathered from conglomerate and sandstone. Soper soils are on hills and uplands and have slopes of 15 to 50 percent. San Emigdio series soils are well-drained soils that formed in dominantly sedimentary alluvium. San Emigdio soils are on fans and floodplains and have slopes of 0 to 15 percent.

Four of the soil types found within Reach 9 have been identified as Prime Farmland, including Hueneme fine sandy loam, Metz loamy sand, Mocho sandy loam, and San Emigdio fine sandy loam soils. Soil types identified as Farmland of Statewide Importance include Mocho loam soils (NRCS 2014).

5.1.2 Environmental Consequences

Significance Threshold

Based on the existing conditions discussed above, impacts to earth resources would be considered significant if the alternative results in the following:

- Expose people or structures to major geologic hazards, including:
    - Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map
    - Strong seismic ground shaking
    - Seismic-related ground failure, including liquefaction;
- Substantial discharge of nonnative material into the SAR; and/or
- Substantial erosion of soils from the Reach 9 measures.

5.1.2.1 Phase 5A

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

The Grouted Stone and Sheet Pile Alternative would entail the removal of existing bank protection and reconstruction of the embankment with grouted stone and sheet pile structures. This alternative would reuse on-site substrate as much as possible to minimize the import of soil. Prior to construction, the project area would be prepared by clearing and grubbing, cutting vegetation, and grading. Clearing activities may require the use of a loader or bulldozer to scrape topsoil, which would be stockpiled for subsequent project use, such as for backfill or to supplement plantings in areas temporarily impacted by

project activities. Additionally, the removal of topsoil would be temporary, since backfill after construction would replenish topsoil removed during clearing and grubbing operations. Subsequent to clearing activities, an 80-foot-wide by 980-foot-long, trapezoidal trench would be excavated for the grouted stone structure. Additional areas will be excavated at locations where tiebacks for the sheet pile wall are to be installed, and where drainages would be extended through the new structures. Excavated material would be temporarily stored in staging areas during construction. Upon completion of construction of the grouted stone structure, the trench would be backfilled with the previously excavated material.

Some loss of unconsolidated substrate could occur during initial storm flows following construction; however, there would not be a substantial change in substrate as a result of construction. This impact would lessen as vegetation is reestablished through the project reach via plantings, hydroseeding, and natural recruitment. The establishment of root structures in the topsoil would minimize erosion. Additionally, as identified in Chapter 5.4 (Surface Water Quality), a Storm Water Pollution Prevention Plan (SWPPP) including best management practices (BMP) would be developed and implemented during construction. As a result, the Grouted Stone Alternative would not result in significant impacts to earth resources and geology associated with flooding, erosion, and siltation. Although soils identified as Prime Farmland (i.e., Hueneme fine sandy loam) coincide with Phase 5A, no agricultural activities currently occur within Phase 5A.

Phase 5A alternatives are located in a seismically active region of southern California, and there is potential for an earthquake or other geologic hazards to occur during the lifetime of Phase 5A. However, previous studies have determined that the river channel in Reach 9 is considered stable, even during major seismic events. Due to the alluvial nature of Reach 9 and potentially high groundwater table, there is also potential for liquefaction of the grouted stone structure. Phase 5A alternatives would, however, be highly compacted, and materials used for construction would not substantially lose strength under earthquake loading and would not liquefy during shaking. In addition, as described in the 1988 Phase II GDM/SEIS, the probability of a design flood event and earthquake occurring simultaneously is low. The Grouted Stone and Sheet Pile Alternative would not cause substantial earth resources and geology impacts associated with exposure of people and property to major geologic hazards.

The foundation of proposed Phase 5A alternatives may exhibit a small amount of settling during and following construction; however, by constructing a grouted stone structure, the Preferred Alternative would not result in impacts to earth resources and geology associated with settling.

Soil Cement and Sheet Pile Alternative (Alternative 2)

The Soil Cement and Sheet Pile Alternative would have impacts similar to the Grouted Stone and Sheet Pile Alternative. Both alternatives have similar project footprints and similar excavation requirements for the construction of protection features, and would reuse on-site soils and other materials to the

greatest extent possible. As a result, the Soil Cement and Sheet Pile Alternative would also result in less than significant impacts to earth resources, seismic stability, and liquefaction.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, reconstruction of the existing bank protection structure to provide additional protection against high flows and scour would not occur. Therefore, future high flow conditions through the project reach could undermine and erode existing bank protection and threaten adjacent infrastructure (i.e., East La Palma Road, the SAR Trail, industrial facilities, and commercial buildings). Periodic emergency repairs of existing bank protection would likely be required. It is likely that any emergency repair would be limited in scope and duration, and would likely entail the discharge of rocks to stabilize the embankment. Therefore, the No Federal Action Alternative would have a less than significant impact on earth resources, seismic stability, and liquefaction.

5.1.2.2 Phase 5B

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

The Grouted Stone and Sheet Pile Alternative would involve replacing existing riprap with a grouted stone structure and further installation of grouted stone on the river bank upstream of the existing LDY-S Levee where the river bank is currently unprotected. Grouted stone would be used for the majority of protection, transitioning to sheet pile only at the upstream-most extent where needed to avoid direct impacts to flowing water. New bank protection would have an adequate foundation depth to minimize scour and provide erosion control and subsequent protection against flood damage. Prior to construction, the project area would be prepared by clearing and grubbing, cutting vegetation, and grading. Clearing activities may require the use of a loader or bulldozer to scrape topsoil, which would be stockpiled for subsequent project use, such as for backfill or to supplement plantings in areas temporarily impacted by project activities. Additionally, the removal of topsoil would be temporary, since backfill after construction would replenish topsoil removed during clearing and grubbing operations. Subsequent to clearing activities, construction of grouted stone revetment would require excavation of a trapezoidal trench approximately 80 feet wide by the length of the proposed protection (approximately 19,700 feet long). A total of approximately 1,116,000 cubic yards of alluvial substrate would be excavated. The estimated amounts of grouted stone and compacted backfill to be used during construction are 80,000 to 94,000 cubic yards (or 166,000 tons) and 1,116,000 cubic yards, respectively. In addition to alluvial excavation, an estimated amount of 65,000 cubic yards of existing stone would be removed and salvaged for reuse to the greatest extent possible. Excavated material would be temporarily stored in staging areas during construction. Upon completion of grouted stone construction, the trench would be backfilled with previously excavated material.

Some loss of unconsolidated substrate could occur during initial storm flows following construction; however, there would not be a substantial change in substrate as a result of construction. This impact would lessen as vegetation is reestablished through the project reach via plantings, hydroseeding, and natural recruitment. The establishment of root structures in the topsoil would minimize erosion.

Additionally, as indicated in Chapter 5.4 (Surface Water Quality), a SWPPP including BMPs would be developed and implemented during construction. As a result, the Grouted Stone Alternative would not result in significant impacts to earth resources and geology associated with flooding, erosion, and siltation. Soils identified as Prime Farmland (Mocho sandy loam) and soils identified as Farmland of Statewide Importance (Mocho loam) coincide with an active citrus orchard. An approximate 3.72-acre portion of the orchard coincides with the TCE of Phase 5B (see Figure 5.5-2). This citrus orchard is identified by the California Department of Conservation's Farmland Mapping and Monitoring Program as Prime Farmland, Unique Farmland, and Farmland of Statewide Importance (Figure 5.1-2). Most of the impacts to the citrus orchard would be temporary, with a very minor encroachment of the buried toe (0.14 acre) under the northernmost edge of the grove. As construction would not result in a permanent conversion of farmland to development or a substantial loss of soils, impacts are considered insignificant.

Phase 5B alternatives are located in a seismically active region of southern California and the Whittier Fault runs under Phase 5AB. As a result, there is potential for an earthquake or other geologic hazards to occur during the lifetime of Phase 5B. However, previous studies have determined that the river channel in Reach 9 is considered stable, even during major seismic events. Due to the alluvial nature of Reach 9 and potentially high groundwater table, there is also potential for liquefaction of the grouted stone structure. Phase 5B alternatives would, however, be highly compacted, and materials used for construction would not substantially lose strength under earthquake loading and would not liquefy during shaking. In addition, as described in the 1988 Phase II GDM/SEIS, the probability of a design flood event and earthquake occurring simultaneously is low. The Preferred Alternative would not cause substantial earth resources and geology impacts associated with exposure of people and property to major geologic hazards.

The foundation of proposed Phase 5B alternatives may exhibit a small amount of settling during and following construction; however, by constructing a grouted stone structure, the Preferred Alternative would not result in impacts to earth resources and geology associated with settling.

Soil Cement Structure Alternative (Alternative 2)

The Soil Cement Alternative would have impacts similar to the Grouted Stone Alternative. Both of these alternatives have similar project footprints and similar excavation requirements for the construction of protection features, and would reuse on-site soils and other materials to the greatest extent possible. As a result, the Soil Cement Alternative would also result in less than significant impacts to earth resources, seismic stability, and liquefaction.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, reconstruction of the existing bank protection structure to provide additional protection against high flows and scour would not occur. Therefore, future high flow conditions through the project reach could undermine and erode existing bank protection and threaten adjacent infrastructure (i.e., East La Palma Road, the SAR Trail, industrial facilities, commercial buildings,

and residential development). Periodic emergency repairs of existing bank protection would likely be required. It is likely that any emergency repair would be limited in scope and duration, and would likely entail the discharge of rocks to stabilize the embankment. Therefore, the No Federal Action Alternative would have a less than significant impact on earth resources, seismic stability, and liquefaction.

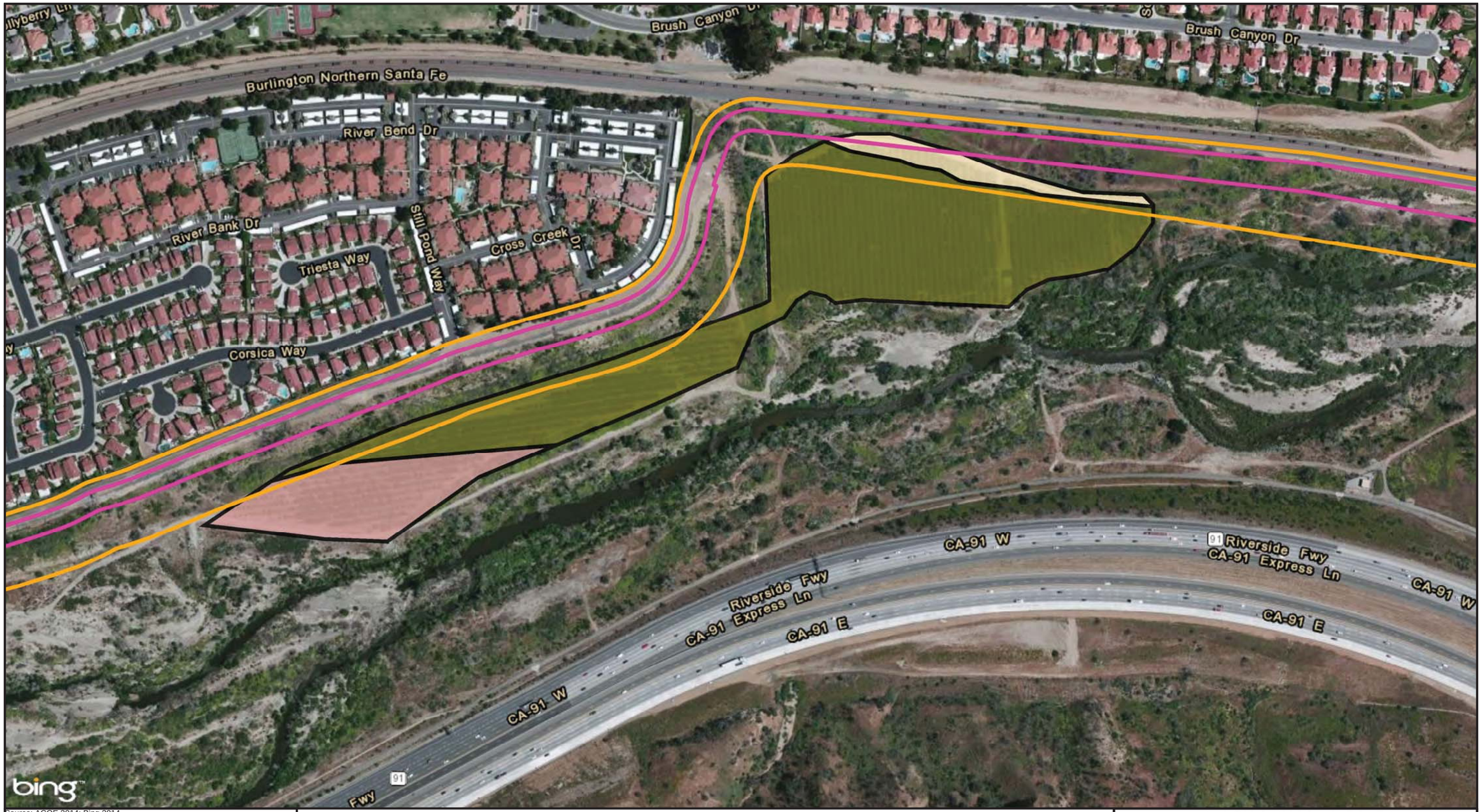
5.1.2.3 Phase 4

Soil Cement Alternative (Preferred Alternative, Alternative 1)

Under the Soil Cement Alternative, an approximate 3,150-foot-long soil cement structure would be constructed. Prior to construction, the project area would be prepared by clearing and grubbing, cutting vegetation, and grading. Clearing activities may require the use of a loader or bulldozer to scrape topsoil, which would be stockpiled for subsequent project use, such as for backfill or to supplement plantings in areas temporarily impacted by project activities. Additionally, the removal of topsoil would be temporary, since backfill after construction would replenish topsoil removed during clearing and grubbing operations. Subsequent to clearing activities, a trapezoidal cut would be required to place the soil cement structure. The excavation footprint would be approximately 100 feet wide along the 3,150-foot span. Approximately 135,000 cubic yards of alluvial substrate would be excavated. The volume of the soil cement structure would be approximately 45,000 cubic yards. Excavated material would be temporarily stored in staging areas during construction.

Existing soil cement may be encountered during excavation. If encountered, it would be demolished and disposed of off-site or processed for reuse as backfill if deemed suitable for the project. Any excavated material not suitable for the soil cement mix or for backfill would be dispose of off-site.

Some loss of unconsolidated substrate could occur during initial storm flows following construction; however, there will not be a substantial change in substrate as a result of construction. This impact would lessen as vegetation is reestablished through the project reach via plantings, hydroseeding, and natural recruitment. The establishment of root structures in the topsoil would minimize erosion. Additionally, as described in Chapter 5.4 (Surface Water Quality), a SWPPP including BMP would be developed and implemented during construction. As a result, the Soil Cement Alternative would not result in significant impacts to earth resources and geology associated with flooding, erosion, and siltation. Although soils identified as Prime Farmland (i.e., Metz loamy sand) coincide with Phase 4, no agricultural activities currently occur within Phase 4.



Source: ACOE 2014; Bing 2014

0 75 150 300 Feet

Scale: 1:3,600; 1 inch = 300 feet

Legend

- Permanent Grouted Stone
- Staging Area
- Temporary Construction Easement
- Prime Farmland
- Farmland of Statewide Importance
- Unique Farmland

REACH 9 PHASE 4, 5A, 5B & BNSF SEA/EIR ADDENDUM

FIGURE 5.1-2
PHASE 5B Project Features - Farmland

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Path: P:\2014\60279208-Reach_9_SEA\900-CAD-GIS\920 GIS-Graphics\925_Docs\Aerial_Base_5B_Farmland.mxd, 12/29/2014, wallacerj

This page intentionally left blank.

Phase 4 alternatives are located in a seismically active region of southern California, and there is potential for an earthquake or other geologic hazards to occur during the lifetime of Phase 4. However, previous studies have determined that the river channel in Reach 9 is considered stable, even during major seismic events. Due to the alluvial nature of Reach 9 and potentially high groundwater table, there is also potential for liquefaction of the soil cement structure. Phase 4 alternatives would, however, be highly compacted, and materials used for construction would not substantially lose strength under earthquake loading and would not liquefy during shaking. In addition, as described in the 1988 Phase II GDM/SEIS, the probability of a design flood event and earthquake occurring simultaneously is low. The Preferred Alternative would not cause substantial earth resources and geology impacts associated with exposure of people and property to major geologic hazards.

The foundation of proposed Phase 4 alternatives may exhibit a small amount of settling during and following construction; however, by constructing a soil cement structure, the Preferred Alternative would not result in impacts to earth resources and geology associated with settling.

Grouted Stone Alternative (Alternative 2)

The Grouted Stone Alternative would have impacts similar to the Soil Cement Alternative. Both of these alternatives have similar project footprints and similar excavation requirements for the construction of protection features, and would reuse on-site soils and other materials to the greatest extent possible. As a result, the Grouted Stone Alternative would also result in less than significant impacts to earth resources, seismic stability, and liquefaction.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, construction of a new soil cement structure in place of existing soil cement would not occur in order to provide additional protection against high flows and scour. Therefore, future high flow conditions through the project reach could undermine and erode existing bank protection and threaten adjacent infrastructure (i.e., SR-91, SAR Trail, and SARI Line). Periodic emergency repairs of existing bank protection would likely be required. It is likely that any emergency repair would be limited in scope and duration, and would likely entail the discharge of rocks to stabilize the embankment. Therefore, the No Federal Action Alternative would have a less than significant impact on earth resources, seismic stability, and liquefaction.

5.1.2.4 BNSF Bridge

Pier and Abutment Protection Alternative (Preferred Alternative, Alternative 1)

Under the BNSF Bridge Preferred Alternative, pier nose and abutment protection features, reinforced concrete walls, sheet pile and reinforced concrete diaphragm walls, and grouted stone protection would be constructed to provide additional scour protection to BNSF Bridge piers and abutments, and tie previously constructed bank protection along the east bank of the SAR into the existing eastern bridge abutment. Reinforced concrete enclosure walls would be installed around Pier Nos. 2 through 5 and

reinforced concrete pier nose extension walls would be constructed immediately upstream of these piers. The project would also construct sheet pile and reinforced concrete diaphragm walls with tieback anchors parallel to existing Pier Nos. 1 and 6 to guide the design flow safely under the bridge (Figure 4.4-1). Additionally, 24-inch grouted stone bank protection would be installed to tie the existing bridge abutment along the east bank of the river channel (Pier No. 1) into bank protection installed upstream (Phase 2A) and downstream (Phase 2B) of the BNSF Bridge. The amount and types of "fill material" associated with this alternative includes 6,175 cy of grouted stone, 637 cy of bedding material under the grouted stone, 4,000 cy of concrete for the pier nose extension walls (1,000 cy each), 1,360 linear feet of H-Piles under each of the pier nose extensions (total of 5,440 linear feet), and 15,200 cy of concrete for the reinforced concrete diaphragm walls. The toe of the bank protection will match the existing toe depths for Phase 2A (el. 401) and mobile home park (el. 398) bank protection. The grouted stone on the river side of the sheet pile wall will be mostly buried.

Some loss of unconsolidated substrate could occur during initial storm flows following construction; however, there will not be a substantial change in substrate as a result of construction. This impact would lessen as vegetation is reestablished through the project reach via plantings, hydroseeding, and natural recruitment. The establishment of root structures in the topsoil would minimize erosion. Additionally, as indicated in Chapter 5.4 (Surface Water Quality), a SWPPP including BMPs would be developed and implemented during construction, including the river diversion. As a result, the BNSF Bridge Preferred Alternative would not result in significant impacts to earth resources and geology associated with flooding, erosion, and siltation. Although soils identified as Prime Farmland (i.e., Metz loamy sand and San Emigdio fine loamy sand) coincide with BNSF Bridge, no agricultural activities currently occur within BNSF Bridge.

BNSF Bridge is located in a seismically active region of southern California, and there is potential for an earthquake or other geologic hazards to occur during the lifetime of BNSF Bridge. However, previous studies have determined that the river channel in Reach 9 is considered stable, even during major seismic events. Due to the alluvial nature of Reach 9 and the potentially high groundwater table, there is also potential for liquefaction of bridge and bank protection features. BNSF Bridge features would, however, be highly compacted, and materials used for construction would not substantially lose strength under earthquake loading and would not liquefy during shaking. In addition, as described in the 1988 Phase II GDM/SEIS, the probability of a design flood event and earthquake occurring simultaneously is low. The Preferred Alternative would not cause substantial earth resources and geology impacts associated with exposure of people and property to major geologic hazards.

The foundation of proposed BNSF Bridge alternatives may exhibit a small amount of settling during and following construction; however, project features have been designed so that no impacts to earth resources and geology associated with settling would occur.

There would not be a substantial change in substrate as a result of project construction. A short-term loss of topsoil and unconsolidated substrate is anticipated; however, vegetation growth would decrease soil erosion from the site and future flows would replenish substrate soils. Additionally, BMPs would be

implemented during construction and the river diversion to control erosion and sedimentation. As a result, the Preferred Alternative would result in less than significant impacts to earth resources.

No Federal Action Alternative (Alternative 2)

Under the No Federal Action Alternative, the construction of bridge pier or abutment protection features to provide additional protection against high flows and scour would not occur. Therefore, future high flow conditions through the project reach could undermine the BNSF Bridge piers, periodically threatening bridge stability and requiring emergency repairs to avoid catastrophic loss. Therefore, under the No Federal Action Alternative, bridge piers and existing protection would periodically be threatened during large flow releases from Prado Dam, requiring emergency repairs of the existing bridge and bank protection. Emergency repairs would be limited in scope and duration, and no permanent changes to existing earth resources would occur. Therefore, the No Federal Action Alternative would have a less than significant impact on earth resources.

5.1.3 Summary of Significance Thresholds Related to Proposed Alternatives

The proposed alternatives would have no significant impacts on earth resources, based on the following:

- Proposed alternatives would not expose people or structures to major geologic hazards, including the rupture of a known earthquake fault, cause seismic ground shaking, or result in seismic-related ground failure, including liquefaction; and/or
- Substantial discharge of nonnative material into the SAR; and/or
- Substantial erosion of soils from the Reach 9 measures.

5.2 Hydrology

5.2.1 Affected Environment

The SAR Basin is the largest watershed in southern California with a drainage area of about 2,670 square miles. The SAR watershed is separated into an upper and a lower basin divided by Prado Dam. The Reach 9 areas occur in the lower SAR basin, between approximately 2 (BNSF Bridge) and 6 (Phase 5A) miles downstream of Prado Dam. As a result, river hydrology in Reach 9 largely reflects the water release regime from Prado Dam into the lower SAR. Releases are dictated by the Prado Dam water control manual.

Since the modifications to Prado Dam in 2008, average outflows have been approximately 450 cfs from October to February and approximately 275 cfs from March to May. Outflows during summer months, averaging around 150 cfs, are usually unconstrained base flows [averages based on flow records from USGS 2012]. The average outflows from March 1 to May are lower due to water conservation agreements with OCWD that limit outflows to match OCWD processing capacity.

The values presented above are averages and do not fully represent the maximum range of flows. For example, in December of 2010 and January of 2011, outflow from the dam attained 5,000 cfs for a few days and was sustained at over 3,000 cfs for some period of time. Channel capacity allows for higher outflows, but concerns with scouring of the SARI Line downstream of the dam prohibited releases in excess of 5,000 cfs. The maximum discharge from the dam (to date) was >10,000 cfs released in January 2005.

5.2.2 Environmental Consequences

Significance Threshold

Based on the existing conditions discussed above, impacts would be considered significant if the alternative results in:

- Substantial change to base flow characteristics such as surface water elevation, flow velocity, channel capacity, and channel configuration.

5.2.2.1 Phase 5A

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

The Grouted Stone and Sheet Pile Alternative would entail the removal of existing bank protection and reconstruction of the embankment with grouted stone and sheet pile structures to a deeper elevation. The excavation footprint for grouted stone protection would be approximately 80 feet wide along the 980-foot reach. The finished structure would be 24 inches thick and have a 2H:1V slope to provide sufficient slope stability. The sheet pile wall would be situated along the top edge of the existing north bank to minimize excavation, which would require an approximate 8-foot vertical excavation into the

existing bank, from the top of the existing bank. This alternative would reuse on-site substrate as much as possible to minimize the import of soil. Excavated material would be temporarily stored in uplands during construction. Upon completion of construction of the grouted stone structure, the trench would be backfilled with the previously excavated material.

The typical cross section of the grouted stone structure presented in Figure 4.1-2 indicates that the 2H:1V slope associated with the new grouted stone structure would extend approximately 40 to 50 feet beyond the toe of the existing riprap into the river's floodplain. Given that the SAR floodplain transecting the Phase 5A area is approximately 900 feet wide, it is unlikely that increasing the width and depth of the existing embankment would affect channel capacity, water surface elevation, or velocity. Moreover, the 40- to 50-foot "encroachment" would be buried in an area that currently is approximately 20 feet below the ground surface and would only be exposed if and when maximum bed degradation occurs. The new sheet pile wall would not extend into the floodplain. Removal of river side vegetation could temporarily reduce channel roughness and increase water velocity through the Phase 5A section of the SAR. However, vegetation is expected to quickly reestablish in the Phase 5A area through hydroseeding, plantings, and natural recruitment. Hydrologic changes associated with vegetation removal will likely return to baseline levels within 1 to 2 years subsequent to the completion of construction. Because implementation of the Grouted Stone and Sheet Pile Alternative would not change the base flow characteristics of the SAR, impacts to hydrology would be less than significant.

Soil Cement and Sheet Pile Alternative (Alternative 2)

Under this alternative, the existing riprap embankment would be replaced with a 10-foot-thick, 1,100-foot-long soil cement structure and a sheet pile wall. The soil cement structure would resemble a vertical parallelogram and would also be constructed with a 2H:1V slope, to the same depth and along the same length of bank as the Grouted Stone and Sheet Pile Alternative (Figure 4.1-5). As a result, the Soil Cement and Sheet Pile Alternative would have similar impacts as the Grouted Stone and Sheet Pile Alternative, resulting in less than significant impacts on hydrology.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, reconstruction of the existing bank protection structure to provide additional protection against high flows and scour would not occur. Therefore, hydrology through the Phase 5A area would remain unchanged. However, future high flow conditions through the Phase 5A section of the SAR could undermine and erode existing bank protection and threaten adjacent infrastructure (i.e., East La Palma Road, the SAR Trail, industrial facilities, and commercial buildings).

Periodic emergency repairs of the existing bank protection would likely be required, which would likely entail the discharge of rocks to stabilize the embankment. Given that the SAR floodplain through the Phase 5A area is approximately 900 feet wide, it is unlikely that the periodic discharge of rocks to stabilize portions of the existing embankment would significantly affect river hydrology.

5.2.2.2 Phase 5B

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

Under the Preferred Alternative, grouted stone and sheet pile would replace existing riprap of the LDY-S Levee, as well as be installed on the river bank upstream of the levee where the river bank is currently unprotected. Grouted stone would be used for the majority of protection, transitioning to sheet pile only at the upstream-most extent where needed to avoid direct impacts to flowing water. The excavation footprint for grouted stone protection would be approximately 80 feet wide along the 19,700-foot reach. The finished structure would be 24 inches thick and have a 2H:1V slope to provide sufficient slope stability. This alternative would reuse on-site substrate as much as possible to minimize the import of soil. Excavated material would be temporarily stored in uplands during construction. Upon completion of construction of the grouted stone structure, the trench would be backfilled with the previously excavated material.

The typical cross section of the grouted stone structure presented in Figure 4.2-2 indicates that the 2:1 slope associated with the new grouted stone structure would extend approximately 22 feet beyond the toe of the existing riprap into the river's floodplain. Given that the SAR floodplain transecting the Phase 5B area ranges between approximately 700 and 2,000 feet wide, it is unlikely that increasing the width and depth of the existing embankment would affect channel capacity, or water surface elevation, or velocity. Moreover, the 22-foot "encroachment" would be buried in an area that currently is approximately 20 feet below the ground surface and would only be exposed if and when maximum bed degradation occurs. Removal of river side vegetation could temporarily reduce channel roughness and increase water velocity through the Phase 5B area. However, vegetation is expected to quickly reestablish in the Phase 5B area through hydroseeding, plantings, and natural recruitment. Hydrologic changes associated with vegetation removal will likely return to baseline levels within 1 to 2 years subsequent to the completion of construction. Based on the above, implementation of the Grouted Stone and Sheet Pile Alternative would result in less than significant impacts on hydrology.

Soil Cement Alternative (Alternative 2)

Under this alternative, the existing riprap embankment would be replaced with a 10-foot-thick, 19,700-foot-long soil cement structure. The soil cement structure would resemble a vertical parallelogram and would be constructed with a 2H:1V slope and extend approximately 10 feet beyond the toe of the existing riprap into the river's floodplain, to the same depth and along the same length of bank as the Grouted Stone Alternative. As a result, the Soil Cement Alternative would have similar impacts as the Grouted Stone Alternative, resulting in less than significant impacts on hydrology.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, reconstruction of the existing bank protection structure to provide additional bank stabilization against high flows and scour would not occur. Therefore, hydrology through the Phase 5A project area would remain unchanged. However, future high flow conditions

through the Phase 5B area could undermine and erode existing bank protection and threaten adjacent infrastructure (i.e., East La Palma Road, the SAR Trail, industrial facilities, and commercial buildings).

Periodic emergency repairs of the existing bank protection would likely be required, which would likely entail the discharge of rocks to stabilize the embankment. Given that the SAR floodplain through the Phase 5B area ranges between approximately 700 and 2,000 feet wide, it is unlikely that the periodic discharge of rocks to stabilize portions of the existing embankment would significantly affect river hydrology.

5.2.2.3 Phase 4

Soil Cement Alternative (Preferred Alternative, Alternative 1)

Under this alternative, an approximate 3,150-foot-long soil cement structure would be constructed in place of the existing soil cement. The new structure would be approximately 30 feet in height and 10 feet in width, and placed at a 1H:1V slope. Approximately 10 feet would be exposed above-ground, with the remaining structure buried. A trapezoidal cut is required to place the soil cement structure. The excavation footprint would be approximately 100 feet wide along the 3,150-foot span. Existing soil cement may be encountered during excavation. If encountered, the contractor would demolish the soil cement and have the option to dispose of it off-site or process it for reuse as backfill if deemed suitable for the project. Any excavated material not suitable for the soil cement mix or for backfill would be disposed of off-site.

In general, the Soil Cement Alternative would retain the approximate configuration and dimension of the existing soil cement embankment. However, this alternative would establish a deeper toe to protect against maximum scour depths. Channel configuration would generally remain the same and, as a result, channel capacity would essentially remain unchanged. Given that the SAR floodplain transecting the Phase 4 project area ranges between approximately 700 and 900 feet wide, it is unlikely that increasing the width and depth of the existing soil cement embankment would affect channel capacity, or water surface elevation, or velocity. Moreover, the 30 foot “encroachment” would be buried in an area that is currently 20 feet below the ground surface and would only be exposed if and when maximum bed degradation occurs. Removal of river side vegetation could temporarily reduce channel roughness and increase capacity through the project area. However, vegetation is expected to quickly reestablish in the project area through hydroseeding, plantings, and natural recruitment. Hydrologic changes associated with vegetation removal will likely return to baseline levels within 1 to 2 years subsequent to the completion of construction. Based on the above, the Soil Cement Alternative would result in less than significant impacts on hydrology.

Grouted Stone Alternative (Alternative 2)

Under this alternative, the existing soil cement embankment would be removed, and an 80-foot-wide, trapezoidal-shaped trench would be excavated along the 3,970-foot-long embankment. A compacted

earthen embankment would be constructed at a 2H:1V slope. The slope would be protected by a 2-foot-thick concrete layer embedded with stones. Launchable derrick stone would be placed at the toe of the structure to provide further protection, resulting in protection that extends approximately 50 feet beyond the toe of the existing soil cement structure into the river's floodplain. Given that the SAR floodplain transecting the Phase 5B area ranges between approximately 700 and 900 feet wide, it is unlikely that increasing the width and depth of the existing embankment would affect channel capacity. Moreover, the 50-foot "encroachment" would be buried in an area that is currently 20 feet below the ground surface and would only be exposed if and when maximum bed degradation occurs. Removal of river side vegetation will temporarily reduce channel roughness and increase capacity through the project area. However, vegetation is expected to quickly reestablish in the project area through hydroseeding, plantings, and natural recruitment. Hydrologic changes associated with vegetation removal will likely return to baseline levels within 1 to 2 years subsequent to the completion of construction. Based on the above, the Grouted Stone Alternative would result in less than significant impacts on hydrology.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, reconstruction of the existing bank protection structure to provide additional protection against high flows and scour would not occur. Therefore, hydrology through the Phase 4 project area would remain unchanged. However, future high flow conditions could undermine and erode segments of SR-91, the SAR Trail, and the SARI Line located adjacent to the project reach. Periodic emergency repairs of the existing bank protection would likely be required, which would likely entail the discharge of rocks to stabilize the embankment. Given that the SAR floodplain through the Reach 9 measures ranges between approximately 700 and 900 feet wide, it is unlikely that the periodic discharge of rocks to stabilize portions of the existing embankment would significantly affect river hydrology.

5.2.2.4 BNSF Bridge

Pier and Abutment Protection Alternative (Preferred Alternative, Alternative 1)

Under the Preferred Alternative, pier nose and abutment protection measures, reinforced concrete walls, sheet pile and reinforced concrete diaphragm walls, and grouted stone protection would be constructed to provide additional scour protection to bridge piers and abutments, and tie previously constructed bank protection along the east bank of the channel into the existing eastern bridge abutment. Reinforced concrete enclosure walls would be installed around Pier Nos. 2 through 5 and reinforced concrete pier nose extension walls would be constructed immediately upstream of these piers. The project would also construct sheet pile and reinforced concrete diaphragm walls with tieback anchors parallel to existing Pier Nos. 1 and 6 to guide the design flow safely under the bridge. Additionally, 24-inch grouted stone bank protection would be installed to tie the existing bridge abutment along the east bank of the river channel (Pier No. 1) into bank protection installed upstream (Phase 2A) and downstream (Phase 2B) of the BNSF Bridge. The toe of the bank protection will match

the existing toe depths for Phase 2A (el. 401) and mobile home park (el. 398) bank protection. The grouted stone on the river side of the sheet pile wall will be mostly buried.

BNSF Bridge pier and bank protection features have been designed so that no significant change in hydrology of the SAR would occur upon implementation. Pier nose extensions have been designed with the smallest footprint possible to provide the necessary protection at bridge piers, and they have been sited (angled) in the channel so that hydrology will not be significantly altered. Channel configuration would generally remain the same and, as a result, channel capacity would essentially remain unchanged. Given that the SAR floodplain transecting the BNSF Bridge measure is approximately 350 feet wide, it is unlikely that installing new grouted stone protection along the east side of the SAR would significantly affect channel capacity, water surface elevation, or velocity. Removal of river side vegetation could temporarily reduce channel roughness and increase capacity through the project area. However, vegetation is expected to quickly reestablish in the project area through hydroseeding, plantings, and natural recruitment. Hydrologic changes associated with vegetation removal will likely return to baseline levels within 1 to 2 years subsequent to the completion of construction. Based on the above, the Pier and Abutment Protection Alternative would result in less than significant impacts on hydrology.

No Federal Action Alternative (Alternative 2)

Under the No Federal Action Alternative, the construction of bridge pier or abutment protection features to provide additional protection against high flows and scour would not occur. Therefore, future high flow conditions through the project reach could undermine the BNSF Bridge piers, periodically threatening bridge stability and requiring emergency repairs to avoid catastrophic loss. Therefore, under the No Federal Action Alternative, bridge piers and existing protection would periodically be threatened during large flow releases from Prado Dam, requiring emergency repairs of the existing bridge and bank protection. Emergency repairs would be limited in scope and duration and would likely entail the discharge of rocks to stabilize existing bridge piers, abutments, and existing embankments. Given that the SAR floodplain through the Reach 9 measures is approximately 400 feet wide, it is unlikely that the periodic discharge of rocks to stabilize piers, abutments, and the existing embankment would significantly affect river hydrology.

5.2.3 Summary of Significance Thresholds Related to Proposed Alternatives

The proposed alternatives would have no significant impacts on hydrology, based on the following:

- Proposed alternatives would not substantially change base flow characteristics such as water surface elevation, flow velocity, channel capacity, and channel configuration.

5.3 Groundwater

5.3.1 Affected Environment

The SAR Basin is divided into the Coastal Basin, Inland Basin, and the San Jacinto Basin. Reach 9 occurs in the Coastal Basin, that portion of the SAR watershed downstream of Prado Dam. The Coastal Basin includes a relatively small unconfined recharge area and a relatively large confined area where groundwater pumping is the primary source of discharge (USGS 2002). Groundwater within Reach 9 occurs primarily within the alluvium of the SAR (Corps 2011). Alluvial aquifers are believed to be unconfined to semi-confined and perched on top of lower permeable bedrock formations. Localized mounds of subsurface water, the result of perennial low flows in the channel, are anticipated to be encountered during construction. During field explorations in March 2014 within the Phase 5A project area, groundwater levels were encountered within approximately 6 to 26 feet of the surface (Corps 2014b). During borings conducted in May 2009 and March 2010 in the Phase 3 project area, which lies just west of Phase 4, depths to groundwater were found to range from 15 to 19 feet below the existing grade, outside of the active river channel (Corps 2011). Finally, geotechnical studies performed in May 2012 in support of BNSF Bridge encountered groundwater between approximately 7 to 15 feet below grade (Corps 2014c). Factors such as seasonal rainfall, groundwater pumping at the Canyon RV Park and Green River Golf Course, irrigation, and discharge from Prado Dam all affect groundwater levels in Reach 9. Water withdrawals such as groundwater pumping and irrigation would decrease groundwater levels, while precipitation in the watershed and discharges from Prado Dam would allow recharge of the groundwater table in Reach 9.

Groundwater Quality

As part of the National Water Quality Assessment Program, administered by the U.S. Geological Survey (USGS), groundwater samples were collected throughout the Santa Ana Basin between 1999 and 2001, and analyzed for the existence of contaminants. This study determined that most exceedances of maximum contaminant levels occurred in shallow, coastal monitoring wells that tap groundwater not used for water supply. Pesticides were detected above the laboratory reporting limit in approximately half of the wells sampled in the Santa Ana Basin. Volatile organic compounds were present in approximately 56 percent of the 207 wells sampled (USGS 2002).

Water supply management activities, such as enhanced groundwater recharge and the discharge of treated wastewater within the SAR Basin, are among many factors affecting groundwater quality. Other factors that contribute to water quality include urbanization throughout the watershed and nonpoint agricultural sources.

5.3.2 Environmental Consequences

Significance Threshold

Based on the existing conditions discussed above, impacts would be considered significant if the alternative:

- Substantially reduces the ability to recharge the underlying aquifer, or causes substantial groundwater contamination or substantial groundwater depletion.

5.3.2.1 Phase 5A

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

Implementation of the grouted stone portion of the Preferred Alternative would entail removal of existing riprap and reconstruction of the embankment with grouted stone. Construction would require excavation of an approximately 24-foot deep by 80-foot-wide by 980-foot-long trapezoidal-shaped trench for construction of the grouted stone structure. Depths to groundwater within Reach 9 have been found to occur within a few feet of the ground surface. As a result, construction activities are anticipated to come into contact with groundwater. Excavated areas would be dewatered by pumping any groundwater encountered outside of the work limits, most likely into the active river channel downstream of the project area, thereby minimizing contact with construction activities. Furthermore, grouted stone is an inert and stable material when cured, and the structure would not leach chemicals into groundwater. Grouted stone construction would occur under dry condition to further ensure that groundwater is not impacted.

Implementation of the sheet pile portion of the Preferred Alternative would entail the excavation of an 8-foot-deep by a few feet wide by 3,040-foot-long vertical trench to facilitate installation of the sheet pile and associated tiebacks. Given the groundwater depth within the project area, it is anticipated that sheet piling will come in to contact with groundwater. However, groundwater is not expected to be exposed, and as such, dewatering for installation of the sheet piling portion for this alternative is not expected. Furthermore, sheet pile is an inert and stable material and the structure would not leach chemicals into the groundwater.

Dewatering during construction will not lead to a substantial depletion of groundwater during the 24-month construction period, especially considering that groundwater extracted during construction would be pumped back into the active channel or elsewhere in the floodplain. Furthermore, upon completion of construction, the trench would be backfilled with previously excavated native material. Therefore, groundwater recharge within Phase 5A would not be compromised.

Grouted stone is not permeable. Therefore, upon installation, the buried portion of the grouted stone structure would form an impermeable barrier. However, since the grouted stone would not encroach a substantial distance into the floodplain, impacts to groundwater recharge would be less than significant.

Soil Cement and Sheet Pile Alternative (Alternative 2)

The Soil Cement and Sheet Pile Alternative would have impacts similar to the Grouted Stone and Sheet Pile Alternative. Similar to the Preferred Alternative, areas excavated for the soil cement structure would be dewatered by pumping any groundwater encountered outside of the work limits, most likely into the active river channel downstream of the project area, thereby minimizing contact with

construction activities. Furthermore, soil cement is an inert and stable material when cured, and the structure would not leach chemicals into groundwater. Soil cement construction would occur under dry condition to further ensure that groundwater is not impacted. Dewatering during construction would not lead to a substantial depletion of groundwater during the construction period, and therefore groundwater recharge would also not be compromised during implementation of this alternative. Furthermore, since soil cement would not encroach a substantial distance into the flood plain, impacts to groundwater recharge would be less than significant.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, reconstruction of the existing bank protection structure to provide additional bank stabilization against high flows and scour would not occur. As a result, excavation of a trapezoidal-shaped trench that could expose groundwater would not be required. Therefore, no impacts would occur to the ability to recharge groundwater in Phase 5A area, nor would there be activities that could result in substantial groundwater contamination.

However, future high volume releases from Prado Dam could undermine and erode existing bank protection and threaten adjacent infrastructure, including East La Palma Road, the SAR Trail, industrial facilities, and commercial development. Periodic emergency repairs of existing bank protection may be required and would likely entail the discharge of rocks to stabilize the embankment. It is possible that emergency repairs would require some amount of excavation to establish a proper toe for rocks. If groundwater is encountered during emergency repairs, it is unlikely that it would hinder the ability to recharge groundwater or result in groundwater contamination, as emergency repairs would be of short duration and BMP would be implemented to reduce the potential for groundwater contamination.

5.3.2.2 Phase 5B

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

The Preferred Alternative would entail removal of existing protection and reconstruction of the embankment with grouted stone and sheet pile. Grouted stone would be used for the majority of protection, transitioning to sheet pile only at the upstream-most extent where needed to avoid direct impacts to flowing water. Construction would require excavation of an approximate 24-foot-deep by 80-foot-wide by 19,700-foot-long trapezoidal-shaped trench along the length of the project area. Depths to groundwater within Reach 9 have been found to occur within a few feet of the ground surface. As a result, construction activities are anticipated to come into contact with groundwater. Excavated areas would be dewatered by pumping any groundwater encountered outside of the work limits, most likely into the active river channel downstream of the Phase 5B area, thereby minimizing contact with construction activities. Furthermore, grouted stone is an inert and stable material when cured and the structure would not leach chemicals into groundwater. Grouted stone construction would occur under dry condition to further ensure that groundwater is not impacted.

Dewatering during construction will not lead to a substantial depletion of groundwater during the 24-month construction period, especially considering that groundwater extracted during construction

would be pumped back into the active channel or elsewhere in the floodplain. Furthermore, upon completion of construction, the trench would be backfilled with previously excavated native material. Therefore, groundwater recharge within Phase 5BA would not be compromised.

Grouted stone is not permeable. Therefore, upon installation, the buried portion of the grouted stone structure would form an impermeable barrier. However, since the grouted stone would not encroach a substantial distance into the floodplain, impacts to groundwater recharge would be less than significant.

Soil Cement Structure Alternative (Alternative 2)

The Soil Cement Alternative would have similar impacts to the Grouted Stone Alternative. Similar to the Preferred Alternative, areas excavated for the soil cement structure would be dewatered by pumping any groundwater encountered outside of the work limits, most likely into the active river channel downstream of the project area, thereby minimizing contact with construction activities. Furthermore, soil cement is an inert and stable material when cured, and the structure would not leach chemicals into groundwater. Soil cement construction would occur under dry condition to further ensure that groundwater is not impacted. Dewatering during construction would not lead to a substantial depletion of groundwater during the construction period, and therefore groundwater recharge would also not be compromised during implementation of this alternative. Furthermore, since soil cement would not encroach a substantial distance into the floodplain, impacts to groundwater recharge would be less than significant.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, reconstruction of the existing bank protection structure to provide additional protection against high flows and scour would not occur. As a result, excavation of a trapezoidal-shaped trench that could expose groundwater would not be required. Therefore, no impacts would occur to the ability to recharge groundwater in this Reach 9 measure, nor would there be activities that could result in substantial groundwater contamination.

However, future high volume releases from Prado Dam could undermine and erode existing bank protection and threaten adjacent infrastructure, including East La Palma Road, the SAR Trail, industrial facilities, and commercial and residential development. Periodic emergency repairs of existing bank protection may be required and would likely entail the discharge of rocks to stabilize the embankment. It is possible that emergency repairs would require some amount of excavation to establish a proper toe for rocks. If groundwater is encountered during emergency repairs, it is unlikely that it would hinder the ability to recharge groundwater, or result in groundwater contamination.

5.3.2.3 Phase 4

Soil Cement Alternative (Preferred Alternative, Alternative 1)

Under the Preferred Alternative, an approximate 3,150 foot-long soil cement structure would be constructed in place of the existing soil cement. The new structure would be approximately 30 feet in

height and 10 feet in width, and placed at a 1H:1V slope. Approximately 10 feet would be exposed above-ground, with the remaining structure buried. A trapezoidal cut is required to place the soil cement structure. The excavation footprint would be approximately 100 feet wide along the 3,150-foot span. Depths to groundwater within Reach 9 have been found to occur within a few feet of the ground surface. As a result, construction activities are anticipated to come into contact with groundwater. Excavated areas would be dewatered by pumping any groundwater encountered outside of the work limits, most likely into the active river channel downstream of this Reach 9 measure, thereby minimizing contact with construction activities. Furthermore, grouted stone is an inert and stable material when cured and the structure would not leach chemicals into groundwater. Grouted stone construction would occur under dry conditions to further ensure that groundwater is not impacted.

Dewatering during construction will not lead to a substantial depletion of groundwater during the construction period, especially considering that groundwater extracted during construction would be pumped back into the active channel or elsewhere in the floodplain. Furthermore, upon completion of construction, the trench would be backfilled with previously excavated native material. Therefore, groundwater recharge within Phase 4 would not be compromised.

Soil cement is not permeable. Therefore, upon installation, the buried portion of the soil cement structure would form an impermeable barrier. However, since soil cement would not encroach a substantial distance into the floodplain, impacts to groundwater recharge would be less than significant.

Grouted Stone Alternative (Alternative 2)

The Grouted Stone Alternative would entail removal of existing bank protection and reconstruction of the embankment with grouted stone. Construction would require excavation of an approximately 24-foot-deep by 80-foot-wide by 3,150 foot-long trapezoidal-shaped trench along the length of the Phase 4 area. Depths to groundwater within Reach 9 have been found to occur within a few feet of the ground surface. As a result, construction activities are anticipated to come into contact with groundwater. Excavated areas would be dewatered by pumping any groundwater encountered outside of the work limits, most likely into the active river channel downstream of this Reach 9 measure, thereby minimizing contact with construction activities. Furthermore, grouted stone is an inert and stable material and the structure would not leach chemicals into groundwater.

Dewatering during construction will not lead to a substantial depletion of groundwater during the construction period, especially considering that groundwater extracted during construction would be pumped back into the active river channel or elsewhere in the floodplain. Furthermore, upon completion of construction, the trench would be backfilled with previously excavated native material. Therefore, groundwater recharge within Phase 4 would not be compromised.

Grouted stone is not permeable. Therefore, upon installation, the buried portion of the grouted stone structure would form an impermeable barrier. However, since the grouted stone would not encroach a substantial distance into the floodplain, impacts to groundwater recharge would be less than significant.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, reconstruction of the existing bank protection structure to provide additional protection against high flows and scour would not occur. As a result, excavation of a trapezoidal-shaped trench that could expose groundwater would not be required. Therefore, no impacts would occur to the ability to recharge groundwater in this Reach 9 measure, nor would there be activities that could result in substantial groundwater contamination.

However, future high volume releases from Prado Dam could undermine and erode existing bank protection and threaten segments of SR-91, the SAR Trail, and SARI Line adjacent to this Reach 9 measure. Periodic emergency repairs of existing bank protection may be required and would likely entail the discharge of rocks to stabilize the embankment. It is possible that emergency repairs would require some amount of excavation to establish a proper toe for rocks. If groundwater is encountered during emergency repairs, it is unlikely that it would hinder the ability to recharge groundwater, or result in groundwater contamination.

5.3.2.4 BNSF Bridge

Pier and Abutment Protection Alternative (Preferred Alternative, Alternative 1)

Under this alternative, pier noses, reinforced concrete walls, sheet pile and reinforced concrete diaphragm walls, and grouted stone protection would be constructed to provide additional scour protection to bridge piers and abutments, and tie previously constructed bank protection along the east bank of the channel into the existing eastern bridge abutment. Reinforced concrete enclosure walls would be installed around Pier Nos. 2 through 5 and reinforced concrete pier nose extension walls would be constructed immediately upstream of these piers. Under this alternative, the Corps would also construct sheet pile and reinforced concrete diaphragm walls with tieback anchors parallel to existing Pier Nos. 1 and 6 to guide the design flow safely under the bridge. Additionally, 24-inch grouted stone bank protection would be installed to tie the existing bridge abutment along the east bank of the river channel (Pier No. 1) into bank protection installed upstream (Phase 2A) and downstream (Phase 2B) of the BNSF Bridge. The toe of the bank protection will match the existing toe depths for Phase 2A (el. 401) and mobile home park (el. 398) bank protection. The grouted stone on the river side of the sheet pile wall will be mostly buried.

Depths to groundwater within Reach 9 have been found to occur within a few feet of the ground surface. As a result, construction activities are anticipated to come into contact with groundwater. Excavated areas would be dewatered by pumping any groundwater encountered outside of the work limits, most likely into the active river channel downstream of the project area, thereby minimizing contact with construction activities. Furthermore, project features (i.e., pier noses, sheet pile, concrete walls, grouted stone) are inert and stable materials when cured and would not leach chemicals into groundwater. These project features would be constructed under dry conditions to further ensure that groundwater is not impacted.

Dewatering during construction will not lead to a substantial depletion of groundwater during the three-year construction period, especially considering that groundwater extracted during construction would be pumped back into the active river channel or elsewhere in the floodplain. Construction of a grouted stone structure along the east bank of the SAR would occur under dry conditions to further ensure that groundwater is not impacted. Dewatering during construction would not lead to a substantial depletion of groundwater during the construction period, and therefore groundwater recharge would also not be compromised during implementation of this alternative. Furthermore, since an impermeable grouted stone structure would not encroach a substantial distance into the floodplain, impacts to groundwater recharge would be less than significant. Finally, upon completion of construction, excavations would be backfilled as required with previously excavated native material. Therefore, the project area's ability to recharge groundwater would not be compromised.

It is anticipated that a less than significant impact to groundwater quality and recharge would also occur during the river diversion. The diversion would be temporary in nature, and surface flows would be diverted within the SAR, not removed from the SAR, so that groundwater recharge would not be compromised. BMP implemented during the river diversion would reduce the potential for groundwater contamination.

No Federal Action Alternative (Alternative 2)

Under the No Federal Action Alternative, the construction of bridge pier and abutment protection features to provide additional protection against high flows and scour would not occur. Therefore, future high flow conditions through the project reach could undermine the BNSF Bridge piers, periodically threatening bridge stability and requiring emergency repairs to avoid catastrophic loss. Therefore, under the No Federal Action Alternative, bridge piers and existing protection would periodically be threatened during large flow releases from Prado Dam, requiring emergency repairs of existing bridge and bank protection. Emergency repairs would be limited in scope and duration and would likely entail the discharge of rocks to stabilize existing bridge piers, abutments, and existing embankments. It is possible that emergency repairs could require some amount of excavation to establish a proper toe for rocks. If groundwater is encountered, it is unlikely that emergency repairs would significantly affect groundwater recharge or contaminate groundwater.

5.3.3 Environmental Commitments

EC-GW-1: Groundwater extracted during construction would be pumped back into the active river channel or elsewhere in the floodplain to minimize potential for groundwater depletion during construction of Reach 9 measures.

5.3.4 Summary of Significance Thresholds Related to Proposed Alternatives

The proposed alternatives would have no significant impacts on groundwater, based on the following:

- Proposed alternatives would not substantially reduce the ability to recharge the underlying aquifer, cause substantial groundwater contamination, or cause substantial groundwater

depletion. Groundwater encountered during construction would be pumped back into the active river channel or elsewhere in the floodplain.

5.4 Surface Water Quality

5.4.1 Affected Environment

Historically, the SAR contained perennial flow; however, the river is now ephemeral throughout most of its course due to the construction of dams, irrigation and water supply diversions, and groundwater pumping. In-stream flows in the SAR are "effluent dominated," and without discharges from area wastewater treatment plants into the river, surface flow would be rare during dry weather. On average, 200,000 acre-feet of natural stream flow passes through Prado Dam into the lower SAR annually. Much of this flow is diverted downstream to recharge basins operated by the OCWD for recharge of underlying groundwater aquifers, which provide for much of the local water supply. The flows in the river reaching the recharge basins consist of a blend of highly treated wastewater effluent, irrigation runoff water, imported water purchased for groundwater recharge, and groundwater forced to the surface by underground barriers. During periods of rainfall, particularly during the winter months (December to March), storm runoff is transported in the river channel to the ocean.

USGS maintains seven active gauging stations to monitor flow and water quality along the SAR and several of its tributaries. Long-term streamflow and water quality data are available for a gauging station approximately 2 miles downstream of Prado Dam. Some 250 constituents have been measured in samples collected over time and in ongoing monitoring of river water quality. Most of these constituents (such as organic contaminants, pesticides, and other synthetic organic compounds and priority pollutants as defined by the U.S. Environmental Protection Agency [USEPA]) are found at very low levels. The concentrations of most constituents in the SAR are highly variable and subject to seasonal changes, much of which is flow related. Seasonal changes in flow and quality are also related to land use, agricultural activities, and wastewater discharge practices. Long-term trends show that concentrations of ammonia, organic nitrogen, ammonia plus organic nitrogen, total organic carbon, and chemical oxygen demand are higher during the wet seasons, which may be related to the flushing of accumulated soluble, colloidal, or particulate material that accumulates during the dry season.

In general, water quality downstream of Prado Dam falls within acceptable limits provided by the Santa Ana RWQCB (SAWPA 2011). Over the nearly 30-year period that records have been maintained at the gauging station below Prado Dam, water quality objectives have been exceeded only occasionally and generally fall within parameters specified in the SAR Basin Plan. However, in the Water Quality Assessment Status for Reporting Year 2010, the portion of the SAR that includes Reach 9 (designated as Reach 2 of the SAR by USEPA) occurs on the 303(d) list of water quality limited segments requiring the development of a Total Maximum Daily Load (TMDL) (USEPA 2014a), for indicator bacteria. TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that load among the various sources of that pollutant.

5.4.2 Environmental Consequences

Significance Threshold

Based on the existing conditions discussed above, impacts would be considered significant if the alternative results in:

- Substantial increases in the rate or amount of surface runoff resulting in flooding on-site or off-site, or contributing runoff water that would exceed the capacity of an existing or planned storm water drainage system;
- An increase in the demand for surface water in areas with existing shortages; and/or
- Long-term violation of RWQCB water quality standards or objectives or impairment of beneficial uses of water.

5.4.2.1 Phase 5A

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

Implementation of the grouted stone portion of the Preferred Alternative would entail removal of existing riprap and reconstruction of the embankment with grouted stone. Construction would require excavation of an approximately 24-foot-deep by 80-foot-wide by 980-foot-long trapezoidal-shaped trench for construction of the grouted stone structure. The trench would be excavated outside of the active river channel, away from surface waters in the SAR. However, depths to groundwater within Reach 9 have been found to occur within a few feet of the ground surface and, as a result, construction activities are anticipated to come into contact with groundwater. Excavated areas would be dewatered by pumping any groundwater encountered outside of the work limits, most likely into the active river channel downstream of this Reach 9 measure, thereby minimizing contact with construction activities.

Implementation of the sheet pile portion of the Preferred Alternative would entail the excavation of an 8-foot-deep by a few feet wide by 3,040-foot-long vertical trench to facilitate installation of the sheet pile and associated tiebacks. Excavation of the sheet pile trench would also occur outside of surface waters; however, given the groundwater depth within this Reach 9 measure, it is anticipated that sheet piling will come in to contact with groundwater. Groundwater is not expected to be exposed and, as such, dewatering for installation of the sheet piling portion of the project is not expected.

Based on the above, there would be no impacts to surface waters. The grouted stone and sheet pile structures would be installed outside of surface waters. Therefore, the Grouted Stone and Sheet Pile Alternative would not introduce or leach inorganic or organic compounds into surface waters. Additionally, the contractor would be required to develop and implement a SWPPP, which should minimize impacts to water quality during project construction. This would include construction of a silt fence or other barrier between the work area and floodplain, where necessary.

Soil Cement and Sheet Pile Alternative (Alternative 2)

The Soil Cement and Sheet Pile Alternative would have impacts similar to the Grouted Stone and Sheet Pile Alternative. Implementation of this alternative would also avoid surface waters and require the development of a SWPPP to minimize impacts to water quality.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, reconstruction of the existing bank protection structure to provide additional protection against high flows and scour would not occur. As a result, excavation of a trapezoidal-shaped trench that could expose groundwater would not be required, and the discharge of groundwater to surface waters of the SAR during dewatering would not occur.

However, future high-volume releases from Prado Dam could undermine and erode existing bank protection and threaten adjacent infrastructure, including East La Palma Road, the SAR Trail, industrial facilities, and commercial development. Periodic emergency repairs of existing bank protection may be required and would likely entail the discharge of rocks to stabilize the embankment. It is possible that emergency repairs would require some amount of discharge into flowing water (if the river channel migrates against or into the embankment), and may require excavation to establish a proper toe for rocks. However, it is unlikely that major repair activities would occur in or near surface water as the river would probably be diverted prior to construction. Moreover, activities would be monitored and appropriate BMP would be implemented to minimize impacts to water quality from debris and loose sediment.

5.4.2.2 Phase 5B

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

The Grouted Stone and Sheet Pile Alternative would entail removal of existing protection and reconstruction of the embankment with grouted stone and sheet pile. Grouted stone would be used for the majority of protection, transitioning to sheet pile only at the upstream-most extent where needed to avoid direct impacts to flowing water. Construction would require excavation of an approximate 24-foot-deep by 80-foot-wide by 19,700-foot-long trapezoidal-shaped trench along the length of the project area. Trench excavation would occur outside of the active river channel, away from surface waters in the SAR. However, depths to groundwater within Reach 9 have been found to occur within a few feet of the ground surface and, as a result, construction activities are anticipated to come into contact with groundwater. Excavated areas would be dewatered by pumping any groundwater encountered outside of the work limits, most likely into the active river channel downstream of the project area, thereby minimizing contact with construction activities.

Based on the above, there would be no impacts to surface waters. The grouted stone structure would be installed outside of surface waters and would not introduce or leach inorganic or organic compounds into surface waters. Additionally, the contractor would be required to develop and implement a SWPPP,

which should minimize impacts to water quality during project construction. This would include construction of a silt fence or other barrier between the work area and floodplain, where necessary.

Soil Cement Alternative (Alternative 2)

The Soil Cement Alternative would have impacts similar to the Grouted Stone Alternative. Implementation of this alternative would also avoid surface waters and require the development of a SWPPP to minimize impacts to water quality.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, reconstruction of the existing bank protection structure to provide additional protection against high flows and scour would not occur. As a result, excavation of a trapezoidal-shaped trench that could expose groundwater would not be required, and the discharge of groundwater to surface waters of the SAR during dewatering would not occur.

However, future high volume releases from Prado Dam could undermine and erode existing bank protection and threaten adjacent infrastructure, including East La Palma Road, the SAR Trail, industrial facilities, and commercial and residential development. Periodic emergency repairs of existing bank protection may be required and would likely entail the discharge of rocks to stabilize the embankment. It is possible that emergency repairs would require some amount of discharge into flowing water (if the river channel migrates against or into the embankment), and may require excavation to establish a proper toe for rocks. However, it is unlikely that major repair activities would occur in or near surface water as the river would probably be diverted prior to construction. Moreover, activities would be monitored and appropriate BMP would be implemented to minimize impacts to water quality from debris and loose sediment.

5.4.2.3 Phase 4

Soil Cement Alternative (Preferred Alternative, Alternative 1)

Under the Soil Cement Alternative, an approximate 3,150-foot-long soil cement structure would be constructed in place of the existing soil cement. The new structure would be approximately 30 feet in height and 10 feet in width, and placed at a 1H:1V slope. Approximately 10 feet would be exposed above-ground, with the remaining structure buried. A trapezoidal cut is required to place the soil cement structure. The excavation footprint would be approximately 100 feet wide along the 3,150foot span. Excavation would occur outside of the active river channel, away from surface waters in the SAR. However, depths to groundwater within Reach 9 have been found to occur within a few feet of the ground surface and, as a result, construction activities are anticipated to come into contact with groundwater. Excavated areas would be dewatered by pumping any groundwater encountered outside of the work limits, most likely into the active river channel downstream of the project area, thereby minimizing contact with construction activities.

Based on the above, there would be no impacts to surface waters. The soil cement structure would be installed outside of surface waters and would not introduce or leach inorganic or organic compounds into surface waters. Additionally, the contractor would be required to develop and implement a SWPPP, which should minimize impacts to water quality during project construction. This would include construction of a silt fence or other barrier between the work area and floodplain, where necessary.

Grouted Stone Alternative (Alternative 2)

The Grouted Stone Alternative would have impacts similar to the Soil Cement Alternative. Implementation of this alternative would also avoid surface waters and require the development of a SWPPP to minimize impacts to water quality.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, reconstruction of the existing bank protection structure to provide additional protection against high flows and scour would not occur. As a result, excavation of a trapezoidal-shaped trench that could expose groundwater would not be required, and the discharge of groundwater to surface waters of the SAR during dewatering would not occur.

However, future high volume releases from Prado Dam could undermine and erode existing bank protection and threaten adjacent infrastructure, including segments of SR-91, the SAR Trail, and the SARI Line located adjacent to the project reach. Since both the highway and the SARI wastewater line that is currently being placed behind the existing bank protection are regionally important, maintenance and emergency repair actions would be undertaken expeditiously to provide protection. Periodic emergency repairs of existing bank protection may be required and would likely entail the discharge of rocks to stabilize the embankment. It is possible that emergency repairs would require some amount of discharge into flowing water (if the river channel migrates against or into the embankment), and may require excavation to establish a proper toe for rocks. However, it is unlikely that major repair activities would occur in or near surface water as the river would probably be diverted prior to construction. Moreover, activities would be monitored and appropriate BMP would be implemented to minimize impacts to water quality from debris and loose sediment.

In the event that high flow conditions lead to rupture of the SARI Line, treated wastewater containing high concentrations of salt would be released into surface waters. Potential rupture of the SARI Line could entail temporary exceedances of surface water quality standards.

5.4.2.4 BNSF Bridge

Pier and Abutment Protection Alternative (Preferred Alternative, Alternative 1)

Under this alternative, reinforced concrete walls, sheet pile and reinforced concrete diaphragm walls, and grouted stone protection would be constructed to provide additional scour protection to bridge piers and abutments, and tie previously constructed bank protection along the east bank of the channel into the existing eastern bridge abutment. Reinforced concrete enclosure walls would be installed

around Pier Nos. 2 through 5 and reinforced concrete pier nose extension walls would be constructed immediately upstream of these piers. The project would also construct sheet pile and reinforced concrete diaphragm walls with tieback anchors parallel to existing Pier Nos. 1 and 6 to guide the design flow safely under the bridge. Additionally, 24-inch grouted stone bank protection would be installed to tie the existing bridge abutment along the east bank of the river channel (Pier No. 1) into bank protection installed upstream (Phase 2A) and downstream (Phase 2B) of the BNSF Bridge. The toe of the bank protection will match the existing toe depths for Phase 2A (el. 401) and mobile home park (el. 398) bank protection. The grouted stone on the river side of the sheet pile wall will be mostly buried.

The construction of the pier noses would require work within the main channel, and construction activities would come into contact with groundwater. However, the flow would be diverted, and the project area dewatered (any groundwater encountered would be pumped outside of the work limits, most likely into the active flow channel downstream of this Reach 9 measure). Therefore, minimal surface water would be present within the project area during construction. The act of diverting surface flows would lead to substantial turbidity for several hundred feet downstream of the diversion point, which is expected to dissipate within a few hours. This analysis is based on observations and measurements obtained during diversions that have recently occurred at other Reach 9 project features, including Phases 2B and 3. Upon completion of construction, a temporary, localized increase in turbidity as flows flush unconsolidated material downstream could occur; however, levels would return to baseline soon after.

Based on the above, temporary impacts to surface waters could occur; however, the contractor would be required to develop and implement a SWPPP, which should minimize impacts to water quality during project construction. This would include construction of a silt fence or other barrier between the work area and floodplain, where necessary.

No Federal Action Alternative (Alternative 2)

Under the No Federal Action Alternative, the construction of bridge pier and abutment protection features to provide additional protection against high flows and scour would not occur. As a result, construction activities within the river channel would not be required and a diversion of the active river channel during construction of in-stream features would not be required. As such, there would be no impacts to the surface waters. However, future high flow conditions through the project reach could undermine the BNSF Bridge piers, periodically threatening bridge stability and requiring emergency repairs to avoid catastrophic loss. Emergency repairs would be limited in scope and duration and would likely entail the discharge of rocks to stabilize existing bridge piers, abutments, and existing embankments, and it is possible that emergency repairs could require some amount of excavation to establish a proper toe for rocks within or near surface waters. This could result in temporary elevations in turbidity. However, turbidity levels would return to baseline conditions upon completion of construction.

5.4.3 Environmental Commitments

Previous environmental commitments and mitigation measures were outlined and summarized in the 2001 Final SEIS/EIR, and remain in effect. The following environmental commitment from the 2001 Final SEIS/EIR would be incorporated into contract specifications or otherwise implemented by the Corps to reduce potential impacts to water quality.

WR-1 Prior to initiating construction, the construction contractor shall prepare an erosion control plan to control potential sedimentation and turbidity impacts. The erosion control plan shall include temporary measures such as sandbags and/or water bars and may include long-term measures such as re-vegetating the access road.

WR-3 The construction contractor shall obtain a National Pollution Discharge Elimination System (NPDES) construction stormwater permit prior to construction.

WR-3 Prior to construction, the construction contractor shall prepare a pollution prevention plan to reduce the potential for accidental release of fuels, pesticides, and other materials. This plan shall include the designation of refueling locations, emergency response procedures, and definition or reporting requirements for any spill that occurs. Equipment for immediate cleanup shall be kept at the staging area for immediate use. This plan shall also include pesticide application activities such as storage, handling of herbicides, and application methods.

The following commitments have been implemented during the construction of previous protection measures in Reach 9, and would be incorporated into contract specifications for current Reach 9 measures to reduce potential impacts to surface and groundwater quality.

EC-WQ-1: Obtain a dewatering permit if the installation and maintenance of the structure extends into the groundwater table.

EC-WQ-2: Keep cleanup equipment and supplies at the staging area for immediate use.

EC-WQ-3: Utilize liners and earthen berms in the establishment of upland refueling areas to isolate potential fuel spills from the aquatic environment. Keep fuel spill cleanup equipment and supplies adjacent to the refueling area.

EC-WQ-4: Place oil drip pans underneath engine block and hydraulic systems for equipment not in use.

5.4.4 Summary of Significance Thresholds Related to Proposed Alternatives

The proposed alternatives would have no significant impacts on surface water, based on the following:

- Proposed alternatives would not substantially increase the rate or amount of surface runoff and cause flooding on-site or off-site, or contribute runoff water that would exceed the capacity of an existing or planned storm water drainage system; and/or

- Proposed alternatives would not increase demand for surface water in areas with existing shortages.

Proposed alternatives would not result in long-term violations of RWQCB water quality standards or objectives or cause impairment of beneficial uses.

5.5 Biological Resources

The information presented in this chapter describes the biological resources that occur within Phases 4, 5A, and 5B, and BNSF Bridge and their vicinities. It includes descriptions of common plant communities and wildlife, including special-status species that have either been observed or have the potential to occur within these Reach 9 measures.

5.5.1 Affected Environment

General Setting

Natural conditions in Reach 9 are generally dictated by climate, which is typical of southern California inland areas. The watershed's Mediterranean climate is characterized by typical hot, dry summers and relatively cooler, wetter winters. The annual precipitation in the region averages approximately eighteen inches per year. Most precipitation occurs between November and March with little to no rainfall during summer months. Prevailing temperatures in the watershed vary depending on location, elevation, and topography. These conditions all contribute to the unique composition of vegetation communities and wildlife species occurring in the region.

Reach 9 occurs within the SAR Canyon, which extends from Prado Dam, approximately 8.3 miles downstream to the vicinity of Weir Canyon Road Bridge, where the river transitions from a relatively natural channel that meanders and bifurcates, to an engineered channel with armored banks. The Reach 9 measures extend from near the upstream end of Reach 9 where the BNSF Bridge spans the river, downstream through the Phase 4 area along the south bank, and Phase 5B then 5A along the north bank, near the downstream end of Reach 9.

Although the SAR consists of a diverse assemblage of habitats that are vital to a variety of biological resources, it is also subject to human disturbance. Disturbances include urban development, agricultural development, and flood control activities. More recently, disturbance to the SAR and its habitats have occurred during construction of the SARI Line, Phase 2A and Phase 3. Other types of disturbances occur in the area as well, including floods, fires, and other more "natural" occurrences. The Freeway Complex Fire, which occurred in 2008, burned approximately 30,300 acres, including the entire Phase 4 area, portions of the Phase 5A and 5B areas, and within close proximity of the BNSF Bridge. In general, plant communities affected by the fire have recovered. Signs of the fire are still apparent in some areas where an occasional burned tree stump with new limbs and leaves is observed.

Plant Communities

A description and analysis of plant communities in Reach 9 of the SAR was originally provided in the 2001 EIS/EIR. A more recent plant community mapping effort was conducted in Reach 9 to comply with requirements related to the Santa Ana River Canyon Habitat Management Plan Maintenance and Monitoring Report (HMP) (County of Orange 2014a) for Reach 9, which itself was a requirement of the SARMP's 1988 SEIS and 2001 Biological Opinion (BO). This HMP mapping effort followed the Orange County Habitat Classification System (HCS) (County of Orange 1992), which was developed specifically

for plant communities occurring within Orange County. It was conducted by LSA Associates, Inc. in early 2012 using orthographically rectified aerial photographs at a scale of 1"=100', combined with field-truthing surveys. The minimum polygon size was 0.5 acres (Orange County 2012a). Reconnaissance-level field surveys of Phases 4, 5A, 5B, and BNSF Bridge were conducted on April 14 and 15, 2014. The surveys were conducted to confirm, and if needed, update existing HMP vegetation data.

At the most general level, four plant communities occur within the Reach 9 measure areas, including: (1) Riparian, (2) Upland, (3) Water, and (4) Developed. These four general scale characterizations of the vegetation communities/land cover types are depicted for each Reach 9 measure in Figures 5.5-1 through 5.5-4. Descriptions of communities/classifications occurring within the Reach 9 measure areas are provided in the following paragraphs and closely follow descriptions provided in the HMP.

Riparian

Two major plant communities are included in the general scale riparian designation. These include riparian, as defined by the Orange County HCS, as well as disturbed communities that occur within the riparian corridor and are generally known to be associated with plant species on the river banks.

Riparian

According to the Orange County HCS, the riparian plant community consists of trees, shrubs, or herbs that occur along watercourses and bodies of water. The vegetation is adapted to flooding and soil saturation during at least a portion of its growing season. Riparian communities are considered sensitive by CDFW (Holland 1986). Seven riparian vegetation communities occur in the Reach 9 measure areas. They are described below.

- *Barren Riparian.* Barren riparian areas have recently experienced a significant flood event that has currently left them devoid of vegetation. The soils within these areas are dominated by cobble and coarse sands. Fine sediments are absent. Although these areas appear disturbed or barren, they are expected in healthy, dynamic native riparian systems. This community type is present in Phases 4, 5A, and 5B.

- *Willow Riparian Scrub.* Willow riparian scrub is dominated by willow species and saplings of riparian forest. Common willow scrub dominants include arroyo willow (*Salix lasiolepis*) and narrow-leaved willow (*Salix exigua*), with lesser amounts of mulefat (*Baccharis salicifolia*) and black willow (*Salix nigra*). Non-native species common in this scrub may include castor bean (*Ricinus communis*), giant reed (*Arundo donax*), tree tobacco (*Nicotiana glauca*), and pampas grass (*Cortaderia* sp.). This community type is present in Phase 5B.

- *Mulefat Scrub.* Mulefat scrub consists of dense stands of mulefat (*Baccharis salicifolia*) and lesser amounts of willow. It usually occupies intermittent streambeds, seeps, and toe of landslides where local seeps develop. Other species associated with this community may include Bermuda grass (*Cynodon dactylon*), California mugwort (*Artemisia douglasiana*), lamb's

quarters (*Chenopodium* sp.), western ragweed (*Ambrosia psilostachya*), Douglas' nightshade (*Solanum douglasii*), castor bean, and cocklebur (*Xanthium strumarium*). This community type is present in Phases 5A and 5B, and BNSF Bridge.

- *Black Willow Riparian Forest.* Black willow riparian forest is a multilayered forest with a canopy dominated by black willow, with some red willow (*Salix laevigata*) and arroyo willow. The subcanopy layer contains arroyo willow and mulefat. Coast live oak and western sycamore are occasionally present on the outer margins of this forest. The understory is composed of different associations of species, such as hoary nettle (*Urtica holosericea*), poison oak (*Toxicodendron diversilobum*), California mugwort, and Douglas' nightshade. The habitat develops on floodplains along major rivers and streams. This habitat type is found along the banks of the SAR and occurs in Phase 5B.

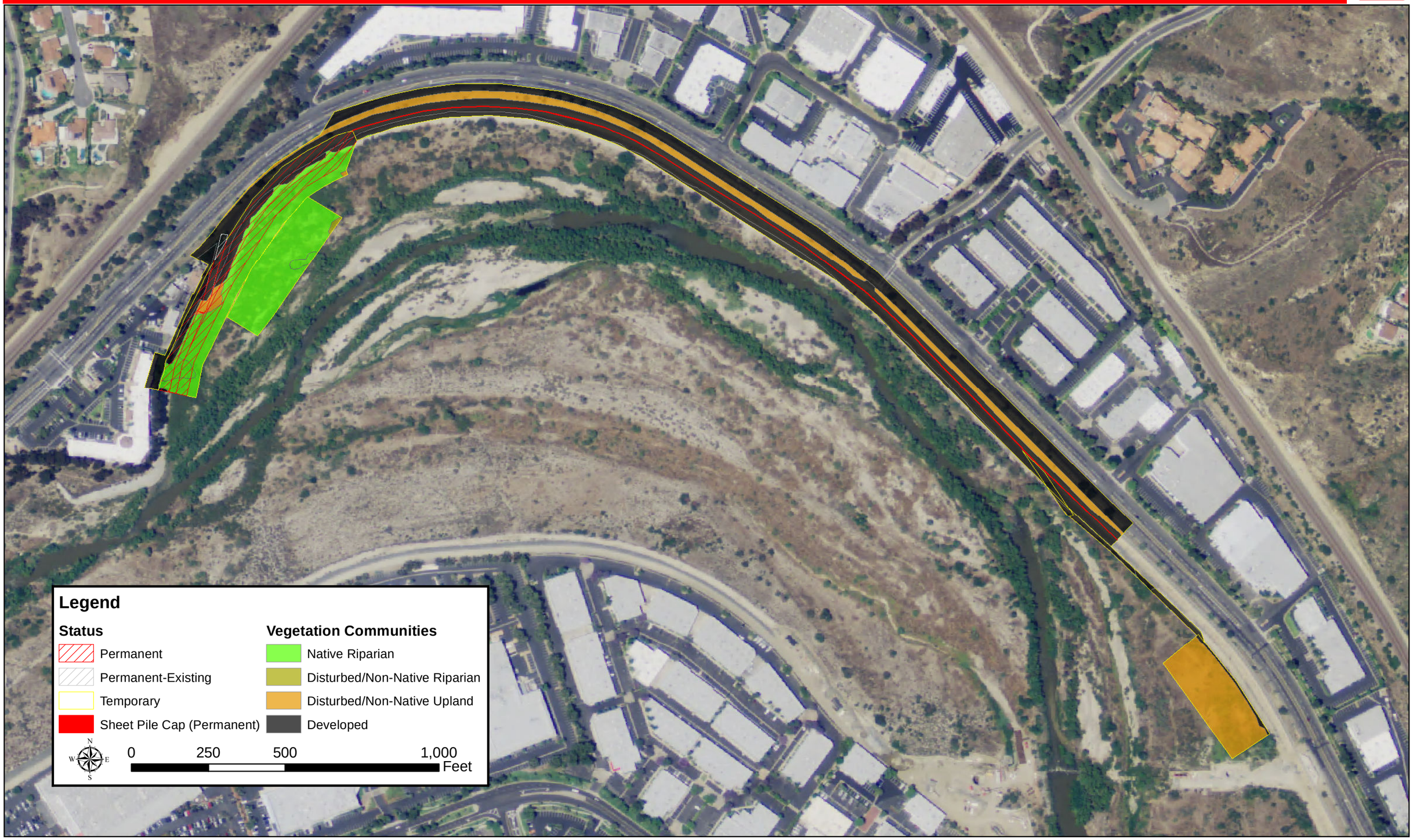
- *Arroyo Willow Riparian Forest.* Arroyo willow riparian forest has a closed canopy of arroyo willow in arborescent form. The understory is similar in composition to black willow forest. The forest occurs on floodplains along major streams and rivers. Within the Reach 9 measure areas this habitat type is mainly found adjacent to the SAR and may integrate with black willow riparian forest and cottonwood-willow riparian forest. This community type is present in Phases 5A and 5B.

- *Cottonwood-Willow Riparian Forest.* Cottonwood-willow riparian forest is a multilayered forest community dominated by cottonwoods (*Populus fremontii*) and willows with other tree species at low numbers and percent cover. It is typically lower on the floodplain than the other forest types previously described. A second canopy layer of mulefat, poison oak, and wild grape (*Vitis californica*) is often associated. The understory is composed of hoary nettle, branching phacelia (*Phacelia ramisissima*), and blackberry (*Rubus ursinus*). Several invasive weedy species, principally giant reed or arundo, castor bean, and tree tobacco, are often found within or beside these forest areas. This community type is found adjacent to the SAR and is present in Phases 5A and 5B, and BNSF Bridge.

- *Herbaceous Riparian.* Herbaceous riparian habitat is an early successional stage of riparian scrub and forest. Flooding or other disturbances often scours woody riparian vegetation away, and the site is rapidly colonized by pioneer wetland herbaceous plants. Flooding is frequent in these areas. This community type is found in Phases 5B and 4.

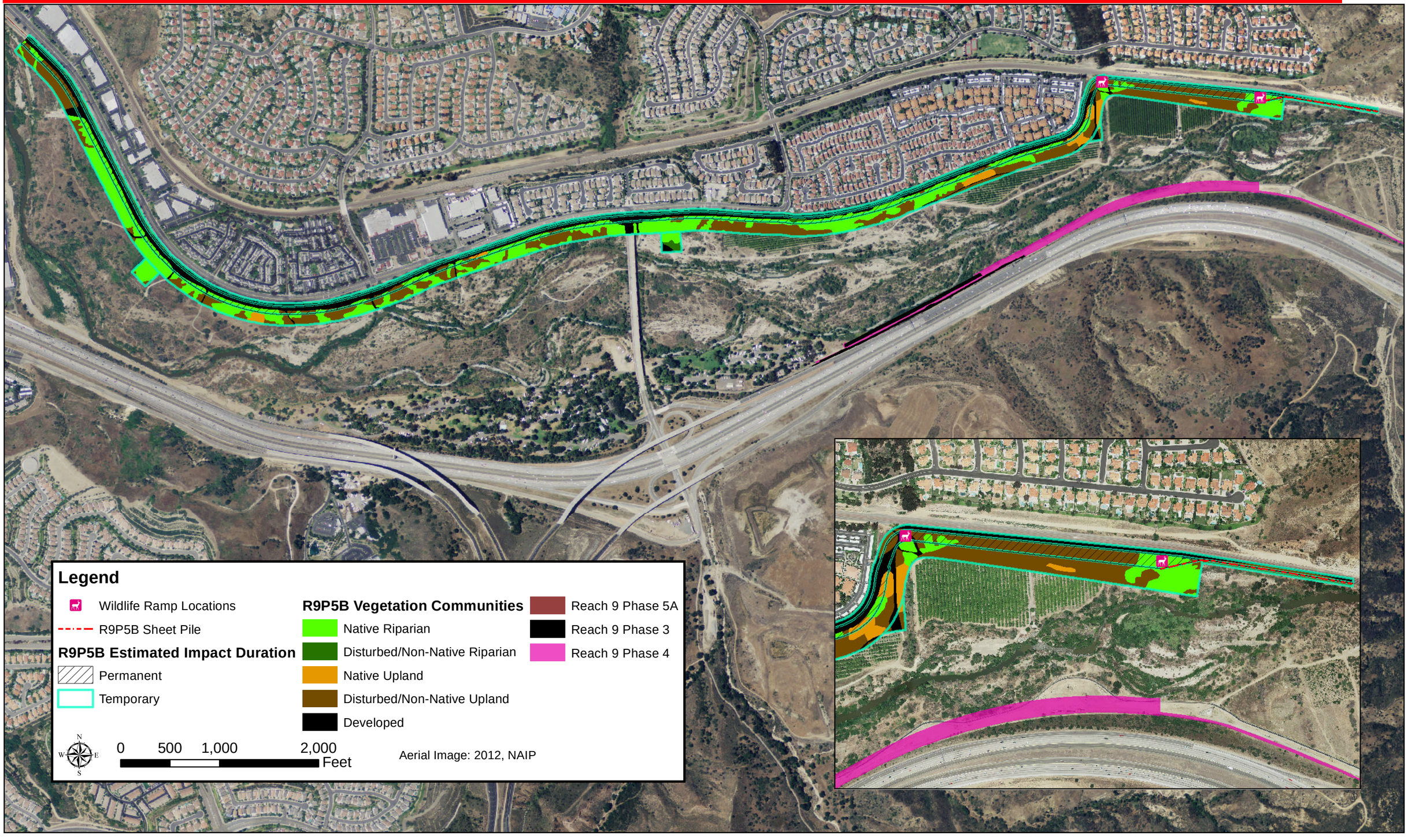
This page intentionally left blank.

Reach 9 Phase 5A: Plant Communities



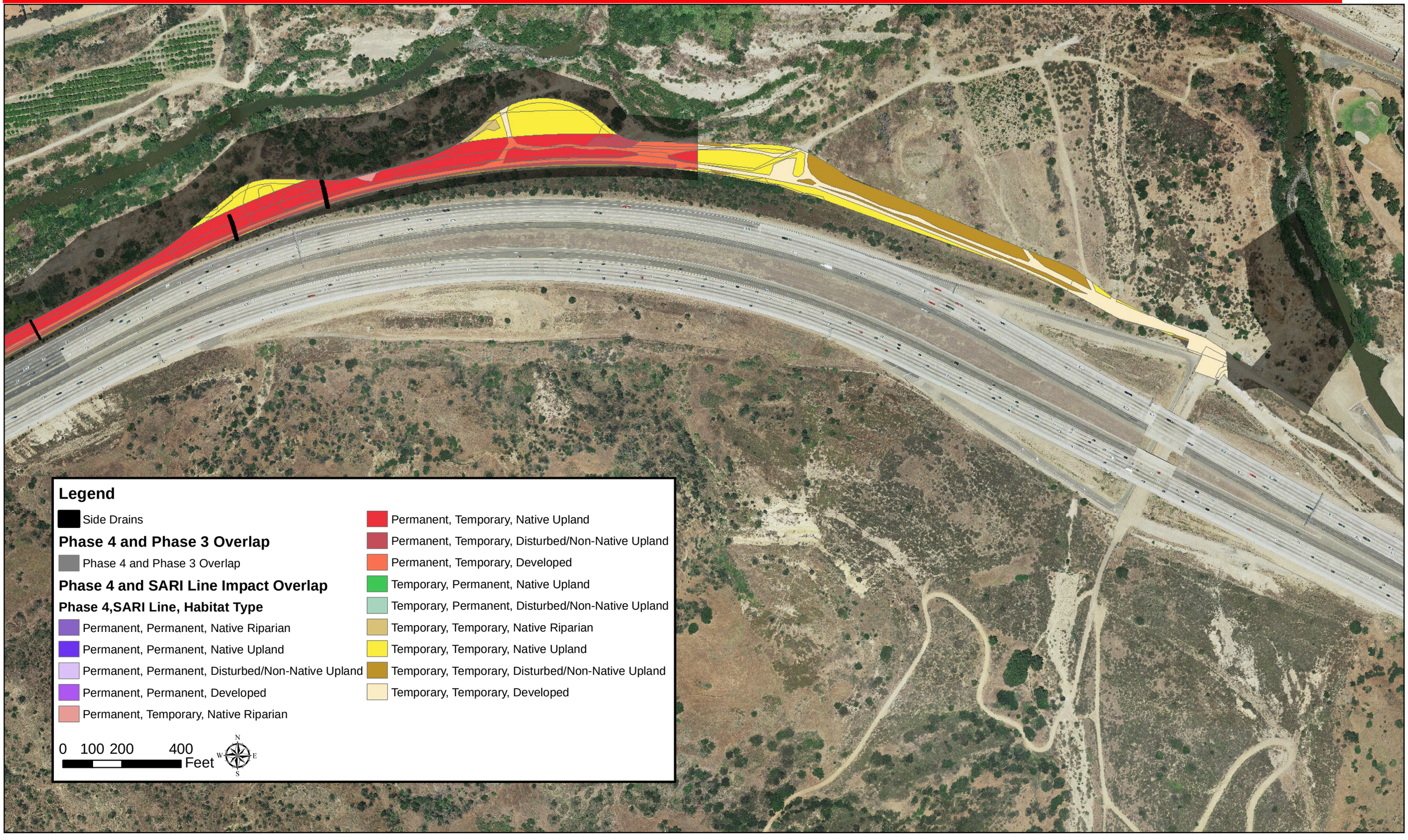
This page intentionally left blank.

Reach 9 Phase 5B: Vegetation Communities



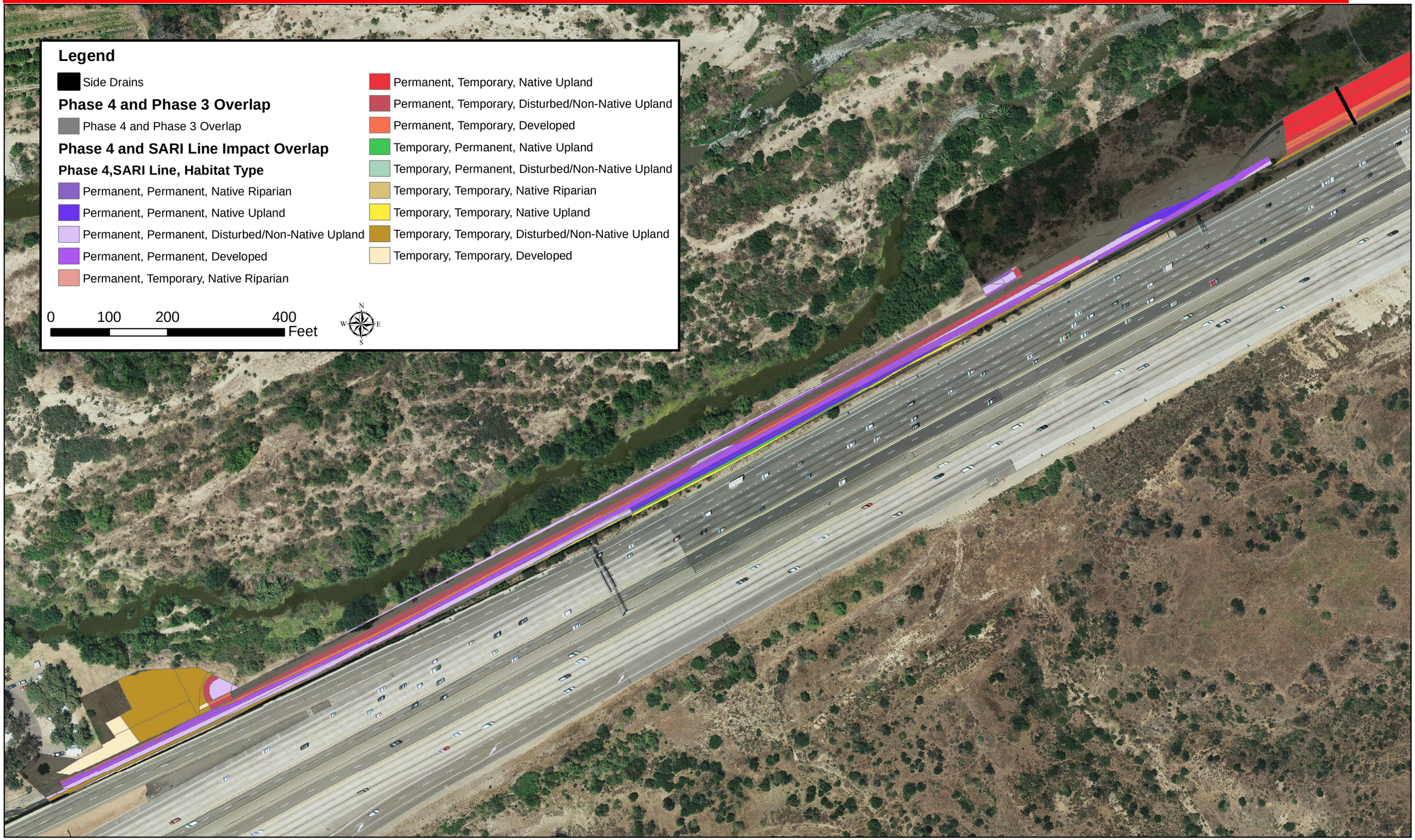
This page intentionally left blank.

Phase 4 Impact Overlap with SARI Line and Phase 3: Plant Communities-Plate 1



This page intentionally left blank.

Phase 4 Impact Overlap with SARI Line and Phase 3: Plant Communities-Plate 2



This page intentionally left blank.

Phase 4 Impact Overlap with SARI Line and Phase 3: Plant Communities-Plate 3

Legend

- Side Drains

Phase 4 and SARI Line Impact Overlap

- Phase 4 and SARI Line Impact Overlap

Phase 4 and Phase 3 Overlap

Phase 4,Phase 3, Habitat Type

- Permanent, No Previous Impact, Native Riparian
- Permanent, No Previous Impact, Native Upland
- Permanent, No Previous Impact, Developed
- Permanent, Permanent, Developed
- Permanent, Temporary, Native Riparian
- Permanent, Temporary, Native Upland
- Permanent, Temporary, Disturbed/Non-Native Upland
- Permanent, Temporary, Developed
- Temporary, No Previous Impact, Native Riparian
- Temporary, No Previous Impact, Disturbed/Non-Native Riparian
- Temporary, No Previous Impact, Native Upland
- Temporary, No Previous Impact, Disturbed/Non-Native Upland
- Temporary, No Previous Impact, Developed
- Temporary, Permanent, Developed
- Temporary, Temporary, Native Riparian
- Temporary, Temporary, Native Upland
- Temporary, Temporary, Disturbed/Non-Native Upland
- Temporary, Temporary, Developed

0 100 200 400 Feet

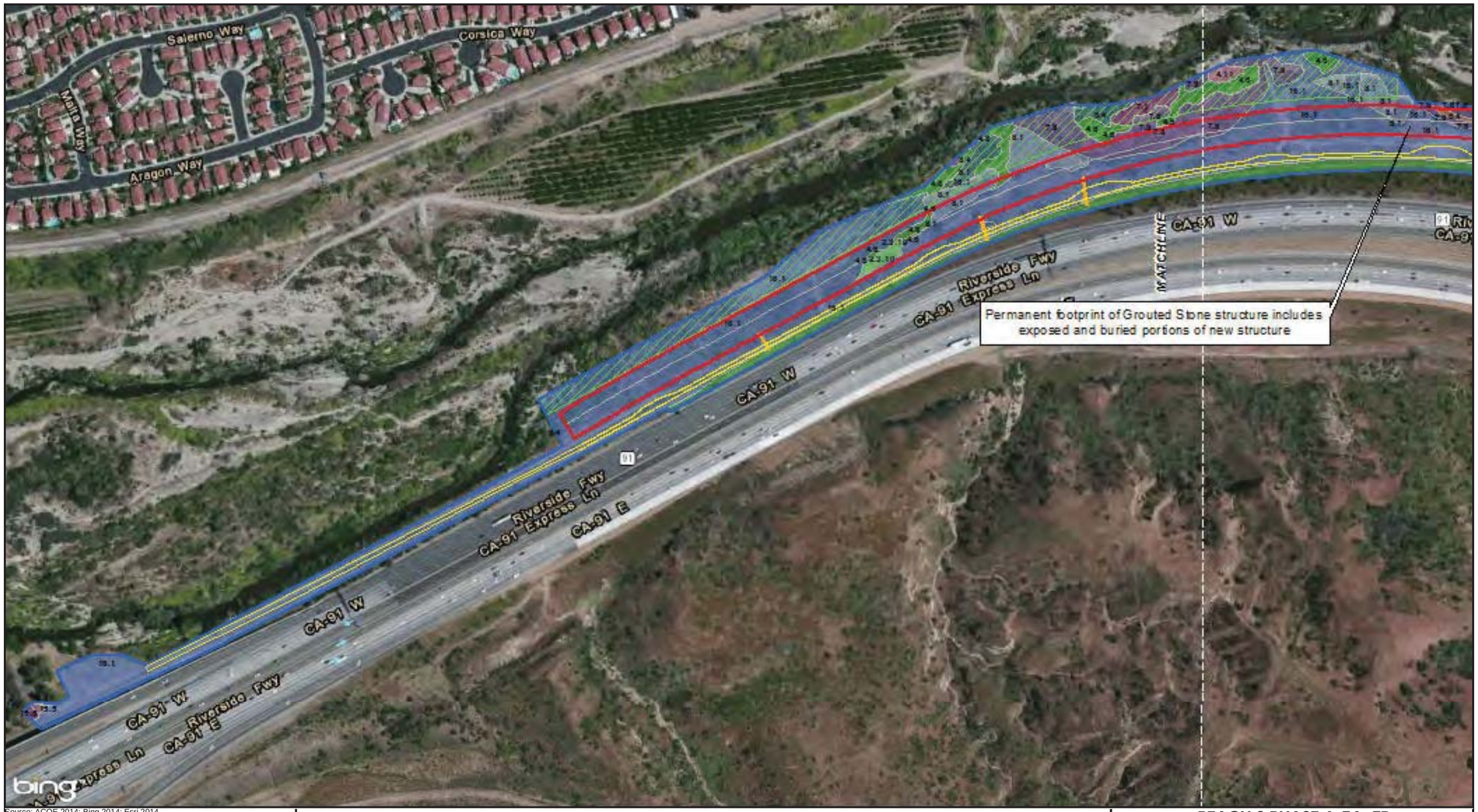
N W E S

This page intentionally left blank.

Phase 4 Impact Overlap with SARI Line and Phase 3: Plant Communities-Plate 4



This page intentionally left blank.



Source: ACOE 2014; Bing 2014; Esri 2014

0 75 150 300 Feet

Scale: 1:3,600 ; 1 inch = 300 feet

Legend

- Maintenance Road
- Staging Area
- Permanent Grouted Stone
- Temporary Construction Easement
- Side Drains

Vegetation Communities

- (15.1) Urban and Commercial
- (15.5) Ornamental Landscaping
- (16.1) Disturbed or Barren
- (2.3.10) Mixed Scrub
- (2.6) Scale-Broom Scrub
- (4.11) Giant Reed Grassland
- (4.6) Ruderal Grassland
- (6.4) Freshwater Marsh
- (7.1) Herbaceous Riparian
- (7.8) Cottonwood-Willow Riparian Forest
- (8.1) Coast Live Oak Woodland
- (8.4) Mexican Elderberry Woodland
- (8.5) Nonnative Woodland

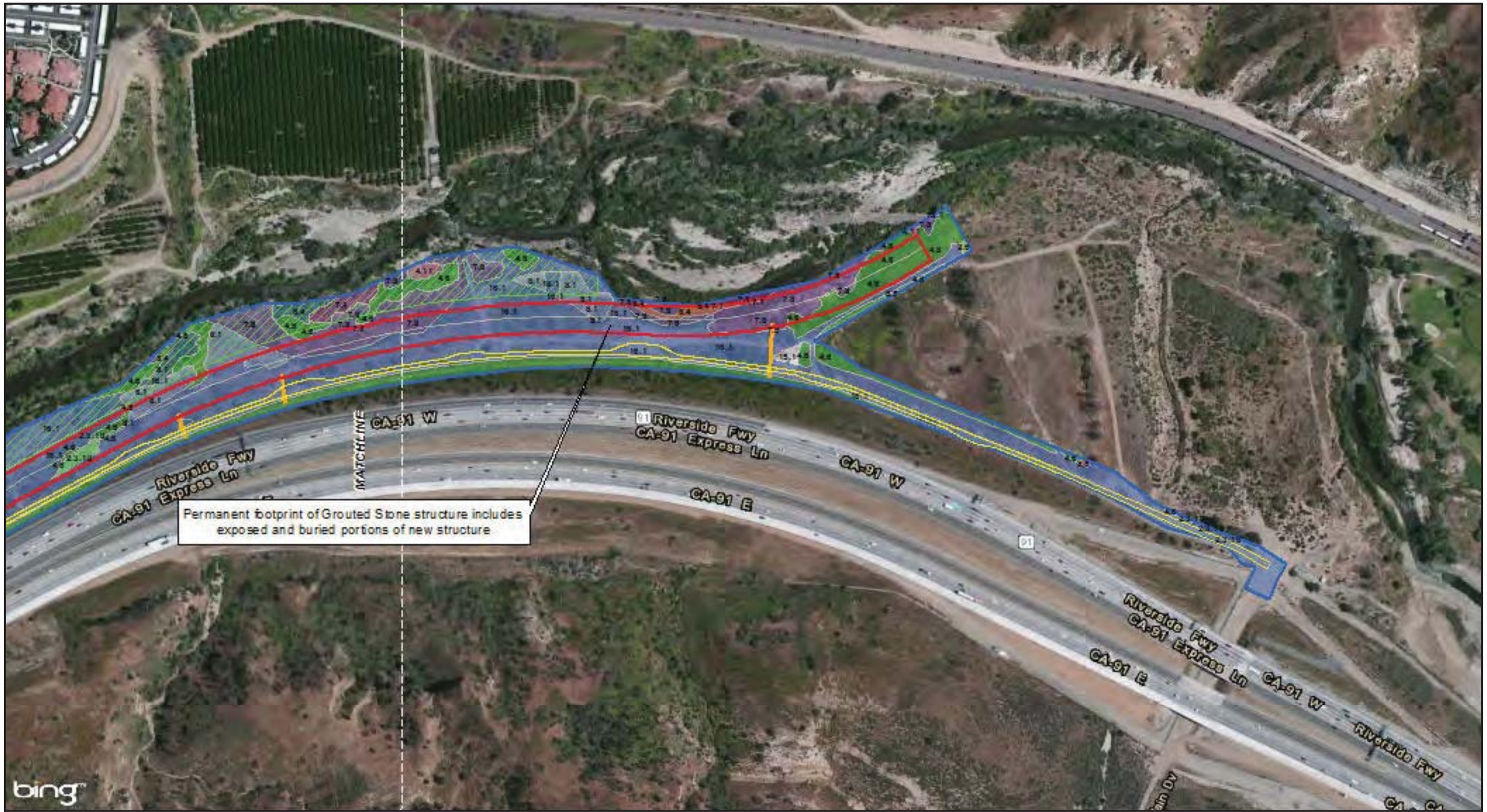
REACH 9 PHASE 4, 5A, 5B & BNSF SEA/EIR ADDENDUM

FIGURE 5.5-3e
PHASE 4 Alternative 2 (Grouted Stone) - Vegetation Communities

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Path: P:\2014\60279208-Reach_9_SEA\900-CAD-GIS\920 GIS-Graphics\925_Docs\Aerial_Base_Phase4_ver2_Alt2_VegCommunity.mxd, 1/21/2015, wallacerj

This page intentionally left blank.



Source: ACOE 2014; Bing 2014; Esri 2014

0 75 150 300 Feet

Scale: 1:3,600 ; 1 inch = 300 feet

Legend

- Maintenance Road
- Staging Area
- Permanent Grouted Stone
- Temporary Construction Easement
- Side Drains

Vegetation Communities

- (15.1) Urban and Commercial
- (15.5) Ornamental Landscaping
- (16.1) Disturbed or Barren
- (2.3.10) Mixed Scrub
- (2.6) Scale-Broom Scrub
- (4.11) Giant Reed Grassland
- (4.6) Ruderal Grassland
- (6.4) Freshwater Marsh
- (7.1) Herbaceous Riparian
- (7.8) Cottonwood-Willow Riparian Forest
- (8.1) Coast Live Oak Woodland
- (8.4) Mexican Elderberry Woodland
- (8.5) Nonnative Woodland

REACH 9 PHASE 4, 5A, 5B & BNSF SEA/EIR ADDENDUM

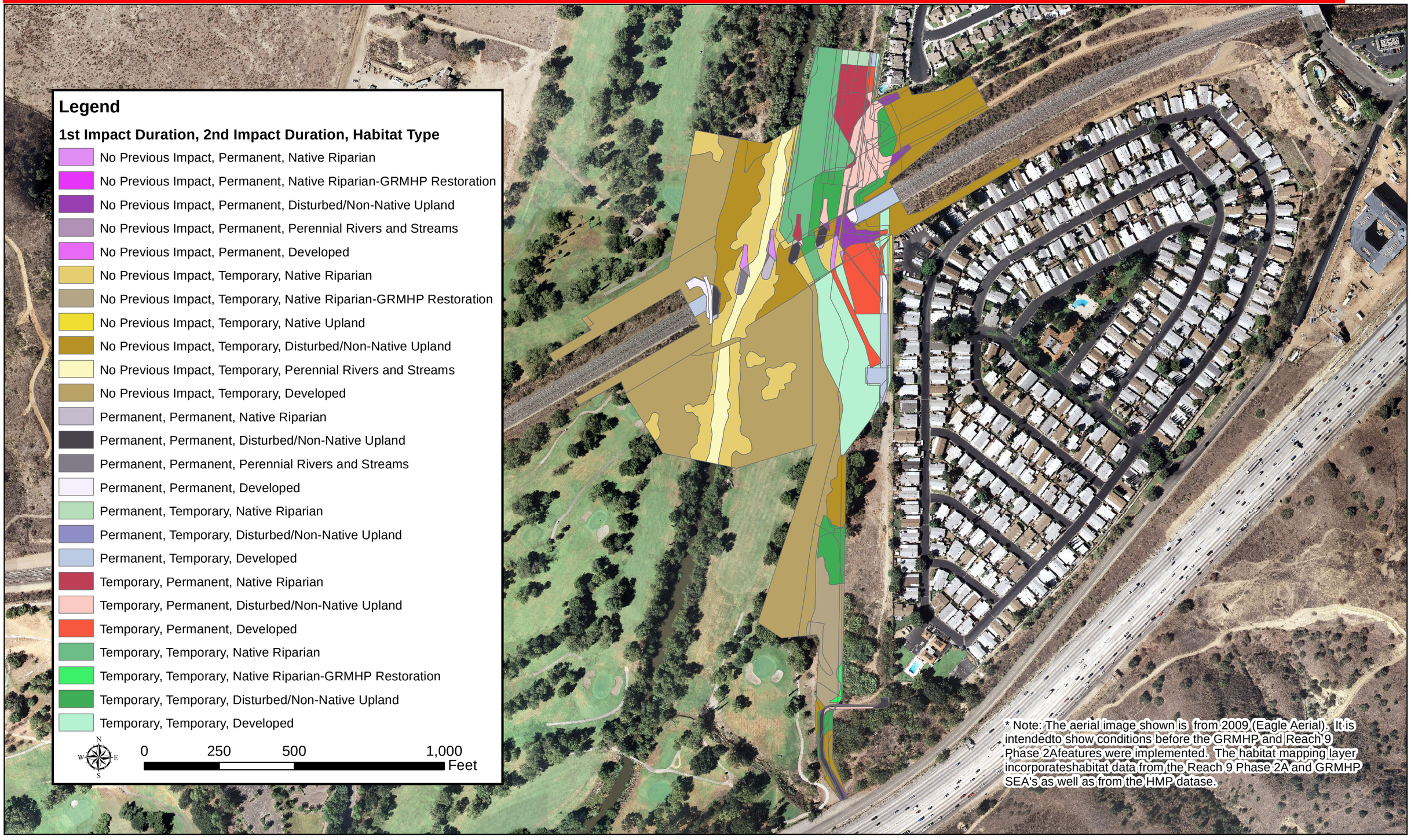
FIGURE 5.5-3f
PHASE 4 Alternative 2 (Grouted Stone) - Vegetation Communities

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Path: P:\2014\60279208-Reach_9_SEA\900-CAD-GIS\920 GIS-Graphics\925_Docs\Aerial_Base_Phase4_ver2_Alt2_VegCommunity.mxd, 1/21/2015, wallacerj

This page intentionally left blank.

BNSF: OverlapAnalysis - Impact Durations and Habitat Types



This page intentionally left blank.

Disturbed

- *Disturbed Riparian.* Disturbed riparian areas are riparian habitats that have experienced a relatively recent disturbance and still show characteristics of riparian habitat. These areas are beginning to re-vegetate naturally with riparian species and have a low percent cover by nonnative ruderal grassland species. This community type is present in Phase 5B and BNSF Bridge.

Upland

The Upland habitat classification is found in areas slightly removed from the immediate banks of the SAR. Habitats occurring in the upland classification are generally less dependent on proximity to the river and saturated soils. Habitat within this general classification includes coastal sage scrub (CSS), and grassland and woodland habitats. The descriptions of habitats occurring within the Upland classification within the Reach 9 measures are provided below.

Coastal sage scrub (CSS): CSS vegetation consists of drought-deciduous, low-growing, soft-leaved shrubs and herbs, and is often a gray-green color. It occupies gentle to steep slopes and occurs most often in shallow or heavy soils at elevations below 3,000 feet. CSS is considered a special-status vegetation type by CDFW because of its high potential to support threatened and endangered wildlife species. The shrubs that make up CSS are relatively short-lived and are adapted to a natural fire regime, possibly with an interval of 40 to 60 years, readily sprouting from seed or from the base of the parent plant following such an event. There are six habitat classifications of CSS that occur within the project area.

- *Sagebrush Scrub*. Sagebrush scrub is almost exclusively dominated by coastal sagebrush (*Artemisia)*, and is usually found on mesic slopes. It usually occurs as small patches within grasslands or with other CSS subtypes that support coastal sagebrush as a codominant. This community is present in Phase 5B.

- *Yerba Santa Scrub.* Yerba Santa scrub is dominated by either thick-leaf (*Eriodictyon crassifolium*) or hairy yerba santa (*Eriodictyon trichocalyx*). This is a relatively scarce habitat type found on sand river terraces within the floodplain of SAR and is present in Phase 5B.

- *Mixed Scrub.* Mixed sage scrub is dominated by a relatively even mix of each of four or more CSS species. CSS species that may make up mixed scrub are California buckwheat (*Eriogonum fasciculatum*), black sage (*Salvia mellifera*), purple sage (*Salvia leucophylla*), white sage (*Salvia apiana*), California encelia (*Encelia californica*), laurel sumac (*Malosma laurina*), bush monkey flower (*Mimulus aurantiacus*), and coast prickly pear (*Opuntia littoralis*). Coastal sagebrush can occur but is not an important species in this community. This habitat classification is found primarily on upper terraces in the floodplain, away from the main river course. This habitat type is present in BNSF Bridge.

- *Scale-Broom Scrub.* Scale-broom scrub (floodplain sage scrub) consists of deep-rooted and upland shrubs that occupy infrequently flooded and scoured habitats such as floodplains and alluvial fans. Scale-broom scrub is dominated by scale-broom (*Lepidospartum squamatum*). Other species that occupy this habitat are California buckwheat, California brickellbush (*Brickellia californica*), mulefat, coastal sagebrush, and laurel sumac. Unlike CSS, scale-broom scrub is primarily associated with streamcourses. This community type is present in Phases 4 and 5B.

- *Scrub-Eucalyptus Planting*. Scrub-eucalyptus planting sites support scrub habitat, but have been planted with rows of eucalyptus trees or eucalyptus trees have become established within the areas. Eucalyptus trees present within these areas are mature and are most likely remnant wind rows. This community type is present in Phase 5B.

Salt Grass Grassland. Salt grass grassland is dominated by salt grass (*Distichlis*). Annual grassland species may also be present but are not dominant. This community type is present in Phase 5B.

Grassland: Historically (pre-European settlement), needlegrass grassland covered as much as 17 percent of California (Keeley 1989 in Orange County, 2012a), but it has been greatly reduced by the invasion of nonnative annual grasses and forbs of Mediterranean origin, changes in the kinds of animals present and their grazing patterns, cultivation, and fire (Heady 1977 in Orange County, 2012a). These nonnative plants, often considered weeds, include grasses such as bromes (*Bromus* spp.), wild oats (*Avena* spp.), barley (*Hordeum* spp.), and herbs such as mustards and thistles. Only 0.1 percent of historic perennial native grasslands in California are extant (Barry 1981 in Orange County 2012a). Due to its reduction in range, native grassland is considered a special status vegetation type by CDFW. There are three classifications of grassland found within the project area. None of these three grassland types are considered native or sensitive.

- *Annual Grassland.* Annual grasslands are dominated by annual grasses that are primarily Mediterranean in origin. Dominant species include bromes, wild oats, fescues, and barleys. Many species of native forbs and bulbs, as well as naturalized annual forbs, are found in this habitat. Native forbs in these grasslands may include common fiddleneck (*Amsinckia intermedia*), miniature lupine (*Lupinus bicolor*), California popcorn flower (*Plagiobothrys* sp.), California milkweed (*Asclepias californica*), common cryptantha (*Cryptantha affinis*), and fascicled tarweed (*Hemizonia fasciculata*). Annual grasslands occur on gradual slopes with deep soils below 3,000 feet in elevation. This habitat type is present in Phase 5B.

- *Giant Reed Grassland.* Giant reed grassland is dominated by dense stands of giant reed, an invasive species found throughout southern California. This habitat type is present in Phase 5B.

- *Ruderal Grassland.* Ruderal grassland consists of early successional grassland dominated by pioneering herbaceous plants that readily colonize disturbed ground. Ruderal grassland is

dominated by many grassland species and species of the genera *Centaurea, Brassica, Malva, Salsola, Eremocarpus, Amaranthus,* and *Atriplex*. Ruderal grassland occurs at locations that have been disturbed by either natural or human causes. Giant reed may also be present within this habitat type; however, it is not a dominant species. Dominant species within this habitat classification often include tocalote (*Centaurea melitensis*) and shortpod mustard (*Hirschfeldia incana*). This habitat type is present in Phases 5A and 5B, and BNSF Bridge.

Woodland: The Woodland habitat classification is generally characterized as a multilayered plant community with a canopy that is approximately 20 to 80 percent tree cover.

- *Coast Live Oak Woodland.* Coast live oak woodland is dominated by coast live oak, with associated shrubs such as California scrub oak (*Quercus berberidifolia*), holly-leaved redberry (*Rhamnus ilicifolia*), California coffee berry (*Rhamnus californica*), toyon (*Heteromeles arbutifolia*), fuchsia-flowering gooseberry (*Ribes speciosum*), Mexican elderberry (*Sambucus mexicana*), and poison oak. Coast live oak woodlands have a limited distribution in the SAR floodplain and are primarily found on upper terraces of the floodplain or as planted groves within Featherly Regional Park. This community type is present in Phase 5A.

- *Mexican Elderberry Woodland.* Mexican elderberry woodland is an open woodland found on stream benches dominated by Mexican elderberry. Scattered laurel sumac, toyon, and lemonade berry (*Rhus integrifolia*) may be found on these open grass benches. This classification is often associated with sycamore riparian woodland. Mexican elderberry woodland is a common habitat type within the floodplain and is found on upper benches of the SAR that have not seen significant flow in decades. This community type is present in Phase 5B.

- *California Walnut Woodland.* California walnut woodland is dominated by southern California black walnut with less dominant species of coast live oak and Mexican elderberry. The understory consists of annual grassland species. The woodland is typical on inland foothills along gradual to moderate slopes. This community type is found adjacent to the orange groves in Phase 5B.

- *Non-native Woodland.* Non-native woodland is characterized by dense stands of non-native tree species, including eucalyptus (*Eucalyptus* spp.), Peruvian pepper (*Schinus molle*), tamarisk (*Tamarix* spp.), and tree of heaven (*Ailanthus altissima*). This habitat type is typically found on upper benches of streamcourses and has an understory dominated by annual grassland species. It is present in Phases 4 and 5B.

Water

Watercourses: Watercourses include flood control channels, streams, and rivers. The only type of watercourse present within the project area is the SAR.

- *Perennial Rivers and Streams.* This habitat classification is characterized as unvegetated, open-water portions of the SAR. Areas defined within the project area as perennial stream correlate to southern California arroyo chub/Santa Ana sucker stream, a habitat recognized as sensitive by CDFW. This habitat type is present in BNSF Bridge.

Marsh: Marsh habitats consist of permanently or seasonally flooded or saturated sites dominated by persistent herbaceous plants. Marsh habitats consist of permanently, seasonally, regularly, or tidally flooded or saturated sites dominated by perennial obligate hydrophytes. There is only one type of marsh habitat found within the SAR.

- *Freshwater Marsh.* Freshwater marsh consists of seasonally or permanently flooded low-lying areas dominated by cat-tail or bulrush species with other perennial or annual obligate hydrophyte species present as subdominants. This habitat primarily occurs along the banks of the SAR, and is present near Phase 4.

Developed

Developed areas represent locations within the Reach 9 measures that are associated with existing or on-going development. For instance, construction of the SARI Line was started in winter/spring of 2012 and included clearing, grubbing, and grading of areas within proximity of the SAR. Existing bank protection structures that do not have vegetative cover was also classified as "developed."

Developed: The major classification known as developed includes urban areas, roads, parks, and cleared or graded sites. There are two detailed classifications that fall within the developed major classification within the project area: (1) urban and commercial and (2) ornamental landscaping.

- *Urban and Commercial.* The urban and commercial detailed classification includes all buildings, pavement, and highway rights-of-way (except freeways and arterial highways). All paved surfaces and flood protection features were mapped as urban and commercial. This classification is present within each of the four Reach 9 measures.

- *Ornamental Landscaping.* Ornamental landscaping (parks and ornamental plantings) consist of introduced trees, shrubs, flowers, and turf grass. Ornamental landscaping occurs along trails and roads, and in parks and golf courses. This classification occurs within each of the four Reach 9 measures.

- *Orchards/Vineyards.* Orchards and vineyards are scattered throughout bottomland portions of Orange County, and include a variety of fruit and nut trees and vines. This classification is present in Phase 5B.

Disturbed: Disturbed or barren (cleared or graded) areas either lack vegetation or are dominated by a sparse cover of ruderal vegetation, such as tocalote, wild oats, shortpod mustard, black mustard (*Brassica nigra*), prickly sow-thistle (*Sonchus asper*), and prickly lettuce (*Lactuca serriola*). This classification occurs in each of the four Reach 9 measures.

Special-Status Plant Species

Special-status plants include those species listed as endangered, threatened, or rare, or those species proposed for listing by US Fish and Wildlife Service (USFWS) under the federal Endangered Species Act (FESA) and CDFW under the California Endangered Species Act (CESA). Additional species are listed by the California Native Plant Society (CNPS), Western Riverside MSHCP, and other species which have been assigned by local jurisdictions as unique or rare, and which have the potential to occur within the Reach 9 measures. The CNPS listing is sanctioned by CDFW and serves essentially as the list of candidate plant species for state listing. CNPS's California Rare Plant Ranks (CRPR) (formerly CNPS List) 1B and 2 species are considered eligible for state listing as endangered or threatened.

No special-status plant species were observed during the reconnaissance-level field surveys conducted at the Reach 9 measures in April 2014. The California Natural Diversity Data Base (CNDDB) (CDFW 2014a) and CNPS (2014) database were reviewed for the most recent distribution information for special-status plant species and sensitive natural communities within the Black Star Canyon and Prado Dam quadrangles, which includes Reach 9. A total of 35 special-status plant species were identified from the database searches to have historically been recorded from these two quadrangles.

The potential for special-status plant (and wildlife) species identified during the database searches to occur within the Reach 9 measures were classified as "Not Expected," "Low," "Moderate," "High," or "Detect." These classifications were derived from an evaluation comparing existing habitats in the Reach 9 measures to the presence and suitability of habitat preferred by the species of interest. The potential for occurrence classifications are described below.

- **Not Expected**. Habitat preferred by the species is absent or very marginal due to disturbances, fragmentation, and/or isolation.
- **Low.** Habitat preferred by the species is marginal due to disturbances, fragmentation, and/or isolation.
- **Moderate**. Species previously reported within 1 mile of the project site, but suitable habitat is of only moderate quality due to disturbances, fragmentation, and/or isolation.
- **High.** Species previously reported from within 1 mile of the project site, and large areas of contiguous, high-quality habitat preferred by the species is present.
- **Detected.** Species detected during field survey.

Special-status plant species identified from the CNDDB and CNPS searches are presented in Table 5.5-1. Of the 36 species identified, one was determined to have high potential, two have moderate potential, and four have low potential to occur in the Reach 9 measures.

Table 5.5-1. Regional Special-Status Plant Species[1]

Common Name *Scientific Name*[2]	Status[3]	General Habitat Description[4]	Potentially Suitable Habitat Present/ Absent	Potential for Occurrence
Chaparral sand-verbena *Abronia villosa* var. *Aurita*	USFWS: None CDFW: None CRPR: 1B.1	Chaparral, coastal scrub, and desert dunes. Elevation 75-1,600 meters (m) (246-5,248 feet (ft)). Blooms January – September.	Present	**Not Expected.** Previous known occurrence of this species from within one mile of Phase 5A and 5B; however, record is from 1930's and habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas.
Braunton's milk-vetch *Astragalus brauntonii*	USFWS: Endangered CDFW: None CRPR: 1B.1	Closed-cone coniferous forest, chaparral, coastal scrub, and valley and foothill grassland. Occurs on recent burns or disturbed areas, in stiff gravelly clay soils overlying granite or limestone. Elevation 4–640 (m) (13–2,100 ft). Blooms January–August.	Present	**Not Expected.** Habitat preferred by this species is marginal within and surrounding the Reach 9 measure areas.
Coulter's saltbush *Atriplex coulteri*	USFWS: None CDFW: None CRPR: 1B.2	Coastal bluff scrub, coastal dunes, coastal scrub, and valley and foothill grasslands. Occurs on alkaline or clay soils. Elevation 3-460 m (9-1,508 ft). Blooms March – October.	Present	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas.
Malibu baccharis *Baccharis malibuensis*	USFWS: None CDFW: None CRPR: 1B.1	Chaparral, Cismontane woodland, coastal scrub, and riparian woodlands. Elevation 150-305 m (492-1,000 ft). Blooms in August.	Present	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas, which occur

Common Name *Scientific Name*[2]	Status[3]	General Habitat Description[4]	Potentially Suitable Habitat Present/ Absent	Potential for Occurrence
				outside of the known elevation range preferred by this species.
Catalina mariposa-lily *Calochortus catalinae*	USFWS: None CDFW: None CRPR: 4.2	Chaparral, cismontane woodland, coastal scrub, and valley and foothill grasslands. Elevation 15-700 m (49-2,296 ft). Blooms February – June.	Present	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas.
Plummer's mariposa-lily *Calochortus plummerae*	USFWS: None CDFW: None CRPR: 4.2 MSHCP: G2	Coastal scrub, chaparral, valley and foothill grassland, cismontane woodland, lower montane coniferous forest. Occurs on rocky and sandy sites, usually of granitic or alluvial material, and can be very common after a fire. Elevation 100–1,700 m (328–5,576 ft). Blooms May – July.	Present	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas.
Intermediate mariposa-lily *Calochortus weedii var. intermedius*	USFWS: None CDFW: None CRPR: 1B.2 MSHCP: G2	Chaparral, coastal scrub, and valley and foothill grasslands. Occurs on rocky and calcareous soils. Elevation 105-855 m (344-2,804 ft). Blooms May – July.	Present	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas.
Lucky morning-glory *Calystegia felix*	USFWS: None CDFW: None CRPR: 3.1	Wetlands, marshes, meadows and seeps, and riparian scrub. Occurs on silty loam, alkaline, and alluvial soils. Elevation 30-215 m (98-705 ft). Blooms March – September.	Present	**Low.** Habitat preferred by this species is marginal within and surrounding the Reach 9 measure areas.

Common Name *Scientific Name*[2]	Status[3]	General Habitat Description[4]	Potentially Suitable Habitat Present/ Absent	Potential for Occurrence
Santa Barbara morning-glory *Calystegia sepium* ssp. *binghamiae*	USFWS: None CDFW: None CRPR: 1A	Coastal marshes and swamps. Blooms in August	Absent	**Not Expected.** Habitat preferred by the species is absent within and surrounding the Reach 9 measure areas.
Lewis' evening-primrose *Camissoniopsis lewisii*	USFWS: None CDFW: None CRPR: 3	Coastal bluff scrub, cismontane woodland, costal dunes, coastal scrub, and valley and foothill grassland. Occurs on sandy or clay soils. Elevation 0-300 m (0-984 ft). Blooms March – June.	Present	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas.
smooth tarplant *Centromadia pungens ssp. laevis*	USFWS: None CDFW: None CRPR: 1B.1 MSHCP: G3	Chenopod scrub, meadows and seeps, playas, riparian woodland, valley and foothill grasslands. Occurs on alkaline soils. Elevation 0-640 m (0-2,100 ft). Blooms April – September.	Present	**Low.** Habitat preferred by this species is marginal within and around the Reach 9 measure areas.
San Fernando Valley spineflower *Chorizanthe parryi* var. *fernandina*	USFWS: Candidate CDFW: Endangered CRPR: 1B.1	Coastal scrub and valley and foothill grasslands. Occurs in sandy soils. Elevation 150–1,220 m (492–4,001 ft). Blooms April–July.	Present	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas, which occur outside of the known elevation range preferred by this species.
Long-spined Spineflower *Chorizanthe polygonoides* var. *longispina*	USFWS: None CDFW: None CRPR: 1B.2 MSHCP: G2	Chaparral, coastal scrub, meadows and seeps, valley and foothill grasslands, and vernal pools. Often occurs on clay soils. Elevation 30-1530 m	Present	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas.

Common Name *Scientific Name*[2]	Status[3]	General Habitat Description[4]	Potentially Suitable Habitat Present/ Absent	Potential for Occurrence
		(98-5,018 ft). Blooms April – July.		
Small-flowered morning-glory *Convolvulus simulans*	USFWS: None CDFW: None CRPR: 4.2 MSHCP: G2	Chaparral, coastal scrub, and valley and foothill grasslands. Occurs on clay, serpentine seeps. Elevation 30-700 m (98-2,296 ft). Blooms March – July.	Present	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas.
Paniculate tarplant *Deinandra paniculata*	USFWS: None CDFW: None CRPR: 4.2	Coastal scrub, valley and foothill grassland, and vernal pools. Elevation 25-940 m (82-3,083 ft). Blooms April – November.	Present	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas.
many-stemmed dudleya *Dudleya multicaulis*	USFWS: None CDFW: None CRPR: 1B.2 MSHCP: G3	Chaparral, coastal scrub, valley and foothill grassland. Occurs in heavy, often clayey soils or grassy slopes. Elevation 0–790 m (0–2,610 ft). Blooms April–July.	Present	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas.
Santa Ana River wollystar *Eriastrum densifolium* ssp. *sanctorum*	USFWS: Endangered CDFW: Endangered CRPR: 1B.1 MSHCP: G3	Chaparral and coastal scrub. Occurs in sandy, gravelly, and alluvial soils. Elevation 91-610 m (298-2,001 ft). Blooms April - September.	Present	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas.
Palmer's grapplinghook *Harpagonella palmeri*	USFWS: None CDFW: None CRPR: 4.2 MSHCP: G2	Chaparral, coastal scrub, and valley and foothill grassland. Elevation 20-955 m (65-3,132 ft). Blooms March – May.	Present	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas.
Tecate cypress *Hesperocyparis forbesii*	USFWS: None CDFW: None CRPR: 1B.1	Closed-cone coniferous forest and chaparral. Occurs on clay, gabbroic or	Absent	**Not Expected.** Habitat preferred by this species is absent or very marginal within and

Common Name *Scientific Name*[2]	Status[3]	General Habitat Description[4]	Potentially Suitable Habitat Present/ Absent	Potential for Occurrence
		metavolcanic soils. Elevation 80-1,500 m (262-4,920 ft).		surrounding the Reach 9 measure areas.
Gowen cypress *Hesperocyparis goveniana*	USFWS: Threatened CDFW: None CRPR: 1B.2	Closed-cone coniferous forest and maritime chaparral. Elevation 30-300 m (98-984 ft).	Absent	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas.
Southern California Black Walnut *Juglans californica* var. *californica*	USFWS: None CDFW: None CRPR: 4.2 MSHCP: G2	Chaparral, cismontane woodland, and coastal scrub. Occur on alluvial soils. Elevation 50-900 m (164-2,952 ft). Blooms March-August.	Present	**High.** Species identified during an April 2012 survey of the Phase 3 project area (Corps 2013), which lies adjacent to the proposed Phase 4 project.
Heart-leaved pitcher sage *Lepechinia cardiophylla*	USFWS: None CDFW: None CRPR: 1B.2 MSHCP: G2	Closed-cone coniferous forest, chaparral, and cismontane woodlands. Elevation 520-1370 m (1,705-4,493 ft). Blooms April – July.	Absent	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas, which occur outside of the known elevation range preferred by this species.
Robinson's pepper-grass *Lepidium virginicum* var. *robinsonii*	USFWS: None CDFW: None CRPR: 4.3	Chaparral and coastal scrub. Occurs on dry soils in shrubland. Elevation 1–885 m (3–2,900 ft). Blooms January – July.	Present	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas.
Ocellated Humboldt lily *Lilium humboldtii* ssp. *Ocellatum*	USFWS: None CDFW: None CRPR: 4.2 MSHCP: G2	Chaparral, cismontane woodland, coastal scrub, lower montane coniferous forest, and riparian woodland. Elevation 30-1,800 m (98-5,904 ft). Blooms March – August.	Present	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas.

Common Name *Scientific Name*[2]	Status[3]	General Habitat Description[4]	Potentially Suitable Habitat Present/ Absent	Potential for Occurrence
Jokerst's monardella *Monardella australis ssp. Jokerstii*	USFWS: None CDFW: None CRPR: 1B.1	Chaparral and lower montane coniferous forests. Occurs on steep scree or talus slopes, between breccia, secondary alluvial benches along drainages and washes. Elevation 1,350-1,750 m (4,428-5,740 ft). Blooms July – September.	Absent	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas.
Intermediate monardella *Monardella hypoleuca ssp. intermedia*	USFWS: None CDFW: None CRPR: 1B.3	Chaparral, cismontane woodland, and occasionally in lower montane coniferous forests. Usually found in the understory. Elevation 400-1,250 m (1,312-4,100 feet). Blooms April – September.	Absent	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas, which occur outside of the known elevation range preferred by this species.
Chaparral nolina *Nolina cismontana*	USFWS: None CDFW: None CRPR: 1B.2	Chaparral and coastal scrub. Occurs on sandstone or gabbro soils. Elevation 140-1,275 m (459-4,182 ft). Blooms March – July.	Absent	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas, which occur outside of the known elevation range preferred by this species.
California beardtongue *Penstemon californicus*	USFWS: None CDFW: None CRPR: 1B.2 MSHCP: G2	Chaparral, lower montane coniferous forests, pinyon and juniper woodlands. Occurs on sandy soils. Elevation 1,170-2,300 m (3,837-7,544 ft). Blooms May – August.	Absent	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas.

Common Name *Scientific Name*[2]	Status[3]	General Habitat Description[4]	Potentially Suitable Habitat Present/ Absent	Potential for Occurrence
Allen's pentachaeta *Pentachaeta aurea ssp. Allenii*	USFWS: None CDFW: None CRPR: 1B.1	Valley and foothill grasslands and coastal scrub. Elevation 75-520 m (246-1,705 ft). Blooms March – June.	Present	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas.
Brand's star phacelia[5] *Phacelia stellaris*	USFWS: None CRPR: 1B.1 MSHCP: G3	Coastal dunes and coastal scrub. Elevation 1-400 m (3-1,312 ft). Blooms March - June	Present	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas.
Wooly chaparral-pea *Pickeringia montana* var. *tomentosa*	USFWS: None CDFW: None CRPR: 4.3	Chaparral. Occurs on gabbroic, granitic, and clay soils. Elevation 0-1,700m (0-5,576 ft). Blooms May – August.	Absent	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas.
Fish's milkwort *Polygala cornuta* var. *fishiae*	USFWS; None CDFW: None CRPR: 4.3 MSHCP: G2	Chaparral, cismontane woodland, and riparian woodland. Elevation 100-1,000 m (328-3,280 ft). Blooms May-August.	Present	**Low.** Habitat preferred by this species is marginal within and around the Reach 9 measure areas.
white rabbit-tobacco *Pseudognaphalium leucocephalum*	USFWS: None CDFW: None CRPR: 2B.2	Riparian woodland, cismontane woodland, coastal scrub, and chaparral. Occurs on sandy, gravelly sites. Elevation 0–2,100 m (0–6,890 ft). Blooms July–December.	Present	**Moderate.** Species previously recorded from SAR bottom in vicinity of Reach 9 measures and habitat preferred by this species is present within and around the Reach 9 measure areas.
Coulter's matilija poppy *Romneya coulteri*	USFWS: None CDFW: None CRPR: 4.2 MSHCP: G1	Chaparral and coastal scrub. Elevation 20-1,200 m (65-3,936 ft). Blooms March – July.	Present	**Moderate.** Species known from vicinity of Reach 9 measures; however, habitat preferred by this species is absent or very marginal within

Common Name *Scientific Name*[2]	Status[3]	General Habitat Description[4]	Potentially Suitable Habitat Present/ Absent	Potential for Occurrence
				and around the Reach 9 measure areas.
Salt Spring checkerbloom *Sidalcea neomexicana*	USFWS: None CDFW: None CRPR: 2B.2	Chaparral, coastal scrub, lower montane coniferous forest, mojavean desert scrub, and playas. Occurs on alkaline and mesic soils. Elevation 15-1,530 m (49-5,018 ft). Blooms March – June.	Present	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas.
San Bernardino aster *Symphyotrichum defoliatum*	USFWS: None CDFW: None CRPR: 1B.2	Cismontane woodland, coastal scrub, lower montane coniferous forest, meadows and seeps, marshes and swamps, and valley and foothill grassland. Occurs near ditches, streams, and springs. Elevation 2-2,040 m (6-6,691 ft). Blooms July – November.	Present	**Low.** Habitat preferred by this species is marginal within and around the Reach 9 measure areas.

[1]Special-Status plant species known from the BlackStar and Prado Dam quadrangles (CDFW 2014a and CNPS 2014).

[2] Nomenclature for special-status plant species conforms to CNPS (2014).

[3] Sensitivity Status Codes

Federal U.S. Fish and Wildlife Service (USFWS)

State California Department of Fish and Wildlife (CDFW)

Other

CNPS California Rare Plant Rank (CRPR)
Rank 1B: Plants rare, threatened, or endangered in California and elsewhere
Rank 2: Plants rare, threatened, or endangered in California, but more common elsewhere
Rank 3: Plants more information is needed for
Rank 4: Plants of limited distribution – a watch list
0.1: Seriously threatened in California
0.2: Fairly endangered in California
0.3: Not very endangered in California

MSHCP Western Riverside County-Multiple Species Habitat Conservation Plan (MSHCP)
G1: Group 1: Take coverage is warranted based upon regional or landscape level considerations.
G2: Group 2: Take coverage is warranted based upon regional or landscape level considerations with the addition of site-specific conservation and managements requirements.
G3: Group 3: Take coverage is warranted based upon regional or landscape level considerations with the addition of specific conservation and management conditions for species within a narrowly defined Habitat or limited geographic area within the MSHCP area.

[4] General Habitat Descriptions sources: CDFW 2014a; CNPS 2014

[5] This species may warrant additional surveys under MSHCP, though current CNDDB data does not indicate any occurrences of this species within the BlackStar and Prado Dam quadrangles.

Descriptions of Special-Status Plant Species With Potential to Occur in the Reach 9 Measures

No federally or State-listed planted species were observed within the Reach 9 measures during the reconnaissance-level surveys. Additionally, no federally or State-listed plants are known from within close proximity of the Reach 9 measures, and as a result are not expected to occur within the project area based on a lack of suitable habitat and recognized distributions of these species in the region. The one species with high potential and two species with moderate potential to occur within the Reach 9 measures are listed by CNPS, and are described in the following paragraphs. A fourth species, coast live oak, is also discussed. Although it is not afforded protection under FESA or CESA, this species is often afforded protection through local and/or State ordinances and management guidelines.

Southern California black walnut

Southern California black walnut is listed by CNPS as CRPR 4.2 and is a MSHCP-covered species. This rating indicates the species is a plant of limited distribution and is fairly endangered in California. The range for southern California black walnut extends from San Luis Obispo County to the southeast along the SAR, eastward through Riverside County. With the exception of a few areas where walnut-dominated woodlands occur, this species is generally associated with a mixture of other trees, particularly oaks. Southern California black walnut occurs in a variety of habitats throughout its range, typically on deep, friable soils that exhibit a high water-holding capacity. In riparian corridors, this species prefers drier slopes that are rarely prone to flooding and erosion activities yet are in proximity to ground water and seasonal surface water. Southern California black walnut was detected within the Phase 3 project area and its immediate vicinity (Corps 2013); the Phase 3 project area occurs just west of Phase 4. Therefore, there is high potential for southern California black walnut to occur within the Reach 9 measures.

White rabbit-tobacco

White rabbit-tobacco is listed by CNPS as CRPR 2B.2 and is a MSHCP-covered species. This rating indicates the species is a rare, threatened, or endangered plant in California, but is more common elsewhere. The species is distributed along coastal habitats of southern California, from southwestern Riverside County north to San Luis Obispo County. White rabbit-tobacco is a perennial herb that typically occurs in sand to gravelly soils within chaparral, cismontane woodland, coastal scrub, and riparian

woodland habitats below approximately 2,100 m (6,800 ft). Although white rabbit-tobacco was not identified during field surveys, suitable habitat for this species is present within and around the Reach 9 measures. As a result, there is moderate potential for white rabbit-tobacco to occur within the Reach 9 measures.

Coulter's matilija poppy

Coulter's matilija poppy is listed by CNPS as CRPR 4.2 and is a MSHCP-covered species. This rating indicates the species is a plant of limited distribution and fairly endangered in California. This species is endemic to Peninsular Ranges in California and Baja California and is known from the Santa Ana Mountains and four southern California counties, including Orange, Riverside, Los Angeles and San Diego. Coulter's matilija poppy is a perennial rhizomatous herb that typically occurs in chaparral and coastal scrub habitats, often in burned areas, between 20-1,200 m (65-3,936 ft). Although Coulter's matilija poppy was not identified during field surveys, it is known from the vicinity of Reach 9. However, habitat preferred by this species is absent or very marginal within and around the Reach 9 measures. As a result, there is moderate potential for Coulter's matilija poppy to occur within the Reach 9 measures.

Coast live oak

Coast live oak is not included as a federal, State, or CNPS-listed species; however, this species is often afforded protection through local and/or State ordinances and management guidelines. Individuals of this species were observed within or within close proximity of all four Reach 9 measures and are represented by individuals of various age classes. Some of the oak trees occurring in or within proximity of the Reach 9 measures were affected to some degree by the 2008 Freeway Complex fire, but are showing signs of emergent growth and appear to be recovering.

Wildlife

Riparian communities support some of the most diverse assemblages of wildlife in the region. This is in part due to their ability to provide access to water, shade, and protection from predation. These areas also provide foraging habitat and are used for nesting and breeding by a number of species. The riparian and upland plant communities that occur in and adjacent to the SAR provide habitat for a variety of resident and migratory wildlife species including several special-status species. Of particular importance are perennial stream areas that provide potential habitat for the federally threatened Santa Ana sucker (*Catostomus santaanae*), riparian areas that provide habitat for the federally and State-endangered least Bell's vireo (*Vireo bellii pusillus*), and upland scrub habitat for the federally endangered coastal California gnatcatcher (*Polioptila californica californica*).

The stretch of the SAR and corresponding floodplain within the vicinity of the Reach 9 measures are surrounded by a variety of different land uses. This leaves the floodplain as the primary habitat area in the immediate vicinity of the measures. The river and corresponding undeveloped floodplain provide a corridor for wildlife to move up and down the river and allows access to linkages to additional core

habitat areas, such as the Santa Ana Mountains, Prado Basin, and Chino Hills, upstream and to a more limited extent downstream of Reach 9.

Common Wildlife

Invertebrates. As in all ecological systems, invertebrates play a crucial role in a number of biological processes. They serve as the primary or secondary food source for a variety of fish, bird, reptile, and mammalian predators; they provide important pollination vectors for numerous plant species; they act as efficient components in controlling pest populations; and, they support the maintenance of the area by performing essential nutrient cycling functions that contribute to soil nutrients. The SAR provides habitat for a vast number of insects, crustaceans, and other invertebrate species. Although specific surveys for invertebrates were not conducted, it is expected that invertebrates in the project area are represented by a composition of insect species that commonly occur in southern California. These include representatives of various orders, such as Orthoptera (grasshoppers, crickets), Odonata (dragonflies, damselflies), Hemiptera (true bugs), Coleoptera (beetles), Diptera (flies), Hymenoptera (bees, wasps, ants), and Lepidoptera (butterflies, moths), among others. In recent river diversions associated with the Reach 9, Phase 2B Project, red swamp crayfish (*Procambarus clarkii*) were also common.

Fish. Two native fish species that have been reported from Reach 9: the federally threatened Santa Ana sucker and the arroyo chub (*Gila orcuttii*), a CDFW Species of Special Concern. Other fish species known to occur in the SAR are introduced non-native species and are expected to occur in varying densities and conditions. The most abundant fish are the common carp (*Cyprinus carpio*), the fathead minnow (*Pimephales promelas*), inland silverside (*Menidia beryllina*), western mosquitofish (*Gambusia affinis*), black bullhead (*Ameiurus melas*), yellow bullhead (*Ameiurus natalis*), channel catfish (*Ictalurus punctatus*), largemouth bass (*Micropterus salmoides*), black crappie (*Pomoxis nigromaculatus*), and green sunfish (*Lepomis cyanellus*).

Amphibians. Amphibians often require a source of standing or flowing water to complete their life cycle. However, some terrestrial species can survive in drier areas by remaining in moist environments found beneath leaf litter and fallen logs, or by burrowing into the soil. No amphibian species were observed during surveys conducted in April 2014; however, based on survey data collected by the Santa Ana Watershed Association (SAWA) within Chino Hills State Park between 1998 and 2003, western toad (*Bufo boreas*), arboreal salamander (*Aneides lugubris*), and garden slender salamander (*Batrachoseps major*) have a high likelihood of occurrence, particularly in upland habitats where moist microclimates are present (USGS, 2004). There is also potential for these species to occur within areas of the riparian mixed scrub habitat that meet similar microclimate characteristics. Other commonly found amphibian species that would be expected to occur within the project area include the Pacific tree frog (*Pseudacris regilla*), California tree frog (*P. cadaverina*), and the non-native bullfrog (*Rana catesbeiana*) and African clawed frog (*Xenopus laevis*).

Reptiles. The potential diversity of reptile species is typically related to the diversity of plant communities found at a particular site. Typically, plant communities that have an abundant amount of

undisturbed leaf litter, rocks, rotting logs, and other cover sources would have a higher diversity of reptile presence than those areas with regular disturbance and subsequently fewer cover elements. The western fence lizard (*Sceloporus occidentalis*) and side-blotch lizard (*Uta stansiburiana*) were the only two reptile species documented during the April 2014 surveys. Several additional reptile species are expected to occur and have been documented in the vicinity of the Reach 9 measure areas, including southern alligator lizard (*Elgaria multiarinata*), western skink (*Eumeces skiltonianus*), striped racer (*Masticophis lateralis*), western yellow-bellied racer (*Coluber constrictor*), California black-headed snake (*Tantilla planiceps*), gopher snake (*Pituophis melanoleucus*), California kingsnake (*Lampropeltis getula californiae*), and the southern Pacific rattlesnake (*Crotalus viridis*) (USGS 2004).

One special-status reptile species has previously been observed in Reach 9. Coast horned lizard (*Phrynosoma blainvillii*) was detected by SAWA in the vicinity of BNSF Bridge during surveys conducted in 2007 and 2008 (SAWA 2008). The Reach 9 measure areas also have potential to provide habitat for other special-status reptile species including, western pond turtle (*Actinemys marmorata*), orange-throated whiptail (*Aspidoscelis hyperythera*), and coastal whiptail (*A. tigris stejnegeri*) (see Table 5.5-3). These three species have not been documented from the immediate vicinity of the SAR, but have been recorded from undisturbed habitats in the Santa Ana Mountains to the south and Chino Hills to the north (CDFW 2014a).

Birds. Bird species are quite diverse and abundant in the Prado Basin and areas downstream, including Reach 9. More than 200 species of birds have been recorded in this area (Hays, 1987). Of these, approximately 95-100 breed nearby in the Prado Basin, and many are likely to occur in Reach 9. Raptors, waterfowl, riparian obligate species, and grassland species are regular inhabitants.

A substantial raptor population also resides in the Prado Basin and may utilize surrounding areas, including Reach 9. A number of raptors that do occur or could occur within the Reach 9 measure areas are special-status species, including Cooper's hawk (*Accipiter cooperii*), sharp-shinned hawk (*Accipiter striatus*), golden eagle (*Aquila chrysaetos*), long-eared owl (*Asio otus*), Swainson's hawk (*Buteo swainsoni*), turkey vulture (*Cathartes aura*), northern harrier (*Circus cyaneus*), and white-tailed kite (*Elanus leucurus*) (see Table 5.5-3).

A variety of bird species that are closely tied to open water resources of the SAR and occur within the nearby Prado Basin may occasionally pass through Reach 9. These species include great egret (*Ardea alba*) and mallard (*Anas platyrhynchos*), which were observed during the surveys, as well as great blue heron (*A. herodias*), snowy egret (*Egretta thula*), black-crowned night heron (*Nycticorax nycticorax*), and tree swallow (*Tachycineta bicolor*).

Bird species observed during site surveys on April 15, 2014 are presented in Table 5-5.2. Species are listed by the Reach 9 measure area they were detected in; however, most are common species that would occur in any or all of the measure areas. Four special-status bird species were detected during the surveys, including Cooper's hawk, a CDFW Watch List species; the federally and State-endangered least

Bell's vireo; and two CDFW Species of Special Concern, the yellow warbler (*Dendroica petechial*) and yellow-breasted chat *(Icteria virens*).

Table 5.5-2. Bird Species Observed during April 2014 Surveys

Common Name	Scientific Name	Phase 4	Phase 5A	Phase 5B	BNSF
ANSERIFORMES					
Anatidae					
Mallard	*Anas platyrhynchos*			X	X
PELICANIFORMES					
Ardeidae					
Great Egret	*Ardea alba*	X			
ACCIPITRIFORMES					
Cathartidae					
Turkey Vulture	Cathartes aura	X		X	X
Accipitridae					
Red-tailed Hawk	*Buteo jamaicensis*	X			
Red-shouldered Hawk	*Buteo lineatus*				X
Cooper's Hawk	*Accipiter cooperii*		X		
COLUMBIFORMES					
Columbidae					
Mourning Dove	*Zenaida macroura*			X	
APODIFORMES					
Trochilidae					
Anna's Hummingbird	*Calypte anna*	X		X	
PASSERIFORMES					
Tyrannidae					
Black Phoebe	*Sayornis nigricans*	X			
Vireonidae					
Least Bell's Vireo[1]	*Vireo bellii pusillus*	X	X	X	
Hutton's Vireo	*Vireo huttoni*			X	
Corvidae					
American Crow	*Corvus brachyrhynchos*			X	
Western Scrub-Jay	*Aphelocoma californica*	X		X	
Hirundinidae					
Cliff Swallow	*Petrochelidon pyrrhonota*			X	X
Violet-green Swallow	*Tachycineta thalassina*	X			
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*		X		
Aegithalidae					
Bushtit	*Psaltriparus minimus*	X	X	X	
Sylviidae					
Wrentit	*Chamaea fasciata*	X		X	
Troglodytidae					
Bewick's Wren	*Thryomanes bewickii*				X
Mimidae					
California Thrasher	*Taxostoma redivivium*		X		
Northern Mockingbird	*Mimus polyglottos*			X	

Common Name	Scientific Name	Phase 4	Phase 5A	Phase 5B	BNSF
Parulidae					
Wilson's Warbler	*Wilsonia pusilla*		X	X	X
Common Yellowthroat	*Geothlypis trichas*	X	X		
Yellow Warbler[2]	*Dendroica petechial*		X	X	X
Yellow-breasted Chat[2]	*Icteria virens*			X	
Emberizidae					
Song Sparrow	*Melospiza melodia*	X	X	X	X
California Towhee	*Pipilo crisalis*	X	X		
Spotted Towhee	*Pipilo maculatus*	X		X	X
Icteridae					
Bullock's Oriole	*Icterus bullockii*			X	
Fringillidae					
Lesser Goldfinch	*Carduelis psaltria*			X	X
American Goldfinch	*Carduelis tristis*	X	X	X	
House Finch	*Carpodacus mexicanus*	X	X	X	X

[1] Federal and State-listed as endangered
[2] CDFW Species of Special Concern

Mammals. Twenty-three species of mammals, including three non-native species, have been observed in the nearby Prado Basin (Zembal et al, 1985). Many of these species have been previously detected within the general vicinity of the SAR or would be expected to occur within the Reach 9 measure areas. The most common small mammals include the California ground squirrel (*Spermophilus beecheyi*), western harvest mouse (*Reithrodontomys megalotis*), California vole (*Microtus californicus*), Botta's pocket gopher (*Thomomys bottae*), and western brush rabbit (*Sylvilagus bachmani*). The only large ungulate known to occur in the vicinity is the mule deer (*Odocoileus hemionus*). Meso-predators known from the area include the gray fox (*Urocyon cinereoargentus*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), and long-tailed weasel (*Mustela frenata*). Top carnivores that have potential to occur in the vicinity include the coyote (*Canis latrans*), bobcat (*Lynx rufus*), and mountain lion (*Puma concolor*).

Several bat species are also known to occur within the vicinity of the Reach 9 measure areas. These species would be most likely to use the sites for foraging. These include the pallid bat (*Antrozous pallidus*), western mastiff bat (*Eumops perotis californicus*), Yuma myotis (*Myotis yumanensis*), and pocketed free-tailed bat (*Nyctinomops femorasaccus*), all of which are CDFW Species of Special Concern. A roosting site is known to occur under a bridge constructed in March 2012 over the SAR, near the end of Green River Road. The bridge crosses over into the Green River Golf Course and occurs approximately 0.3 miles downstream (south) of BNSF Bridge. A survey conducted in July 2013 by SAWA indicated that a maternity roost is present under the bridge. Big brown bat (*Eptesicus fuscus*), California bat (*Myotis californicus*), and Yuma myotis were detected (SAWA 2013). Surveys of the railroad bridge are ongoing. Initial surveys by SAWA in July 2015 detected a small number of bats (56) around the bridge, although it could not be verified that all of those came out of the bridge. Ten large bats (tentatively identified as big brown bats) and ten smaller bats (species unknown) were seen exiting the bridge by one surveyor.

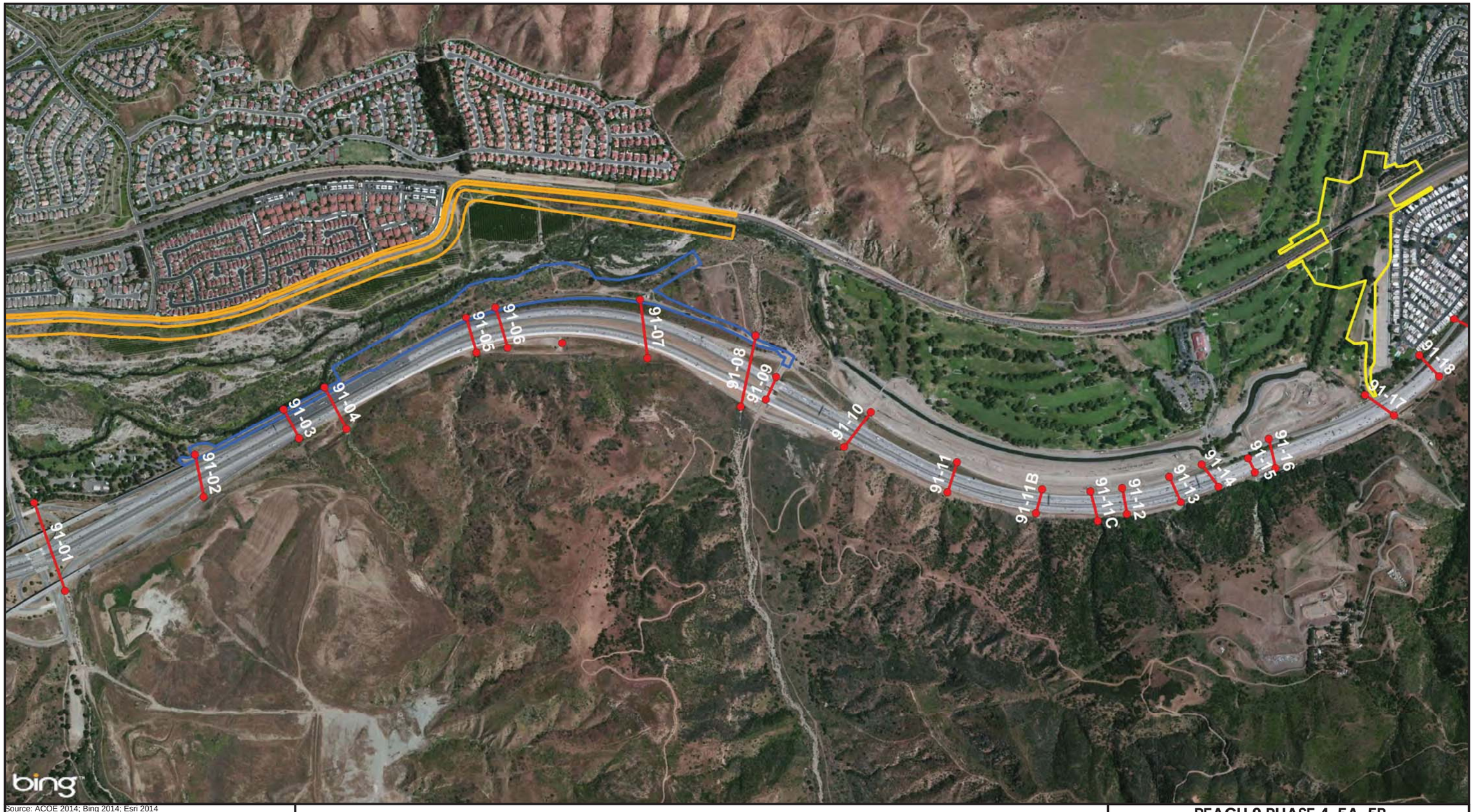
Other bats were observed flying over and under the bridge, but the surveyors believed they may have come from another location. Bats are not known to utilize the BNSF Bridge as a maternity roost.

Wildlife Movement. Linkages and corridors facilitate regional animal movement and are generally centered on waterways, riparian corridors, flood control channels, and contiguous upland habitat. Drainage ways generally serve as movement corridors because they are natural elements in the landscape that guide animal movement (Noss, 1991; Ndubisi et al., 1995; R. Walker and Craighead, 1997, in Hilty et al., 2006). Corridors would ideally offer wildlife unobstructed terrain for foraging and for dispersal of young individuals. In reality, many corridors may have disturbed characteristics. It is necessary to consider the state of the urban/wild land matrix in addition to spatial and temporal scales when analyzing potential corridors. For example, some species will require large amounts of habitat to fulfill their life history, and others will require less; some species will require use of corridors on temporal scales as short as minutes or hours to as long as generations.

Landscapes contain a variety of movement paths, territories, travel routes, and other features that facilitate wildlife movement, which in turn maintains a healthy exchange of genetic material, provides areas for forage, and other life history requirements. The relative size and characteristics of these features are different for each species that uses them. Urban or otherwise developed and/or disturbed landscapes results in fragmentation of habitat. This can affect the way wildlife uses a particular landscape, which emphasizes the need for wildlife corridors and linkages to connect remaining habitat patches. Determinants for use of corridors and linkages are dependent on several factors depending on which species is in question. In general, these determinants include the ability to find adequate cover, food, and water and minimization or elimination of obstacles (e.g. man-made noise, lighting, or structures).

The linkage between core habitats in the Santa Ana Mountains, the Prado Basin, and the Puente-Chino Hills was once several miles wide. It is now extremely limited, due in large part to SR-91, the Corona Expressway (SR-71), and urban development. The only passageways remaining for wildlife to utilize to safely traverse SR-91 and SR-71 are freeway undercrossings. These passageways can provide vital ecological connections for wildlife moving between remaining patches of quality habitat.

Eight undercrossings run beneath SR-91 in the vicinity of Phase 4 (Figure 5.5-5). Four of these undercrossings have openings located within the TCE. These culverts are labeled as 91-02, and 91-05, 91-06, and 91-07 on Figure 5.5-5. Three undercrossings outlet beyond (north of) the TCE, including 91-03, 91-04, and 91-08. The remaining undercrossing, 91-09, known as the “Coal Canyon” underpass, is an important wildlife movement corridor for numerous wildlife species. The culverts under SR-91 are used extensively by small mammals as well as by mountain lions (Marsh et al. 1990).



Source: ACOE 2014; Bing 2014; Esri 2014

0 500 1,000 2,000 Feet

Scale:1:12,000 ; 1 inch = 1,000 feet

Legend

- Undercrossings
- BNSF Bridge Temporary Construction Easement
- Phase 4 Temporary Construction Easement
- Phase 5B Temporary Construction Easement

REACH 9 PHASE 4, 5A, 5B & BNSF SEA/EIR ADDENDUM

FIGURE 5.5-5
SR-91 Undercrossings

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Path: P:\2014\60279208-Reach_9_SEA\900-CAD-GIS\920 GIS-Graphics\925_Docs\Reach9_WildlifeMovement.mxd, 12/22/2014, wallacerj

This page intentionally left blank.

One undercrossing, 91-17, outlets near the TCE of BNSF Bridge, at the entrance to the project site off Green River Road. This undercrossing is an approximate 12-foot by 12-foot cement box culvert, which occurs beneath SR-91 and Green River Road and opens up to a small drainage. This culvert provides a relatively safe passage for wildlife beneath SR-91, between the Santa Ana Mountains to the south and the Chino Hills to the north. Bobcat, grey fox, coyotes, and several other mammalian species, have been documented using this culvert on a regular basis (Corps 2009).

Special-Status Wildlife Species

Special-status wildlife species include those listed by USFWS under FESA and CDFW under CESA, those included under the Western Riverside MSHCP, and other species which have been identified by local jurisdictions as unique or rare and which have the potential to occur within the project area. USFWS officially lists species as either threatened or endangered, or as a candidate for listing. Additional species receive federal protection under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act (MBTA), and state protection under California Environmental Quality Act (CEQA) Section 15380(d). All birds except European starlings; English house sparrows; rock doves (pigeons); and non-migratory game birds such as quail, pheasant, and grouse are protected under the MBTA. Non-migratory game birds are protected under California Fish and Game Code (CFGC) Section 3503. Many other species are considered by CDFW to be California Species of Special Concern (SSC), listed in CDFW (2014b), Remsen (1978), and Williams (1986). Others are on a CDFW Watch List (CDFW 2014b). The CNDDB tracks species within California for which there is conservation concern, including many that are not formally listed, and assigns them a CNDDB Rank CDFW 2014b). Although SSC, CDFW Watch List species, and species that are tracked by the CNDDB but not formally listed are afforded no official legal status, they may receive special consideration during the CEQA review process. CDFW further classifies some species as "Fully Protected," indicating that the species may not be "taken" or possessed except for scientific purposes under special permit from CDFW (CDFW 2014b). Additionally, CFGC Sections 3503, 3505, and 3800 prohibit the take, destruction, or possession of any bird, nest, or egg of any bird except English house sparrows and European starlings unless authorization is obtained from CDFW.

CNDDB

The results of a CNDDB search indicates that eight wildlife species known from the Black Star Canyon and Prado Dam quadrangle are federally listed or State-listed as threatened or endangered: San Diego fairy shrimp (*Branchinecta sandiegonensis*), Swainson's hawk (*Buteo swainsoni*), Santa Ana sucker (*Catostomus santaanae*), western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), southwestern willow flycatcher (*Empidonax trailii extimus*), bald eagle (*Haliaeetus leucocephalus*), coastal California gnatcatcher (*Polioptila californica californica*), and least Bell's vireo (*Vireo bellii pusillus*).

2001 SEIS/EIR

The 2001 SEIS/EIR identified a number of special-status species that occur or potentially could occur in Reach 9, including four birds, two amphibians, and one fish species that are listed under FESA. Phase 5A,

5B, and 4, and BNSF BNSF Bridge were not analyzed in the 2001 SEIS/EIR, but since the four projects occur within Reach 9, the species identified in the 2001 SEIS/EIR are relevant. Least Bell's vireo, listed as endangered under FESA in 1986, is a common summer breeding resident in nearby Prado Basin and throughout Reach 9. As such, this species has been a major focus in previous documents. Southwestern willow flycatcher, another summer breeding resident in the Prado Basin, is much less common, and has not been seen in Reach 9 since 1999. It was afforded protection under FESA nine years after the least Bell's vireo, in 1995. The peregrine falcon was formally listed under FESA in 1984, but was already protected under legislation that preceded FESA, and was delisted in 1999 due to recovery of the species. The bald eagle was formally listed under FESA in 1978; however, it was delisted in 2007. Peregrine falcon and bald eagle are occasional winter visitors to the Prado Basin, but are not known to breed in Reach 9. The 2001 SEIS/EIR analyzed two additional bird species, western yellow-billed cuckoo (*Coccyzus americanus*) and Swainson's hawk, which are State-listed as endangered and threatened, respectively. Western yellow-billed cuckoo has since also been afforded protection under FESA, being listed as threatened in October 2014.

Arroyo toad (*Anaxyrus californicus*) was listed under FESA as endangered in 1995; however, it has never been recorded in Reach 9. The California red-legged frog (*Rana draytonii*) was federally-listed as threatened in 1996 and was formerly a resident in the Prado Basin, but is not expected to occur in the Reach 9 measure areas. In 2000, the Santa Ana sucker was federally-listed as a threatened under FESA and critical habitat was re-designated for the species in 2010. Critical habitat for this species extends through Reach 9, as shown on Figures 5.5-6c and 5.5-6d.

Based on a literature review, updated survey efforts, occurrence information, distribution maps, and correspondence with local experts, it was determined that the 29 special-status wildlife species listed in Table 5.5-3 have been documented or have potential to occur in the vicinity of the Reach 9 measures. Those species listed either as federally or State-endangered or threatened, and known to be present or with at least some potential (low, moderate, or high) to occur within the Reach 9 measures will be discussed further in this document.

Table 5.5-3. Regional Special-Status Animal Species[1]

Common Name *Scientific Name*[2]	Status[3]	General Habitat Description[4]	Potentially Suitable Habitat Present/ Absent	Potential for Occurrence
Invertebrates				
San Diego Fairy Shrimp *Branchinecta sandiegonensis*	USFWS: Endangered CDFW: None	Found in vernal pool complexes from Santa Barbara to Baja California.	Absent	**Not Expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas.
Fish				
Santa Ana sucker *Catostomus santaanae*	USFWS: threatened	Found in cismontane stream systems in Southern California	Present at BNSF only (footprints	**Moderate.** Habitat preferred by this species is absent at Phase 5A, 5B

Common Name *Scientific Name*[2]	Status[3]	General Habitat Description[4]	Potentially Suitable Habitat Present/ Absent	Potential for Occurrence
	CDFW: SSC MSHCP: G3	and including the SAR. Habitat generalists, but prefer sand-cobble bottoms, cool, clear water, and algae.	of other measures do not extend into the SAR's active channel)	and 4; however, suitable habitat is present at BNSF Bridge site. This species is known from portions of the SAR where suitable habitat occurs above and below Prado Dam. Nearest record is within the general project area. Previously observed in Prado Dam outlet channel in 2008 and in the Reach 9, Phase 2B project area in Spring 2010. This species is currently restricted to middle and lower portions of the river, mainly along reaches with flows enhanced by wastewater (Moyle et al, 1995).
Amphibians				
northern leopard frog *Lithobates pipiens*	USFWS: None CDFW: SSC	Found in grassland, brushland, woodland, and forests, ranging high into mountains. Frequents springs, slowly flowing streams, marshes, bogs, ponds, canals, and other permanent waters with vegetation. May be found foraging in nearby grasslands.	Present	**Not expected.** Habitat preferred by this species is absent or very marginal within and surrounding the Reach 9 measure areas, which are also outside of the general geographical range of this species. Previously recorded in vicinity of Reach 9 in 1957; individual was a suspected transplant.
Western spadefoot *Spea hammondii*	USFWS: None CDFW: SSC MSHCP: G2	Occurs primarily in grassland habitats, but can be found in valley foothill hardwood woodlands. Vernal pools are essential for breeding and egg-laying.	Present	**Moderate.** Habitat preferred by this species is present within and surrounding the Reach 9 measure areas.
Coast Range newt *Taricha torosa*	USFWS: None CDFW: SCC MSHCP: G3	Coastal drainages from Mendocino south to San Diego County. Lives in terrestrial habitats and will	Present	**Moderate.** Habitat preferred by this species is present within and surrounding the Reach 9 measure areas.

Common Name *Scientific Name*[2]	Status[3]	General Habitat Description[4]	Potentially Suitable Habitat Present/ Absent	Potential for Occurrence
		migrate over 1 km to breed in ponds, reservoirs and slow moving streams.		
REPTILES				
orangethroat whiptail *Aspidoscelis hyperythra*	USFWS: None CDFW: SSC MSHCP: G1	Found in washes, streams, terraces, and other sandy areas. Frequent coastal chaparral, thorn-scrub and streamside growth.	Present	**Moderate.** Pockets of habitat preferred by this species is present within and surrounding the Reach 9 measures. Previously recorded in the vicinity of Reach 9 measure areas near Coal Canyon and Scully Hill.
coastal whiptail *Aspidoscelis tigris stejnegeri*	USFWS: None CDFW: SSC MSHCP: G1	Found in deserts and semiarid areas with sparse vegetation and open areas. Also in woodland and riparian areas. Substrate may be firm soils, sandy, or rocky.	Present	**Low**. Habitat preferred by this species is present within and surrounding the Reach 9 measures; however, previous records are more than one mile from Reach 9 measure areas.
red-diamond rattlesnake *Crotalus ruber*	USFWS: None CDFW: SSC MSHCP: G2	Found in desert scrub, thorn-scrub, coastal sage, chaparral, and woodland. Occasionally found in grassland and cultivated areas.	Present	**Moderate**. Habitat preferred by this species is present within and surrounding the Reach 9 measure areas. Species has been observed at the Green River Golf Club.
western pond turtle *Emys marmorata*	USFWS: None CDFW: SSC MSHCP: G3	Aquatic turtle of ponds, marshes, rivers, streams, and irrigation ditches, usually with aquatic vegetation. Needs basking sites and suitable upland habitat (sandy banks or grassy open fields) up to 0.5 km from water, for laying eggs.	Present	**Moderate**. Suitable habitat is present within and surrounding the Reach 9 measure areas.
coast horned lizard *Phrynosoma blainvillii*	USFWS: None CDFW: SSC	Inhabits coastal sage scrub and chaparral in arid and semiarid climates. Prefers friable, rocky, or	Present	**High.** This species has been detected in the vicinity of BNSF Bridge (SAWA 2008). The Reach 9 measure areas support

Common Name *Scientific Name*[2]	Status[3]	General Habitat Description[4]	Potentially Suitable Habitat Present/ Absent	Potential for Occurrence
		shallow sandy soils.		suitable habitat and are within the known distribution for this species.
coast patch-nosed snake *Salvadora hexalepis virgultea*	USFWS: None CDFW: SSC	Found in grasslands, chaparral, sagebrush, pinon-juniper woodland, and desert scrub. Prefers rocky and sandy areas, occasionally arboreal.	Present	**Low.** Marginally suitable habitat is present within and surrounding the Reach 9 measure areas.
two-striped garter snake *Thamnophis hammondii*	USFWS: None CDFW: SSC	Highly aquatic, found in or near permanent freshwater. Often along streams with rocky beds and riparian growth.	Present	**Low.** Marginally suitable habitat is present within and surrounding the Reach 9 measure areas.
BIRDS				
Cooper's hawk *Accipiter cooperii*	USFWS: None CDFW: WL MSHCP: G2	Inhabits various types of mixed deciduous forests and open woodlands, including small woodlots, riparian woodlands in dry country, open and pinyon woodlands, and forested mountainous regions. Also now nests in many cities.	Present	**Detected.** This species was detected in the vicinity of Phase 5A and the Reach 9 measure areas support suitable habitat and are within the known distribution of this species.
southern California rufous-crowned sparrow *Aimophila ruficeps canescens*	USFWS: None CDFW: WL MSHCP: G2	Southern California resident within sage scrub and sparse mixed chaparral habitat. Frequents relatively steep, often rocky hillsides with grass and forb patches.	Present	**Low**. Marginally suitable habitat is present within and surrounding the Reach 9 measure areas.
grasshopper sparrow *Ammodramus savannarum*	USFWS: None CDFW: SSC MSHCP: G2	Inhabits dense grasslands on rolling hills, lowland plains, in valleys and on hillsides on lower mountain slopes. Prefers native	Absent	**Not Expected**. The Reach 9 measure areas do not contain suitable habitat for this species.

Common Name *Scientific Name*[2]	Status[3]	General Habitat Description[4]	Potentially Suitable Habitat Present/ Absent	Potential for Occurrence
		grasslands with a mix of grasses, forbs and scattered shrubs. Loosely colonial when nesting.		
golden eagle *Aquila chrysaetos*	USFWS: None CDFW: FP, WL MSHCP: G2	Found in open spaces surrounding cliffs mountains, and hills. Preferred habitats include desert, tundra, shrublands, grasslands, forests, farmlands, and areas along rivers and streams.	Present	**Moderate.** Suitable habitat is present within and surrounding the Reach 9 measure areas.
long-eared owl *Asio otus*	USFWS: None CDFW: SSC	Found in dense stands of tall shrubs or trees, usually adjacent to open grasslands or scrub.	Present	**Low**. Marginally suitable habitat is present within and surrounding the Reach 9 measure areas.
burrowing owl *Athene cunicularia*	USFWS: None CDFW: SSC MSHCP: G3	Inhabits open, dry annual or perennial grasslands, deserts, and scrublands characterized by low-growing vegetation. Subterranean nester, dependent upon burrowing mammals, most notably, California ground squirrel.	Absent	**Not Expected**. The Reach 9 measure areas do not contain suitable habitat for this species.
Swainson's hawk *Buteo swainsoni*	USFWS: none CDFW: Threatened MSHCP: G1	Breeds in grassland with scattered trees, juniper-sage flats, riparian areas, savannahs, and agricultural or ranch lands. Requires adjacent suitable foraging areas such as grasslands, or alfalfa or grain fields supporting rodent populations.	Present	**Low**. Marginally suitable habitat is present within and surrounding the Reach 9 measure areas.

Common Name *Scientific Name*[2]	Status[3]	General Habitat Description[4]	Potentially Suitable Habitat Present/ Absent	Potential for Occurrence
coastal cactus wren *campylorhynchus brunneicapillus sandiegensis*	USFWS: none CDFW: SSC MSHCP: G3	Found in coastal sage scrub and chaparral. Requires dense stands of cactus or for breeding and nesting.	Absent	**Not Expected**. The Reach 9 measure areas do not contain suitable habitat for this species.
western yellow-billed cuckoo *Coccyzus americanus occidentalis*	USFWS: Threatened CDFW: Endangered MSHCP: G3	Nests in riparian forest along broad, lower flood-bottoms of larger river systems. Prefers riparian jungles or willow, often mixed with cottonwoods, with a lower story of blackberry, nettles, or wild grape.	Present	**Low.** The Reach 9 measures contain marginally suitable habitat that could be utilized by this species during migration.
yellow warbler *Dendroica petechia*	USFWS: none CDFW: SSC MSHCP: G2	Nests in mature riparian woodland of cottonwood, willow, alder, and ash trees that have reached their full height.	Present	**Detected**. This species was detected in the proximity of Phases 5A, 5B, and BNSF Bridge during April 2014 surveys of the Reach 9 measure areas.
white-tailed kite *Elanus leucurus*	USFWS: None CDFW: FP MSHCP: G2	Inhabits rolling foothills and valley margins with scattered oaks and river bottomlands or marshes next to deciduous woodland. Open grasslands, meadows, or marshes for foraging close to isolated, dense-topped trees for nesting and perching.	Present	**High**. Suitable habitat is present within and surrounding the Reach 9 measures. Known from Prado Dam and is a known winter visitor in Reach 9.
Peregrine falcon *Falco peregrinus anatum*	USFWS: Delisted CDFW: Delisted, FP MSHCP: G1	Nest sites are typically on ledges of large cliff faces, also on city buildings and bridges. Occur in wetlands, woodlands, agricultural areas, and coastal habitats.	Present	**Low.** Marginally suitable habitat is present within and surrounding the Reach 9 measure areas.
southwestern willow flycatcher *Empidonax traillii extimus*	USFWS: Endangered CDFW: Endangered	Riparian woodlands in southern California.	Present	**Low**. Marginally suitable habitat is present within and surrounding the Reach 9 measure areas.

Common Name *Scientific Name*[2]	Status[3]	General Habitat Description[4]	Potentially Suitable Habitat Present/ Absent	Potential for Occurrence
	MSHCP: G3			
bald eagle *Haliaeetus leucocephalus*	USFWS: Delisted, CDFW: Endangered, FP MSHCP: G1	Found in forested areas near lakes, reservoirs, rivers, marshes, and coasts. Have been known to congregate at fisheries and below dams.	Present	**Low**. Marginally suitable habitat is present within and surrounding the Reach 9 measure areas.
yellow-breasted chat *Icteria virens*	USFWS: None CDFW: SSC MSHCP: G2	Summer resident that inhabits riparian thickets of willow and other brush tangles near watercourses. Nests in low dense riparian habitat, consisting of willow, blackberry, and wild grape. Nests within 10 feet of the ground.	Present	**Detected**. This species was detected in the proximity of Phase 5B during April 2014 surveys of the Reach 9 measure areas.
coastal California gnatcatcher *Polioptila californica californica*	USFWS: Threatened CDFW: SSC MSHCP: G2	Obligate, permanent resident of coastal sage scrub below 2.500 feet in southern California. Inhabits low, coastal sage scrub in arid washes, on mesas and slopes.	Present	**Moderate**. This species was detected nesting just downstream of the Car Wash Strip Mall during construction of Phase 1 in 2009, and has moved into restored habitat in the Phase 1 project area. It has also been encountered during SARI Line construction in the vicinity of Phase 2B; has been detected at Coal, Weir and Gypsum Canyons; and recently detected near the east end of the Phase 4 TCE (near the gully repair area). According to State Parks, gnatcatchers have also been detected on the north side of SR-91 near the east end of the Reach 9, Phase 5B temporary construction

Common Name *Scientific Name*[2]	Status[3]	General Habitat Description[4]	Potentially Suitable Habitat Present/ Absent	Potential for Occurrence
				easement. As a result this species has moderate potential to occur within and surrounding the Reach 9 measure areas, in particular Phase 4. Surveys of all potential habitats within proposed project areas are ongoing. With the exception of the scrub habitat at the east end of Phase 4, most of these areas are only marginally suitable for the CAGN; however, most of the habitat is relatively open and CAGN could use it to move up and down the floodplain to access suitable habitat within the floodplain or on the adjacent slopes.
Least Bell's vireo *Vireo bellii pusillus*	USFWS: Endangered CDFW: Endangered MSHCP: G2	Summer resident of southern California in low riparian habitat in vicinity of water or in dry river bottoms, below 2,000 feet (610 meters).	Present	**Detected**. This species has been observed nesting within and surrounding the Reach 9 measure areas, and was detected at Phases 4, 5A, and 5B during April 2014 surveys.
MAMMALS				
pallid bat *Antrozous palidus*	USFWS: None CDFW: SSC WBWG: H	Deserts, grasslands, shrublands, woodlands and forests. Most common in open, dry habitats with rock areas for roosting. Roosts must protect bats from high temperatures; very sensitive to disturbance of roosting sites.	Absent	**Not Expected**. The Reach 9 measure areas do not contain suitable habitat for this species.
western mastiff bat *Eumops perotis*	USFWS: None	Open semiarid to arid habitats, including	Absent	**Not Expected**. The Reach 9 measure areas do not

Common Name *Scientific Name*[2]	Status[3]	General Habitat Description[4]	Potentially Suitable Habitat Present/ Absent	Potential for Occurrence
californicus	CDFW: SSC WBWG: H	conifer and deciduous woodlands, coastal scrub, grassland, and chaparral. Roosts in crevices in cliff faces, high buildings, trees, and tunnels. Roost locations are generally high above the ground providing a 3-meter minimum clearance below the entrance for flight. Requires large open-water drinking sites.		contain suitable habitat for this species.

[1] Special-status species known from the BlackStar and Prado quadrangles.
[2] Nomenclature for special-status animals conforms to CDFW 2014a.
[3] Sensitivity Status Codes (CDFW 2011)

Federal U.S. Fish and Wildlife Service (USFWS)
State California Department of Fish and Wildlife (CDFW)
SSC – California Species of Special Concern
FP – Fully Protected
WL – Watch List
California Natural Diversity Data Base (CNDDB) – No state status, tracked by CNDDB or otherwise considered locally sensitive
Other Western Bat Working Group (WBWG)
High (H) Priority – These species are imperiled or are at high risk of imperilment
Medium (M) Priority – Indicates a level of concern that should warrant closer evaluation, more research, and conservation actions of both species and possible threats.
MSHCP Western Riverside Multiple-Species Habitat Conservation Plan
G1: Group 1: Take coverage is warranted based upon regional or landscape level considerations.
G2: Group 2: Take coverage is warranted based upon regional or landscape level considerations with the addition of site-specific conservation and managements requirements.
G3: Group 3: Take coverage is warranted based upon regional or landscape level considerations with the addition of specific conservation and management conditions for species within a narrowly defined Habitat or limited geographic area within the MSHCP area.

[4] General Habitat Description source: CDFW 2014a

Descriptions of Special-Status Wildlife Species with Potential to Occur in the Reach 9 Measures

Federal and State Listed Species

Santa Ana Sucker

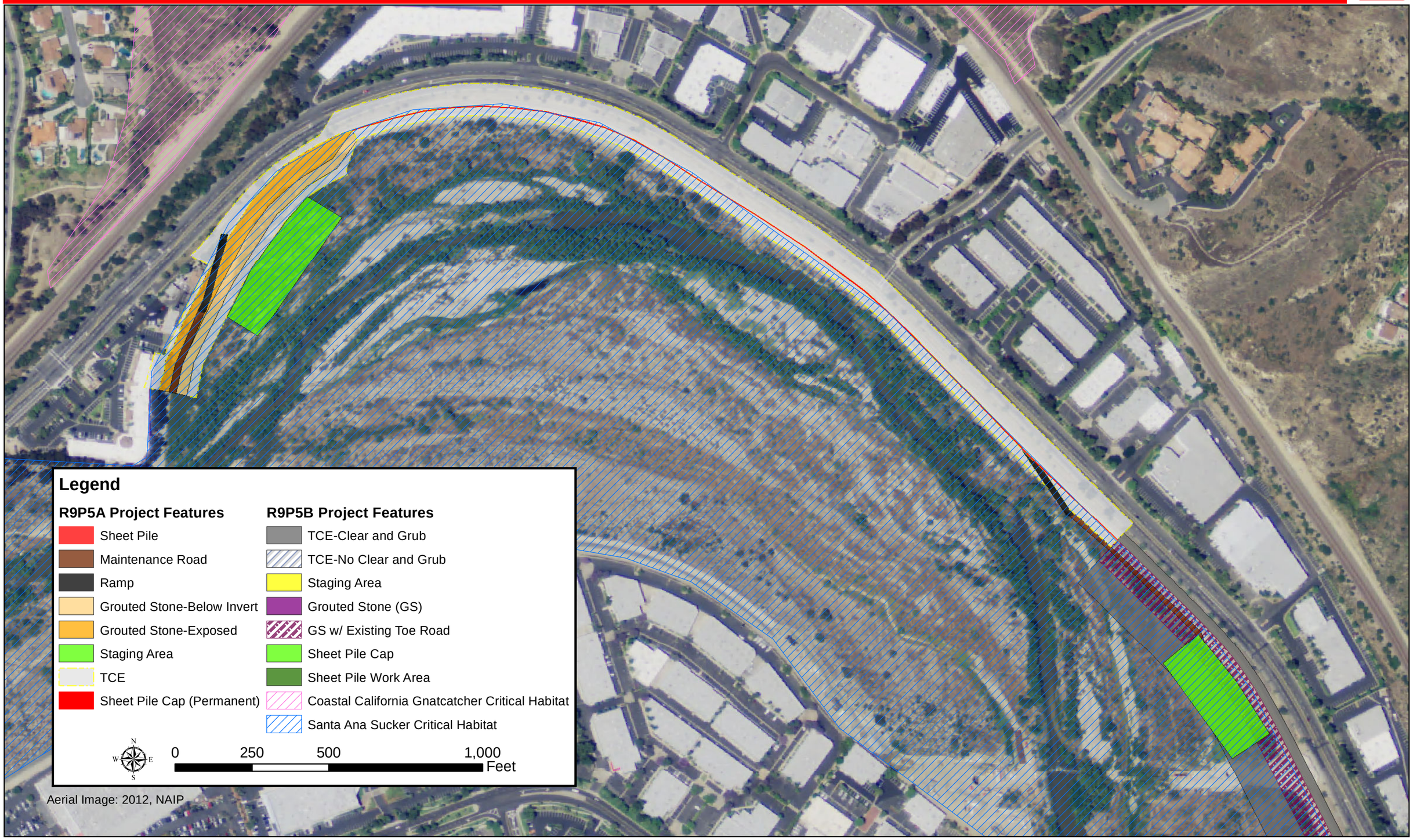
Santa Ana sucker is federally threatened, a California Species of Special Concern, and a MSHCP-covered species. The Santa Ana sucker historically occurred in small, shallow, low-elevation streams in the Los Angeles, San Gabriel, and Santa Ana River systems (Swift et al., 1993). They also historically occurred in the upper Santa Ana River, on Cajon and City Creeks in the foothills of the San Bernardino Mountains, and in Santiago Creek in the foothills of the Santa Ana Mountains (Moyle et al., 1995). Currently, the Santa Ana sucker is restricted to 3 noncontiguous populations: the lower Big Tujunga Creek; the east, west, and north forks of the San Gabriel River; and the lower and middle SAR (USFWS, 2000). Introduced populations are present in the Santa Clara River, Sespe Creek, Santa Paula Creek, Piru Creek, and San Francisquito Creek. Hybridization with the Owen's sucker (*Catostomus fumeiventris*) has occurred in the Santa Clara River drainage populations. The Santa Ana sucker is known to occur in patches throughout the SAR where habitat is suitable. Most populations have been found where the substrate is composed of sand or gravel.

Critical habitat was re-designated for the species in 2010. This most recent modification to designated critical habitat includes a total of approximately 9,331 acres located within three units (Units 1-3). Unit 1 is located along portions of the SAR and is further divided into three separate units (Subunits A-C). Unit 2 includes portions of the San Gabriel River and Unit 3 encompasses sections of Gold Canyon, Big Tujunga Wash, Delta Canyon, and Stone Canyon. The Reach 9 measures fall within critical habitat Subunit 1C (Lower SAR) (Figures 5.5-6a-d). This subunit totals approximately 767 acres and is located near the City of Corona in Riverside County and the cities of Anaheim and Yorba Linda in Orange County. Approximately 10.7 miles of the SAR's main stem is included in this subunit. This reach spans from the Prado Dam outlet in Riverside County downstream to roughly 0.6 miles downstream of the SR-90 (Imperial Highway) Bridge in Orange County. Water flows into Subunit 1C are regulated by releases from Prado Dam.

The distribution of suckers downstream of Prado Dam is quite sparse. Observations of the fish have been infrequent. There is a CNDDB record of occurrence for this species approximately 0.75 miles downstream from the project in 1996. The Corps also documented one adult sucker in Reach 9, Phase 2B during a diversion in 2010, approximately 2.5 river miles upstream. None were detected during Reach 9, Phase 3 diversions in 2013 and 2014.

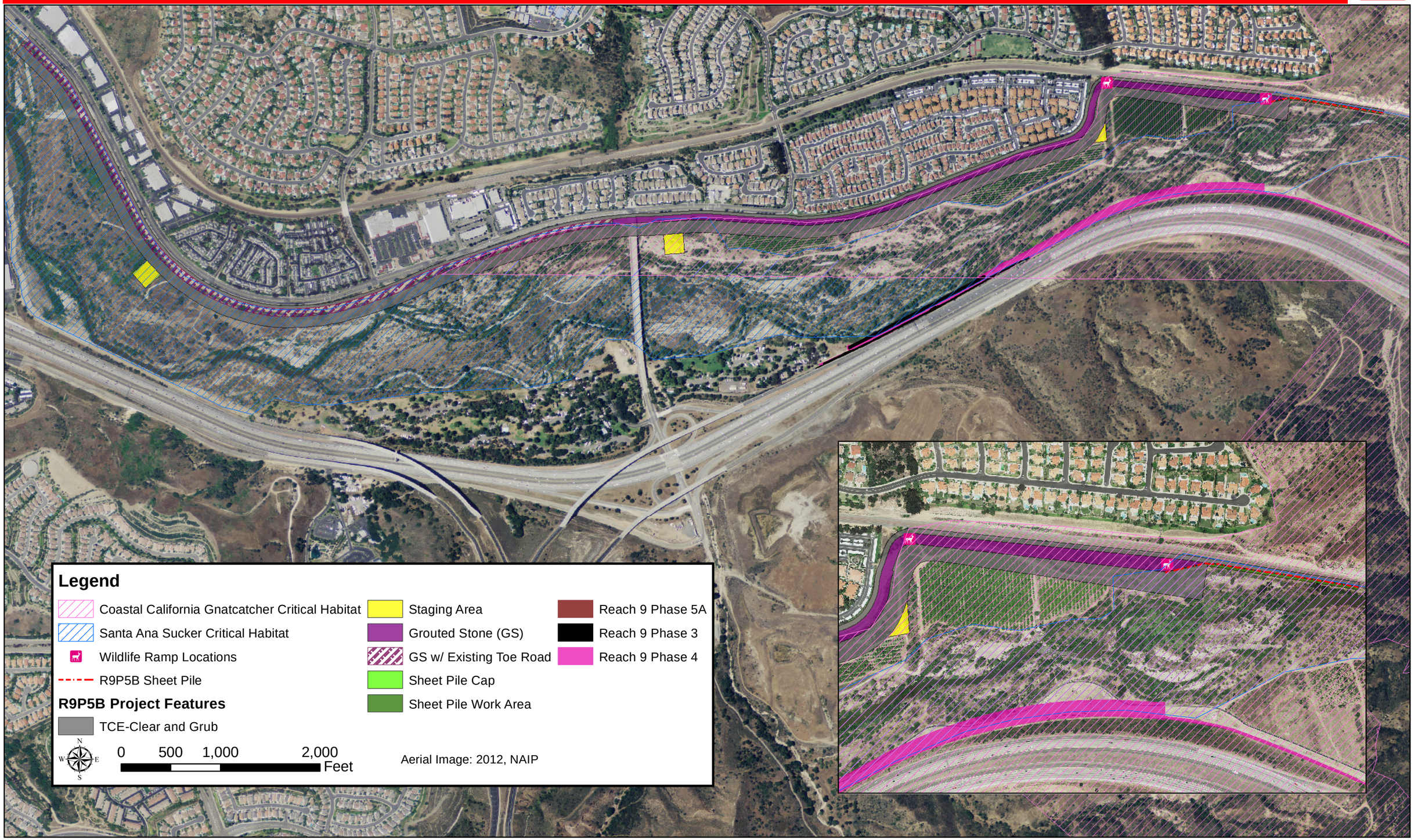
This page intentionally left blank.

Reach 9 Phase 5A: Critical Habitat



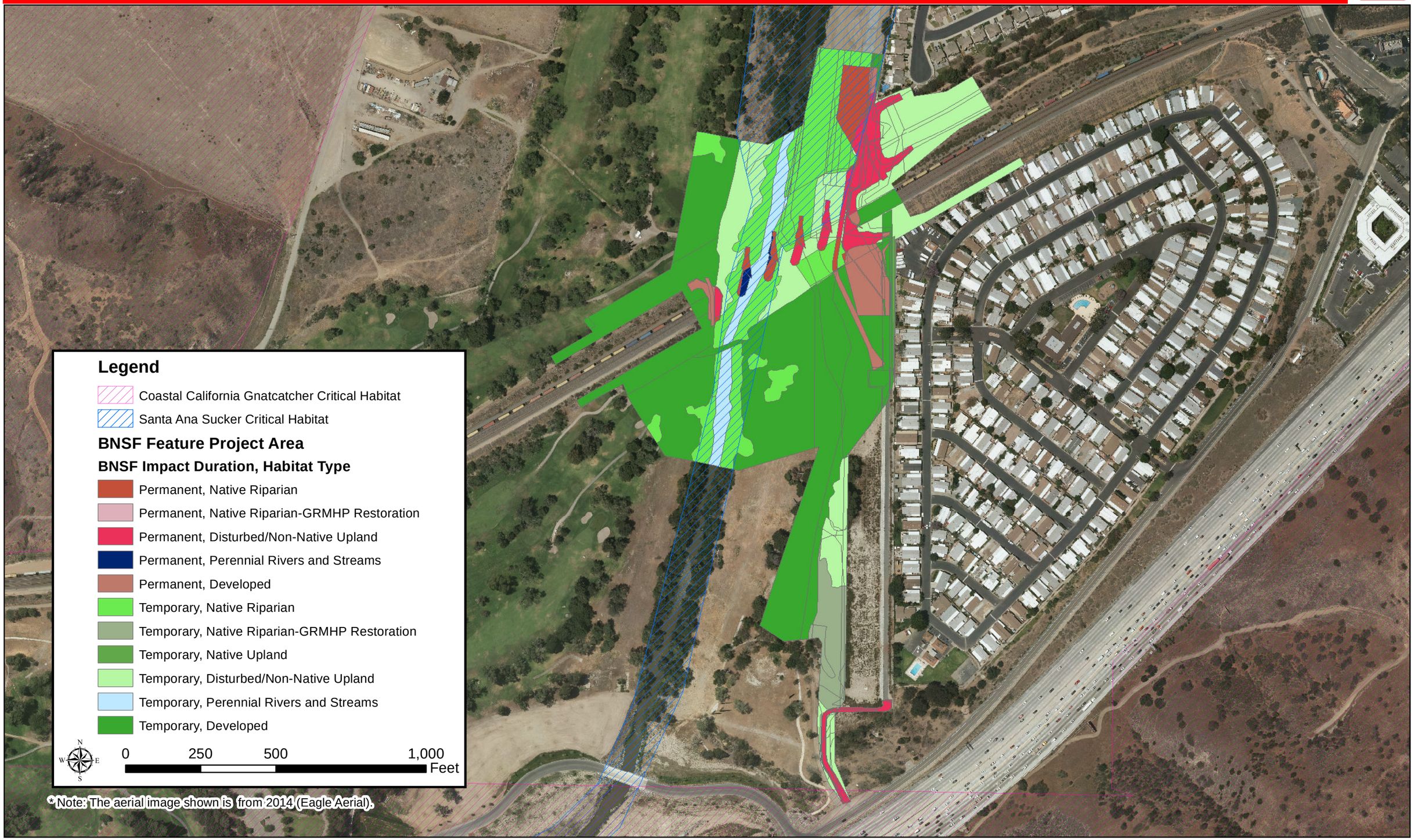
This page intentionally left blank.

Reach 9 Phase 5B: Critical Habitat



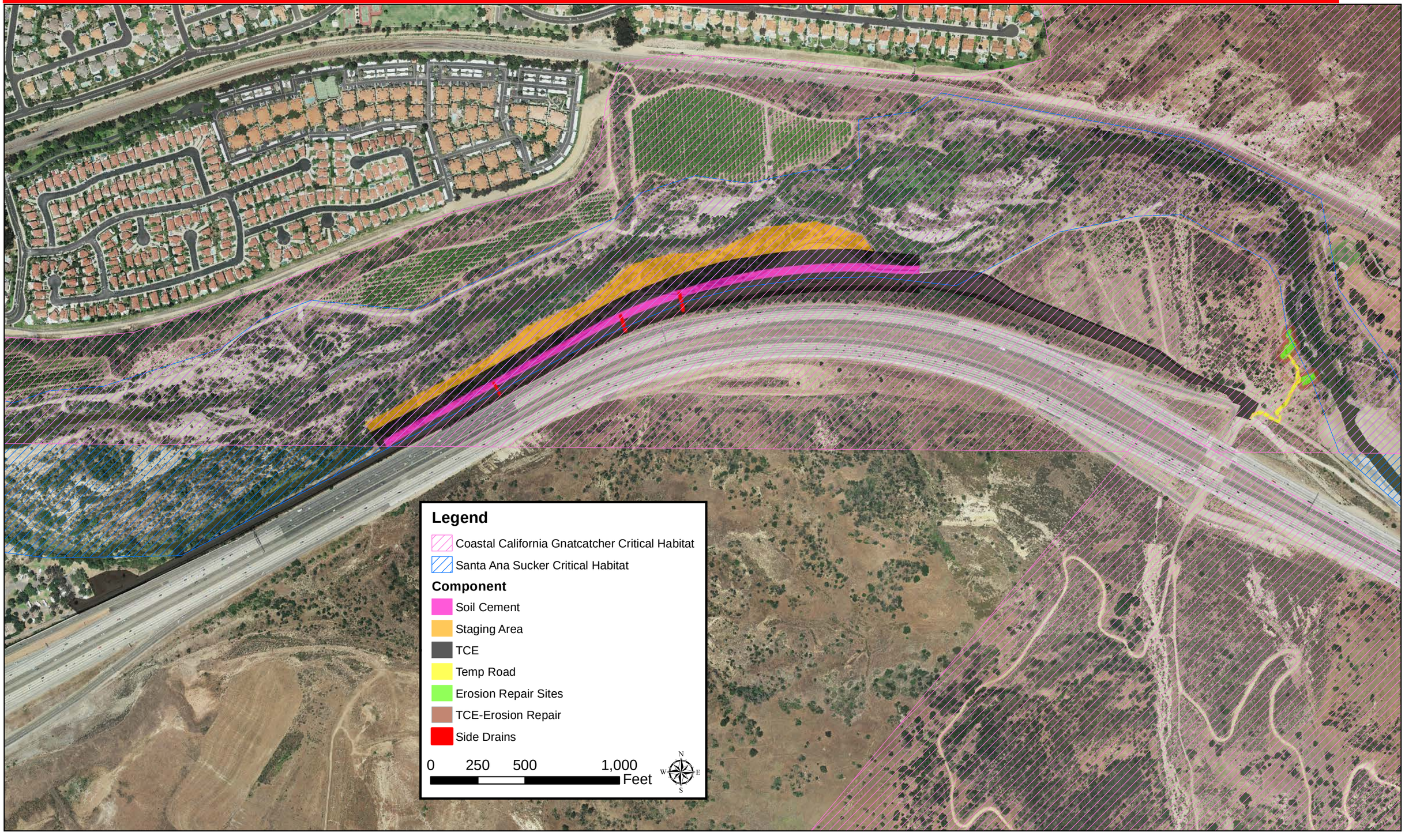
This page intentionally left blank.

BNSF: OverlapAnalysis - Impact Durations, Habitat Types, and Critical Habitat



This page intentionally left blank.

Reach 9 Phase 4 Soil Cement: Critical Habitat



This page intentionally left blank.

Swainson's Hawk

Swainson's hawk is listed as State threatened and is a MSHCP-covered species. It inhabits grasslands, sage-steppe plains, and agricultural regions of western North America during its breeding season and winters in grassland and agricultural regions from Central Mexico to southern South America (England, et al., 1997; Woodbridge et al., 1995a). The North American breeding range extends north from California to British Columbia east of the Sierra Nevada and Cascade Ranges, east to Saskatchewan, and south to northern Mexico. Several disjunct populations occur throughout the breeding range, including populations in Alaska, western Missouri, and the Sacramento and San Joaquin Valleys of California (England et al., 1997). This species occurs in southern California as a rare to uncommon transient with breeding mostly confined to valleys in the northern interior of the state. Along the coast, the Swainson's hawk is a rare spring and fall migrant. Swainson's hawks have been observed on several occasions in the Prado Basin during spring migration and can reasonably be expected to forage within the vicinity of the Reach 9 measure areas. Nesting habitat is not available; however, there is moderate potential for this species to occur in the vicinity of the Reach 9 measures.

Western Yellow-Billed Cuckoo

Western yellow-billed cuckoo is listed as threatened under FESA, endangered under CESA, and is a MSHCP-covered species. Within California, the Western subspecies historical breeding range occurred from San Diego County northwest along the coast through San Francisco Bay to Sonoma County, San Joaquin and Sacramento valleys and from Kern to Shasta counties: it also included several sites in Siskiyou, Inyo, San Bernardino, and Imperial counties (Hughes 1999). Breeding habitat typically consists of large swaths of contiguous riparian habitat, particularly cottonwood-willow riparian woodlands. Willow is almost always a dominant component of the vegetation. Optimum habitat includes water features, low, scrubby vegetation, and dense thickets along streams and marshes. This species has also been known to inhabit overgrown orchards and abandoned farmland. It typically nests in sites with at least some willow, dense low-level or understory foliage, high humidity, and wooded foraging spaces in excess of 93 m (300 ft) in width and 10 ha (25 ac) in area (Gaines 1974b, 1977a). Historical records have shown this species to occur above Prado Dam; however, it has not been documented within Reach 9. There is an assumed low potential for western yellow-billed cuckoo to occur as a possible transient within the proximity of the Reach 9 measure areas.

Southwestern Willow Flycatcher

Southwestern willow flycatcher is both federally and state endangered, and a MSHCP-covered species. It is a riparian obligate that is present in the United States only during the summer months. The historic breeding range of the species once included southern California, much of Arizona and New Mexico, western Texas, southwestern Colorado, southern Nevada and Utah, and northern portions of Sonora and Baja California, Mexico (Unitt, 1987). Currently, breeding is only known from southern California, extreme southern Nevada, Arizona, New Mexico, and western Texas (Hubbard, 1987; Unitt, 1987; Browning, 1993; McKernan and Braden, 1998; Sedgwick, 2000). This flycatcher species typically requires

a relatively complex vegetative structure that includes flowing or open water (occasionally very moist soils that support insect breeding may suffice), a moderate to tall canopy (i.e. young, regenerating vegetation is not favored), open areas for foraging (especially for males), and areas where the canopy is separated from an understory (the shaded, open region favored by females for foraging).

In southern California, this subspecies is a very rare and local summer resident that is known to breed at very few locations. Documented breeding sites in the general region include the San Bernardino Mountains and the Mojave River to the northeast, and the Santa Clara River to the northwest (USFWS, 2002). On a more local scale, the nearby Prado Basin has in recent years harbored the species in small numbers. Two territories were documented during surveys as recently as 2014. The species was first recorded in the Prado Basin in 1987. Between 1992 and 2006, up to nine territorial (i.e. adult male) southwestern willow flycatchers had been reported (Pike et al, 1992, 1995, 1997, 1999, 2003, and 2005). Individuals have been observed in the Prado Basin as early as April and early May (Pike et al., 2005). This bird was observed at four locations during monitoring activities conducted by Aspen Environmental Group (Aspen) in 2005 at the edge of the Prado Basin, approximately 5.5 river miles from the project area. Subsequent surveys along the river conducted annually by SAWA and reconnaissance surveys conducted for the Reach 9 Phase 2B Project in 2009, the Auxiliary Dike Project in 2009, and the Reach 9 Phase 2A Project in 2010 and 2011 did not result in positive detections. All known flycatcher territories within or near the Prado Basin have been located in proximity to surface water, which is consistent with the biology of the species (Pike et al., 2005).

Additionally, Pike *et al.* (2005) reports that territories in the Prado Basin have incorporated overgrown clearings with at least a few moderately tall, often dense willow trees. These habitat features, as mentioned above, are thought to be favored for foraging. Breeding willow flycatchers have been documented primarily in the southern portions of the Prado Basin, where 19 or 29 nests occurring throughout the basin were documented between 1996 and 2004 (Pike et al., 2005). The CNDDB indicates one record from 1999 of a sighting of the species in the northern portion of the SAR floodplain, just west of the Gypsum Canyon Road Bridge. This sighting is within close proximity of Phase 5B; however, there is an assumed low potential for southwestern willow flycatcher to occur within the proximity of the Reach 9 measure areas.

Coastal California Gnatcatcher

Coastal California gnatcatcher is listed as threatened under FESA, a California Species of Special Concern, and a MSHCP-covered species. It is primarily restricted to coastal sage scrub habitats of coastal southern California and northern Baja California. This subspecies sometimes occurs in other types of habitats adjacent to coastal sage scrub, including grasslands, chaparral, and riparian habitat. Although breeding territories have been reported in non-sage scrub habitats, these habitats are most commonly used for foraging or dispersal in the non-breeding season (Atwood, 1980; Campbell et al., 1998; Rotenberry and Scott, 1998). In California, this gnatcatcher species is a year-round resident of scrub dominated plant communities from southern Ventura County southward through Los Angeles, Orange, San Bernardino, Riverside, and San Diego counties (Atwood, 1980). This species was not observed during surveys conducted in April 2014, but does have potential to occur within the project area. 2015 surveys are

ongoing. Gnatcatchers were documented near SARI Line construction within the immediate vicinity of Reach 9 Phase 2B and are documented in the CNDDB across the SAR from Phase 5A, and south of SR-91 in Gypsum Canyon and Weir Canyon (CDFW 2014a). Presence of gnatcatcher has also been detected at Coal Canyon. According to State Parks, gnatcatchers have also been detected on the north side of SR-91 near the east end of the Reach 9, Phase 5B temporary construction easement. During 2015 surveys, this species was detected near the east end of the Phase 4 TCE (near the gully repair area). With the exception of the scrub habitat at the east end of Phase 4, most of the proposed project areas are only marginally suitable for the CAGN; however, most of the habitat is relatively open and CAGN could use it to move up and down the floodplain to access suitable habitat within the floodplain or on the adjacent slopes. Therefore, there is at least a moderate potential for this species to occur within the proximity of the Reach 9 measure areas.

Final designated critical habitat for the coastal California gnatcatcher includes approximately 197,303 acres in San Diego, Orange, Riverside, San Bernardino, Los Angeles, and Ventura Counties. Phases 4 and 5B largely occur within designated critical habitat (Figures 5.5-6b and 5.5-6d).

Least Bell's Vireo

Least Bell's vireo is listed as endangered under both FESA and CESA, and is a MSHCP-covered species. This species was historically common in lowland riparian habitat, ranging from coastal southern California through the Sacramento and San Joaquin Valleys with scattered populations in the Coast Ranges, Sierra Nevada, Mojave Desert, and Owens and Death Valleys (Kus, 2002). This species currently occurs only in riparian woodlands (especially Southern Cottonwood Willow Riparian Forest, Southern Willow Scrub, and Mulefat Scrub) in southern California. The majority of breeding pairs occur in San Diego, Santa Barbara, and Riverside Counties. Smaller populations are known in Los Angeles, San Bernardino, and Imperial Counties (USFWS, 1998). Approximately half of the current population is thought to occur within drainages on Camp Pendleton in northwestern San Diego County.

This species has a high probability of occurring within and adjacent to the project area. Data provided by the Santa Ana Watershed Association (SAWA) from the 2014 vireo breeding season shows nesting sites within the boundaries of the TCEs for all four Reach 9 measures. One occurs within Phase 5A, ten in Phase 5B, one in Phase 4, and two within BNSF Bridge (Figure 5.5-7a through 5.5-7d). Additionally, a number of territories were also located within close proximity of the Reach 9 measure areas.

State Fully-Protected Species

Bald Eagle

The bald eagle was recently removed from the federal list of threatened and endangered species. It is however still a State endangered, as well as a Fully-Protected species, and is a MSHCP-covered species. This species may be found in winter throughout most of California at lakes, reservoirs, rivers, and some rangelands and coastal wetlands. Breeding habitats are mainly in mountain and foothill forests and woodlands near reservoirs, lakes, and rivers. Most breeding territories are in northern California, but the

eagles also nest in scattered locations in the central and southern Sierra Nevada and foothills, in several locations from the central coast range to inland southern California, and on Santa Catalina Island. Bald eagles have historically been irregular and rare winter visitors to Reach 9. There is low potential for this species to occur within proximity of the Reach 9 measure areas.

Golden Eagle

Golden eagle is also covered by the Bald and Golden Eagle Protection Act is a Watch List species, and a MSHCP-covered species. The breeding range for golden eagles extends across western North America from Alaska south to northern Baja California and east to central Tennessee, Pennsylvania, and Maine (AOU, 1998; Johnsgard, 1990). Throughout California, with the exception of the floor of the Central Valley, golden eagles are an uncommon permanent resident and migrant. It is considered more common in southern California than in the northern half of the state. This species is known to nest within the Prado Basin and has been observed just upstream of Prado Dam, within the Prado Basin Auxiliary Dike measure. There is moderate potential for this species to be observed within the Reach 9 measure areas.

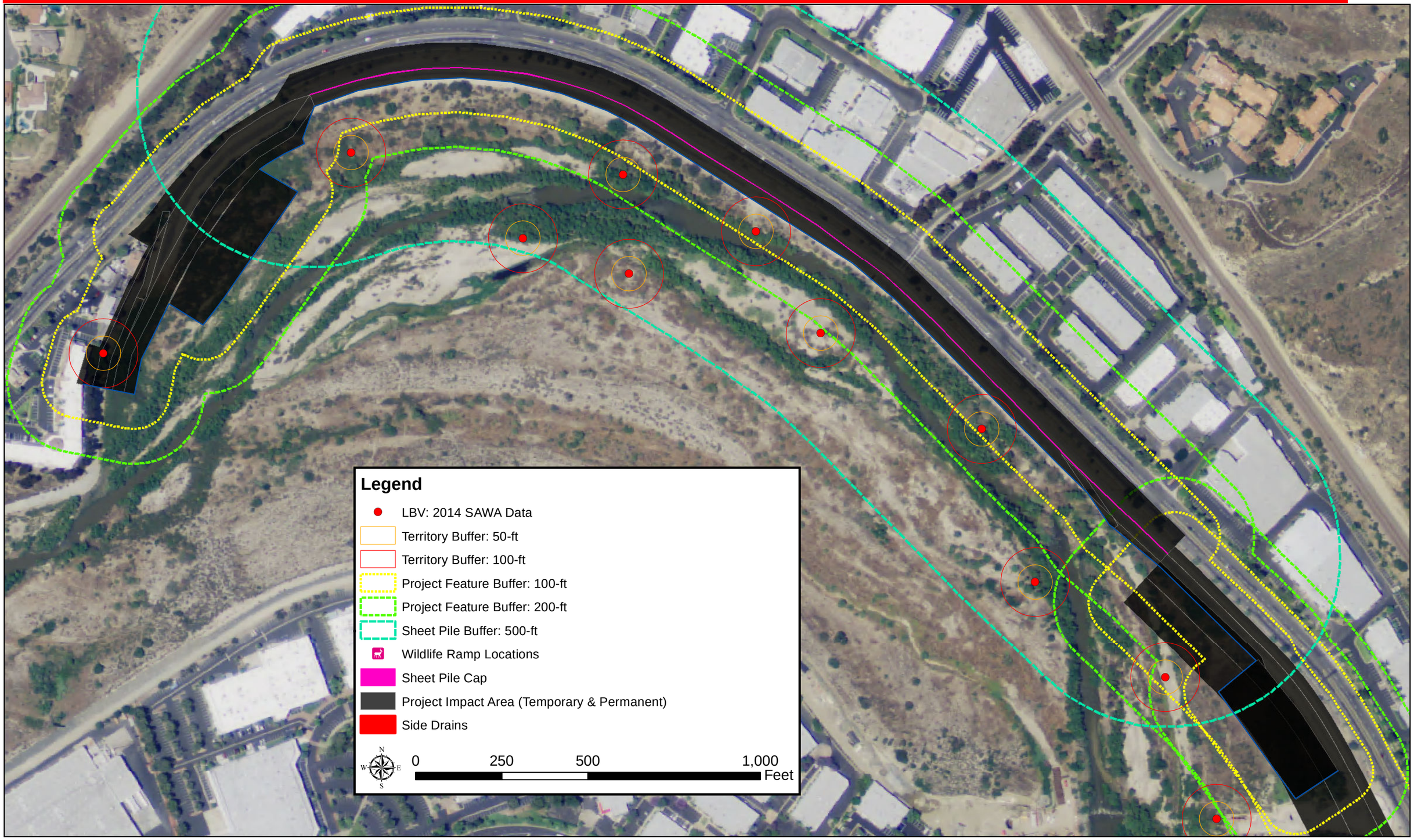
White-Tailed Kite

White-tailed kite is a resident in California, southern Texas, Washington, Oregon, and Florida. It also occurs as a resident from Mexico into parts of South America (Dunk, 1995). In California, this species inhabits coastal and valley lowlands and is typically found in agricultural areas. Its population has increased in numbers along with its range in recent decades (Zeiner et al., 1990a). This species occurs regularly near Prado Dam and is a known year-around visitor. As a result there is high potential for this species to occur in the proximity of the Reach 9 measure areas.

Peregrine Falcon

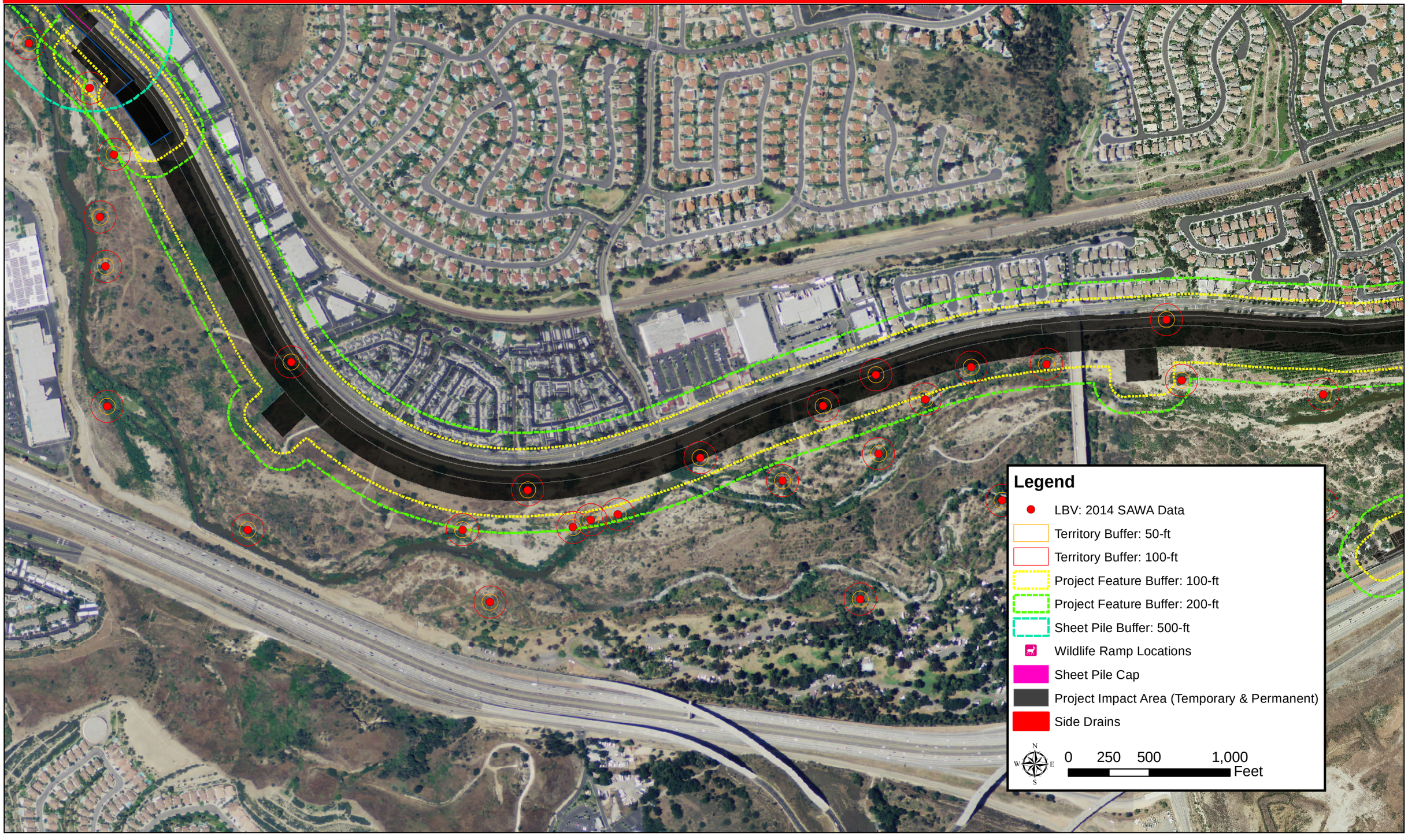
The peregrine falcon was recently removed from the federal list of threatened and endangered species. It is still State endangered and a MSHCP-covered species. This bird prefers coastal estuaries and other wetlands that concentrate waterfowl and shorebirds, but forages widely over many habitats, especially during migration. It is known to occur in southern California as a rare to uncommon migrant and winter visitor, especially along the coast. It breeds locally on the Channel Islands (both self- and man-induced reintroductions following extirpation earlier in the century). A few introduced birds have also bred successfully in the Los Angeles and San Diego metropolitan areas where they nest on ledges of tall buildings. The peregrine falcon is known to occur as a rare transient and irregular winter visitor in Reach 9. As a result, this species has low potential to occur within proximity of the Reach 9 measure areas.

2014 Least Bell's Vireo Occurrences (Tile 1-R9P5A)



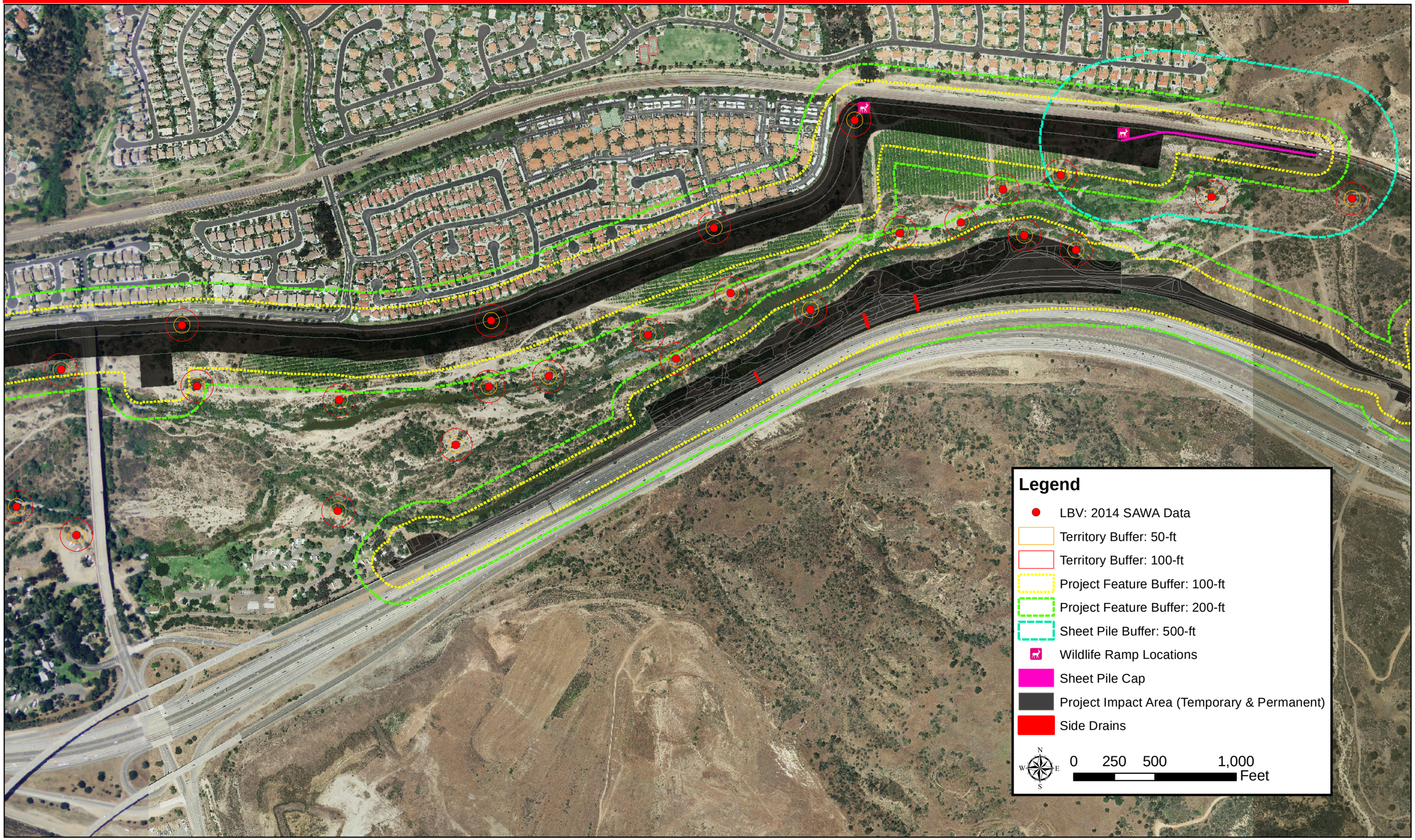
This page intentionally left blank.

2014 Least Bell's Vireo Occurrences (Tile 2-R9P5B)



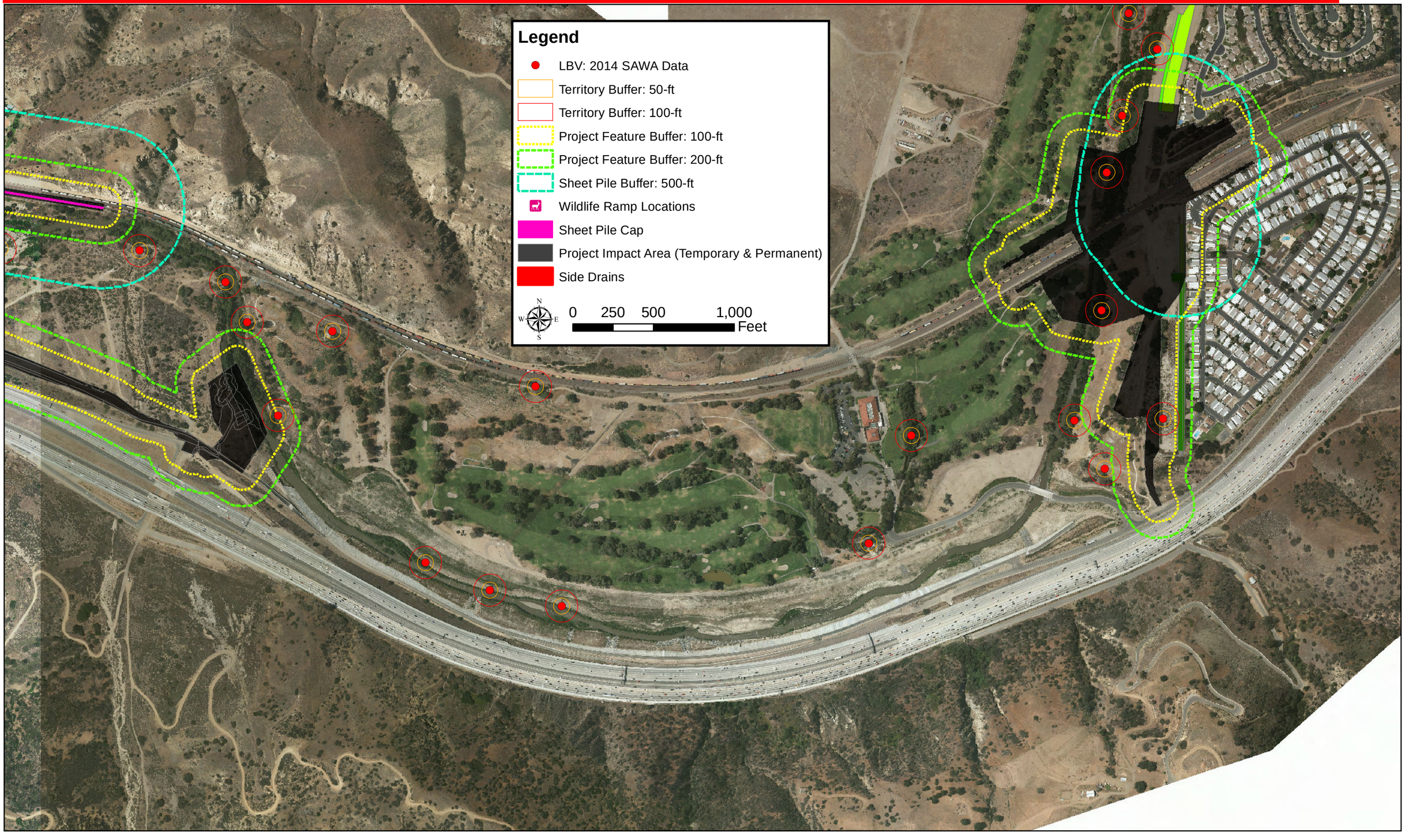
This page intentionally left blank.

2014 Least Bell's Vireo Occurrences (Tile 3-R9P5B & R9P4)



This page intentionally left blank.

2014 Least Bell's Vireo Occurrences (Tile 4-R9P5B, R9P4 & BNSF)



This page intentionally left blank.

5.5.2 Environmental Consequences

Significance Thresholds

An impact to biological resources would occur if the proposed Reach 9 alternatives result in:

- A direct adverse effect on a population of a threatened, endangered or candidate species or the loss or disturbance of important habitat for a listed or candidate species.
- A net loss in the habitat value of a sensitive biological habitat or area of special biological significance.
- Substantial impedance to the movement or migration of fish or wildlife.
- Substantial loss to the population of any native fish, wildlife or vegetation. For the purpose of this analysis, substantial is defined as a change in a population or habitat that is detectable over natural variability for a period of 5 years or more.
- Substantial loss in overall diversity of the ecosystem.

An evaluation of whether an impact on biological resources would be substantial or "significant" must consider the resource at appropriate scales and in proper ecological context. Impacts are sometimes locally important but not significant because, although they would result in an adverse alteration of existing conditions, they would not substantially diminish, or result in the permanent loss of, an important resource on a population-wide or region-wide basis. Biological resources may be either directly or indirectly impacted by a project. Direct and indirect impacts may be either permanent or temporary in nature. These impact categories are defined below.

- **Direct**: Any alteration, physical disturbance, or destruction of biological resources that would result from project-related activities is considered a direct impact. Examples include clearing vegetation, encroaching into wetlands, diverting natural surface water flows, and the loss of individual species and/or their habitats.

- **Indirect**: As a result of project-related activities, biological resources may also be affected in a manner that is ancillary to physical impacts. Potential indirect impacts that could occur from any riverine construction project include changes to erosion and sedimentation, changes to hydrology, or long term degradation of natural vegetation communities. These changes may in turn affect vegetation communities and sensitive species. Other examples include elevated noise and dust levels, soil compaction, increased human activity, decreased water quality, and the introduction of invasive wildlife (domestic cats and dogs) and plants.

- **Permanent**: All impacts that result in the long-term or irreversible removal of biological resources are considered permanent. Examples include constructing a building or permanent road on an area containing biological resources.

- **Temporary**: Any impacts considered to have reversible effects on biological resources can be viewed as temporary. Examples include the generation of fugitive dust during construction; or

removing vegetation and either allowing natural vegetation to recolonize, or actively re-vegetating affected areas.

5.5.2.1 Phase 5A

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

Vegetation Communities

Implementation of the Phase 5A Grouted Stone and Sheet Pile Alternative would result in direct and indirect effects on vegetation resulting in both permanent and temporary impacts.

Permanent impacts. The above-ground (exposed) portion of new grouted stone and sheet pile structures proposed under the Grouted Stone and Sheet Pile Alternative, areas where no vegetation will be planted or could establish itself, would not result in new permanent impacts because the proposed new protection structures would replace existing protection; net permanent impacts would be zero. Permanent impacts would occur from the back-filled portion along the extended toe of new structures. Although vegetation can be planted and establish itself on the buried portion of the new grouted stone structure, permanent impacts occur where the buried toe of the new grouted stone structure goes deeper and further out into the floodplain, and where a significant scour event could remove overlying soils exposing the buried toe. For the grouted stone structure along Phase 5A Preferred Alternative, the distance between the existing toe and the toe of grouted stone proposed under the Preferred Alternative is determined to be 40-50 feet (see Figure 4.1-2); 50 feet was used for the analysis. No permanent impacts are associated with the sheet pile structure, as it is being installed within the footprint of existing protection. Permanent impacts associated with the Grouted Stone and Sheet Pile Alternative are primarily to Riparian classifications (i.e., mulefat scrub) (see Figure 5.5-1).

Temporary impacts. Temporary impacts were calculated by subtracting permanent impact acreages from total TCE acreages for each measure. Staging areas are included under temporary impact acreages. Temporary impacts associated with the Phase 5A Grouted Stone and Sheet Pile Alternative are primarily to Developed classifications (i.e., Urban and Commercial).

Temporary impacts would occur during the removal of vegetation and during ground-disturbing construction activities, including grading and excavating, and from increased human presence and noise. Other temporary impacts to vegetation communities could include alterations in existing topography and hydrology regimes (until construction areas are restored), the accumulation of fugitive dust, disruptions to native seed banks from ground disturbance, and the colonization of nonnative/invasive plant species. Implementation of BMPs such as silt fences or berms to control runoff, and the restoration of temporarily disturbed areas with native vegetation would avoid and minimize other indirect effects, including an increase in the amount of compacted or modified surface that may increase the potential for forceful surface runoff, increased erosion, and potential destruction of intact vegetation outside the permanent impact footprints.

Permanent and temporary impacts associated with implementation of the Phase 5A Grouted Stone and Sheet Pile Alternative are presented in Table 5.5-4 below. Within the Phase 5A work area, the Grouted Stone and Sheet Pile Alternative would entail 1.28 acres of permanent impacts associated with the proposed grouted stone structure and 11.94 acres of temporary impacts associated with the TCE and staging areas.

Table 5.5-4. Phase 5A-Grouted Stone and Sheet Pile Alternative: Permanent and Temporary Impacts

Vegetation Communities and Classifications	Permanent Impacts (acres)	Temporary Impacts (acres)
Riparian		
TOTAL RIPARIAN	**1.18**	**2.16**
Upland		
TOTAL UPLAND	**0.1**	**2.78**
Developed		
TOTAL DEVELOPED	**0**	**7**
TOTAL	**1.28**	**11.94**

Note: Detailed acreage impacts based on vegetation communities or other cover types were included in the draft SEA/EIR Addendum. Updated GIS shows only consolidated acreages for the final SEA/EIR Addendum.

Mitigation Measures for Impacts to Vegetation Communities

The 2001 SEIS/EIR included a series of mitigation measures that would be implemented for Reach 9 elements of the SARMP to compensate for impacts to vegetation communities. These include measures to mitigate for temporary and permanent effects to aquatic, riparian, and upland habitats, such as BR-17A,which would minimize project grading activities, which feasibly would maintain existing root systems; BR-18, which would remove giant reed (*Arundo donax*) (also known by the common name arundo) and other non-native vegetation from areas upstream of Reach 9 as mitigation for temporary impacts; BR-18, BR-18A, BR-26B, and BR-26C, which require the restoration and maintenance of native habitats that are temporarily disturbed during project construction activities; BR-20, which would limit vegetation removal to designated areas; BR-24, which would provide monitoring for signs of plant stress to riparian vegetation; and BR-26A, which requires hydro-seeding with local native shrubs and ground cover species in upland areas disturbed by project activities. BR-18, BR-18B and BR-18C have since been modified through a 2012 Biological Opinion Amendment which adjusts the methods and mitigation ratios for off-site habitat restoration, as discussed below. As a result, these commitments have been combined into one commitment, BR-18, as presented in Chapter 5.5.3 below. (BR-18A is still listed separately.) EC-BR-5, from the 2011 SEA for Reach 9, Phase 2A, has been added to this document to ensure compliance with all mitigation measures and environmental commitments during construction activities. These measures would reduce the effects of the proposed action by reducing impacts and fully restoring native plant communities on-site after construction is complete, and by providing adequate compensation by restoring native vegetation upstream of the project area. A full list of approved mitigation measures and environmental commitments can be found in Chapter 6 of this document. Adherence to identified mitigation measures and environmental commitments would reduce impacts to vegetation communities to less than significant levels.

Mitigation Ratios for Impacts to Vegetation Communities

Mitigation measure BR-18 requires the Corps and non-federal sponsors to remove arundo (and other non-native invasive vegetation) from the watershed and restore riparian habitat. The specific ratios and some of the mitigation options that had been previously coordinated with USFWS and other agencies were modified in a BO amendment dated March 28, 2012 (see Appendix B). Similar modifications of CDFW permits/agreements will also be requested by the non-federal sponsors. With the BO amendment, the concept of improving habitat conditions through removal of non-native species remains the same, but the mitigation ratios for temporary impacts to riparian habitat may be adjusted if "life of the project" management of the mitigation site does not occur: The original (2001) BO had required 1:1 off-site mitigation for temporary impacts to riparian habitat; this option is still available if a mechanism is put in place to ensure continued management of this area for the life of the flood control project. Otherwise, the 2012 BO Amendment provides an option of 3:1 off-site mitigation (removing 3 acres of arundo for each acre of riparian habitat temporarily affected by the project) with a 5-year management commitment. The determination of which mitigation option to pursue for these Reach 9 measures will be included in the Final SEA/EIR Addendum, pending discussion with the non-federal sponsors.

Mitigation ratios for permanent impacts remain consistent with previous environmental documents and permits, although the mechanism for ensuring future maintenance of the mitigation areas has changed. These ratios are 3:1 for each acre of Upland (or non-riparian) habitat permanently impacted; and 5:1 for each acre of Riparian habitat permanently impacted. No mitigation for impacts to Developed classifications (i.e., Disturbed or Barren, Urban Commercial, etc.) would be required, although the project would replace or retain existing Developed conditions. Mitigation requirements for the Phase 5A Grouted Stone and Sheet Pile Alternative, based on the anticipated permanent and temporary impacts noted in Table 5.5-4, are presented in Table 5.5-5 below. Mitigation for the Grouted Stone and Sheet Pile Alternative would include the removal of 8.36 acres of non-native invasives if it is determined that requirements of a 1:1 ratio can be met, or 12.68 acres if a 3:1 ratio is selected. Mitigation would be implemented prior to or during construction of each Reach 9 measure.

Table 5.5-5. Phase 5A-Grouted Stone and Sheet Pile Alternative (Preferred Alternative) Mitigation Requirements

Vegetation Communities and Classifications	**Permanent Impacts (ac)**	**Mitigation acreage for Perm Impacts**	**Temporary Impacts (ac)**	**Mitigation acreage for Temp Impacts**
Riparian[1]	1.18	5.9	2.16	2.16/6.48
Upland[2]	0.1	0.3	2.78	NA
Developed	0	NA	7	NA
Total Mitigation		6.2		2.16/6.48
Total Mitigation Required Using 1:1 Ratio for Temp Impacts = 8.36 acres **Total Mitigation Required Using 3:1 Ratio for Temp Impacts = 12.68 acres**				

[1] Mitigation acreages based on 5:1 ratio for permanent impacts and 1:1/3:1 for temporary impacts.

[2] Mitigation acreages based on 3:1 ratio for permanent impacts. Temporary impacts are restored on-site.

Habitat Management Plan

BR-16A from the 2001 SEIS/EIR (as well as commitments from the 1988 SEIS) required completion of a HMP for Reach 9, public ownership of the entire floodplain between Prado Dam and Weir Canyon Road (estimated to be approximately 1,123.6 acres plus approximately 340.5 acres in Brush Canyon), and management of this area in a manner that maintains or enhances existing riparian habitat acreages and wildlife values. The HMP was completed in 2014 (County of Orange 2014a). The entire footprint of Phases 4, 5A, and 5B occur within the HMP, and all but the alignment of the BNSF railway bridge under the BNSF Bridge measure occurs in the HMP. While the Phase 5A Grouted Stone and Sheet Pile Alternative and other Reach 9 measures will result in permanent encroachments into the HMP, most of this encroachment consists of buried structure that will be backfilled and re-vegetated, and would only be exposed if and when future high flows result in bed degradation and shifting of the active river channel. Moreover, habitat values will be fully mitigated as described above. As discussed later in this document, wildlife movement will not be significantly affected, and all temporarily impacted areas will be restored.

Noxious and Invasive Plants

Typically in areas where few exotic species occur, the characteristics of the existing topsoil structure, cryptogrammic crusts, or the existing native vegetation prevent weed seeds from germinating. Once soil disturbance has occurred, the soil structure and native biotic components are affected such that these factors no longer preclude the establishment of noxious or invasive weeds. Following establishment, new populations of weeds are often extremely difficult to eradicate. In riparian areas where access to groundwater is available exotics plants such as giant reed, tamarisk, or white sweet clover (*Melilotus alba*) can quickly out compete many native plant species. Another important factor is the potential spread of exotic plant species to riparian corridors. Many plant species utilized in landscaping can be invasive and spread to adjacent wetlands. Exotic vegetation has been demonstrated to be more abundant in riparian habitats that are in close proximity to urbanized areas. Studies have shown that riparian bird species richness and density tend to be negatively correlated with exotic vegetation abundance, presumably because exotic plant assemblages fail to provide the necessary structural and nutritional resources that native plant communities provide (Rottenborn, 1997 and 1999; Mills et al., 1989; Anderson et al., 1977). Urbanized areas tend to support higher concentrations of common disturbance-following species that often displace local species dependent of riparian habitats. As many noxious weeds occurring in southern California are fast-growing plants adapted to high light conditions, removal of canopy vegetation may release weed seeds present in the seed bank from dormancy and allow them to germinate and establish. Weeds can also be imported to the site from equipment that recently worked in infested areas.

Temporarily impacted areas will be fully restored and monitored for at least 5 years to ensure non-native vegetation does not return or establish itself over time. These invasive plant species can cause a long-lasting change to the environment by increasing vegetative cover, creating a dense layer that prevents native vegetation from germinating, altering soil and hydrological conditions through nitrogen

fixation, or may drain the water table. Noxious weeds can create such an unfavorable environment for wildlife that associate, mutualistic species necessary for native plant cycles, such as seed dispersers, fossorial mammals, or pollinators, can become lost from the area.

A positive direct impact from implementation of the Reach 9 measures is that some areas classified as Developed or those comprised of giant reed (arundo) grassland, would be removed by implementation of the Phase 5A Grouted Stone and Sheet Pile Alternative. Temporarily impacted areas would be restored with appropriate native vegetation and those that were characterized as giant reed grassland or were otherwise disturbed are expected to provide a direct positive impact to wildlife species that utilize these habitats. Additionally, areas where permanent impacts encroach further into the floodplain will be buried by several feet of backfill material and replanted with native vegetation. Therefore, until or unless the backfill material erodes, implementation of the alternative will result in improved habitat conditions due to native plantings, which in some instances may replace non-native vegetation.

To reduce the effects of exotic weeds on natural plant communities, the Corps would implement mitigation measures provided in the 2001 SEIS/EIR along with environmental commitments prepared as part of this document. These include BR-18, which requires the restoration and maintenance of native riparian and upland habitats that are temporarily disturbed during project construction activities; BR-26A, which requires hydro-seeding with local native shrubs and ground cover species in upland areas disturbed by project activities; EC-BR-9, which requires implementation of container plants in upland areas to expedite restoration of these habitats; EC-BR-1, which requires the delineation of work areas prior to disturbance; EC-BR-3, which requires worker training; and EC-BR-5, which ensures compliance with all mitigation measures and environmental commitments during construction activities. These measures would reduce the effects of the proposed alternatives by reducing the potential spread and colonization of weedy species and by restoring native plant communities at the conclusion of construction. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. Adherence to identified mitigation measures and environmental commitments would reduce impacts to vegetation communities to less than significant.

Special-Status Plant Species

No plant species federally or State-listed as threatened or endangered under their respective Endangered Species Acts were observed during surveys conducted for this project. Although no special-status plant species were identified in the Reach 9 measure areas during surveys, seven plant species known from the area have at least some potential (low, moderate, or high) to occur based on habitat conditions occurring on-site and the known distributions of the species (Table 5.5-1). None of the seven species are listed as threatened or endangered under FESA or CESA.

Implementation of the Phase 5A Grouted Stone and Sheet Pile Alternative and other Reach 9 measures could result in both direct and indirect effects to special-status plant species, if present, within their respective project areas. Direct impacts to special-status plants, if present, would occur as a result of the removal of plants during clearing and grubbing during preparation of the sites. Removal of non-native

plant communities and restoring them to native communities will provide more available area for special-status species to proliferate and reduce the pressure of invasion from exotic species.

Indirect impacts to special-status plant species, if present, could occur from the accumulation of fugitive dust related to project construction, the introduction and proliferation of non-native invasive plants, and increased soil compaction, erosion, and sedimentation. Because noxious weeds can permanently degrade rare plant and animal habitats, their proliferation as a result of project activities could adversely affect special-status plant species, if they are present. However, with implementation of mitigation measures discussed above, it is not anticipated that noxious weeds will become established. Excessive dust can decrease or limit plant survivorship by decreasing photosynthetic output, reducing transpiration, and adversely affecting reproductive success. Soil compaction, erosion, and sedimentation resulting from project activities can also indirectly impact rare plants if they are present; however with implementation of BMP such as silt curtains or berms to control runoff, and the restoration of temporarily disturbed areas, these impacts would less than significant.

Operational effects could occur during routine inspection and maintenance of project components. These impacts could include trampling or crushing of special-status plant species, should they occur, by vehicular or foot traffic, alterations in topography and hydrology, increased erosion and sedimentation, and the introduction of non-native, invasive plants. However, routine maintenance will be conducted from paved access roads and activities would not encroach into adjacent habitats that may contain undisturbed habitat potentially suitable for special status plants.

Oak Trees

No coast live oak trees where identified within the Phase 5A Grouted Stone and Sheet Pile Alternative. However, should coast live oak trees be identified during project implementation, where possible, project related activities will be conducted outside of the drip line of oak trees. The use of BMP such as silt curtains or berms to control runoff, and the restoration of temporarily disturbed areas would minimize and mitigate potential indirect impacts to coast live oaks, including alterations to topography, erosion, and sedimentation if runoff through the project area is not controlled. Impacts could also occur during routine inspection and maintenance of Reach 9 measures; however with implementation of BMP, impacts will be minimized and avoided.

Mitigation Measures for Impacts to Special-Status Plant Species

The 2001 SEIS/EIR included a series of mitigation measures applicable to Reach 9 measures that would be implemented to compensate for impacts to special-status plant species. Construction-related mitigation measures from the 2001 SEIS/EIR and additional commitments developed for this document will be implemented to reduce potential impacts to special status plants. These include EC-AQ-2, which requires the implementation of techniques to control fugitive dust; and WR-1, which requires the preparation of an erosion control plan. Prior to application of hydro-seed or other planting techniques, the soil would be properly prepared; this could include tasks such as decompacting the soil. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document.

Adherence to identified mitigation measures and environmental commitments would reduce impacts to special-status plants to less than significant levels.

Mitigation measures and environmental commitments would also be implemented to compensate for potential impacts to coast live oaks present within the Reach 9 measures. These would include EC-BR3, which requires worker training; and EC-BR-6, which requires replacement of all removed oaks at a 4:1 ratio. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. Adherence to identified mitigation measures and environmental commitments would reduce impacts to oak trees and oak woodlands to less than significant levels.

Special-Status Wildlife Species

Habitats in and along the SAR support a variety of both common and special-status wildlife species. Wildlife species that rely on existing habitat within the Reach 9 measures for all or significant portions of their life history could be affected. Surface water present within Reach 9 likely serves to attract species that live in the vicinity to the SAR, thus increasing the likelihood of use by wildlife. A total of 4 special-status wildlife species were detected during April 2014 surveys of the Reach 9 measures, including least Bell's vireo (Phases 4, 5A, and 5B), yellow warbler (Phases 5A, 5B, and BNSF Bridge), yellow-breasted chat (Phase 5B), and Cooper's hawk (Phase 5A), all of which could occur in any of the Reach 9 measure areas.

The Reach 9 measures contain suitable foraging and nesting habitat for both resident and migratory birds. As previously described, construction related activities have the potential to disturb vegetation utilized by wildlife, including nesting birds. Construction noise could also disturb or harass birds breeding within the general vicinity of Reach 9 measure areas. With the exception of a few non-native birds, any active nest is fully protected against take pursuant to the Migratory Bird Treaty Act (MBTA) and relevant CDFW Codes. Impacts to nesting birds could occur if construction activities disrupt habitat utilized for nesting or construction activity results in abandonment of the nest.

Direct impacts to wildlife that would occur as a result of construction activities include the removal of vegetation and subsequent temporary loss of wildlife habitat. In addition, construction activities would result in the displacement of some resident wildlife species, in most cases on a temporary basis. There is the chance that some individuals could also be killed or injured during construction. Construction may also result in the temporary degradation of the value of adjacent habitat areas due to proximity to disturbance, fugitive dust accumulation, increased human presence, and increased vehicle traffic and noise during construction. Indirect impacts may include increased human presence and the loss of habitat through the colonization of noxious weeds.

Impacts during periodic inspection and maintenance of project components would be limited. During inspections, wildlife could be affected from noise, human presence, and fugitive dust. Impacts associated with implementation of the OMRR&R manual is expected to be minimal, short term, and in most cases would not directly affect wildlife. Activities would be conducted from paved access roads and activities would not encroach into adjacent habitats that may contain undisturbed habitat

potentially suitable for special status wildlife. If repairs are required, potential effects to wildlife would likely be low.

Project related impacts to wildlife within Reach 9, both common and special-status, have been previously analyzed in the 2001 SEIS/EIR and a series of subsequent SEAs. Impacts have not been analyzed specifically for the currently proposed Reach 9 measures; however, they have been for several other SARMP features in the immediate vicinity that contain similar habitat types and wildlife. The 2001 SEIS/EIR included a series of mitigation measures that would be implemented to compensate for impacts to special-status wildlife, should they occur. Construction related mitigation measures from the 2001 SEIS/EIR and additional environmental commitments developed for this document will be implemented to reduce potential impacts to common and special-status wildlife. These include measures to offset the permanent and temporary loss of habitat, such as BR-18, BR- 8B, BR-26B, and BR-26C, which require the restoration and maintenance of native habitats that are disturbed during project construction. Additional measures would be implemented to minimize and/or avoid impacts to wildlife associated with mortality due to vehicular or mechanical crushing, exposure to fugitive dust, the spread and colonization of invasive weeds, and increased human presence. These include EC-BR-3, which requires pre-construction sweeps and relocation of special-status (non-listed) species occurring in the project area; EC-AQ-2, which requires the implementation of techniques to control fugitive dust; BR-26A, which requires hydro-seeding with local native shrubs and ground cover species in upland areas disturbed by construction; EC-BR-3, which requires worker training; and EC-BR-5, which ensures compliance with all mitigation measures and environmental commitments during construction. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. Implementation of these mitigation measures and environmental commitments will result in less than significant impacts to wildlife.

Federally and State-Listed and California Fully Protected Species

Habitat in the Reach 9 measure areas has the potential to support federally and State-listed wildlife species. Effects to these species have been analyzed in the 2001 SEIS/EIR, the 2001 Biological Opinion and the 2012 BO Amendment prepared for the SARMP. While the currently proposed Reach 9 measures were not specifically analyzed in the 2001 SEIS/EIR and BO, the evaluation of potential effects from the other SARMP features that were analyzed in Reach 9 is similar and provides a valid reference. As is described in further detail in subsequent paragraphs, the implementation of avoidance and mitigation measures is expected to maintain less than significant impacts to federally and State-listed wildlife species.

Santa Ana Sucker

The Santa Ana sucker is listed as a federally threatened and CDFW species of special concern. Suckers have been documented within Reach 9 and are assumed to be present in low numbers; however breeding in Reach 9 has not been confirmed in recent years. Designated critical habitat for the species occurs within the Phase 5A project area, as is shown in Figure 5.5-6a. 6.19 acres of sucker critical

habitatwould be temporarily affected and 2.22 acres would be permanently affected by Phase 5A. However, unlike construction of BNSF Bridge protection, this measure would not result in permanent or temporary impacts directly within the low flow channel (i.e., Perennial Streams) or other suitable aquatic habitats where sucker may be present. Temporary impacts to the vegetated floodplain will be restored with native upland or riparian vegetation as appropriate, and permanent impacts will be mitigated off-site. As a result, substantial impacts to suckers and their designated critical habitat would not occur. Therefore, this species will not be discussed further here, but will be analyzed in Chapter 5.5.2.4 BNSF Bridge.

Southwestern Willow Flycatcher

Southwestern willow flycatcher has not been identified in the proposed project area or in Reach 9 since SAWA has been conducting surveys (since 2001). Due to the narrow breadth of riparian corridors through the Reach 9 measures and combined with a narrow or absent buffer, and proximity to human development, the Reach 9 measures do not support suitable breeding habitat. The last successful breeding pair of this species was documented in the Prado Basin in 1988. Therefore, there is low potential for this species to occur in the Phase 5A Grouted Stone and Sheet Pile Alternative and other Reach 9 measure areas as a transient.

Since suitable breeding and nesting habitat for southwestern willow flycatcher does not occur within the Phase 5A Grouted Stone and Sheet Pile Alternative and other Reach 9 measure areas, and continuing surveys by SAWA have not identified any resident or nesting individuals or home ranges within the area of the measures, the alternatives associated with the Reach 9 measures are not expected to result in adverse direct, indirect, or operational impacts to breeding or nesting flycatcher individuals.

Potential impacts to southwestern willow flycatchers were analyzed for areas within reasonable proximity to the Reach 9 measures in the 2001 SEIS/EIR and the 2001 BO prepared for the SARMP. Although these documents concur that impacts to breeding southwestern willow flycatchers would not occur as a result of activities proposed for those projects, a series of mitigation measures were provided to further ensure that impacts to this species are avoided, should transient or dispersing individuals occur in the project area. The following measures are relevant for the Reach 9 measures and will be adopted. These include BR-17, which requires vegetation clearing to be conducted outside of the known flycatcher nesting season; and BR-19, which requires cowbird trapping at a minimum of 10 sites in the Reach 9 (other other areas along the Santa Ana River subject to review by the USFWS) during all years when construction of the proposed project is occurring and 5 years following construction. Additional measures to offset the permanent loss and temporary disturbance of suitable foraging habitat include BR- 18, BR-26B, and BR-26C, which require the restoration and maintenance of native habitats that are temporarily disturbed during project construction activities. Additionally, mitigation measures and environmental commitments developed for this document would be implemented. These would include EC-BR-3, which requires worker training; and EC-BR-5, which ensures compliance with all mitigation measures and environmental commitments during construction activities.

While the southwestern willow flycatcher has not been observed within Reach 9 in over a decade, the adoption of the mitigation measures described in the previous paragraphs would further reduce the possibility of any impact from implementation of the Reach 9 measures on the species. Therefore, there is expected to be no effect to this species from the proposed measures. Critical habitat for the species does not coincide with the Reach 9 measures, so there would be no adverse modification to designated critical habitat for the species.

Coastal California Gnatcatcher

No coastal California gnatcatchers were observed during surveys performed in 2014 within the Phase 5A Grouted Stone and Sheet Pile Alternative and other Reach 9 measure areas. Designated critical habitat for the species does not coincide with the Phase 5A Grouted Stone and Sheet Pile Alternative; however, it extends through nearly all of Phase 4 and approximately two-thirds of Phase 5B. Direct impacts to gnatcatcher habitat would not occur during implementation of the Phase 5A Grouted Stone and Sheet Pile Alternative. Although limited, the presence of suitable habitat and known individuals within the vicinity of the Phase 5A Grouted Stone Alternative and the other Reach 9 measures results in a moderate potential for this species to occur.

Direct impacts could include disruption of breeding activity in adjacent habitats due to increased noise, fugitive dust, and activities associated with construction. Indirect impacts could include the degradation of habitat due to the potential introduction and colonization of invasive weeds that could serve to out-compete habitat preferred by the gnatcatcher. Impacts to the species during routine inspections and maintenance are expected to be negligible, since tasks would be confined to the new protection structures themselves, which are not immediately adjacent to gnatcatcher habitat, and maintenance roads.

Environmental commitments detailed in the 2001 SEIS/EIR and other SARMP documents are relevant to address potential effects to gnatcatcher. These include measures to compensate for permanent and temporary effects to Upland habitats gnatcatchers may occupy. Commitments include BR-17, which requires vegetation clearing to be conducted outside of the known nesting season and BR-18, which requires off-site mitigation for permanently impacted Upland areas at a 3:1 ratio and restoration of temporarily impact areas. According to the 2001 SEIS/EIR and 2001 BO, a number of substantive measures would be implemented to minimize potential noise and vibration effects as a result of project construction activities. As stated in the 2001 BO, these measures were intended to ensure that: (1) noise does not exceed 60 dBA; or, (2) noise does not exceed 5 dBA above ambient conditions if said levels are above 60 dBA. In order to comply with noise requirements addressed in the project BO's, mitigation measure BR-21, which requires the installation of noise barriers between construction areas and riparian habitat, will be installed where necessary and feasible; it is assumed barriers would be installed along the TCE. Barriers may not be installed if it is determined that the additional footprint required would result in a greater impact to adjacent nesting territories than the construction noise itself. Additional mitigation measures from the 2001 SEIS/EIR and project BO's and environmental commitments developed for this document that would be implemented to further avoid and/or

minimize impacts to the gnatcatcher include EC-AQ-2, which requires the implementation of techniques to control fugitive dust; EC-BR-3, which requires worker training; and, EC-BR-5, which ensures compliance with all mitigation measures and environmental commitments during construction activities. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. Implementation of these mitigation measures and environmental commitments are designed to ensure that project effect on the species is as minimal as possible and feasible.

With implementation of these avoidance/minimization measures, and based on initial results of 2015 surveys and ongoing coordination with USFWS, the proposed Reach 9 measures may affect, but are not likely to adversely affect the coastal California gnatcatcher. Designated critical habitat for the species does not occur within the Phase 5A Grouted Stone and Sheet Pile Alternative (see Figure 5.5-6a) and as a result adverse modification to critical habitat would not occur under this alternative.

Least Bell's Vireo

SAWA reported a total of 114 least Bell's vireo territories in Reach 9 during 2014 protocol surveys, the same number documented during 2013 surveys. It is anticipated that implementation of the Reach 9 measures would result in temporary displacement of any vireo territory occurring within the TCE of any measure, and the potential for a temporary displacement of territories occurring within 200-feet of a TCE, due to construction noise or other disturbance. Noise barriers would be installed where feasible, and although it is anticipated that barriers attenuate sound levels to some degree, there is still the potential for noise to exceed established thresholds for some distance on the other side of the wall; especially in cases where equipment or activities are occurring immediately adjacent to the barrier. Noise from sheet pile construction, in particular, would carry further, and it is assumed that even with sound walls, thresholds could be exceeded within 500' of construction.

Displacements of nests occurring within the TCE plus 200-foot buffer, collectively known as the Area of Potential Effect (APE), are assumed to result in "take" of vireo. The use of pile drivers during installation of sheet piling would likely extend the APE out approximately 500 feet beyond the TCE. The number of territories within the APE for the proposed Reach 9 measures are presented in Table 5.5-6 below and those within the APE of the Phase 5A Grouted Stone and Sheet Pile Alternative are depicted in Figure 5.5-7a. While "take" is assumed for the purpose of this analysis, it will be possible and even likely for nesting to occur within the APE. Monitoring will determine whether or not "take" occurred within the APE as a result of the project (i.e., if significantly fewer pairs successfully nested in the APE as compared to prior years and other unaffected areas; if noise levels were elevated despite sound walls; and, or if nest abandonment occurred with no other likely cause).

Table 5.5-6. Least Bell's Vireo Territories Occurring Within the Area of Potential Effect

	No. of Territories Within the TCE	No. of Territories Outside TCE but Inside APE
Phase 5A	1	8
Phase 5B	9	11
Phase 4	1	5

	No. of Territories Within the TCE	No. of Territories Outside TCE but Inside APE
BNSF Bridge	2	2
TOTALS	13	26

As documented in the 2001 SEIS/EIR, implementation of Reach 9 measures would result in direct and indirect impacts to nesting least Bell's vireo individuals and habitat occurring in Reach 9. As depicted in Figure 5.5-7a, one vireo territory coincides with the Phase 5A Grouted Stone and Sheet Pile Alternative's TCE, resulting in a temporary disturbance to this territory. Direct impacts to least Bell's vireo would also include the permanent removal of suitable habitat (general scale riparian classification). Table 5.5-4 indicates that 1.18 acres of Riparian habitat would be permanently impacted by implementation of the Phase 5A Grouted Stone and Sheet Pile Alternative. Although quantified and mitigated as a permanent impact, this area would be buried and would only be exposed if high flows erode backfill and expose the buried toe. Until then, "permanently" impacted areas are expected to support riparian or other native habitat. Temporary impacts to Riparian habitat would also directly impact vireo. Table 5.5-4 indicates that 2.16 acres of Riparian habitat would be temporarily impacted by implementation of the Phase 5A Grouted Stone and Sheet Pile Alternative.

Additional direct impacts to least Bell's vireo could include disruption of breeding activity in adjacent, undisturbed habitat due to increased fugitive dust, noise, and human presence associated with construction activities. Such disturbances can result in the incidental loss of fertile eggs or nestlings, or otherwise lead to nest abandonment. Additionally, birds use their sense of hearing to locate their young and mates, to establish and defend territories, and to locate and evade predators (Scherzinger, 1970). As a result, vireo pairs that nest within the area of potential effect could be adversely affected in the absence of specific measures to abate noise and fugitive dust during construction. Based on observations of vireos that nested successfully within and adjacent to other SARMP measures in the vicinity (including the Corps' Sewage Treatment Plant dike, Prado Embankment and Reach 9, Phase 2B projects), it is anticipated that most of the nesting locations outside of the direct project footprint will continue to support vireos during and after construction. Sound levels will be monitored and barriers will be installed along the TCE, if necessary, to reduce indirect impacts to birds outside of the construction area. However, for the purposes of this evaluation, it is anticipated that implementation of the Phase 5A Grouted Stone and Sheet Pile Alternative could potentially result in take of the 8 vireo territories that occur within the 200-foot buffer (see Figure 5.5-7a), for a total project take of 9 vireo territories.

Indirect impacts to vireo could include the degradation of habitat due to the potential introduction and colonization of invasive weeds. Routine inspection and maintenance activities could also disturb vireo due to the presence of maintenance personnel and equipment adjacent to recovered riparian habitats.

The 2001 BO authorized "take" of up to 31 pairs of vireos downstream of Prado Dam. Previous construction of the Prado outlet structure and Reach 9 Phases 1, 2A (including Green River Mobile Home

Park and Green River Housing Estates) and 2B features has resulted in "take" of all 31 pairs. An additional take of 2 pairs was authorized and occurred during construction of Reach 9, Phase 3. The currently proposed Reach 9 measures' potential impact to 39 vireo territories (13 territories within the TCE and an additional 26 territories in the 200-500 foot buffer) will require additional authorization, or another amendment to the BO. The Corps will consult with USFWS prior to construction of Phase 5A and other Reach 9 measures to obtain an amended or new BO that would authorize additional "take" of least Bell's vireo.

The range of potential effects to least Bell's vireo associated with the proposed action are similar to those that have been contemplated previously in the 2001 SEIS/EIR, and 2001 BO and its 2012 and 2013 amendments. These documents included a series of mitigation measures that would also be implemented during construction of newly proposed features to compensate for impacts to least Bell's vireo. These include measures to address permanent and temporary effects to habitats in which vireos occur in the project area, such as BR-18, which would remove arundo from areas upstream of the project area; require the restoration and maintenance of riparian habitat that is temporarily disturbed during project construction; and which would provide compensation through creation or restoration of riparian habitat for each acre of habitat permanently affected by project construction. In addition, several other measures would be implemented that specifically address impacts to least Bell's vireo and other nesting birds. These include BR-17, which requires vegetation clearing to be conducted outside of the known vireo nesting season; and, BR-19, which requires cowbird trapping at a minimum of 10 sites in Reach 9 (or other areas along the Santa Ana River and environs where trapping would likely be more effective for vireo production, subject to review and approval of the USFWS) during all years when construction of the proposed project is occurring and 5 years following construction or funding towards a cowbird trapping program. According to the 2001 SEIS/EIR, 2001 BO and 2012 BO Amendment, a number of substantive measures would be implemented to minimize potential noise and vibration effects to least Bell's vireo as a result of project construction activities. These measures were intended to ensure that: (1) noise does not exceed 60 dBA within occupied vireo habitat; or, (2) noise does not exceed 5 dBA above ambient conditions if said levels are above 60 dBA. In order to comply with noise requirements addressed in the 2001 BO and the 2012 BO Amendment, mitigation measure BR-21 will be implemented, which requires the installation of noise barriers between construction areas and riparian habitat where necessary and feasible. It is anticipated that barriers would be installed along the TCE. Barriers may not be installed if it is determined that the additional footprint required would result in a greater impact to adjacent nesting territories than the construction noise itself. Additional mitigation measures from the 2001 SEIS/EIR and 2001 BO and environmental commitments developed for this document that would be implemented to further avoid and/or minimize impacts to least Bell's vireo include EC-AQ-2, which requires the implementation of techniques to control fugitive dust; EC-BR-3, which requires worker training; and, EC-BR-5, which ensures compliance with all mitigation measures and environmental commitments during construction activities. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. With the implementation of these avoidance and minimization measures, the proposed project is not likely to jeopardize the continued existence of the least Bell's vireo. Designated critical habitat for the species does not occur

within the project area, consequently there will be no adverse modification to designated critical habitat.

Golden Eagle, Bald Eagle, Swainson's Hawk, and White-Tailed Kite

Although none of these species were identified in the Reach 9 measure areas during the April 2014 surveys, each are known to occur in the region and have the potential to occur within the Reach 9 measure areas. The proposed measures do not support suitable nesting habitat for golden eagle and bald eagle. However, these species have historically been documented nesting in the region; golden eagle approximately 5 miles north of the Reach 9 measures in the Chino Hills and bald eagle approximately 7 miles to the south at Irvine Lake. Suitable nesting habitat for white-tailed kite exists within and surrounding Reach 9 measures and breeding is strongly suspected in suitable habitat throughout the region; however, these species have not been documented within Reach 9. Swainson's hawk does not breed in the vicinity of the Reach 9 measures. Suitable foraging habitat for each of these species does occur.

Direct impacts to these species could include the temporary disturbance of breeding habitat (white-tailed kite) and foraging habitat. If white-tailed kite is breeding in Reach 9, disturbance to breeding habitat due to construction activities could result in reduced reproductive success, although it is assumed that most individuals would be able to successfully relocate to unaffected areas in the immediate vicinity. The removal of existing vegetation and topsoil within work areas would likely cause small terrestrial wildlife populations, which serve as important food resources for raptors, to move into unaffected areas. Subsequently, foraging opportunities may temporarily increase within the first few days or weeks of construction as individuals are displaced.

Project related impacts to raptors in Reach 9 have previously been analyzed in the 2001 SEIS/EIR. While the currently proposed Reach 9 measures were not detailed in the 2001 SEIS/EIR, the analysis for projects within Reach 9 is valid due to the its analysis of effects to similar habitats and species.

Significant impacts to these species is not expected due to the relatively small amount of natural habitats that would be disturbed as a result of implementation of the Reach 9 measures in comparison to the amount of suitable habitat available to these species in Reach 9 and within the region. To further ensure that impacts to golden eagle, bald eagle, Swainson's hawk, and white-tailed kite are minimized and/or avoided, a series of mitigation measures provided in the 2001 SEIS/EIR and environmental commitments developed for this document would be implemented. These include measures to offset the permanent loss and temporary disturbance of suitable foraging habitat, such as BR-16A, which requires the finalization of a habitat management plan; BR-18, BR-26B, and BR-26C, which require the restoration and maintenance of native habitats that are temporarily disturbed during project construction activities; and, BR-18C, which would provide compensation through creation or restoration of riparian habitat for each acre of habitat permanently affected by project construction. Additional mitigation measures and environmental commitments that would be implemented include EC-BR-2, which requires construction site inspections for active raptor nests and agency coordination upon the

discovery of an active nest site; EC-BR-3, which requires worker training; and, EC-BR-5, which ensures compliance with all mitigation measures and environmental commitments during construction activities. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. Implementation of these mitigation measures and environmental commitments will result in less than significant impacts to golden eagle, bald eagle, Swainson's hawk, and white-tailed kite, should they occur.

Soil Cement and Sheet Pile Alternative (Alternative 2)

Permanent and temporary impacts to vegetation communities associated with the Phase 5A Soil Cement and Sheet Pile Alternative would be similar to those under the Grouted Stone and Sheet Pile Alternative. Under both the grouted stone and sheet pile, and soil cement and sheet pile alternatives, the proposed structures would be installed in the same location and at a 2H:1V slope. As a result, the potential permanent and temporary impacts to vegetation communities anticipated during implementation of the Soil Cement and Sheet Pile Alternative would be the same as those presented above in Table 5.5-4 for the Grouted Stone and Sheet Pile Alternative. The same mitigation ratios as those present in Table 5.5-5 would also apply. Potential impacts to special-status plant and wildlife species and measures to minimize and mitigate them would also be similar to the Grouted Stone and Sheet Pile Alternative. As a result, impacts to biological resources under the Soil Cement and Sheet Pile Alternative could be significant; however, with implementation of measures identified under the Grouted Stone and Sheet Pile Alternative (and presented in Chapter 6), impacts to biological resources upon implementation of The Soil Cement and Sheet Pile Alternative would also be minimized and mitigated to less than significant levels.

No Federal Action Alternative (Alternative 3)

Under the Phase 5B No Federal Action Alternative, no disturbance from construction would occur and there would be no direct or indirect impacts to biological resources. However, future high volume releases from Prado Dam could undermine and erode existing bank protection structures and threaten adjacent infrastructure. Periodic emergency repairs of existing protection may be required and would likely entail the discharge of rocks to stabilize the embankment and bridge piers and abutments. Placement of rock during emergency repair may require the use of heavy equipment and work within flowing water. Any emergency repair is expected to be localized, which would minimize its impact to biological resources to the extent possible. It is assumed that a biological monitor would be on site during the repairs to ensure implementation of avoidance and minimization measures and to document disturbances cause by the emergency action. If scour has produced a condition where existing structures are damaged or in danger of failing, it is presumable that stream side vegetation has been severely disturbed or even uprooted and washed away. After rock has been placed, voids between rocks would be capable of providing cover to native fish and insects while streamside plants recover.

Future Operations and Maintenance

Future maintenance activities associated with Phase 5A alternatives may include routine inspections and monitoring of project structures by access road, lowered ramp, or floating device, such as a raft or boat; mobilizing dump trucks and hydraulic excavators to haul and place stones in the river to protect project structures as necessary; periodic weeding, patching soil cement, and road maintenance; periodic clearing of debris around drainage structures; and, periodic repairs to fencing and gates.

Impacts related to maintenance activities of project structures could include trampling or crushing of vegetation by vehicular or foot traffic, alterations in topography and hydrology, increased erosion and sedimentation, and the introduction of non-native, invasive plants due to increased human presence on foot or equipment. Most inspections and minor repairs would be confined to paved maintenance and access roads. Impacts to native vegetation and wildlife, therefore, would be minimal and are not expected to be significant.

5.5.2.2 Phase 5B

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

Vegetation Communities

Permanent impacts. The above-ground (exposed) portion of the new grouted stone structure proposed under the Phase 5B Grouted Stone and Sheet Pile Alternative, areas where no vegetation will be planted or could establish itself, would not result in new permanent impacts because the proposed new protection structure would replace existing protection; net permanent impacts would be zero. However; similar to Phase 5A, permanent impacts would occur from the back-filled portion along the extended toe of the new structure. Although vegetation can be planted and establish itself on the buried portion of the new grouted stone structure, permanent impacts occur where the buried toe of the new grouted stone structure goes deeper and further out into the floodplain, and where a significant scour event could remove overlying soils exposing the buried toe. For the grouted stone structure along the Phase 5B Grouted Stone and Sheet Pile Alternative, the distance between the existing toe and the toe of grouted stone proposed under the Grouted Stone and Sheet Pile Alternative is determined to be 22 feet (see Figure 4.2-2). Permanent impacts associated with the Phase 5B Grouted Stone and Sheet Pile Alternative are primarily to Riparian classifications (i.e., Mexican Elderberry, mulefat scrub) (see Figures 5.5-2). Due to the preliminary nature of this alternative's design, the grouted stone structure coincides with Perennial Stream habitat at the eastern terminus (Figure 5.5-2); however, future implementation of this alternative will not encroach into this habitat and permanent impacts to Perennial Stream habitat is not anticipated.

Temporary impacts. Temporary impacts were calculated by subtracting permanent impact acreages from total TCE acreages for each measure. Staging areas are included under temporary impact acreages. Temporary impacts associated with the Phase 5B Grouted Stone and Sheet Pile Alternative occur nearly equally to Riparian, Upland, and Developed classifications. Due to the preliminary nature of this

alternative's design, the TCE coincides with Perennial Stream habitat at the eastern terminus (Figure 5.5-2); however, future implementation of this alternative will not encroach into this habitat and temporary impacts to Perennial Stream habitat is not anticipated.

Similar to Phase 5A, temporary impacts would occur during the removal of vegetation and during ground-disturbing construction activities, including grading and excavating, and from increased human presence, vehicle traffic, and noise. Other temporary impacts to vegetation communities could include alterations in existing topography and hydrology regimes (until construction areas are restored), the accumulation of fugitive dust, disruptions to native seed banks from ground disturbance, and the colonization of nonnative/invasive plant species. Implementation of BMPs such as silt fences or berms to control runoff, and the restoration of temporarily disturbed areas with native vegetation would avoid and minimize other indirect effects, including an increase in the amount of compacted or modified surface that may increase the potential for forceful surface runoff, increased erosion, and potential destruction of intact vegetation outside the permanent impact footprints.

Permanent and temporary impacts associated with implementation of the Phase 5B Grouted Stone and Sheet Pile Alternative are presented in Table 5.5-7. Within the Phase 5B work area, the Grouted Stone and Sheet Pile Alternative would entail 24.13 acres of permanent impacts associated with the proposed grouted stone structure and 52.75 acres of temporary impacts associated with the TCE and staging areas.

Mitigation Measures for Impacts to Vegetation Communities

As presented in Chapter 5.5.2.1 (Phase 5A), the 2001 SEIS/EIR included a series of mitigation measures that would be implemented for Reach 9 elements of the SARMP to compensate for impacts to vegetation communities. These include measures to mitigate for temporary and permanent effects to aquatic, riparian, and upland habitats, such as BR-17A,which would minimize project grading activities, which feasibly would maintain existing root systems; BR-18, which would remove giant reed and other non-native vegetation from areas upstream of Reach 9 as mitigation for temporary impacts; BR-18A, BR-18B, BR-26B, and BR-26C, which require the restoration and maintenance of native habitats that are temporarily disturbed during project construction activities; BR-18C, which would provide compensation through creation or restoration of riparian habitat for each acre of habitat permanently affected by

Table 5.5-7. Phase 5B-Grouted Stone and Sheet Pile Alternative: Permanent and Temporary Impacts

Vegetation Communities and Classifications	Permanent Impacts (acres)	Temporary Impacts (acres)
Riparian		
TOTAL RIPARIAN	**7.72**	**19.82**
Upland		
TOTAL UPLAND	**4.7**	**21.82**
Developed		
TOTAL DEVELOPED	**11.71**	**11.11**
TOTAL	**24.13**	**52.75**

Note: Detailed acreage impacts based on vegetation communities or other cover types were included in the draft SEA/EIR Addendum. Updated GIS shows only consolidated acreages for the final SEA/EIR Addendum.

project construction; BR-20, which would limit vegetation removal to designated areas; BR-24, which would provide monitoring for signs of plant stress to riparian vegetation; and BR-26A, which requires hydro-seeding with local native shrubs and ground cover species in upland areas disturbed by project activities. BR-18, BR-18B and BR-18C have since been modified through a 2012 Biological Opinion Amendment which adjusts the methods and mitigation ratios for off-site habitat restoration, as discussed below. As a result, these commitments have been combined into one commitment, BR-18, as presented in Chapter 5.5.3 below. (BR-18A is still listed separately.) EC-BR-5, from the 2011 SEA for Reach 9, Phase 2A, has also been added to this document to ensure compliance with all mitigation measures and environmental commitments during construction activities. These measures would reduce the effects of the proposed action by reducing impacts and fully restoring native plant communities on-site after construction is complete, and by providing adequate compensation by restoring native vegetation upstream of the project area. A full list of approved mitigation measures and environmental commitments can be found in Chapter 6 of this document. Adherence to identified mitigation measures and environmental commitments would reduce impacts to vegetation communities to less than significant levels.

Mitigation Ratios for Impacts to Vegetation Communities

As discussed in Chapter 5.5.2.1, mitigation measure BR-18 requires the Corps and non-federal sponsors to remove arundo (and other non-native invasive vegetation) from the watershed and restore riparian habitat to compensate for permanent and temporary impacts to vegetation communities. Mitigation requirements for the Phase 5B Grouted Stone and Sheet Pile Alternative, based on the anticipated permanent and temporary impacts noted in Table 5.5-7, are presented in Table 5.5-8 below. Mitigation for the Grouted Stone and Sheet Pile Alternative would include the removal of 72.52 acres of non-native invasives if it is determined that requirements of a 1:1 ratio can be met, or 112.16 acres if a 3:1 ratio is selected. Mitigation would be implemented prior to or during construction of each Reach 9 measure.

Table 5.5-8. Phase 5B-Grouted Stone and Sheet Pile (Preferred Alternative) Mitigation Requirements

Vegetation Communities and Classifications	Permanent Impacts (ac)	Mitigation acreage for Perm Impacts	Temporary Impacts (ac)	Mitigation acreage for Temp Impacts
Riparian[1]	7.72	38.6	19.82	19.82/59.46
Upland[2]	4.7	14.1	21.82	NA
Developed	11.71	NA	11.11	NA
Total Mitigation		52.7		19.82/59.46
Total Mitigation Required Using 1:1 Ratio for Temp Impacts = 72.52 acres **Total Mitigation Required Using 3:1 Ratio for Temp Impacts = 112.16 acres**				

[1] Mitigation acreages based on 5:1 ratio for permanent impacts and 1:1/3:1 for temporary impacts.

[2] Mitigation acreages based on 3:1 ratio for permanent impacts. Temporary impacts are restored on-site.

Habitat Management Plan

As presented in Chapter 5.5.2.1, measures from the 2001 SEIS/EIR (as well as commitments from the 1988 SEIS) required completion of a HMP for Reach 9, public ownership of the entire floodplain between Prado Dam and Weir Canyon Road, and management of this area in a manner that maintains or enhances existing riparian habitat acreages and wildlife values. While the Phase 5B Grouted Stone and Sheet Pile Alternative and other Reach 9 measures will result in permanent encroachments into the HMP, most of this encroachment consists of buried structure that will be backfilled and re-vegetated, and would only be exposed if and when future high flows result in bed degradation and shifting of the active river channel. Moreover, habitat values will be fully mitigated.

Noxious and Invasive Plants

As discussed in Chapter 5.5.2.1, areas temporarily impacted during construction will be fully restored and monitored for at least 5 years to ensure non-native vegetation does not return or establish itself over time. Measures to reduce the effects of exotic weeds on natural plant communities would also be the same for the Phase 5B Grouted Stone and Sheet Pile Alternative as those presented in Chapter 5.5.2.1 for the Phase 5A Grouted Stone Alternative. The Corps would implement mitigation measures provided in the 2001 SEIS/EIR, along with environmental commitments prepared as part of this document, to reduce the effects of the proposed alternatives by reducing the potential spread and colonization of weedy species and by restoring native plant communities at the conclusion of construction. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. Adherence to identified mitigation measures and environmental commitments would reduce impacts to vegetation communities to less than significant.

Special-Status Plant Species

Similar to the Phase 5A Grouted Stone Alternative discussed in Chapter 5.5.2.1, no plant species federally or State-listed as threatened or endangered under their respective Endangered Species Acts were observed during surveys conducted for this project. However, implementation of the Phase 5B

Grouted Stone and Sheet Pile Alternative and other Reach 9 measures could result in both direct and indirect effects to special-status plant species, if present, within their respective project areas. Direct impacts to special-status plants would occur as a result of the removal of plants during clearing and grubbing to prepare the sites, while indirect impacts could occur from the accumulation of fugitive dust related to project construction, the introduction and proliferation of non-native invasive plants, and increased soil compaction, erosion, and sedimentation. However, with implementation of mitigation measures, it is not anticipated that project activities will impact rare plants, resulting in impacts that would be less than significant.

Operational effects could occur during routine inspection and maintenance of project components. These impacts could include trampling or crushing of special-status plant species, should they occur, by vehicular or foot traffic, alterations in topography and hydrology, increased erosion and sedimentation, and the introduction of non-native, invasive plants. However, routine maintenance will be conducted from paved access roads and activities would not encroach into adjacent habitats that may contain undisturbed habitat potentially suitable for special status plants.

Oak Trees

Coast live oak trees have been identified within the permanent footprint and TCE of the Phase 5B Grouted Stone and Sheet Pile Alternative. Many of the oak trees occurring in these areas were affected to some degree by the 2008 Freeway Complex fire; however, most of these are exhibiting signs of emergent vegetative growth. As presented in Chapter 5.5.2.1, where possible, project related activities will be conducted outside of the drip line of oak trees. Additionally, BMP such as silt curtains or berms would be employed to control runoff, and the restoration of temporarily disturbed areas would minimize and mitigate potential indirect impacts to coast live oaks, including alterations to topography, erosion, and sedimentation if runoff through the project area is not controlled. Impacts could also occur during routine inspection and maintenance of Reach 9 measures; however with implementation of BMP, impacts will be minimized and avoided.

Mitigation Measures for Impacts to Special-Status Plant Species

The 2001 SEIS/EIR included a series of mitigation measures applicable to Reach 9 measures that would be implemented to compensate for impacts to special-status plant species. As discussed in Chapter 5.5.2.1, construction-related mitigation measures from the 2001 SEIS/EIR and additional commitments developed for this document will be implemented to reduce potential impacts to special status plants. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. Adherence to identified mitigation measures and environmental commitments would reduce impacts to special-status plants to less than significant levels.

Mitigation measures and environmental commitments would also be implemented to compensate for potential impacts to coast live oaks present within the Reach 9 measures. These would include EC-BR3, which requires worker training; and EC-BR-6, which requires replacement of all removed oaks at a 4:1 ratio. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of

this document. Adherence to identified mitigation measures and environmental commitments would reduce impacts to oak trees and oak woodlands to less than significant levels.

Special-Status Wildlife Species

As presented in Chapter 5.5.2.1, a total of 4 special-status wildlife species were detected during April 2014 surveys of the Reach 9 measure areas, including least Bell's vireo (Phases 5A, 5B, and 4), yellow warbler (Phases 5A, 5B, and BNSF Bridge), yellow-breasted chat (Phase 5B), and Cooper's hawk (Phase 5A), which could all occur in any of the Reach 9 measure areas. Direct and indirect impacts to wildlife under the Phase 5B Grouted Stone and Sheet Pile Alternative would be similar to those discussed for the Phase 5A Grouted Stone Alternative in Chapter 5.5.2.1. As a result, the mitigation measures and environmental commitments previously discussed in Chapter 5.5.2.1 would also apply to the Phase 5B Grouted Stone and Sheet Pile Alternative. The full list of mitigation measures and environmental commitments to be implemented under Phase 5B can be found in Chapter 6 of this document. Implementation of these mitigation measures and environmental commitments will result in less than significant impacts to wildlife. The federally and state-listed species and California Fully Protected species discussed previously in Chapter 5.5.2.1, are further discussed in relation to the Phase 5B Grouted Stone and Sheet Pile Alternative below.

Santa Ana Sucker

Designated critical habitat for the species occurs within the Phase 5B Grouted Stone and Sheet Pile Alternative, as is shown in Figure 5.5-6b; however implementation of this alternative would not impact aquatic habitats suitable for sucker. Temporary impacts (25.65 acres) and permanent impacts (11.35 acres) to critical habitat will occur in upland areas of the Santa Ana River floodplain, outside the current alignment of the low flow channel, and would be restored with native riparian or upland scrub vegetation in appropriate areas. As a result, substantial impacts to suckers and their designated critical habitat would not occur.

Southwestern Willow Flycatcher

As presented in Chapter 5.5.2.1, southwestern willow flycatcher has not been identified in Reach 9 since SAWA began conducting surveys in 2001. Due to the narrow breadth of riparian corridors through the Reach 9 measures and combined with a narrow or absent buffer, and proximity to human development, the Reach 9 measures do not support suitable breeding habitat. Therefore, there is low potential for this species to occur in the Phase 5B Grouted Stone and Sheet Pile Alternative and other Reach 9 measure areas as a transient.

Since suitable breeding and nesting habitat for southwestern willow flycatcher does not occur within the Phase 5B Grouted Stone and Sheet Pile Alternative, and continuing surveys by SAWA have not identified any resident or nesting individuals or home ranges within the area of the measures, the alternatives associated with the Reach 9 measures are not expected to result in adverse direct, indirect, or operational impacts to breeding or nesting flycatcher individuals.

While the southwestern willow flycatcher has not been observed within Reach 9 in over a decade, the adoption of the mitigation measures described in Chapter 5.5.2.1 would further reduce the possibility of any impact from implementation of the Reach 9 measures on the species. Therefore, there is expected to be no effect to this species from the proposed Phase 5B Grouted Stone and Sheet Pile Alternative. Critical habitat for the species does not coincide with the Reach 9 measures, so there would be no adverse modification to designated critical habitat for the species.

Coastal California Gnatcatcher

As discussed in Chapter 5.5.2.1, no coastal California gnatcatchers were observed during surveys performed in 2014 within the Phase 5B Grouted Stone and Sheet Pile Alternative and other Reach 9 measure areas. Designated critical habitat for the species does, however, coincide with approximately two-thirds of Phase 5B (Figure 5.5-6b). Under the Phase 5B Grouted Stone and Sheet Pile Alternative, minor permanent impacts (0.1 acre) and temporary impacts (0.18 acre) to habitat preferred by this species (i.e., Sagebrush Scrub) would occur (see Table 5.5-7). Although limited, the presence of suitable habitat within the Phase 5B Grouted Stone and Sheet Pile Alternative and known individuals within the vicinity of Phase 5B, results in a moderate potential for this species to occur in the area of this measure.

Direct impacts could include disruption of breeding activity in adjacent habitats due to increased noise, fugitive dust, and activities associated with construction. Indirect impacts could include the degradation of habitat due to the potential introduction and colonization of invasive weeds that could serve to out-compete habitat preferred by the gnatcatcher. Impacts to the species during routine inspections and maintenance are expected to be negligible, since tasks would be confined to the new protection structures themselves, which are not immediately adjacent to gnatcatcher habitat, and maintenance roads.

Environmental commitments detailed in the 2001 SEIS/EIR and other SARMP documents are relevant to address potential effects to gnatcatcher. These include measures to compensate for permanent and temporary effects to Upland habitats gnatcatchers may occupy. Commitments include BR-17, which requires vegetation clearing to be conducted outside of the known nesting season and BR-18, which requires restoration of temporary impact areas. According to the 2001 SEIS/EIR and 2001 BO, a number of substantive measures would be implemented to minimize potential noise and vibration effects as a result of project construction activities. As stated in the 2001 BO, these measures were intended to ensure that: (1) noise does not exceed 60 dBA within occupied vireo habitat; or, (2) noise does not exceed 5 dBA above ambient conditions if said levels are above 60 dBA. In order to comply with noise requirements addressed in the 2001 BO, mitigation measure BR-21, which requires the installation of noise barriers between construction areas and riparian habitat where necessary and feasible; it is anticipated that barriers would be installed along the TCE. Barriers may not be installed if it is determined that the additional footprint required would result in a greater impact to adjacent nesting territories than the construction noise itself. Additional mitigation measures from the 2001 SEIS/EIR and project BO's and environmental commitments developed for this document that would be implemented to further avoid and/or minimize impacts to the gnatcatcher include EC-AQ-2, which requires the

implementation of techniques to control fugitive dust; EC-BR-3, which requires worker training; and, EC-BR-5, which ensures compliance with all mitigation measures and environmental commitments during construction activities. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. Implementation of these mitigation measures and environmental commitments are designed to ensure that project effects on the species are as minimal as possible and feasible.

With implementation of these avoidance and minimization measures, the proposed Phase 5B Grouted Stone and Sheet Pile Alternative may affect, but is not likely to adversely affect the coastal California gnatcatcher. Designated critical habitat for the species occurs within the Phase 5B Grouted Stone and Sheet Pile Alternative (see Figure 5.5-6b) and as a result impacts to critical habitat would occur under this alternative. Temporary and permanent impacts to critical habitat are identified as 28.65 acres and 7.65 acres, respectively. However, upon implementation of measures to mitigate and minimize impacts to scrub habitat preferred by this species, modifications to critical habitat would be temporary in nature and decreased to a less than significant level.

Least Bell's Vireo

As presented in Chapter 5.5.2.1, it is anticipated that implementation of the Phase 5B Grouted Stone and Sheet Pile Alternative would result in temporary displacement of 20 vireo territories occurring within the APE (TCE and 200-foot buffer) of this alternative, as presented in Table 5.5-6 and depicted in Figures 5.5-7a and b.

As documented in the 2001 SEIS/EIR, implementation of Reach 9 measures would result in direct and indirect impacts to nesting least Bell's vireo individuals and habitat occurring in Reach 9. As depicted in Figure 5.5-7a and b, 9 vireo territories coincide with the Phase 5B Grouted Stone and Sheet Pile Alternative's TCE, resulting in temporary disturbances to these territories. Direct impacts to least Bell's vireo would also include the permanent removal of suitable habitat (general scale riparian classification). Table 5.5-7 indicates that 7.72 acres of Riparian habitat would be permanently impacted and 19.82 acres of Riparian habitat temporarily impacted by implementation of the Phase 5B Grouted Stone and Sheet Pile Alternative. Although quantified and mitigated as a permanent impact, this area would be buried and would only be exposed if high flows erode backfill and expose the buried toe. Until then, "permanently" impacted areas are expected to support riparian or other native habitat.

Additional direct impacts to least Bell's vireo could include disruption of breeding activity in adjacent, undisturbed habitat due to increased fugitive dust, noise, and human presence associated with construction activities. Such disturbances can result in the incidental loss of fertile eggs or nestlings, or otherwise lead to nest abandonment. Additionally, birds use their sense of hearing to locate their young and mates, to establish and defend territories, and to locate and evade predators (Scherzinger, 1970). As a result, vireo pairs that nest within the area of potential effect could be adversely affected in the absence of specific measures to abate noise and fugitive dust during construction. Based on observations of vireos that nested successfully within and adjacent to other SARMP measures in the vicinity (including the Corps' Sewage Treatment Plant dike, Prado Embankment and Reach 9, Phase 2B

projects), it is anticipated that most of the nesting locations outside of the direct project footprint will continue to support vireos during and after construction. As discussed further below, sound levels will be monitored and sound walls or other barricades will be constructed if necessary to reduce indirect impacts to birds outside of the construction area. However, for the purposes of this evaluation, it is anticipated that implementation of the Phase 5B Grouted Stone and Sheet Pile Alternative could potentially result in take of the 11 vireo territories that occur within the 200-foot buffer (see Figures 5.5-7a and b), for a total project take of 20 vireo territories. The Corps will consult with USFWS prior to construction of Phase 5B to obtain an amended or new BO that would authorize additional "take" of least Bell's vireo.

As described in Chapter 5.5.2.1, the range of potential effects to least Bell's vireo associated with this alternative are similar to those that have been contemplated previously in the 2001 SEIS/EIR, and 2001 BO and its 2012 and 2013 amendments. These documents included a series of mitigation measures that would also be implemented during construction of the currently proposed features to compensate for impacts to least Bell's vireo. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. With the implementation of these avoidance and minimization measures, the proposed project is not likely to jeopardize the continued existence of the least Bell's vireo. Designated critical habitat for the species does not occur within the project area, consequently there will be no adverse modification to designated critical habitat.

Golden Eagle, Bald Eagle, Swainson's Hawk, and White-Tailed Kite

As presented in Chapter 5.5.2.1, none of these species were identified in the Reach 9 measure areas during the April 2014 surveys; however, each are known to occur in the region and have the potential to occur within the Reach 9 measure areas. To further ensure that impacts to golden eagle, bald eagle, Swainson's hawk, and white-tailed kite are minimized and/or avoided, the mitigation measures provided in the 2001 SEIS/EIR and environmental commitments developed for these species, as presented in Chapter 5.5.2.1, would be implemented. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. Implementation of these mitigation measures and environmental commitments will result in less than significant impacts to golden eagle, bald eagle, Swainson's hawk, and white-tailed kite, should they occur.

<u>Soil Cement Alternative (Alternative 2)</u>

Permanent and temporary impacts to vegetation communities associated with the Phase 5B Soil Cement and Sheet Pile Alternative would be similar to those under the Grouted Stone and Sheet Pile Alternative. Under both the grouted stone and soil cement alternatives, the proposed structures would be installed in the same location and at a 2H:1V slope. As a result, impacts would be the same for the Soil Cement and Sheet Pile Alternative as presented above in Table 5.5-7 for the Grouted Stone and Sheet Pile Alternative. The same mitigation ratios as those presented in Table 5.5-8 would also apply. Potential impacts to special-status plant and wildlife species and measures to minimize and mitigate them would also be similar to the Grouted Stone and Sheet Pile Alternative. As a result, impacts to biological

resources under the Soil Cement and Sheet Pile Alternative could be significant; however, with implementation of measures identified under the Grouted Stone and Sheet Pile Alternative (and presented in Chapter 6), impacts to biological resources upon implementation of The Soil Cement and Sheet Pile Alternative would also be minimized and mitigated to less than significant levels.

No Federal Action Alternative (Alternative 3)

Under the Phase 5B No Federal Action Alternative, no disturbance from construction would occur and there would be no direct or indirect impacts to biological resources. However, future high volume releases from Prado Dam could undermine and erode existing bank protection structures and threaten adjacent infrastructure. Periodic emergency repairs of existing protection may be required and would likely entail the discharge of rocks to stabilize the embankment and bridge piers and abutments. Placement of rock during emergency repair may require the use of heavy equipment and work within flowing water. Any emergency repair is expected to be localized, which would minimize its impact to biological resources to the extent possible. It is assumed that a biological monitor would be on site during the repairs to ensure implementation of avoidance and minimization measures and to document disturbances cause by the emergency action. If scour has produced a condition where existing structures are damaged or in danger of failing, it is presumable that stream side vegetation has been severely disturbed or even uprooted and washed away. After rock has been placed, voids between rocks would be capable of providing cover to native fish and insects while streamside plants recover.

Future Operations and Maintenance

Future maintenance activities associated with Phase 5B alternatives may include routine inspections and monitoring of project structures by access road, lowered ramp, or floating device, such as a raft or boat; mobilizing dump trucks and hydraulic excavators to haul and place stones in the river to protect project structures as necessary; periodic weeding, patching soil cement, and road maintenance; periodic clearing of debris around drainage structures; and, periodic repairs to fencing and gates.

Impacts related to maintenance activities of project structures could include trampling or crushing of vegetation by vehicular or foot traffic, alterations in topography and hydrology, increased erosion and sedimentation, and the introduction of non-native, invasive plants due to increased human presence on foot or equipment. Most inspections and minor repairs would be confined to paved maintenance and access roads. Impacts to native vegetation and wildlife, therefore, would be minimal and are not expected to be significant.

5.5.2.3 Phase 4

Soil Cement Alternative (Preferred Alternative, Alternative 1)

Vegetation Communities

Permanent impacts. The above-ground (exposed) portion of the new soil cement structure proposed under the Phase 4 Soil Cement Alternative, areas where no vegetation will be planted or could establish

itself, would not result in new permanent impacts because the proposed new protection structure would replace existing protection; net permanent impacts would be zero. However; similar to Phases 5A and 5B, permanent impacts would occur from the back-filled portion along the extended toe of the new structure. Although vegetation can be planted and establish itself on the buried portion of the new soil cement structure, permanent impacts occur where the buried toe of the new soil cement structure goes deeper and further out into the floodplain, and where a significant scour event could remove overlying soils exposing the buried toe. As a result, permanent impacts associated with the new soil cement structure were calculated only for that portion of the buried toe that extends beyond the toe of the existing structure. For the soil cement structure, the distance between the existing toe and the toe of the soil cement structure proposed under the Soil Cement Alternative is determined to be 30 feet. Additional permanent impacts under Phase 4 include the permanent maintenance road that will be installed along the soil cement structure through both the Phase 4 and Phase 3 measures. Permanent impacts associated with the Phase 4 Soil Cement Alternative are primarily to the Developed classification (i.e., Disturbed or Barren) (see Figures 5.5-3a-d).

Temporary impacts. Temporary impacts were calculated by subtracting permanent impact acreages from total TCE acreages for each measure. The Phase 4 staging area occurs within the TCE and is included under temporary impact acreages. Temporary impacts associated with the Phase 4 Soil Cement Alternative occur primarily to the Developed classification (see Figure 5.5-3a-d). Due to the preliminary nature of this alternative's design, Freshwater March habitat coincides with the TCE in the eastern portion of the site (Figure 5.5-3b); however, future implementation of this alternative will not encroach into this habitat and temporary impacts to Freshwater Marsh habitat are not anticipated. Additionally the repair of erosion areas on State Parks property that will be restored by the contractor under Phase 4, are not included in temporary impact calculations for this measure, which are used to determine mitigation requirements. The gully repair work is considered mitigation for previous Phase 2B impacts, and as such does not require additional mitigation.

Similar to Phases 5A and 5B, temporary impacts would occur during the removal of vegetation and during ground-disturbing construction activities, including grading and excavating, and from increased human presence, vehicle traffic, and noise. Other temporary impacts to vegetation communities could include alterations in existing topography and hydrology regimes (until construction areas are restored), the accumulation of fugitive dust, disruptions to native seed banks from ground disturbance, and the colonization of nonnative/invasive plant species. Implementation of BMPs such as silt fences or berms to control runoff, and the restoration of temporarily disturbed areas with native vegetation would avoid and minimize other indirect effects, including an increase in the amount of compacted or modified surface that may increase the potential for forceful surface runoff, increased erosion, and potential destruction of intact vegetation outside the permanent impact footprints.

Permanent and temporary impacts associated with implementation of the Phase 4 Soil Cement Alternative are presented in Table 5.5-9 below. Within the Phase 4 work area, the Soil Cement Alternative would entail 6.33 acres of permanent impacts associated with the proposed soil cement

structure and maintenance road; and 11.42 acres of temporary impacts associated with the TCE/staging area.

Table 5.5-9. Phase 4-Soil Cement Alternative: Permanent and Temporary Impacts

Vegetation Communities and Classifications	Permanent Impacts (acres)	Temporary Impacts (acres)
Riparian		
TOTAL RIPARIAN	**0.1**	**2.97**
Upland		
TOTAL UPLAND	**4.05**	**5.96**
Developed		
TOTAL DEVELOPED	**2.18**	**2.49**
TOTAL	**6.33**	**11.42**

Note: Detailed acreage impacts based on vegetation communities or other cover types were included in the draft SEA/EIR Addendum. Updated GIS shows only consolidated acreages for the final SEA/EIR Addendum.

Mitigation Measures for Impacts to Vegetation Communities

As presented in Chapter 5.5.2.1 (Phase 5A), the 2001 SEIS/EIR included a series of mitigation measures that would be implemented for Reach 9 elements of the SARMP to compensate for impacts to vegetation communities. These include measures to mitigate for temporary and permanent effects to aquatic, riparian, and upland habitats, such as BR-17A,which would minimize project grading activities, which feasibly would maintain existing root systems; BR-18, which would remove giant reed and other non-native vegetation from areas upstream of Reach 9 as mitigation for temporary impacts; BR-18A, BR-18B, BR-26B, and BR-26C, which require the restoration and maintenance of native habitats that are temporarily disturbed during project construction activities; BR-18C, which would provide compensation through creation or restoration of riparian habitat for each acre of habitat permanently affected by project construction; BR-20, which would limit vegetation removal to designated areas; BR-24, which would provide monitoring for signs of plant stress to riparian vegetation; and BR-26A, which requires hydroseeding with local native shrubs and ground cover species in upland areas disturbed by project activities. BR-18, BR-18B and BR-18C have since been modified through a 2012 Biological Opinion Amendment which adjusts the methods and mitigation ratios for off-site habitat restoration, as discussed below. As a result, these commitments have been combined into one commitment, BR-18, as presented in Chapter 5.5.3 below. EC-BR-5, from the 2011 SEA for Reach 9, Phase 2A, has also been added to this document to ensure compliance with all mitigation measures and environmental commitments during construction activities. These measures would reduce the effects of the proposed action by reducing impacts and fully restoring native plant communities on-site after construction is complete, and by providing adequate compensation by restoring native vegetation upstream of the project area. A full list of approved mitigation measures and environmental commitments can be found in Chapter 6 of this document. Adherence to identified mitigation measures and environmental commitments would reduce impacts to vegetation communities to less than significant levels.

Mitigation Ratios for Impacts to Vegetation Communities

As discussed in Chapter 5.5.2.1, mitigation measure BR-18 requires the Corps and non-federal sponsors to remove arundo (and other non-native invasive vegetation) from the watershed and restore riparian habitat to compensate for permanent and temporary impacts to vegetation communities. Mitigation requirements for the Phase 4 Soil Cement Alternative, based on the anticipated permanent and temporary impacts noted in Table 5.5-9, are presented in Table 5.5-10 below. Mitigation for the Soil Cement Alternative would include the removal of 15.62 acres of non-native invasives if it is determined that requirements of a 1:1 ratio can be met, or 21.56 acres if a 3:1 ratio is selected. Mitigation would be implemented prior to or during construction of each Reach 9 measure.

Table 5.5-10. Phase 4-Soil Cement (Preferred Alternative) Mitigation Requirements

Vegetation Communities and Classifications	**Permanent Impacts (ac)**	**Mitigation acreage for Perm Impacts**	**Temporary Impacts (ac)**	**Mitigation acreage for Temp Impacts**
Riparian[1]	0.1	0.5	2.97	2.97/8.91
Upland[2]	4.05	12.15	5.96	NA
Developed	2.18	NA	2.49	NA
Total Mitigation		12.65		2.97/8.91
Total Mitigation Required Using 1:1 Ratio for Temp Impacts = 15.62 acres **Total Mitigation Required Using 3:1 Ratio for Temp Impacts = 21.56 acres**				

[1] Mitigation acreages based on 5:1 ratio for permanent impacts and 1:1/3:1 for temporary impacts.

[2] Mitigation acreages based on 3:1 ratio for permanent impacts. Temporary impacts are restored on-site.

Habitat Management Plan

As presented in Chapter 5.5.2.1, measures from the 2001 SEIS/EIR (as well as commitments from the 1988 SEIS) required completion of a HMP for Reach 9, public ownership of the entire floodplain between Prado Dam and Weir Canyon Road, and management of this area in a manner that maintains or enhances existing riparian habitat acreages and wildlife values. While the Phase 4 Soil Cement Alternative and other Reach 9 measures will result in permanent encroachments into the HMP, most of this encroachment consists of buried structure that will be backfilled and re-vegetated, and would only be exposed if and when future high flows result in bed degradation and shifting of the active river channel. Moreover, habitat values will be fully mitigated.

Noxious and Invasive Plants

As discussed in Chapter 5.5.2.1, areas temporarily impacted during construction will be fully restored and monitored for at least 5 years to ensure non-native vegetation does not return or establish itself over time. Measures to reduce the effects of exotic weeds on natural plant communities would also be the same for the Phase 4 Soil Cement Alternative as those presented in Chapter 5.5.2.1. The Corps would implement mitigation measures provided in the 2001 SEIS/EIR, along with environmental commitments prepared as part of this document, to reduce the effects of the proposed alternatives by

reducing the potential spread and colonization of weedy species and by restoring native plant communities at the conclusion of construction. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. Adherence to identified mitigation measures and environmental commitments would reduce impacts to vegetation communities to less than significant.

Special-Status Plant Species

Similar to the Phase 5A Grouted Stone and Sheet Pile Alternative (Preferred Alternative) discussed in Chapter 5.5.2.1, no plant species federally or State-listed as threatened or endangered under their respective Endangered Species Acts were observed during surveys conducted for this project. However, implementation of the Phase 5B Grouted Stone and Sheet Pile Alternative and other Reach 9 measures could result in both direct and indirect effects to special-status plant species, if present, within their respective project areas. Direct impacts to special-status plants would occur as a result of the removal of plants during clearing and grubbing to prepare the sites, while indirect impacts could occur from the accumulation of fugitive dust related to project construction, the introduction and proliferation of non-native invasive plants, and increased soil compaction, erosion, and sedimentation. However, with implementation of mitigation measures, it is not anticipated that project activities will impact rare plants, resulting in impacts that would be less than significant.

Operational effects could occur during routine inspection and maintenance of project components. These impacts could include trampling or crushing of special-status plant species, should they occur, by vehicular or foot traffic, alterations in topography and hydrology, increased erosion and sedimentation, and the introduction of non-native, invasive plants. However, routine maintenance will be conducted from paved access roads and activities would not encroach into adjacent habitats that may contain undisturbed habitat potentially suitable for special status plants.

Oak Trees

No coast live oak trees where identified within the Phase 4 Soil Cement Alternative. However, should coast live oak trees be identified during project implementation, where possible, project related activities will be conducted outside of the drip line of oak trees. The use of BMP such as silt curtains or berms to control runoff, and the restoration of temporarily disturbed areas would minimize and mitigate potential indirect impacts to coast live oaks, including alterations to topography, erosion, and sedimentation if runoff through the project area is not controlled. Impacts could also occur during routine inspection and maintenance of Reach 9 measures; however with implementation of BMP, impacts will be minimized and avoided.

Mitigation Measures for Impacts to Special-Status Plant Species

The 2001 SEIS/EIR included a series of mitigation measures applicable to Reach 9 measures that would be implemented to compensate for impacts to special-status plant species. As discussed in Chapter 5.5.2.1, construction-related mitigation measures from the 2001 SEIS/EIR and additional commitments developed for this document will be implemented to reduce potential impacts to special status plants. A

full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. Adherence to identified mitigation measures and environmental commitments would reduce impacts to special-status plants to less than significant levels.

Mitigation measures and environmental commitments would also be implemented to compensate for potential impacts to coast live oaks present within the Reach 9 measures. These would include EC-BR3, which requires worker training; and EC-BR-6, which requires replacement of all removed oaks at a 4:1 ratio. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. Adherence to identified mitigation measures and environmental commitments would reduce impacts to oak trees and oak woodlands to less than significant levels.

Special-Status Wildlife Species

As presented in Chapter 5.5.2.1, a total of 4 special-status wildlife species were detected during April 2014 surveys of the Reach 9 measure areas, including least Bell's vireo (Phases 5A, 5B, and 4), yellow warbler (Phases 5A, 5B, and BNSF Bridge), yellow-breasted chat (Phase 5B), and Cooper's hawk (Phase 5A), all of which could occur in all Reach 9 measure areas. Direct and indirect impacts to wildlife under the Phase 4 Soil Cement Alternative would be similar to those discussed for the Phase 5A Grouted Stone and Sheet Pile Alternative in Chapter 5.5.2.1 and the Phase 5B Grouted Stone and Sheet Pile Alternative discussed in Chapter 5.5.2.2. As a result, the mitigation measures and environmental commitments previously discussed in Chapter 5.5.2.1 would also apply to the Phase 4 Soil Cement Alternative. The full list of mitigation measures and environmental commitments to be implemented under Phase 4 can be found in Chapter 6 of this document. Implementation of these mitigation measures and environmental commitments will result in less than significant impacts to wildlife. The federally and state-listed species and California Fully Protected species discussed previously in Chapter 5.5.2.1, are further discussed in relation to the Phase 4 Soil Cement Alternative below.

Santa Ana Sucker

Designated critical habitat for the species occurs within the Phase 4 Soil Cement Alternative, as is shown in Figure 5.5-6b; however implementation of this alternative would not impact aquatic habitats suitable for sucker. Temporary impacts (11.18 acres) and permanent impacts (5.09 acres) to critical habitat will occur in upland areas of the Santa Ana River floodplain, outside the current alignment of the low flow channel, and will be restored with native riparian or upland scrub vegetation in appropriate areas. As a result, substantial impacts to suckers and their designated critical habitat would not occur.

Southwestern Willow Flycatcher

As presented in Chapter 5.5.2.1, southwestern willow flycatcher has not been identified in Reach 9 since SAWA began conducting surveys in 2001. Due to the narrow breadth of riparian corridors through the Reach 9 measures and combined with a narrow or absent buffer, and proximity to human development, the Reach 9 measures do not support suitable breeding habitat. Therefore, there is low potential for this species to occur in the Phase 4 Soil Cement Alternative and other Reach 9 measure areas as a transient.

Since suitable breeding and nesting habitat for southwestern willow flycatcher does not occur within the Phase 4 Soil Cement Alternative, and continuing surveys by SAWA have not identified any resident or nesting individuals or home ranges within the area of the measures, the alternatives associated with the Reach 9 measures are not expected to result in adverse direct, indirect, or operational impacts to breeding or nesting flycatcher individuals.

While the southwestern willow flycatcher has not been observed within Reach 9 in over a decade, the adoption of the mitigation measures described in Chapter 5.5.2.1 would further reduce the possibility of any impact from implementation of the Reach 9 measures on the species. Therefore, there is expected to be no effect to this species from the proposed Phase 4 Soil Cement Alternative. Critical habitat for the species does not coincide with the Reach 9 measures, so there would be no adverse modification to designated critical habitat for the species.

Coastal California Gnatcatcher

As discussed in Chapter 5.5.2.1, no coastal California gnatcatchers were observed during surveys performed in 2014 within the Phase 4 Soil Cement Alternative and other Reach 9 measure areas. Designated critical habitat for the species does, however, coincide with most of Phase 4 (Figure 5.5-6d). Under the Phase 4 Soil Cement Alternative, no permanent or temporary impacts to habitat preferred by this species (i.e., Sagebrush Scrub) would occur (see Table 5.5-9). Although limited, the presence of suitable habitat and known individuals within the vicinity of the Phase 4 Soil Cement Alternative and the other Reach 9 measures results in a moderate potential for this species to occur.

Direct impacts could include disruption of breeding activity in adjacent habitats due to increased noise, fugitive dust, and activities associated with construction. Indirect impacts could include the degradation of habitat due to the potential introduction and colonization of invasive weeds that could serve to out-compete habitat preferred by the gnatcatcher. Impacts to the species during routine inspections and maintenance are expected to be negligible, since tasks would be confined to the new protection structures themselves, which are not immediately adjacent to gnatcatcher habitat, and maintenance roads.

Environmental commitments detailed in the 2001 SEIS/EIR and other SARMP documents are relevant to address potential effects to gnatcatcher. These include measures to compensate for permanent and temporary effects to Upland habitats gnatcatchers may occupy. Commitments include BR-17, which requires vegetation clearing to be conducted outside of the known nesting season and BR-18, which requires restoration of temporary impact areas. According to the 2001 SEIS/EIR and 2001 BO, a number of substantive measures would be implemented to minimize potential noise and vibration effects as a result of project construction activities. As stated in the 2001 BO, these measures were intended to ensure that: (1) noise does not exceed 60 dBA within occupied vireo habitat; or, (2) noise does not exceed 5 dBA above ambient conditions if said levels are above 60 dBA. In order to comply with noise requirements addressed in the 2001 BO, mitigation measure BR-21, which requires the installation of noise barriers between construction areas and riparian habitat where necessary and feasible; it is anticipated that barriers would be installed along the TCE. Barriers may not be installed if it is

determined that the additional footprint required would result in a greater impact to adjacent nesting territories than the construction noise itself. Additional mitigation measures from the 2001 SEIS/EIR and project BO's and environmental commitments developed for this document that would be implemented to further avoid and/or minimize impacts to the gnatcatcher include EC-AQ-2, which requires the implementation of techniques to control fugitive dust; EC-BR-3, which requires worker training; and, EC-BR-5, which ensures compliance with all mitigation measures and environmental commitments during construction activities. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. Implementation of these mitigation measures and environmental commitments are designed to ensure that project effect on the species is as minimal as possible and feasible.

With implementation of these avoidance and minimization measures, the proposed Phase 4 Soil Cement Alternative may affect, but not likely to adversely affect the coastal California gnatcatcher. Designated critical habitat for the species occurs within the Phase 4 Soil Cement Alternative (see Figure 5.5-6d) and as a result adverse modification to critical habitat would occur under this alternative. Temporary and permanent impacts to critical habitat are identified as 16.6 acres and 6.22 acres, respectively. However, upon implementation of measures to mitigate and minimize impacts to scrub habitat preferred by this species, modifications to critical habitat would be temporary in nature and decreased to a less than significant level.

Least Bell's Vireo

As presented in Chapter 5.5.2.1, it is anticipated that implementation of the Phase 4 Soil Cement Alternative would result in temporary displacement of five vireo territories occurring within the APE of this alternative, as presented in Table and depicted in Figures 5.5-7c and 5.5-7d.

As documented in the 2001 SEIS/EIR, implementation of Reach 9 measures would result in direct and indirect impacts to nesting least Bell's vireo individuals and habitat occurring in Reach 9. As depicted in Figure 5.5-7c and Figure 5.5-7d, one vireo territory coincides with the Phase 4 Soil Cement Alternative's TCE, resulting in a temporary disturbance to this territory. Direct impacts to least Bell's vireo would also include the permanent removal of suitable habitat (general scale Riparian classification); Table 5.5-7 indicates that 7.72 acres of Riparian habitat would be permanently impacted. Although quantified and mitigated as a permanent impact, this area would be buried and would only be exposed if high flows erode backfill and expose the buried toe. Until then, "permanently" impacted areas are expected to support riparian or other native habitat. Temporary impacts to Riparian habitat would also directly impact vireo. Table 5.5-7 indicates that 19.82 acres of Riparian habitat would be temporarily impacted by implementation of the Phase 5B Grouted Stone and Sheet Pile Alternative.

Additional direct impacts to least Bell's vireo could include disruption of breeding activity in adjacent, undisturbed habitat due to increased fugitive dust, noise, and human presence associated with construction activities. Such disturbances can result in the incidental loss of fertile eggs or nestlings, or otherwise lead to nest abandonment. Additionally, birds use their sense of hearing to locate their young

and mates, to establish and defend territories, and to locate and evade predators (Scherzinger, 1970). As a result, vireo pairs that nest within the area of potential effect could be adversely affected in the absence of specific measures to abate noise and fugitive dust during construction. Based on observations of vireos that nested successfully within and adjacent to other SARMP measures in the vicinity (including the Corps' Sewage Treatment Plant dike, Prado Embankment and Reach 9, Phase 2B projects), it is anticipated that most of the nesting locations outside of the direct project footprint will continue to support vireos during and after construction. As discussed further below, sound levels will be monitored and sound walls or other barricades will be constructed if necessary to reduce indirect impacts to birds outside of the construction area. However, for the purposes of this evaluation, it is anticipated that implementation of the Phase 4 Soil Cement Alternative could potentially result in take of the five vireo territories that occur within the 200-foot buffer (see Figures 5.5-7c and 5.5-7d), for a total project take of six vireo territories. The Corps will consult with USFWS prior to construction of Phase 4 to obtain an amended or new BO that would authorize additional "take" of least Bell's vireo.

As described in Chapter 5.5.2.1, the range of potential effects to least Bell's vireo associated with the proposed action are similar to those that have been contemplated previously in the 2001 SEIS/EIR, and 2001 BO and its 2012 and 2013 amendments. These documents included a series of mitigation measures that would also be implemented during construction of the currently proposed features to compensate for impacts to least Bell's vireo. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. With the implementation of these avoidance and minimization measures, the proposed project is not likely to jeopardize the continued existence of the least Bell's vireo. Designated critical habitat for the species does not occur within the project area, consequently there will be no adverse modification to designated critical habitat.

Golden Eagle, Bald Eagle, Swainson's Hawk, and White-Tailed Kite

As presented in Chapter 5.5.2.1, none of these species were identified in the Reach 9 measure areas during the April 2014 surveys; however, each are known to occur in the region and have the potential to occur within the Reach 9 measure areas. To further ensure that impacts to golden eagle, bald eagle, Swainson's hawk, and white-tailed kite are minimized and/or avoided, the mitigation measures provided in the 2001 SEIS/EIR and environmental commitments developed for these species, as presented in Chapter 5.5.2.1, would be implemented. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. Implementation of these mitigation measures and environmental commitments will result in less than significant impacts to golden eagle, bald eagle, Swainson's hawk, and white-tailed kite, should they occur.

Wildlife Movement

As part of the SARMP, the Corps is required to maintain wildlife movement and habitat connectivity commensurate with baseline conditions. Specific design features to facilitate wildlife movement were developed for Reach 9, Phase 3 during project design. Measures EC-BR-11 requires construction activities take place during day time hours to reduce potential direct and indirect impacts to wildlife movement, and EC-BR-13 requires that switchback ramps be incorporated into the embankment to

facilitate wildlife movement into and out of Phase 4 as wildlife transitions between 60-inch culverts being altered by Phase 4, and the floodplain. The full measures can be found in Chapter 6 of this document. Implementation of these measures would result in less than significant impacts to wildlife movement.

Grouted Stone Alternative (Alternative 2)

Permanent impacts. The above-ground (exposed) portion of the Grouted Stone Alternative proposed under Phase 4, areas where no vegetation will be planted or could establish itself, would not result in new permanent impacts because the proposed new protection structure would replace existing protection; net permanent impacts would be zero. However; similar to Phases 5A and 5B, permanent impacts would occur from the back-filled portion along the extended toe of the new structure. Although vegetation can be planted and establish itself on the buried portion of the grouted stone structure, permanent impacts occur where the buried toe of the new soil cement structure goes deeper and further out into the floodplain, and where a significant scour event could remove overlying soils exposing the buried toe. As a result, permanent impacts associated with the new soil cement structure were calculated only for that portion of the buried toe that extends beyond the toe of the existing structure. For the grouted stone structure (Alternative 2) along Phase 4, the distance between the existing toe and the toe of grouted stone proposed under the Preferred Alternative is determined to be 50 feet. Permanent impacts associated with the Phase 4 Soil Cement Alternative are primarily to the Developed classification (i.e., Disturbed or Barren) (see Figures 5.5-3e and d).

Temporary impacts. Temporary impacts were calculated by subtracting permanent impact acreages from total TCE acreages for each measure. The Phase 4 staging area occurs within the TCE and is included under temporary impact acreages. Temporary impacts associated with the Phase 4 Soil Cement Alternative occur primarily to the Developed classification (i.e., Disturbed or Barren) (see Figures 5.5-3e and d). Due to the preliminary nature of this alternative's design, Freshwater Marsh habitat coincides with the TCE in the eastern portion project (Figure 5.2-3d); however, future implementation of this alternative will not encroach into this habitat and temporary impacts to Freshwater Marsh habitat are not anticipated.

Similar to Phases 5A and 5B, temporary impacts would occur during the removal of vegetation and during ground-disturbing construction activities, including grading and excavating, and from increased human presence, vehicle traffic, and noise. Other temporary impacts to vegetation communities could include alterations in existing topography and hydrology regimes (until construction areas are restored), the accumulation of fugitive dust, disruptions to native seed banks from ground disturbance, and the colonization of nonnative/invasive plant species. Implementation of BMPs such as silt fences or berms to control runoff, and the restoration of temporarily disturbed areas with native vegetation would avoid and minimize other indirect effects, including an increase in the amount of compacted or modified surface that may increase the potential for forceful surface runoff, increased erosion, and potential destruction of intact vegetation outside the permanent impact footprints.

Permanent and temporary impacts associated with the Phase 4 Grouted Stone Alternative are presented in Table 5.5-11 below. Within the Phase 4 work area, the Grouted Stone Alternative would entail 6.50 acres of permanent impacts associated with the proposed grouted stone structure (4.35 acres) and the permanent maintenance road (2.15 acres); and 22.10 acres of temporary impacts associated with the TCE/staging area.

Mitigation Measures for Impacts to Vegetation Communities

As presented in Chapter 5.5.2.1 (Phase 5A), the 2001 SEIS/EIR included a series of mitigation measures that would be implemented for Reach 9 elements of the SARMP to compensate for impacts to vegetation communities. These include measures to mitigate for temporary and permanent effects to aquatic, riparian, and upland habitats, such as BR-17A,which would minimize project grading activities, which feasibly would maintain existing root systems; BR-18, which would remove giant reed and other non-native vegetation from areas upstream of Reach 9 as mitigation for temporary impacts; BR-18A,

Table 5.5-11. Phase 4-Grouted Stone Alternative: Permanent and Temporary Impacts

Vegetation Communities and Classifications	Permanent Impacts (acres)	Temporary Impacts (acres)
Riparian		
TOTAL RIPARIAN	**0.55**	**3.19**
Upland		
TOTAL UPLAND	**0.59**	**5.68**
Developed		
TOTAL DEVELOPED	**5.36**	**13.23**
TOTAL	**6.50**	**22.10**

Note: Detailed acreage impacts based on vegetation communities or other cover types were included in the draft SEA/EIR Addendum. Updated GIS shows only consolidated acreages for the final SEA/EIR Addendum.

BR-18B, BR-26B, and BR-26C, which require the restoration and maintenance of native habitats that are temporarily disturbed during project construction activities; BR-18C, which would provide compensation through creation or restoration of riparian habitat for each acre of habitat permanently affected by project construction; BR-20, which would limit vegetation removal to designated areas; BR-24, which would provide monitoring for signs of plant stress to riparian vegetation; and BR-26A, which requires hydroseeding with local native shrubs and ground cover species in upland areas disturbed by project activities. BR-18, BR-18B and BR-18C have since been modified through a 2012 Biological Opinion Amendment which adjusts the methods and mitigation ratios for off-site habitat restoration, as discussed below. As a result, these commitments have been combined into one commitment, BR-18, as presented in Chapter 5.5.3 below. EC-BR-5, from the 2011 SEA for Reach 9, Phase 2A, has also been added to this document to ensure compliance with all mitigation measures and environmental commitments during construction activities. These measures would reduce the effects of the proposed action by reducing impacts and fully restoring native plant communities on-site after construction is complete, and by providing adequate compensation by restoring native vegetation upstream of the project area. A full list of approved mitigation measures and environmental commitments can be found

in Chapter 6 of this document. Adherence to identified mitigation measures and environmental commitments would reduce impacts to vegetation communities to less than significant levels.

Mitigation Ratios for Impacts to Vegetation Communities

As discussed in Chapter 5.5.2.1, mitigation measure BR-18 requires the Corps and non-federal sponsors to remove arundo (and other non-native invasive vegetation) from the watershed and restore riparian habitat to compensate for permanent and temporary impacts to vegetation communities. Mitigation requirements for Phase 4 Grouted Stone Alternative, based on the anticipated permanent and temporary impacts noted in Table 5.5-11, are presented in Table 5.5-12 below. Mitigation for the Grouted Stone Alternative would include the removal of 7.71 acres of non-native invasives if it is determined that requirements of a 1:1 ratio can be met, or 14.09 acres if a 3:1 ratio is selected. Mitigation would be implemented prior to or during construction of each Reach 9 measure.

Table 5.5-12. Phase 4-Grouted Stone (Alternative 2) Mitigation Requirements

Vegetation Communities and Classifications	**Permanent Impacts (ac)**	**Mitigation acreage for Perm Impacts**	**Temporary Impacts (ac)**	**Mitigation acreage for Temp Impacts**
Riparian[1]	0.55	2.75	3.19	3.19/9.57
Upland[2]	0.59	1.77	5.68	NA
Developed	5.36	NA	13.23	NA
Total Mitigation		4.52		3.19/9.57
Total Mitigation Required Using 1:1 Ratio for Temp Impacts = 7.71 acres **Total Mitigation Required Using 3:1 Ratio for Temp Impacts = 14.09 acres**				

[1] Mitigation acreages based on 5:1 ratio for permanent impacts and 1:1/3:1 for temporary impacts.

[2] Mitigation acreages based on 3:1 ratio for permanent impacts. Temporary impacts are restored on-site.

Habitat Management Plan

As presented in Chapter 5.5.2.1, measures from the 2001 SEIS/EIR (as well as commitments from the 1988 SEIS) required completion of a HMP for Reach 9, public ownership of the entire floodplain between Prado Dam and Weir Canyon Road, and management of this area in a manner that maintains or enhances existing riparian habitat acreages and wildlife values. While the Phase 4 Grouted Stone Alternative and other Reach 9 measures will result in permanent encroachments into the HMP, most of this encroachment consists of buried structure that will be backfilled and re-vegetated, and would only be exposed if and when future high flows result in bed degradation and shifting of the active river channel. Moreover, habitat values will be fully mitigated.

Noxious and Invasive Plants

As discussed in Chapter 5.5.2.1, areas temporarily impacted during construction will be fully restored and monitored for at least 5 years to ensure non-native vegetation does not return or establish itself over time. Measures to reduce the effects of exotic weeds on natural plant communities would also be the same for the Phase 4 Soil Cement Alternative as those presented in Chapter 5.5.2.1. The Corps

would implement mitigation measures provided in the 2001 SEIS/EIR, along with environmental commitments prepared as part of this document, to reduce the effects of the proposed alternatives by reducing the potential spread and colonization of weedy species and by restoring native plant communities at the conclusion of construction. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. Adherence to identified mitigation measures and environmental commitments would reduce impacts to vegetation communities to less than significant.

Special-Status Plant Species

Similar to the Phase 5A Grouted Stone and Sheet Pile Alternative discussed in Chapter 5.5.2.1, no plant species federally or State-listed as threatened or endangered under their respective Endangered Species Acts were observed during surveys conducted for this project. However, implementation of the Phase 4 Grouted Stone Alternative and other Reach 9 measures could result in both direct and indirect effects to special-status plant species, if present, within their respective project areas. Direct impacts to special-status plants would occur as a result of the removal of plants during clearing and grubbing to prepare the sites, while indirect impacts could occur from the accumulation of fugitive dust related to project construction, the introduction and proliferation of non-native invasive plants, and increased soil compaction, erosion, and sedimentation. However, with implementation of mitigation measures, it is not anticipated that project activities will impact rare plants, resulting in impacts that would be less than significant.

Operational effects could occur during routine inspection and maintenance of project components. These impacts could include trampling or crushing of special-status plant species, should they occur, by vehicular or foot traffic, alterations in topography and hydrology, increased erosion and sedimentation, and the introduction of non-native, invasive plants. However, routine maintenance will be conducted from paved access roads and activities would not encroach into adjacent habitats that may contain undisturbed habitat potentially suitable for special status plants.

Oak Trees

No coast live oak trees where identified within Phase 4. However, should coast live oak trees be identified during project implementation, BMP would be implemented to minimize and avoid direct and indirect impacts to the species.

Mitigation Measures for Impacts to Special-Status Plant Species

The 2001 SEIS/EIR included a series of mitigation measures applicable to Reach 9 measures that would be implemented to compensate for impacts to special-status plant species. As discussed in Chapter 5.5.2.1, construction-related mitigation measures from the 2001 SEIS/EIR and additional commitments developed for this document will be implemented to reduce potential impacts to special status plants. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. Adherence to identified mitigation measures and environmental commitments would reduce impacts to special-status plants to less than significant levels.

Mitigation measures and environmental commitments would also be implemented to compensate for potential impacts to coast live oaks present within the Reach 9 measures. These would include EC-BR3, which requires worker training; and EC-BR-6, which requires replacement of all removed oaks at a 4:1 ratio. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. Adherence to identified mitigation measures and environmental commitments would reduce impacts to oak trees and oak woodlands to less than significant levels.

Special-Status Wildlife Species

As presented in Chapter 5.5.2.1, a total of 4 special-status wildlife species were detected during April 2014 surveys of the Reach 9 measure areas, including least Bell's vireo (Phases 5A, 5B, and 4), yellow warbler (Phases 5A, 5B, and BNSF Bridge), yellow-breasted chat (Phase 5B), and Cooper's hawk (Phase 5A), all of which could occur in all Reach 9 measure areas. Direct and indirect impacts to wildlife (i.e., Santa Ana sucker, southwestern willow flycatcher, and coastal California gnatcatcher) under the Phase 4 Grouted Stone Alternative would be similar to those discussed for the Phase 4 Soil Cement Alternative above; only least Bell's vireo will be discussed further. As a result, the mitigation measures and environmental commitments previously discussed in Chapter 5.5.2.1 would also apply to the Phase 4 Grouted Stone Alternative. The full list of mitigation measures and environmental commitments to be implemented under the Phase 4 Soil Cement Alternative can be found in Chapter 6 of this document. Implementation of these mitigation measures and environmental commitments will result in less than significant impacts to wildlife and wildlife movement under this alternative.

Least Bell's Vireo

As presented in Chapter 5.5.2.1, it is anticipated that implementation of Phase 4 would result in temporary displacement of five vireo territories occurring within the APE of this alternative, as presented in Table 5.5-6 and depicted in Figures 5.5-7c and 5.5-7d . Direct impacts to least Bell's vireo would also include the permanent removal of suitable habitat (general scale Riparian classification). Table 5.5-11 indicates that 0.55 acres of Riparian habitat would be permanently impacted. Although quantified and mitigated as a permanent impact, this area would be buried and would only be exposed if high flows erode backfill and expose the buried toe. Until then, permanently impacted areas are expected to support riparian or other native habitat. Temporary impacts to Riparian habitat would also directly impact vireo. Table 5.5.11 indicates that 3.19 acres of Riparian habitat would be temporarily impacted by implementation of the Phase 4 Grouted Stone Alternative. Similar to the Phase 4 Soil Cement Alternative, with the implementation of avoidance and minimization measures, the proposed project may adversely affect, but would not jeopardize the least Bell's vireo. Designated critical habitat for the species does not occur within the project area, consequently there will be no adverse modification to designated critical habitat.

<u>No Federal Action Alternative (Alternative 3)</u>

Under the Phase 4 No Federal Action Alternative, no disturbance from construction would occur and there would be no direct or indirect impacts to biological resources. However, future high volume

releases from Prado Dam could undermine and erode existing bank protection structures and threaten adjacent infrastructure. Periodic emergency repairs of existing protection may be required and would likely entail the discharge of rocks to stabilize the embankment and bridge piers and abutments. Placement of rock during emergency repair may require the use of heavy equipment and work within flowing water. Any emergency repair is expected to be localized, which would minimize its impact to biological resources to the extent possible. It is assumed that a biological monitor would be on site during the repairs to ensure implementation of avoidance and minimization measures and to document disturbances cause by the emergency action. If scour has produced a condition where existing structures are damaged or in danger of failing, it is presumable that stream side vegetation has been severely disturbed or even uprooted and washed away. After rock has been placed, voids between rocks would be capable of providing cover to native fish and insects while streamside plants recover.

Future Operations and Maintenance

Future maintenance activities associated with Phase 4 alternatives may include routine inspections and monitoring of project structures by access road, lowered ramp, or floating device, such as a raft or boat; mobilizing dump trucks and hydraulic excavators to haul and place stones in the river to protect project structures as necessary; periodic weeding, patching soil cement, and road maintenance; periodic clearing of debris around drainage structures; and, periodic repairs to fencing and gates.

Impacts related to maintenance activities of project structures could include trampling or crushing of vegetation by vehicular or foot traffic, alterations in topography and hydrology, increased erosion and sedimentation, and the introduction of non-native, invasive plants due to increased human presence on foot or equipment. Most inspections and minor repairs would be confined to paved maintenance and access roads. Impacts to native vegetation and wildlife, therefore, would be minimal and are not expected to be significant.

5.5.2.4 BNSF Bridge

Pier Noses and Abutment Protection Alternative (Alternative 1, Preferred Alternative)

Vegetation Communities

Permanent impacts. Under the BNSF Bridge Preferred Alternative, none of the new proposed bridge and bank protection features will replace existing features and as a result, the full extent of each permanent feature contributes to the total permanent impacts calculated for this measure. Permanent impacts under BNSF Bridge include the new pier nose extensions, sheet pile enclosure walls, sheet pile walls, grouted stone structures, storm drains, and a new paved road proposed on the east side of the SAR (Figure 4.4-1). Pavement proposed to restore a golf cart path off the west bank will be impacted by project activities; however, it was not included in permanent impact calculations, since it will be a replacement of existing pavement. Permanent impacts associated with the BNSF Bridge Preferred Alternative are primarily to the Developed classification (i.e., Disturbed or Barren) (see Figure 5.5-4).

Temporary impacts. Temporary impacts were calculated by subtracting permanent impact acreages from total TCE acreages for each measure. Staging will occur throughout the TCE; no staging areas were identified outside the BNSF Bridge TCE. Temporary impacts associated with the BNSF Bridge Preferred Alternative occur primarily to the Developed classification (i.e., Ornamental/Landscape and Disturbed or Barren) (see Figure 5.5-4).

Similar to Phases 5A, 5B, and 4, temporary impacts would occur during the removal of vegetation and during ground-disturbing construction activities, including grading and excavating, and from increased human presence, vehicle traffic, and noise. Other temporary impacts to vegetation communities could include alterations in existing topography and hydrology regimes (until construction areas are restored), the accumulation of fugitive dust, disruptions to native seed banks from ground disturbance, and the colonization of nonnative/invasive plant species. Implementation of BMPs such as silt fences or berms to control runoff, and the restoration of temporarily disturbed areas with native vegetation would avoid and minimize other indirect effects, including an increase in the amount of compacted or modified surface that may increase the potential for forceful surface runoff, increased erosion, and potential destruction of intact vegetation outside the permanent impact footprints.

Permanent and temporary impacts associated with implementation of the BNSF Bridge Preferred Alternative are presented in Table 5.5-13 below. Within the BNSF Bridge work area, the Preferred Alternative would entail 2.67 acres of permanent impacts and 18.02 acres of temporary impacts associated with the TCE/staging area.

Table 5.5-13. BNSF Bridge Pier and Abutment Protection Alternative: Permanent and Temporary Impacts

Vegetation Communities and Classifications	**Permanent Impacts (acres)**	**Temporary Impacts (acres)**
Waters		
Perennial Stream	**0.28**	**0.94**
Riparian		
TOTAL RIPARIAN	**0.63**	**3.58**
Upland		
TOTAL UPLAND	**0.94**	**3.73**
Developed		
TOTAL DEVELOPED	**0.82**	**9.77**
TOTAL	**2.67**	**18.02**

Note: Detailed acreage impacts based on vegetative or other community types were included in the draft SEA/EIR Addendum. Updated GIS shows only consolidated acreages for the final SEA/EIR Addendum.

[1] BNSF Bridge protection features include: pier nose extension walls, pier enclosure walls, concrete walls, grouted stone, and concrete pavement

Mitigation Measures for Impacts to Vegetation Communities

As presented in Chapter 5.5.2.1 (Phase 5A), the 2001 SEIS/EIR included a series of mitigation measures that would be implemented for Reach 9 elements of the SARMP to compensate for impacts to vegetation communities. These include measures to mitigate for temporary and permanent effects to aquatic, riparian, and upland habitats, such as BR-17A,which would minimize project grading activities, which feasibly would maintain existing root systems; BR-18, which would remove giant reed and other non-native vegetation from areas upstream of Reach 9 as mitigation for temporary impacts; BR-18A, BR-18B, BR-26B, and BR-26C, which require the restoration and maintenance of native habitats that are temporarily disturbed during project construction activities; BR-18C, which would provide compensation through creation or restoration of riparian habitat for each acre of habitat permanently affected by project construction; BR-20, which would limit vegetation removal to designated areas; BR-24, which would provide monitoring for signs of plant stress to riparian vegetation; and BR-26A, which requires hydroseeding with local native shrubs and ground cover species in upland areas disturbed by project activities. BR-18, BR-18B and BR-18C have since been modified through a 2012 Biological Opinion Amendment which adjusts the methods and mitigation ratios for off-site habitat restoration, as discussed below. As a result, these commitments have been combined into one commitment, BR-18, as presented in Chapter 5.5.3 below. EC-BR-5, from the 2011 SEA for Reach 9, Phase 2A, has also been added to this document to ensure compliance with all mitigation measures and environmental commitments during construction activities. These measures would reduce the effects of the proposed action by reducing impacts and fully restoring native plant communities on-site after construction is complete, and by providing adequate compensation by restoring native vegetation upstream of the project area. A full list of approved mitigation measures and environmental commitments can be found in Chapter 6 of this document. Adherence to identified mitigation measures and environmental commitments would reduce impacts to vegetation communities to less than significant levels.

Mitigation Ratios for Impacts to Waters and Vegetation Communities

Mitigation for permanent and temporary impacts of the BNSF Bridge Preferred Alternative to Waters (i.e., Perennial Stream) would occur at a 1:1 ratio and involve stream creation or enhancement at a time and place to be determined. In addition, temporary impacted areas will be restored. Mitigation requirements for BNSF Bridge, based on the anticipated permanent and temporary impacts noted in Table 5.5-13, are presented in Table 5.5-14 below. Mitigation for BNSF Bridge would include 1.22 acres of stream creation or restoration to compensate for permanent (0.28 acre) and temporary (0.94 acre) impacts to stream habitat during construction of pier nose extensions and enclosure walls. Since mitigation acreages presented in Table 5.5-14 are for non-native invasive removal, the mitigation acreage for impacts to Waters is not included in the total in Table 5.5-14.

As discussed in Chapter 5.5.2.1, mitigation measure BR-18 requires the Corps and non-federal sponsors to remove arundo (and other non-native invasive vegetation) from the watershed and restore riparian habitat to compensate for permanent and temporary impacts to vegetation communities. Mitigation requirements for the BNSF Bridge Preferred Alternative, based on the anticipated permanent and temporary impacts noted in Table 5.5-13, are presented in Table 5.5-14 below. Mitigation for the

Preferred Alternative would include the removal of 9.55 acres of non-native invasives if it is determined that requirements of a 1:1 ratio can be met, or 16.71 acres if a 3:1 ratio is selected. Mitigation would be implemented prior to or during construction of each Reach 9 measure.

Table 5.5-14. BNSF Bridge Pier and Abutment Protection Alternative (Preferred Alternative) Mitigation Requirements

Waters and Vegetation Communities and Classifications	**Permanent Impacts (ac)**	**Mitigation acreage**	**Temporary Impacts (ac)**	**Mitigation acreage**
Waters[1]	0.28	0.28	0.94	0.94
Total Mitigation Required for Waters = 1.22 acres				
Riparian[2]	0.63	3.15	3.58	3.58/10.74
Upland[3]	0.94	2.82	3.73	NA
Developed	0.82	NA	9.77	NA
Total Vegetation Mitigation		5.97		3.53/10.74
Total Mitigation Required for Vegetation Using 1:1 Ratio for Temp Impacts =9.55 acres **Total Mitigation Required for Vegetation Using 3:1 Ratio for Temp Impacts = 16.71 acres**				

[1] Mitigation for permanent and temporary impacts to Waters will be mitigated at 1:1 through stream creation or enhancement.
[2] Mitigation acreages based on 5:1 ratio for permanent impacts and 1:1/3:1 for temporary impacts.
[3] Mitigation acreages based on 3:1 ratio for permanent impacts. Temporary impacted areas will be restored on-site.

Habitat Management Plan

As presented in Chapter 5.5.2.1, measures from the 2001 SEIS/EIR (as well as commitments from the 1988 SEIS) required completion of a HMP for Reach 9, public ownership of the entire floodplain between Prado Dam and Weir Canyon Road, and management of this area in a manner that maintains or enhances existing riparian habitat acreages and wildlife values. While the BNSF Bridge Preferred Alternative and other Reach 9 measures will result in permanent encroachments into the HMP, most of this encroachment consists of buried structure that will be backfilled and re-vegetated, and would only be exposed if and when future high flows result in bed degradation and shifting of the active river channel. Moreover, habitat values will be fully mitigated.

Noxious and Invasive Plants

As discussed in Chapter 5.5.2.1, areas temporarily impacted during construction will be fully restored and monitored for at least 5 years to ensure non-native vegetation does not return or establish itself over time. Measures to reduce the effects of exotic weeds on natural plant communities would also be the same for the BNSF Bridge Preferred Alternative as those presented in Chapter 5.5.2.1 for the Phase 5A Grouted Stone and Sheet Pile Alternative. The Corps would implement mitigation measures provided in the 2001 SEIS/EIR, along with environmental commitments prepared as part of this document, to reduce the effects of the proposed alternatives by reducing the potential spread and colonization of weedy species and by restoring native plant communities at the conclusion of construction. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document.

Adherence to identified mitigation measures and environmental commitments would reduce impacts to vegetation communities to less than significant.

Special-Status Plant Species

Similar to the Phase 5A Grouted Stone and Sheet Pile Alternative discussed in Chapter 5.5.2.1, no plant species federally or State-listed as threatened or endangered under their respective Endangered Species Acts were observed during surveys conducted for this project. However, implementation of the BNSF Bridge Preferred Alternative and other Reach 9 measures could result in both direct and indirect effects to special-status plant species, if present, within their respective project areas. Direct impacts to special-status plants would occur as a result of the removal of plants during clearing and grubbing to prepare the sites, while indirect impacts could occur from the accumulation of fugitive dust related to project construction, the introduction and proliferation of non-native invasive plants, and increased soil compaction, erosion, and sedimentation. However, with implementation of mitigation measures, it is not anticipated that project activities will impact rare plants, resulting in impacts that would be less than significant.

Operational effects could occur during routine inspection and maintenance of project components. These impacts could include trampling or crushing of special-status plant species, should they occur, by vehicular or foot traffic, alterations in topography and hydrology, increased erosion and sedimentation, and the introduction of non-native, invasive plants. However, routine maintenance will be conducted from paved access roads and activities would not encroach into adjacent habitats that may contain undisturbed habitat potentially suitable for special status plants.

Oak Trees

No coast live oak trees where identified within the BNSF Bridge Preferred Alternative. However, should coast live oak trees be identified during project implementation, where possible, project related activities will be conducted outside of the drip line of oak trees. The use of BMP such as silt curtains or berms to control runoff, and the restoration of temporarily disturbed areas would minimize and mitigate potential indirect impacts to coast live oaks, including alterations to topography, erosion, and sedimentation if runoff through the project area is not controlled. Impacts could also occur during routine inspection and maintenance of Reach 9 measures; however with implementation of BMP, impacts will be minimized and avoided.

Mitigation Measures for Impacts to Special-Status Plant Species

The 2001 SEIS/EIR included a series of mitigation measures applicable to Reach 9 measures that would be implemented to compensate for impacts to special-status plant species. As discussed in Chapter 5.5.2.1, construction-related mitigation measures from the 2001 SEIS/EIR and additional commitments developed for this document will be implemented to reduce potential impacts to special status plants. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. Adherence to identified mitigation measures and environmental commitments would reduce impacts to special-status plants to less than significant levels.

Mitigation measures and environmental commitments would also be implemented to compensate for potential impacts to coast live oaks present within the Reach 9 measures. These would include EC-BR3, which requires worker training; and EC-BR-6, which requires replacement of all removed oaks at a 4:1 ratio. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. Adherence to identified mitigation measures and environmental commitments would reduce impacts to oak trees and oak woodlands to less than significant levels.

Special-Status Wildlife Species

As presented in Chapter 5.5.2.1, a total of 4 special-status wildlife species were detected during April 2014 surveys of the Reach 9 measure areas, including least Bell's vireo (Phases 5A, 5B, and 4), yellow warbler (Phases 5A, 5B, and BNSF Bridge), yellow-breasted chat (Phase 5B), and Cooper's hawk (Phase 5A), which could all occur in any of the Reach 9 measure areas. Direct and indirect impacts to wildlife under the BNSF Bridge Preferred Alternative would be similar to those discussed for the Phase 5A Grouted Stone and Sheet Pile Alternative in Chapter 5.5.2.1. As a result, the mitigation measures and environmental commitments previously discussed in Chapter 5.5.2.1 would also apply to the BNSF Bridge Preferred Alternative. The full list of mitigation measures and environmental commitments to be implemented under BNSF Bridge can be found in Chapter 6 of this document. Implementation of these mitigation measures and environmental commitments will result in less than significant impacts to wildlife. The federally and state-listed species and California Fully Protected species discussed previously in Chapter 5.5.2.1, are further discussed in relation to the BNSF Bridge Preferred Alternative below.

Santa Ana Sucker

Construction of the BNSF Bridge Preferred Alternative would result in permanent and temporary impacts to sucker habitat (i.e., Perennial Streams). A total of 0.28 acres of Perennial Stream habitat would be permanently impacted by construction of pier protection, and 0.94 acres of this habitat would be temporarily impacted during implementation. Additionally, designated critical habitat for the species occurs within the BNSF Bridge Preferred Alternative, as shown in Figure 5.5-6c. 4.49 acres of temporary impacts and 0.34 acres of permanent impacts to critical habitat will occur in upland areas of the Santa Ana River floodplain, outside the current alignment of the low flow channel, and will be restored with native riparian or upland scrub vegetation in appropriate areas. 0.02 acres of temporary impacts and 0.94 acres of permanent impacts to critical habitat will occur in the perennial stream areas.

The control of water during installation of pier nose extension walls and sheet pile enclosure walls would require the contractor to divert water to facilitate construction activities at bridge piers Nos. 4 and 5, which occur within the active river channel. The specific method and location of the diversion will be proposed by the contractor and coordinated with USFWS.

Diversion activities would not occur during sucker spawning season unless otherwise coordinated with USFWS. Sucker spawning season generally occurs from late March to early July, with peak occurring in late May and June (USFWS, 2001; Greenfield et al. 1970; Swift 2001). Prior to diversion or dewatering of surface flows, including building of coffer dam and river management (diversion), a qualified biologist

would survey areas to be dewatered to identify potential locations where suckers may occur. This would allow the biologists to focus on areas of quality habitat when conducting monitoring for the species during surface flow dewatering activities. The qualified biologist(s) would actively monitor during any diversion or surface water dewatering activities to minimize the likelihood of stranding and direct interactions between construction equipment and suckers. No work would be conducted in the channel until it is confirmed that no suckers are present by a qualified biologist. Block nets and/or stakes, or other means, would be used to delineate areas that have been determined to be clear or suckers that are ready for further construction work. Non–native species would be removed from the system when encountered, an overall benefit to aquatic biota in the SAR.

Although the 2001 BO and 2012 and 2013 BO Amendments for Reach 9 do not include the Reach 9 measures analyzed in this document, there is a remaining incidental take balance of less than 4 suckers as a result of capture and relocation and less than 5 as a result of stranding. Should this remaining "take" (or any other amount) be applied to BNSF and if, during the course of dewatering or other construction activities, the biologist feels this amount of incidental take will be exceeded, construction will be temporarily halted. The Corps would then coordinate with the USFWS on how to best proceed.

Once the section of river running through BNSF Bridge is dewatered a survey will be required to document habitat characteristics of the dewatered section. A qualified biologist will document the location and extent of river substrates, noting features including, but not limited to, gravel beds, boulders, and sand bars. The biologist would also look for locations and approximate sizes of pools, runs, and riffles. This information will be used to inform restoration of the river bed following construction.

Indirect impacts would be expected to be temporary and associated with the rehabilitation of the perennial stream and stream side habitat, including algae accumulation, re-colonization of benthic invertebrates following construction, and lack of shade while stream side vegetation regrows. All indirect impacts are expected to be temporary and are expected to be ameliorated upon restoration of the site following construction.

Project related impacts to Santa Ana sucker have previously been analyzed in the 2001 SEIS/EIR and Project BOs, which analyze similar effects in the Reach 9 area. These documents included a series of measures that would be implemented to avoid, minimize and compensate for impacts to this species associated with construction. Measures directed at off-setting impacts associated with permanent loss or temporary disturbance to Santa Ana sucker habitat include BR-26B, which requires the restoration and maintenance of aquatic (perennial stream) habitat that is temporarily disturbed during construction activities; and, BR-26C, which would provide compensation through creation and/or enhancement of aquatic (perennial stream) habitat within the SAR or its tributaries. Details of the measures can be found in Section 5.5.3 and in Section 6 of this document, "Santa Ana Sucker Conservation Measures" and "Reintroduction of Captively Bred Santa Ana Sucker or Gravel/Cobble Augmentation."

Additional measures would be implemented to minimize and/or avoid impacts to Santa Ana sucker associated with dewatering activities, increased levels of sedimentation, turbidity and siltation, and exposure to accidental releases of contaminants. These include WR-1 and BR-23, which require the preparation of an erosion control plan and the implementation of erosion control measures, respectively; WR-3, which would require the obtainment of a National Pollution Discharge Elimination Stormwater (NPDES) construction stormwater permit prior to construction; EC-BR-4, which would require the preparation of a Spill Prevention and Contingency Plan. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. Implementation of these mitigation measures and environmental commitments will ensure that construction of the new measures and BNSF Bridge improvements has no increased effect on the Santa Ana sucker beyond those anticipated and addressed in the 2001 SEIS/EIR and Biological Opinion, , and the 2012 and 2015 BO Amendments (see Appendix B).

Southwestern Willow Flycatcher

As presented in Chapter 5.5.2.1, southwestern willow flycatcher has not been identified in Reach 9 since SAWA began conducting surveys in 2001, and was last reported in 1999 (CDFW 2014a). Due to the narrow breadth of riparian corridors through the Reach 9 measures and combined with a narrow or absent buffer, and proximity to human development, the Reach 9 measures do not support suitable breeding habitat. Therefore, there is low potential for this species to occur in the BNSF Bridge Preferred Alternative and other Reach 9 measure areas as a transient.

Since suitable breeding and nesting habitat for southwestern willow flycatcher does not occur within the BNSF Bridge Preferred Alternative, and continuing surveys by SAWA have not identified any resident or nesting individuals or home ranges within the area of the measures, the alternatives associated with the Reach 9 measures are not expected to result in adverse direct, indirect, or operational impacts to breeding or nesting flycatcher individuals.

While the southwestern willow flycatcher has not been observed within Reach 9 in over a decade, the adoption of the mitigation measures described in Chapter 5.5.2.1 would further reduce the possibility of any impact from implementation of the Reach 9 measures on the species. Therefore, there is expected to be no effect to this species from the proposed BNSF Bridge Preferred Alternative. Critical habitat for the species does not coincide with the Reach 9 measures, so there would be no adverse modification to designated critical habitat for the species.

Coastal California Gnatcatcher

As discussed in Chapter 5.5.2.1, no coastal California gnatcatchers were observed during surveys performed in 2014 within the BNSF Bridge Preferred Alternative and other Reach 9 measure areas. Habitat preferred by this species (i.e., Sagebrush Scrub) does not coincide with BNSF Bridge and limited designated critical habitat for the species coincides with the measure (Figure 5.5-6c). Although limited, the presence of suitable habitat within Reach 9 and known individuals within the vicinity of Reach 9

measure areas, results in a moderate potential for this species to occur in the BNSF Bridge measure area.

Direct impacts could include disruption of breeding activity in adjacent habitats due to increased noise, fugitive dust, and activities associated with construction. Indirect impacts could include the degradation of habitat due to the potential introduction and colonization of invasive weeds that could serve to out-compete habitat preferred by the gnatcatcher. Impacts to the species during routine inspections and maintenance are expected to be negligible, since tasks would be confined to the new protection structures themselves, which are not immediately adjacent to gnatcatcher habitat, and maintenance roads.

Environmental commitments detailed in the 2001 SEIS/EIR and other SARMP documents are relevant to address potential effects to gnatcatcher. These include measures to compensate for permanent and temporary effects to Upland habitats gnatcatchers may occupy. Commitments include BR-17, which requires vegetation clearing to be conducted outside of the known nesting season and BR-18, which requires restoration of temporary impact areas. According to the 2001 SEIS/EIR and 2001 BO, a number of substantive measures would be implemented to minimize potential noise and vibration effects as a result of project construction activities. As stated in the 2001 BO, these measures were intended to ensure that: (1) noise does not exceed 60 dBA within occupied vireo habitat; or, (2) noise does not exceed 5 dBA above ambient conditions if said levels are above 60 dBA. In order to comply with noise requirements addressed in the 2001 BO, mitigation measure BR-21, which requires the installation of noise barriers between construction areas and riparian habitat where necessary and feasible; it is anticipated that barriers would be installed along the TCE. Barriers may not be installed if it is determined that the additional footprint required would result in a greater impact to adjacent nesting territories than the construction noise itself. Additional mitigation measures from the 2001 SEIS/EIR and project BO's and environmental commitments developed for this document that would be implemented to further avoid and/or minimize impacts to the gnatcatcher include EC-AQ-2, which requires the implementation of techniques to control fugitive dust; EC-BR-3, which requires worker training; and, EC-BR-5, which ensures compliance with all mitigation measures and environmental commitments during construction activities. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. Implementation of these mitigation measures and environmental commitments are designed to ensure that project effect on the species is as minimal as possible and feasible.

With implementation of these avoidance and minimization measures, the proposed BNSF Bridge Preferred Alternative may affect, but is not likely to adversely affect the coastal California gnatcatcher. Designated critical habitat for the species occurs within the BNSF Bridge area (see Figure 5.5-6c). Minor temporary and permanent impacts to critical habitat are identified as 0.01 acres and 0.03 acres, respectively. Upon implementation of measures to mitigate and minimize impacts to scrub habitat preferred by this species, modifications to critical habitat would be temporary in nature and decreased to a less than significant level.

Least Bell's Vireo

As presented in Chapter 5.5.2.1, it is anticipated that implementation of the BNSF Bridge Preferred Alternative would result in temporary displacement of two vireo territories occurring within the APE of this alternative, as presented in Table 5.5-6 and depicted in Figure 5.5-7d.

As documented in the 2001 SEIS/EIR, implementation of Reach 9 measures would result in direct and indirect impacts to nesting least Bell's vireo individuals and habitat occurring in Reach 9. As depicted in Figure 5.5-7d, two vireo territories coincide with the BNSF Bridge Preferred Alternative's TCE, resulting in temporary disturbances to these territories. Direct impacts to least Bell's vireo would also include the permanent removal of suitable habitat (general scale Riparian classification); Table 5.5-12 indicates that 0.63 acres of Riparian habitat would be permanently impacted. Table 5.5.12 indicates that 3.58 acres of Riparian habitat would be temporarily impacted by implementation of the BNSF Bridge Preferred Alternative.

Additional direct impacts to least Bell's vireo could include disruption of breeding activity in adjacent, undisturbed habitat due to increased fugitive dust, noise, and human presence associated with construction activities. Such disturbances can result in the incidental loss of fertile eggs or nestlings, or otherwise lead to nest abandonment. Additionally, birds use their sense of hearing to locate their young and mates, to establish and defend territories, and to locate and evade predators (Scherzinger, 1970). As a result, vireo pairs that nest within the area of potential effect could be adversely affected in the absence of specific measures to abate noise and fugitive dust during construction. Based on observations of vireos that nested successfully within and adjacent to other SARMP measures in the vicinity (including the Corps' Sewage Treatment Plant dike, Prado Embankment and Reach 9, Phase 2B projects), it is anticipated that most of the nesting locations outside of the direct project footprint will continue to support vireos during and after construction. As discussed further below, sound levels will be monitored and sound walls or other barricades will be constructed if necessary to reduce indirect impacts to birds outside of the construction area. However, for the purposes of this evaluation, it is anticipated that implementation of the BNSF Bridge Preferred Alternative could potentially result in take of the two vireo territories that occur within the 200-foot buffer (see Figures 5.5-7a and b), for a total project take of four vireo territories. The Corps will consult with USFWS prior to construction of Phase 5B to obtain an amended or new BO that would authorize additional "take" of least Bell's vireo.

As described in Chapter 5.5.2.1, the range of potential effects to least Bell's vireo associated with this alternative are similar to those that have been contemplated previously in the 2001 SEIS/EIR, and 2001 BO and its 2012 amendment. These documents included a series of mitigation measures that would also be implemented during construction of the currently proposed features to compensate for impacts to least Bell's vireo. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. With the implementation of these avoidance and minimization measures, the proposed project is not likely to jeopardize the continued existence of the least Bell's vireo. Designated critical habitat for the species does not occur within the project area, consequently there will be no adverse modification to designated critical habitat.

Golden Eagle, Bald Eagle, Swainson's Hawk, and White-Tailed Kite

As presented in Chapter 5.5.2.1, none of these species were identified in the Reach 9 measure areas during the April 2014 surveys; however, each are known to occur in the region and have the potential to occur within the Reach 9 measure areas. To further ensure that impacts to golden eagle, bald eagle, Swainson's hawk, and white-tailed kite are minimized and/or avoided, the mitigation measures provided in the 2001 SEIS/EIR and environmental commitments developed for these species, as presented in Chapter 5.5.2.1, would be implemented. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. Implementation of these mitigation measures and environmental commitments will result in less than significant impacts to golden eagle, bald eagle, Swainson's hawk, and white-tailed kite, should they occur.

Western Riverside MSHCP

The MSHCP is a comprehensive, multi-jurisdictional plan focusing on conservation of species and associated habitats in the western portion of Riverside County. The overall goal of the MSHCP is to maintain biological and ecological diversity within a rapidly urbanizing region, and it is intended to allow the Riverside County and its cities to better control local land-use decisions and maintain a strong economic climate in the region while addressing the requirements of FESA and CESA. While compliance with FESA will be accomplished through a Section 7 consultation between the Corps and USFWS (rather than through the MSHCP process), a discussion of the MSHCP in relation to the BNSF Bridge project is provided below. Areas of interest in the MSHCP that fall within the BNSF Bridge project area are provided in Table 5.5-15.

Table 5.5-15. BNSF Bridge-Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP)

MSHCP Plan Area [(1)]	Temescal Canyon
MSHCP Plan Subunit [(2)]	Not a Part
MSHCP Criteria Area [(3)]	Not a Part
MSHCP Criteria Area Cell Group [(4)]	Not a Part
MSHCP Criteria Cells [(5)]	Not a Part
Regional Conservation Authority (RCA) Conserved Lands [(6)]	Not a Part
Public/Quasi-Public (PQP) Lands [(7)]	Approximately 3 acres of Project north of bridge and 6 acres south of the bridge falls within PQP land.
SKR Reserve	Not a Part
SKR HCP Fee Area	Not a Part
Burrowing Owl Survey Area [(8)]	Survey Required
Amphibian Survey Area [(8)]	No Surveys Required
Other Mammal Survey Area [(8)]	No surveys Required
Criteria Area Species Survey Area [(9)]	No surveys Required
Narrow Endemic Species Survey Area [(10)]	Surveys required for *Phacelia Stellaris*
Cores and Linkages [(11)]	Not a Part, but adjacent to (south of) Existing Core A and (west of) Proposed Constrained Linkage 1.
Biologically Equivalent or Superior Determination [(12)]	Required for project footprint impacts to riparian habitat

(1) A community planning area defined in the County of Riverside General Plan. Sixteen County of Riverside Area Plans are located within the MSHCP Plan Area.
(2) A portion of an Area Plan for which Biological Issues and Considerations and target acreages have been specified in Section 3.3 of the MSHCP, Volume I.
(3) The area comprised of Cells depicted on *Figure 3-1* of the *MSHCP, Volume I*. Guidance within this area will be used to assemble overall MSHCP Conservation Area.
(4) An identified grouping of Cells within the Criteria Area. Criteria have been developed for individual Cell Groupings
(5) A unit within the Criteria Area generally 160 acres in size, approximating one quarter section. Criteria have been developed for individual Cells.
(6) Land that is permanently protected and managed in its natural state for the benefit of the Covered Species under legal arrangements that prevent its conversion to other land uses, and the institutional arrangements that provide for its ongoing management.
(7) Subset of MSHCP Conservation Area lands known to be in public/private ownership and expected to be managed for open space value and/or in a manner that contributes to the Conservation of Covered Species (including lands contained in existing reserves), as generally depicted in Figure 3-1 of the MSHCP, Volume I.
(8) For locations with positive survey results, 90% of those portions of the property that provide for long-term conservation value for the identified species shall be avoided until it is demonstrated that conservation goals for the particular species are met. Avoidance shall not be considered to be Conservation contributing to Reserve Assembly unless the avoided populations are acquired and managed as Additional Reserve Lands.
(9) Within identified Criteria Area Plant Species survey areas, site-specific focused surveys for Criteria Area Plant Species shall be conducted where appropriate Habitat is present.
(10) Within identified Narrow Endemic Plant Species survey areas (including the MSHCP Conservation Area), site-specific focused surveys for Narrow Endemic Plant Species shall be required for all public and private projects where appropriate Habitat is present.
(11) The MSHCP Conservation Area is comprised of a variety of existing and proposed Cores, Extensions of Existing Cores, Linkages, Constrained Linkages and Non-contiguous Habitat Blocks. These features are generally referenced as Cores and Linkages and support the life history requirements and provide for movement of one or more MSHCP covered species
(12) Documentation that a particular project alternative will be biologically equivalent or superior to a project consistent with the guidelines and thresholds established in the policies for the Protection of Species Associated with Riparian/Riverine Areas and Vernal Pools set forth in Section 6.1.2 of the MSHCP, policies for the Protection of Narrow Endemic Plant Species set forth in Section 6.1.3 of the MSHCP, Additional Survey Needs and Procedures policies set forth in Section 6.3.2 of the MSHCP, and the Criteria Refinement Process set forth in Section 6.5 of the MSHCP.

BNSF Bridge will not conflict with the MSHCP. The proposed activity associated with this project will not alter the land use for the currently depicted PQP land such that it would not contribute to the Reserve Assembly; therefore, no replacement acreage is required. In addition, the proposed project is a Covered Activity pursuant to Section 7.3.7 of the MSHCP. The project is a flood control improvement project associated with Prado Basin, which is listed in Table 7-14 of the MSHCP. Flood control facilities in PQP areas are also considered Covered Activities. Therefore, the proposed project will not affect the conservation value of PQP lands.

The project is located within the species survey areas for burrowing owl and narrow endemic plant species. The project site does not contain suitable habitat for these species. In addition, the mitigation measures and environmental commitments listed in Chapter 6 will be implemented to ensure that

impacts to MSHCP-covered species are minimized and/or avoided, resulting in less than significant impacts to covered species.

Section 6.1.2 of the MSHCP (Protection of Species Associated with Riparian/Riverine Areas and Vernal Pools) provides the process for which protection of riparian/riverine areas and vernal pools would occur. The intent of this process is to maintain habitat value for those species utilizing such habitats. During botanical surveys, the presence of vernal pools was not identified within the BNSF Bridge Preferred Alternative. Additional surveys will be conducted to confirm absence of vernal pools and to update general habitat conditions prior to construction.

Section 6.1.2 of the MSHCP also identifies that specific survey requirements should be considered for least Bell's vireo and southwestern willow flycatcher in riparian areas where suitable habitat occurs. As presented in Chapter 5.5.2.1, it is anticipated that implementation of the BNSF Bridge Preferred Alternative would result in temporary displacement of four vireo territories. The range of potential effects to least Bell's vireo associated with this alternative are similar to those that have been contemplated previously in the 2001 SEIS/EIR, and 2001 BO and its 2012 amendment. These documents included a series of mitigation measures that would also be implemented during construction of the currently proposed features to compensate for impacts to least Bell's vireo. A full list of mitigation measures and environmental commitments can be found in Chapter 6 of this document. With the implementation of these avoidance and minimization measures, the proposed project is not likely to jeopardize the continued existence of the least Bell's vireo. As presented in Chapter 5.5.2.1, southwestern willow flycatcher has not been identified in Reach 9 since SAWA began conducting surveys in 2001, and was last reported in 1999 (CDFW 2014a). Also, as discussed in Chapter 5.5.2.1, due to the narrow breadth of riparian corridors through the Reach 9 measures and combined with a narrow or absent buffer, and proximity to human development, the Reach 9 measures do not support suitable breeding habitat. In addition, the adoption of the mitigation measures described in Chapter 5.5.2.1 would further reduce the possibility of any impact from implementation of the Reach 9 measures on the species.

Mitigation and compensation measures included in Chapter 6, the 2001 SEIS and associated permits (including the 2001 BO and its 2012 amendment, and the 2002 CESA permit) require the Corps and project sponsors to remove non-native invasive vegetation from the watershed and restore riparian habitat at the following ratios: 1:1 for each acre of riparian habitat temporarily disturbed by the project (or 3:1 if the non-native removal area is monitored and managed for only a five year period); 3:1 for each acre of upland (or non-riparian) habitat permanently impacted; and 5:1 for each acre or riparian habitat permanently impacted. Based on the anticipated impacts identified in Table 5.5-14, 0.63 acres of riparian habitat will be permanently impacted and 3.58 acres of riparian habitat will be temporarily impacted resulting in mitigation of at least 6.73 acres (assuming 1:1 for temporary riparian impacts). Based on the above information, the project will not conflict with Section 6.1.2 of the MSHCP.

Wildlife is expected to be able to move through the BNSF Railroad Project Area in a manner similar to what they would in the existing condition. Steps have also been taken to improve the long term viability

of this area for wildlife movement, even though this particular location currently represents a pinch point. Wildlife can continue to make at grade crossings over the railroad. Wildlife can also move beneath the railroad between east and west abutments and Piers 1 and 6, respectively. Based on the above information, the BNSF project will not conflict with the MSHCP.

No Federal Action Alternative (Alternative 2)

Under the BNSF Bridge No Federal Action Alternative, no disturbance from construction would occur and there would be no direct or indirect impacts to biological resources. However, future high volume releases from Prado Dam could undermine and erode existing bridge piers and abutments and threaten adjacent infrastructure. Periodic emergency repairs of existing bridge structures may be required and would likely entail the discharge of rocks to stabilize piers and abutments. Placement of rock during emergency repair may require the use of heavy equipment and work within flowing water. Any emergency repair is expected to be localized, which would minimize its impact to biological resources to the extent possible. It is assumed that a biological monitor would be on site during the repairs to ensure implementation of avoidance and minimization measures and to document disturbances cause by the emergency action. If scour has produced a condition where existing structures are damaged or in danger of failing, it is presumable that stream side vegetation has been severely disturbed or even uprooted and washed away. After rock has been placed, voids between rocks would be capable of providing cover to native fish and insects while streamside plants recover.

Future Operations and Maintenance

Future maintenance activities associated with BNSF Bridge may include routine inspections and monitoring of project structures by access road, lowered ramp, or floating device, such as a raft or boat; mobilizing dump trucks and hydraulic excavators to haul and place stones in the river to protect project structures as necessary; periodic weeding, patching soil cement, and road maintenance; periodic clearing of debris around drainage structures; and, periodic repairs to fencing and gates.

Impacts related to maintenance activities of project structures could include trampling or crushing of vegetation by vehicular or foot traffic, alterations in topography and hydrology, increased erosion and sedimentation, and the introduction of non-native, invasive plants due to increased human presence on foot or equipment. Most inspections and minor repairs would be confined to paved maintenance and access roads. Impacts to native vegetation and wildlife, therefore, would be minimal and are not expected to be significant.

5.5.2.5 Summary Impact and Mitigation Tables

Table 5.5-16 and 5.5-17 below provide a summary of permanent and temporary impacts to vegetation communities and classifications for all four Reach 9 measures.

Table 5.5-16. Reach 9 Measures: Permanent Impacts to Vegetation Communities in Acres

Vegetation Communities and Other Cover Types	Phase 5A Preferred Grouted Stone + Sheet Pile	Phase 5B Preferred Grouted Stone + Sheet Pile	Phase 4 Preferred Soil Cement	Phase 4 Alt 2 Grouted Stone	BNSF Bridge Protection Features[1]
Waters					
Perennial Stream					0.28
TOTAL WATERS					
Riparian					
TOTAL RIPARIAN	**1.18**	**7.72**	**0.1**	**0.55**	**0.63**
Upland					
TOTAL UPLAND	**0.1**	**4.7**	**4.05**	**0.59**	**0.94**
Developed					
TOTAL DEVELOPED	**0**	**11.71**	**2.18**	**5.36**	**0.82**
TOTAL	**1.28**	**24.13**	**6.33**	**6.50**	**2.67**

[1] BNSF Bridge protection features include: pier nose extension walls, pier enclosure walls, concrete walls, grouted stone, and concrete pavement.

Note: Detailed acreage impacts based on vegetation communities or other cover types were included in the draft SEA/EIR Addendum. Updated GIS shows only consolidated acreages for the final SEA/EIR Addendum.

Table 5.5-17. Reach 9 Measures: Temporary Impacts to Vegetation Communities in Acres

Vegetation Communities and Other Cover Types	Phase 5A Preferred Grouted Stone + Sheet Pile	Phase 5B Preferred Grouted Stone + Sheet Pile	Phase 4 Preferred Soil Cement	Phase 4 Alt 2 Grouted Stone	BNSF Bridge Protection Features
Waters					
Perennial Stream					0.94
TOTAL WATERS					**0.94**
Riparian					
TOTAL RIPARIAN	**2.16**	**19.82**	**2.97**	**3.19**	**3.58**
Upland					
TOTAL UPLAND	**2.78**	**21.82**	**5.96**	**5.68**	**3.73**
Developed					
TOTAL DEVELOPED	**7**	**11.11**	**2.49**	**13.23**	**9.77**
TOTAL	**11.94**	**52.75**	**11.42**	**22.10**	**18.02**

Note: Detailed acreage impacts based on vegetation communities or other cover types were included in the draft SEA/EIR Addendum. Updated GIS shows only consolidated acreages for the final SEA/EIR Addendum.

Table 5.5-18 provides a summary of anticipated mitigation ratios and acreages for all four Reach 9 measures.

Table 5.5-18. Reach 9 Measures: Total Mitigation Acreages

Reach 9 Measure	Mitigation acreage for Perm Impacts[1]	Mitigation acreage for Temp Impacts[2] 1:1/3:1
Phase 5A Grouted Stone	6.2	2.16/6.48
Phase 5B Grouted Stone	52.7	19.82/59.46
Phase 4 Soil Cement	12.65	2.97/8.91
Phase 4 Grouted Stone	4.52	3.19/9.57
BNSF Bridge – Waters[3]	0.28	0.94
BNSF Bridge - Vegetation	5.97	3.53/10.74

[1] Mitigation ratios for permanent impacts to Riparian habitats is 5:1, and impacts to Uplands is 3:1.
[2] Mitigation ratios for temporary impacts to Riparian habitat is 1:1 or 3:1, pending determination by Corps.
[3] Mitigation for permanent and temporary impacts to Waters will be mitigated at 1:1 through stream creation or enhancement.

5.5.3 Environmental Commitments

The following commitments from the 2001 Final SEIS/EIR would be incorporated into contract specifications for the proposed project or implemented by the Corps to reduce potential impacts to biological resources.

BR-16 Prior to construction a monitoring program shall be developed and implemented by the Corps that entails surveys for least Bell's vireo and southwestern willow flycatcher in the spring and early summer in the year prior to construction, as well as during the year of construction. [Prior year surveys (through 2014) were conducted by SAWA.] ***(Ongoing through combined efforts of Corps, OCWD and SAWA.)***

For the current Reach 9 projects, the Corps will also be conducting gnatcatcher surveys prior to and during construction of each feature.

BR-16A Within 1 year after initiation of construction activities, a habitat management plan shall be finalized for the areas where the Corps and/or project sponsors have the legal right/jurisdiction. The USFWS and CDFW shall be provided the opportunity to review the plan, which will address how the Corps and/or their sponsors will maintain or increase the baseline amount of riparian habitat, and funding. This plan will also address conservation goals and thresholds, monitoring and evaluation methodologies, and reporting and review procedures. [Update: OCFCD has finalized the Habitat Management Plan.] ***(Plan completed; implementation ongoing.)***

BR-17 Clearing of vegetation associated with project construction during periods when coastal California gnatcatcher, least Bell's vireo, and southwestern willow flycatcher are not nesting (which in this area is considered to be 15 August through 15 February).

BR-17A Grading activities associated with project construction shall be kept to a minimum and existing root systems will be left intact to the extent possible.

BR-18 In compliance with the 2012 BO Amendment, the Corps and non-federal sponsors shall restore (through arundo and other non-native removal) three acres of riverine habitat for each acre of wetland/riparian habitat temporarily disturbed by the project impact, as well as for each acre of non-riparian floodplain habitat permanently affected; and shall restore five acres for each acre of permanent impact to wetland/riparian habitat. The restoration conducted for permanent impacts shall be monitored and maintained for the life of the project. *The 3:1 mitigation requirement for temporary impacts assumes that the restored (mitigation) area will only be actively maintained for five years. The Corps also has the option of compensating for temporary impacts to riparian/wetland habitat by restoring one acre in an off-site location for each acre affected (1:1), and maintaining the restored area in perpetuity.)"* ***(Mitigation contract awarded in 2013 for 215 acres of non-native removal/habitat restoration, which should be sufficient for***

anticipated impacts. Acreage of actual disturbance will be documented and compared to acreage restored; any shortfalls will be addressed through additional mitigation.)

BR-18A The USACE shall successfully restore each acre of riparian vegetation that is temporarily disturbed during construction-related activities and will keep all temporarily disturbed areas free of exotic plants until riparian vegetation is re-established. If the site has not begun to recover within 5 years (i.e., 50 percent of the disturbed areas are not vegetated with young riparian vegetation), then the site will be replanted with cuttings from native riparian species. ***From BR-18B:*** The USACE shall maintain non-riparian areas that are temporarily disturbed or destroyed free of exotic plants for 8 years. Container plants will be planted and irrigated in upland areas to expedite the restoration process.

BR-19 The Corps [or its non-federal sponsor] shall implement cowbird trapping at a minimum of 10 sites in the Reach 9 (other other areas along the Santa Ana River and environs where trapping would likely be more effective for vireo production, subject to review and approval of the USFWS) during all years when construction of the proposed project is occurring and 5 years following construction. Alternatively, a cash contribution shall be made to the Santa Ana River Conservation Trust Fund for the equivalent amount of cowbird trapping in the upper Prado Basin and Reach 9. Trapping shall be conducted during least Bell's vireo and southwestern willow flycatcher egg-laying season (15 March to 30 July).

BR-20 The Corps shall monitor construction activities to assure that vegetation is removed only in the designated areas. Riparian areas not to be disturbed shall be flagged.

BR-21 If any construction is to take place during the time of year when least Bell's vireo is present, the construction contractor shall install noise barriers between construction areas and riparian habitat, where practicable all the TCE, prior to March 1. The Corps shall continue to coordinate with the USFWS to determine where noise barriers are necessary or prudent for the Reach 9 measures, since the footprint required for construction of the barriers may result in additional habitat removal. These noise barriers shall be kept in place until all construction in the area is completed. Sound monitoring and vireo surveys will be conducted throughout the nesting season to determine if noise barriers or other modifications are warranted.

a. Prior to the commencement of construction activities, ambient noise levels shall be measured at 50 feet and 100 feet from the proposed boundaries of the construction sites and recorded in a graphic format.
b. Where ambient noise is less than 60 dBA and it is determined that construction-related noise levels may exceed 60 dBA: monitoring shall be conducted at 50 feet and 100 feet from the sound wall, or at the boundary of occupied habitat (if habitat areas are more than 100 feet from the construction site), to ensure that

construction-related noise does not exceed 60 dBA within these areas. If construction noise levels exceed authorized limits, the contractor shall modify the sound barriers, equipment, or procedures (including construction schedules) as necessary to meet these conditions, to the extent practicable. If construction noise levels within riparian habitat areas outside the project footprint cannot be reduced below 60 dBA Leq hourly during the period of February 28 through August 15 of any year, the Corps will offset impacts at a 1:1 ratio per breeding season affected by such noise levels. This 1:1 ratio will be based on the acreage of riparian habitat outside the project footprint subject to noise levels over 60 dBA Leq hourly during the noted period, per the number of breeding seasons affected (e.g., 1 acre of riparian habitat affected by noise in two breeding seasons will result in 2 acres of restoration; 1 acre of riparian habitat affected by two separate project phases or segments in a single breeding season will result in 1 acre of restoration). The area affected will be determined by periodic project noise monitoring. This offsetting measure will consist of riparian habitat restoration (non-native invasive vegetation control) for 5 years, from the upper Santa Ana River watershed and/or action area.

c. Where pre-construction ambient noise is greater than 60 dBA: monitoring shall be conducted at 50 feet and 100 feet from the sound wall, or at the boundary of occupied habitat (if habitat areas are more than 100 feet from the construction site), to ensure that construction does not result in a significant increase over ambient conditions (i.e., noise level increases shall not exceed 5 dBA over ambient.) If construction noise levels exceed authorized limits, the contractor shall modify the sound barriers, equipment, or procedures (including construction schedules) as necessary to meet these conditions, to the extent practicable. If construction noise levels within riparian habitat areas outside the project footprint cannot be reduced to or below 5 dBA Leq hourly over ambient noise levels during the period of February 28 through August 15 of any year, the Corps will offset impacts at a 1:1 ratio per vireo breeding season affected by such noise levels. This 1:1 ratio will be based on the acreage of riparian habitat subject to noise levels more than 5 dBA Leq hourly over ambient during the noted period, as determined by periodic project noise monitoring. This offsetting measure will consist of riparian habitat restoration (non-native invasive vegetation control) for 5 years, from the upper Santa Ana River watershed and/or action area.

BR-22 To minimize impacts on the Santa Ana sucker population, in areas where dewatering is to take place, the construction contractor shall direct discharge water into a stilling basin and allowed to flow through existing vegetation and into the river downstream of the construction area.

BR-23 During construction, the construction contractor shall implement measures to control sedimentation; these include re-contouring, sandbagging, the development of stilling

basins, and other appropriate erosion control measures developed on a site-specific basis.

BR-24 During construction, riparian vegetation adjacent to de-watering areas shall be monitored by the Corps for signs of plant stress. Supplemental watering shall be added to this vegetation, as needed.

BR-25 In areas where de-watering or a diversion is necessary, a permitted Santa Ana sucker biologist shall be retained by the Corps to survey for suckers prior to and during any river diversions. If suckers are found, they shall be removed and relocated to appropriate habitats outside of the construction area.

BR-26A As construction is completed in a given area, the construction contractor shall restore all disturbed upland areas. Container stock of local and appropriate native shrubs and groundcover will be used. Hydroseed will also be applied to supplement the container plants. Hydroseed will also be applied to supplement the container plants. Hydroseed mixes will be composed of local and appropriate native shrubs and groundcover. The mix of native species in the container plant hydroseed seed palettes shall be approved in advance by the Environmental Resources Branch of the Corps' Los Angeles District. Container plants and hydroseeded areas shall be irrigated as needed for at least one year or until success has been achieved. Weeding will also occur. See BR-18A for further detail regarding weeding requirements.

BR-26B The Corps shall successfully restore each acre of perennial stream that is temporarily disturbed during construction related activities. Restoration of perennial stream habitats would include:

- Replacement of pre-construction substrates and microhabitat features
- Maintenance or re-establishment of natural channel morphology (e.g., stream meanders, pool-riffle complexes)
- Maintenance or re-establishment of perennial flows
- Verification that the structure and composition of the restored area is similar to pre-construction conditions.

BR-26C The Corps shall create and/or enhance one acre of perennial stream habitat within the SAR or its tributaries for each acre of unvegetated perennial stream that is temporarily or permanently disturbed during construction-related activities. Creation/enhancement activities could include but are not limited to the following:

- The development of pool-riffle complexes by placing clusters of various sized boulders within the river channel to provide limited cover and areas of reduced water velocity

- The creation of potential sucker habitat below Prado Dam within one or more tributaries of the SAR
- The creation of lateral stream habitats that is essential for the survival of larval suckers.

In coordination with the USFWS, the Corps has agreed to implement alternative measures in lieu of BR-26C for impacts to perennial stream that occurred during construction of the Reach 9 Phase 3 project (addressed in separate environmental documentation) and that are anticipated to occur during construction of BNSF bridge pier protection. These measures are listed at the end of this section.

Source: 2011 Final SEA/EIR Addendum for Reach 9, Phase 2A

The following commitments from the 2011 Final SEA/EIR Addendum for the Reach 9, Phase 2A project would be incorporated into contract specifications for the proposed project or implemented by the Corps to reduce potential impacts to biological resources.

EC-BR-1 Upon development of final construction plans and prior to site disturbance, the Corps shall clearly delineate the limits of construction on project plans. All construction, site disturbance, and vegetation removal shall be located within the delineated construction boundaries. The storage of equipment and materials, and temporary stockpiling of soil shall be located within designated areas only, and outside of natural habitat areas. The limits of construction shall be delineated in the field with temporary construction fencing, staking, or flagging.

EC-BR-2 Prior to construction activities and throughout the construction period, a Corps qualified biologist (or the environmental monitor) shall inspect the construction site and adjacent areas to determine if any raptors are nesting within 500 feet of the construction site. If active nests are found, the Corps biologist will coordinate with USFWS and CDFW to determine appropriate avoidance or minimization measures.

EC-BR-3 Prior to construction activities, a qualified biologist (or environmental monitor) shall conduct pre-construction training for all construction crew members. The training shall focus on required mitigation measures and environmental commitments and conditions of regulatory agency permits and approvals (if required). The training shall also include a summary of sensitive species and habitats potentially present within and adjacent to the project site.

EC-BR-4 The construction contractor will prepare a Spill Prevention and Contingency Plan. The Plan shall be implemented prior to and during site disturbance and construction activities. The plan will include measures to prevent or avoid an incidental leak or spill, including identification of materials necessary for containment and clean-up and contact information for management and agency staff. The plan necessary containment clean-up materials shall be kept within the construction area during all construction activities.

The construction contractor shall ensure workers are educated on measures included in the plan at the preconstruction meeting or prior to beginning work on the project.

EC-BR-5 The Corps biologist (or the environmental monitor) shall monitor construction activities to ensure compliance with environmental commitments.

EC-BR-6 Upon completion of construction activities, the Corps shall mitigate for the removal of coast live oaks within the project area by replacing all removed oak trees at a ratio of 4:1. Any planted oak trees that do not survive the first two years will be replaced in-kind. At the end of the initial five year monitoring period, any oak trees that do not survive will then be replaced at a 10:1 ratio, with an additional one-year (minimum) plant establishment monitoring period. Replacement plantings shall be located within the project area as well as within other restoration areas located along the Santa Ana River Mainstem Project area and may consist of acorn plantings, potted nursery stock, or a combination of both. All plant propagules shall be collected within a five-mile radius and within 1,000 feet elevation of the project area. All planting locations, procedures, and results shall be evaluated by a qualified arborist/botanist.

The Corps shall develop and implement an Oak Resource Management Plan to be submitted for review by the USFWS and CDFW that is designed to meet the objectives of the successful establishment and long-term survival of replaced oak trees in the project area. This plan shall include the following:

- A map identifying locations where oak tree plantings occur, specifically targeting suitable soil types;
- A detailed schedule indicating when plantings will occur;
- A description of the irrigation methodology;
- Measures to control exotic vegetation at the planting locations;
- Certification of use of local propagules;
- Measures to provide protection from herbivory;
- Success criteria shall include:
    - All oak plantings will exhibit a minimum of an 80% survivability rate without artificial irrigation for no less than one year after artificial irrigation is removed.
    - All oak trees shall be monitored for a minimum of five (5) years or until all success criteria as identified in the plan have been met. Individual oak trees that do not meet the success criteria shall be replanted and corrected prior to replanting.

EC-AQ-2 All unpaved construction roads shall be stabilized with a non-toxic soil stabilizer or soil weighting agent, with or without the use of geotextiles that can be determined to be both, as efficient, or more efficient for fugitive dust control as California Air Resources

Board approved soil stabilizers, and shall not increase any other environmental impacts including loss of vegetation.

Source: 2013 Final SEA/EIR Addendum for the Reach 9, Phase 3

The following commitments from the 2013 Final SEA/EIR Addendum for the Reach 9, Phase 3 project would be incorporated into contract specifications for the Reach 9 measures or implemented by the Corps to reduce potential impacts to biological resources.

EC-BR-7 Any areas within the Reach 9 measures that are characterized as "Giant Reed Grassland" shall be cleared and grubbed and removed from the construction area to a suitable disposal site.

EC-BR-8 The project biologist or biological monitor shall immediately inform the Corps' contracting officer or site inspector to stop work should he/she notice a construction activity that may result in exceedance of incidental take amounts or undocumented impact to any biological resource.

EC-BR-9 Container plants shall be planted to augment the hydro-seed treatment in upland areas to expedite restoration processes. *(See also BR-26A)*

EC-BR-10 Where possible, project related activities will be conducted outside of the drip line of oak trees.

EC-BR-11 Work hours will be limited to day time hours to reduce potential direct and indirect impacts to wildlife movement.

EC-BR-12 Imported soil shall be tested for compatibility with native soil, re-vegetation palette, and the ecology of the project area and vicinity. Samples shall be tested from the project site, the proposed import source, and any combinations of mixtures of the native soil and imported soil desired for use within the site. The results of the tests must show compatibility with existing soil, re-vegetation palette and ecology of the project area and vicinity, as determined by the project biologist and soils/geology team members.

EC-BR-13 Switchback ramps will be incorporated into the embankment to facilitate wildlife movement into and out of Phase 4 as wildlife transitions between 60-inch culverts being altered by the project, and the floodplain. Ramps shall provide access to the base of the structure, as well as a ramp to the top of the structure.

EC-BR-14 Prior to initiating construction, the construction contractor shall prepare an erosion control plan to control potential sedimentation and turbidity impacts. The erosion control plan shall include temporary measures such as sandbags and/or water bars and may include long-term measures such as re-vegetating the access road.

EC-BR-15 Prior to construction, the construction contractor shall prepare a pollution prevention plan to reduce the potential for accidental release of fuels, pesticides, and other materials. This plan shall include the designation of refueling locations, emergency response procedures, and definition or reporting requirements for any spill that occurs. Equipment for immediate cleanup shall be kept at the staging area for immediate use. This plan shall also include pesticide application activities such as storage, handling of herbicides, and application methods.

2015 SEA/EIR Addendum

EC-BR-16 The Corps and/or the non-federal sponsors shall continue to conduct bats survey(s) prior to construction of BNSF Bridge and coordinate with CDFW to determine appropriate avoidance and minimization measures.

EC-BR-17 Additional surveys will be conducted to confirm absence of vernal pools and to update general habitat conditions prior to construction.

Santa Ana Sucker Conservation Measures

The Corps shall successfully restore each acre of perennial stream that is temporarily disturbed during construction-related activities. Restoration shall include: 1) replacement of pre-construction substrates and microhabitat features; 2) maintenance or re-establishment of natural channel morphology (e.g., stream meanders, pool-riffle complexes); 3) maintenance or re-establishment of perennial flows; and 4) verification that the structure and composition of the restored area is similar to pre-construction conditions. A conceptual habitat restoration plan shall be reviewed and approved by the USFWS prior to initiating construction activities that will affect perennial stream habitat for the sucker.

- Restoration activities for the Santa Ana sucker will be conducted between August 15 and February 28, outside the vireo breeding and nesting season, or in a manner that otherwise avoids adverse effects to the vireo.

- **2.54 Acre Scour Enhancement** -- To offset temporary impacts to 2.54 acres of perennial stream habitat from the completed Reach 9 Phase 3 project, the Corps will create six or more 'habitat nodes' in the reach of the Santa Ana River between Rialto Drain and Mission Boulevard (or other areas subject to review and approval of the Service), to improve the viability of the extant population of Santa Ana suckers this area. Boulders, large woody debris, or other materials will be placed in the low-flow channel to promote scour of fine sediments, consistent exposure of course sediment substrates, river meander, and pool formation. Substrate augmentation (e.g., river gravel and cobble) may also occur in the same area to enhance perennial stream habitat function. A small, one-person suction dredge may also be used to expose existing gravel and cobble within the riverbed.

Suction dredge operators will be accompanied by Service-approved biologists familiar with Santa Ana suckers and their habitats in order to avoid negative impacts to suckers. This measure is expected to enhance perennial stream habitat within at least 2.54 acres of occupied habitat along about 4 miles of river, as measured by the area of pools created, gravel/cobble substrates exposed, and other functional Santa Ana sucker habitat features created/enhanced. Monitoring will be conducted for 5 years and will include water quality, visual observations of substrate, and other surface topography and fish surveys. Any non-native aquatic predators encountered during the surveys will be removed from the system. A conceptual habitat restoration plan will be reviewed and approved by the Service prior to initiating these habitat restoration activities. The restoration activities noted herein will be initiated prior to the initiation of construction for the BNSF Bridge project segment.

- **Reintroduction of Captively Bred Santa Ana Sucker or Gravel/Cobble Augmentation** – To offset impacts to Santa Ana sucker from the BNSF bridge protection segment and to help to sustain and enhance the viability of the overall population in the river into the future, the Corps will either (A) expand the range of the species through active reintroduction of captively-bred Santa Ana sucker to suitable unoccupied habitat within its historical range in the Santa Ana River; OR (B) perform gravel/cobble augmentation within Reach 9.

  (A) The Corps, within its contractual authorities, will contract with a Service-approved entity that can demonstrate the ability to re-introduce captively-bred Santa Ana suckers over a period of 5 years to a suitable unoccupied location(s) with the intent of establishing a new self-sustaining population within the former range of the species on the Santa Ana River. The contract will be awarded and a plan of action, including identification of target re-introduction area(s), will be developed prior to initiation of construction of the BNSF bridge project and no later than 1 year after the date of this Biological Opinion, unless otherwise approved by the Service. The Contract requirements will include the following: (1) rearing and maintaining a sufficient number of breeding adults to support re-introduction of a minimum of about 500 juvenile suckers into the target area per year (or alternate numbers proposed in the Plan of Action and agreed to by the Corps and Service); (2) annual relocations for up to 5 years; and (3) monitoring, adaptive management, and reporting during the 5-year re-introduction period. Task 1 will be completed within 3 years of the date of initiation of the contract, or within 2 years of completion of any necessary approvals/permits, whichever is later. Task 2 will be initiated within 4 years of the date of initiation of the contract, or within 3 years of completion of any necessary approvals/permits, whichever is later. Reporting will occur annually to the Service following initiation of relocations.

  If it becomes infeasible to re-introduce captively-bred Santa Ana suckers (e.g., if prior to reintroduction of suckers it becomes clear that no suitable re-introduction site is available, and/or that landowner/stakeholder opposition cannot be overcome), no

further funding will be obligated to captive breeding or re-introduction efforts. Instead, the Corps will coordinate with the Service to initiate the option identified below.

OR:

(B) The Corps will implement gravel and cobble augmentation within Reach 9 for sediment management improvement and Santa Ana sucker habitat enhancement. Gravel (0.04 to 2.5 inch diameter rock which may include some sand, with about half of the material larger than 0.2 inch) and cobble (2.5 to 10 inch diameter rock), all river-rounded and otherwise appropriate for Santa Ana sucker spawning will be placed by the Corps within the low-flow channel within select locations in Reach 9 to provide available fluvial sediment to the river and to enhance habitats for Santa Ana sucker. It is expected that at least 2 acres of riverbed will be enhanced by direct placement of river gravel and cobble to an average depth of 2 feet, or through other methods developed by the Corps in a Plan of Action, subject to the review and approval of the Service. Additional appropriate locations will be selected for a passive gravel augmentation. Total river gravel to be placed will be about 25,000 tons; total river cobble to be placed will be about 10,000 tons. The river cobble and about half of the augmented river gravel will be immediately placed as bars within the river's low-flow appropriate locations in Reach 9 (per the 2 acres of direct gravel and cobble placement noted above). The remaining half of the river gravel will be placed as passive augmentation along river channel in the upper portion of Reach 9 for future fluvial transport and natural deposition downstream.

• **Channel Complexity Enhancement** -- Along the base of the Phase 4 soil cement structure, large rock will be irregularly placed to increase the morphological complexity of the lower embankment area. At the interface of the soil cement slope with the final earthen fill surface, 0.5- to 2-ton rocks in groupings of 5 to 15 rocks each will be loosely placed on the soil surface, semi-randomly every 100-200 feet along the 3,150-foot length of the Phase 4 embankment. Placement of this rock (locations, arrangement, etc., per the expected channel complexity needs of the Santa Ana sucker) will be directed in the field by a fish biologist approved by the Service.

General Conservation Measures to Maintain Wildlife Movement Through the Action Area

In order to maintain wildlife movement in the project area at existing or better conditions, the Corps will develop a plan of action for wildlife movement-related ramps, culvert exit-entrance structures/features/substrate enhancements, corridor cover vegetation, and other features associated with the project structures where appropriate, subject to the review and approval of the Service. Many of these features are outlined in this Final SEA/EIR Addendum. The Corps will implement this plan of

action in construction/development of these features as part of project construction and operations/maintenance.

5.5.4 Summary of Significance Thresholds Related to Proposed Alternatives

Implementation of the proposed alternatives would have no significant impacts on biological resources, based on the following:

- Although proposed alternatives would result in adverse effects on federally listed species, as well as the loss or disturbance of important habitat for those species, impacts will be fully mitigated on and off-site. Temporary construction easements will be re-vegetated, and additional habitat restoration will occur off-site to mitigate for temporal losses and well as permanent impacts. Therefore, effects to listed species will be temporary.
- As a result of this mitigation, proposed alternatives would not result in a net loss in habitat value of a sensitive biological habitat or area of special biological significance.
- Proposed alternatives would not impede the movement or migration of fish or wildlife.
- Proposed alternatives would not result in a substantial loss to the population of any native fish, wildlife or vegetation.
- Proposed alternatives would not result in a substantial loss in overall diversity of the ecosystem.

5.6 Air Quality

5.6.1 Affected Environment

USEPA and the California Air Resources Board (CARB) focus on the following air pollutants as indicators of ambient air quality: ozone, carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), respirable particulate matter with a diameter of 10 micrometers or less (PM_{10}), fine particulate matter with a diameter of 2.5 micrometers or less ($PM_{2.5}$), and lead. Because the ambient air quality standards for these air pollutants are regulated using human health and environmentally based criteria, they are commonly referred to as "criteria air pollutants."

Health-based air quality standards have been established for these criteria pollutants by USEPA at the national level and CARB at the state level. These standards were established to protect the public with a margin of safety from adverse health impacts due to exposure to air pollution. California has also established standards for sulfates, visibility-reducing particles, hydrogen sulfide, and vinyl chloride. A brief description of each criteria air pollutant, including source types and impacts to health, is provided below along with the most current monitoring station data and attainment designations for the project study areas. Table 5.6-1 presents the California Ambient Air Quality Standards (CAAQS) and the National Ambient Air Quality Standards (NAAQS).

Table 5.6-1. National and California Ambient Air Quality Standards

		California Standards [a]		National Standards [b]		
Pollutant	Averaging Time	Concentration [c]	Method	Primary [c,d]	Secondary [c,e]	Method
Ozone	1 hour	0.09 ppm (180 µg/m^3)	Ultraviolet photometry	–	Same as primary standard	Ultraviolet photometry
	8 hours	0.070 ppm (137 µg/m^3)		0.075 ppm (147 µg/m^3)		
Respirable particulate matter (PM_{10})	24 hours	50 µg/m^3	Gravimetric or beta attenuation	150 µg/m^3	Same as primary standard	Inertial separation and gravimetric analysis
	Annual arithmetic mean	20 µg/m^3		–		
Fine particulate matter ($PM_{2.5}$)	24 hours	–	–	35 µg/m^3	Same as primary standard	Inertial separation and gravimetric analysis
	Annual arithmetic mean	12 µg/m^3	Gravimetric or beta attenuation	12 µg/m^3	15 µg/m^3	
Carbon monoxide	1 hour	20 ppm (23 mg/m^3)	Nondispersive infrared photometry (NDIR)	35 ppm (40 mg/m^3)	–	Nondispersive infrared photometry (NDIR)
	8 hours	9.0 ppm (10 mg/m^3)		9 ppm (10 mg/m^3)	–	
	8 hours (Lake Tahoe)	6 ppm (7 mg/m^3)		–	–	

Pollutant	Averaging Time	California Standards [a] Concentration [c]	California Standards [a] Method	National Standards [b] Primary [c,d]	National Standards [b] Secondary [c,e]	National Standards [b] Method
Nitrogen dioxide [f]	1 hour	0.18 ppm (339 µg/m^3)	Gas phase chemiluminescence	100 ppb (188 µg/m^3)	–	Gas phase Chemiluminescence
	Annual arithmetic mean	0.030 ppm (57 µg/m^3)		0.053 ppm (100 µg/m^3)	Same as primary standard	
Sulfur dioxide [g]	1 hour	0.25 ppm (655 µg/m^3)	Ultraviolet fluorescence	75 ppb (196 µg/m^3)	–	Spectrophotometry (paraosaniline method)
	3 hours	–		–	0.5 ppm (1,300 µg/m^3)	
	24 hours	0.04 ppm (105 µg/m^3)		0.14 ppm (for certain areas) [g]	–	
	Annual arithmetic mean	–		0.030 ppm (for certain areas) [g]	–	
Lead [h,i]	30-day average	1.5 µg/m^3	Atomic absorption	–	–	High-volume sampler and atomic absorption
	Calendar quarter	–		1.5 µg/m^3 (for certain areas) [i]	Same as primary standard	
	Rolling 3-month average	–		0.15 µg/m^3		
Visibility-reducing particles [j]	8 hours	See footnote j	Beta attenuation and transmittance through filter tape	No national standards		
Sulfates	24 hours	25 µg/m^3	Ion chromatography			
Hydrogen sulfide	1 hour	0.03 ppm (42 µg/m^3)	Ultraviolet fluorescence			
Vinyl chloride [j]	24 hours	0.01 ppm (26 µg/m^3)	Gas chromatography			

Notes: mg/m^3 = milligrams per cubic meter; $PM_{2.5}$ = fine particulate matter with an aerodynamic resistance diameter of 2.5 micrometers or less; PM_{10} = respirable particulate matter with an aerodynamic resistance diameter of 10 micrometers or less; ppb = parts per billion; ppm = parts per million; µg/m^3 = micrograms per cubic meter

[a] California standards for ozone, carbon monoxide (except 8-hour Lake Tahoe), sulfur dioxide (1- and 24-hour), nitrogen dioxide, and particulate matter (PM_{10}, $PM_{2.5}$, and visibility-reducing particles), are values that are not to be exceeded. All others are not to be equaled or exceeded. California ambient air quality standards are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations.

[b] National standards (other than ozone, particulate matter, and those based on annual arithmetic mean) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest 8-hour concentration measured at each site in a year, averaged over 3 years, is equal to or less than the standard. For PM_{10}, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 µg/m^3 is equal to or less than 1. For $PM_{2.5}$, the 24-hour standard is attained

[g] On June 2, 2010, a new 1-hour SO_2 standard was established and the existing 24-hour and annual primary standards were revoked. To attain the 1-hour national standard, the 3-year average of the annual 99th percentile of the 1-hour daily maximum concentrations at each site must not exceed 75 ppb. The 1971 SO_2 national standards (24-hour and annual) remain in effect until 1 year after an area is designated for the 2010 standard, except that in areas designated nonattainment for the 1971 standards, the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standards are approved.
Note that the 1-hour national standard is in units of ppb. California standards are in units of ppm. To directly compare the 1-hour national standard to the California standard, the units can be converted to ppm. In this case,

when 98% of the daily concentrations, averaged over 3 years, are equal to or less than the standards. Contact the U.S. Environmental Protection Agency for further clarification and current national policies.

[c] Concentration expressed first in the units in which it was promulgated. Equivalent units given in parentheses are based on a reference temperature of 25 degrees Celsius (°C) and a reference pressure of 760 torr. Most measurements of air quality are to be corrected to a reference temperature of 25°C and reference pressure of 760 torr; parts per million (ppm) in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

[d] National Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.

[e] National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

[f] To attain the 1-hour national standard, the 3-year average of the annual 98th percentile of the 1-hour daily maximum concentrations at each site must not exceed 100 ppb. Note that the national 1-hour standard is in units of ppb. California standards are in units of ppm. To directly compare the national 1-hour standard to the California standards, the units can be converted from ppb to ppm. In this case, the national standard of 100 ppb is identical to 0.100 ppm. the national standard of 75 ppb is identical of 0.075 ppm.

[h] The California Air Resources Board (CARB) has identified lead and vinyl chloride as toxic air contaminants, with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.

[i] The national standard for lead was revised on October 15, 2008, to a rolling 3-month average. The 1978 lead standard (1.5 $\mu g/m^3$ as a quarterly average) remains in effect until 1 year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standards are approved.

[j] In 1989, CARB converted both the general statewide 10-mile visibility standard and the Lake Tahoe 30-mile visibility standard to instrumental equivalents, which are "extinction of 0.23 per kilometer" and the "extinction of 0.07 per kilometer" for the statewide and Lake Tahoe Air Basin standards, respectively.

Source: CARB 2013

Reach 9 is located within the South Coast Air Basin (SCAB) in southern California, and within the jurisdiction of the South Coast Air Quality Management District (SCAQMD). SCAQMD is the air pollution control agency for all of Orange County and the urban portions of Los Angeles, Riverside, and Orange Counties. Ambient air pollutant concentrations in the Basin are measured at air quality monitoring stations operated by CARB and the SCAQMD. The closest and most representative air quality monitoring station to the project site is the Anaheim monitoring station. Data from this monitoring station is considered representative of Reach 9 for ambient air quality depending upon the time of year, climate conditions, and air flow systems (see Table 5.6-2 below).

As shown in Table 5.6-2, ambient air concentrations of CO and NO_2 have not exceeded the NAAQS or the CAAQS in the past 3 years. Concentrations of $PM_{2.5}$ exceeded the NAAQS in all of the past 3 years. Ozone concentrations exceeded the CAAQS in 2011, and PM_{10} concentrations exceeded the CAAQS in 2011 and 2013.

The USEPA and CARB classify an area as attainment, unclassified, or nonattainment, depending on whether the monitored ambient air quality data shows compliance, insufficient data available, or noncompliance with the ambient air quality standards, respectively. Table 5.6-3 below summarizes the federal and California attainment status of the criteria pollutants for the Reach 9 area based on the NAAQS and the CAAQS, respectively.

Table 5.6-2. Summary of Ambient Air Quality Concentrations

	2011	2012	2013
Ozone			
1-hour (ppm)	0.088	0.079	0.084
Days above the Federal Standard	0	0	0
Days above the State Standard	0	0	0
8-hour (ppm)	0.072	0.067	0.070
Days above the Federal Standard	0	0	0
Days above the State Standard	1	0	0
Carbon Monoxide			
8-hour (ppm)	2.08	2.34	*
Days above the Federal Standard	0	0	*
Days above the State Standard	0	0	*
Nitrogen Dioxide			
1-hour (ppm)	0.074	0.067	0.082
Annual (ppm)	0.017	0.015	0.017
PM_{10}			
24-hour ($\mu g/m^3$)	53.0	48.0	77.0
Days above the Federal Standard	0	0	0
Days above the State Standard	2	0	1
Annual Arithmetic Mean ($\mu g/m^3$)	24.9	22.4	25.4
$PM_{2.5}$			
24-hour ($\mu g/m^3$)	39.2	50.1	37.8
Days above the Federal Standard	2	4	1
Annual Arithmetic Mean ($\mu g/m^3$)	10.9	10.8	10.0

Source: CARB 2014a.
Acronyms: ppm = parts per million; $\mu g/m^3$ = micrograms per cubic meter
Notes:
*Insufficient (or no) data available to be considered valid.

Table 5.6-3. Attainment Status of the South Coast Air Basin

Pollutant	Attainment Status	
	Federal	State
O_3 – 1-Hour	--	Nonattainment
O_3 – 8-hour	Nonattainment (Extreme)	Nonattainment
CO	Attainment/Maintenance	Attainment
NO_2	Attainment	Attainment
SO_2	Attainment	Attainment
PM_{10}	Attainment/Maintenance	Nonattainment
$PM_{2.5}$	Nonattainment	Nonattainment
Lead	Attainment	Attainment

Source: USEPA 2014b; CARB 2014b.

The attainment status for the SCAB has changed since the 2001 SEIS/EIR. $PM_{2.5}$ and lead standards were not implemented at the time of the SEIS/EIR. The attainment status for CO and PM_{10} has been changed to nonattainment from attainment in the 2001 SEIS/EIR.

Greenhouse Gas Emissions

Greenhouse gas (GHG) emissions have the potential to adversely affect the environment because such emissions contribute, on a cumulative basis, to global climate change. GHG emissions related to human activities have been determined as likely responsible for intensifying the greenhouse effect and leading to a trend of unnatural warming of the earth's atmosphere and oceans, with corresponding effects on global circulation patterns and climate (IPCC 2013). The following GHGs are widely accepted as the principal contributors to human-induced global climate change: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3).

On February 18, 2010, the Council on Environmental Quality (CEQ) chair issued a memorandum titled Draft National Environmental Policy Act (NEPA) Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions (CEQ 2010). In particular, the guidance proposes a reference point of 25,000 metric tons (MT) per year of direct GHG emissions as a "useful indicator" of when federal agencies should evaluate climate change impacts in their NEPA documents.

In 2006, California passed the Assembly Bill (AB) 32, the California Global Warming Solutions Act of 2006. AB 32 further details and puts into law the mid-term GHG reduction target established in Executive Order S-3-05 to reduce GHG emissions to 1990 levels by 2020. In December 2008, CARB adopted its Climate Change Scoping Plan (Scoping Plan), which contains the main strategies California will implement to achieve the required GHG reductions required by AB 32 (CARB 2008). CARB is required to update the Scoping Plan at least once every 5 years to evaluate progress and develop future inventories that may guide this process. CARB approved the First Update to the Climate Change Scoping Plan: Building on the Framework in June 2014 (CARB 2014c).

Sensitive Receptors

Certain land uses are considered more sensitive to air pollution than others due to the types of population groups or activities involved. Sensitive population groups include children, the elderly, the acutely ill, and the chronically ill, especially those with cardio-respiratory diseases.

Residential areas are also considered sensitive to air pollution because residents (including children and the elderly) tend to be at home for extended periods of time, resulting in sustained exposure to any pollutants present. Recreational land uses are considered moderately sensitive to air pollution. Although exposure periods are generally short, exercise places a high demand on respiratory functions, which can be impaired by air pollution. In addition, noticeable air pollution can detract from the enjoyment of recreation. Industrial and commercial areas are considered the least sensitive to air pollution. Exposure periods are relatively short and intermittent, as the majority of the workers tend to stay indoors most of the time.

The nearest sensitive receptors to Phase 5A include users of the SAR Trail, which currently lies immediately adjacent to Phase 5A and will be rerouted along the perimeter of the site; Featherly

Regional Park, approximately 200 feet to the south); and single-family homes, approximately 500 feet to the north. Construction of Phase 5B would also occur immediately adjacent to the current and rerouted SAR Trail, within 200 feet of Featherly Regional Park, and 200 feet of single-family homes located to the north. Additionally, Canyon RV Park is located approximately 500 feet south of Phase 5B. The nearest sensitive receptors to Phase 4 include the SAR Trail, which currently lies within the site and during construction will be rerouted within the TCE; Canyon RV Park approximately 1,000 feet to the west; and Green River Golf Course located approximately 1,500 feet east of Phase 4. The nearest sensitive receptors to BNSF Bridge include the Green River Mobile Home Park to the east and Green River Golf Course to the west, both of which occur within 200 to 300 feet. Additionally, residential homes in the Green River Housing Estates lie within approximately 500 feet to the northeast.

5.6.2 Environmental Consequences

Significance Threshold

Based upon the thresholds contained in Appendix G of the CEQA Guidelines, implementation of the alternative would result in a significant adverse impact related to air quality and GHG emissions if it would:

- Conflict with or obstruct implementation of the applicable air quality plan;
- Violate any air quality standard or contribute substantially to an existing or projected air quality violation;
- Result in a cumulatively considerable net increase of any criteria pollutant for which the South Coast Air Basin (SCAB) is in non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions that exceed quantitative thresholds for ozone precursors);
- Expose sensitive receptors to substantial pollutant concentrations;
- Create objectionable odors affecting a substantial number of people;
- Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment; or
- Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing GHG emissions.

The General Conformity Rule (40 CFR Sections 51.850–51.860 and 93.150–93.160) requires any federal agency responsible for an action in a federal nonattainment or attainment/maintenance area to demonstrate conformity to the applicable State Implementation Plan (SIP), which is the 2012 Air Quality Management Plan (AQMP). The process to evaluate General Conformity for a proposed federal action involves an applicability analysis, conformity determination, and review. To do so, the federal agency must determine that the action is either exempt from General Conformity Rule requirements or subject to a formal conformity determination. Conformance to the SIP is demonstrated by obtaining appropriate

permits from the SCAQMD, or by demonstrating that emissions would be less than *de minimis* thresholds. If the regulating federal agency determines that the General Conformity regulations do not apply to the federal action, no further analysis or documentation is required.

The General Conformity *de minimis* thresholds are based on the attainment status of the SCAB. The total annual direct and indirect project emissions from project construction activities would be compared against the *de minimis* levels for the attainment status of these pollutants. The applicable *de minimis* thresholds for the project emissions generated in the SCAB are shown in Table 5.6-4.

Table 5.6-4 Applicable General Conformity/NEPA Significance Thresholds

Pollutant	*De minimis* Emission Threshold (tons/year)
CO	100
NO_X	10
VOC	10
SO_X	100
PM_{10}	100
$PM_{2.5}$	100

CO = carbon monoxide; NOx = nitogen oxides;
PM_{10} = respirable particulate matter with a diameter of 10 micrometers or less; PM2.5 = fine particulate matter with a diameter of 2.5 micrometers or less; SOx = sulfur oxides;
VOC = volatile organic compounds

Source: 40 CFR Part 93

Pursuant to Clean Air Act regulations at 40 CFR 932.158(a)(5)(v), emissions of ozone (i.e., VOC and NOx - the precursors to ozone) or nitrogen dioxide are deemed to be in compliance with applicable SIP for projects where the action involves regional water and/or wastewater projects. Furthermore, as indicated in Section 4.4.4 of the 2001 EIS, the project is sized to meet the population projection in the SIP. As a result, emissions of VOC, NOx, and NO2 are deemed to be in compliance with the SIP and a conformity analysis is not required for these pollutants.

The SCAQMD has developed significance thresholds to address the first four thresholds in the bulleted list above. Significance determinations are based on the maximum daily emissions during a construction period, which provides a “worst-case” analysis of the construction emissions. Similarly, significance determinations for operational emissions are based on the maximum daily emissions during the operational phase.

The SCAQMD has also developed a localized significance threshold (LST) methodology to evaluate the potential localized impacts of criteria pollutants from construction and operational activities (SCAQMD

2003). The LST methodology requires an analysis to determine whether emissions of specified criteria pollutants would cause ambient air quality standards to be exceeded at the nearest off-site receptor.

GHG emissions are compared to the CEQ threshold of 25,000 MT carbon dioxide equivalent (CO_2e) per year and the SCAQMD threshold of 10,000 MT CO_2e per year. Since the project is primarily construction related and does not involve residential or commercial land uses, the SCAQMD-adopted threshold of 10,000 MT CO_2e per year is also considered an appropriate screening threshold for this analysis. The SCAQMD also recommends that construction emissions associated with a project be amortized over the life of the project and added to the operational emissions (SCAQMD 2009). Construction-related GHG emissions are amortized and evaluated as a component of the proposed project's operational emissions over the life of the project.

The analysis of air quality impacts describes the emissions associated with the proposed alternatives and determines whether implementation of the alternatives would result in a different magnitude of impacts, compared to the impacts discussed in the 2001 SEIS/EIR.

5.6.2.1 Phase 5A

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

Conflict with or Obstruct Implementation of the Applicable Air Quality Plan

Construction activities for the Grouted Stone and Sheet Pile Alternative would not substantially change the assumed overall level of impact for the SARMP that was addressed in the 2001 SEIS/EIR. Subsequent to the 2001 SEIS/EIR, the SCAQMD revised the air quality plan. The most recent AQMP was adopted by the SCAQMD in December 2012.

Consistency with the AQMP is based on whether the project would exceed the estimated air basin emissions used as the basis of the AQMP. Assumptions for off-road equipment emissions in the 2012 AQMP were developed based on hours of activity and equipment population reported to CARB for rule compliance. Growth projections are also derived from projections of population and vehicle miles traveled (VMT). Operation of the alternative does not involve any uses that would increase population or employment beyond those considered in the City and County General Plans. Because the Preferred Alternative would be consistent with the assumptions regarding equipment activity and emissions in the 2012 AQMP and existing planning documents, it is expected that the intensity of construction and operational emissions associated with the Grouted Stone and Sheet Pile Alternative would have been accounted for in the AQMP. Therefore, implementation of the Preferred Alternative would not conflict with or obstruct implementation of the AQMP. Therefore, this impact would be less than significant.

Violate any Air Quality Standard or Contribute Substantially to an Existing or Projected Air Quality Violation

Construction of the Preferred Alternative for Phase 5A would include grouted stone and sheet pile protection. Equipment to be used for construction of the grouted stone structure would include

excavators, front-end loaders, bulldozers, dump trucks, a grader, concrete pump trucks, and water trucks. Equipment to be used for construction of the sheet pile protection would include a hydraulic hammer and heavy-duty cranes. Construction is expected to take up to 24 months to complete.

Construction emissions from the operation of diesel-fueled off-road equipment were estimated using CARB's off-road diesel emissions inventory model (OFFROAD), which provides emission rates in pounds per hour (lbs/hr) based on fuel consumption and activity of various off-road fleet categories. Construction emissions from the operation of gasoline-fueled on-road light and heavy duty trucks (i.e., worker commute trips, haul trucks, dump trucks, flat-bed trucks, etc.) were estimated using CARB's On-Road Emission Factors (EMFAC) 2011 mobile source emission factors.

Fugitive dust emissions from earthmoving activities vary as a function of conditional parameters such as soil silt content, soil moisture, wind speed, acreage of disturbance area, and VMT on- and off-site. Emissions from earthmoving activities are typically associated with material handling activities including haul truck unloading, scraper unloading, bulldozer activity, and grading. Fugitive dust emissions were estimated using the USEPA's Compilation of Air Pollutant Factors (AP-42) and based on VMT, material loading (in tons per day), and hours of operation.

Table 5.6-5 shows the annual emissions associated with construction of the Preferred Alternative for Phase 5A. Additional modeling assumptions and details are provided in Appendix C incorporated here by reference.

Table 5.6-5. Phase 5A – Grouted Stone and Sheet Pile Alternative – General Conformity Applicability Analysis

Emission Source	Criteria Pollutant Emissions (tons/year)				
	VOC	**NO_X**	**CO**	**PM_{10}**	**$PM_{2.5}$**
2015	1.19	10.08	4.71	6.02	1.70
2016	2.13	17.88	8.41	11.01	3.09
2017	1.19	10.30	4.78	5.99	1.69
Maximum Annual Emissions	**2.13**	**17.88**	**8.41**	**11.01**	**3.09**
De minimis Thresholds[1]	10	10	100	100	100
Exceed *de minimis* Thresholds?	No	Yes	No	No	No
Exempt from Conformity Analysis and Complies with SIP?	Yes[2]	Yes[2]	Yes	Yes	Yes

[1] *De minimis* thresholds for General Conformity of South Coast Air Basin nonattainment pollutants VOC and and $PM_{2.5}$, and maintenance pollutants CO and PM_{10}. As described in the 2001 SEIS/EIR, annual NOx emissions were determined to be in conformance under 40 CFR 93.158(a)(5)(v).

[2] Pursuant to Clean Air Act regulations at 40 CFR 932.158(a)(5)(v), emissions of ozone (i.e., VOC and NOx - the precursors to ozone) or nitrogen dioxide are deemed to be in compliance with applicable SIP for projects where the action involves regional water and/or wastewater projects. Furthermore, as indicated in Section 4.4.4 of the 2001 EIS, the project is sized to meet the population projection in the SIP. As a result, emissions of VOC, NOx, and NO2 are deemed to be in compliance with the SIP and a conformity analysis is not required for these pollutants.

Source: Modeled by AECOM 2014; for more detail see Appendix C.

As shown in Table 5.6-5, the annual volatile organic compounds (VOC), CO, PM_{10}, and $PM_{2.5}$ emissions would be less than the General Conformity *de minimis* thresholds. As described in the 2001 SEIS/EIR, the SARMP, including bank stabilization in several other locations within Reach 9, was determined to be exempt from the requirement to prepare a conformity analysis pursuant to 40 CFR 93.158(a)(5)(v). Consistent with the approach in the 2001 SEIS/EIR, the annual nitrogen oxides (NOx) emissions associated with the Grouted Stone and Sheet Pile Alternative were determined to be in conformance under 40 CFR 93.158(a)(5)(v). Therefore, construction-related emissions associated with the Grouted Stone and Sheet Pile Alternative would conform to the SIP, and a formal conformity analysis would not be required.

As shown in Table 5.6-6, construction emissions for the Phase 5A Grouted Stone and Sheet Pile Alternative would result in maximum daily emissions of approximately 20 pounds of VOC, 149 pounds of NOx, 82 pounds of CO, 92 pounds of PM_{10}, and 26 pounds of $PM_{2.5}$. Additional modeling assumptions and details are provided in Appendix C.

Table 5.6-6. Phase 5A – Grouted Stone and Sheet Pile Alternative – Daily Construction Emissions

Emission Source	Criteria Pollutant Emissions (pounds/day)				
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
Maximum Daily Emissions	19.95	149.37	82.18	92.35	26.32
Daily Thresholds	**75**	**100**	**550**	**150**	**55**
Exceed Thresholds?	**No**	**Yes**	**No**	**No**	**No**

Source: Modeled by AECOM 2014; for more detail see Appendix C.

As shown in Table 5.6-6, construction-related emissions of VOC, CO, PM_{10}, and $PM_{2.5}$ would not exceed the thresholds of significance and would not violate any air quality standard or contribute substantially to an existing or projected air quality violation. Construction-generated NOx emissions would exceed the applicable emission thresholds. However, the daily emission construction thresholds were developed in order to ensure compliance with the SIP. Pursuant to Clean Air Act regulations at 40 CFR 932.158(a)(5)(v), emissions of ozone (i.e., VOC and NOx - the precursors to ozone) or NO2 are deemed to be in compliance with applicable SIP for projects where the action involves regional water and/or wastewater projects. Furthermore, as indicated in Section 4.4.4 of the 2001 SEIS/EIR, the project is sized to meet the population projection in the SIP. As a result, emissions of VOC, NOx, and NO2 are deemed to be in compliance with the SIP and a conformity analysis is not required for these pollutants. Based on the above, NOx emissions would be in compliance with the SIP. Impacts would be less than significant but mitigation measures would be implemented.

Result in a Cumulatively Considerable Net Increase of Any Criteria Pollutant for Which the Project Region is Non-Attainment under an Applicable Federal or State Ambient Air Quality Standard (Including Releasing Emissions Which Exceed Quantitative Thresholds for Ozone Precursors)

By its very nature, air pollution is largely a cumulative impact. A project's emissions may be individually limited, but cumulatively considerable when taken in combination with past, present, and future development projects. The SCAQMD thresholds of significance are relevant to whether a project's

individual emissions would result in a cumulatively considerable incremental contribution to the existing cumulative air quality conditions.

Construction-generated NOx emissions would exceed the applicable emission thresholds. However, the SCAQMD thresholds of significance were developed in order to ensure compliance with the SIP. Pursuant to Clean Air Act regulations at 40 CFR 932.158(a)(5)(v), emissions of ozone (i.e., VOC and NOx - the precursors to ozone) or NO2 are deemed to be in compliance with applicable SIP for projects where the action involves regional water and/or wastewater projects. Furthermore, as indicated in Section 4.4.4 of the 2001 SEIS/EIR, the project is sized to meet the population projection in the SIP. As a result, emissions of VOC, NOx, and NO2 are deemed to be in compliance with the SIP and a conformity analysis is not required for these pollutants. Based on the above, NOx emissions would be in compliance with the SIP. Impacts would be less than significant but mitigation measures would be implemented.

Expose Sensitive Receptors to Substantial Pollutant Concentrations

The 2001 SEIS/EIR did not evaluate the SCAQMD criteria for LST, or toxic air contaminant (TAC) emissions. The greatest potential for TAC emissions would be related to diesel PM emissions associated with heavy-duty construction equipment operations.

Trucks are expected to use a portion of East La Palma Avenue, the SAR Trail, and the existing dirt access road at the base of the levee. Additionally, trips on city streets and highways would be required for delivery of construction materials. These trips would result in only short-term periodic increases in emissions levels during normal construction hours. The nearest sensitive receptors to the proposed project site would be individuals utilizing the existing SAR Trail, which is anticipated to be re-routed onto East La Palma Avenue during construction. The nearest residential development is located approximately 500 feet away from the Phase 5A measure area.

SCAQMD localized significant thresholds are new criteria, which were not discussed in the 2001 SEIS/EIR. Although LST criteria were not discussed in 2001, considering the magnitude of the total SARMP emissions, the localized impacts of project construction are expected to be no greater than the impacts that would have been determined in the 2001 SEIS/EIR, had a localized impact determination been completed.

The greatest potential for TAC emissions would be related to diesel PM emissions associated with heavy-duty construction equipment operations. Health effects from carcinogenic TACs are usually described in terms of individual cancer risk, which is based on a 70-year lifetime exposure to TACs. Heavy-duty construction equipment would only operate intermittently each day during the 2-year construction period and would cease following build-out of the project alternative. Therefore, if the duration of potentially harmful construction activities near a sensitive receptor was 2 years, then the exposure would be approximately 3 percent of the total exposure period used for typical health risk calculations (i.e., 70 years). In addition, construction activities would move sequentially and, therefore, individual sensitive receptors would be exposed to TAC emissions for less than 2 years. Due to the significant improvements in engine technology and turnover in the equipment fleet since 2001, the diesel PM

emissions would also be anticipated to be lower than what would have been analyzed originally in the 2001 SEIS/EIR. Therefore, the Phase 5A Grouted Stone and Sheet Pile Alternative would not expose sensitive receptors to substantial construction pollutant concentrations. This impact would be less than significant.

Create Objectionable Odors Affecting a Substantial Number of People

Sources that may emit odors during construction activities include exhaust from diesel construction equipment and heavy-duty trucks, which could be considered offensive to some individuals. Odors from these sources would be localized and generally confined to the immediate area surrounding Phase 5A. The odors would be typical of most construction sites and temporary in nature. Because of the amount and types of equipment, the temporary nature of these emissions, and the highly diffusive properties of diesel exhaust, nearby receptors would not be affected by diesel exhaust odors associated with project construction. After construction of the proposed project, all construction-related odors would cease. Operation of the Phase 5A Grouted Stone and Sheet Pile Alternative would not be expected to add any new odor sources. As a result, this alternative would not create objectionable odors that would affect a substantial number of people. This impact would be less than significant.

Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment.

Heavy-duty off-road equipment, material transport, and worker commutes during construction of the proposed project would result in exhaust-related GHG emissions. The project has an expected life of 50 years after construction is complete. As discussed earlier, OMRR&R activities would not generate substantial emissions and were not estimated for the proposed project. The total construction-related GHG emissions for the Phase 5A Grouted Stone and Sheet Pile Alternative were estimated at 6,448 MT CO_2e. Construction emissions amortized over the assumed lifetime of the project would be 129 MT CO_2e per year. The Phase 5A Grouted Stone and Sheet Pile Alternative would not emit more than 25,000 MT CO_2e per year. According to CEQ guidance, no further analysis is required. The annualized total construction emissions over the lifetime of the project would also be less than the 10,000 MT CO_2e per year threshold of significance recommended by SCAQMD. Therefore, the Phase 5A Grouted Stone and Sheet Pile Alternative would not generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment. This impact would be less than significant.

Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing GHG emissions

CARB's First Update to the Climate Change Scoping Plan: Building on the framework includes measures to meet California's goal of reducing emissions to 1990 levels by 2020 and also reiterates the state's role in the long-term goal established in Executive Order S-3-05, which is to reduce GHG emissions to 80 percent below 1990 levels by 2050. CARB's Scoping Plan update includes measures that would indirectly address GHG emissions from construction activities, including the phasing-in of cleaner technology for diesel engine fleets and the development of a Low Carbon Fuel Standard. The Phase 5A Grouted Stone

and Sheet Pile Alternative would comply with statewide mandates or standards set forth by the Scoping Plan update.

The purpose of the proposed project is to provide river bank protection from predicted future scour associated with the design flood event from Prado Dam. Specifically, the purpose of Phase 5A is to protect roadways, industrial and commercial development, and residential housing in the City of Yorba Linda from potential instability along the banks of the SAR. The proposed project would protect infrastructure and resources by helping to avoid rebuild and repair expenditures, losses and disruptions to economic activities, and reduction in the quality of life of local residents in the case that a flood event impacted the area. The intent, purpose, and function of the proposed project are in line with goals of the AB 32 Scoping Plan to protect against the detrimental effects of climate change. No other applicable plans, policies, or regulations adopted for the purpose of reducing GHG emissions apply to the proposed project. Therefore, the project would not conflict with any applicable plan, policy, or regulation for the purpose of reducing GHG emissions. This impact would be less than significant.

Soil Cement and Sheet Pile Alternative (Alternative 2)

Under this alternative, a soil cement structure would be installed with sheet piling, instead of grouted stone with sheet piling. As shown in Tables 5.6-7 and 5.6-8, the annual and daily emissions for the Soil Cement and Sheet Pile Alternative would be greater than the Grouted Stone and Sheet Pile Alternative. However, the Soil Cement and Sheet Pile Alternative would have overall impacts (e.g., significant and unavoidable NOx emissions) similar to the Grouted Stone and Sheet Pile Alternative. Implementation of the Soil Cement and Sheet Pile Alternative would not conflict with or obstruct implementation of the AQMP. Table 5.6-7 shows the annual emissions associated with construction of the Soil Cement and Sheet Pile Alternative for Phase 5A. Additional modeling assumptions and details are provided in Appendix C.

Table 5.6-7. Phase 5A – Soil Cement and Sheet Pile Alternative – General Conformity Analysis

Emission Source	Criteria Pollutant Emissions (tons/year)				
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
2015	2.36	20.34	9.11	5.55	1.88
2016	4.28	37.08	16.49	10.16	3.43
2017	3.08	26.97	11.96	7.26	2.45
Maximum Annual Emissions	**4.28**	**37.08**	**16.49**	**10.16**	**3.43**
De minimis Thresholds[1]	10	10	100	100	100
Exceed *de minimis* Thresholds?	No	Yes	No	No	No
Exempt from Conformity Analysis and Complies with SIP?	Yes[2]	Yes[2]	Yes	Yes	Yes

[1] *De minimis* thresholds for General Conformity of SCAB nonattainment pollutants VOC and and $PM_{2.5}$, and maintenance pollutants CO and PM_{10}. As described in the 2001 SEIS/EIR, annual NOx emissions were determined to be in conformance under 40 CFR 93.158(a)(5)(v).

[2] Pursuant to Clean Air Act regulations at 40 CFR 932.158(a)(5)(v), emissions of ozone (i.e., VOC and NOx - the precursors to ozone) or nitrogen dioxide are deemed to be in compliance with applicable SIP for projects where the action involves regional water and/or wastewater projects. Furthermore, as indicated in Section 4.4.4 of the 2001 EIS, the project is sized to meet the population projection in the SIP. As a result, emissions of VOC, NOx,

and NO2 are deemed to be in compliance with the SIP and a conformity analysis is not required for these pollutants.
Source: Modeled by AECOM 2014; for more detail see Appendix C.

As shown in Table 5.6-5, the annual VOC, CO, PM_{10}, and $PM_{2.5}$ emissions would be less than the General Conformity *de minimis* thresholds. Construction-generated NOx emissions would exceed the applicable emission thresholds. However, the daily emission construction thresholds were developed in order to ensure compliance with the SIP. Pursuant to Clean Air Act regulations at 40 CFR 932.158(a)(5)(v), emissions of ozone (i.e., VOC and NOx - the precursors to ozone) or NO2 are deemed to be in compliance with applicable SIP for projects where the action involves regional water and/or wastewater projects. Furthermore, as indicated in Section 4.4.4 of the 2001 SEIS/EIR, the project is sized to meet the population projection in the SIP. As a result, emissions of VOC, NOx, and NO2 are deemed to be in compliance with the SIP and a conformity analysis is not required for these pollutants. Based on the above, NOx emissions would be in compliance with the SIP. Impacts would be less than significant but mitigation measures would be implemented.

As shown in Table 5.6-8, construction emissions for the proposed project would result in maximum daily emissions of approximately 38 pounds of VOC, 308 pounds of NOx, 149 pounds of CO, 85 pounds of PM_{10}, and 29 pounds of $PM_{2.5}$. Additional modeling assumptions and details are provided in Appendix C.

Table 5.6-8. Phase 5A Soil Cement and Sheet Pile Alternative – Daily Construction Emissions

Emission Source	Criteria Pollutant Emissions (pounds/day)				
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
Maximum Daily Emissions	37.68	308.31	148.93	85.19	29.07
Daily Thresholds	**75**	**100**	**550**	**150**	**55**
Exceed Thresholds?	**No**	**Yes**	**No**	**Yes**	**No**

Source: Modeled by AECOM 2014; for more detail see Appendix C.

As shown in Table 5.2-8, construction-generated NOx emissions would exceed the applicable mass emission thresholds. However, the daily emission construction thresholds were developed in order to ensure compliance with the SIP. Pursuant to Clean Air Act regulations at 40 CFR 932.158(a)(5)(v), emissions of ozone (i.e., VOC and NOx - the precursors to ozone) or NO2 are deemed to be in compliance with applicable SIP for projects where the action involves regional water and/or wastewater projects. Furthermore, as indicated in Section 4.4.4 of the 2001 SEIS/EIR Addendum, the project is sized to meet the population projection in the SIP. As a result, emissions of VOC, NOx, and NO2 are deemed to be in compliance with the SIP and a conformity analysis is not required for these pollutants. Based on the above, NOx emissions would be in compliance with the SIP. Impacts would be less than significant but mitigation measures would be implemented.

Because the Soil Cement and Sheet Pile Alternative would exceed the SCAQMD project-level air quality significance thresholds, proposed 5A construction emissions would have a cumulatively considerable contribution to the region's air quality. The localized impacts of project construction are expected to be no greater than the impacts that would have been determined in the 2001 SEIS/EIR, had a localized impact determination been completed. Due to the significant improvements in engine technology and

turnover in the equipment fleet since 2001, the diesel PM emissions would be anticipated to be lower than what would have been analyzed for similar projects in Reach 9 in the 2001 SEIS/EIR. Therefore, this alternative would not expose sensitive receptors to substantial construction pollutant concentrations. The Soil Cement and Sheet Pile Alternative would not create objectionable odors affecting a substantial number of people.

The total construction-related GHG emissions for the Soil Cement and Sheet Pile Alternative were estimated at 13,866 MT CO_2e. Construction emissions amortized over the assumed lifetime of the project would be 277 MT CO_2e per year. Alternative 2 would not emit more than 25,000 MT CO_2e per year. According to CEQ guidance, no further analysis is required. The annualized total construction emissions over the lifetime of the project would also be less than the 10,000 MT CO_2e per year threshold of significance recommended by SCAQMD. This alternative would not generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment. Alternative 2 would not conflict with any applicable plan, policy, or regulation for the purpose of reducing GHG emissions. This impact would be less than significant.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, there would be no construction of the bank erosion protection structure to provide additional flood protection. There would be no emissions from off-road construction equipment or on-road motor vehicles for the import or export of fill from the project area. Based on the above, there would be no impact on air quality.

However, future high flow conditions could require emergency repairs of the existing bank protection. It is likely that any emergency repair would be limited in scope and duration. Air quality impacts associated with emergency repairs would not be anticipated to exceed General Conformity *de minimis* thresholds or the SCAQMD daily emission thresholds.

5.6.2.2 Phase 5B

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

Conflict with or Obstruct Implementation of the Applicable Air Quality Plan.

Construction activities under the Grouted Stone Alternative would not substantially change the assumed overall level of impact for the SARMP addressed in the 2001 SEIS/EIR. Because the Phase 5B Grouted Stone and Sheet Pile Alternative would be consistent with the assumptions regarding equipment activity and emissions in the 2012 AQMP and existing planning documents, it is expected that the intensity of construction and operational emissions associated with the Grouted Stone Alternative would have been accounted for in the AQMP. Therefore, implementation of the Phase 5B Grouted Stone and Sheet Pile Alternative would not conflict with or obstruct implementation of the AQMP. This impact would be less than significant.

Violate any Air Quality Standard or Contribute Substantially to an Existing or Projected Air Quality Violation

Under this alternative, grouted stone would replace existing riprap of the levee and be installed on the river bank upstream of the levee. New bank protection would have an adequate foundation depth to minimize scour and provide erosion control. Equipment to be used for construction of the grouted stone structure would include, but is not limited to, excavators, front-end loaders, bulldozers, dump trucks, a grader, concrete pump trucks, and water trucks. Construction is expected to take 24 months to complete.

Table 5.6-9 shows the annual emissions associated with construction of the Grouted Stone Alternative for Phase 5A. Additional modeling assumptions and details are provided in Appendix C.

Table 5.6-9. Phase 5B – Grouted Stone and Sheet Pile Alternative – General Conformity Analysis

Emission Source	Criteria Pollutant Emissions (tons/year)				
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
2016	0.17	1.05	0.74	9.37	1.99
2017	1.83	15.49	7.37	17.67	4.05
2018	1.03	9.04	4.22	9.59	2.21
Maximum Annual Emissions	1.83	15.49	7.37	17.67	4.05
De minimis Thresholds[1]	10	10	100	100	100
Exceed *de minimis* Thresholds?	No	Yes	No	No	No
Exempt from Conformity Analysis and Complies with SIP?	Yes[2]	Yes[2]	Yes	Yes	Yes

[1] *De minimis* thresholds for General Conformity of SCAB nonattainment pollutants VOC and and $PM_{2.5}$, and maintenance pollutants CO and PM_{10}. As described in the 2001 SEIS/EIR, annual NOx emissions were determined to be in conformance under 40 CFR 93.158(a)(5)(v).

[2] Pursuant to Clean Air Act regulations at 40 CFR 932.158(a)(5)(v), emissions of ozone (i.e., VOC and NOx - the precursors to ozone) or nitrogen dioxide are deemed to be in compliance with applicable SIP for projects where the action involves regional water and/or wastewater projects. Furthermore, as indicated in Section 4.4.4 of the 2001 EIS, the project is sized to meet the population projection in the SIP. As a result, emissions of VOC, NOx, and NO2 are deemed to be in compliance with the SIP and a conformity analysis is not required for these pollutants.

Source: Modeled by AECOM 2014; for more detail see Appendix C.

As shown in Table 5.6-9, the annual VOC, CO, PM_{10}, and $PM_{2.5}$ emissions would be less than the General Conformity *de minimis* thresholds. Construction-generated NOx emissions would exceed the applicable emission thresholds. However, the SCAQMD thresholds of significance were developed in order to ensure compliance with the SIP. Pursuant to Clean Air Act regulations at 40 CFR 932.158(a)(5)(v), emissions of ozone (i.e., VOC and NOx - the precursors to ozone) or NO2 are deemed to be in compliance with applicable SIP for projects where the action involves regional water and/or wastewater projects. Furthermore, as indicated in Section 4.4.4 of the 2001 SEIS/EIR, the project is sized to meet the population projection in the SIP. As a result, emissions of VOC, NOx, and NO2 are deemed to be in compliance with the SIP and a conformity analysis is not required for these pollutants. Based on the above, NOx emissions would be in compliance with the SIP. Impacts would be less than significant but mitigation measures would be implemented.

As shown in Table 5.6-10, construction emissions for the proposed project would result in maximum daily emissions of approximately 28 pounds of VOC, 220 pounds of NOx, 120 pounds of CO, 192 pounds of PM_{10}, and 45 pounds of $PM_{2.5}$. Additional modeling assumptions and details are provided in Appendix C.

Table 5.6-10. Phase 5B - Grouted Stone and Sheet Pile Alternative – Daily Construction Emissions

Emission Source	Criteria Pollutant Emissions (pounds/day)				
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
Maximum Daily Emissions	16.80	125.50	69.87	147.54	34.08
Daily Thresholds	**75**	**100**	**550**	**150**	**55**
Exceed Thresholds?	**No**	**Yes**	**No**	**No**	**No**

Source: Modeled by AECOM 2014; for more detail see Appendix C.

As shown in Table 5.6-10, construction-related emissions of VOC, CO, PM_{10}, and $PM_{2.5}$ would not exceed the thresholds of significance and would not violate any air quality standard or contribute substantially to an existing or projected air quality violation. Construction-generated NOx emissions would exceed the applicable emission thresholds. However, the SCAQMD thresholds of significance were developed in order to ensure compliance with the SIP. Pursuant to Clean Air Act regulations at 40 CFR 932.158(a)(5)(v), emissions of ozone (i.e., VOC and NOx - the precursors to ozone) or NO2 are deemed to be in compliance with applicable SIP for projects where the action involves regional water and/or wastewater projects. Furthermore, as indicated in Section 4.4.4 of the 2001 EIS, the project is sized to meet the population projection in the SIP. As a result, emissions of VOC, NOx, and NO2 are deemed to be in compliance with the SIP and a conformity analysis is not required for these pollutants. Based on the above, NOx emissions would be in compliance with the SIP. Impacts would be less than significant but mitigation measures would be implemented.

Long-term OMRR&R activities would not generate substantial criteria pollutant emissions. Therefore, operational emissions were not estimated for the project alternative. These long-term activities would not generate substantial criteria pollutant emissions and would not be anticipated to exceed the daily or annual *de minimis* thresholds for any criteria pollutants.

Result in a Cumulatively Considerable Net Increase of Any Criteria Pollutant for which the Project Region is Non-Attainment under an Applicable Federal or State Ambient Air Quality Standard (Including Releasing Emissions which Exceed Quantitative Thresholds for Ozone Precursors)

By its very nature, air pollution is largely a cumulative impact. A project's emissions may be individually limited, but cumulatively considerable when taken in combination with past, present, and future development projects. The SCAQMD thresholds of significance are relevant to whether a project's individual emissions would result in a cumulatively considerable incremental contribution to the existing cumulative air quality conditions.

Construction-generated NOx emissions would exceed the applicable emission thresholds. However, the SCAQMD thresholds of significance were developed in order to ensure compliance with the SIP.

Pursuant to Clean Air Act regulations at 40 CFR 932.158(a)(5)(v), emissions of ozone (i.e., VOC and NOx - the precursors to ozone) or NO2 are deemed to be in compliance with applicable SIP for projects where the action involves regional water and/or wastewater projects. Furthermore, as indicated in Section 4.4.4 of the 2001 SEIS/EIR, the project is sized to meet the population projection in the SIP. As a result, emissions of VOC, NOx, and NO2 are deemed to be in compliance with the SIP and a conformity analysis is not required for these pollutants. Based on the above, NOx emissions would be in compliance with the SIP. Impacts would be less than significant but mitigation measures would be implemented.

Expose Sensitive Receptors to Substantial Pollutant Concentrations

The nearest sensitive receptors to the proposed project site would be individuals utilizing the existing SAR Trail, which is anticipated to be re-routed onto East La Palma Avenue during construction, and individuals at commercial and industrial facilities, and in residential development located 200 feet north of Phase 5B.

SCAQMD localized significant thresholds are new criteria, which were not discussed in the 2001 SEIS/EIR. Although LST criteria were not discussed in 2001, considering the magnitude of the total project emissions, the localized impacts of project construction are expected to be no greater than the impacts that would have been determined in the 2001 SEIS/EIR, had a localized impact determination been completed.

Heavy-duty construction equipment would only operate intermittently each day during the 2-year construction period and would cease following build-out of the project alternative. Therefore, assuming that the duration of potentially harmful construction activities near a sensitive receptor was 2 years, then the exposure would be approximately 3 percent of the total exposure period used for typical health risk calculations (i.e., 70 years). Construction activities would move sequentially and, therefore, individual sensitive receptors would be exposed to TAC emissions for less than 2 years. Due to the significant improvements in engine technology and turnover in the equipment fleet since 2001, the diesel PM emissions would also be anticipated to be lower than what would have been analyzed originally in the 2001 SEIS/EIR. Therefore, the Phase 5B Grouted Stone and Sheet Pile Alternative would not expose sensitive receptors to substantial construction pollutant concentrations. This impact would be less than significant.

Create Objectionable Odors Affecting a Substantial Number of People

Odors would be typical of most construction sites and temporary in nature. Because of the amount and types of equipment, the temporary nature of these emissions, and the highly diffusive properties of diesel exhaust, nearby receptors would not be affected by diesel exhaust odors associated with project construction. After construction of the alternative, all construction-related odors would cease. Operation of the Phase 5B Grouted Stone and Sheet Pile Alternative would not be expected to add any new odor sources. As a result, the Phase 5B Grouted Stone and Sheet Pile Alternative would not create objectionable odors that would affect a substantial number of people. This impact would be less than significant.

Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment.

Heavy-duty off-road equipment, material transport, and worker commutes during construction of the proposed project would result in exhaust-related GHG emissions. The total construction-related GHG emissions for the Phase 5B Preferred Alternative were estimated at 4,225 MT CO_2e. Construction emissions amortized over the assumed lifetime of the project would be 85 MT CO_2e per year. The Phase 5B Preferred Alternative would not emit more than 25,000 MT CO_2e per year. According to CEQ guidance, no further analysis is required. The annualized total construction emissions over the lifetime of the project would be less than the 10,000 MT CO_2e per year threshold of significance recommended by SCAQMD. Therefore, the Phase 5B Preferred Alternative would not generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment. This impact would be less than significant.

Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing GHG emissions

The project alternative would comply with statewide mandates or standards set forth by the Scoping Plan update. The purpose of Phase 5B is to provide river bank protection from predicted future scour associated with the design flood event from Prado Dam. Specifically, the purpose of Phase 5B is to protect roadways, industrial and commercial development, and residential housing in the City of Yorba Linda. The intent, purpose, and function of the proposed project align with the goals of the AB 32 Scoping Plan to protect against the detrimental effects of climate change. No other applicable plans, policies, or regulations adopted for the purpose of reducing GHG emissions apply to the proposed project. Therefore, the project alternative would not conflict with any applicable plan, policy, or regulation for the purpose of reducing GHG emissions. This impact would be less than significant.

Soil Cement Alternative (Alternative 2)

The Soil Cement Alternative would have impacts similar to the Grouted Stone Alternative. As shown in Tables 5.6-11 and 5.6-12, the annual and daily emissions for the Phase 5B Soil Cement Alternative would be greater than the Grouted Stone and Sheet Pile Alternative. However, the Soil Cement Alternative would have overall impacts (e.g., significant and unavoidable NOx emissions) similar to the Grouted Stone and Sheet Pile Alternative. Implementation of the project alternative would not conflict with or obstruct implementation of the AQMP. Table 5.6-11 shows the annual emissions associated with construction of Alternative 2 for Phase 5B. Additional modeling assumptions and details are provided in Appendix C.

Table 5.6-11. Phase 5B – Soil Cement Alternative – General Conformity Analysis

Emission Source	Criteria Pollutant Emissions (tons/year)				
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
2016	2.20	19.08	8.55	9.44	2.39
2017	3.98	34.79	15.47	17.29	4.36

Emission Source	Criteria Pollutant Emissions (tons/year)				
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
2018	2.85	25.19	11.16	12.26	3.10
Maximum Annual Emissions	3.98	34.79	15.47	17.29	4.36
De minimis Thresholds[1]	10	10	100	100	100
Exceed *de minimis* Thresholds?	No	Yes	No	No	No
Exempt from Conformity Analysis and Complies with SIP?	Yes[2]	Yes[2]	Yes	Yes	Yes

[1] *De minimis* thresholds for General Conformity of SCAB nonattainment pollutants VOC and and $PM_{2.5}$, and maintenance pollutants CO and PM_{10}. As described in the 2001 SEIS/EIR, annual NOx emissions were determined to be in conformance under 40 CFR 93.158(a)(5)(v).

[2] Pursuant to Clean Air Act regulations at 40 CFR 932.158(a)(5)(v), emissions of ozone (i.e., VOC and NOx - the precursors to ozone) or nitrogen dioxide are deemed to be in compliance with applicable SIP for projects where the action involves regional water and/or wastewater projects. Furthermore, as indicated in Section 4.4.4 of the 2001 SEIS/EIR, the project is sized to meet the population projection in the SIP. As a result, emissions of VOC, NOx, and NO2 are deemed to be in compliance with the SIP and a conformity analysis is not required for these pollutants.

Source: Modeled by AECOM 2014; for more detail see Appendix C.

As shown in Table 5.6-11, the annual VOC, CO, PM_{10}, and $PM_{2.5}$ emissions would be less than the General Conformity *de minimis* thresholds. Construction-generated NOx emissions would exceed the applicable emission thresholds. However, the SCAQMD thresholds of significance were developed in order to ensure compliance with the SIP. Pursuant to Clean Air Act regulations at 40 CFR 932.158(a)(5)(v), emissions of ozone (i.e., VOC and NOx - the precursors to ozone) or NO2 are deemed to be in compliance with applicable SIP for projects where the action involves regional water and/or wastewater projects. Furthermore, as indicated in Section 4.4.4 of the 2001 SEIS/EIR, the project is sized to meet the population projection in the SIP. As a result, emissions of VOC, NOx, and NO2 are deemed to be in compliance with the SIP and a conformity analysis is not required for these pollutants. Based on the above, NOx emissions would be in compliance with the SIP. Impacts would be less than significant but mitigation measures would be implemented.

As shown in Table 5.6-12, construction emissions for the Phase 5B Soil Cement Alternative would result in maximum daily emissions of approximately 35 pounds of VOC, 284 pounds of NOx, 137 pounds of CO, 144 pounds of PM_{10}, and 37 pounds of $PM_{2.5}$. Additional modeling assumptions and details are provided in Appendix C.

Table 5.6-12. Phase 5B – Soil Cement Alternative – Daily Construction Emissions

Emission Source	Criteria Pollutant Emissions (pounds/day)				
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
Maximum Daily Emissions	34.53	284.44	136.63	144.31	36.63
Daily Thresholds	**75**	**100**	**550**	**150**	**55**
Exceed Thresholds?	**No**	**Yes**	**No**	**No**	**No**

Source: Modeled by AECOM 2014; for more detail see Appendix C.

As shown in Table 5.2-12, construction-generated NOx emissions would exceed the applicable emission thresholds. However, the SCAQMD thresholds of significance were developed in order to ensure compliance with the SIP. Pursuant to Clean Air Act regulations at 40 CFR 932.158(a)(5)(v), emissions of

ozone (i.e., VOC and NOx - the precursors to ozone) or NO2 are deemed to be in compliance with applicable SIP for projects where the action involves regional water and/or wastewater projects. Furthermore, as indicated in Section 4.4.4 of the 2001 SEIS/EIR, the project is sized to meet the population projection in the SIP. As a result, emissions of VOC, NOx, and NO2 are deemed to be in compliance with the SIP and a conformity analysis is not required for these pollutants. Based on the above, NOx emissions would be in compliance with the SIP. Impacts would be less than significant but mitigation measures would be implemented.

The localized impacts of project construction are expected to be no greater than the impacts that would have been determined in the 2001 SEIS/EIR, had a localized impact determination been completed. Due to the significant improvements in engine technology and turnover in the equipment fleet since 2001, the diesel PM emissions would be anticipated to be lower than what would have been analyzed for similar measures in Reach 9 in the 2001 SEIS/EIR. Therefore, the Soil Cement Alternative would not expose sensitive receptors to substantial construction pollutant concentrations. The Soil Cement Alternative would not create objectionable odors affecting a substantial number of people.

The total construction-related GHG emissions for the Phase 5B Soil Cement Alternative were estimated at 12,821 MT CO_2e. Construction emissions amortized over the assumed lifetime of the project would be 256 MT CO_2e per year. Alternative 2 would not emit more than 25,000 MT CO_2e per year. According to CEQ guidance, no further analysis is required. The annualized total construction emissions over the lifetime of the project would also be less than the 10,000 MT CO_2e per year threshold of significance recommended by SCAQMD. This alternative would not generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment. The Soil Cement Alternative would not conflict with any applicable plan, policy, or regulation for the purpose of reducing GHG emissions. This impact would be less than significant.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, there would be no construction of the bank erosion protection structure to provide additional flood protection. There would be no emissions from off-road construction equipment or on-road motor vehicles for the import or export of fill from the project area. Based on the above, there would be no impact on air quality.

However, future high flow conditions could require emergency repairs of the existing bank protection. It is likely that any emergency repair would be limited in scope and duration. Air quality impacts associated with emergency repairs would not be anticipated to exceed General Conformity *de minimis* thresholds or the SCAQMD daily emission thresholds.

5.6.2.3 Phase 4

Soil Cement Alternative (Preferred Alternative, Alternative 1)

Conflict with or Obstruct Implementation of the Applicable Air Quality Plan.

Construction activities under the Soil Cement Alternative would not substantially change from the assumed overall level of impact for the SARMP addressed in the 2001 SEIS/EIR. Because the Phase 4 Soil Cement Alternative would be consistent with the assumptions regarding equipment activity and emissions in the 2012 AQMP and existing planning documents, it is expected that the intensity of construction and operational emissions associated with the this alternative would have been accounted for in the AQMP. Implementation of the Phase 4 Soil Cement Alternative would not conflict with or obstruct implementation of the AQMP. Therefore, this impact would be less than significant.

Violate any Air Quality Standard or Contribute Substantially to an Existing or Projected Air Quality Violation

Under this alternative, an approximately 150-foot-long soil cement structure would be constructed in front of the existing soil cement. The anticipated construction sequence includes clear and grub, placement of sound wall, installation of dewatering system, excavation of toe, stockpile material, placement of soil cement, backfill, extension of side drains, removal of dewatering system, construction of permanent bike path, removal of temporary bike paths, hydro-seeding and replanting. Equipment anticipated to be used for construction of the soil cement structure under this alternative would include, but is not limited to, excavators, front-end loaders, bulldozers, dump trucks, soil cement compactors (i.e., sheep-foot and smooth-wheel rollers), a grader, concrete pump trucks, water trucks, and a soil cement batch plant. In addition, the alternative will require approximately 60,000 cy of fill material. The designated borrow site is within Prado Basin. One-way trip from the borrow site to the project site is approximately 15 miles. It is assumed that the fill material will be imported using double-belly dump trucks. Each truck can carry approximately 15 cy of material; therefore, a total of approximately 4,000 truck trips will be required. Construction is expected to continue to approximately December 2017.

Table 5.6-13 shows the annual emissions associated with construction of the Phase 4 Soil Cement Alternative. Additional modeling assumptions and details are provided in Appendix C.

Table 5.6-13. Phase 4 – Soil Cement Alternative – General Conformity Analysis

Emission Source	Criteria Pollutant Emissions (tons/year)				
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
2016	0.07	0.79	0.53	7.735	1.66
2017	2.36	19.86	9.56	9.47	2.488
Maximum Annual Emissions	2.816	19.66	10.41	8.46	103.75
De minimis Thresholds[1]	10	10	100	100	100
Exceed *de minimis* Thresholds?	No	Yes	No	No	No
Exempt from Conformity Analysis and Complies with SIP?	Yes[2]	Yes[2]	Yes	Yes	Yes

1 *De minimis* thresholds for General Conformity of SCAB nonattainment pollutants VOC and and $PM_{2.5}$, and maintenance pollutants CO and PM_{10}. As described in the 2001 SEIS/EIR, annual NOx emissions were determined to be in conformance under 40 CFR 93.158(a)(5)(v).

2 Pursuant to Clean Air Act regulations at 40 CFR 932.158(a)(5)(v), emissions of ozone (i.e., VOC and NOx - the precursors to ozone) or nitrogen dioxide are deemed to be in compliance with applicable SIP for projects

where the action involves regional water and/or wastewater projects. Furthermore, as indicated in Section 4.4.4 of the 2001 SEIS/EIR, the project is sized to meet the population projection in the SIP. As a result, emissions of VOC, NOx, and NO2 are deemed to be in compliance with the SIP and a conformity analysis is not required for these pollutants.

Source: Modeled by AECOM 2014; for more detail see Appendix C.

As shown in Table 5.6-13, the annual VOC, CO, PM_{10}, and $PM_{2.5}$ emissions would be less than the General Conformity *de minimis* thresholds. Construction-generated NOx emissions would exceed the applicable emission thresholds. However, the SCAQMD thresholds of significance were developed in order to ensure compliance with the SIP. Pursuant to Clean Air Act regulations at 40 CFR 932.158(a)(5)(v), emissions of ozone (i.e., VOC and NOx - the precursors to ozone) or NO2 are deemed to be in compliance with applicable SIP for projects where the action involves regional water and/or wastewater projects. Furthermore, as indicated in Section 4.4.4 of the 2001 SEIS/EIR, the project is sized to meet the population projection in the SIP. As a result, emissions of VOC, NOx, and NO2 are deemed to be in compliance with the SIP and a conformity analysis is not required for these pollutants. Based on the above, NOx emissions would be in compliance with the SIP. Impacts would be less than significant but mitigation measures would be implemented.

As shown in Table 5.6-14, construction emissions for the project alternative would result in maximum daily emissions of approximately 34 pounds of VOC, 292 pounds of NOx, 142 pounds of CO, 166 pounds of PM_{10}, and 41 pounds of $PM_{2.5}$. Additional modeling assumptions and details are provided in Appendix C.

Table 5.6-14. Phase 4 – Soil Cement Alternative – Daily Construction Emissions

Emission Source	Criteria Pollutant Emissions (pounds/day)				
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
Maximum Daily Emissions	34.01	291.78	142.23	165.85	40.91
Daily Thresholds	**75**	**100**	**550**	**150**	**55**
Exceed Thresholds?	**No**	**Yes**	**No**	**No[1]**	**No**

[1] Application of AQ-12 would reduce PM_{10} emissions by approximately 50%. Thus, the residual emissions would be not exceed Daily Thresholds.

Source: Modeled by AECOM 2014; for more detail see Appendix C.

As shown in Table 5.6-14, construction-related emissions of VOC, CO, and $PM_{2.5}$ would not exceed the thresholds of significance and would not violate any air quality standard or contribute substantially to an existing or projected air quality violation. Construction-generated NOx and PM_{10} emissions would exceed the applicable emission thresholds. Application of AQ-12 would reduce PM_{10} emissions by approximately 50%. Thus, the residual emissions would be less than significant.

The SCAQMD thresholds of significance were developed in order to ensure compliance with the SIP. Pursuant to Clean Air Act regulations at 40 CFR 932.158(a)(5)(v), emissions of ozone (i.e., VOC and NOx - the precursors to ozone) or NO2 are deemed to be in compliance with applicable SIP for projects where the action involves regional water and/or wastewater projects. Furthermore, as indicated in Section

4.4.4 of the 2001 SEIS/EIR, the project is sized to meet the population projection in the SIP. As a result, emissions of VOC, NOx, and NO2 are deemed to be in compliance with the SIP and a conformity analysis is not required for these pollutants. Based on the above, NOx emissions would be in compliance with the SIP. Impacts would be less than significant but mitigation measures would be implemented.

Result in a Cumulatively Considerable Net Increase of Any Criteria Pollutant for which the Project Region is Non-Attainment under an Applicable Federal or State Ambient Air Quality Standard (Including Releasing Emissions which Exceed Quantitative Thresholds for Ozone Precursors)

By its very nature, air pollution is largely a cumulative impact. A project's emissions may be individually limited, but cumulatively considerable when taken in combination with past, present, and future development projects. The SCAQMD thresholds of significance are relevant to whether a project's individual emissions would result in a cumulatively considerable incremental contribution to the existing cumulative air quality conditions.

Construction-generated NOx emissions would exceed the applicable emission thresholds. However, the SCAQMD thresholds of significance were developed in order to ensure compliance with the SIP. Pursuant to Clean Air Act regulations at 40 CFR 932.158(a)(5)(v), emissions of ozone (i.e., VOC and NOx - the precursors to ozone) or NO2 are deemed to be in compliance with applicable SIP for projects where the action involves regional water and/or wastewater projects. Furthermore, as indicated in Section 4.4.4 of the 2001 SEIS/EIR, the project is sized to meet the population projection in the SIP. As a result, emissions of VOC, NOx, and NO2 are deemed to be in compliance with the SIP and a conformity analysis is not required for these pollutants. Based on the above, NOx emissions would be in compliance with the SIP. Impacts would be less than significant but mitigation measures would be implemented.

Expose Sensitive Receptors to Substantial Pollutant Concentrations

The nearest sensitive receptors to Phase 4 would be individuals utilizing the existing SAR Trail, which would be re-routed through Phase 4 during construction, and users of Green River Golf Course, portions of which lie within approximately 1,500 feet east of the project site. The nearest residential development is located more than 1,000 feet to the north, across the SAR from the project site.

SCAQMD localized significant thresholds are new criteria, which were not discussed in the 2001 SEIS/EIR. Although LST criteria were not discussed in 2001, considering the magnitude of the total project emissions, the localized impacts of project construction are expected to be no greater than the impacts that would have been determined in the 2001 SEIS/EIR, had a localized impact determination been completed.

Heavy-duty construction equipment would only operate intermittently each day during the 1-year construction period and would cease following build-out of the project alternative. Therefore, assuming that the duration of potentially harmful construction activities near a sensitive receptor was 1 year, then the exposure would be approximately 1 percent of the total exposure period used for typical health risk calculations (i.e., 70 years). Construction activities would move sequentially and, therefore, individual sensitive receptors would be exposed to TAC emissions for less than 1 year. Due to the significant

improvements in engine technology and turnover in the equipment fleet since 2001, the diesel PM emissions would also be anticipated to be lower than what would have been analyzed originally in the 2001 SEIS/EIR. Therefore, the Phase 4 Soil Cement Alternative would not expose sensitive receptors to substantial construction pollutant concentrations. This impact would be less than significant.

Create Objectionable Odors Affecting a Substantial Number of People

Odors would be typical of most construction sites and temporary in nature. Because of the amount and types of equipment, the temporary nature of these emissions, and the highly diffusive properties of diesel exhaust, nearby receptors would not be affected by diesel exhaust odors associated with project construction. After construction of the project alternative, all construction-related odors would cease. Operation of this alternative would not be expected to add any new odor sources. As a result, the Phase 4 Soil Cement Alternative would not create objectionable odors that would affect a substantial number of people. This impact would be less than significant.

Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment.

The total construction-related GHG emissions for the Phase 4 Soil Cement Alternative were estimated at 3,429 MT CO_2e. Construction emissions amortized over the assumed lifetime of the project would be 68 MT CO_2e per year. The Phase 4 Preferred Alternative would not emit more than 25,000 MT CO_2e per year. According to CEQ guidance, no further analysis is required. The annualized total construction emissions over the lifetime of the project would be less than the 10,000 MT CO_2e per year threshold of significance recommended by SCAQMD. Therefore, the project alternative would not generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment. This impact would be less than significant.

Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing GHG emissions

The proposed project would comply with statewide mandates or standards set forth by the Scoping Plan update. The purpose of the proposed project is to provide river bank protection from predicted future scour associated with the design flood event from Prado Dam. Specifically, the purpose of Phase 4 is to protect infrastructure and resources, but also to help avoid rebuild and repair expenditures, losses and disruptions to economic activities, and reduction in the quality of life of local residents in the case that a flood event impacted the area. The intent, purpose, and function of the proposed project align with the goals of the AB 32 Scoping Plan to protect against the detrimental effects of climate change. No other applicable plans, policies, or regulations adopted for the purpose of reducing GHG emissions apply to the proposed project. Therefore, the Phase 4 Soil Cement Alternative would not conflict with any applicable plan, policy, or regulation for the purpose of reducing GHG emissions. This impact would be less than significant.

<u>Grouted Stone Alternative (Alternative 2)</u>

The Grouted Stone Alternative would have impacts similar to the Soil Cement Alternative. As shown in Tables 5.6-15 and 5.6-16, the annual and daily emissions for the Grouted Stone Alternative would be less than the Soil Cement Alternative. However, the Grouted Stone Alternative would have overall impacts (e.g., significant and unavoidable NOx emissions) similar to the Soil Cement Alternative. Implementation of the Grouted Stone Alternative would not conflict with or obstruct implementation of the AQMP. Table 5.6-15 shows the annual emissions associated with construction of the Grouted Stone Alternative. Additional modeling assumptions and details are provided in Appendix C.

As shown in Table 5.6-15, the annual VOC, CO, PM_{10}, and $PM_{2.5}$ emissions would be less than the General Conformity *de minimis* thresholds. Consistent with the approach in the 2001 SEIS/EIR, the annual NOx emissions associated with the Grouted Stone Alternative were determined to be in conformance under 40 CFR 93.158(a)(5)(v). Therefore, construction-related emissions associated with Phase 4 Grouted Stone Alternative would conform to the SIP, and a formal conformity analysis would not be required.

Table 5.6-15. Phase 4 – Grouted Stone Alternative – General Conformity Analysis

Emission Source	Criteria Pollutant Emissions (tons/year)				
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
2016	0.04	0.31	0.25	4.59	1.24
2017	0.98	7.30	4.20	5.58	1.66
Maximum Annual Emissions	0.98	7.30	4.20	5.58	1.66
De minimis Thresholds[1]	10	10	100	100	100
Exceed *de minimis* Thresholds?	No	No	No	No	No
Exempt from Conformity Analysis and Complies with SIP?	Yes	Yes	Yes	Yes	Yes

[1] *De minimis* thresholds for General Conformity of SCAB nonattainment pollutants VOC and and $PM_{2.5}$, and maintenance pollutants CO and PM_{10}. As described in the 2001 SEIS/EIR, annual NOx emissions were determined to be in conformance under 40 CFR 93.158(a)(5)(v).

Source: Modeled by AECOM 2014; for more detail see Appendix C.

As shown in Table 5.6-16, construction emissions for the Grouted Stone Alternative would result in maximum daily emissions of approximately 18 pounds of VOC, 156 pounds of NOx, 86 pounds of CO, 77 pounds of PM_{10}, and 24 pounds of $PM_{2.5}$. Additional modeling assumptions and details are provided in Appendix C.

Table 5.6-16. Phase 4 – Grouted Stone Alternative - Daily Construction Emissions

Emission Source	Criteria Pollutant Emissions (pounds/day)				
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
Maximum Daily Emissions	17.74	155.55	86.37	76.57	24.10
Daily Thresholds	**75**	**100**	**550**	**150**	**55**
Exceed Thresholds?	**No**	**Yes**	**No**	**No**	**No**

Source: Modeled by AECOM 2014; for more detail see Appendix C.

As shown in Table 5.2-16, construction-generated NOx emissions would exceed the applicable emission thresholds. However, the SCAQMD thresholds of significance were developed in order to ensure

compliance with the SIP. Pursuant to Clean Air Act regulations at 40 CFR 932.158(a)(5)(v), emissions of ozone (i.e., VOC and NOx - the precursors to ozone) or NO2 are deemed to be in compliance with applicable SIP for projects where the action involves regional water and/or wastewater projects. Furthermore, as indicated in Section 4.4.4 of the 2001 SEIS/EIR, the project is sized to meet the population projection in the SIP. As a result, emissions of VOC, NOx, and NO2 are deemed to be in compliance with the SIP and a conformity analysis is not required for these pollutants. Based on the above, NOx emissions would be in compliance with the SIP. Impacts would be less than significant but mitigation measures would be implemented.

Because the Grouted Stone Alternative would exceed the SCAQMD project-level air quality significance thresholds, the proposed project's construction emissions would have a cumulatively considerable contribution to the region's air quality. The localized impacts of project construction are expected to be no greater than the impacts that would have been determined in the 2001 SEIS/EIR, had a localized impact determination been completed. Due to the significant improvements in engine technology and turnover in the equipment fleet since 2001, the diesel PM emissions would be anticipated to be lower than what would have been analyzed for similar measures in Reach 9 in the 2001 SEIS/EIR. Therefore, the Phase 4 Grouted Stone Alternative would not expose sensitive receptors to substantial construction pollutant concentrations. This impact would be less than significant. Alternative 2 would not create objectionable odors affecting a substantial number of people.

The total construction-related GHG emissions for the Grouted Stone Alternative were estimated at 1,314 MT CO_2e. Construction emissions amortized over the assumed lifetime of the project would be 26 MT CO_2e per year. Alternative 2 would not emit more than 25,000 MT CO_2e per year. According to CEQ guidance, no further analysis is required. The annualized total construction emissions over the lifetime of the project would also be less than the 10,000 MT CO_2e per year threshold of significance recommended by SCAQMD. The Grouted Stone Alternative would not generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment. Phase 4 Grouted Stone Alternative would not conflict with any applicable plan, policy, or regulation for the purpose of reducing GHG emissions. This impact would be less than significant.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, there would be no construction of the bank erosion protection structure to provide additional flood protection. There would be no emissions from off-road construction equipment or on-road motor vehicles for the import or export of fill from the project area. Based on the above, there would be no impact to air quality.

However, future high flow conditions could require emergency repairs of the existing bank protection. It is likely that any emergency repair would be limited in scope and duration. Air quality impacts associated with emergency repairs would not be anticipated to exceed General Conformity *de minimis* thresholds or the SCAQMD daily emission thresholds.

5.6.2.4 BNSF Bridge

Pier and Abutment Protection Alternative (Preferred Alternative, Alternative 1)

Conflict with or Obstruct Implementation of the Applicable Air Quality Plan.

Construction activities for the BNSF Bridge Preferred Alternative would not substantially change the assumed overall level of impact for the SARMP addressed in the 2001 SEIS/EIR. Because the BNSF Bridge Preferred Alternative would be consistent with the assumptions regarding equipment activity and emissions in the 2012 AQMP and existing planning documents, it is expected that the intensity of construction and operational emissions associated with the project alternative would have been accounted for in the AQMP. Therefore, implementation of the Preferred Alternative would not conflict with or obstruct implementation of the AQMP. This impact would be less than significant.

Violate any Air Quality Standard or Contribute Substantially to an Existing or Projected Air Quality Violation

The BNSF Bridge Preferred Alternative would include construction of reinforced concrete walls, sheet pile and reinforced concrete diaphragm walls, and grouted stone protection. Equipment to be used for construction of bridge and bank protection features under this alternative would include, but is not limited to, cranes, bulldozers, excavators, compactors, dump trucks, rollers, pickup trucks, earth augers, vacuum trucks, pile drivers, low overhead drill rigs, and low headroom hydromill. Construction is expected to take 22 months to complete.

Table 5.6-17 shows the annual emissions associated with construction of the BNSF Bridge Preferred Alternative. Additional modeling assumptions and details are provided in Appendix C.

Table 5.6-17. BNSF Bridge - General Conformity Analysis

Emission Source	Criteria Pollutant Emissions (tons/year)				
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
2016	0.51	3.48	1.89	4.33	1.24
2017	0.67	4.27	2.48	8.57	2.40
2018	0.53	3.69	2.01	4.69	1.34
Maximum Annual Emissions	0.67	4.27	2.48	8.57	2.40
De minimis Thresholds[1]	10	10	100	100	100
Exceed *de minimis* Thresholds?	No	No	No	No	No

[1] *De minimis* thresholds for General Conformity of SCAB nonattainment pollutants VOC and and $PM_{2.5}$, and maintenance pollutants CO and PM_{10}. As described in the 2001 SEIS/EIR, annual NOx emissions were determined to be in conformance under 40 CFR 93.158(a)(5)(v).

Source: Modeled by AECOM 2014; for more detail see Appendix C.

As shown in Table 5.6-17, the annual VOC, CO, PM_{10}, and $PM_{2.5}$ emissions would be less than the General Conformity *de minimis* thresholds. Consistent with the approach in the 2001 SEIS/EIR, the annual NOx emissions associated with the BNSF Bridge Preferred Alternative were determined to be in conformance under 40 CFR 93.158(a)(5)(v). Therefore, construction-related emissions associated with the Preferred Alternative would conform to the SIP, and a formal conformity analysis would not be required.

As shown in Table 5.6-18, construction emissions for the proposed project would result in maximum daily emissions of approximately 56 pounds of VOC, 431 pounds of NOx, 206 pounds of CO, 87 pounds of PM_{10}, and 32 pounds of $PM_{2.5}$. Additional modeling assumptions and details are provided in Appendix C.

Table 5.6-18. BNSF Bridge – Pier and Abutment Protection Alternative – Daily Construction Emissions

Emission Source	Criteria Pollutant Emissions (pounds/day)				
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
Maximum Daily Emissions	56.36	431.20	206.06	86.55	32.43
Daily Thresholds	**75**	**100**	**550**	**150**	**55**
Exceed Thresholds?	**No**	**Yes**	**No**	**No**	**No**

Source: Modeled by AECOM 2014; for more detail see Appendix C.

As shown in Table 5.6-18, construction-related emissions of VOC, CO, PM_{10}, and $PM_{2.5}$ would not exceed the thresholds of significance and would not violate any air quality standard or contribute substantially to an existing or projected air quality violation. Construction-generated NOx emissions would exceed the applicable emission thresholds. However, the SCAQMD thresholds of significance were developed in order to ensure compliance with the SIP. Pursuant to Clean Air Act regulations at 40 CFR 932.158(a)(5)(v), emissions of ozone (i.e., VOC and NOx - the precursors to ozone) or NO2 are deemed to be in compliance with applicable SIP for projects where the action involves regional water and/or wastewater projects. Furthermore, as indicated in Section 4.4.4 of the 2001 SEIS/EIR, the project is sized to meet the population projection in the SIP. As a result, emissions of VOC, NOx, and NO2 are deemed to be in compliance with the SIP and a conformity analysis is not required for these pollutants. Based on the above, NOx emissions would be in compliance with the SIP. Impacts would be less than significant but mitigation measures would be implemented.

The BNSF Bridge Preferred Alternative is not anticipated to generate substantial new vehicle trips or use of off-road equipment during OMRR&R activities. No new permanent, stationary source of emissions would be constructed or operated as part of the project. Activities would include structural and non-structural repairs and inspections. These long-term activities would not generate substantial criteria pollutant emissions. Therefore, operational emissions were not estimated for the proposed project.

Result in a Cumulatively Considerable Net Increase of Any Criteria Pollutant for which the Project Region is Non-Attainment under an Applicable Federal or State Ambient Air Quality Standard (Including Releasing Emissions which Exceed Quantitative Thresholds for Ozone Precursors)

By its very nature, air pollution is largely a cumulative impact. A project's emissions may be individually limited, but cumulatively considerable when taken in combination with past, present, and future development projects. The SCAQMD thresholds of significance are relevant to whether a project's individual emissions would result in a cumulatively considerable incremental contribution to the existing cumulative air quality conditions.

Construction-generated NOx emissions would exceed the applicable emission thresholds. However, the SCAQMD thresholds of significance were developed in order to ensure compliance with the SIP. Pursuant to Clean Air Act regulations at 40 CFR 932.158(a)(5)(v), emissions of ozone (i.e., VOC and NOx - the precursors to ozone) or NO2 are deemed to be in compliance with applicable SIP for projects where the action involves regional water and/or wastewater projects. Furthermore, as indicated in Section 4.4.4 of the 2001 SEIS/EIR, the project is sized to meet the population projection in the SIP. As a result, emissions of VOC, NOx, and NO2 are deemed to be in compliance with the SIP and a conformity analysis is not required for these pollutants. Based on the above, NOx emissions would be in compliance with the SIP. Impacts would be less than significant but mitigation measures would be implemented.

Expose Sensitive Receptors to Substantial Pollutant Concentrations

The nearest sensitive receptors to BNSF Bridge would be users of the Green River Golf Course, adjacent to the site on the west, and residents of the Green River Mobile Home Park, approximately 200 feet east of the project site.

SCAQMD localized significant thresholds are new criteria, which were not discussed in the 2001 SEIS/EIR. Although LST criteria were not discussed in 2001, considering the magnitude of the total project emissions, the localized impacts of project construction are expected to be no greater than the impacts that would have been determined in the 2001 SEIS/EIR, had a localized impact determination been completed.

The greatest potential for TAC emissions would be related to diesel PM emissions associated with heavy-duty construction equipment operations. Health effects from carcinogenic TACs are usually described in terms of individual cancer risk, which is based on a 70-year lifetime exposure to TACs. Heavy-duty construction equipment would only operate intermittently each day during the 2-year construction period and would cease following build-out of the project alternative. Therefore, assuming that the duration of potentially harmful construction activities near a sensitive receptor was 2 years, then the exposure would be approximately 3 percent of the total exposure period used for typical health risk calculations (i.e., 70 years). Due to the significant improvements in engine technology and turnover in the equipment fleet since 2001, the diesel PM emissions would also be anticipated to be lower than what would have been analyzed originally in the 2001 SEIS/EIR. Therefore, the BNSF Bridge Preferred Alternative would not expose sensitive receptors to substantial construction pollutant concentrations. This impact would be less than significant.

Create Objectionable Odors Affecting a Substantial Number of People

Odors would be typical of most construction sites and temporary in nature. Because of the amount and types of equipment, the temporary nature of these emissions, and the highly diffusive properties of diesel exhaust, nearby receptors would not be affected by diesel exhaust odors associated with project construction. After construction of the alternative, all construction-related odors would cease. Operation of the BNSF Bridge Preferred Alternative would not be expected to add any new odor

sources. As a result, the BNSF Bridge Preferred Alternative would not create objectionable odors that would affect a substantial number of people. This impact would be less than significant.

Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment.

The total construction-related GHG emissions for the BNSF Bridge Preferred Alternative were estimated at 1,879 MT CO_2e. The BNSF Bridge Preferred Alternative would not emit more than 25,000 MT CO_2e per year. According to CEQ guidance, no further analysis is required. Construction emissions amortized over the assumed lifetime of the project would be 38 MT CO_2e per year. The annualized total construction emissions over the lifetime of the project would be less than the 10,000 MT CO_2e per year threshold of significance recommended by SCAQMD. Therefore, the BNSF Bridge Preferred Alternative would not generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment. This impact would be less than significant.

Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing GHG emissions

The BNSF Bridge Preferred Alternative would comply with statewide mandates or standards set forth by the Scoping Plan update. The purpose of the proposed project is to provide river bank protection from predicted future scour associated with the design flood event from Prado Dam. Specifically, the purpose of the BNSF Bridge Preferred Alternative is to protect infrastructure and resources, but also to help avoid rebuild and repair expenditures, losses and disruptions to economic activities, and reduction in the quality of life of local residents in the event of a flood. The intent, purpose, and function of the proposed project align with the goals of the AB 32 Scoping Plan to protect against the detrimental effects of climate change. No other applicable plans, policies, or regulations adopted for the purpose of reducing GHG emissions apply to the proposed project. Therefore, the project would not conflict with any applicable plan, policy, or regulation for the purpose of reducing GHG emissions. This impact would be less than significant.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, there would be no construction of bridge pier or abutment protection features to provide additional flood protection. There would be no emissions from off-road construction equipment or on-road motor vehicles for the import or export of fill and materials to and from the project area. Based on the above, there would be no impact on air quality.

However, future high flow conditions could require emergency repairs of existing protection at BNSF Bridge. It is likely that any emergency repair would be limited in scope and duration. Air quality impacts associated with emergency repairs would not be anticipated to exceed General Conformity *de minimis* thresholds or the SCAQMD daily emission thresholds.

5.6.3 Environmental Commitments

Mitigation measures were addressed and documented in the 2001 SEIS/ EIR. Implementation of the following environmental commitments identified in the 2001 SEIS/EIR by the Corps would reduce the temporary construction-related air quality impacts.

The following measures will be implemented to reduce construction emissions of NOx:

AQ-1 The project construction contractor shall retard diesel engine injection timing by 2 degrees before top center on all construction equipment that was manufactured before 1996, and that does not have an existing internal combustion (IC) engine warranty with the manufacturer. The contractor shall provide a certification from a third-party certified mechanic prior to start of construction, stating the timing of all diesel-powered construction equipment engines have been retarded 2 degrees before top center.

AQ-2 The project construction contractor shall use high-pressure injectors on all diesel engines that were manufactured before 1996, and which do not have existing IC engine warranties with the manufacturer. The contractor shall provide documentation of warranty and manufacture date or a certification from a third-party certified mechanic stating that all diesel construction equipment engines are utilizing high-pressure fuel injectors.

AQ-3 The project construction contractor shall use Caterpillar pre-chamber diesel engines or equivalent, and perform proper maintenance and operation.

AQ-4 The project construction contractor shall electrify equipment, where feasible.

AQ-5 The project construction contractor shall restrict the idling of construction equipment to 10 minutes.

AQ-6 The project construction contractor shall ensure that equipment will be maintained in proper tune to prevent visible soot from reducing light transmission through the exhaust stack exit by more than 20 percent for more than 3 minutes per hour and use low-sulfur fuel as required by SCAQMD regulation.

AQ-7 The project construction contractor shall use catalytic converters on all gasoline equipment (except for small [2-cylinder] generator engines). If this measure is not implemented, emissions from gasoline equipment shall be offset by other means (e.g., Emission Reduction Credits).

AQ-8 The project construction contractor shall cease construction during periods of high ambient ozone concentrations (i.e., Stage 2 smog alerts) near the construction area (SCAQMD 1993).

AQ-9 The project construction contractor shall schedule all material deliveries to the construction spread outside of peak traffic hours, and minimize other truck trips during peak traffic hours, or as approved by local jurisdictions.

AQ-10 The project construction contractor shall use only solar-powered traffic signs (no gasoline-powered generators shall be used).

The following measures will be implemented to reduce construction emissions of PM_{10}:

AQ-11 The project construction contractor shall apply non-toxic soil stabilizers according to manufacturers' specification to all inactive construction areas (previously graded areas inactive for 10 days or more; soil stockpiled for 2 days or more).

AQ-12 The project construction contractor shall enclose, cover, water twice daily, or apply non-toxic soil binders according to manufacturers' specifications to exposed stockpiles (i.e., gravel, sand, dirt) with 5 percent or greater silt content.

AQ-13 In areas where dewatering is not required, the project construction contractor shall water active grading/excavation sites at least twice daily.

AQ-14 The project construction contractor shall increase dust control watering when wind speeds exceed 15 mph for a sustained period of greater than 10 minutes, as measured by an anemometer. The amount of additional watering would depend upon soil moisture content at the time; but no airborne dust should be visible.

AQ-15 The project construction contractor shall suspend all excavating and grading operations when wind speeds (as instantaneous gusts) exceed 25 mph (40 kph).

AQ-16 The project construction contractor shall ensure that trucks hauling dirt on public roads to and from the site are covered and maintain a 50 mm (2 in) differential between the maximum height of any hauled material and the top of the haul trailer. Haul truck drivers shall water the load prior to leaving the site to prevent soil loss during transport.

AQ-17 The project construction contractor shall ensure that graded surfaces used for off-road parking, materials lay-down, or awaiting future construction are stabilized for dust control, as needed.

AQ-18 The project construction contractor shall sweep streets in the project vicinity once a day if visible soil material is carried to adjacent streets.

AQ-19 The project construction contractor shall install wheel washers where vehicles enter and exit unpaved roads onto paved roads, or wash off trucks and any equipment leaving the site each trip.

AQ-20 The project construction contractor shall apply water three times daily, or apply non-toxic soil stabilizers according to manufacturers' specifications to all unpaved parking, staging areas, or unpaved road surfaces.

AQ-21 The project construction contractor shall ensure that traffic speeds on all unpaved roads to be reduced to 15 mph (25 kph) or less.

The following measures will be implemented to reduce construction emissions of CO and ROC:

AQ-22 Prior to the approval of plans and specifications, the Corps shall ensure that plans and specifications specify that all heavy equipment shall be maintained in a proper state of tune as per the manufacturer's specifications.

The following environmental commitments have been updated and are required to reduce criteria pollutant emissions:

AQ-23 Prepare and implement a fugitive dust emission control plan. Measures to be incorporated into the plan shall include, but are not limited to, the following:

- Water the unpaved road access and other disturbed areas of the active construction sites at least three times per day, or apply CARB-certified soil binders.
- Enclose or cover exposed soil piles with a 5 percent or greater silt content. Alternatively water three times daily, or apply CARB-certified soil binders.
- Install rumble plates and wheel washers/cleaners or wash the wheels/exteriors of trucks and other heavy equipment where vehicles exit the site.
- Sweep paved areas daily with water sweepers if visible soil material from the construction sites or unpaved access roads is carried onto such areas.

AQ-24 Diesel engine idle time shall be restricted to no more than 5 minutes in duration. This is not required for trucks that require engines to be on while waiting onsite, such as concrete trucks.

AQ-25 Use lower emitting off-road diesel-fueled equipment. All off-road construction diesel engines not registered under CARB's Statewide Portable Equipment Registration Program, which have a rating of 50 hp or more, shall meet, at a minimum, the Tier 3 California Emission Standards for Off-Road Compression-Ignition Engines as specified in California Code of Regulations, Title 13, section 2423(b) (1) unless that such engine is not available for a particular item of equipment. In the event a Tier 3 engine is not available for any off-road engine larger than 50 hp, that engine shall be equipped with a Tier 2 engine. This measure does not apply to construction equipment that are active at the site for less than 2 weeks total duration and specific exceptions to these requirements may be allowed on a case-by-case basis in the determination of extreme financial difficulty for subcontractors that are using specialized self-owned construction equipment.

AQ-26 Use on-road vehicles that meet California on-road emission standards.

AQ-27 Schedule deliveries outside of peak hours. All material deliveries to the project site shall be scheduled to occur outside of peak "rush hour" traffic hours (7:00 to 10:00 a.m. and 4:00 to 7:00 p.m.) to the extent feasible, and other truck trips during peak traffic hours shall be minimized to the extent feasible.

5.6.4 Summary of Significance Thresholds Related to Proposed Alternatives

Consistent with previous analyses conducted for the SARMP (and disclosed in previous Environmental Impact States), the proposed alternatives would have significant impacts on air quality, based on the following:

- Implementation of the Preferred Alternative or Alternative 2 of each Reach 9 measure would violate air quality standards for NOx contribute substantially to an existing or projected air quality violation.
- Implementation of the Preferred Alternative or Alternative 2 of each Reach 9 measure would result in a cumulatively considerable net increase of a criteria pollutant (NOx) for which the SARMP region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions that exceed quantitative thresholds for ozone precursors).

The proposed alternatives would not have significant impacts on the following:

- The proposed alternatives would not conflict with or obstruct implementation of the applicable air quality plan;
- The proposed alternatives would not expose sensitive receptors to substantial pollutant concentrations;
- The proposed alternatives would not create objectionable odors affecting a substantial number of people;
- The proposed alternatives would not generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment;
- The proposed alternative would not conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing GHG emissions.

5.7 Noise

5.7.1 Affected Environment

5.7.1.1 Phase 5A, Phase 5B, and Phase 4

Phase 5A, Phase 5B, and Phase 4 are located within the City of Yorba Linda, Orange County. Title 8, Chapter 8.32 of the City of Yorba Linda Municipal Code provides exterior and interior noise standards, special provisions, exemptions, and variances for noise sources. The City of Yorba Linda Municipal Code only provides protection for residential uses and does not protect institutional, commercial, office, and industrial uses (City of Yorba Linda 2014a).

- Section 8.32.060 Noise Standards – Exterior. The following standards, unless otherwise specifically indicated, shall apply to all residential property with a designated noise zone I (all residential properties in the city): 55 A-weighted decibels (dBA) (7:00 a.m. – 10:00 p.m.) and 50 dBA (10 p.m. – 7 a.m.).

  Based on the above standards, an impact would occur if the maximum allowable noise level is exceeded by:

  a. The noise standard for a cumulative period of more than 30 minutes in any hour;
  b. The noise standard plus 5 dBA for a cumulative period of more than 15 minutes in any hour;
  c. The noise standard plus 10 dBA for a cumulative period of more than 5 minutes in any hour;
  d. The noise standard plus 15 dBA for a cumulative period of more than 1 minute in any hour; or
  e. The noise standard plus 20 dBA for any period of time.

There are certain exempt activities, which include occasional recreational events, emergency-related noise, agricultural operations, and construction. Construction activities are specifically exempt from the noise ordinance pursuant to Section 8.32.090(D) of the City of Yorba Linda Municipal Code providing that “Noise sources associated with construction, repair, remodeling, or grading of any real property, provided said activities do not take place between the hours of 8:00 p.m. and 7:00 a.m. on weekdays, including Saturday, or at any time on Sunday or a federal holiday.” If the construction activities need to occur outside of this timeframe, an application may be filed with the Health Officer for a variance pursuant to Section 8.32.120, Variance Procedure, of the City of Yorba Linda Municipal Code.

The primary sources of noise are traffic on SR-91 (located approximately 360 feet to 4,000 feet south of Phases 5A, 5B, and 4 areas); traffic on East La Palma Avenue (located approximately 150 feet north of Phases 5A and 5B areas); and rail traffic on the BNSF railway (located approximately 800 feet to 1,100 feet north of Phases 5A, 5B, and 4, and immediately above the BNSF Bridge area).

As part of the 1993 Yorba Linda General Plan Noise Element development process, noise measurements were taken within the Featherly Regional Park near the intersection of Gypsum Canyon Road and SR-91. The noise measurements demonstrated a sound level of 65.9 dBA at approximately 200 feet from the

predominant noise sources: Gypsum Canyon Road and SR-91. This noise level is significantly above the City of Yorba Linda noise ordinance limits of 55 dBA. Additionally, a noise study near the construction area revealed that traffic noise at SR-91 was approximately 79.6 dBA (Corps 2001a). The Riverside County General Plan estimates 65 Day-Night Average Noise Level (Ldn) noise contour associated with operations on BNSF Railroad tracks. On the north side of the construction area is a set of three railroad tracks used by freight and passenger trains. According to sound level estimates provided in the City of Yorba Linda General Plan Noise Element, sound levels from railway operations range from 55 to 60 dBA at residential properties on the north side of the construction area (approximately 900 feet from the tracks) to 70 to 75 dBA at homes nearest the tracks. The railway noise can also occur at any time of the day or night. As a result, many homes experience significant, existing noise impacts from the railway that are frequently above the ordinance noise limits.

Heavy trucks can generate vibrations that depend on vehicle type, weight, and pavement conditions. Existing vibration in the construction site vicinity would be related to heavy truck traffic on East La Palma Avenue and SR-91. There are also railroad tracks that travel in the vicinity of the construction site.

Generally, sensitive receptors are defined as residential areas, churches, schools, and recreational areas. Sensitive receptors within the vicinity of Phases 5A, 5B, and 4 include residential developments (approximately 200 feet to 1,100 feet north of Phases 5A, 5B, and 4), Bryant Ranch Elementary School (approximately 2,300 feet north of Phase 5B), St. Francis of Assisi Catholic School (approximately 1,300 feet west of Phase 5A), churches within the industrial area (approximately 300 feet to 1,000 feet north of Phases 5A and 5B), Green River Golf Course (approximately 1,500 feet east of Phase 4 and 2,000 feet east of Phase 5B), Featherly Regional Park (approximately 200 feet south of Phases 5A and 5B), and Canyon RV Park (approximately 500 feet south of Phase 5B and 1,000 feet west of Phase 4).

5.7.1.2 BNSF Bridge

BNSF Bridge is located within Riverside County, California, downstream from Prado Dam. Title 17, Section 1784.040 of the City of Corona Municipal Code identifies two separate types of noise sources: transportation and stationary. Stationary noise includes construction noise. This section of the City of Corona Municipal Code specifically articulates maximum allowable noise levels (i.e., standards) from 7:00 a.m. to 10:00 p.m. (City of Corona 2013).

Noise standards for regulating the impact of stationary noise sources to a neighboring private property are presented in Table 5.7-1. Noise standards for transportation-related noise are presented in Table 5.7-2.

Table 5.7-1. City of Corona Stationary Noise Source Standards

Type of Land Use	Maximum Allowable Noise Levels			
	Exterior Noise		Interior Noise Level	
	7:00 a.m. to 10:00 p.m.	7:00 a.m. to 10:00 p.m.	7:00 a.m. to 10:00 p.m.	7:00 a.m. to 10:00 p.m.
Residential Uses	55 dBA	50 dBA	45 dBA	35 dBA
Other Sensitive Land Uses	55 dBA	50 dBA	45 dBA	35 dBA
Commercial Uses	65 dBA	60 dBA	Not applicable	Not applicable
Industrial, Manufacturing, or Agricultural Uses	75 dBA	70 dBA	Not applicable	Not applicable

Source: City of Corona 2013

Based on the standards presented in Table 5.7-1 above, City of Corona Municipal Code 17.84.040 (c)(2)(d) indicates that an impact will occur if the maximum allowable noise level is exceeded by:

a. The noise standard for a cumulative period of more than 30 minutes in any hour;
b. The noise standard plus 5 dB for a cumulative period of more than 15 minutes in any hour;
c. The noise standard plus 10 dB for a cumulative period of more than 5 minutes in any hour;
d. The noise standard plus 15 dB for a cumulative period of more than 1 minute in any hour; or
e. The noise standard plus 20 dB for any period of time.

Table 5.7-2. City of Corona Transportation Noise Source Standards

Type of Land Use	Exterior Noise Level	Interior Noise Level
	(Private Outdoor Living Areas)	
Residential (Roadway)	65 CNEL	45 CNEL
Other sensitive land uses (Roadway)	65 CNEL	45 CNEL

Note: CNEL = Community Noise Equivalent Level
Source: City of Corona 2013

Construction noise is prohibited between the hours of 8:00 p.m. to 7:00 a.m., Monday through Saturday and 6:00 p.m. to 10:00 a.m. on Sundays and federal holidays, pursuant to Section .17.84.040 (D), Special Provision. If construction activities need to occur outside of this timeframe, an application may be filed with the Community Development Department for a variance pursuant to Section 17.84.040 (H), Noise Variance.

The primary sources of noise in the vicinity of BNSF Bridge are traffic on SR-91 to the south (approximately 1,800 feet) and rail traffic on the BNSF railway. During any typical 24-hour period, 75 to 90 freight trains use the BNSF railway. Because freight traffic occurs around the clock, nighttime traffic on the railroad has the potential to be the most disruptive to the community noise environment (City of Corona 2013). Sensitive receptors include Green River Mobile Home Park to the east and Green River Golf Course to the west, both of which lie within 200 to 300 feet of BNSF Bridge. Additionally, residential development in the Green River Housing Estates lies within approximately 500 feet to the northeast. Ambient noise levels near the BNSF Bridge area are as follow (see Table 5.7-3 and Figure 5.7-1):

Table 5.7-3. Ambient Noise Levels within Proximity of BNSF Bridge

Site	dbA	Source
1	79.6	Traffic (SR-91)
2	57.4	Traffic (Buffered by Slope)
3	59	Traffic
4	60.9	Traffic
5	61	Traffic
6	60	No Train Present
6	82.9	Freight Train

Source: Santa Ana River: Reach 9 Phase II Green River Mobile Home Park Embankment Final Supplemental Environmental Assessment, September 2008

There are no stationary sources of vibration near the BNSF Bridge site. The railroad tracks that travel in the vicinity of the construction site can generate vibrations.

5.7.2 Environmental Consequences

Significance Threshold

Based on the existing conditions presented above, impacts would be considered significant if the alternative result in:

- Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies (without first receiving a variance from the appropriate agency);
- Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels (without first receiving a variance from the appropriate agency); and/or
- A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.

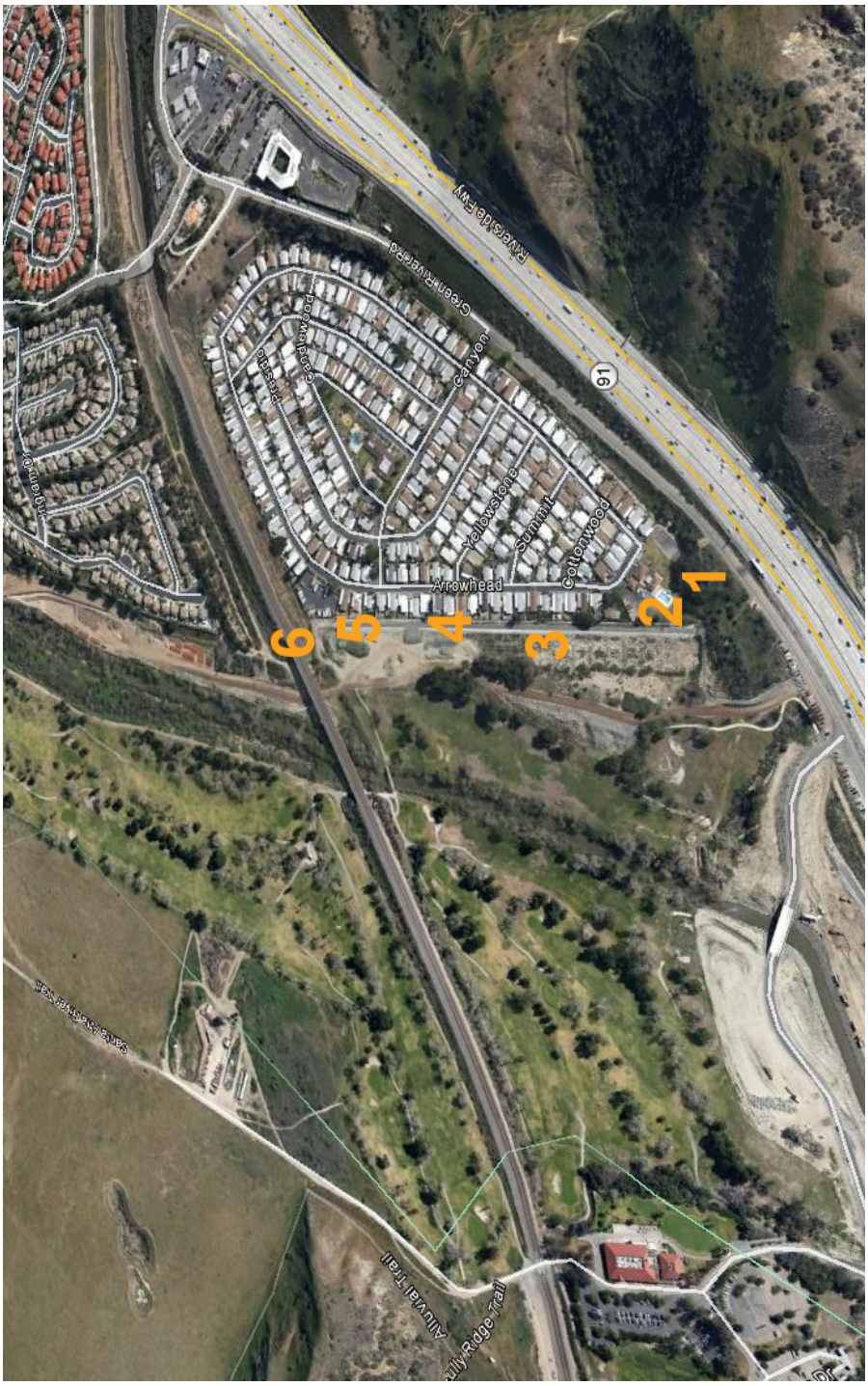
5.7.2.1 Phase 5A

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

Construction of the Grouted Stone and Sheet Pile Alternative would require truck trips, construction equipment delivery trips, and workers' vehicles to and from Phase 5A in the City of Yorba Linda. It is anticipated that no more than 16 truck deliveries per day would occur during a 66-day period. Access to the Phase 5A area would occur via East La Palma Avenue, the SAR Trail along the top of the existing LDY-S Levee, and the existing dirt access road at the base of the levee. Additionally, trips on city streets and highways may be required for delivery of construction materials. These trips would result in only short-term periodic (approximately 24 months) increases in noise levels during normal construction hours. The nearest sensitive receptors to Phase 5A would be passive recreation users using the existing SAR Trail, which is anticipated to be re-routed onto East La Palma Avenue during construction, and individuals at

commercial and industrial facilities located approximately 200 feet north

Figure 5.7-1 Noise Monitoring Locations



of Phase 5A, along the north side of East La Palma Avenue. Although noise from mobile construction equipment would be audible at the SAR Trail and commercial and industrial facilities, the City of Yorba Linda exempts construction-related activities from noise regulations provided the activities take place between the hours of 7:00 a.m. and 8:00 p.m. on weekdays and Saturday. Furthermore, if construction activities occur outside allowable hours, the construction contractor is required to ensure all required waivers are obtained from the City of Yorba Linda (see Section 5.7.3 [Environmental Commitments]).

Construction of the Grouted Stone and Sheet Pile Alternative would result in temporary noise impacts for the duration of activities, expected to be up to 24 months. As described in Section 4.1.1 of this document, short-term temporary construction noise impacts would occur in two phases: one to construct the grouted stone structure and one for installation of sheet pile protection. Equipment to be used for construction of the grouted stone structure would include, but is not limited to, excavators, front-end loaders, bulldozers, dump trucks, a grader, concrete pump trucks, and water trucks. Additionally, delivery trucks would be associated with imported material. Equipment to be used for construction of the sheet pile protection would include a hydraulic hammer and heavy-duty cranes. The equipment used for each phase ranges widely and, therefore, the noise impacts would vary. Noise associated with typical construction equipment (i.e., front loaders, pavers, trucks) at 50 feet ranges from 80 dBA to 90 dBA (USEPA 1972)). The noise levels are atmospherically attenuated by a factor of 6 dB per doubling of the distance. Potential noise levels at various distances are shown in Table 5.7-4, below. Noise levels of 95 dBA are typical for pile driving equipment at 50 feet (FHWA 2006).

Table 5.7-4. Potential Noise Levels at Various Distances

Distance from Construction Activities (ft)	Noise Levels (dBA)
50	80–90
100	74–84
200	68–78
400	66–72
800	60–66

Source: USEPA 1972

As stated above, Phase 5A is located adjacent to the SAR Trail, which is anticipated to be re-routed onto East La Palma Avenue during construction, and commercial and industrial facilities located approximately 200 feet north of Phase 5A, along the north side of East La Palma Avenue. The nearest residential development is located approximately 800 feet from Phase 5A. The loudest equipment (tractors, backhoes, jack hammers, pile drivers) may require over 1,000 feet in distance from the source to achieve a 65 dBA exterior exposure level. This estimate assumes a clear line of sight from the source to the receiver. However, variations in terrain elevation, existing vegetation, and/or existing structures (i.e., East La Palma Avenue) would act as noise barriers that may interrupt the dispersion of equipment noise. Noise levels would return to baseline conditions upon completion of construction. Also, noise levels will be monitored for biological resources purposes and measures such as constructing sound walls would be implemented if noise becomes problematic for the surrounding development or natural

environment. Furthermore, implementation of the environmental commitments would reduce construction noise to a less than significant impact.

Construction activities of the Grouted Stone and Sheet Pile Alternative would comply with the City of Yorba Linda Noise Ordinance, which prohibits construction from occurring between 8:00 p.m. and 7:00 a.m. Monday through Saturday, and any time on Sunday and federal holidays. Daily construction would occur between 8:00 a.m. and 5:00 p.m., Monday through Friday, excluding weekends and federal holidays. Accordingly, construction noise would be exempted as long as construction would not occur between the hours of 8:00 p.m. and 7:00 a.m. Monday through Saturday, or anytime on Sunday and federal holidays. Additionally, as described in the 2001 SEIS/SEIR, implementation of Mitigation Measure N-4 would ensure that impacts are less than significant.

2001 SEIS/SEIR Mitigation Measure

N-4 In areas of noise sensitivity such as the residential uses at Green River Mobile Home Park and Green River Housing Estates, the construction contractor shall erect temporary noise barriers where feasible, to limit direct line-of-sight noise impacts during construction.

Therefore, while surrounding land uses would be subject to a substantial increase in short-term noise levels, the construction work would be sequenced and scheduled to reduce impacts to less than significant.

Subsequent to construction of this alternative, periodic OMRR&R activities would be required. This would include minor structural repairs, vegetation removal from hard structures and maintenance roads, removal of small mammal burrows, and inspections (semi-annual and after major storm events). Equipment that would be utilized during routine OMRR&R activities includes pickup trucks, ½- and ¾-ton trucks, spray rigs, fence trucks, bobcats, bulldozers, loaders, backhoes, tractors, transports, motor graders, cranes, water trucks, 5- and 10-yard dump trucks and excavators. Similar to construction, these OMRR&R activities would only result in temporary short-term periodic noise from mobile and stationary equipment use. In addition, any necessary construction activity would occur within the limitations of applicable noise ordinances of the local jurisdiction. Furthermore, implementation of the environmental commitments would reduce maintenance noise to a less than significant impact.

Soil Cement and Sheet Pile Alternative (Alternative 2)

Under the Soil Cement and Sheet Pile Alternative, a soil cement structure would be installed with sheet piling, instead of grouted stone with sheet piling. This alternative would also require truck trips and would utilize similar construction equipment within a similar time period (approximately 24 months). Therefore, this alternative would have impacts similar to the Grouted Stone and Sheet Pile Alternative. Although the addition of a batch plant for the soil cement protection would generate additional noise impacts, it would still be in compliance with local noise ordinances. Furthermore, implementation of the environmental commitments and Mitigation Measure N-4 would ensure that impacts are less than significant.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, there would be no Phase 5A embankment protection construction and related activities. The baseline noise levels are expected to continue into the future arising primarily from the traffic on SR-91 and East La Palma Avenue and rail traffic on the BNSF railway. Therefore, no temporary noise impacts would be associated with the use of construction equipment in the Phase 5A area. SARMP-related noise impacts would not occur under the No Federal Action Alternative, unless or until emergency bank repair activities were required to combat localized erosion. Actions necessary to address erosion, or required for flood fighting, would be temporary in nature and would comply with local noise ordinances or apply for a variance.

5.7.2.2 Phase 5B

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

Construction of the Grouted Stone and Sheet Pile Alternative under Phase 5B would require truck trips to and from the site in the City of Yorba Linda. It is anticipated that between 20-40 truck deliveries per day would occur during construction period. Access to the Phase 5B area would occur via East La Palma Avenue, the SAR Trail along the top of the LDY-S Levee, and the existing dirt access road at the base of the levee. Additionally, trips on city streets and highways may be required for delivery of construction materials. These trips would result in only short-term periodic increases in noise levels during normal construction hours. The nearest sensitive receptors to the Phase 5B site would be recreational users using the SAR Trail, which is anticipated to be re-routed onto East La Palma Avenue during construction; individuals at commercial and industrial facilities; and in residential development located 100 to 200 feet north of Phase 5B. Although noise from mobile construction equipment would be audible at the SAR Trail, commercial and industrial facilities, and residential developments, the City of Yorba Linda exempts construction-related activities from noise regulations provided they take place between the hours of 7:00 a.m. and 8:00 p.m. on weekdays and Saturday. Furthermore, if construction activities occur outside allowable hours, the construction contractor is required to ensure all required waivers are obtained from the City of Yorba Linda (see Section 5.7.3 [Environmental Commitments]).

Construction of the Grouted Stone Alternative would result in temporary noise impacts for the duration of construction, which is expected to be up to 24 months. Short-term temporary construction noise impacts would occur in phases related to excavation, construction of grouted stone structure, and backfill. Equipment to be used for construction of the grouted stone structure would include, but is not limited to, excavators, front-end loaders, bulldozers, dump trucks, a grader, concrete pump trucks, and water trucks. Additionally, delivery trucks would be associated with imported materials. The equipment used for each phase ranges widely and, therefore, the noise impacts would vary. Noise associated with construction equipment at 50 feet ranges from 80 dBA to 90 dBA (USEPA 1972). The noise levels are atmospherically attenuated by a factor of 6 dB per doubling of the distance. Potential noise levels at various distances are shown in Table 5.7-4, above.

As stated above, Phase 5B is located adjacent to the SAR Trail, which is anticipated to be re-routed onto East La Palma Avenue during construction; commercial and industrial facilities; and residential development located approximately 100 to 200 feet north of Phase 5B. The loudest equipment (tractors, backhoes, jack hammers) may require over 1,000 feet in distance from the source to achieve a 65 dBA exterior exposure level. This estimate assumes a clear line of sight from the source to the receiver. However, variations in terrain elevation, existing vegetation, and/or existing structures (i.e., East La Palma Avenue) would act as noise barriers that may interrupt the dispersion of equipment noise. Noise levels would return to baseline conditions upon completion of construction. Also, noise levels will be monitored for biological resources purposes and measures such as constructing sound walls would be implemented if noise becomes problematic for the surrounding development. Furthermore, implementation of the environmental commitments would reduce construction noise to a less than significant impact.

Construction activities would comply with the City of Yorba Linda Noise Ordinance, which prohibits construction from occurring between 8 p.m. and 7 a.m. Monday through Saturday, and anytime on Sunday and federal holidays. Daily construction would occur between 8:00 a.m. and 5:00 p.m., Monday through Friday excluding weekends and federal holidays. Accordingly, construction noise would be exempted as long as construction would not occur between the hours of 8:00 p.m. and 7:00 a.m. Monday through Saturday, or anytime on Sunday or federal holidays. Additionally, as described in the 2001 SEIS/SEIR, implementation of Mitigation Measure N-4 would ensure that impacts are less than significant.

Therefore, while surrounding land uses would be subject to a substantial increase in short-term noise levels, the construction work would be sequenced and scheduled to reduce impacts to less than significant.

Subsequent to construction of this alternative, periodic OMRR&R activities would be required. This would include minor structural repairs, vegetation removal from hard structures and maintenance roads, removal of small mammal burrows, and inspections (semi-annual and after major storm events). Equipment that would be utilized during routine OMRR&R activities includes pickup trucks, ½- and ¾-ton trucks, spray rigs, fence trucks, bobcats, bulldozers, loaders, backhoes, tractors, transports, motor graders, cranes, water trucks, 5- and 10-yard dump trucks, and excavators. Similar to construction, these OMRR&R activities would only result in temporary short-term periodic noise from mobile and stationary equipment use. In addition, any necessary construction activity would occur within the limitations of applicable noise ordinances of the local jurisdiction. Furthermore, implementation of the environmental commitments would reduce maintenance noise to a less than significant impact.

Soil Cement Alternative (Alternative 2)

Under the Soil Cement Alternative, a 10-foot-thick soil cement structure would be installed instead of grouted stone. This alternative would also require truck trips and would utilize similar construction equipment within a similar time period (24 months). Therefore, it would have impacts similar to the Grouted Stone Alternative. The addition of a batch plant for the soil cement protection would generate

additional impacts, although still in compliance with local noise ordinances. Furthermore, implementation of the environmental commitments and Mitigation Measure N-4 would ensure that impacts are less than significant.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, there would be no Phase 5B embankment protection construction and related activities. The baseline noise levels are expected to continue into the future arising primarily from the traffic on SR-91 and East La Palma Avenue and rail traffic on the BNSF railway. Therefore, no temporary noise impacts would be associated with the use of construction equipment in Phase 5B. SARMP-related noise impacts would not occur under the No Federal Action Alternative, unless or until emergency bank repair activities were required to combat localized erosion. Actions necessary to address erosion, or required for flood fighting, would be temporary in nature and would comply with local noise ordinances or apply for a variance.

5.7.2.3 Phase 4

Soil Cement Alternative (Preferred Alternative, Alternative 1)

Construction of soil cement protection under Phase 4 would require truck trips to and from the site in the City of Yorba Linda. It is anticipated that no more than 30 truck deliveries per day would occur during a 6-week period. Access to the Phase 4 area would occur via Coal Canyon Road off-ramps from SR-91. Once equipment and workers exit at Coal Canyon, they would be able to immediately access the Phase 4 area via existing access roads that run west (downstream) of Coal Canyon Road, parallel to SR-91. This route is currently used to access the Phase 3 measure of Reach 9, which lies downstream of Phase 4. Access roads would remain upon completion of Phase 3 for use during Phase 4 construction. Since these haul roads are being utilized by the Corps for construction of Phase 3, Phase 4 construction would not be introducing new sources of noise impacts to surrounding land uses. Trips on city streets and highways may also be required for delivery of construction materials. These trips would result in only short-term periodic increases in noise levels during normal construction hours. The nearest sensitive receptors to the Phase 4 area would be recreational users utilizing the SAR Trail, which would be re-routed through the Phase 4 TCE during construction; users of Green River Golf Course, portions of which lie within approximately 1,500 feet east of the project site; and users of Canyon RV Park, located approximately 400 feet west of the project site. The nearest residential development is located more than 1,000 feet to the north, across the SAR from the Phase 4 site. Although noise from mobile construction equipment would be audible at the SAR Trail and potentially the golf course, the City of Yorba Linda exempts construction-related activities from noise regulations provided they take place between the hours of 7:00 a.m. and 8:00 p.m. on weekdays and Saturday. Furthermore, if construction activities occur outside allowable hours, the construction contractor is required to ensure all required waivers are obtained from the City of Yorba Linda (see Section 5.7.3 [Environmental Commitments]).

Construction of this alternative is expected to continue to approximately December 2017, resulting in temporary noise impacts with periodic long-term impacts for OMRR&R activities on a routine and as

needed basis. As described in Chapter 4.2.1 of this document, short-term temporary construction noise impacts would occur in phases. Equipment to be used for construction of the soil cement structure would include, but is not limited to, excavators, front-end loaders, bulldozers, dump trucks, soil cement compactors (i.e., sheep-foot and smooth-wheel rollers), a grader, concrete pump trucks, water trucks, and a soil cement batch plant. Additionally, delivery trucks would be associated with imported materials. The equipment used for each phase ranges widely and, therefore, the noise impacts would vary. Noise associated with construction equipment at 50 feet ranges from 80 dBA to 90 dBA (USEPA 1972). The noise levels are atmospherically attenuated by a factor of 6 dB per doubling of the distance. Potential noise levels at various distances are shown in Table 5.7-4, above.

As stated above, Phase 4 is located adjacent to the SAR Trail, which is anticipated to be re-routed during construction, and users of Green River Golf Course (approximately 1,500 feet away). The nearest residential development is located more than 1,000 feet to the north, across the SAR from the Phase 4 site. The loudest equipment (tractors, backhoes, jack hammers, batch plant) may require over 1,000 feet in distance from the source to achieve a 65 dBA exterior exposure level. This estimate assumes a clear line of sight from the source to the receiver. However, variations in terrain elevation, existing vegetation, and/or existing structures would act as noise barriers that may interrupt the dispersion of equipment noise. Noise levels would return to baseline conditions upon completion of construction. Also, noise levels would be monitored for biological resources purposes and measures such as constructing sound walls would be implemented if noise becomes problematic for sensitive receptors. Furthermore, implementation of the environmental commitments would reduce construction noise to a less than significant impact.

Construction activities would comply with the City of Yorba Linda Noise Ordinance, which prohibits construction from occurring between 8:00 p.m. and 7:00 a.m. Monday through Saturday and anytime on Sunday and federal holidays. Construction would occur between 8:00 a.m. and 5:00 p.m., Monday through Friday excluding weekend and federal holidays. Accordingly, construction noise would be exempted as long as construction would not occur between the hours of 8:00 p.m. and 7:00 a.m. Monday through Saturday, or anytime on Sunday and federal holidays. Additionally, as described in the 2001 SEIS/SEIR, implementation of Mitigation Measure N-4 would ensure that impacts are less than significant.

Therefore, while surrounding land uses would be subject to a substantial increase in short-term noise levels, the construction work would be sequenced and scheduled to reduce impacts to less than significant.

Subsequent to construction of this alternative, periodic OMRR&R activities would be required. This would include minor repairs, vegetation removal from hard structures and maintenance roads, removal of small mammal burrows, and inspections (semi-annual and after major storm events). Equipment that would be utilized during routine OMRR&R activities includes pickup trucks, ½- and ¾-ton trucks, spray rigs, fence trucks, bobcats, bulldozers, loaders, backhoes, tractors, transports, motor graders, cranes, water trucks, 5- and 10-yard dump trucks, and excavators. Similar to construction, these OMRR&R activities would only result in temporary short-term periodic noise from mobile and stationary

equipment use. In addition, any necessary construction activity would occur within the limitations of applicable noise ordinances of the local jurisdiction. Furthermore, implementation of the environmental commitments and Mitigation Measure N-4 would ensure that impacts are less than significant.

Grouted Stone Alternative (Alternative 2)

Under the Grouted Stone Alternative, the existing soil cement embankment would be removed, and an 80-foot-wide, trapezoidal-shaped trench would be excavated along the 3,970-foot-long embankment. This alternative would also require truck trips and would utilize similar construction equipment within a similar time period as Phase 1. Therefore, it would have impacts similar to the Soil Cement Alternative.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, no Phase 4 embankment protection construction and related activities would occur. The baseline noise levels are expected to continue into the future arising primarily from the traffic on SR-91 and East La Palma Avenue and rail traffic on the BNSF railway. Therefore, no temporary noise impacts would be associated with the use of construction equipment in the Phase 4 area. SARMP-related noise impacts would not occur under the No Federal Action Alternative, unless or until emergency bank repair activities were required to combat localized erosion. Actions necessary to address erosion, or required for flood fighting, would be temporary in nature and would comply with local noise ordinances or apply for a variance.

5.7.2.4 BNSF Bridge

Pier and Abutment Protection Alternative (Preferred Alternative, Alternative 1)

Construction of features under the BNSF Bridge Preferred Alternative at bridge piers, and grouted stone and sheet pile structures along the river bank, would require truck trips to and from the site. It is anticipated that no more than 50 truck deliveries per day would occur during a 60-working day period. Access to BNSF Bridge would occur via SR-91; Green River Road; and temporary access/haul roads on the Green River Golf Course, adjacent to the Green River Mobile Home Park levee. Additionally, trips on city streets and highways may be required for delivery of construction materials. These trips would result in only short-term periodic increase in noise levels during normal construction hours. It should be noted that the BNSF railway transects the construction site and nearby land users have been exposed to existing noise from the BNSF railway. The nearest sensitive receptors to the construction site would be users of the Green River Golf Course, adjacent to the west side of the site, and residents of the Green River Mobile Home Park, approximately 350 feet east of the site. Although noise from mobile construction equipment would be audible at the golf course and residential development, noise impacts would be temporary and would comply with applicable local noise ordinances. Furthermore, if construction activities occur outside allowable hours, the construction contractor is required to ensure all required waivers are obtained from the City of Corona (see Section 5.7.3 [Environmental Commitments]).

Construction of this alternative would result in temporary noise impacts for the duration of activities, expected to be up to 24 months. Short-term temporary construction noise impacts would occur in phases. Equipment to be used for construction of bridge and bank protection features would include, but is not limited to, cranes, bulldozers, excavators, compactors, dump trucks, rollers, pickup trucks, earth augers, vacuum trucks, pile drivers, low overhead drill rigs, and low headroom hydromill. Additionally, delivery trucks would be associated with imported materials. The equipment used for each phase (as described in Section 4.4.1 of this document) ranges widely and, therefore, the noise impacts would vary. Noise associated with construction equipment at 50 feet ranges from 80 dBA to 90 dBA (USEPA 1972). The noise levels are atmospherically attenuated by a factor of 6 dB per doubling of the distance. Potential noise levels at various distances are shown in Table 5.7-4, above.

As stated above, nearest sensitive receptors to the BNSF Bridge site would be users of the Green River Golf Course and residents of the Green River Mobile Home Park, approximately 350 feet east of BNSF Bridge. The loudest equipment (tractors, backhoes, jack hammers, pile drivers) may require over 1,000 feet in distance from the source to achieve a 65 dBA exterior exposure level. This estimate assumes a clear line of sight from the source to the receiver. However, variations in terrain elevation, existing vegetation, and/or existing structures would act as noise barriers that may interrupt the dispersion of equipment noise. Noise levels would return to baseline conditions upon completion of construction. Also, noise levels would be monitored for biological resources purposes and measures such as constructing sound walls would be implemented if noise becomes problematic for the surrounding development. Furthermore, implementation of the environmental commitments would reduce construction noise to a less than significant impact.

Construction activities would comply with the City of Corona Noise Ordinance, which prohibits construction from occurring between 8:00 p.m. and 7:00 a.m., Monday through Saturday, and between 6:00 p.m. and 10:00 a.m. on Sunday and federal holidays. Construction would occur between 7:00 a.m. and 4:00 p.m., Monday through Friday. Accordingly, construction noise would be exempted as long as there is compliance with the daytime and nighttime requirements. Furthermore, if construction activities occur outside allowable hours, the construction contractor is required to ensure all required waivers are obtained from the City of Corona (see Section 5.7.3 [Environmental Commitments]). Additionally, as described in the 2001 SEIS/SEIR, implementation of Mitigation Measure N-4 would ensure that impacts are less than significant.

Therefore, while recreational and residential land uses would be subject to a substantial increase in short-term noise levels, compliance with applicable local noise ordinances would reduce impacts to less than significant.

Subsequent to construction of this alternative, periodic OMRR&R activities would be required. This would include minor structural repairs, vegetation removal from hard structures and maintenance roads, removal of small mammal burrows, and inspections (semi-annual and after major storm events). Since the scale of these activities would be minimal relative to the construction phase of the BNSF Bridge, significant operational impacts are not anticipated. In addition, any necessary construction activity would occur within the limitations of the applicable noise ordinance of the local jurisdiction.

No Federal Action Alternative (Alternative 2)

Under the No Federal Action Alternative, no bridge and embankment protection construction and related activities would occur. Therefore, no temporary noise impacts would be associated with the use of construction equipment at the BNSF Bridge site. Noise-related impacts would not occur under the No Federal Action Alternative, unless or until emergency bank repair activities were required to combat localized erosion. These activities would be temporary in nature and would also be in compliance with local noise ordinances.

5.7.3 Environmental Commitments

The following mitigation measure from the 2001 SEIS/SEIR would be incorporated into contract specifications for the Reach 9 measures to reduce potential impacts to noise.

N-4 In areas of noise sensitivity such as the residential uses at Green River Mobile Home Park and Green River Housing Estates, the construction contractor shall erect temporary noise barriers where feasible to limit direct line-of-sight noise impacts during construction.

The following additional environmental commitments would be incorporated into contract specifications for the Reach 9 measures to reduce potential impacts to noise.

EC-N-1 Prior to issuance of a building permit and applicable maintenance activities, the construction contractor shall obtain a noise variance per local ordinance, for all noise sources exceeding noise ordinances of the local jurisdiction.

EC-N-2 The construction contractor will be required to monitor sound levels and make modifications to equipment or procedures if necessary to reduce sound to acceptable or permitted levels.

5.7.4 Summary of Significance Thresholds Related to Proposed Alternatives

The proposed alternatives would have no significant impacts on noise, based on the following:

- Proposed alternatives would not expose persons to or generate noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies (without first receiving a variance from the appropriate agency);
- They would not expose persons to or generate excessive groundborne vibration or groundborne noise levels (without first receiving a variance from the appropriate agency); and/or
- They would not result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.

5.8 Cultural Resources

5.8.1 Affected Environment

The APE was surveyed for the presence of historic and prehistoric resources in 1985 by ECOS Management Criteria, Inc. (Brock and Langenwalter 1985). This survey identified and inventoried National Register of Historic Places (NRHP) resources along the Santa Ana River from Prado Dam Flood Control Basin all the way to the Pacific Ocean. The APE for this feature was reevaluated more recently during preparation of the 2001 SEIS/EIR and it was determined that there are no historic or prehistoric resources present within the APE.

From an archeological perspective, the APE is generally quite disturbed. Periodic flooding episodes from the Santa Ana River would have likely destroyed any cultural resources sites present. The field survey did not encounter any prehistoric remains. No historical remains greater than 50 years were observed.

A Sacred Lands file check will be requested of the Native American Heritage Commission.

5.8.2 Environmental Consequences

Significance Threshold

Based on the existing conditions discussed above, impacts would be considered significant on cultural resources if the alternative results in:

- Permanent modification of characteristics and qualities of a resource listed or eligible for listing on the National Register of Historic Places
- Removal or destruction of buried prehistoric cultural resources

5.8.2.1 Phase 5A

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

The Grouted Stone and Sheet Pile Alternative proposes to replace existing ungrouted riprap with grouted stone structure and installation of steel sheet pile wall. Phase 5A construction would not affect cultural resources. Additionally, implementation of Mitigation Measure CR-1 would ensure that impacts are less than significant.

Soil Cement and Sheet Pile Alternative (Alternative 2)

The Soil Cement and Sheet Pile Alternative would have impacts similar to the Grouted Stone and Sheet Pile Alternative. Similar to the Preferred Alternative, Alternative 2 would not affect cultural resources. Additionally, implementation of Mitigation Measure CR-1 would ensure that impacts are less than significant.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, existing riprap would remain along the north bank. It would not be replaced with a grouted stone and sheet pile structure and installed to minimize scour, provide erosion control, and protect adjacent infrastructure (i.e., East La Palma Avenue, SAR Trail, industrial facilities, and commercial buildings) from potential flood damage. The No Federal Action Alternative would have a less than significant impact to cultural resources.

5.8.2.2 Phase 5B

Grouted Stone Alternative (Preferred Alternative, Alternative 1)

Construction proposed in Phase 5B would result in the replacement of existing riprap with a grouted stone structure to a deeper elevation than currently exists. Phase 5B construction would not affect cultural resources. Implementation of Mitigation Measure CR-1 would ensure that impacts are less than significant.

Soil Cement Alternative (Alternative 2)

The Soil Cement Alternative would have impacts similar to the Grouted Stone Alternative. Similar to the Grouted Stone Alternative, this alternative would not affect cultural resources. Implementation of Mitigation Measure CR-1 would ensure that impacts are less than significant.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, existing riprap bank protection would remain along the north bank. It would not be replaced with a grouted stone structure and installed to minimize scour, to provide erosion control, and to protect adjacent infrastructure (i.e., East La Palma Avenue, SAR Trail, industrial facilities, commercial buildings, and residential housing development) from potential flood damage. The No Federal Action Alternative would have a less than significant impact to cultural resources.

5.8.2.3 Phase 4

Soil Cement Alternative (Preferred Alternative, Alternative 1)

The Soil Cement Alternative proposes to construct a soil cement structure in place of existing soil cement. Implementation of Mitigation Measure CR-1 would ensure that impacts are less than significant.

Grouted Stone Alternative (Alternative 2)

The Grouted Stone Structure Alternative would have impacts similar to the Soil Cement Alternative. Similar to the Preferred Alternative, Alternative 2 would not affect cultural resources. Implementation of Mitigation Measure CR-1 would ensure that impacts are less than significant.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, there would be no reconstruction of the existing bank protection structure to provide additional protection against high flows and scour. Therefore, the No Federal Action Alternative would have a less than significant impact to cultural resources. Implementation of Mitigation Measure CR-1 would ensure that impacts are less than significant.

5.8.2.4 BNSF Bridge

Pier and Abutment Protection Alternative (Preferred Alternative, Alternative 1)

The BNSF Bridge Preferred Alternative proposes to provide additional scour protection to bridge piers and abutments of the existing BNSF bridges. Access to BNSF Bridge would occur on temporary access/haul roads through Green River Golf Course on the west side of the river and on a Phase 2B maintenance road on the east side.

The BNSF Bridge Preferred Alternative would have a less than significant impact to cultural resources. Implementation of Mitigation Measure CR-1 would ensure that impacts are less than significant.

No Federal Action Alternative (Alternative 2)

Under the No Federal Action Alternative, there would be no construction of bridge pier or abutment protection features to provide additional protection against high flows and scour. The No Federal Action Alternative would have a less than significant impact to cultural resources.

5.8.3 Environmental Commitments

The following environmental commitment would be incorporated by the Corps to ensure that adverse effects to historic properties and human remains are mitigated:

CR-1 Monitor construction activities with an archeologist meeting the Secretary of the Interior's Qualification Standards. In the event that previously unknown resources are found during construction, the Corps shall comply with the requirements of 36 CFR 800.13.

5.8.4 Summary of Significance Thresholds Related to Proposed Alternatives

The proposed alternatives would have no significant impacts on cultural resources, based on the following:

- There will be no permanent modification of characteristics and qualities of a resource listed or eligible for listing on the National Register of Historic Places.
- There will be no removal or destruction of buried prehistoric cultural resources

5.9 Land Use

5.9.1 Affected Environment

5.9.1.1 Phases 5A and 5B

Phases 5A and 5B are contiguous measures that occur along the north bank of the SAR, within the City of Yorba Linda in Orange County, California. The Phase 5A and Phase 5B sites are designated as Open Space-General (OS/G) (City of Yorba Linda 2010) and zoned as OS (FP-2) (City of Yorba Linda 2012). Land uses occurring in the vicinity of Phases 5A and 5B include Open Space-General (OS-G) (e.g., Featherly Regional Park, Santa Ana River, Canyon RV Park); Commercial-General (C-G) (e.g., Savi Ranch Shopping Center); Industrial-Manufacturing (I-M); Residential-High (R-H), and R-Medium High (R-MH). Open Space is predominantly used for public parks and recreation facilities; privately owned recreation facilities and slope, landscape, and greenbelt areas; and conservation areas, including flood control areas. General Commercial designation provides for a variety of retail, service, and entertainment facilities. Industrial uses include business park developments, warehousing and storage, light manufacturing, research and development, and other similar activities. The residential mix comprises of a variety of lot sizes. The BNSF railway is located north of Phases 5A and 5B, and the SAR and SR-91 occur south of the area.

The Phase 5A and 5B measures also lie within the boundaries of the OCFCD's Santa Ana River Canyon Habitat Management Plan (HMP). The goal of the HMP is to 1) develop a plan for the management of floodplain habitat to be protected as open space per the requirements of the LCA, the 1998 Phase II GDM/SEIS, and the Report of the Chief of Engineers; 2) identify the Habitat Management Area (HMA) and its resources as required by the 1988 Phase II GDM/SEIS and LCA; 3) identify various activities permitted within the HMA; 4) identify maintenance standards and responsibilities; and 5) identify existing uses within the floodplain and any operational constraints posed by existing uses. The plan also includes management tasks that are required for preservation and maintenance of existing habitat and recommendations for potential habitat enhancement.

5.9.1.2 Phase 4

Phase 4 occurs along the south bank of the SAR, within the City of Yorba Linda in Orange County, California. The Phase 4 site is designated as OS-G and C-G (City of Yorba Linda 2010), and is zoned OS (FP-2) and Planned Development (PD)-22 (Coal Canyon) (City of Yorba Linda 2012). Land uses occurring in the vicinity of Phase 4 include OS-G (e.g., Canyon RV Park) and C-G. Similar to Phases 5A and 5B areas, the BNSF railway is located to the north and SR-91 to the south of this Reach 9 measure. Additionally, Chino Hills State Park is located east of this Reach 9 measure. This recreational facility includes extensive network of open space and wilderness areas and numerous cycling, hiking, and equestrian trails. The Phase 4 measure also occurs within the HMP.

5.9.1.3 BNSF Bridge

The BNSF Bridge area occurs within and along both banks of the SAR, within the City of Corona in Riverside County, California. According to the City of Corona General Plan, the BNSF Bridge site is

designated as OS-G (City of Corona 2012), and is zoned OS (City of Corona 2009). Land uses occurring in the vicinity of the BNSF Bridge area include OS-Recreation (OS-R) (e.g., Green River Golf Course), OS-G, Medium Density Residential (6 to 15 dwelling units/acre) (MDR) (e.g., Green River Mobile Home park), and General Commercial (GC). Open Space General designation applies to lands permanently committed to or protected for open space purposes due to their value as habitat, topography, scenic quality, public safety (e.g., flood control channels), or comparable purpose. Open Space Recreation designation applies to lands committed as open space for public or private recreational purposes, such as golf courses. Medium Density Residential designation accommodates attached housing types, such as townhomes and duplexes and single-family detached housing in a condominium form of development. General Commercial designation accommodates a broad range of commercial uses that serve local neighborhoods, the community, and visitors. Typical uses include supermarkets, department stores, apparel stores, theaters, and nonretail uses such as offices and banks. These areas also include primarily auto-oriented uses such as hotels and motels, car dealerships, auto service and repair businesses, and construction suppliers. The BNSF railway crosses over the BNSF Bridge area, which is currently used as an access site by the Corps. The BNSF railroad bridge is located at the transition between Reach 9, Phases 2A and 2B. There are three separate bridges, each with one track. These bridges cross the riverbed of the SAR. The BNSF rail line carries heavy east-west freight traffic and about 15 daily Metrolink and Amtrak passenger trains, from Los Angeles and Orange Counties through Riverside County to points east. The BNSF Bridge site is currently used for access by the Corps to Phases 2A and 2B, and other points along the SAR.

The BNSF Bridge measure occurs within the HMP, as well as the Western Riverside County Multi-Species Habitat Conservation Plan (MSHCP). The MSHCP is a comprehensive, multi-jurisdictional plan focusing on conservation of species and their associated habitats in the western portion of the County. The MSHCP is one of several large, multi-jurisdictional habitat-planning efforts in Southern California with the overall goal of maintaining biological and ecological diversity within a rapidly urbanizing region, and is intended to allow the County and its cities to better control local land-use decisions and maintain a strong economic climate in the region while addressing the requirements of the federal and State Endangered Species Acts.

5.9.2 Environmental Consequences

Significance Threshold

Based on the existing conditions discussed above, impacts would be considered significant on land use if the alternative results in:

- Incompatibilities with surrounding or on–site uses; and/or
- Inconsistencies with applicable land use plans and policies.

5.9.2.1 Phase 5A

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

Phase 5A proposes to provide erosion protection for the north bank of the SAR and flood risk management for multiple industrial facilities, commercial buildings, Southern California Pacific Rail Road, and residential housing developments in the City of Yorba Linda. Clearing and grubbing would be required to prepare staging areas and work zones, which would be restored with native vegetation upon completion of construction. Staging areas would occupy areas of 1.4 and 1.38 acres, respectively (Figures 4.1-1 and 4.1-2).

Construction of these improvements may temporarily interfere with recreational activities associated with temporary closure of the SAR Trail. A temporary trail detour would be provided by placing k-rails within a portion of the eastbound (river adjacent) driving lane on East La Palma Avenue. However, Phase 5A would not result in permanent incompatibilities with the aforementioned land uses and would not prevent existing on-site land uses (riparian areas, vacant land, and access roads) from continuing in essentially the same manner. Phase 5A would provide erosion protection for the north bank of the SAR and flood damage protection for portions of East La Palma Avenue, the SAR Trail, industrial facilities, commercial buildings, and residential development. It would not adversely affect recreation potential or habitat viability of the area. Therefore, Phase 5A would not be incompatible with surrounding or on-site land uses, and would not prevent or inhibit the existing land uses.

The City of Yorba Linda General Plan designates Phase 5A as Open Space General. The Open Space designation provides for active and passive recreation areas, passive open space, conservation, and public safety land uses, either public or private in nature. City of Yorba Linda zoning designation for Phase 5A is Open Space with a floodplain overlay (FP-2). The Open Space zone is intended for general agriculture, open space, and public uses. No changes to the existing City of Yorba Linda zoning and General Plan land use designations would occur. In addition, the Phase 5A elements would not be inconsistent with the City of Yorba Linda General Plan, which includes goals for flood protection and the preservation and enhancement of the SAR and Featherly Regional Park as an open space/recreation opportunity. Therefore, Phase 5A would not conflict with any applicable City of Yorba Linda land use plan, policy, or regulation.

Phase 5A, as constructed under this alternative, would require semi-annual inspections and inspections after each major storm event of grouted stone embankment, sheet pile and tiebacks, and interior drainage structures. Maintenance of the structure would be required per the OMRR&R manual and would include minor structural repairs, vegetation removal from hard structures and maintenance roads, removal of small mammal burrows, and inspections. An existing dirt access road located along the base of the existing LDY-S Levee, and the existing SAR Trail at the top of the north bank, could be used for such tasks. As with the construction of Phase 5A, future OMRR&R activities would temporarily interfere with recreational activities. However, the primary purpose of the dirt access road is for maintenance of SARMP measures. Furthermore, OMRR&R activities would not permanently affect

recreational activities. OMRR&R activities would not be incompatible with existing on-site or surrounding land uses. Therefore, the Grouted Stone and Sheet Pile Alternative would have a less than significant impact on land use.

Additionally, since the encroachment into the HMP proposed under this alternative consists of a buried structure that will be backfilled and re-vegetated, and would only be exposed if and when future high flows result in bed degradation and shifting of the active river channel, conflicts of the Grouted Stone and Sheet Pile Alternative with the HMP would not occur. Moreover, as presented in Chapter 5.5 Biological Resources, habitat values will be fully mitigated. As a result, the Grouted Stone and Sheet Pile Alternative would have a less than significant impact on the HMP.

Soil Cement and Sheet Pile Alternative (Alternative 2)

The Soil Cement and Sheet Pile Alternative would have impacts similar to the Grouted Stone and Sheet Pile Alternative. Since the footprint of this alternative is similar to the Grouted Stone and Sheet Pile Alternative, construction of this alternative may temporarily interfere with recreational activities associated with temporary closure of the SAR Trail; however, a temporary trail detour would be provided. As a result, this alternative would not be incompatible with surrounding or on-site land uses, and would not prevent or inhibit the existing land uses. Additionally, as presented above, the Soil Cement and Sheet Pile Alternative would have a less than significant impact on the HMP.

No Federal Action Alternative (Alternative 3)

With the No Federal Action Alternative, existing riprap protection would remain along the north embankment of the SAR. Existing riprap was not constructed to a sufficient depth to safely convey 30,000 cfs flows from Prado Dam. Because the riprap would not be replaced, future high flow releases from Prado Dam could result in significant scour and erosion to banks of the SAR, threatening existing infrastructure and requiring emergency repairs. It is likely that any emergency repair would be limited in scope and duration and would likely entail the discharge of rocks to stabilize the embankment, and would not prevent against eminent bank failure. Emergency repairs could temporarily affect a portion of East La Palma Avenue and the SAR Trail. Subsequent to emergency repairs, use of the trail would be restored. There would be no permanent changes to the existing land uses. Therefore, the No Federal Action Alternative would have a less than significant impact on land use and the HMP.

5.9.2.2 Phase 5B

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

The Grouted Stone and Sheet Pile Alternative proposes to provide erosion protection for the north bank of the SAR to support high-velocity flows from Prado Dam. Three staging areas are required; although specific locations have not yet been selected, it is likely that two would be required along the main Phase 5B construction area, with a third staging area required farther upstream (east) near the BNSF railway in an open field where the site would be above higher flows and disturbance to habitats would primarily be limited to communities composed of non-native plant species. Each staging area would be

approximately 1 acre in size. Clearing and grubbing would be required to prepare the staging areas and work zones, which would be restored with native vegetation upon completion of construction.

Construction of the Grouted Stone and Sheet Pile Alternative may temporarily interfere with recreational activities associated with temporary closure of the SAR Trail. A temporary trail detour would be provided. However, construction of this alternative would not result in permanent incompatibilities with the aforementioned land uses and would not prevent existing on-site land uses (riparian areas, vacant land, and access roads) from continuing in essentially the same manner. Phase 5B would provide erosion protection for the north bank of the SAR. It would not adversely affect recreation potential or habitat viability of the area. Therefore, Phase 5B would not be incompatible with surrounding or on-site land uses, and would not prevent or inhibit the existing land uses.

The City of Yorba Linda General Plan designates Phase 5B as Open Space General. The Open Space designation provides for active and passive recreation areas, passive open space, conservation, and public safety land uses, either public or private in nature. City of Yorba Linda zoning designation for Phase 5B is OS with a floodplain overlay (FP-2). The Open Space zone is intended for general agriculture, open space, and public uses. No changes to the existing City of Yorba Linda zoning and General Plan land use designations would occur. The project elements would not be inconsistent with the City of Yorba Linda General Plan, which includes goals for flood protection and the preservation and enhancement of the SAR and Featherly Regional Park and an open space/recreation opportunity. Therefore, Phase 5B would not conflict with any applicable City of Yorba Linda land use plan, policy, or regulation.

Phase 5B, as constructed under this alternative, would require semi-annual inspections and inspections after each major storm event of the soil cement structure, interior drainage structures, and the SAR Trail. Maintenance of the structure would be required per O&M manual. The existing 15-foot-wide dirt road along the base of the existing riprap protection would be restored, as necessary, upon construction completion, and could be used for maintenance access. As with the construction of Phase 5B, future OMRR&R activities would temporarily interfere with recreational activities. However, the primary purpose of the dirt access road is for maintenance of SARMP measures. Furthermore, OMRR&R would not permanently affect recreational activities. OMRR&R activities would not be incompatible with existing on-site or surrounding land uses. Therefore, the Grouted Stone Alternative would have a less than significant impact on land use.

Additionally as described in Chapter 5.9.2.1, the Grouted Stone Alternative's encroachment into the HMP would not conflict with the HMP, and this alternative would have a less than significant impact on the HMP.

Soil Cement Alternative (Alternative 2)

The Soil Cement Structure Alternative would have impacts similar to the Preferred Alternative, the Grouted Stone Alternative. Since the footprint of Alternative 2 is similar to the Preferred Alternative, construction of this alternative may temporarily interfere with recreational activities associated with temporary closure of the SAR Trail; however, a temporary trail detour would be provided. As a result,

this alternative would not be incompatible with surrounding or on-site land uses, and would not prevent or inhibit the existing land uses. Additionally, as presented above, the Soil Cement Alternative would have a less than significant impact on the HMP.

No Federal Action Alternative (Alternative 3)

With the No Federal Action Alternative, existing riprap protection would remain along the north embankment of the SAR. Existing riprap was not constructed to a sufficient depth to safely convey 30,000 cfs flows from Prado Dam. Because the riprap would not be replaced, future high flow releases from Prado Dam could result in significant scour and erosion to banks of the SAR, threatening existing infrastructure and requiring emergency repairs of the existing bank protection. It is likely that any emergency repair would be limited in scope and duration and would likely entail the discharge of rocks to stabilize the embankment, and would not prevent against eminent bank failure. Emergency repairs could temporarily affect a portion of East La Palma Avenue and the SAR Trail. Subsequent to emergency repairs, use of the trail would be restored. There would be no permanent changes to the existing land uses. Therefore, the No Federal Action Alternative would have a less than significant impact on land use and the HMP.

5.9.2.3 Phase 4

Soil Cement Alternative (Preferred Alternative, Alternative 1)

Phase 4 proposes to provide erosion protection for the south bank of the SAR to support high-velocity flows from Prado Dam in the vicinity of SR-91 and the SAR Trail in the City of Yorba Linda. Approximately 5.7 acres of land would be used for staging and stockpiling, and the soil cement batch plant, located parallel to the alignment of the proposed soil cement structure on the river-side of Phase 4. Clearing and grubbing may be required to prepare staging areas and work zones, which would be restored with native vegetation upon completion of construction.

Construction of these improvements may temporarily interfere with recreational activities with the temporary closure of the SAR Trail and by providing a temporary detour/trail. As part of construction, the trail would be restored to its previous alignment and condition. Construction of Phase 5A under this alternative would not result in permanent incompatibilities with the aforementioned land uses and would not prevent the existing on-site land uses (riparian areas, vacant land, and access roads) from continuing in essentially the same manner. Phase 4 would provide erosion protection for the south bank of the SAR. It would not adversely affect recreational potential or habitat viability of the area. Therefore, Phase 4 would not be incompatible with surrounding or on-site land uses, and would not prevent or inhibit the existing land uses.

The City of Yorba Linda General Plan designates Phase 4 as Open Space General and Commercial General. The Open Space designation provides for active and passive recreation areas, passive open space, conservation, and safety land uses, either public or private in nature. The Commercial General designation provides for a variety of retail, service, and entertainment facilities. City of Yorba Linda zoning designation for Phase 4 is OS with a floodplain overlay (FP-2) and Planned Development-22. The

Open Space zone is intended for general agriculture, open space, and public uses. The PD-22 zone is intended for preservation as a wildlife corridor by the State of California. No changes to the existing City of Yorba Linda zoning and General Plan land use designations would occur. The project elements would not be inconsistent with the City of Yorba Linda General Plan, which includes goals for flood protection and the preservation and enhancement of the SAR and Featherly Regional Park as open space/recreation opportunities. Therefore, Phase 4 would not conflict with any applicable City of Yorba Linda land use plan, policy, or regulation.

Phase 4, as constructed under this alternative, would require structural and non-structural repairs. Maintenance of the structure would be required per the O&M manual. The restored SAR Trail along the top of the soil cement structure would be used for such tasks. As with the construction of Phase 5A, future OMRR&R activities would temporarily interfere with recreational activities. However, the restored SAR Trail along the top of the soil cement structure is also intended as access for maintenance of bank protection structures. OMRR&R activities would not permanently affect recreational activities. OMMR&R activities would not be incompatible with existing on-site or surrounding land uses. Therefore, the Soil Cement Alternative would have a less than significant impact on land use.

Additionally as described in Chapter 5.9.2.1, the Soil Cement Alternative's encroachment into the HMP would not conflict with the HMP, and this alternative would have a less than significant impact on the HMP.

Grouted Stone Alternative (Alternative 2)

The Grouted Stone Alternative would have impacts similar to the Preferred Alternative, the Soil Cement Alternative. Since the footprint of Alternative 2 is similar to the Preferred Alternative, construction of this alternative may temporarily interfere with recreational activities associated with temporary closure of the SAR Trail; however, a temporary trail detour would be provided. As a result, this alternative would not be incompatible with surrounding or on-site land uses, and would not prevent or inhibit the existing land uses. Additionally, as presented above, the Soil Cement Alternative would have a less than significant impact on the HMP.

No Federal Action Alternative (Alternative 3)

With the No Federal Action Alternative, there would be no reconstruction of the existing bank protection structure to provide additional protection against high flows and scour. Since the toe of the existing bank protection structure is not deep enough to protect against scour associated with high flow events, future high flow releases from Prado Dam could undermine the structure and threaten portions of SR-91 along the south bank of the SAR and could require periodic emergency repairs of the existing bank protection. It is likely that any emergency repair would be limited in scope and duration and would likely entail the discharge of rocks to stabilize the embankment, and would not prevent against eminent bank failure. Emergency repairs could temporarily affect a portion of SR-91 and the SAR Trail. Subsequent to emergency repairs, use of the trail would be restored. There would be no permanent

changes to the existing land uses. Therefore, the No Federal Action Alternative would have a less than significant impact on land use and the HMP.

5.9.2.4 BNSF Bridge

Pier and Abutment Protection Alternative (Preferred Alternative, Alternative 1)

BNSF Bridge protection would provide additional scour protection for the piers and abutments of the existing BNSF Bridge. Staging would occur within and throughout the TCE as needed. Clearing and grubbing would be required to prepare the staging areas and work zones, which would be restored with native vegetation upon completion of construction.

Access to BNSF Bridge area would occur via SR-91 and Green River Road, and on temporary access/haul roads on the Green River Golf Course on the west side of the SAR, and existing maintenance roads along the Green River Mobile Home Park and Phase 2A bank protection features on the east side of the SAR. However, the BNSF Bridge measure would not result in permanent incompatibilities with on-site land uses and would not prevent existing land uses from continuing in essentially the same manner. The purpose of the proposed project is to provide flood damage reduction to land uses on-site and in surrounding areas. Therefore, the project would not be incompatible with surrounding or on-site land uses, and would not prevent or inhibit the existing land uses.

The City of Corona General Plan designates BNSF Bridge as Open Space-General and is zoned OS. Open Space General designation applies to lands permanently committed or protected for open space purposes due to their value as habitat, topography, scenic quality, public safety (e.g., flood control channels), or comparable purpose. No changes to the existing City of Corona zoning and General Plan land use designations would occur. In addition, BNSF Bridge elements would not be inconsistent with the City of Corona General Plan, which includes goals for flood protection.

Future OMRR&R activities would include structural repairs. Maintenance of the structures would be required per the OMRR&R manual and would be conducted in accordance with the LCA and the Construction-Management Agreement with BNSF railway. The existing Green River Mobile Home Park bank protection maintenance road would be used for permanent access to the project site from the south and the Phase 2A bank protection maintenance road for permanent access from the north. The emergency ingress and egress access road under the bridge would remain open during and after project construction. As with project construction, maintenance would not be permanently incompatible with existing on-site or surrounding land uses. Therefore, the BNSF Bridge Preferred Alternative would have a less than significant impact on land use.

Additionally as described in Chapter 5.9.2.1, the BNSF Bridge alternative's encroachment into the HMP would not conflict with the HMP, and would have a less than significant impact on the HMP. The same is anticipated regarding compliance with the MSHCP. As presented in Chapter 5.5 Biological Resources, this alternative would have a less than significant impact on the MSHCP.

No Federal Action Alternative (Alternative 2)

With the No Federal Action Alternative, there would be no construction of bridge pier or abutment protection features to provide additional protection against high flows and scour. Therefore, future high flow conditions through the BNSF Bridge reach could undermine the BNSF Bridge piers, periodically threatening bridge stability and requiring emergency repairs to avoid catastrophic loss. It is likely that any emergency repairs would be limited in scope and duration and no permanent changes to the existing land uses would occur. Therefore, the No Federal Action Alternative would have a less than significant impact on land use, unless undetected erosions were to result in a catastrophic loss of one or more bridge piers or tracks. Even in that case, it is anticipated that replacement construction would occur as soon as possible, and therefore no changes to land use would occur.

5.9.3 Summary of Significance Thresholds Related to Proposed Alternatives

The proposed alternatives would have no significant impacts on land use, based on the following:

- Proposed alternatives would not be incompatible with surrounding or on–site uses; and/or
- They would not be inconsistent with applicable land use plans and policies.

5.10 Recreation

5.10.1 Affected Environment

Park and recreational facilities that are located within approximately 1 mile of the Phases 5A, 5B, 4, and BNSF Bridge areas are provided in Table 5.10-1.

Table 5.10-1. Parks and Recreation Facilities within Approximately 1.5 Mile of the Reach 9 Measures

Park Name	Location	Description/Amenities	Phase(s) Located Within 1.5 Miles
CITY OF YORBA LINDA OWNED/MAINTAINED PARK AND RECREATION FACILITIES			
Vista Lampara Park	Intersection of Vista Lampara and Cam Caluroso	This park includes the following: open field space and play equipment.	Phase 5A Phase 5B Phase 4
Bryant Ranch Park	24705 Paseo de Toronto	This park includes the following: play area and picnic benches.	Phase 5A Phase 5B Phase 4
Brush Canyon Park	28282 Brush Canyon Dr	This park includes the following: a par course, a playground, two baseball/softball fields, a soccer/multipurpose field, two tennis courts, and a basketball court.	Phase 5A Phase 5B Phase 4
Susanna Bixby Bryant Ranch Museum and Garden	5700 Susanna Bryant Dr	This recreation facility includes the following: a Yorba Linda Heritage Museum and botanic garden.	Phase 5A Phase 5B Phase 4
CITY OF ANAHEIM OWNED/MAINTAINED PARK AND RECREATION FACILITIES			
Ronald Reagan Park	945 S. Weir Canyon Rd	This recreational facility includes the following: softball fields, play area, group picnic shelter, football/soccer fields, basketball courts, and volleyball court.	Phase 5A Phase 5B Phase 4
COUNTY OF ORANGE OWNED/MAINTAINED PARK AND RECREATION FACILITIES			
Featherly Regional Park	24001 Santa Ana Canyon Rd	This recreational facility has limited public access and is predominantly natural wilderness riparian habitat. However, the eastern portion of the park is developed as Canyon RV Park	Phase 5A Phase 5B Phase 4
Green River Golf Course	5215 Green River Road, Corona	Golf course and event facilities	Phase 5B Phase 4 BNSF Bridge
STATE OF CALIFORNIA OWNED/MAINTAINED PARK AND RECREATION FACILITIES			
Chino Hills State Park (CHSP)	4500 Carbon Canyon Rd (State Route 142) Brea, California 92823	This recreational facility includes extensive network of open space and wilderness areas and numerous cycling, hiking, and equestrian trails.	Phase 5B Phase 4 BNSF Bridge

Sources: City of Yorba Linda (2014b, c, d); City of Anaheim Parks Division (2014); OC Parks (2014); State Parks (2014).

5.10.1.1 Phases 5A and 5B

The SAR Trail, a Class I (off-road, paved) Bike Path, which runs from the Green River Golf Course to Huntington Beach (OCTA 2014a), occurs within the footprint of the Phase 5A and 5B areas. The existing bike path, maintained by OC Parks, is used for walking, jogging, running, and hiking, and can be used for horse riding by permit.

Featherly Regional Park is located south of the Phase 5A and 5B areas. The park includes 364 acres of mostly natural areas along the SAR with restricted public access. The only developed portion of the park is the 63-acre Canyon RV Park, a privately operated facility. Activities are limited to viewing the park's natural riparian wilderness area from the SAR Trail, and RV and youth group camping in Canyon RV Park (OC Parks 2014). Vista Lampara Park, Bryant Ranch Park, Brush Canyon Park, Box Canyon Park, and Susanna Bixby Bryant Ranch Museum and Garden are located in residential areas within 1.5 miles north of Phases 5A and 5B (City of Yorba Linda 2014b). Additionally, Ronald Reagan Park occurs approximately 0.90 mile south of Phase 5B, in Anaheim Hills.

5.10.1.2 Phase 4

The SAR Trail crosses over the SAR to the south side on Gypsum Canyon Road, continuing east through Phase 3 and Phase 4, and on to its current terminus at the Green River Golf Club. Phase 4 lies upstream of the Canyon RV Park (Phase 3 lies between the RV Park and Phase 4). This park offers 140 RV sites, group camping areas, and 10 cabins (Canyon RV Park 2014). Green River Golf Course, located east of Phase 4, is owned and operated by the County of Orange. This 36-hole course spans Orange, San Bernardino, and Riverside Counties within the floodplain of the SAR between the BNSF Bridge and SR-91 (Corps 2009). The land underlying the Green River Golf Course was acquired by OCFCD for the SARMP. Golf course operations are secondary to requirements of the SARMP and are only allowed to the extent compatible with the SARMP.

5.10.1.3 BNSF Bridge

Green River Golf Course is located immediately west of the BNSF Bridge, with a small portion of the golf course overlapping the BNSF Bridge footprint. This golf course is located within the SARMP footprint. Chino Hills State Park lies just north of the golf course. It is operated by State Parks and offers numerous passive recreation opportunities, such as hiking, bird watching, and jogging trails.

5.10.2 Environmental Consequences

Significance Threshold

Based on the existing conditions discussed above, impacts would be considered significant on recreation if the alternative:

- Increases the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated; and/or

- Substantially or permanently decreases existing use, quality, or availability of recreational areas.

5.10.2.1 Phase 5A

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

Phase 5A proposes to replace existing ungrouted riprap structure with grouted stone structure and installation of steel sheet pile wall. Phase 5A construction would not affect recreation at the Featherly Regional Park or other nearby recreational facilities; however, construction would require a temporary closure of the SAR Trail and thus a temporary trail detour would be provided by placing k-rails within a portion of the eastbound (river adjacent) driving lane on La Palma Avenue. Additionally, as described in the 2001 SEIS/SEIR, implementation of Mitigation Measure LU-2 would ensure that impacts are less than significant.

2001 SEIS/EIR Mitigation Measure

LU-2 The construction or maintenance contractor shall keep bike trails open at all times and provide detour alignments as necessary. The contractor shall provide signage to alert trail users of construction zones, and detours shall be provided along with flag personnel, and fencing as necessary for safety. Prior to construction or maintenance activity, the contractor shall obtain approval from the Manager, County of Orange, Public Facilities and Resources Department, Beaches and Parks, of detour plans that include a diagram and text describing the proposed detour and safety measures. After construction, the contractor shall restore the trail to original condition. Repairs shall be coordinated with County of Orange, Public Facilities and Resources Department, Supervising Maintenance Technician.

During construction of Phase 5A, a temporary increase in the use of nearby parks and recreational facilities in the vicinity of Phase 5A could occur from construction employees utilizing these parks and facilities. However, due to the large number of parks and recreational facilities located within the vicinity of Phase 5A, and a short project construction approximately 24 months, it is anticipated that the temporary increase at parks and recreational facilities within the vicinity of the Phase 5A area during construction would not result in substantial or accelerated physical deterioration of these parks and recreational facilities. Therefore, impacts during construction would be less than significant.

Future maintenance of Phase 5A would include routine inspections and minor repairs, when needed. An existing dirt access road located along the base of the existing LDY-S Levee would remain during construction and could be used for future OMRR&R tasks. Therefore, impacts on recreation from routine maintenance-related activities would be less than significant.

Soil Cement and Sheet Pile Alternative (Alternative 2)

The Soil Cement and Sheet Pile Alternative would have impacts similar to the Grouted Stone and Sheet Pile Alternative. Similar to the Preferred Alternative, the Soil Cement and Sheet Pile Alternative would

not affect recreation at the Featherly Regional Park or other nearby recreational facilities; however, construction would require a temporary closure of the SAR Trail and thus a temporary trail detour would be provided by placing k-rails within a portion of the eastbound (river adjacent) driving lane on La Palma Avenue. Additionally, implementation of Mitigation Measure LU-2 would ensure that impacts are less than significant. Also, similar to the Preferred Alternative, it is anticipated that the temporary increase at parks and recreational facilities within the vicinity of the Phase 5A area during construction of the Soil Cement and Sheet Pile Alternative would not result in substantial or accelerated physical deterioration of these parks and recreational facilities.

Future maintenance of Phase 5A under the Soil Cement and Sheet Pile Alternative would be similar to the Preferred Alternative and, therefore, the impacts on recreation from routine maintenance-related activities would be less than significant.

No Federal Action Alternative (Alternative 3)

With the No Federal Action Alternative, the existing riprap levee would remain along the north bank. It would not be replaced with a grouted stone and sheet pile structure and installed to minimize scour, provide erosion control, and protect adjacent infrastructure (i.e., East La Palma Avenue, SAR Trail, industrial facilities, and commercial buildings) from potential flood damage. Therefore, future high flow releases from Prado Dam could threaten existing infrastructure requiring emergency repairs. Actions necessary to address erosion, or required for flood fighting, would be temporary in nature. Subsequent to emergency repairs, the use of the trail and park would be restored. There would be no permanent changes to recreational uses of these facilities. Therefore, the No Federal Action Alternative would have a less than significant impact on recreation.

5.10.2.2 Phase 5B

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

Construction proposed under the Phase 5B Grouted Stone and Sheet Pile Alternative would result in the replacement of existing riprap with a grouted stone structure to a deeper elevation than currently exists. Phase 5B construction would not affect recreation at Featherly Regional Park or other nearby recreational facilities, such as Brush Canyon and Box Canyon Parks. However, construction would require temporary closure of the SAR Trail and a temporary detour/trail would be provided. Additionally, as described in the 2001 SEIS/SEIR, implementation of Mitigation Measure LU-2 would ensure that impacts are less than significant.

During construction of Phase 5B, a temporary increase in the use of nearby parks and recreational facilities in the vicinity of Phase 5B could occur from construction employees utilizing these parks and facilities. However, due to the large number of parks and recreational facilities located within the vicinity of Phase 5B and a short project construction period of 24 months, it is anticipated that the temporary increase at parks and recreational facilities within the vicinity of Phase 5B area during

construction would not result in substantial or accelerated physical deterioration of these parks and recreational facilities. Therefore, impacts during construction would be less than significant.

Future maintenance of the Phase 5B Grouted Stone structure would include routine inspections and minor repairs, when needed. An existing dirt access road located along the base of the existing levee would remain after construction and could be used for future OMRR&R tasks. Therefore, impacts on recreation from routine maintenance-related activities would be less than significant.

Soil Cement Alternative (Alternative 2)

The Soil Cement Alternative would have impacts similar to the Grouted Stone Alternative. Similar to the Grouted Stone Alternative, this alternative would not affect recreation at the Featherly Regional Park or other nearby recreational facilities; however, construction would require a temporary closure of the SAR Trail and thus a temporary trail detour would be provided. Additionally, implementation of Mitigation Measure LU-2 would ensure that impacts are less than significant. Also, similar to the Preferred Alternative, it is anticipated that the temporary increase at parks and recreational facilities within the vicinity of Phase 5B area during construction of Alternative 2 would not result in substantial or accelerated physical deterioration of these parks and recreational facilities.

Future maintenance of Phase 5B under Alternative 2 would be similar to the Preferred Alternative and, therefore, the impacts on recreation from routine maintenance-related activities would be less than significant.

No Federal Action Alternative (Alternative 3)

With the No Federal Action Alternative, existing riprap bank protection would remain along the north bank. It would not be replaced with a grouted stone structure and installed to minimize scour, to provide erosion control, and to protect adjacent infrastructure (i.e., East La Palma Avenue, SAR Trail, industrial facilities, commercial buildings, and residential housing development) from potential flood damage. Therefore, future high flow releases from Prado Dam could threaten existing infrastructure requiring emergency repairs. Emergency repairs could temporarily affect use of the SAR Trail. Subsequent to emergency repairs, use of the trail would be restored. There would be no permanent changes to recreational uses of this facility. Therefore, the No Federal Action Alternative would have a less than significant impact on recreation.

5.10.2.3 Phase 4

Soil Cement Alternative (Preferred Alternative, Alternative 1)

The Phase 4 Soil Cement Alternative proposes to construct a soil cement structure in place of existing soil cement. Project construction would not affect recreation at the Green River Golf Course and Canyon RV Park. Construction would not require a temporary closure of the SAR Trail, as a temporary detour/trail will be provided around the construction site. As part of Phase 4 construction, the trail would be restored to its previous alignment and condition. Additionally, as described in the 2001

SEIS/SEIR, implementation of Mitigation Measure LU-2 would ensure that impacts are less than significant.

During construction of the Soil Cement Alternative, a temporary increase in the use of nearby parks and recreational facilities in the vicinity of Phase 4 could occur from construction employees utilizing these parks and facilities. However, due to the large number of parks and recreational facilities located within the vicinity of Phase 4, it is anticipated that the temporary increase at parks and recreational facilities within the vicinity of Phase 4 during construction would not result in substantial or accelerated physical deterioration of these parks and recreational facilities. Therefore, impacts during construction would be less than significant.

Future maintenance of the Soil Cement Alternative would include routine inspections and minor repairs, when needed. A road of decomposed granite would be installed next to the soil cement structure (on top of bank) and used for OMRR&R tasks, and would serve as the permanent trail. Inspections and repairs of Phase 4 would be temporary in nature. Therefore, impacts on recreation from routine inspection and maintenance-related activities would be less than significant.

Grouted Stone Alternative (Alternative 2)

The Grouted Stone Structure Alternative would have impacts similar to the Soil Cement Alternative. Similar to the Preferred Alternative, Alternative 2 would not affect recreation at the Green River Golf Course and Canyon RV Park. Additionally, construction would not require a temporary closure of the SAR Trail, as a temporary detour/trail would be provided around the construction site. Additionally, implementation of Mitigation Measure LU-2 would ensure that impacts are less than significant. Also, similar to the Preferred Alternative, it is anticipated that the temporary increase at parks and recreational facilities within the vicinity of Phase 4 area during construction of Alternative 2 would not result in substantial or accelerated physical deterioration of these parks and recreational facilities.

Future maintenance of Phase4 under Alternative 2 would be similar to the Preferred Alternative and, therefore, the impacts on recreation from routine maintenance-related activities would be less than significant.

No Federal Action Alternative (Alternative 3)

With the No Federal Action Alternative, there would be no reconstruction of the existing bank protection structure to provide additional protection against high flows and scour. Therefore, future high flow releases from Prado Dam could threaten existing infrastructure, requiring emergency repairs. Actions necessary to address erosion, or required for flood fighting, would be temporary in nature. Subsequent to emergency repairs, use of the trail would be restored. There would be no permanent changes to recreational uses of this facility. Therefore, the No Federal Action Alternative would have a less than significant impact on recreation.

5.10.2.4 BNSF Bridge

Pier and Abutment Protection Alternative (Preferred Alternative, Alternative 1)

The BNSF Bridge Preferred Alternative proposes to provide additional scour protection to bridge piers and abutments of the existing BNSF bridges. Access to the BNSF Bridge would occur on temporary access/haul roads through Green River Golf Course on the west side of the river and on a Phase 2B maintenance road on the east side. Although access to the project site would not affect play at the golf course, BNSF Bridge construction would temporarily affect play at the golf course where a small portion of the course falls within the BNSF Bridge footprint. Play in this portion of the golf course would be temporary suspended should construction activities interfere with activities on the golf course. An approximate 150-foot length of a paved golf cart path along the west side of the SAR will be affected by construction and restored to pre-existing conditions as part of BNSF Bridge. There are no other recreation facilities near BNSF Bridge that would be affected by proposed construction activities.

During construction of BNSF Bridge, a temporary increase in the use of nearby parks and recreational facilities in the vicinity of BNSF Bridge could occur from construction employees utilizing these parks and facilities. However, due to the large number of parks and recreational facilities located within the vicinity of BNSF Bridge, and a short project construction period of three years, it is anticipated that the temporary increase at parks and recreational facilities within the vicinity of BNSF Bridge during construction would not result in substantial or accelerated physical deterioration of these parks and recreational facilities. Therefore, construction impacts would be less than significant.

Future maintenance of the BNSF Bridge would include routine inspections and minor structural repairs, when needed. An existing maintenance road on the Green River Mobile Home Park bank protection structure would be utilized for permanent access to the project from the south and a road on the Phase 2A bank protection structure for permanent access from the north. These access roads occur on the east side of the SAR, across from the Green River Golf Course. Therefore, routine maintenance-related impacts on recreation at the golf course would be less than significant.

No Federal Action Alternative (Alternative 2)

With the No Federal Action Alternative, there would be no construction of bridge pier or abutment protection features to provide additional protection against high flows and scour. Therefore, future high flow conditions through the project reach could undermine the BNSF bridge piers, periodically threatening bridge stability and requiring emergency repairs to avoid catastrophic loss. Actions necessary to address erosion, or required for flood fighting, would be temporary in nature. Subsequent to emergency repairs, use of the Green River Golf Course would be restored. Emergency repairs would be limited in scope and duration and no permanent changes to existing recreational uses would occur. Therefore, the No Federal Action Alternative would have a less than significant impact on recreation.

5.10.3 Environmental Commitments

The following mitigation measure from the 2001 Final SEIS/SEIR would be incorporated into contract specifications for the Reach 9 measures to reduce potential impacts to recreation.

LU-2 The construction or maintenance contractor shall keep bike trails open at all times and provide detour alignments as necessary. The contractor shall provide signage to alert trail users of construction zones, and detours shall be provided along with flag personnel, and fencing as necessary for safety. Prior to construction or maintenance activity, the contractor shall obtain approval from the Manager, County of Orange, Public Facilities and Resources Department, Beaches and Parks, of detour plans that include a diagram and text describing the proposed detour and safety measures. After construction, the contractor shall restore the trail to original condition. Repairs shall be coordinated with County of Orange, Public Facilities and Resources Department, Supervising Maintenance Technician.

5.10.4 Summary of Significance Thresholds Related to Proposed Alternatives

The proposed alternatives would have no significant impacts on recreation, based on the following:

- Proposed alternatives would not increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated; and/or
- They would not substantially or permanently decrease existing use, quality, or availability of recreational areas.

5.11 Transportation

5.11.1 Affected Environment

Transportation and traffic routes in the vicinity of the Reach 9 measures include the following:

- SR-91: SR-91 is a six- to eight-lane freeway that runs parallel to (south of) the SAR near the Reach 9 measures.
- East La Palma Avenue: La Palma Avenue is classified as a primary arterial by Orange County Master Plan of Arterial Highways (MPAH) (OCTA 2013a). Phases 5A and 5B are south of and accessible via East La Palma Avenue.
- Gypsum Canyon Road: Gypsum Canyon Road is a four-lane north-south street that crosses the SAR connecting East La Palma Avenue with SR-91. It is classified as a secondary arterial by Orange County MPAH. Phase 5A lies west of, and Phases 5B and 4 east of, Gypsum Canyon Road. Phases 5A and 5B are directly accessible via Gypsum Canyon Road.
- Green River Road: Green River Road is classified as a major arterial six-lane road by the Corona General Plan Update (City of Corona 2004). BNSF Bridge is north and west of Green River Road.
- BNSF Railway: BNSF Bridge includes the BNSF railway between Green River Golf Course and Crestridge Drive. This rail line carries heavy east-west freight train traffic and about 15 Metrolink and Amtrak passenger trains, from Los Angeles and Orange Counties through Riverside County to points east.
- OCTA 794: Public transit service in the vicinity of the Reach 9 measures is operated by OCTA. OCTA Route 794 is an east-west local fixed route providing services along the SR-91, south of Phases 4, 5A, and 5B. The route does not provide any stops within these areas (OCTA 2014b).

Annual Average Daily Traffic (AADT) capacities represent the general level of daily traffic that each roadway type can carry. Table 5.11-1 below shows the current (baseline) traffic volumes, including the 2012 AADT totals for roadways in the vicinity of the Reach 9 measures (Caltrans 2012).

Table 5.11-1 Current Traffic Volumes

Roadway Name	AADT
SR-91 (Weir Canyon Road)[1]	233,000
SR-91 (JCT. RTE. 241)[1]	259,000
SR-91 (Gypsum Canyon Road)[1]	259,000
SR-91 (Coal Canyon Road)[1]	259,000
SR-91 (Green River Drive)[1]	253,000
Gypsum Canyon Road (La Palma Avenue to SR-91)[2]	11,200
La Palma Avenue (Yorba Linda Boulevard to Via Lomas De Yorba West)[3]	20,000
La Palma Avenue (Via Lomas De Yorba West to Via Lomas De Yorba East)[3]	15,000
La Palma Avenue (Via Lomas De Yorba East to Gypsum Canyon)[3]	12,000
La Palma Avenue (Gypsum Canyon to Camino De Bryant)[2]	13,600
Green River Road (to Crestridge Drive)[4]	2,800

Source: [1]Caltrans 2012; [2]City of Yorba Linda 2008; [3]OCTA 2013b; [4]City of Corona 2014a

5.11.2 Environmental Consequences

Significance Threshold

Based on the existing conditions discussed above, impacts on transportation use would be considered significant if the alternative:

- Causes an increase in traffic that is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in the number of vehicle trips, the volume-to-capacity ratio on roads, or congestion at intersection); and/or
- Substantially increases hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses.

5.11.2.1 Phase 5A

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

Construction-related traffic would result in temporary, short-term increases in local traffic. Construction-related traffic would utilize existing roadways for project access and haul roads, including East La Palma Avenue, the SAR Trail along the top of the existing LDY-S Levee, and an existing dirt access road at the base of the levee. The trail and dirt road along the base of the levee occur within the Phase 5A TCE and no new haul roads are anticipated for Phase 5A construction. Occasional equipment and materials deliveries would also occur, and truck trips (on average 16 truck trips per day) would be needed to haul away existing rock and material, and to bring in new riprap and sheet pile/tiebacks. However, the temporary addition of construction workers and truck trips on local roadways would be intermittent and relatively low in number compared to existing traffic volumes, and would not be anticipated to cause a significant increase in traffic.

The proposed Phase 5A construction traffic would use SR-91 and East La Palma Avenue to converge from regional and local roadways to access Phase 5A. Therefore, these roadways would likely experience the most intense amount of construction-related traffic. As shown in Table 5.11-1, the existing average daily traffic on the nearest segment of SR-91 (Weir Canyon Road) averages 233,000 daily traffic trips and 20,000 for East La Palma Avenue (Yorba Linda Boulevard to Via Lomas De Yorba West). Therefore, given the high volume of existing traffic, proposed daily truck trips would account for a minimal increase in existing average daily traffic volumes along utilized roadways and is unlikely to exceed the capacity of these roadways. It should be noted that all traffic identified with construction would be isolated, temporary, short in duration, and coordinated with appropriate agencies. In addition, commonly used traffic control measures would be employed as needed. Although the addition of these truck trips to local roadways is not anticipated to result in a significant transportation impact, the project would adhere to the environmental commitment in Section 5.11.3, which includes the use of flag personnel and other traffic control devices where necessary to ensure traffic safety.

Temporary closure of the SAR Trail would be required during construction. A temporary detour/bike path would be provided. Impacts to pedestrian and bicycle traffic would be less than significant with implementation of the temporary trail detour.

Similar to construction traffic, access for long-term OMRR&R activities would be concentrated along the same segments of SR-91 and East La Palma Avenue used to access the Phase 5A site. The existing trail at the top of the bank and the dirt road at the base of the existing levee would be used for routine inspection and OMRR&R work; the existing dirt access road along the base of the levee would be restored to previous conditions. No new access road would be necessary for future OMRR&R activities. Therefore, maintenance-related traffic would account for a negligible increase in daily trips along utilized roadways (per traffic volumes shown in Table 5.11-1). Maintenance activities are consistent with current plans and existing uses, will not be incompatible with emergency access, and will not result in a traffic hazard. As a result, maintenance-related traffic would not significantly impact capacity of regional and local roadways.

Soil Cement and Sheet Pile Alternative (Alternative 2)

The Soil Cement and Sheet Pile Alternative would have impacts similar to the Grouted Stone and Sheet Pile Alternative. Construction and maintenance-related traffic associated with Alternative 2 would be consistent with current plans and existing uses, would not be incompatible with emergency access, and would not result in a traffic hazard.

No Federal Action Alternative (Alternative 3)

With the No Federal Action Alternative, existing riprap protection would not be replaced with a grouted stone and sheet pile structures, and would not be installed to minimize scour, provide erosion control, and protect adjacent infrastructure (i.e., SR-91, East La Palma Avenue, SAR Trail, industrial facilities, and commercial buildings) from high flow releases from Prado Dam. Therefore, future high flow conditions could threaten existing infrastructure requiring emergency repairs of the existing bank protection. Emergency repairs could require the import of fill material to stabilize the bank protection structure. Traffic associated with emergency repairs would utilize the existing trail and maintenance road at the base of the levee. It is likely that any emergency repair would be limited in scope and duration, and there would be short-term, *de minimis* impacts to traffic during emergency repairs. Therefore, the No Federal Action Alternative would have a less than significant impact on transportation.

5.11.2.2 Phase 5B

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

Construction-related traffic would result in temporary, short-term increases in local traffic. Construction-related traffic would utilize existing roadways for project access and as haul roads, including East La Palma Avenue, the SAR Trail along the top of the existing LDY-S Levee, and an existing dirt access road at the base of the levee. The trail and dirt road along the base of the levee occur within the Phase 5B TCE and no new haul roads are anticipated for Phase 5B construction. Occasional

equipment and materials deliveries would also occur. However, the temporary addition of construction workers and truck trips (on average 20 trips per day) on local roadways would be intermittent and low in number, and would not be anticipated to cause a significant increase in traffic.

Construction traffic associated with this alternative would use SR-91 and East La Palma Avenue to converge from regional and local roadways to access the Phase 5B site. Therefore, these roadways would likely experience the most intense amount of construction-related traffic. As shown in Table 5.11-1, the existing average daily traffic on the nearest segment of SR-91 (Weir Canyon Road) averages 233,000 daily traffic trips and 20,000 for East La Palma Avenue (Yorba Linda Boulevard to Via Lomas De Yorba West). Therefore, given the high volume of existing traffic, proposed daily truck trips would account for a minimal increase in existing average daily traffic volumes along utilized roadways and is unlikely to exceed the capacity of these roadways. It should be noted that all traffic identified with construction would be isolated, temporary, short in duration, and coordinated with appropriate agencies. In addition, commonly used traffic control measures would be employed as needed. Although the addition of these truck trips to local roadways is not anticipated to result in a significant transportation impact, the project would adhere to the environmental commitment in Section 5.11.3, which includes the use of flag personnel and other traffic control devices where necessary to ensure traffic safety.

Temporary closure of the SAR Trail would be required during construction. It is anticipated that a temporary detour/bike path would be provided. Impacts to pedestrian and bicycle traffic would be less than significant with implementation of the temporary trail detour.

Similar to construction traffic, access for long-term OMRR&R activities would be concentrated along the same segments of SR-91 and East La Palma Avenue to access Phase 5B. The existing trail at the top of the bank and the dirt road at the base of the existing levee would be used for routine inspection and OMRR&R work; the existing dirt access road along the base of the levee would be restored to previous conditions. No new access road would be necessary for future OMRR&R activities. Therefore, maintenance-related traffic would account for a negligible increase in daily trips along utilized roadways (per traffic volumes shown in Table 5.11-1). Maintenance activities are consistent with current plans and existing uses, will not be incompatible with emergency access, and will not result in a traffic hazard. As a result, maintenance-related traffic would not significantly impact capacity of regional and local roadways.

Soil Cement Alternative (Alternative 2)

The Soil Cement Alternative would have impacts similar to the Grouted Stone Alternative. Construction and maintenance-related traffic associated with Alternative 2 would be consistent with current plans and existing uses, would not be incompatible with emergency access, and would not result in a traffic hazard.

No Federal Action Alternative (Alternative 3)

With the No Federal Action Alternative, existing riprap protection would not be replaced with a soil cement structure to protect adjacent infrastructure (i.e., SR-91, East La Palma Avenue, SAR Trail, BNSF rail line, industrial facilities, commercial buildings, and residential housing development) from high flows and scour. Therefore, future high flow conditions could threaten existing infrastructure requiring emergency repairs of the existing bank protection. Emergency repairs would require the import of fill material to stabilize the bank protection structure. Traffic associated with emergency repairs would utilize the existing trail and maintenance road at the base of the levee. It is likely that any emergency repair would be limited in scope and duration, and there would be short-term, *de minimis* impacts to traffic during emergency repairs. Therefore, the No Federal Action Alternative would have a less than significant impact on transportation.

5.11.2.3 Phase 4

Soil Cement Alternative (Preferred Alternative, Alternative 1)

Construction-related traffic would result in temporary, short-term increases in local traffic. Construction-related traffic would utilize the SR-91 Coal Canyon on/off ramps for access to the site for project access and as haul roads. Once equipment and workers exit at Coal Canyon Road, they would be able to immediately access Phase 4 via existing access roads that run west (downstream) of Coal Canyon Road, parallel to SR-91and the SAR. This route is currently used to access the Phase 3 bank protection project, which lies downstream of Phase 4. Access roads would remain upon completion of Phase 3 for use during Phase 4 construction. No new haul roads are anticipated for Phase 4 construction. Occasional equipment and materials deliveries would also occur. However, the temporary addition of construction workers and truck trips on local roadways would be intermittent and low in number, and not anticipated to cause a significant increase in traffic.

Phase 4 construction traffic would use SR-91 and Coal Canyon Road to converge on Phase 4 from regional and local roadways. Therefore, these roadways would likely experience the most intense amount of construction-related traffic; a daily average of 30 truck trips are anticipated. As shown in Table 5.11-1, the existing average daily traffic on the nearest segment of SR-91 (Coal Canyon Road) averages 259,000 daily traffic trips. Therefore, given the high volume of existing traffic, proposed daily truck trips would account for a minimal increase in existing average daily traffic volumes along utilized roadways, and is unlikely to exceed the capacity of these roadways. It should be noted that all traffic identified with construction would be isolated, temporary, short in duration, and coordinated with appropriate agencies. In addition, commonly used traffic control measures would be employed as needed. Although the addition of these truck trips to local roadways is not anticipated to result in a significant transportation impact, the project would adhere to the environmental commitment in Section 5.11.3, which includes the use of flag personnel and other traffic control devices where necessary to ensure traffic safety.

Similar to project construction, long-term OMRR&R activities would be concentrated along the same segments of SR-91 and Coal Canyon Road to access the Phase 4 site. As part of this alternative, the SAR Trail would be restored to its previous alignment and condition, and used during O&M activities.

Therefore, maintenance-related traffic would account for a negligible increase in daily trips along utilized roadways (per traffic volumes shown in Table 5.11-1). Maintenance activities are consistent with current plans and existing uses, will not be incompatible with emergency access, and will not result in a traffic hazard. As a result, maintenance-related traffic would not significantly impact capacity of regional and local roadways.

Grouted Stone Alternative (Alternative 2)

The Grouted Stone Alternative would have impacts similar to the Soil Cement Alternative, although additional truck trips would likely be needed to haul in stone. Construction and maintenance-related traffic associated with this alternative would be consistent with current plans and existing uses, would not be incompatible with emergency access, and would not result in a traffic hazard.

No Federal Action Alternative (Alternative 3)

With the No Federal Action Alternative, there would be no reconstruction of the existing bank protection structure to provide additional protection against high flows and scour. Therefore, future high flow releases from Prado Dam could undermine the structure and threaten the segment of SR-91 located adjacent to the project reach, as well as a segment of the SARI Line located south of the project. Therefore, under the No Federal Action Alternative, SR-91 and the SARI Line would periodically be threatened during high flow conditions and require emergency repairs of existing bank protection. Emergency repairs would require the import of fill material to stabilize the bank protection structure. Traffic associated with emergency repairs would utilize the existing trail and maintenance road at the base of the levee. It is likely that any emergency repair would be limited in scope and duration, and there would be short-term, *de minimis* impacts to traffic during emergency repairs. Therefore, the No Federal Action Alternative would have a less than significant impact on transportation.

5.11.2.4 BNSF Bridge

Pier and Abutment Protection Alternative (Preferred Alternative, Alternative 1)

Construction-related traffic would result in temporary, short-term increases in local traffic. Construction-related trucks would be required for delivering riprap, demolition, and miscellaneous earthwork. The estimated peak number of daily truck trips for BNSF Bridge is 50. Average daily truck trips are anticipated to be around 20 or less, for 60 working days. Construction-related traffic would utilize existing roadways for access to the project site, including SR-91 and Green River Drive. There are also temporary access/haul roads along the Green River Golf Course on the west side of the SAR, and along the Green River Mobile Home Park and Phase 2A protection structures on the east side of the SAR. During construction, permanent emergency ingress and egress for the Green River Mobile Home Park Owner's Association would be provided. Occasional equipment and materials deliveries would also occur. However, the temporary addition of construction workers and truck trips on local roadways would be intermittent and low in number, and would not be anticipated to cause a significant increase in traffic.

BNSF Bridge construction traffic would use SR-91 and Green River Drive to converge on the site from regional and local roadways. Therefore, these roadways would likely experience the most intense amount of construction-related traffic. The maximum number of daily truck trips is 50, on average, and the number of anticipated daily truck trips would be approximately 20 or less truck trips per day. As shown in Table 5.11-1, the existing average daily traffic on the nearest segment of SR-91 (Green River Drive) averages 253,000 daily traffic trips and 2,800 for Green River Road (to Crestridge Drive). Therefore, given the high volume of existing traffic, proposed daily truck trips would account for a minimal increase in existing average daily traffic volumes along utilized roadways and is unlikely to exceed the capacity of these roadways. It should be noted that all traffic identified with construction would be isolated, temporary, short in duration, and coordinated with appropriate agencies. In addition, commonly used traffic control measures would be employed as needed. Although the addition of these truck trips to local roadways is not anticipated to result in a significant transportation impact, the project would adhere to the environmental commitment in Section 5.11.3, which includes the use of flag personnel and other traffic control devices where necessary to ensure traffic safety.

Similar to construction traffic, long-term OMRR&R activities would be concentrated along the same segments of SR-91 and Green River Drive used to access the BNSF Bridge site. Along the east side of the SAR, the existing Green River Mobile Home Park bank protection maintenance road would be utilized for permanent access to the project from the south and the Phase 2A bank protection maintenance road for permanent access from the north. The emergency ingress and egress access road under the bridge would remain during and after project construction. Therefore, maintenance-related traffic would account for a negligible increase in daily trips along utilized roadways (per traffic volumes shown in Table 5.11-1). Maintenance activities are consistent with current plans and existing uses, will not be incompatible with emergency access, and will not result in a traffic hazard. As a result, maintenance-related traffic would not significantly impact capacity of regional and local roadways.

No Federal Action Alternative (Alternative 2)

Under the No Federal Action Alternative, there would be no construction of bridge pier or abutment protection features to provide additional protection against high flows and scour. Therefore, future high flow conditions through the project reach would undermine the structure and threaten the stability of the bridge, periodically requiring emergency repairs to avoid catastrophic loss. Emergency repairs would require the import of fill material to stabilize the bridge structure. Traffic associated with emergency repairs would utilize existing maintenance road. It is likely that any emergency repair would be limited in scope and duration, and there would be short-term, *de minimis* impacts to traffic during emergency repairs. Therefore, the No Federal Action Alternative would have a less than significant impact on transportation.

5.11.3 Environmental Commitment

The following environmental commitments would be incorporated into contract specifications for the Reach 9 measures to reduce potential impacts to traffic.

EC-TR-1 The construction contract shall coordinate with the City of Yorba Linda/City of Corona and prepare a Construction Traffic Control Plan and Implementation Program. The Traffic Control Plan must be prepared in accordance with Caltrans Manual on Uniform Traffic Control Devices and WATCH Manual and must include, but is not limited to, the following issues:

a) Timing of heavy equipment and building materials deliveries;
b) Potential redirecting construction traffic with a flag person;
c) Signing, lighting, and traffic control device placement if required;
d) Need for construction work hours and arrival/departure times outside regularly scheduled construction;
e) Access for emergency vehicles to the project site;
f) Pedestrian and bicycle safety from construction vehicle travel routes to the project site, avoiding residential neighborhoods to the maximum extent feasible;
g) Identification of safety procedures for exiting and entering the site access gate;
h) Compliance with Caltrans, Orange County, Riverside County, and other relevant jurisdictions' limitations on vehicle sizes, weights, and travel routes. In addition, the Corps' contractor shall obtain all necessary transportation and oversize load permits from Caltrans, Orange County, Riverside County, and other relevant jurisdictions for roadway use; and
i) Identification of any construction activities that could impede upon the adjacent BNSF railroad lines and identify rail line crossings procedures for oversize vehicles. (This is not anticipated to occur.)

5.11.4 Summary of Significance Thresholds Related to Proposed Alternatives

The proposed alternatives would have no significant impacts on transportation, based on the following:

- Proposed alternatives would not cause an increase in traffic that would be substantial in relation to the existing traffic load and capacity of the street system; and/or
- Design/use would not increase hazards, with implementation of bike detours and standard safety protocols.

5.12 Aesthetics

5.12.1 Affected Environment

The northern boundary of Phases 4, 5A, and 5B lie in the partially developed SAR Canyon, which includes arterial streets (Gypsum Canyon Road and East La Palma Avenue), residential developments, commercial areas, industrial sites, a regional recreational park (Featherly Regional Park), and Canyon RV Park. The southern boundary of Phases 4, 5A, and 5B encompasses a scenic vista of undeveloped riparian areas along the SAR and the surrounding open space areas that feature varying topography and prominent ridgelines and a major freeway (SR-91). Four miles of SR-91, from SR-55 to east of the City of Anaheim city limits, are officially designated as a state scenic highway (Caltrans 2014). This segment of SR-91 is located to the south of Phases 4, 5A, and 5B. According to the City of Yorba Linda General Plan, no highways or roadways have been designated as scenic corridors (City of Yorba Linda 1993) within Phase 4, 5A, and 5B. However, it does recognize the "scenic and visual qualities of hillside areas and ridgelines" of SAR Canyon, and indicates a desire to "preserve and protect the scenic and visual quality of canyon and hillside areas as a resource of public importance."

BNSF Bridge also lies in the partially-developed SAR Canyon and includes SR-91, arterial street (Green River Road), residential areas, and commercial areas. This area also includes Green River Golf Course, the Santa Ana Mountains, and Chino Hills State Park. A portion of SR-91, from the I-15 interchange to the SR-55 interchange near Santa Ana, which includes a portion of the freeway SR-91 south of the Reach 9 measures, is considered by the County of Riverside to lie in a California State-eligible scenic corridor. The City of Corona General Plan does include a goal to "maintain, establish, develop, and protection of the City's highways and corridors for scenic purposes."

5.12.2 Environmental Consequences

Significance Threshold

Based on the existing conditions discussed above, impacts would be considered significant if the alternative:

- Has a substantial adverse effect on a scenic vista;
- Substantially damages scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway;
- Substantially degrades the existing visual character or quality of the site and its surroundings; and/or
- Creates a new source of substantial light or glare that would adversely affect day or nighttime views in the area.

5.12.2.1 Phase 5A

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

Construction under the Grouted Stone and Sheet Pile Alternative may create temporary impacts to aesthetics (e.g., exposed surfaces, construction debris, equipment, and truck traffic) associated with construction activities. However, these aesthetic impacts would be short-term and would cease with completion of Phase 5A construction.

Prior to construction, Phase 5A will be prepared for construction via clearing and grubbing. During construction, an approximate 37.5-foot-tall grouted stone structure would be placed against the existing bank and buried approximately 18 to 20 feet below the channel invert. In addition, derrick stone would be installed for additional scour protection. Construction of derrick stone and grouted stone revetment would require excavation of a trapezoidal trench approximately 80 feet wide by 980 feet long. Installation of the 45- to 50.5-foot sheet pile structures and tiebacks would require an approximately 8-foot vertical excavation of the existing bank, from the top of the existing bank. The sheet pile would be driven vertically down into the bank to an elevation designed to minimize scour and provide erosion control and support the conveyance capacity required by SARMP operations. Dewatering would occur for grouted stone construction by using sump pumps when groundwater is encountered during excavation of the trench and placement of grouted stone. Furthermore, staging areas would be located at the upstream and downstream ends of this Reach 9 measure to store construction equipment and materials and to use as turnaround areas. Proposed grouted stone and sheet pile would be buried and the area would be revegetated with native plantings. Therefore, views of open space areas and prominent ridgelines from areas within the vicinity of the construction area would not be blocked or altered following construction.

Upon completion of project construction, staging and construction areas would be restored with native vegetation and construction dewatering structures would be removed. The river side of the sheet pile wall would be backfilled and the slope would be planted with native vegetation. Additionally, a riprap bank already exists on and around the site and this view would not be substantially altered. Use of the staging area, construction access roads and other temporary work areas would be limited to the construction period, and therefore would not permanently impact the visual character of the site. Temporary impacts associated with the construction would be restored to pre-construction conditions. Phase 5A would not significantly diminish the overall view of the SAR and surrounding vegetation. Additionally, Phase 5A is not located within a scenic vista corridor and it would not damage scenic resources on SR-91 (designated scenic highway segment), which is located to the south of Phase 5A. Additionally, there is no lighting along the existing SAR Trail that coincides within the Phase 5A construction footprint, and use of the facilities is restricted to daylight hours. Phase 5A would not include lighting or materials that would generate substantial light or glare. Therefore, construction of the Grouted Stone and Sheet Pile Alternative would have a less than significant impact on aesthetics. Future OMRR&R of the project site would include routine inspections and minor repairs of the proposed structures, when needed. However, OMRR&R activities of the embankment would not alter the visual

character of the site, nor would such activities degrade the visual quality of the site. Therefore, OMRR&R activities of the Grouted Stone and Sheet Pile Alternative would have a less than significant impact on aesthetics.

Soil Cement and Sheet Pile Alternative (Alternative 2)

The Soil Cement and Sheet Pile Alternative would have impacts similar to the Grouted Stone and Sheet Pile Alternative, and would not result in significant impacts to the visual character and quality of the site and surrounding area. Like existing bank protection, the soil cement and sheet pile structure would be partially buried and revegetated with native plantings upon completion of construction. It is anticipated that replacing an existing hard structure with a different type of protection structure would not significantly alter the viewshed.

No Federal Action Alternative (Alternative 3)

With the No Federal Action Alternative, existing riprap protection would not be replaced with a grouted stone and sheet pile structure, and would not be installed to minimize scour, provide erosion control, and protect adjacent infrastructure (i.e., SR-91, East La Palma Avenue, SAR Trail, industrial facilities, and commercial buildings) from high flows from Prado Dam. Therefore, future high flow conditions could threaten existing infrastructure, requiring emergency repairs. Emergency repairs would be temporary and limited in scope and duration. They would likely entail the discharge of rock to stabilize the embankment and may require limited removal of vegetation growing adjacent to the embankment. Due to the relative abundance of surface flow and groundwater, impacted areas within the SAR would be repopulated with native vegetation within a few years via native recruitment. The existing views of the riparian vegetation in the SAR would remain unaltered over the long-term. Therefore, the No Federal Action Alternative would have less than significant impacts on aesthetics.

5.12.2.2 Phase 5B

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

Construction under the Grouted Stone and Sheet Pile Alternative may create temporary impacts to aesthetics (e.g., exposed surfaces, construction debris, equipment, and truck traffic) associated with construction activities. However, these aesthetic impacts would be short-term and would cease with completion of the construction of Phase 5B.

Construction of Phase 5B would be initiated with the removal of existing ungrouted riprap and vegetation within the TCE. During construction, the grouted stone structure, which would range in height from 30 to 45 feet, would be buried approximately 25 feet deep. Construction of grouted stone revetment would require excavation of a trapezoidal trench approximately 80 feet wide by 19,700 feet long. Dewatering would occur for grouted stone construction by using sump pumps when groundwater is encountered during excavation of the trench and placement of grouted stone. Furthermore, there would be three staging areas; two along the main area along East La Palma Avenue, and a third for the extension area near the BNSF railway. The proposed grouted stone would be buried and the area would

be revegetated with native plantings. Therefore, views of open space areas and prominent ridgelines from areas within the vicinity of the construction area would not be blocked or altered following construction.

Upon completion of project construction, staging and construction areas would be restored with native vegetation and dewatering structures would be removed. Additionally, a riprap bank already exists on and around the construction site, and this view would not be substantially altered. Phase 5B would not significantly diminish the overall view of the SAR and surrounding vegetation. Use of the staging area, construction access roads, and other temporary work areas would be limited to the construction period, and therefore would not permanently impact the visual character of the site. Additionally, Phase 5B is not located within a scenic vista corridor and it would not damage scenic resources on SR-91 (designated scenic highway segment), which is located to the west of this Reach 9 measure. Additionally, there is no lighting along the existing SAR Trail that coincides within the Phase 5B construction footprint, and use of the facilities is restricted to daylight hours. Phase 5B would not include lighting or materials that would generate substantial light or glare. Therefore, construction of the Grouted Stone Alternative would have a less than significant impact on aesthetics.

Future OMRR&R of the Grouted Stone and Sheet Pile Alternative site would include routine inspections and minor repairs of the proposed structures, when needed. OMRR&R activities would be short in duration and not result in physical changes to the bank protection structures that would significantly alter the visual character and quality of the site. Therefore, OMRR&R activities of the Grouted Stone Alternative would have a less than significant impact on aesthetics.

Soil Cement Structure Alternative (Alternative 2)

The Soil Cement Structure Alternative would have impacts similar to the Grouted Stone Alternative and would not result in significant impacts to the visual character and quality of the site and surrounding area. Like existing bank protection, the soil cement structure would be partially buried and revegetated with native plantings upon completion of construction. It is anticipated that replacing an existing hard structure with a different type of protection structure would not significantly alter the viewshed.

No Federal Action Alternative (Alternative 3)

With the No Federal Action Alternative, existing riprap protection would not be replaced with a grouted stone or soil cement structure to protect adjacent infrastructure (i.e., SR-91, East La Palma Avenue, SAR Trail, BNSF rail line, industrial facilities, commercial buildings, and residential housing developments) from high flows and scour. Therefore, future high flow conditions could threaten existing infrastructure, requiring emergency repairs. Emergency repairs would be temporary and limited in scope and duration. They would likely entail the discharge of rocks to stabilize the embankment and may require limited removal of vegetation growing adjacent to the embankment. Due to the relative abundance of surface flow and groundwater, impacted areas within the SAR would be repopulated with native vegetation within a few years via native recruitment. The existing views of the riparian vegetation in the SAR would

remain unaltered over the long-term. Therefore, the No Federal Action Alternative would have less than significant impacts on aesthetics.

5.12.2.3 Phase 4

Soil Cement Alternative (Preferred Alternative, Alternative 1)

Construction under the Soil Cement Alternative may create temporary impacts to aesthetics (e.g., exposed surfaces, construction debris, equipment, and truck traffic) associated with construction activities. However, these aesthetic impacts would be short-term and would cease with completion of the construction of Phase 4.

Construction of the Soil Cement Alternative would be initiated with the removal of vegetation within the TCE, as needed. During construction, an approximately 3,150 foot-long soil cement structure would be constructed in place of existing soil cement. The new structure would be approximately 30 feet in height and 10 feet in width. Approximately 10 feet of the structure would be exposed above-ground, with the remaining structure buried. Construction of the soil cement structure would require excavation of a trapezoidal trench approximately 100 feet wide along the 3,150 foot span. Dewatering would occur during excavation, soil cement would be placed, and the trench would be backfilled. Furthermore, staging areas may be located parallel to the proposed soil cement alignment, on the river-side of the project. Phase 4 construction involves replacing existing soil cement structure with a new soil cement structure. Therefore, views of open space areas and prominent ridgelines from areas within the vicinity of the construction area would not be blocked or altered following construction.

Upon completion of the construction, the staging areas and construction area would be restored with native vegetation and dewatering structures would be removed. Additionally, a soil cement bank already exists on and around the Phase 4 site, and this view would not be substantially altered with the new structure. Phase 4 would not significantly diminish the overall view of the SAR and surrounding vegetation. Use of the staging area, construction access roads, a batch plant, and other temporary work areas would be limited to the construction period, and therefore would not permanently impact the visual character of the Phase 4 site. Additionally, Phase 4 is not located within a scenic vista corridor and the construction of this alternative would not damage scenic resources on SR-91 (designated scenic highway segment), which is located to the west of the Phase 4 area. Currently, there is no lighting within the construction area. Phase 4 would not include lighting or materials that would generate substantial light or glare. Therefore, construction of the Soil Cement Alternative would have a less than significant impact on aesthetics.

Future OMRR&R of the Phase 4 site would include routine inspections and minor repairs of the proposed structures, when needed. OMRR&R activities would be short in duration and not result in physical changes to the bank protection structures that would significantly alter the visual character and quality of the site. Therefore, OMRR&R activities of the Soil Cement Alternative would have a less than significant impact on aesthetics.

Grouted Stone Alternative (Alternative 2)

The Grouted Stone Alternative would have impacts similar to the Soil Cement Alternative, and would not result in significant impacts to the visual character and quality of the site and surrounding area. Like existing bank protection, the grouted stone structure would be partially buried and revegetated with native plantings upon completion of construction. It is anticipated that replacing an existing hard structure with a different type of protection structure would not significantly alter the viewshed.

No Federal Action Alternative (Alternative 3)

With the No Federal Action Alternative, there would be no reconstruction of the existing bank protection structure to provide additional protection against high flows and scour. Therefore, future high flow releases from Prado Dam could undermine the structure and threaten the segment of SR-91 located adjacent to the project reach, as well as segments of the SAR Trail, and SARI Line located in the project vicinity. Therefore, under the No Federal Action Alternative, SR-91, the SAR Trail, and the SARI Line would periodically be threatened during high flow conditions, requiring emergency repairs of the existing bank protection. Emergency repairs would be temporary and limited in scope and duration. Repairs would likely entail the discharge of rocks to stabilize the embankment and may require limited removal of vegetation growing adjacent to the embankment. Due to the relative abundance of surface flow and groundwater, impacted areas within the SAR would be repopulated with native vegetation within a few years via native recruitment. Existing views of riparian vegetation in the SAR would remain unaltered over the long-term. Therefore, the No Federal Action Alternative would have less than significant impacts on aesthetics.

5.12.2.4 BNSF Bridge

Pier and Abutment Protection Alternative (Preferred Alternative, Alternative 1)

Construction under the BNSF Bridge Preferred Alternative may create temporary impacts to aesthetics (e.g., exposed surfaces, construction debris, equipment, and truck traffic) associated with construction activities. However, these aesthetic impacts would be short-term and would cease with completion of the construction of BNSF Bridge.

Construction of the BNSF Bridge Preferred Alternative would be initiated with the removal of vegetation within the TCE, as needed. During construction, reinforced concrete walls, sheet pile, reinforced concrete diaphragm walls, and grouted stone would be provided for additional scour protection to bridge piers and abutments, and to tie previously constructed bank protection along the east bank of the channel into the existing eastern bridge abutment. A river diversion and dewatering would occur to install bridge protection features. Furthermore, staging areas would occur within and throughout the TCE as needed to construct the project. These construction activities would temporarily reduce the aesthetic quality of the area. However, upon completion of the construction, the staging areas and construction area would be restored with native vegetation and project equipment would be removed. Additionally, railroad tracks and bridge piers already exist on and around the BNSF Bridge site, and this view would not be substantially altered. BNSF Bridge would not significantly diminish the overall view of the SAR and surrounding vegetation. Use of the staging area, construction access roads, and other

temporary work areas would be limited to the construction period, and therefore would not permanently impact the visual character of the BNSF Bridge site. Additionally, BNSF Bridge is not located within a scenic vista corridor and BNSF Bridge would not damage scenic resources on SR-91 (designated scenic highway segment), which is located to the west of BNSF Bridge. BNSF Bridge would not include lighting or materials that would generate substantial light or glare. Therefore, views of the construction area would not be blocked or altered following construction.

Future OMRR&R of the BNSF Bridge site would include routine inspections and minor repairs of the proposed structures, when needed. OMRR&R activities would be short in duration and not result in physical changes to the bridge and bank protection structures that would significantly alter the visual character and quality of the site. Therefore, OMRR&R activities of the Preferred Alternative would have a less than significant impact on aesthetics.

No Federal Action Alternative (Alternative 2)

With the No Federal Action Alternative, there would be no construction of bridge pier or abutment protection features to provide additional protection against high flows and scour. Therefore, future high flow conditions through the project reach would undermine the structure and threaten the stability of the bridge, periodically requiring emergency repairs to avoid catastrophic loss. However, emergency repairs would be limited in scope and duration and no permanent changes to the existing land uses would occur. Therefore, the No Federal Action Alternative would have a less than significant impact on aesthetics.

5.12.3 Summary of Significance Thresholds Related to Proposed Alternatives

The proposed alternatives would have no significant impacts on aesthetics, based on the following:

- Proposed alternatives would not have a substantial adverse effect on a scenic vista;
- They would not substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway;
- They would not substantially degrade the existing visual character or quality of the site and its surroundings; and/or
- They would not create a new source of substantial light or glare that would adversely affect day or nighttime views in the area.

5.13 Public Utilities and Services

5.13.1 Affected Environment

5.13.1.1 Phases 5A, 5B and 4

Table 5.13-1 presents utility providers serving the Phases 5A, 5B, and 4 areas.

Table 5.13-1. Utility and Service Providers for the Phases 5A, 5B, and 4 Areas

Utility and Service	Provider
Fire Protection	Orange County Fire Authority
Police Protection	Orange County Sheriff's Department
School	Placentia-Yorba Linda Unified School District, Orange Unified School District
Water	Yorba Linda Water District
Wastewater	Orange County Sanitation District, City of Yorba Linda
Solid Waste Disposal	Yorba Linda Disposal Services
Electrical Energy	Southern California Edison Company
Natural Gas	Southern California Gas Company

5.13.1.2 BNSF Bridge

Table 5.13-2 presents utility providers serving the BNSF Bridge area.

Table 5.13-2. Utility and Service Providers for the BNSF Bridge Area

Utility and Service	Provider
Fire Protection	City of Corona Fire Department
Police Protection	City of Corona Police Department
School	Corona-Norco Unified School District, Alvord Unified School District
Water	City of Corona Department of Water and Power
Wastewater	City of Corona Department of Water and Power
Solid Waste Disposal	Waste Management, Inc.
Electrical Energy	Southern California Edison Company
Natural Gas	Southern California Gas Company

In addition, the Reach 9 measures encompass the following utility lines:

- SARI Line: The SARI Line is a 23-mile-long wastewater pipeline that extends from the Orange/San Bernardino County boundary just southwest of Prado Dam to the OCSD sewage treatment plant in Fountain Valley. The SARI Line serves the sewage disposal needs of Yorba Linda; east Anaheim; Orange; and portions of Garden Grove, Santa Ana and Fountain Valley. It also serves segments of Riverside and San Bernardino Counties by conveying raw sewage and brine (wastewater from agriculture, commercial, industrial, and other sources) to OCSD's treatment plant. Several segments of the SARI Line lie under the SAR within Santa Ana Canyon between the Orange/San Bernardino county boundary and Weir Canyon Road (County of Orange 2014b). A segment of the SARI Line is installed parallel to the SAR between the Phase 4 embankment and SR-91.

- Yorba Linda Spur: The Yorba Linda Spur is a 15-inch-diameter sewage disposal pipeline within a segment of La Palma Avenue and the SAR Trail. The limits of the pipeline on La Palma Avenue are from Via Lomas De Yorba East to Corbit Place in the City of Yorba Linda (City of Yorba Linda 2014c). A segment of the Yorba Linda Spur in installed perpendicular to the Phase 5B embankment.

- Existing interior side drains: There are six OCFD interior side drains within the Phase 5A and 5B footprint. They would be modified to accommodate the proposed bank protection under Phase 5A and Phase 5B. Modification would include demolishing the existing outlet structures and flap gates and reconstructing the outlet structures and flap gates as well as extension of the RCPs. In addition, four existing interior side drains within the Phase 4 footprint would be modified to accommodate the proposed bank protection under Phase 4. Modification would include demolishing the existing outlet structures; extending the RCP and RCBs; and reconstructing the outlet structures. This modification would be completed without disrupting existing drainage under SR-91. Under the BNSF Bridge construction, existing side drains would be extended through new bank protection on the east side of the SAR, and new outlet drains would be constructed where bank protection crosses existing drainage paths. This modification would be completed without disrupting existing infrastructure outside of the BNSF Bridge.

5.13.2 Environmental Consequences

Significance Threshold

Based on the existing conditions discussed above, impacts would be considered significant on public utilities and services if the alternative:

- Adversely impacts existing utilities or services without providing adequate replacement; and/or
- Results in increased demand for police, fire protection, school, or other government services.

5.13.2.1 Phase 5A

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

The Grouted Stone and Sheet Pile Alternative does not involve development of new residential or non-residential structures that would contribute to a permanent increase in population to the area. It represents improvement to, and enhancement of, existing erosion and flood damage protection. Therefore, implementation of Phase 5A would not result in an increased demand for police, fire protection, school, or other government services. Subsequent to construction, land use adjacent to Phase 5A features would result in a reduced need for emergency services during certain storm events because features of Phase 5A would provide flood damage reduction.

The Grouted Stone and Sheet Pile Alternative would result in beneficial impacts to public utilities and services by providing additional protection from flood damage to infrastructure adjacent to Phase 5A (i.e., East La Palma Avenue, SAR Trail, industrial facilities, and commercial buildings). Additionally, there

are six existing interior side drains, owned by City of Yorba Linda that would be modified to accommodate the proposed bank protection. Modification would include demolishing the existing outlet structures and flap gates and reconstructing the outlet structures and flap gates as well as extension of the RCPs. This modification would be completed without disrupting existing drainage under East La Palma Avenue. Therefore, the Grouted Stone and Sheet Pile Alternative would have a less than significant impact to public utilities and services.

Future OMRR&R of the site would include routine inspections and minor repairs of the proposed structures, when needed. These activities would require relatively small amounts of materials, would typically occur for only a short period of time, and would not require a substantial number of new workers for OMRR&R of the embankment. Therefore, operation of Phase 5A would not result in an increase in the local population, leading to long-term demands to local public services. Since no new operational employees would be needed, OMRR&R activities would not generate any additional population that could exceed the capacity of local public service providers. Future OMRR&R activities would not disrupt existing utilities services and would not interfere with maintenance activity of utility providers. Demands on utilities (water, wastewater treatment facility, storm water drainage facility, and solid waste) during maintenance would also be temporary and relatively minor. OMMR&R activities would not include uses that would require substantial increases to utilities and public services. Therefore, future O&M would not result in any significant impact to public services and utilities.

Soil Cement and Sheet Pile Alternative (Alternative 2)

The Soil Cement and Sheet Pile Alternative would have impacts similar to the Grouted Stone and Sheet Pile Alternative. Thus, construction of this alternative would result in beneficial impacts to public utilities and services by providing additional protection from flood damage to infrastructure adjacent to Phase 5A. Since the footprint of this alternative is similar to the Preferred Alternative, it would require six existing interior side drains to be modified to accommodate the proposed bank protection without disrupting existing drainage under East La Palma Avenue. Also, future OMRR&R activities would not include uses that would require a substantial increase to utilities and public services. Therefore, Alternative 2 would have a less than significant impact to public utilities and services.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, existing riprap protection would not be replaced with a grouted stone and sheet pile structure to minimize scour, provide erosion control, and protect adjacent infrastructure (i.e., East La Palma Avenue, SAR Trail, industrial facilities, and commercial buildings) from large controlled releases from Prado Dam. Therefore, under the No Federal Action Alternative, existing bank protection and infrastructure would periodically be threatened during high flow conditions, requiring emergency repairs of the existing bank protection. Emergency repairs would be temporary and limited in scope and duration. They would likely entail the discharge of rock to stabilize the embankment. In addition, since highways, utility lines, and other infrastructure in the vicinity are of regional importance, maintenance and repair actions would be undertaken as necessary to provide

protection. Therefore, the No Federal Action Alternative would have a less than significant impact to public utilities and services.

5.13.2.2 Phase 5B

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

The Grouted Stone and Sheet Pile Alternative does not involve development of new residential or non-residential structures that would contribute to a permanent increase in population to the area. It represents improvement to, and enhancement of, existing erosion and flood damage protection. Therefore, implementation of Phase 5B would not result in an increased demand for police, fire protection, school, or other government services. Subsequent to construction, the land use adjacent to Phase 5B features would result in a reduced need for emergency services during certain storm events because the features of Phase 5B would provide flood damage reduction.

The Grouted Stone and Sheet Pile Alternative would result in beneficial impacts to public utilities and services by providing additional protection from flood damage to infrastructure adjacent to Phase 5B (i.e., East La Palma Avenue, SAR Trail, industrial facilities, commercial buildings, and residential development). Additionally, interior side drains would be modified to accommodate the proposed bank protection. Modification would include demolishing the existing outlet structures and flap gates and reconstructing the outlet structures and flap gates as well as extension of the RCPs. This modification would be completed without disrupting existing drainage under East La Palma Avenue. Therefore, the Grouted Stone Alternative would have a less than significant impact to public utilities and services.

Future OMRR&R of the Phase 5B site would include routine inspections and minor repairs of the proposed structures, when needed. These activities would require relatively small amounts of materials, would typically occur for only a short period of time, and would not require a substantial number of new workers for OMRR&R of the embankment. Therefore, operation of Phase 5B would not result in an increase in the local population, leading to long-term demands to local public services. Since no new operational employees would be needed, OMRR&R activities would not generate any additional population that could exceed the capacity of local public service providers. Future OMRR&R activities would not disrupt existing utilities services and would not interfere with maintenance activity of utility providers. Demands on utilities (water, wastewater treatment facility, storm water drainage facility, and solid waste) during maintenance would also be temporary and relatively minor. OMRR&R activities would not include uses that would require a substantial increase to utilities and public services. Therefore, future O&M would not result in any significant impact to public services and utilities.

Soil Cement Structure Alternative (Alternative 2)

The Soil Cement Structure Alternative would have impacts similar to the Grouted Stone Alternative. Thus, construction of this alternative would result in beneficial impacts to public utilities and services by providing additional protection from flood damage to infrastructure adjacent to Phase 5B. Since the footprint of this alternative is similar to the Preferred Alternative, it would require the existing interior side drains to be modified to accommodate the proposed bank protection without disrupting existing

drainage under East La Palma Avenue. Also, future OMRR&R activities would not include uses that would require a substantial increase to utilities and public services. Therefore, Alternative 2 would have a less than significant impact to public utilities and services.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, existing riprap protection would not be replaced with a grouted stone and sheet pile structure to minimize scour, provide erosion control, and protect adjacent infrastructure (i.e., East La Palma Avenue, SAR Trail, industrial facilities, commercial buildings, and residential development) from large controlled releases from Prado Dam. Therefore, under the No Federal Action Alternative, existing bank protection and infrastructure would periodically be threatened during high flow conditions, requiring emergency repairs of the existing bank protection. Emergency repairs would be temporary and limited in scope and duration. They would likely entail the discharge of rock to stabilize the embankment. In addition, since highways, utility lines, and other infrastructure in the vicinity are of regional importance, maintenance and repair actions would be undertaken as necessary to provide protection. Therefore, the No Federal Action Alternative would have a less than significant impact to public utilities and services.

5.13.2.3 Phase 4

Soil Cement Alternative (Preferred Alternative, Alternative 1)

The Soil Cement Alternative does not involve development of new residential or non-residential structures that would contribute to a permanent increase in population to the area. It represents improvement to, and enhancement of, existing embankment protection. Therefore, implementation of Phase 4 would not result in an increased demand for police, fire protection, school, or other government services. Subsequent to construction, the land use adjacent to Phase 4 features would result in a reduced need for emergency services during certain storm events because the features of Phase 4 would provide flood damage reduction.

The Soil Cement Alternative would result in beneficial impacts to public utilities and services by providing additional protection from flood damage to infrastructure adjacent to Phase 4 (i.e., SR-91, SAR Trail, SARI Line). Additionally, four existing interior side drains would be modified to accommodate the proposed bank protection. Modification would include demolishing the existing outlet structures; extending the RCP and RCBs; and reconstructing the outlet structures. This modification would be completed without disrupting existing drainage under SR-91. Therefore, the Grouted Stone Alternative would have a less than significant impact to public utilizes and services.

Future OMRR&R of the site would include routine inspections and minor repairs of the proposed structures, when needed. These activities would require relatively small amounts of materials, would typically occur for only a short period of time, and would not require a substantial number of new workers for OMRR&R of the embankment. Therefore, operation of Phase 4 would not result in an increase in the local population, leading to long-term demands to local public services. Since no new

operational employees would be needed, OMRR&R activities would not generate any additional population that could exceed the capacity of local public service providers. Future OMRR&R activities would not disrupt existing utilities services and would not interfere with maintenance activity of utility providers. Demands on utilities (water, wastewater treatment facility, storm water drainage facility, and solid waste) during maintenance would also be temporary and relatively minor. OMMR&R activities would not include uses that would require substantial increases to utilities and public services. Therefore, future OMRR&R would not result in any significant impact to public services and utilities.

Grouted Stone Alternative (Alternative 2)

The Grouted Stone Alternative would have impacts similar to the Soil Cement Alternative. Thus, construction of this alternative would result in beneficial impacts to public utilities and services by providing additional protection from flood damage to infrastructure adjacent to Phase 4. Since the footprint of this alternative is similar to the Preferred Alternative, it would require four existing interior side drains to be modified to accommodate the proposed bank protection without disrupting existing drainage under SR-91. Also, future OMRR&R activities would not include uses that would require a substantial increase to utilities and public services. Therefore, Alternative 2 would have a less than significant impact to public utilities and services.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, reconstruction of existing bank protection to provide additional protection against high flows and scour would not occur. Therefore, future large controlled releases from Prado Dam could undermine the structure and threaten the segment of SR-91 located adjacent to the project reach, as well as a segment of the SARI Line located south of the back protection (see Figure 4.3-3). Under the No Federal Action Alternative, SR-91 and the SARI Line could periodically be threatened during high flow conditions, requiring emergency repairs of existing bank protection. Emergency repairs would be temporary and limited in scope and duration. They would likely entail the discharge of rock to stabilize the embankment. In addition, due to the regional importance of SR-91 and the SARI Line, necessary maintenance and repair actions would be provided. With bank protection, the possibility of high flow conditions within the project reach eroding and rupturing infrastructure would be minimal. However, since highways and utility lines in the Phase 4 vicinity are of regional importance, maintenance and repair actions would be undertaken as necessary to provide protection. Therefore, the No Federal Action Alternative would have a less than significant impact to public utilities and services.

5.13.2.4 BNSF Bridge

Pier and Abutment Protection Alternative (Preferred Alternative, Alternative 1)

BNSF Bridge Preferred Alternative does not involve development of new residential or non-residential structures that would contribute to a permanent increase in population to the area. It represents constructing additional scour protection for the piers and abutments of the existing bridges. Therefore, implementation of BNSF Bridge would not result in an increased demand for police, fire protection, school, or other government services. Subsequent to construction, the land use adjacent to the

proposed project features would result in a reduced need for emergency services during certain storm events because the features of the proposed project would provide flood damage reduction.

The BNSF Bridge Preferred Alternative would result in beneficial impacts to public utilities and services by providing additional protection from flood damage to the BNSF Bridge. Additionally, existing side drains would be extended through new bank protection on the east side of the SAR, and new outlet drains would be constructed where bank protection crosses existing drainage paths. This modification would be completed without disrupting existing infrastructure outside of the BNSF Bridge area. Therefore, the Pier and Abutment Protection Alternative would have a less than significant impact to public utilizes and services.

Future OMRR&R of the site would include routine inspections and minor repairs of the proposed structures, when needed. These activities would require relatively small amounts of materials, would typically occur for only a short period of time, and would not require a substantial number of new workers for OMRR&R activities. Therefore, operation of BNSF Bridge would not result in an increase in the local population, leading to long-term demands to local public services. Since no new operational employees would be needed, OMRR&R activities would not generate any additional population that could exceed the capacity of local public service providers. Future OMRR&R activities would not disrupt existing utilities services and would not interfere with maintenance activity of utility providers. Demands on utilities (water, wastewater treatment facility, storm water drainage facility, and solid waste) during maintenance would also be temporary and relatively minor. OMMR&R activities would not include uses that would require substantial increases to utilities and public services. Therefore, future OMRR&R would not result in any significant impacts to public services and utilities.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, construction of bridge pier and abutment protection features to provide additional protection against high flows and scour would not occur. Therefore, future large controlled releases from Prado Dam through the project reach could undermine the structure and threaten stability of the bridge, periodically requiring emergency repairs to avoid catastrophic loss. Emergency repairs would be temporary and limited in scope and duration. In addition, due to the regional importance of the railway, necessary maintenance and repair actions would be undertaken as necessary to provide protection. Therefore, the No Federal Action Alternative would have a less than significant impact to public utilities and services.

5.13.3 Summary of Significance Thresholds Related to Proposed Alternatives

The proposed alternatives would have no significant impacts on public utilities and services, based on the following:

- Proposed alternatives would not adversely impact existing utilities or services without providing adequate replacement; and/or

- They would not result in increased demand for police, fire protection, school, or other government services.

5.14 Hazardous Materials

5.14.1 Affected Environment

Searches were performed through the federal and state hazardous material site database including the RWQCB's Geotracker website (http://geotracker.waterboards.ca.gov/), Department of Toxic Substances Control (DTSC) EnviroStor website (http://www.envirostor.dtsc.ca.gov/public/), and California Environmental Protection Agency Cortese List website (http://www.calepa.ca.gov/sitecleanup/corteselist/SectionA.htm). Based on the searches, there are no known, existing hazardous toxic radioactive wastes (HTRW) below or above the ground in the Reach 9 measures or in the immediate vicinity.

5.14.2 Environmental Consequences

Significance Threshold

Based on the existing conditions discussed above, impacts would be considered significant if the alternative:

- Creates a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials; and or
- Creates a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment.

5.14.2.1Phase 5A

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

The Grouted Stone and Sheet Pile Alternative consists of replacing an existing ungrouted riprap structure with a grouted stone and sheet pile structure along the north bank of the SAR. Since no HTRW sites are known in or within the vicinity of Phase 5A, construction is not expected to unearth or otherwise disturb HTRW.

Earthmoving equipment would be on the river bank and adjacent portions of the riverbed. Contact between machinery and the riverine environment could potentially introduce minimal amounts of oil and lubricant into the aquatic environment. However, Phase 5A would be dewatered during construction of the grouted stone structure using sump pumps when groundwater is encountered during excavation of the trench and placement of grouted stone. Therefore, the possibility of introducing oil and lubricant into the aquatic environment would be minimal.

The Grouted Stone and Sheet Pile Alternative would not require long-term storage, treatment, disposal, or transport of substantial quantities of hazardous materials. However, small quantities of hazardous materials would be stored, used, and handled during the construction to operate construction equipment. These materials would be enclosed within containers designed for safe storage. Storage of

substantial quantities of these materials along the river bank is not anticipated. Furthermore, construction vehicles may require on-site fueling or routine or emergency maintenance that could result in the release of oil, diesel fuel, transmission fluid, or other materials. However, the materials would not be used in quantities or stored in a manner that would pose a significant hazard to the public or construction workers themselves. Therefore, impacts from general construction activities would be less than significant.

The potential for an accidental release of toxic materials from construction vehicles (e.g., oil and diesel fuel) would be mitigated by maintaining construction vehicles in protected areas so that fluids would be contained within an isolated or impervious area a safe distance from the SAR. Spills or leaks would be cleaned up immediately, and any contaminated soil would be disposed of properly.

As standard Corps practice to alleviate fire hazards, a water truck would always be present during construction activities. In addition, Corps construction projects are required to comply with fire prevention and protection practices set forth in the Corps' Safety and Health Requirements Manual (EM 385-1-1). The provisions of EM 385-1-1 are incorporated into all Corps construction specifications, and the contractor is required to prepare a fire prevention and protection plan for the construction project.

Future OMRR&R of the Grouted Stone and Sheet Pile Alternative would include routine inspections and minor repairs of the proposed structures, when needed. If the structural repairs require work within the watercourse, the work area would be dewatered with portable dewatering structures such as k-rails or coffer dams. This work would require additional environmental documentation and permitting. Non-structural repairs would entail removal of vegetation and debris that may accumulate on and around the grouted stone and sheet pile structure, or the removal of small mammal burrows from the earthen embankment that supports the grouted stone structure. Herbicides or rodenticides may be applied as needed in a manner that avoids impacts to non-target species. The impacts related to future OMRR&R would be less than significant.

Based on the above, the Grouted Stone and Sheet Pile Alternative would have a less than significant impact with respect to hazardous materials.

Soil Cement and Sheet Pile Alternative (Alternative 2)

The Soil Cement and Sheet Pile Alternative would have impacts similar to the Grouted Stone and Sheet Pile Alternative. Similar to the Preferred Alternative, construction of Alternative 2 is not expected to unearth or otherwise disturb HTRW. The possibility of introducing oil and lubricant into the aquatic environment would be minimal as well. Additionally, small quantities of hazardous materials to operate construction equipment would be enclosed within containers designed for safe storage. The potential for an accidental release of toxic materials from construction vehicles (e.g., oil and diesel fuel) would be mitigated by maintaining construction vehicles in protected areas so that fluids would be contained within an isolated or impervious area a safe distance from the SAR. Spills or leaks would be cleaned up immediately, and any contaminated soil would be disposed of properly. As standard Corps practice to alleviate fire hazards, a water truck would always be present during construction activities. In addition,

the Soil Cement and Sheet Pile Alternative would comply with fire prevention and protection practices set forth in the Corps' Safety and Health Requirements Manual (EM 385-1-1). Similar to the Preferred Alternative, the impacts related to future OMRR&R for Alternative 2 would be less than significant. Based on the above, the Soil Cement and Sheet Pile Alternative would have a less than significant impact with respect to hazardous materials.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, existing riprap protection would not be replaced with a grouted stone and sheet pile structure to minimize scour, provide erosion control, and protect adjacent infrastructure (i.e., East La Palma Avenue, SAR Trail, industrial facilities, and commercial buildings) from large controlled releases from Prado Dam. Therefore, under the No Federal Action Alternative, existing bank protection and infrastructure would periodically be threatened during high flow conditions, requiring emergency repairs of the existing bank protection. However, due to the regional importance of surrounding infrastructure, necessary maintenance and repair actions would be provided. With the protection, the possibility of high flow conditions within the project reach damaging infrastructure would be minimal. However, if high flow conditions lead to the rupture of infrastructure, hazardous materials could be released into the aquatic environment. All emergency repair activities involving the transportation, usage, and disposal of hazardous materials would be subject to federal, state, and local health and safety requirements. In addition, storage, handling, and disposal of the materials would be regulated by the California DTSC, USEPA, and city/county fire department(s). Although Phase 5A is located within a High Fire Hazard Severity Zone (City of Yorba Linda 2011), emergency repair activities are not anticipated to increase the risk of fire. In addition, emergency repair work would be in compliance with county and local requirements. Therefore, the No Federal Action Alternative would have a less than significant impact related to the hazardous materials.

5.14.2.2 Phase 5B

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

The Grouted Stone Alternative consists of replacing existing riprap protection with a grouted stone structure that would continue on the river bank upstream of existing protection where the river bank is currently unprotected. Since no HTRW sites are known in or within the vicinity of Phase 5B, the construction activity is not expected to unearth or otherwise disturb HTRW.

Earthmoving equipment would be on the river bank and adjacent portions of the riverbed. Contact between machinery and the riverine environment could potentially introduce minimal amounts of oil and lubricant into the aquatic environment. However, Phase 5B would be dewatered during construction of the grouted stone structure using sump pumps when groundwater is encountered during excavation of the trench and placement of grouted stone. Therefore, the possibility of introducing oil and lubricant into the aquatic environment would be minimal.

The Grouted Stone Alternative would not require long-term storage, treatment, disposal, or transport of substantial quantities of hazardous materials. However, small quantities of hazardous materials would be stored, used, and handled during project construction to operate construction equipment. These materials would be enclosed within containers designed for safe storage. Storage of substantial quantities of these materials along the river bank is not anticipated. Furthermore, construction vehicles may require on-site fueling or routine or emergency maintenance that could result in the release of oil, diesel fuel, transmission fluid, or other materials. However, the materials would not be used in quantities or stored in a manner that would pose a significant hazard to the public or construction workers themselves. Therefore, impacts from general construction activities would be less than significant.

The potential for an accidental release of toxic materials from construction vehicles (e.g., oil and diesel fuel) would be mitigated by maintaining construction vehicles in protected areas so that fluids would be contained within an isolated or impervious area a safe distance from the SAR. Spills or leaks would be cleaned up immediately, and any contaminated soil would be disposed of properly.

As standard Corps practice to alleviate fire hazards, a water truck would always be present during construction activities. In addition, Corps construction projects are required to comply with fire prevention and protection practices set forth in EM 385-1-1.The provisions of EM 385-1-1 are incorporated into all Corps construction specifications, and the contractor is required to prepare a fire prevention and protection plan for the construction project.

Future OMRR&R of Phase 5B would include routine inspections and minor repairs of the proposed structures, when needed. If the structural repairs require work within the watercourse, the work area would be dewatered with portable dewatering structures such as k-rails or coffer dams. This work would require additional environmental documentation and permitting. Non-structural repairs would entail removal of vegetation and debris that may accumulate on and around the grouted stone and sheet pile structure, or the removal of small mammal burrows from the earthen embankment that supports the grouted stone structure. Herbicides or rodenticides may be applied as needed in a manner that avoids impacts to non-target species. The impacts related to future O&M would be less than significant.

Based on the above, the Grouted Stone and Sheet Pile Alternative would have a less than significant impact with respect to hazardous materials.

Soil Cement Structure Alternative (Alternative 2)

The Soil Cement Structure Alternative would have impacts similar to the Grouted Stone Alternative. Similar to the Preferred Alternative, construction of Alternative 2 is not expected to unearth or otherwise disturb HTRW. The possibility of introducing oil and lubricant into the aquatic environment would be minimal as well. Additionally, small quantities of hazardous materials to operate construction equipment would be enclosed within containers designed for safe storage. The potential for an accidental release of toxic materials from construction vehicles (e.g., oil and diesel fuel) would be mitigated by maintaining construction vehicles in protected areas so that fluids would be contained

within an isolated or impervious area a safe distance from the SAR. Spills or leaks would be cleaned up immediately, and any contaminated soil would be disposed of properly. As standard Corps practice to alleviate fire hazards, a water truck would always be present during construction activities. In addition, Alternative 2 would comply with fire prevention and protection practices set forth in the Corps' Safety and Health Requirements Manual (EM 385-1-1). Similar to the Preferred Alternative, the impacts related to future OMRR&R for Alternative 2 would be less than significant. Based on the above, the Soil Cement Structure Alternative would have a less than significant impact with respect to hazardous materials.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, existing riprap protection would not be replaced with a grouted stone and sheet pile structure to minimize scour, provide erosion control, and protect adjacent infrastructure (i.e., East La Palma Avenue, SAR Trail, industrial facilities, commercial buildings, and residential development) from large controlled releases from Prado Dam. Therefore, under the No Federal Action Alternative, existing bank protection and infrastructure would periodically be threatened during high flow conditions, requiring emergency repairs of the existing bank protection. However, due to the regional importance of surrounding infrastructure, necessary maintenance and repair actions would be provided. With the protection, the possibility of high flow conditions within the project reach damaging infrastructure would be minimal. However, if high flow conditions lead to the rupture of infrastructure, hazardous materials could be released into the aquatic environment. All emergency repair activities involving the transportation, usage, and disposal of hazardous materials would be subject to federal, state, and local health and safety requirements. In addition, storage, handling, and disposal of the materials would be regulated by the DTSC, USEPA, and city/county fire department(s). Although the project site is located within a High Fire Hazard Severity Zone (City of Yorba Linda 2011), emergency repair activities are not anticipated to increase the risk of fire. In addition, emergency repair work would be in compliance with county and local requirements. Therefore, the No Federal Action Alternative would have a less than significant impact related to the hazardous materials.

5.14.2.3 Phase 4

Soil Cement Alternative (Preferred Alternative, Alternative 1)

The Soil Cement Alternative consists of constructing a soil cement structure in front of existing soil cement along the south bank of the SAR, parallel to SR-91. Since no HTRW sites are known in or within the vicinity of Phase 4, the construction activity is not expected to unearth or otherwise disturb HTRW.

Earthmoving equipment would be on the river bank and adjacent portions of the riverbed. Contact between machinery and the riverine environment could potentially introduce minimal amounts of oil and lubricant into the aquatic environment. However, Phase 4 would be dewatered during construction of the grouted stone structure using sump pumps when groundwater is encountered during excavation of the trench and placement of grouted stone. Therefore, the possibility of introducing oil and lubricant into the aquatic environment would be minimal.

The Soil Cement Alternative would not require long-term storage, treatment, disposal, or transport of substantial quantities of hazardous materials. However, small quantities of hazardous materials would be stored, used, and handled during the construction to operate construction equipment. These materials would be enclosed within containers designed for safe storage. Storage of substantial quantities of these materials along the river bank is not anticipated. Furthermore, construction vehicles may require on-site fueling or routine or emergency maintenance that could result in the release of oil, diesel fuel, transmission fluid, or other materials. However, the materials would not be used in quantities or stored in a manner that would pose a significant hazard to the public or construction workers themselves. Therefore, impacts from general construction activities would be less than significant.

The potential for an accidental release of toxic materials from construction vehicles (e.g., oil and diesel fuel) would be mitigated by maintaining construction vehicles in protected areas so that fluids would be contained within an isolated or impervious area a safe distance from the SAR. Spills or leaks would be cleaned up immediately, and any contaminated soil would be disposed of properly.

As standard Corps practice to alleviate fire hazards, a water truck would always be present during construction activities. In addition, Corps construction projects are required to comply with fire prevention and protection practices set forth in EM 385-1-1. The provisions of EM 385-1-1 are incorporated into all Corps construction specifications, and the contractor is required to prepare a fire prevention and protection plan for the construction project.

Future OMRR&R of the Soil Cement Alternative would include routine inspections and minor repairs of the proposed structures, when needed. If the structural repairs require work within the watercourse, the work area would be dewatered with portable dewatering structures such as k-rails or coffer dams. This work would require additional environmental documentation and permitting. Non-structural repairs would entail removal of vegetation and debris that may accumulate on and around the grouted stone and sheet pile structure, or the removal of small mammal burrows from the earthen embankment that supports the grouted stone structure. Herbicides or rodenticides may be applied as needed in a manner that avoids impacts to non-target species. The impacts related to future OMRR&R would be less than significant.

Based on the above, the Soil Cement Alternative would have a less than significant impact with respect to hazardous materials.

Grouted Stone Alternative (Alternative 2)

The Grouted Stone Alternative would have impacts similar to the Soil Cement Alternative. Similar to the Preferred Alternative, construction of Alternative 2 is not expected to unearth or otherwise disturb HTRW. The possibility of introducing oil and lubricant into the aquatic environment would be minimal as well. Additionally, small quantities of hazardous materials to operate construction equipment would be enclosed within containers designed for safe storage. The potential for an accidental release of toxic materials from construction vehicles (e.g., oil and diesel fuel) would be mitigated by maintaining

construction vehicles in protected areas so that fluids would be contained within an isolated or impervious area a safe distance from the SAR. Spills or leaks would be cleaned up immediately, and any contaminated soil would be disposed of properly. As standard Corps practice to alleviate fire hazards, a water truck would always be present during construction activities. In addition, Alternative 2 would comply with fire prevention and protection practices set forth in the Corps' Safety and Health Requirements Manual (EM 385-1-1). Similar to the Preferred Alternative, the impacts related to future OMRR&R for Alternative 2 would be less than significant. Based on the above, the Grouted Stone Alternative would have a less than significant impact with respect to hazardous materials.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, no reconstruction of existing bank protection to provide additional protection against high flows and scour would occur. Therefore, future large controlled releases from Prado Dam could undermine the structure and threaten the segment of SR-91 located adjacent to the project reach, as well as a segment of the SARI Line located south of the back protection (see Figure 4.3-3). Therefore, under the No Federal Action Alternative, SR-91, the SAR Trail, and the SARI Line could periodically be threatened during high flow conditions, requiring emergency repairs of existing bank protection. However, due to the regional importance of SR-91 and the SARI Line, necessary maintenance and repair actions would be provided. With bank protection, the possibility of high flow conditions within the project reach eroding and rupturing infrastructure would be minimal. However, if high flow conditions lead to rupture of the SARI Line, treated wastewater containing high concentrations of salt would be released into the aquatic environment. The contents of the wastewater line are not considered hazardous. Additionally, wastewater introduced into the aquatic environment would be diluted. All emergency repair activities involving the transportation, usage, and disposal of hazardous materials would be subject to federal, state, and local health and safety requirements. In addition, storage, handling, and disposal of the materials would be regulated by DTSC, USEPA, and city/county fire department(s). Although the project site is located within a High Fire Hazard Severity Zone (City of Yorba Linda 2011), emergency repair activities are not anticipated to increase the risk of fire. In addition, the emergency repair works would be in compliance with county and local requirements. Therefore, the No Federal Action Alternative would have a less than significant impact related to the hazardous materials.

5.14.2.4 BNSF Bridge

Pier and Abutment Protection Alternative (Preferred Alternative, Alternative 1)

The BNSF Bridge Preferred Alternative consists of constructing reinforced concrete walls, sheet pile and reinforced concrete diaphragm walls, and grouted stone protection. This construction would provide additional scour protection to bridge piers and abutments, and tie previously constructed bank protection along the east bank of the channel into the existing eastern bridge abutment. Since no HTRW sites are known in or within the vicinity of BNSF Bridge, construction is not expected to unearth or otherwise disturb HTRW.

Earthmoving equipment would be on the river bank and adjacent portions of the riverbed. Contact between machinery and the riverine environment could potentially introduce minimal amounts of oil and lubricant into the aquatic environment. However, BNSF Bridge would be dewatered during construction of the grouted stone structure using sump pumps when groundwater is encountered during excavation of the trench and placement of grouted stone. Therefore, the possibility of introducing oil and lubricant into the aquatic environment would be minimal.

The BNSF Bridge Preferred Alternative would not require long-term storage, treatment, disposal, or transport of substantial quantities of hazardous materials. However, small quantities of hazardous materials would be stored, used, and handled during the construction to operate construction equipment. These materials would be enclosed within containers designed for safe storage. Storage of substantial quantities of these materials along the river bank is not anticipated. Furthermore, construction vehicles may require on-site fueling or routine or emergency maintenance that could result in the release of oil, diesel fuel, transmission fluid, or other materials. However, the materials would not be used in quantities or stored in a manner that would pose a significant hazard to the public or construction workers themselves. Therefore, impacts from general construction activities would be less than significant.

The potential for an accidental release of toxic materials from construction vehicles (e.g., oil and diesel fuel) would be mitigated by maintaining construction vehicles in protected areas so that fluids would be contained within an isolated or impervious area a safe distance from the SAR. Spills or leaks would be cleaned up immediately, and any contaminated soil would be disposed of properly.

As standard Corps practice to alleviate fire hazards, a water truck would always be present during construction activities. In addition, Corps construction projects are required to comply with fire prevention and protection practices set forth in EM 385-1-1. The provisions of EM 385-1-1 are incorporated into all Corps construction specifications, and the contractor is required to prepare a fire prevention and protection plan for the construction project.

Future OMRR&R of the BNSF Bridge Preferred Alternative would include routine inspections and minor repairs of the proposed structures, when needed. If the structural repairs require work within the watercourse, the work area would be dewatered with portable dewatering structures such as k-rails or coffer dams. This work would require additional environmental documentation and permitting. Non-structural repairs would entail removal of vegetation and debris that may accumulate on and around the grouted stone and sheet pile structure, or the removal of small mammal burrows from the earthen embankment that supports the grouted stone structure. Herbicides or rodenticides may be applied as needed in a manner that avoids impacts to non-target species. The impacts related to future OMRR&R would be less than significant.

Based on the above, the BNSF Bridge Preferred Alternative would have a less than significant impact with respect to hazardous materials.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, no construction of bridge pier or abutment protection features to provide additional protection against high flows and scour would occur. Therefore, future large controlled releases from Prado Dam could undermine the structure and threaten the stability of the bridge, periodically requiring emergency repairs, to avoid catastrophic loss. Due to the regional importance of the railway, necessary maintenance and repair actions would be provided. With the pier and abutment protection, the possibility of high flow conditions within the project reach eroding and rupturing the structure would be minimal. However, if high flow conditions result in damage to the BNSF Bridge structure, necessary emergency repair work would be required. All emergency repair activities involving the transportation, usage, and disposal of hazardous materials would be subject to federal, state, and local health and safety requirements. In addition, storage, handling, and disposal of the materials would be regulated by DTSC, USEPA, and city/county fire department(s). The proposed project site is not located within a fire hazard severity zone (City of Corona 2014b). Therefore, the No Federal Action Alternative would have a less than significant impact related to the hazardous materials.

5.14.3 Summary of Significance Thresholds Related to Proposed Alternatives

The proposed alternatives would have no significant impacts on hazardous materials, based on the following:

- Proposed alternatives would not create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials; and/or
- They would not create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment.

5.15 Socioeconomics

5.15.1 Affected Environment

Phases 4, 5A, and 5B are located within the City of Yorba Linda, and BNSF Bridge is located within the City of Corona. Therefore, Orange County and Riverside County serve as the reference socioeconomic demographics. Socioeconomic data including population, housing and employment are shown in Table 5.15-1 below.

Table 5.15-1: Population, Housing, and Employment

Population; Housing; Employment	City of Yorba Linda	County of Orange	City of Corona	County of Riverside
Total Population[1]	64,234	3,010,232	152,374	2,189,641
Total Households[2]	21,576	992,781	44,950	686,260
Total Housing Units[2]	22,305	1,048,9007	47,174	800,707
Total Employment[3]	32,324	1,448,768	68,910	869,427
Unemployment Rate[3]	6.8%	9.0%	12.2%	14.2%
Employment –Construction[4]	3.1%	4.1%	5.7%	6.5%
Median Household Income[3]	$116,881	$75,566	$78,982	$57,096
Per Capita Income[3]	$49,533	$34,233	$27,200	$23,863

Source: United States Census Bureau, American FactFinder[1]
[1] 2010 Demographic Profile
[2] 2010 Census
[3] 2008-2012 American Community Survey
[4] 2008-2012 American Community Survey 5-Year Estimates

5.15.2 Environmental Consequences

Significance Threshold

Based on the existing conditions presented in Chapter 5.15.1 above, impacts would be considered significant if the alternative:

- Induces substantial population growth in an area, either directly or indirectly;
- Displaces substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere; and/or
- Displaces substantial numbers of people, necessitating the construction of replacement housing elsewhere. Results in a substantial loss of jobs or employment opportunities.

[1] U.S. Department of Commerce. United States Census Bureau. American FactFinder. Community Facts. [online]: http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml. Accessed April 10. 2014.

5.15.2.1 Phase 5A

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

A socioeconomic impact would occur if implementation of Grouted Stone and Sheet Pile Alternative action would result in substantial shifts in population trends, adversely affect regional spending or earning patterns, or introduce overwhelming demand for public services or utilities.

Construction of the Grouted Stone and Sheet Pile Alternative would be short-term (approximately 24 months) and would not attract a long-term worker population to Phase 5A. The estimated number of construction workers is 12, although exact numbers will vary widely throughout different phases of construction, and as subcontractors are brought on board for specific tasks. The majority of the construction-related jobs are expected to be filled by both currently employed and unemployed labor force participants from the surrounding area, although some construction personnel may originate from outside the region. Construction of Phase 5A is not anticipated to significantly increase the region's population. Implementation of Phase 5A would neither place a demand on employment opportunities, housing, or public facilities, nor would it create significant new employment opportunities, housing, or public facilities in the region. In addition, minority or low-income communities would not be disproportionately affected by implementation of this alternative. Local populations would directly benefit from the construction as it would provide flood damage reduction. Therefore, the Grouted Stone and Sheet Pile Alternative would not adversely affect socioeconomics. It is anticipated that construction personnel would actually add to the local economy by visiting local hotels, restaurants, stores, etc.

Future OMRR&R activities would not have the potential to result in substantial shifts in population trends, adversely affect regional spending or earning patterns, or introduce overwhelming demand for public services or utilities. Therefore, future OMRR&R activities would not adversely affect socioeconomics.

Soil Cement and Sheet Pile Alternative (Alternative 2)

The Soil Cement and Sheet Pile Alternative would have impacts similar to the Grouted Stone and Sheet Pile Alternative. Similar to the Grouted Stone Alternative, this alternative would require approximately 12 construction workers and therefore would not increase the region's population. Alternative 2 would also neither place a demand on employment opportunities, housing, or public facilities, nor would it create significant new employment opportunities, housing, or public facilities in the region. In addition, minority or low-income communities would not be disproportionately affected by implementation of the Soil Cement and Sheet Pile Alternative. Local populations would directly benefit from the construction as it would provide flood damage reduction. Therefore, the Soil Cement and Sheet Pile Alternative would not adversely affect socioeconomics.

No Federal Action Alternative (Alternative 3)

With the No Federal Action Alternative, existing riprap protection would not be replaced with a grouted stone and sheet pile structure to minimize scour, provide erosion control, and protect the adjacent infrastructure (i.e., East La Palma Avenue, SAR Trail, industrial facilities, and commercial buildings) from large controlled releases from Prado Dam. Therefore, under the No Federal Action Alternative, existing bank protection and infrastructure would periodically be threatened during high flow conditions, requiring emergency repairs of the existing bank protection. It is likely that any emergency repair work would be short-term and construction work would be limited. It would not require additional housing for construction laborers since the construction is within commuting distance from Los Angeles, San Bernardino, Orange, and Riverside Counties. In addition, emergency repair work would not entail the construction of infrastructure or utilities that would result in growth of the surrounding area. Therefore, the No Federal Action Alternative would not adversely affect socioeconomics.

5.15.2.2 Phase 5B

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

Construction of the Grouted Stone and Sheet Pile Alternative would be short-term (approximately 24 months) and would not attract a long-term worker population to Phase 5B area. The estimated number of construction workers is 25, although exact numbers will vary widely throughout different phases of construction, and as subcontractors are brought on board for specific tasks. The majority of the construction-related jobs are expected to be filled by both currently employed and unemployed labor force participants from the surrounding area, although some construction personnel may originate from outside the region. Construction of Phase 5B is not anticipated to significantly increase the region's population. Implementation of Phase 5B would neither place a demand on employment opportunities, housing, or public facilities, nor would it create significant new employment opportunities, housing, or public facilities in the region. In addition, minority or low-income communities would not be disproportionately affected by implementation of Phase 5B. Local populations would directly benefit from the construction as it would provide flood damage reduction. Therefore, the Grouted Stone Alternative would not adversely affect socioeconomics. It is anticipated that construction personnel would actually add to the local economy by visiting local hotels, restaurants, stores, etc.

Future OMRR&R activities would not have the potential to result in substantial shifts in population trends, adversely affect regional spending or earning patterns, or introduce overwhelming demand for public services or utilities. Therefore, future OMRR&R activities would not adversely affect socioeconomics.

Soil Cement Alternative (Alternative 2)

The Soil Cement Alternative would have impacts similar to the Grouted Stone Alternative. Similar to the Grouted Stone Alternative, this alternative would require approximately 25 construction workers and therefore would not increase the region's population. The Soil Cement Alternative would also neither place a demand on employment opportunities, housing, or public facilities, nor would it create significant new employment opportunities, housing, or public facilities in the region. In addition,

minority or low-income communities would not be disproportionately affected by implementation of the Soil Cement Alternative. Local populations would directly benefit from the construction as it would provide flood damage reduction. Therefore, the Soil Cement Alternative would not adversely affect socioeconomics.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, existing riprap protection would not be replaced with a grouted stone and sheet pile structure to minimize scour, provide erosion control, and protect the adjacent infrastructure (i.e., East La Palma Avenue, SAR Trail, industrial facilities, and commercial buildings) from large controlled releases from Prado Dam. Therefore, under the No Federal Action Alternative, existing bank protection and infrastructure would periodically be threatened during high flow conditions, requiring emergency repairs of the existing bank protection. It is likely that any emergency repair work would be short-term and construction work would be limited. It would not require additional housing for construction laborers since the construction is within commuting distance from Los Angeles, San Bernardino, Orange, and Riverside Counties. In addition, emergency repair work would not entail the construction of infrastructure or utilities that would result in growth of the surrounding area. Therefore, the No Federal Action Alternative would not adversely affect socioeconomics.

5.15.2.3 Phase 4

Soil Cement Alternative (Preferred Alternative, Alternative 1)

Construction of the Soil Cement Alternative is expected to continue to approximately December 2017and would not attract a long-term worker population to Phase 4. The estimated number of construction workers is 30, although exact numbers will vary widely throughout different phases of construction, and as subcontractors are brought on board for specific tasks. The majority of the construction-related jobs are expected to be filled by both currently employed and unemployed labor force participants from the surrounding area, although some construction personnel may originate from outside the region. Construction of Phase 4 is not anticipated to significantly increase the region's population. Implementation of the Soil Cement Alternative would neither place a demand on employment opportunities, housing, or public facilities, nor would it create significant new employment opportunities, housing, or public facilities in the region. In addition, minority or low-income communities would not be disproportionately affected by implementation of the Soil Cement Alternative. Local populations would directly benefit from the construction as it would provide flood damage reduction. Therefore, the Soil Cement Alternative would not adversely affect socioeconomics. It is anticipated that construction personnel would actually add to the local economy by visiting local hotels, restaurants, stores, etc.

Future OMRR&R would not have the potential to result in substantial shifts in population trends, adversely affect regional spending or earning patterns, or introduce overwhelming demand for public services or utilities. Therefore, future OMRR&R activities would not adversely affect socioeconomics.

Grouted Stone Alternative (Alternative 2)

The Grouted Stone Alternative would have impacts similar to the Soil Cement Alternative. Similar to the Soil Cement Alternative, this alternative would require approximately 30 construction workers and therefore would not increase the region's population. The Grouted Stone Alternative would also neither place a demand on employment opportunities, housing, or public facilities, nor would it create significant new employment opportunities, housing, or public facilities in the region. In addition, minority or low-income communities would not be disproportionately affected by implementation of the Grouted Stone Alternative. Local populations would directly benefit from the construction as it would provide flood damage reduction. Therefore, the Grouted Stone Alternative would not adversely affect socioeconomics.

No Federal Action Alternative (Alternative 3)

With the No Federal Action Alternative, existing riprap protection would not be replaced with a grouted stone and sheet pile structure to minimize scour, provide erosion control, and protect the adjacent infrastructure (i.e., East La Palma Avenue, SAR Trail, industrial facilities, and commercial buildings) from large controlled releases from Prado Dam. Therefore, under the No Federal Action Alternative, existing bank protection and infrastructure would periodically be threatened during high flow conditions, requiring emergency repairs of the existing bank protection. It is likely that any emergency repair work would be short-term and construction work would be limited. It would not require additional housing for construction laborers since the construction is within commuting distance from Los Angeles, San Bernardino, Orange, and Riverside Counties. In addition, emergency repair work would not entail the construction of infrastructure or utilities that would result in growth of the surrounding area. Therefore, the No Federal Action Alternative would not adversely affect socioeconomics.

5.15.2.4 BNSF Bridge

Pier and Abutment Protection Alternative (Preferred Alternative, Alternative 1)

Construction of the BNSF Bridge Preferred Alternative would be short-term (approximately 18 to 22 months) and would not attract a long-term worker population to BNSF Bridge. The estimated number of construction workers is 15, although exact numbers will vary widely throughout different phases of construction, and as subcontractors are brought on board for specific tasks. The majority of the construction-related jobs are expected to be filled by both currently employed and unemployed labor force participants from the surrounding area, although some construction personnel may originate from outside the region. Construction of the BNSF Bridge is not anticipated to significantly increase the region's population. Implementation of the BNSF Bridge Preferred Alternative would neither place a demand on employment opportunities, housing, or public facilities, nor would it create significant new employment opportunities, housing, or public facilities in the region. In addition, minority or low-income communities would not be disproportionately affected by implementation of the BNSF Bridge Preferred Alternative. Local populations would directly benefit from the construction as it would provide flood

damage reduction. Therefore, the BNSF Bridge Preferred Alternative would not adversely affect socioeconomics.

Future OMRR&R activities would not have the potential to result in substantial shifts in population trends, adversely affect regional spending or earning patterns, or introduce overwhelming demand for public services or utilities. Therefore, future OMRR&R activities would not adversely affect socioeconomics. It is anticipated that construction personnel would actually add to the local economy by visiting local hotels, restaurants, stores, etc.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, no construction of bridge pier or abutment protection features to provide additional protection against high flows and scour would occur. Therefore, future large controlled releases from Prado Dam could undermine the structure and threaten the stability of the bridge, periodically requiring emergency repairs to avoid catastrophic loss. It is likely that any emergency repair work would be short-term and construction work would be limited. It would not require additional housing for construction laborers since the construction is within commuting distance from Los Angeles, San Bernardino, Orange, and Riverside Counties. In addition, emergency repair work would not entail the construction of infrastructure or utilities that would result in growth of the surrounding area. Therefore, the No Federal Action Alternative would not adversely affect socioeconomics.

5.15.3 Summary of Significance Thresholds Related to Proposed Alternatives

The proposed alternatives would not adversely affect socioeconomics, based on the following:

- Proposed alternatives would not induce substantial population growth in an area, either directly or indirectly; and
- They would not displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere; and
- They would not result in a substantial loss of jobs or employment opportunities.

5.16 Environmental Justice

5.16.1 Affected Environment

The 1994 Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires all Federal agencies to conduct "programs, policies, and activities that substantially affect human health or the environment, in a manner that ensures that such programs, policies, and activities do not have the effect of excluding persons (including populations) from participation in, denying persons (including populations) the benefits of, or subjecting persons (including populations) to discrimination under, such programs, policies, and activities, because of their race, color, or national origin." Section 1-101 of the Executive Order 12898 requires Federal agencies to identify and address "disproportionately high and adverse human health or environmental effects" of programs on minority and low-income populations (Executive Order 1994).

CEQ) identifies minority groups as Asian, American Indian and Alaskan Native, Native Hawaiian & Pacific Islander, Black or African American, and Latino. CEQ further defines minority population as any group of minorities that exceed 50 percent of the existing population within an area where a minority group comprises a meaningful greater percentage of the local population than in the general population.

Phases 5A, 5B, and 4 are located within the City of Yorba Linda, and BNSF Bridge is located in the City of Corona; therefore, Orange County and Riverside County serve as the reference socioeconomic demographics. Ethnicity and low-income data are shown in Table 5.16-1 below.

Table 5.16-1: Ethnicity and Low Income

Ethnicity and Low Income	City of Yorba Linda	County of Orange	City of Corona	County of Riverside
Total Population[1]	64,234	3,010,232	152,374	2,189,641
Poverty Data				
Individuals Below Poverty Level[2]	2.8%	11.7%	9.9%	15.6%
Ethnicity Data[3]				
White	75.1%	60.8%	59.7%	61.0
Black	1.3%	1.7%	5.9%	6.4
Hispanic/Latino	14.4%	33.7%	43.6%	45.5
Asian	15.6%	17.9%	9.9%	6.0
American Indian/Alaska Native	0.4%	0.6%	0.8%	1.1
Native Hawaiian/Other Pacific Islander	0.1%	0.3%	0.4%	0.3

Source: United States Census Bureau, American FactFinder[2]
[1] 2010 Demographic Profile
[2] 2008-2012 American Community Survey 5-Year Estimates
[3] 2010 Census

[2] U.S. Department of Commerce. United States Census Bureau. American FactFinder. Community Facts. [online]: http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml. Accessed April 10. 2014.

5.16.2 Environmental Consequences

Significance Threshold

Based on the existing conditions discussed above in Chapter 5.16.1, impacts would be considered significant if the alternative results in:

- Disproportionately high and adverse human health or environmental effect on minority and low-income populations.

5.16.2.1Phase 5A

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

The Grouted Stone and Sheet Pile Alternative includes replacing an existing ungrouted riprap structure along the north bank of the SAR with a grouted stone and sheet pile structure. Phase 5A would provide protection to adjacent infrastructure (i.e., East La Palma Avenue, SAR Trail, industrial facilities, and commercial buildings), and all those who use this infrastructure, from large controlled releases from Prado Dam. As presented in this SEA/EIR Addendum, environmental impacts to natural, social, and public resources associated with the Grouted Stone and Sheet Pile Alternative would not be significant, and as a result, this alternative would not disproportionately affect minority and low-income populations. Therefore, the Grouted Stone and Sheet Pile Alternative would have a less than significant impact on environmental justice.

Soil Cement and Sheet Pile Alternative (Alternative 2)

The Soil Cement and Sheet Pile Alternative would have impacts similar to the Grouted Stone and Sheet Pile Alternative. As presented in this SEA/EIR Addendum, environmental impacts to natural, social, and public resources associated with this alternative would not be significant, as a result, this alternative would not disproportionately affect minority and low-income populations. Therefore, the Soil Cement and Sheet Pile Alternative would have a less than significant impact on environmental justice.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, existing riprap protection would not be replaced with a grouted stone and sheet pile structure to minimize scour, provide erosion control, and protect the adjacent infrastructure (i.e., East La Palma Avenue, SAR Trail, industrial facilities, and commercial buildings) from large controlled releases from Prado Dam. Therefore, under the No Federal Action Alternative, existing bank protection and infrastructure would periodically be threatened during high flow conditions, requiring emergency repairs of the existing protection. Emergency repair would require the import of fill material and possibly discharge of rocks to stabilize the bank protection structure. It is likely that any emergency repair would be limited in scope and duration. Emergency repair work would not result in adverse human health or environmental effects as the majority of the work would stay within the footprint of existing maintenance access routes and the riprap protection. Although

emergency repairs could temporarily affect use of the SAR Trail, a temporary detour/trail would be provided during construction, and use of the trail would be restored subsequent to emergency repairs. Repairs would provide equal protection to everyone who uses East La Palma Avenue, the SAR Trail, and adjacent infrastructure and the No Federal Action Alternative would not disproportionately affect minority and low-income populations. Therefore, the No Federal Action Alternative would have a less than significant impact on environmental justice.

5.16.2.2 Phase 5B

Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)

The Grouted Stone Alternative includes replacing an existing ungrouted riprap structure along the north bank of the SAR with a grouted stone structure. Phase 5B would provide protection to adjacent infrastructure (i.e., East La Palma Avenue, SAR Trail, industrial facilities, commercial buildings, and residential development), and all those who use this infrastructure, from large controlled releases from Prado Dam. As presented in this SEA/EIR Addendum, environmental impacts to natural, social, and public resources associated with the Grouted Stone Alternative would not be significant, and as a result, this alternative would not disproportionately affect minority and low-income populations. Therefore, the Grouted Stone Alternative would have a less than significant impact on environmental justice.

Soil Cement Structure Alternative (Alternative 2)

The Soil Cement Structure Alternative would have impacts similar to the Grouted Stone Alternative. As presented in this SEA/EIR Addendum, environmental impacts to natural, social, and public resources associated with the Soil Cement Alternative would not be significant, as a result, this alternative would not disproportionately affect minority and low-income populations. Therefore, the Soil Cement Alternative would have a less than significant impact on environmental justice.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, existing riprap protection would not be replaced with a grouted stone structure to minimize scour, provide erosion control, and protect the adjacent infrastructure (i.e., East La Palma Avenue, SAR Trail, industrial facilities, commercial buildings, and residential development) from large controlled releases from Prado Dam. Therefore, under the No Federal Action Alternative, existing bank protection and infrastructure would periodically be threatened during high flow conditions, requiring emergency repairs of the existing protection. Emergency repair would require the import of fill material and possibly discharge of rocks to stabilize the bank protection structure. It is likely that any emergency repair would be limited in scope and duration. Emergency repair work would not result in adverse human health or environmental effects as the majority of the work would stay within the footprint of existing maintenance access routes and the riprap protection. Although emergency repairs could temporarily affect use of the SAR Trail, a temporary detour/trail would be provided during construction, and use of the trail would be restored subsequent to emergency repairs. Repairs would provide equal protection to everyone who uses East La Palma Avenue, the SAR

Trail, and adjacent infrastructure and the No Federal Action Alternative would not disproportionately affect minority and low-income populations. Therefore, the No Federal Action Alternative would have a less than significant impact on environmental justice.

5.16.2.3 Phase 4

Soil Cement Alternative (Preferred Alternative, Alternative 1)

The Soil Cement Alternative consists of constructing a soil cement structure in front of existing soil cement along the south bank of the SAR, parallel to SR-91. This alternative would protect the embankment of the heavily transited SR-91, the SAR Trail, and the SARI Line from large controlled releases from Prado Dam. As presented in this SEA/EIR Addendum, environmental impacts to natural, social, and public resources associated with the Soil Cement Alternative would not be significant, and, as a result, this alternative would not disproportionately affect minority and low-income populations. Therefore, the Soil Cement Alternative would have a less than significant impact on environmental justice.

Grouted Stone Alternative (Alternative 2)

The Grouted Stone Alternative would have impacts similar to the Soil Cement Alternative. As presented in this SEA/EIR Addendum, environmental impacts to natural, social, and public resources associated with this alternative would not be significant, and as a result, this alternative would not disproportionately affect minority and low-income populations. Therefore, the Grouted Stone Alternative would have a less than significant impact on environmental justice.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, no reconstruction of existing bank protection to provide additional protection against high flows and scour would occur. Therefore, future large controlled releases from Prado Dam could undermine the structure and threaten the segment of SR-91, the SAR Trail, and a segment of the SARI Line located south of the back protection (see Figure 4.3-3). Therefore, under the No Federal Action Alternative, SR-91, the SAR Trail, and the SARI Line could periodically be threatened during high flow conditions, requiring emergency repairs of existing bank protection. Emergency repair would require the import of fill material and possibly discharge of rocks to stabilize the bank protection structure. It is likely that any emergency repair would be limited in scope and duration. Emergency repair work would not result in adverse human health or environmental effects as the majority of the work would stay within the footprint of existing maintenance access routes and the soil cement protection. Emergency repairs would provide equal protection to everyone who uses SR-91 and the SAR Trail and the No Federal Action Alternative would not disproportionately affect minority and low-income populations. Therefore, the No Federal Action Alternative would have a less than significant impact on environmental justice.

5.16.2.4 BNSF Bridge

Pier and Abutment Protection Alternative (Preferred Alternative, Alternative 1)

The BNSF Bridge Preferred Alternative includes construction of additional scour protection for the piers and abutments of the existing bridges to protect from future large controlled releases from Prado Dam, and from long-term scour of the riverbed and local scour of the piers. As presented in this SEA/EIR Addendum, environmental impacts to natural, social, and public resources associated with the BNSF Bridge Preferred Alternative would not be significant, and as a result, this alternative would not disproportionately affect minority and low-income populations. Therefore, the BNSF Bridge Preferred Alternative would have a less than significant impact on environmental justice.

No Federal Action Alternative (Alternative 3)

Under the No Federal Action Alternative, no construction of bridge pier or abutment protection features to provide additional protection against high flows and scour would occur. Therefore, future large controlled releases from Prado Dam could undermine the structure and threaten the stability of the bridge, periodically requiring emergency repairs to avoid catastrophic loss. However, due to the regional importance of the railway, necessary maintenance and repair actions would be provided. With the pier and abutment protection, the possibility of high flow conditions within the project reach eroding and rupturing the structure would be minimal. However, if high flow conditions result in damage to the BNSF Bridge structure, necessary emergency repair work would be required. The emergency repairs would provide equal protection to everyone who uses the BNSF railway and the No Federal Action Alternative would not disproportionately affect minority and low-income populations. Therefore, the No Federal Action Alternative would have a less than significant impact on environmental justice.

5.16.3 Summary of Significance Thresholds Related to Proposed Alternatives

The proposed alternatives would have no significant impacts on environmental justice, based on the following:

- Proposed alternatives would not result in disproportionately high and adverse human health or environmental effect on minority and low-income populations.

5.17 Cumulative Impacts

A cumulative impact is the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time in the proposed activity area. Those actions can be undertaken by various agencies (federal, state, or local) or private entities. A discussion of cumulative impacts resulting from actions and projects that are proposed, under implementation, or reasonably anticipated to be implemented in the near future is required.

Cumulative environmental impacts are most likely to arise when a relationship exists between a proposed activity and other projects expected to occur in a similar location, in a similar time period, and/or involving similar actions. Projects in proximity to the Reach 9 measures activity area would be expected to have more potential for a relationship that could result in potential cumulative impacts than those more geographically separated.

This cumulative impact discussion analyzes cumulative projects located within approximately 2 miles of the Reach 9 measures (see Figure 2-3) that could have the ability to combine with impacts from the Reach 9 measures analyzed in this SEA/EIR Addendum.

Table 5.17-1. Cumulative Projects in the Reach 9 Measures Activity Area (within 2-mile radius)

Project Name/Case Number	General Location	Description	Status
City of Yorba Linda			
Old Canal Road Annex – Savi Ranch	Old Canal Road and Eastpark Drive (APN 352-117-13).	This project is a multi-family rezone that allows for the development of 84 residential units.	Planned.
Mitsubishi Motors Site - Savi Ranch	Oakcrest Circle and Eastpark Drive.	This project is a multi-family rezone that allows for the development of 96 residential units.	Planned.
County of Orange			
SAR Parkway Extension Project	North and south sides of the SAR between Gypsum Canyon Road and Orange/Riverside/San Bernardino County boundaries.	Construction of a new bikeway, riding and hiking trail, and associated amenities on the north and south banks of the SAR between Gypsum Canyon Road and the Orange County boundary.	Planned
Esperanza Hills Specific Plan	Located within unincorporated area of the County of Orange, east of San Antonio Road and north of Stonehaven Drive (Via del Agua) near the City of Yorba Linda.	This project is a residential development consisting of (1) a maximum of 240 single-family residential units; (2) active and passive parks; (3) trails (pedestrian, bicycle, and equestrian) with linkages to existing trails and open space areas; (4) open space; (5) underground water reservoirs;	Draft EIR released in December 2013 for public review.

Project Name/Case Number	General Location	Description	Status
		(6) estate lots; and (7) continued oil production.	
Cielo Vista	Located approximately 2 miles northwest of State Route (SR) 91 and approximately 6 miles east of SR-57 in unincorporated Orange County within the City of Yorba Linda Sphere of Influence.	This project allows for the development of up to 112 single-family dwellings.	Draft EIR released in November 2013 for public review.
OCFCD: Santa Ana River Interceptor (SARI) Line Abandonment/Severing.	Throughout alignment of the SARI Line in Orange County.	The project consists of typical sewer pipe abandonment procedures.	Estimated completion November 2015.
OCSD: SARI Line Emergency Rock Removal	South (left) bank of the SAR, parallel to SR-91.	This project consists of removing emergency rock piles located inside the footprint of the Phase 4 project area as part of construction site preparation.	
City of Anaheim			
Mountain Park Specific Plan	Located generally in Gypsum Canyon, south of SR-91, and east and west of the Eastern Transportation Corridor (SR-241).	This project allows for the development of up to 2,500 new homes, a city fire station, an elementary school site and adjacent public community park, a trail staging area, and public and private recreational facilities, including public riding and hiking trails. This project will preserve approximately 2,163 acres of the site as permanent open space.	Approved and on hold.
Santa Ana Canyon Road Widening (Mountain Park) (Tracker ID 64)	Santa Ana Canyon Road from SR-241 to Gypsum Canyon Road.	Road widening.	Under construction and anticipated to be completed in 2017.
Tract 17020 (Tracker ID 69)	Quarry Village, east of Gypsum Canyon Road.	This project includes 153 single-family residences, 1,442 condos, and a water reservoir site.	Under construction and anticipated to be completed in 2017.
Mountain Park (E/of SR-241) Tract 17020 (Tracker ID 59)	Red Rock Village.	Residential with park/greenbelt areas development.	Under construction and anticipated to be completed in 2016.

Project Name/Case Number	General Location	Description	Status
Mountain Park Drive Overcrossing SR-241 (Tracker ID 61)	Mountain Park Drive and SR-241.	Overcrossing bridge.	Under construction and anticipated to be completed in 2017.
Mountain Park (W/o SR-241) GRA 2006-02418; RCP 2006-05667(Tracker ID 58)	Mountain Park Drive and SR-241.	West Village, 145-lot subdivision, community, park and school sites.	Under construction and anticipated to be completed in 2017.
City of Corona			
Green River Road Widening: SR-91 to Palisades (48-1106)	Green River Road from Palisades Drive to SR-91.	This project includes widening Green River Road from four to six lanes from Palisades to SR-91. Improvements will include a new storm drain, sewer and water lines, a new traffic signal at Palisades Drive and a traffic signal modification at Dominguez Ranch Road.	Construction is anticipated to start in January 2015.
Riverside County Transportation Commission (RCTC)			
SR-91 Project	SR-91 from the Orange County/Riverside County line to Interstate 15 (I-15).	This project consists of the following: (1) extending the tolled express lanes on SR-91 between the Orange County/Riverside County line and I-15.; (2) adding one regular lane between SR-71 and I-15; (3) adding one regular lane from the I-15/SR-91 Interchange to Pierce Street; and improving five local interchanges and the I-15/SR-91 Interchange.	Under construction and anticipated to be completed in 2017.
Orange County Water District (OCWD)			
Orange County Water District Prado Basin Sediment Management Project	Prado Basin in western Riverside County.	This project will remove between 250,000 and 500,000 cubic yards of materials from the Prado Basin and re-entrain it into the lower SAR.	Recirculated EIR released in September 2014 for public review.
U.S. Army Corps of Engineers (Corps)			
Reach 9, Phase 2A Green River Housing Estates (GRHE) and Upper SR-91 Embankment	Riverside County. South (left) bank of SAR, extending from BNSF Bridge, upstream for approximately 1.4 miles.	This project constructed approximately 5,760 feet of bank protection for the GRHE, and 1,878 feet for the Upper SR-91.Provides flood damage reduction to GRHE.	Estimated completion of construction, early 2015
Reach 9, Phase 2B Green River Golf Course (GRGC) Embankment and	Riverside and Orange Counties. South (left) bank of the SAR, between the GRMH embankment	This project constructed approximately 6,000 feet of bank protection along the GRGC. Provides flood damage	Construction completed 2014.

Project Name/Case Number	General Location	Description	Status
Perennial Stream	and Reach 9, Phase 4.	reduction to SR-91.	
Reach 9, Phase 3	Orange County. South (left) bank of the SAR, immediately downstream (west) of Phase 4.	This project constructed approximately 1,600 feet of bank protection. Provides flood damage reduction to SR-91 and SARI Line.	Estimated completion of construction, early 2015
Reach 9, BNSF Bridge	Riverside County. Project activities will occur on both banks and in SAR at the BNSF railroad bridge. Site lies between GRGC to the west, and GRHE and GRMH to the east.	This project will construct pier nose walls and enclosure walls at bridge piers; and grouted stone, sheet pile, and concrete wall protection on both river banks and at bridge abutments to protect from maximum scour. Will provide flood damage reduction to the BNSF railroad bridge and tie together previously constructed Phase 2A and GRMH bank protection structures.	Estimated start December 2015 and completion October 2017
Reach 9, Phase 4	Orange County. South (left) bank of SAR, immediately upstream of Phase 3.	This project will construct approximately 3,150 feet of new bank protection (soil cement) that will extend deeper than existing protection to provide protection from maximum scour. Will provide flood damage reduction to SR-91 and SARI Line.	Estimated start September 2015 and completion December 2017.
Reach 9, Phase 5A	Orange County. North (right) bank of SAR, immediately upstream of Reach 9, Phase 1 in City of Yorba Linda.	This project will construct approximately 4,083 feet of new bank protection (grouted stone and sheet pile) that will extend deeper than existing protection to provide protection from maximum scour. Will provide flood damage reduction to SAR Trail, East La Palma Ave, and adjacent industrial, commercial, and residential development.	Estimated start fall 2015 and completion fall 2017.
Reach 9, Phase 5B	Orange County. North (right) bank of SAR, immediately upstream of Reach 9, Phase 5A in City of Yorba Linda.	This project will construct approximately 19,700 feet of new bank protection (grouted stone and sheet pile) that will extend deeper than existing protection to provide protection from maximum scour. Will provide flood damage reduction to SAR Trail, East La Palma Ave, and adjacent industrial, commercial, and residential development.	Estimated start August 2016 and completion October 2018.

Source: County of Orange 2014a; City of Anaheim 2014; City of Corona 2014c; RCTC 2014; OCWD 2014.

The assessment below focuses on addressing the following: (1) the area(s) in which the effects of the proposed project would be felt; (2) the effects that are expected in the area(s) from the proposed project; (3) past, present, and reasonably foreseeable future actions that have or that are expected to have impacts in the same area; (4) the impacts or expected impacts from these other actions; and (5) the overall impact(s) that can be expected if the individual impacts are allowed to accumulate.

Earth Resources, Water Resources, and Hydrology

Construction activities for the proposed Reach 9 measures would not have earth and water resources, and hydrology impacts above and beyond those determined in the 2001 Final SEIS/EIR, which were largely characterized by other flood control projects in and downstream from the Prado Basin. As discussed above in Chapter 5.1 Earth Resources, 5.2 Hydrology, 5.3 Groundwater, and 5.4 Surface Water Quality, implementation the proposed Reach 9 measures would include full compliance with applicable laws and regulations, as well as environmental commitments identified in the 2001 Final SEIS/EIR and in Chapter 6 of this document. As such, potential impacts to earth and water resources and hydrology would be site-specific and not significant. Earth and water resources and hydrology impacts of the proposed Reach 9 measures would not singly, or cumulatively, combine with similar impacts of other projects as significant impacts. Also, the proposed Reach 9 measures would provide protection from flood damage to adjacent developed areas and meet the water quality objective discussed in Chapter 5.4. Other Corps flood control measures and the SARI Line project would also contribute to meeting water quality objectives, resulting in an overall benefit in the cumulative scenario. Therefore, cumulative impacts on earth and water resources and hydrology from the proposed Reach 9 measures would be less than significant on earth and water resources and hydrology.

Biological Resources

Implementation of the Reach 9 measures analyzed in this SEA/EIR Addendum has potential to contribute to cumulative biological impacts. Although each of the proposed Reach 9 measures would limit impacts to native habitats and species to the greatest extent possible, there is a potential additive effect associated with vegetation removal and ground disturbance when combined with other Reach 9 measures in the vicinity. In addition to the four measures discussed in this document, Phases 2A and 3 which are nearing completion of construction and would subsequently restore and mitigate biological impacts. Phase 2B has been completed and restoration efforts there are well underway. Additive cumulative impacts resulting from these previous measures and the Reach 9 measures analyzed in this document would occur to riparian, upland, and perennial stream habitats, as well as to the federally and State-endangered least Bell's vireo. The environmental commitments provided in Section 6 would, however, reduce impacts of Reach 9 measures to less than significant levels and would avoid a significant contribution to cumulative impacts on biological resources in the vicinity of Reach 9 (Section 5.5). BR-18 would mitigate for impacts to vegetation communities occurring during implementation of Reach 9 measures, and the Corps would obtain an amended or new BO authorizing the anticipated "take" of least Bell's vireo under each measure and mitigation for impacts to riparian habitat suitable for this species.

Restoration of riparian, upland, and perennial stream habitats within Reach 9 are currently underway for previous Reach 9 measures (i.e., Phase 2B). Restored areas are expected to be capable of supporting least Bell's vireo during future nesting seasons, and aquatic habitats associated with the Perennial Stream Restoration Project related to Phase 2B are expected to provide quality habitat for various life history requirements of the Santa Ana sucker. Additionally, wildlife movement will be restored to its full capacity as Reach 9 measures are completed. Impacts to wildlife movement are minimized during construction by limiting work to daylight hours to avoid disturbances when wildlife are most likely to be moving throughout the site and through undercrossings that run below SR-91.

Upon implementation of the environmental commitments provided in Chapter 6, Reach 9 measures combined with other projects would not contribute to cumulative biological resources impacts. The effects of the Reach 9 measures are site-specific and localized, and would not result in incremental cumulative impacts to biological resources through increased disturbance, such as removal of habitat, or degradation of habitat through traffic, increased noise, or decreased water quality. By providing protection from flood damage, the construction of Reach 9 measures may reduce future impacts to natural habitats and species that could be at risk during restoration/rebuilding of flood-damaged areas. With implementation of the environmental commitments, impacts of the Reach 9 measures would be reduced to less than significant levels and effects of the measures would not be considered cumulatively significant.

Construction activities associated with the SARI Line and SR-91 are not expected to have an appreciable cumulative impact to biological resources. All prior Reach 9 measures constructed by the Corps considered the SARI Line and SR-91 to avoid replication of impacts to biological resources to the extent possible. It is anticipated that culverts will not be lengthened or detrimentally altered as a part of the SARI Line and SR-91 projects within Phases 2A, 2B, 3, and 4; and that impacts to wildlife movement through the undercrossings to traverse SR-91 would not be affected. These projects also include requirements to restore areas disturbed by the project, and they would be held to success standards and commitments that are expected to result in restoration efforts that successfully mitigate project impacts. Additionally, the success standards and commitments of these projects are similar to those adhered to by the Corps for SARMP measures.

Air Quality

The SCAQMD regional analysis focuses on whether a specific project would result in a cumulatively considerable increase in emissions. By its very nature, air pollution is largely a cumulative impact. The nonattainment status of regional pollutants is a result of past and present development within the Basin, and this regional impact is cumulative rather than being attributable to any one source. A project's emissions may be individually limited, but cumulatively considerable when taken in combination with past, present, and future development projects.

The primary air quality impacts of Reach 9 measures would occur during construction, since the operational impacts would result from limited vehicle trips for OMRR&R activities. The SCAQMD thresholds of significance were developed in order to ensure compliance with the SIP. Pursuant to Clean

Air Act regulations at 40 CFR 932.158(a)(5)(v), emissions of ozone (i.e., VOC and NOx - the precursors to ozone) or NO2 are deemed to be in compliance with applicable SIP for projects where the action involves regional water and/or wastewater projects. Furthermore, as indicated in Section 4.4.4 of the 2001 SEIS/EIR, the project is sized to meet the population projection in the SIP. As a result, emissions of VOC, NOx, and NO2 are deemed to be in compliance with the SIP and a conformity analysis is not required for these pollutants. Based on the above, NOx emissions would be in compliance with the SIP. Impacts would be less than significant cumulatively.

Noise

As discussed in Section 5.7, implementation of Phases 5A, 5B, 4, and BNSF Bridge would not result in significant impacts related to noise. Proposed construction in conjunction with construction of the cumulative projects identified in Table 5.17-1 would temporarily increase ambient noise levels in the vicinity of the construction area. Construction activities associated with other projects in proximity to the Reach 9 measures could potentially occur at the same time as the Reach 9 measures and disturb sensitive receptors near multiple project locations. In addition, mobile construction vehicles bringing construction supplies to cumulative project sites could share travel routes with the Reach 9 measures thus impacting sensitive receptors along shared travel routes.

Construction impacts of all cumulative projects would be temporary and of short duration. Each project would be required to comply with local noise ordinances. As previously discussed, construction noise associated with the Reach 9 measures would be less than significant. Furthermore, with the implementation of 2001 SEIS/EIR Mitigation Measure N-4 and required environmental commitments, the Reach 9 measures would result in less than significant construction noise impacts. It is assumed that cumulative projects identified in Table 5.17-1 that could contribute to construction noise of the Reach 9 measures would require similar project-specific mitigation measures and environmental commitments to reduce construction noise impacts. Therefore, while overall development of the Reach 9 measures area could result in cumulative temporary construction noise impacts, the Reach 9 measures would have a less than significant project-specific cumulative contribution to construction-related noise impacts to receptors within proximity of multiple construction projects.

Cultural Resources

As discussed in Chapter 5.8 of this SEA/EIR Addendum, no adverse impacts on cultural resources would occur, and to ensure impacts are less than significant, an archeological monitor would be present during ground disturbance. As a result, it is unlikely that the Reach 9 measures would contribute to the cumulative loss or destruction of cultural resources.

Land Use

Land use impacts tend to be localized, affecting properties in the immediate vicinity of the project. As discussed in Section 5.9 of this SEA/EIR Addendum, Reach 9 measures would not be incompatible with existing land uses and would not be inconsistent with applicable plans and policies. Potential land use

impacts from Reach 9 measures would affect existing recreational land uses surrounding the site. Therefore, Reach 9 measures would not contribute to cumulative impacts from other projects scheduled to occur in the area.

Recreation

As described in Section 5.10 of this SEA/EIR Addendum, implementation of the Reach 9 measures would not result in new or substantial impacts to recreation. No contribution to cumulative impacts in the region would occur.

Transportation

Cumulative development within the area (see Table 5.17-1) would generate construction and operational trips to and from the respective project sites using local roadways, including La Palma Avenue, SR-91, Gypsum Canyon Road and Green River Road. Construction of these phases would also result in an increase in temporary delays and construction vehicle trips on the local roadway network. However, as discussed in Section 5.11, construction trips associated with the Reach 9 measures would have a less than significant impact on the existing capacities of the above-mentioned roadways used by construction vehicles. While development of cumulative projects identified in Table 5.17-1 would result in cumulative project-related traffic impacts and additional traffic volumes on study area roadways, the contribution of the Reach 9 measures' to this impact would be minimal and would cease upon completion of construction. Therefore, the contribution of the Reach 9 measures to cumulative impacts would be less than significant.

Aesthetics

The Reach 9 measures activities would be short term, localized, and would not significantly impact or conflict with visual resource (see Section 5.12). Reach 9 measures would not contribute to a degradation or alteration of the scenic viewscape, and any potential impacts would cease to occur upon completion of the proposed activity. As such, no cumulative aesthetics impacts would occur.

Public Utilities and Services

Reach 9 measures would have no significant impacts on public utilities and services (see Section 5.13). As such, the Reach 9 measures would not contribute to an incremental impact on public utilities and services that would be cumulatively considerable.

Hazardous Materials

As discussed in Section 5.14, construction and operation of Reach 9 measures would not result in increased risks to public safety through reasonably foreseeable upset and accident conditions involving release of existing on-site hazardous materials into the environment. Also the Reach 9 measures would not create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials. The construction would be a beneficial impact. Therefore, safety risks associated with Reach 9 measures would not result in a significant cumulative impact.

Socioeconomics

The Reach 9 measures would not create socioeconomic impacts to any adjacent communities in the region (see Chapter 5.15). As such, implementation of the Reach 9 measures would not contribute to an incremental socioeconomic effect that would be cumulatively considerable.

Environmental Justice

As discussed in Section 5.16, the Reach 9 measures would not have a significant impact on environmental justice. As such, implementation of the Reach 9 measures would not result in a significant cumulative impact.

6.0 ENVIRONMENTAL COMMITMENTS

6.1 Environmental Commitments

As discussed in Section 5 analysis, the proposed project would not result in any significant impacts to earth resources, hydrology, groundwater, surface water quality, biological resources, noise, cultural resources, land use, recreation, transportation, aesthetics, public utilities and services, hazardous materials, socioeconomics, and environmental justice. Significant impacts to air quality are consistent with those described in previous environmental documents for the SARMP. Several resources could have potential short-term impacts on the environment and, thus, would require environmental commitments to further reduce impacts. The following environmental commitments (in addition to the approved mitigation measures from the 2001 Final SEIS/SEIR) have been incorporated into the Reach 9 measures for the purpose of minimizing environmental effects.

Groundwater

The following environmental commitment would be incorporated into contract specifications for the Reach 9 measures to reduce potential impacts to groundwater.

EC-GW-1 Groundwater extracted during construction would be pumped back into the active river channel or elsewhere in the floodplain to minimize potential for groundwater depletion during construction of Reach 9 measures.

Surface Water Quality

Previous environmental commitments and mitigation measures were outlined and summarized in the 2001 Final SEIS/EIR, and remain in effect. The following environmental commitment from the 2001 Final SEIS/EIR would be incorporated into contract specifications or otherwise implemented by the Corps to reduce potential impacts to water quality.

WR-1 Prior to initiating construction, the construction contractor shall prepare an erosion control plan to control potential sedimentation and turbidity impacts. The erosion control plan shall include temporary measures such as sandbags and/or water bars and may include long-term measures such as re-vegetating the access road.

WR-2 The construction contractor shall obtain a National Pollution Discharge Elimination System (NPDES) construction stormwater permit prior to construction.

WR-3 Prior to construction, the construction contractor shall prepare a pollution prevention plan to reduce the potential for accidental release of fuels, pesticides, and other materials. This plan shall include the designation of refueling locations, emergency response procedures, and definition or reporting requirements for any spill that occurs.

Equipment for immediate cleanup shall be kept at the staging area for immediate use. This plan shall also include pesticide application activities such as storage, handling of herbicides, and application methods.

The following commitments have been implemented during the construction of previous protection measures in Reach 9, and would be incorporated into contract specifications for current Reach 9 measures to reduce potential impacts to surface and groundwater quality.

EC-WQ-1 Obtain a dewatering permit if the installation and maintenance of the structure extends into the groundwater table.

EC-WQ-2 Keep cleanup equipment and supplies at the staging area for immediate use.

EC-WQ-3 Utilize liners and earthen berms in the establishment of upland refueling areas to isolate potential fuel spills from the aquatic environment. Keep fuel spill cleanup equipment and supplies adjacent to the refueling area.

EC-WQ-4 Place oil drip pans underneath engine block and hydraulic systems for equipment not in use.

Biological Resources

The following commitments from the 2001 Final SEIS/EIR would be incorporated into contract specifications for the proposed project or implemented by the Corps to reduce potential impacts to biological resources.

BR-16 Prior to construction, a monitoring program shall be developed and implemented by the Corps that entails surveys for least Bell's vireo southwestern willow flycatcher in the spring and early summer in the year prior to construction, as well as during the year of construction. [Prior year surveys (through 2014) were conducted by SAWA.] For the current Reach 9 projects, the Corps will also be conducting gnatcatcher surveys prior to and during construction of each feature. ***(Ongoing through combined efforts of Corps, OCWD and SAWA.)***

BR-16A Within 1 year after initiation of construction activities, a habitat management plan shall be finalized for the areas where the Corps and/or project sponsors have the legal right/jurisdiction. The USFWS and CDFW shall be provided the opportunity to review the plan, which will address how the Corps and/or their sponsors will maintain or increase the baseline amount of riparian habitat, and funding. This plan will also address conservation goals and thresholds, monitoring and evaluation methodologies, and reporting and review procedures. [Update: OCFCD has finalized the HMP] ***(Plan completed; implementation ongoing.)***

BR-17 The construction contractor shall only clear vegetation associated with project construction during periods when coastal California gnatcatcher, least Bell's vireo, and southwestern willow flycatcher are not nesting (which in this area is considered August 15 through February 28).

BR-17A Grading activities associated with project construction shall be kept to a minimum and existing root systems will be left intact to the extent possible.

BR-18 In compliance with the 2012 BO Amendment, the Corps and non-federal sponsors will restore (through arundo and other non-native removal) 3 acres of riverine habitat for each acre of wetland/riparian habitat temporarily disturbed by the project impact, as well as for each acre of non-riparian floodplain habitat permanently affected; and shall restore 5 acres for each acre of permanent impact to wetland/riparian habitat. The restoration conducted for permanent impacts will be maintained for the life of the project. *The 3:1 mitigation requirement for temporary impacts assumes that the restored (mitigation) area will only be actively maintained for 5 years. The Corps also has the option of compensating for temporary impacts to riparian/wetland habitat by restoring 1 acre in an off-site location for each acre affected (1:1), and maintaining the restored area in perpetuity.)"* ***(Mitigation contract awarded in 2013 for 215 acres of non-native removal/habitat restoration, which should be sufficient for anticipated impacts. Acreage of actual disturbance will be documented and compared to acreage restored; any shortfalls will be addressed through additional mitigation.)***

BR-18A The USACE shall successfully restore each acre of riparian vegetation that is temporarily disturbed during construction-related activities and will keep all temporarily disturbed areas free of exotic plants until riparian vegetation is re-established. If the site has not begun to recover within 5 years (i.e., 50 percent of the disturbed areas are not vegetated with young riparian vegetation), then the site will be replanted with cuttings from native riparian species. ***From BR-18B:*** The USACE shall maintain non-riparian areas that are temporarily disturbed or destroyed free of exotic plants for 8 years. Container plants shall be planted and irrigated in upland areas to expedite the restoration process.

BR-19 The Corps [or its non-federal sponsor] shall implement cowbird trapping at a minimum of 10 sites in Reach 9 (other other areas along the Santa Ana River and environs where trapping would likely be more effective for vireo production, subject to review and approval of the USFWS) during all years when construction of the proposed project is occurring and 5 years following construction. Alternatively, a cash contribution shall be made to the Santa Ana River Conservation Trust Fund for the equivalent amount of cowbird trapping in the upper Prado Basin and Reach 9. Trapping shall occur during least Bell's vireo and southwestern willow flycatcher egg-laying season (March 15 to July 30).

BR-20 The Corps shall monitor construction activities to ensure that vegetation is removed only in the designated areas. Riparian areas not to be disturbed shall be flagged.

BR-21 If any construction is to take place during the time of year when least Bell's vireo or flycatcher is present, the construction contractor shall install noise barriers between construction areas and riparian habitat, where practicable all the TCE, prior to March 1. The Corps shall continue to coordinate with the USFWS to determine whether noise barriers are necessary or prudent for the Reach 9 measures, since the footprint required for construction of the barriers may result in additional habitat removal. These noise barriers shall be kept in place until all construction in the area is completed. Sound monitoring and vireo surveys will be conducted throughout the nesting season to determine if noise barriers or other modifications are warranted.

d. Prior to the commencement of construction activities, ambient noise levels shall be measured at 50 feet and 100 feet from the proposed boundaries of the construction sites and recorded in a graphic format.
e. Where ambient noise is less than 60 dBA and it is determined that construction-related noise levels may exceed 60 dBA: monitoring shall be conducted at 50 feet and 100 feet from the sound wall, or at the boundary of occupied habitat (if habitat areas are more than 100 feet from the construction site), to ensure that construction-related noise does not exceed 60 dBA within these areas. If construction noise levels exceed authorized limits, the contractor shall modify the sound barriers, equipment, or procedures (including construction schedules) as necessary to meet these conditions, to the extent practicable. If construction noise levels within riparian habitat areas outside the project footprint cannot be reduced below 60 dBA Leq hourly during the period of February 28 through August 15 of any year, the Corps will offset impacts at a 1:1 ratio per breeding season affected by such noise levels. This 1:1 ratio will be based on the acreage of riparian habitat outside the project footprint subject to noise levels over 60 dBA Leq hourly during the noted period, per the number of breeding seasons affected (e.g., 1 acre of riparian habitat affected by noise in two breeding seasons will result in 2 acres of restoration; 1 acre of riparian habitat affected by two separate project phases or segments in a single breeding season will result in 1 acre of restoration). The area affected will be determined by periodic project noise monitoring. This offsetting measure will consist of riparian habitat restoration (non-native invasive vegetation control) for 5 years, from the upper Santa Ana River watershed and/or action area.
f. Where pre-construction ambient noise is greater than 60 dBA: monitoring shall be conducted at 50 feet and 100 feet from the sound wall, or at the boundary of occupied habitat (if habitat areas are more than 100 feet from the construction site), to ensure that construction does not result in a significant increase over ambient conditions (i.e., noise level increases shall not exceed 5 dBA over ambient.) If construction noise levels exceed authorized limits, the contractor shall modify the

sound barriers, equipment, or procedures (including construction schedules) as necessary to meet these conditions, to the extent practicable. If construction noise levels within riparian habitat areas outside the project footprint cannot be reduced to or below 5 dBA Leq hourly over ambient noise levels during the period of February 28 through August 15 of any year, the Corps will offset impacts at a 1:1 ratio per vireo breeding season affected by such noise levels. This 1:1 ratio will be based on the acreage of riparian habitat subject to noise levels more than 5 dBA Leq hourly over ambient during the noted period, as determined by periodic project noise monitoring. This offsetting measure will consist of riparian habitat restoration (non-native invasive vegetation control) for 5 years, from the upper Santa Ana River watershed and/or action area.

BR-22 To minimize impacts on the Santa Ana sucker population, in areas where dewatering is to take place, the construction contractor shall direct discharge water into a stilling basin and allowed to flow through existing vegetation and into the river downstream of the construction area.

BR-23 During construction, the construction contractor shall implement measures to control sedimentation; these include re-contouring, sandbagging, the development of stilling basins, and other appropriate erosion control measures developed on a site-specific basis.

BR-24 During construction, riparian vegetation adjacent to de-watering areas shall be monitored by the Corps for signs of plant stress. Supplemental watering shall be added to this vegetation, as needed.

BR-25 In areas where de-watering or a diversion is necessary, a permitted Santa Ana sucker biologist shall be retained by the Corps to survey for suckers prior to and during any river diversions. If suckers are found, they shall be removed and relocated to appropriate habitats outside of the construction area.

BR-26A As construction is completed in a given area, the construction contractor shall restore all disturbed upland areas. Container stock of local and appropriate native shrubs and groundcover will be used. Hydroseed will also be applied to supplement the container plants. Hydroseed mixes will be composed of local and appropriate native shrubs and groundcover. The mix of native species in the container plant hydroseed seed palettes shall be approved in advance by the Environmental Resources Branch of the Corps' Los Angeles District. Container plants and hydroseeded areas shall be irrigated as needed for at least one year or until success has been achieved. Weeding will also occur. See BR-18A for further detail regarding weeding requirements.

BR-26B The Corps shall successfully restore each acre of perennial stream that is temporarily disturbed during construction related activities. Restoration of perennial stream habitats would include:

- Replacement of pre-construction substrates and microhabitat features
- Maintenance or re-establishment of natural channel morphology (e.g., stream meanders, pool-riffle complexes)
- Maintenance or re-establishment of perennial flows
- Verification that the structure and composition of the restored area are similar to pre-construction conditions.

BR-26C The Corps shall create and/or enhance 1 acre of perennial stream habitat within the SAR or its tributaries for each acre of unvegetated perennial stream that is temporarily or permanently disturbed during construction-related activities. Creation/enhancement activities could include, but are not limited to, the following:

- The development of pool-riffle complexes by placing clusters of various sized boulders within the river channel to provide limited cover and areas of reduced water velocity
- The creation of potential sucker habitat below Prado Dam within one or more tributaries of the SAR
- The creation of lateral stream habitats that is essential for the survival of larval suckers.

In coordination with the USFWS, the Corps has agreed to implement alternative measures in lieu of BR-26C for impacts to perennial stream that occurred during construction of the Reach 9 Phase 3 project (addressed in separate environmental documentation) and that are anticipated to occur during construction of BNSF bridge pier protection. These measures are listed at the end of this section.

Source: 2011 Final SEA/EIR Addendum for Reach 9, Phase 2A

The following commitments from the 2011 Final SEA/EIR Addendum for the Reach 9, Phase 2A project would be incorporated into contract specifications for the proposed project or implemented by the Corps to reduce potential impacts to biological resources.

EC-BR-1 Upon development of final construction plans and prior to site disturbance, the Corps shall clearly delineate the limits of construction on project plans. All construction, site disturbance, and vegetation removal shall be located within the delineated construction boundaries. The storage of equipment and materials, and temporary stockpiling of soil shall be located within designated areas only, and outside of natural habitat areas. The limits of construction shall be delineated in the field with temporary construction fencing, staking, or flagging.

EC-BR-2 Prior to construction activities and throughout the construction period, a Corps qualified biologist (or the environmental monitor) shall inspect the construction site and adjacent areas to determine if any raptors are nesting within 500 feet of the construction site. If active nests are found, the Corps biologist will coordinate with USFWS and CDFW to determine appropriate avoidance or minimization measures.

EC-BR-3 Prior to construction activities, a qualified biologist (or environmental monitor) shall conduct pre-construction training for all construction crew members. The training shall focus on required mitigation measures and environmental commitments and conditions of regulatory agency permits and approvals (if required). The training shall also include a summary of sensitive species and habitats potentially present within and adjacent to the project site.

EC-BR-4 The construction contractor will prepare a Spill Prevention and Contingency Plan. The Plan shall be implemented prior to and during site disturbance and construction activities. The plan will include measures to prevent or avoid an incidental leak or spill, including identification of materials necessary for containment and cleanup and contact information for management and agency staff. The plan will also require that containment cleanup materials be kept within the construction area during all construction activities. The construction contractor shall ensure workers are educated on measures included in the plan at the preconstruction meeting or prior to beginning work on the project.

EC-BR-5 The Corps biologist (or the environmental monitor) shall monitor construction activities to ensure compliance with environmental commitments.

EC-BR-6 Upon completion of construction activities, the Corps shall mitigate for the removal of coast live oaks within the project area by replacing all removed oak trees at a ratio of 4:1. Any planted oak trees that do not survive the first two years will be replaced in-kind. At the end of the initial five year monitoring period, any oak trees that do not survive will then be replaced at a 10:1 ratio, with an additional 1-year (minimum) plant establishment monitoring period. Replacement plantings shall be located within the project area as well as within other restoration areas located along the Santa Ana River Mainstem project area and may consist of acorn plantings, potted nursery stock, or a combination of both. All plant propagules shall be collected within a 5-mile radius and within 1,000 feet elevation of the project area. All planting locations, procedures, and results shall be evaluated by a qualified arborist/botanist.

The Corps shall develop and implement an Oak Resource Management Plan to be submitted for review by the USFWS and CDFW that is designed to meet the objectives of the successful establishment and long-term survival of replaced oak trees in the project area. This plan shall include the following:

- A map identifying locations where oak tree plantings occur, specifically targeting suitable soil types;
- A detailed schedule indicating when plantings will occur;
- A description of the irrigation methodology;
- Measures to control exotic vegetation at the planting locations;
- Certification of use of local propagules;
- Measures to provide protection from herbivory;
- Success criteria shall include:
    - All oak plantings will exhibit a minimum of an 80 percent survivability rate without artificial irrigation for no less than 1 year after artificial irrigation is removed.
    - All oak trees shall be monitored for a minimum of five (5) years or until all success criteria as identified in the plan have been met. Individual oak trees that do not meet the success criteria shall be replanted and corrected prior to replanting.

EC-AQ-2 All unpaved construction roads shall be stabilized with a non-toxic soil stabilizer or soil weighting agent, with or without the use of geotextiles that can be determined to be both, as efficient, or more efficient for fugitive dust control as California Air Resources Board approved soil stabilizers, and shall not increase any other environmental impacts including loss of vegetation.

Source: 2013 Final SEA/EIR Addendum for the Reach 9, Phase 3

The following commitments from the 2013 Final SEA/EIR Addendum for the Reach 9, Phase 3 project would be incorporated into contract specifications for the Reach 9 measures or implemented by the Corps to reduce potential impacts to biological resources.

EC-BR-7 Any areas within the Reach 9 measures that are characterized as "Giant Reed Grassland" shall be cleared and grubbed and removed from the construction area to a suitable disposal site.

EC-BR-8 The project biologist or biological monitor shall immediately inform the Corps' contracting officer or site inspector to stop work should he/she notice a construction activity that may result in exceedance of incidental take amounts or undocumented impact to any biological resource.

EC-BR-9 Container plants shall be planted to augment the hydro-seed treatment in upland areas to expedite restoration processes. *(See also BR-26A)*

EC-BR-10 Where possible, project related activities will be conducted outside of the drip line of oak trees.

EC-BR-11 Work hours will be limited to day time hours to reduce potential direct and indirect impacts to wildlife movement.

EC-BR-12 Imported soil shall be tested for compatibility with native soil, re-vegetation palette, and the ecology of the project area and vicinity. Samples shall be tested from the project site, the proposed import source, and any combinations of mixtures of the native soil and imported soil desired for use within the site. The results of the tests must show compatibility with existing soil, re-vegetation palette and ecology of the project area and vicinity, as determined by the project biologist and soils/geology team members.

EC-BR-13 Switchback ramps will be incorporated into the embankment to facilitate wildlife movement into and out of Phase 4 as wildlife transitions between 60-inch culverts being altered by the project, and the floodplain. Ramps shall provide access to the base of the structure, as well as a ramp to the top of the structure.

EC-BR-14 Prior to initiating construction, the construction contractor shall prepare an erosion control plan to control potential sedimentation and turbidity impacts. The erosion control plan shall include temporary measures such as sandbags and/or water bars and may include long-term measures such as re-vegetating the access road.

EC-BR-15 Prior to construction, the construction contractor shall prepare a pollution prevention plan to reduce the potential for accidental release of fuels, pesticides, and other materials. This plan shall include the designation of refueling locations, emergency response procedures, and definition or reporting requirements for any spill that occurs. Equipment for immediate cleanup shall be kept at the staging area for immediate use. This plan shall also include pesticide application activities such as storage, handling of herbicides, and application methods.

2015 SEA/EIR Addendum

EC-BR-16 The Corps and/or the non-federal sponsors shall continue to conduct bats survey(s) prior to construction of BNSF Bridge and coordinate with CDFW to determine appropriate avoidance and minimization measures.

EC-BR-17 Additional surveys will be conducted to confirm absence of vernal pools and to update general habitat conditions prior to construction.

Santa Ana Sucker Conservation Measures

The Corps shall successfully restore each acre of perennial stream that is temporarily disturbed during construction-related activities. Restoration shall include: 1) replacement of pre-construction substrates and microhabitat features; 2) maintenance or re-establishment of natural channel morphology (e.g., stream meanders, pool-riffle complexes); 3) maintenance or re-establishment of perennial flows; and 4)

verification that the structure and composition of the restored area is similar to pre-construction conditions. A conceptual habitat restoration plan shall be reviewed and approved by the USFWS prior to initiating construction activities that will affect perennial stream habitat for the sucker.

- Restoration activities for the Santa Ana sucker will be conducted between August 15 and February 28, outside the vireo breeding and nesting season, or in a manner that otherwise avoids adverse effects to the vireo.

- **2.54 Acre Scour Enhancement** -- To offset temporary impacts to 2.54 acres of perennial stream habitat from the completed Reach 9 Phase 3 project, the Corps will create six or more 'habitat nodes' in the reach of the Santa Ana River between Rialto Drain and Mission Boulevard (or other areas subject to review and approval of the Service), to improve the viability of the extant population of Santa Ana suckers this area. Boulders, large woody debris, or other materials will be placed in the low-flow channel to promote scour of fine sediments, consistent exposure of course sediment substrates, river meander, and pool formation. Substrate augmentation (e.g., river gravel and cobble) may also occur in the same area to enhance perennial stream habitat function. A small, one-person suction dredge may also be used to expose existing gravel and cobble within the riverbed.

  Suction dredge operators will be accompanied by Service-approved biologists familiar with Santa Ana suckers and their habitats in order to avoid negative impacts to suckers.
  This measure is expected to enhance perennial stream habitat within at least 2.54 acres of occupied habitat along about 4 miles of river, as measured by the area of pools created, gravel/cobble substrates exposed, and other functional Santa Ana sucker habitat features created/enhanced. Monitoring will be conducted for 5 years and will include water quality, visual observations of substrate, and other surface topography and fish surveys. Any non-native aquatic predators encountered during the surveys will be removed from the system. A conceptual habitat restoration plan will be reviewed and approved by the Service prior to initiating these habitat restoration activities. The restoration activities noted herein will be initiated prior to the initiation of construction for the BNSF Bridge project segment.

- **Reintroduction of Captively Bred Santa Ana Sucker or Gravel/Cobble Augmentation** – To offset impacts to Santa Ana sucker from the BNSF bridge protection segment and to help to sustain and enhance the viability of the overall population in the river into the future, the Corps will either (A) expand the range of the species through active reintroduction of captively bred Santa Ana sucker to suitable unoccupied habitat within its historical range in the Santa Ana River; OR (B) perform gravel/cobble augmentation within Reach 9.

  (A) The Corps, within its contractual authorities, will contract with a Service-approved entity that can demonstrate the ability to re-introduce captively-bred Santa Ana suckers over a period of 5 years to a suitable unoccupied location(s) with the intent of

establishing a new self-sustaining population within the former range of the species on the Santa Ana River. The contract will be awarded and a plan of action, including identification of target re-introduction area(s), will be developed prior to initiation of construction of the BNSF bridge project and no later than 1 year after the date of this Biological Opinion, unless otherwise approved by the Service. The Contract requirements will include the following: (1) rearing and maintaining a sufficient number of breeding adults to support re-introduction of a minimum of about 500 juvenile suckers into the target area per year (or alternate numbers proposed in the Plan of Action and agreed to by the Corps and Service); (2) annual relocations for up to 5 years; and (3) monitoring, adaptive management, and reporting during the 5-year re-introduction period. Task 1 will be completed within 3 years of the date of initiation of the contract, or within 2 years of completion of any necessary approvals/permits, whichever is later. Task 2 will be initiated within 4 years of the date of initiation of the contract, or within 3 years of completion of any necessary approvals/permits, whichever is later. Reporting will occur annually to the Service following initiation of relocations.

If it becomes infeasible to re-introduce captively-bred Santa Ana suckers (e.g., if prior to reintroduction of suckers it becomes clear that no suitable re-introduction site is available, and/or that landowner/stakeholder opposition cannot be overcome), no further funding will be obligated to captive breeding or re-introduction efforts. Instead, the Corps will coordinate with the Service to initiate the option identified below.

OR:

(B) The Corps will implement gravel and cobble augmentation within Reach 9 for sediment management improvement and Santa Ana sucker habitat enhancement. Gravel (0.04 to 2.5 inch diameter rock which may include some sand, with about half of the material larger than 0.2 inch) and cobble (2.5 to 10 inch diameter rock), all river-rounded and otherwise appropriate for Santa Ana sucker spawning will be placed by the Corps within the low-flow channel within select locations in Reach 9 to provide available fluvial sediment to the river and to enhance habitats for Santa Ana sucker. It is expected that at least 2 acres of riverbed will be enhanced by direct placement of river gravel and cobble to an average depth of 2 feet, or through other methods developed by the Corps in a Plan of Action, subject to the review and approval of the Service. Additional appropriate locations will be selected for a passive gravel augmentation. Total river gravel to be placed will be about 25,000 tons; total river cobble to be placed will be about 10,000 tons. The river cobble and about half of the augmented river gravel will be immediately placed as bars within the river's low-flow appropriate locations in Reach 9 (per the 2 acres of direct gravel and cobble placement noted above). The remaining half of the river gravel will be placed as passive augmentation along river channel in the

upper portion of Reach 9 for future fluvial transport and natural deposition downstream.

• **Channel Complexity Enhancement** -- Along the base of the Phase 4 soil cement structure, large rock will be irregularly placed to increase the morphological complexity of the lower embankment area. At the interface of the soil cement slope with the final earthen fill surface, 0.5- to 2-ton rocks in groupings of 5 to 15 rocks each will be loosely placed on the soil surface, semi-randomly every 100-200 feet along the 3,150-foot length of the Phase 4 embankment. Placement of this rock (locations, arrangement, etc., per the expected channel complexity needs of the Santa Ana sucker) will be directed in the field by a fish biologist approved by the Service.

General Conservation Measures to Maintain Wildlife Movement Through the Action Area

In order to maintain wildlife movement in the project area at existing or better conditions, the Corps will develop a plan of action for wildlife movement-related ramps, culvert exit-entrance structures/features/substrate enhancements, corridor cover vegetation, and other features associated with the project structures where appropriate, subject to the review and approval of the Service. Many of these features are outlined in this Final SEA/EIR Addendum. The Corps will implement this plan of action in construction/development of these features as part of project construction and operations/maintenance.

Air Quality

Implementation of the following environmental commitments identified in the 2001 SEIS/EIR by the Corps would reduce the temporary construction-related air quality impacts.

The following measures will be implemented to reduce construction emissions of NOx:

AQ-1 The project construction contractor shall retard diesel engine injection timing by 2 degrees before top center on all construction equipment that was manufactured before 1996, and that does not have an existing internal combustion (IC) engine warranty with the manufacturer. The contractor shall provide a certification from a third-party certified mechanic prior to start of construction, stating the timing of all diesel-powered construction equipment engines have been retarded 2 degrees before top center.

AQ-2 The project construction contractor shall use high-pressure injectors on all diesel engines that were manufactured before 1996, and which do not have existing IC engine warranties with the manufacturer. The contractor shall provide documentation of warranty and manufacture date or a certification from a third-party certified mechanic stating that all diesel construction equipment engines are utilizing high-pressure fuel injectors.

AQ-3 The project construction contractor shall use Caterpillar pre-chamber diesel engines or equivalent, and perform proper maintenance and operation.

AQ-4 The project construction contractor shall electrify equipment, where feasible.

AQ-5 The project construction contractor shall restrict the idling of construction equipment to 10 minutes.

AQ-6 The project construction contractor shall ensure that equipment will be maintained in proper tune to prevent visible soot from reducing light transmission through the exhaust stack exit by more than 20 percent for more than 3 minutes per hour and use low-sulfur fuel as required by SCAQMD regulation.

AQ-7 The project construction contractor shall use catalytic converters on all gasoline equipment (except for small [2-cylinder] generator engines). If this measure is not implemented, emissions from gasoline equipment shall be offset by other means (e.g., Emission Reduction Credits).

AQ-8 The project construction contractor shall cease construction during periods of high ambient ozone concentrations (i.e., Stage 2 smog alerts) near the construction area (SCAQMD 1993).

AQ-9 The project construction contractor shall schedule all material deliveries to the construction spread outside of peak traffic hours, and minimize other truck trips during peak traffic hours, or as approved by local jurisdictions.

AQ-10 The project construction contractor shall use only solar-powered traffic signs (no gasoline-powered generators shall be used).

The following measures will be implemented to reduce construction emissions of PM_{10}:

AQ-11 The project construction contractor shall apply non-toxic soil stabilizers according to manufacturers' specification to all inactive construction areas (previously graded areas inactive for 10 days or more; soil stockpiled for 2 days or more).

AQ-12 The project construction contractor shall enclose, cover, water twice daily, or apply non-toxic soil binders according to manufacturers' specifications to exposed stockpiles (i.e., gravel, sand, dirt) with 5 percent or greater silt content.

AQ-13 In areas where dewatering is not required, the project construction contractor shall water active grading/excavation sites at least twice daily.

AQ-14 The project construction contractor shall increase dust control watering when wind speeds exceed 15 mph for a sustained period of greater than 10 minutes, as measured

by an anemometer. The amount of additional watering would depend upon soil moisture content at the time; but no airborne dust should be visible.

AQ-15 The project construction contractor shall suspend all excavating and grading operations when wind speeds (as instantaneous gusts) exceed 25 mph (40 kph).

AQ-16 The project construction contractor shall ensure that trucks hauling dirt on public roads to and from the site are covered and maintain a 50 mm (2 in) differential between the maximum height of any hauled material and the top of the haul trailer. Haul truck drivers shall water the load prior to leaving the site to prevent soil loss during transport.

AQ-17 The project construction contractor shall ensure that graded surfaces used for off-road parking, materials lay-down, or awaiting future construction are stabilized for dust control, as needed.

AQ-18 The project construction contractor shall sweep streets in the project vicinity once a day if visible soil material is carried to adjacent streets.

AQ-19 The project construction contractor shall install wheel washers where vehicles enter and exit unpaved roads onto paved roads, or wash off trucks and any equipment leaving the site each trip.

AQ-20 The project construction contractor shall apply water three times daily, or apply non-toxic soil stabilizers according to manufacturers' specifications to all unpaved parking, staging areas, or unpaved road surfaces.

AQ-21 The project construction contractor shall ensure that traffic speeds on all unpaved roads to be reduced to 15 mph (25 kph) or less.

The following measures will be implemented to reduce construction emissions of CO and ROC:

AQ-22 Prior to the approval of plans and specifications, the Corps shall ensure that plans and specifications specify that all heavy equipment shall be maintained in a proper state of tune as per the manufacturer's specifications.

The following environmental commitments have been updated and are required to reduce criteria pollutant emissions:

AQ-23 Prepare and implement a fugitive dust emission control plan. Measures to be incorporated into the plan shall include, but are not limited to, the following:

- Water the unpaved road access and other disturbed areas of the active construction sites at least three times per day, or apply CARB-certified soil binders.
- Enclose or cover exposed soil piles with a 5 percent or greater silt content. Alternatively water three times daily, or apply CARB-certified soil binders.

- Install rumble plates and wheel washers/cleaners or wash the wheels/exteriors of trucks and other heavy equipment where vehicles exit the site.
- Sweep paved areas daily with water sweepers if visible soil material from the construction sites or unpaved access roads is carried onto such areas.

AQ-24 Diesel engine idle time shall be restricted to no more than 5 minutes in duration. This is not required for trucks that require engines to be on while waiting onsite, such as concrete trucks.

AQ-25 Use lower emitting off-road diesel-fueled equipment. All off-road construction diesel engines not registered under CARB's Statewide Portable Equipment Registration Program, which have a rating of 50 hp or more, shall meet, at a minimum, the Tier 3 California Emission Standards for Off-Road Compression-Ignition Engines as specified in California Code of Regulations, Title 13, section 2423(b) (1) unless that such engine is not available for a particular item of equipment. In the event a Tier 3 engine is not available for any off-road engine larger than 50 hp, that engine shall be equipped with a Tier 2 engine. This measure does not apply to construction equipment that are active at the site for less than 2 weeks total duration and specific exceptions to these requirements may be allowed on a case-by-case basis in the determination of extreme financial difficulty for subcontractors that are using specialized self-owned construction equipment.

AQ-26 Use on-road vehicles that meet California on-road emission standards.

AQ-27 Schedule deliveries outside of peak hours. All material deliveries to the project site shall be scheduled to occur outside of peak "rush hour" traffic hours (7:00 to 10:00 a.m. and 4:00 to 7:00 p.m.) to the extent feasible, and other truck trips during peak traffic hours shall be minimized to the extent feasible.

Noise

The following mitigation measure from the 2001 SEIS/SEIR would be incorporated into contract specifications for the Reach 9 measures to reduce potential impacts to noise.

N-4 In areas of noise sensitivity such as the residential uses at Green River Mobile Home Park and Green River Housing Estates, the construction contractor shall erect temporary noise barriers where feasible to limit direct line-of-sight noise impacts during construction.

The following additional environmental commitments would be incorporated into contract specifications for the Reach 9 measures to reduce potential impacts to noise.

EC-N-1 Prior to issuance of a building permit and applicable maintenance activities, the construction contractor shall obtain a noise variance per local ordinance, for all noise sources exceeding noise ordinances of the local jurisdiction.

EC-N-2 The construction contractor will be required to monitor sound levels and make modifications to equipment or procedures if necessary to reduce sound to acceptable or permitted levels.

Cultural Resources

The following environmental commitment would be incorporated by the Corps to ensure that adverse effects to historic properties and human remains are mitigated:

EC-CR-1 Construction shall be monitored by an archeologist meeting the Secretary of the Interior's Qualification Standards. In the event that previously unknown resources are found during construction, the Corps shall comply with the requirements of 36 CFR 800.13.

Recreation

The following mitigation measure from the 2001 Final SEIS/SEIR would be incorporated into contract specifications for the Reach 9 measures to reduce potential impacts to recreation.

LU-2 The construction or maintenance contractor shall keep bike trails open at all times and provide detour alignments as necessary. The contractor shall provide signage to alert trail users of construction zones, and detours shall be provided along with flag personnel, and fencing as necessary for safety. Prior to construction or maintenance activity, the contractor shall obtain approval from the Manager, County of Orange, Public Facilities and Resources Department, Beaches and Parks, of detour plans that include a diagram and text describing the proposed detour and safety measures. After construction, the contractor shall restore the trail to original condition. Repairs shall be coordinated with County of Orange, Public Facilities and Resources Department, Supervising Maintenance Technician.

Traffic

The following environmental commitments would be incorporated into contract specifications for the Reach 9 measures to reduce potential impacts to traffic.

EC-TR-1 The construction contract shall coordinate with the City of Yorba Linda/City of Corona and prepare a Construction Traffic Control Plan and Implementation Program. The Traffic Control Plan must be prepared in accordance with Caltrans Manual on Uniform Traffic Control Devices and WATCH Manual and must include but not limited to the following issues:

a) Timing of heavy equipment and building materials deliveries;
b) Potential redirecting construction traffic with a flag person;
c) Signing, lighting, and traffic control device placement if required;
d) Need for construction work hours and arrival/departure times outside regularly scheduled construction;
e) Access for emergency vehicles to the project site;
f) Pedestrian and bicycle safety from construction vehicle travel routes to the project site, avoiding residential neighborhoods to the maximum extent feasible;
g) Identification of safety procedures for exiting and entering the site access gate;
h) Compliance with Caltrans, Orange County, Riverside County, and other relevant jurisdictions' limitations on vehicle sizes, weights, and travel routes. In addition, the Corps' contractor shall obtain all necessary transportation and oversize load permits from Caltrans, Orange County, Riverside County, and other relevant jurisdictions for roadway use; and
i) Identification of any construction activities that could impede upon the adjacent BNSF railroad lines and identify rail line crossings procedures for oversize vehicles. (This is not anticipated to occur.)

7.0 ENVIRONMENTAL COMPLIANCE

7.1 Relevant Federal, State, and Local Statutes, Laws, and Guidelines

The following section provides a brief summary of the laws, regulations, Executive Orders, and other guidelines that are relevant to the proposed project activities and alternatives. Included in this summary is a discussion of the consistency of the proposed project with each of the plans, policies, and regulations listed below.

Federal Laws and Regulations

The National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA)

This SEA/EIR Addendum was prepared in accordance with both NEPA and CEQA. Pursuant to Section 15164 of the State CEQA Guidelines, an addendum to an approved EIR shall be prepared if "none of the conditions described in Section 15162 of the guidelines calling for preparation of a subsequent EIR have occurred, only if minor technical changes or additions are necessary to make the EIR under consideration adequate under CEQA, and the changes to the EIR made by the addendum do not raise important new issues about significant effects on the environment."

The subject SEA documents that the above conditions have been met. The proposed modifications will not significantly impact any resources other than those described in the previously prepared environmental documents. Preparation of an SEIS/EIR is, therefore, not required.

National Historic Preservation Act (NHPA) of 1966, as amended

The Reach 9 measures are in compliance. The Corps is in compliance with Section 106 of the act. A programmatic agreement (PA) was executed for the Santa Ana River Project in 1992 by the Advisory Council on Historic Preservation. This document detailed the procedures to be followed for each feature of the project. This feature is in compliance with the stipulations in the PA. No additional coordination with the SHPO is required unless an unanticipated discovery is made during construction. In that event the Corps would comply with the procedures in 36 CFR 800.13.

Bald and Golden Eagle Protection Act, as Amended

The Bald and Golden Eagle Protection Act prohibits the take, possession, sale, purchase, barter, offer to sell, purchase, or barter, transport, export, or import of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit (16 U.S. Code [USC] 668[a]; 50 CFR 22). The proposed Reach 9 measures are in compliance and would not affect bald or golden eagles.

Fish and Wildlife Coordination Act (FWCA), as Amended

The Reach 9 measures are in compliance. The SARMP has been fully coordinated with USFWS, CDFW, and other agencies. Two Coordination Act Reports have been prepared for the SARP (1988 and 1999). These documents are included in the 1988 GDM/SEIS and the 2001 SEIS/EIR, and the recommendations continue to be carried forward during implementation of each SARMP measure. In recent years, numerous meetings have occurred between USFWS, CDFW, other resource agencies; non-federal sponsors; and the Corps to discuss previous and current Reach 9 measures, SARI Line, and other proposed and ongoing embankment protection projects. Discussions included potential impacts to, mitigation for, and minimization and avoidance measures for nesting birds covered under the MBTA; species covered under the FESA and CESA (such as the least Bell's vireo and Santa Ana sucker); and wildlife movement issues. Specific issues related to the current Reach 9 measures have also been fully coordinated with the resource agencies. Furthermore, this SEA/EIR Addendum had been sent to USFWS, CDFW, and other resource agencies for review. There is no change in compliance from the 2001 Final SEIS/EIR.

The Federal Endangered Species Act (FESA), as Amended

The Corps requested initiation of formal consultation with the USFWS on January 23, 2015. Potential effects of the proposed Reach 9 measures on federally-listed species (least Bell's vireo, Santa Ana sucker and California gnatcatcher) and on designated critical habitat have been addressed in consultation with USFWS. The USFWS and CDFW provided comments on the Draft SEA/EIR Addendum subsequent to the public review period. The Corps and OCFCD coordinated with the USFWS and CDFW extensively on the review comments and on the proposed responses. Modifications to the project description, including conservation measures, were made based on this coordination. See Appendix F for copies of the comment letters and responses to the comments. A Biological Opinion was received on July 23, 2015 which concluded formal consultation under Section 7 of the ESA for the proposed Reach 9 measures. The Reach 9 Phases 4, 5A, 5B & BNSF Bridge project is in compliance with ESA.

Migratory Bird Treaty Act (MBTA)

The MBTA prohibits persons, except as permitted by regulations, "to pursue, take, or kill…any migratory bird, or any part, nest, or egg of any such bird, included in the terms of conventions" with certain other countries (16 USC 703). Direct and indirect acts are prohibited under this definition, although harassment and habitat modification are not included unless they result in the direct loss of birds, nests, or eggs. The current list of species protected by the MBTA includes several hundred species and essentially includes all native birds. Mitigation measures developed in the 2001 Final SEIS/EIR have been formulated to reduce impacts on migratory birds.

Clean Air Act (CAA), as amended

Reach 9 measures are in compliance. Impacts of Reach 9 measures were analyzed in Section 5.6 and found to be similar to those identified for the overall Santa Ana River, Prado Basin, and Vicinity flood

control project in the 2001 Final SEIS/EIR for which a General Conformity Analysis was performed. Because changes have not been made a new conformity analysis is not required.. The contractor would be responsible for implementing mitigation measures included in this document and complying with all Federal, State, and local laws regarding air quality.

Clean Water Act (CWA), as amended

This action would be in compliance with the guidelines in 40 CFR 230.10 (c), promulgated by USEPA under section 404 (b) (1) and Section 404 of the CWA guidelines. The overall SARMP, including the Reach 9 measures, entails the discharge of dredged material into waters of the United States. Information on the SARMP's compliance, including a 404 (b) (1) evaluation, and a waiver of 401 certification pursuant to the Corps' CWA implementation regulations (33 CFR 336.1(a) (1)) may be found in the 2001 EIS/EIR. A new 404(b)(1) Evaluation for the currently proposed Reach 9 measures has been prepared and is included in Appendix D. In January 2015, the Corps requested 401 Certification for these measures from the Santa Ana Regional RWQCB. As no response was received from the RWQCB, the Corps has assumed a waiver of 401 Certification for the proposed action. Measures to protect water quality during dewatering and construction (i.e., river diversion and control of sedimentation) would be similar to those to be implemented during construction of previous Reach 9 measures. The Reach 9 project remains in compliance with the Clean Water Act.

Farmland Protection Policy Act

The Farmland Protection and Policy Act was enacted in 1981 to minimize the loss of prime farmland and unique farmlands as a result of Federal actions by converting these lands to nonagricultural uses. It ensures that federal programs are compatible with state and local governments, and private programs and policies to protect farmland. Prime farmland is farmland that has the best combination of physical and chemical characteristics for producing food, feed, forage, and fiber and oilseed crops, and is also available for these uses. A unique farmland is land other than prime farmland that is used for production of specific high-value food and fiber crops; it has the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high-quality or high yields of specific crops.

An approximate 3.72-acre portion of the Phase 5B TCE coincides with a citrus orchard identified by the California Department of Conservation's Farmland Mapping and Monitoring Program as Prime Farmland, Unique Farmland, and Farmland of Statewide Importance (Figure 5.1-2). Most of the impacts to the citrus orchard would be temporary, with a very minor encroachment of the buried toe (0.14 acre) under the northernmost edge of the grove. As construction would not result in a permanent conversion of farmland to development or a substantial loss of soils, impacts are considered insignificant.

Executive Order 11988, Floodplain Management

Under this Executive Order, the Corps must take action to avoid development in the flood basin (e.g., 100 year flood) unless it is the only practicable alternative to reduce hazards and risks associated with floods; to minimize the impact of floods on human safety, welfare, and health; and to restore and

preserve the natural and beneficial value of the case floodplain. Alternatives of the Reach 9 measures would avoid development in the flood basin to the extent practicable to reduce hazards and risks. The Reach 9 measures are in compliance.

Executive Order 11900, Protection of Wetlands

In developing alternatives for the Reach 9 measures, the Corps considered the effects of the project on the survival and quality of wetlands. Measures were designed to "…avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative…" Mitigation measures have been formulated to reduce impacts to wetlands.

Executive Order 12898, Environmental Justice

The Reach 9 measures are in compliance. No impacts would result from implementation of the Reach 9 measures that would directly affect or displace areas of low-income population.

Executive Order 13112, Invasive Species

Executive Order 13112 requires federal agencies to prevent the introduction of invasive species; provide for their control; and minimize the economic, ecological, and human health effects that invasive species cause. The environmental protection standard specifications direct the contractor to implement measures to prevent the spread of invasive species. Mitigation measures developed in the 2001 Final SEIS/EIR and this SEA/EIR Addendum have been formulated to reduce impacts from invasive species.

Resource Conservation and Recovery Act of 1976 (Public Law 94-580)

This act is the principal federal law in the United States governing the disposal of solid waste and hazardous waste. The Corps and the contractor(s) that would construct the Reach 9 measures would be in compliance of this act.

State Regulations

California Regional Water Quality Control Board (RWQCB)

The Corps applied for 401 Certification on January 23, 2015, but received no response from the RWQCB. Therefore, the Corps has assumed a waiver. The Corps will continue to coordinate informally with the RWQCB, and the construction contractors will comply with separate requirements to request discharge permits where applicable, prepare SWPPPs, and provide notifications to the State Water Resources Control Board. These plans would ensure that impacts to water quality as a result of Reach 9 project activities would not take place.

California Air Resources Board (CARB)

CARB has issued a number of CAAQS. These standards include pollutants not covered under the NAAQS and also require more stringent standards than those under the NAAQS. There is no change in compliance from the 2001 Final SEIS/EIR.

In 2006, in response to concerns related to global warming and climate change, the California State Legislature adopted the "California Global Warming Solutions Act of 2006." This bill focuses on reducing GHGs in California and requires CARB to adopt rules and regulations that would achieve GHG emissions equivalent to state-wide levels in 1990 by 2020. The Reach 9 measures would not conflict with any applicable plan, policy, or regulation for the purpose of reducing GHG emissions.

California Endangered Species Act (CESA)

The Reach 9 measures are or would be in compliance. Effects of the proposed Reach 9 measures on state-listed species are being addressed in consultations by OCFCD with CDFW. The CESA permit (2081-2001-023-06) previously issued for the SARMP may be amended after receipt of a Biological Opinion by USFWS to address the proposed measures, if necessary. Coordination with CDFW is ongoing to determine necessity, considering that construction will be overseen by the federal government, and routine OMMR&R conducted by the non-federal sponsors would not result in additional effects to state-listed species.

California Department of Fish and Wildlife Code, Section 1600

Reach 9 projects are, or would be in compliance. A 1601 Streambed Alteration Agreement (SAA No. 6-2001-263) was issued for the SARMP in 2002. This SAA had expired, and a new SAA (1600-2009-0031-R6) was signed by OCFCD in October 2009. This revised agreement; however, did not specifically incorporate the currently proposed Reach 9 measures. OCFCD is coordinating with CDFW to obtain a new or revised agreement that includes the currently proposed Reach 9 measures. Minimization and avoidance measures included in the amended SAA would be followed during construction of Reach 9 measures.

Local Regulations

South Coast Air Quality Management District (SCAQMD)

The Reach 9 measures are within SCAQMD jurisdiction. The SCAQMD is responsible for planning, implementing, and enforcing federal and state ambient standards within this portion of the air basin. Agency regulations are primarily focused on stationary sources; therefore, most regulations are not relevant to the proposed project.

The SCAQMD has visible emissions, nuisance, and fugitive dust emissions regulations with which the Reach 9 measures will need to comply during construction. These rules restrict visible dust emissions, prohibit emissions that can cause a public nuisance, and require the prevention and reduction of fugitive dust emissions to the extent possible. There is no change in compliance from the 2001 Final SEIS/EIR.

City of Yorba Linda Municipal Code

Title 8, Chapter 8.32 of the City of Yorba Linda Municipal Code provides exterior and interior noise standards, special provisions, exemptions, and variances for noise sources (City of Yorba Linda 2014a). The City of Yorba Linda Municipal Code only provides protection for residential uses and does not protect institutional, commercial, office, and industrial uses (City of Yorba Linda 2014a).

Certain exempt activities include occasional recreational events, emergency-related noise, agricultural operations, and construction. Construction activities are specifically exempt from the noise ordinance pursuant to Section 8.32.090(D) of the City of Yorba Linda Municipal Code providing that "Noise sources associated with construction, repair, remodeling, or grading of any real property, provided said activities do not take place between the hours of 8:00 p.m. and 7:00 a.m. on weekdays, including Saturday, or at any time on Sunday or a federal holiday." If the construction activities need to occur outside of this timeframe, an application may be filed with the Health Officer for a variance pursuant to Section 8.32.120, Variance Procedure, of the City of Yorba Linda Municipal Code. Environmental Commitment N-1 (see Section 6.0 for text) has been incorporated into the Reach 9 measures to ensure this waiver is obtained.

City of Corona Municipal Code

Title 17, Section 1784.040 of the City of Corona Municipal Code identifies two separate types of noise sources: transportation and stationary. Stationary noise includes construction noise. This section of the City of Corona Municipal Code specifically articulates maximum allowable noise levels (i.e., standards) from 7:00 a.m. to 10:00 p.m. (City of Corona 2013).

Construction noise is prohibited between the hours of 8:00 p.m. to 7:00 a.m., Monday through Saturday and 6:00 p.m. to 10:00 a.m. on Sundays and federal holidays, pursuant to Section .17.84.040 (D), Special Provision. If construction activities need to occur outside of this timeframe, an application may be filed with the Community Development Department for a variance pursuant to Section 17.84.040 (H), Noise Variance. Environmental Commitment N-1 (see Section 6.0 for text) has been incorporated into the Reach 9 measures to ensure this waiver is obtained.

This page intentionally left blank.

8.0 COORDINATION

Reach 9, Phases 4, 5A, 5B, and BNSF Bridge would be or have been fully coordinated with numerous agencies, organizations, and individuals, including USFWS, CDFW, State Parks, also known as California Department of Parks and Recreation), SHPO, Santa Ana RWQCB, Caltrans, Orange County agencies, and local cities. This final SEA/EIR Addendum will be distributed to several public agencies and numerous interested parties as identified in the Distribution List, Appendix E.

The SARMP has been fully coordinated with resource agencies and interested parties since the 1970s. Summaries of past coordination, consultation, and permitting are included in the 1988 SEIS and the 2001 Final SEIS/EIR. In recent years, numerous meetings have occurred between USFWS, CDFW, other resource agencies, non-federal sponsors and the Corps to discuss the various proposed projects in Reach 9. These projects include the Reach 9, Phases 4, 5A, 5B, and BNSF Bridge (the subject of this SEA), SARI Line, and other proposed and ongoing embankment protection projects. Specific issues related to the Reach 9 measures would be or have also been coordinated with resource agencies, apart from the overall Reach 9 discussions. This final SEA has served as the Biological Assessment that was used to facilitate formal consultation with USFWS for the Reach 9 measures.

This page intentionally left blank.

9.0 LIST OF PREPARERS AND REVIEWERS

Name	Sections	Background
U.S. Army Corps of Engineers		
Hayley Lovan	Biologist, Chief, Ecosystem Planning Section	B.S. Biology Years of Experience: 23 years
Christopher Jones	Biologist and Environmental Coordinator, Ecosystem Planning Section	
Steve Dibble	Senior Archaeologist, Ecosystem Planning Section	M.A. Anthropology B.A. Anthropology Years of Experience: 31 years
Megan Wong	Biologist, Ecosystem Planning Section	
AECOM		
Teri Fenner	Principal, Project Review	M.A. Geography, Conservation of Environmental Quality B.A. Urban Studies and Planning B.A. Political Science Years of Experience: 24 years
Arthur Popp	Project Manager, Project Background, Project Location, Purpose and Need, Alternatives, Biological Resources	M.S. Aquatic Biology B.S. Biology Years of Experience: 19 years
Jane Chang	Noise, Land Use, Recreation, Transportation, Aesthetics, Public Utilities and Services, Hazardous Materials, Socioeconomics, Environmental Justices	Master of Urban Regional Planning B.A. Environmental Design and Analysis Years of Experience: 14 years
Jason Paukovits	Air Quality	Master of Public Policy Master of Environmental Management B.S. Environmental Resource Management B.A. Psychology Years of Experience: 13 years
John Parent	Geology and Soils, Hydrology, Groundwater, Surface Water Quality, Biological Resources	B.S. Biology Years of Experience: 3 years
Dao Lee	GIS Specialist	M.S. Environmental Science, Water Resources B.S. Applied Ecology Years of Experience: 15 years
James Wallace	GIS Specialist	M.A. Anthropology B.A. Anthropology Years of Experience: 7 years

This page intentionally left blank.

10.0 CONCLUSION

The construction of the Reach 9, Phases 4, 5A, 5B, and BNSF Bridge embankment protection proposed action would not have any significant impact on the environmental quality of the area, beyond temporary air quality impacts related to overall SARMP construction that have been addressed in previous Environmental Impact Statements (EIS). Therefore, an EIS is not required for these features.

This page intentionally left blank.

11.0 LIST OF ACRONYMS AND ABBREVIATIONS

AADT	annual average daily traffic
AB	Assembly Bill
Ac	Acre
APE	Area of Potential Effect
AQMP	Air Quality Management Plan
BMP	best management practice
BNSF	Burlington Northern Santa Fe
BO	Biological Opinion
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CESA	California Endangered Species Act
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CFR	California Fish and Game Code
cfs	cubic feet per second
CH_4	methane
CNDDB	California Natural Diversity Data Base
CNEL	Community noise equivalent level
CNPS	California Native Plant Society
CO	carbon monoxide
CO_2	carbon dioxide
CO_2	carbon dioxide equivalent
Corps	U.S. Army Corps of Engineers
CRPR	California Rare Plant Rank
CSS	coastal sage scrub
CWA	Clean Water Act
dBA	A-weighted decibel
dbh	diameter at breast height
DTSC	Department of Toxic Substances Control
EDR	Engineering Document Report
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
FESA	Federal Endangered Species Act

FWCA	Fish and Wildlife Coordination Act
FY	fiscal year
GC	General Commercial
GDM	General Design Memorandum
GHG	greenhouse gas
HFC	hydrofluorocarbon
HMP	Habitat Management Plan
hp	horsepower
HTRW	Hazardous Toxic Radioactive Wastes
H:V	horizontal-to-vertical
I	Industrial
IC	Internal combustion
IPCC	Intergovernmental Panel on Climate Change
kph	kilometers per hour
Ldn	Day-Night Average Noise Level
LEDPA	Least Environmental Damaging Practicable Alternative
LRR	Limited Reevaluation Report
LCA	Local Cooperation Agreement
LDY-S	Lomas De Yorba-Sur
LST	localized significance threshold
MBTA	Migratory Bird Treaty Act
MDR	Medium Density Residential
MFR	memorandum for record
MPAH	Master Plan of Arterial Highways
MPE	maximum probable earthquake
mph	miles per hour
$\mu g/m^3$	micrograms per cubic meter
MT	metric ton
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act (42 U.S.C. § 4321 et seq.)
NF_3	nitrogen trifluoride
NHPA	National Historic Preservation Act
NO_2	nitrogen dioxide
NRCS	Natural Resources Conservation Service
O&M	operation and maintenance
OC	Orange County
OCFCD	Orange County Flood Control District
OC Parks	Orange County Parks
OCSD	Orange County Sanitation District

OCTA	Orange County Transportation Authority
OCWD	Orange County Water District
OMRR&R	Operation, Maintenance, Repair, Replacement and Rehabilitation
OS/G	Open Space General
PA	Programmatic Agreement
PD	Planned Development
PFC	perfluorocarbon
PM	particulate matter
$PM_{2.5}$	fine particulate matter with a diameter of 2.5 micrometers or less
PM_{10}	respirable particulate matter with a diameter of 10 micrometers or less
ppm	parts per million
R	Residential
RCB	reinforced concrete box
RCFC&WCD	Riverside County Flood Control and Water Conservation District
RCP	reinforced concrete pipe
R/W	right-of-way
RV	recreational vehicle
RWQCB	Regional Water Quality Control Board
SAA	Stream Alteration Agreement
SAR	Santa Ana River
SARI	Santa Ana River Interceptor
SARMP	Santa Ana River Mainstem Flood Control Project
SAWA	Santa Ana Watershed Association
SAWPA	Santa Ana Watershed Project Authority
SCAB	South Coast Air Basin
SCAQMD	South Coast Air Quality Management District
SEA	Supplemental Environmental Assessment
SEIR	Supplemental Environmental Impact Report
SEIS	Supplemental Environmental Impact Statement
SF_6	sulfur hexafluoride
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SO_2	sulfur dioxide
SR	State Route
SWPPP	Storm Water Pollution Prevention Plan
TAC	toxic air contaminant
TCE	temporary construction easement
TMDL	Total Maximum Daily Load
U.S.	United States
USC	United States Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service

USGS	U.S. Geological Survey
VMT	Vehicle miles traveled
VOC	volatile organic compound
WRDA	Water Resources Development Act

12.0 REFERENCES

American Ornithologists' Union (AOU). 1998. Checklist of North American Birds. 7th ed. Am. Ornithological Union, Washington, D.C.

Anderson, B.W., A. Higgins, and R.D. Ohmart. 1977. Avian use of saltcedar communities in the lower Colorado River valley. U.S. Department of Agriculture Forest Service General Technical Report RM-43

Atwood, J.L. 1980. The United States Distribution of California Black-Tailed Gnatcatcher. Western Birds. Vol. 11(2). 65-78.

Brock, J. and P.E. Langenwalter (Brock and Langenwalter). 1985. Phase II: Archaeological Studies of the Prado Basin and the Lower Santa Ana River.

Browning, M.R. 1993. Comments on the taxonomy of *Empidonax traillii* (willow flycatcher). Western Birds 24:241-257.

Bunte, K. 2004. State of the Science Review, Gravel Mitigation and Augmentation Below Hydroelectric Dams: A Geomorphological Perspective. USDA Forest Service, Rocky Mountain Research Station, Report submitted to the Stream Systems Technology Center, Fort Collins, CO, 234 p. Available: http://www.stream.fs.fed.us/publications/PDFs/Gravel Augmentation Report.pdf)

California Air Resources Board (CARB). 2014a. Air Quality Data Statistics. Available at http://www.arb.ca.gov/adam/welcome.html. Accessed August 7, 2014.

_____. 2014b. 2014b. Area Designation Maps/State and National. Available at http://www.arb.ca.gov/desig/desig.htm. Accessed August 7, 2014.

_____. 2014c. First Update to the Climate Change Scoping Plan: Building on the Framework. Pursuant to AB 32, the California Global Warming Solutions Act of 2006. Available at http://www.arb.ca.gov/cc/scopingplan/2013_update/first_update_climate_change_scoping_pla n.pd f. Accessed August 7, 2014.

_____. 2013. Ambient Air Quality Standards. Available at http://www.arb.ca.gov/research/aaqs/caaqs/caaqs.htm. Accessed August 7, 2014.

_____. 2008. Climate Change Scoping Plan. Available at www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm.Accessed August 7, 2014

California Department of Fish and Wildlife (CDFW). 2014a. California Natural Diversity Database (CNDDB). Full report for Prado Dam and Black Star Canyon Quadrangles. September.

_____. 2014b. Special Animals List. California Natural Diversity Database (CNDDB). September.

California Department of Parks and Recreation (State Parks). 2014. Chino Hills State Park. [online]: http://www.parks.ca.gov/?page_id=648. Accessed November 24, 2014.

California Department of Transportation (Caltrans). 2014. California Scenic Highway Mapping System [online]: http://www.dot.ca.gov/hq/LandArch/scenic_highways/. Accessed November 25, 2014.

California Environmental Protection Agency Cortese List website. 2014. [online]: (http://www.calepa.ca.gov/sitecleanup/corteselist/SectionA.htm. Accessed April 17, 2014.

Campbell, K.F., R.A. Erickson, W.E. Haas, and M.A. Patten. 1998. California Gnatcatcher use of habitats other than coastal sage scrub: conservation and management implications. Western Birds 29:421-433.

Canyon Recreational Vehicle (RV) Park. 2014. [online]: http://canyonrvpark.com/home/. Accessed April 9, 2014.

Chang, Howard. 2003. Scour Study of the Santa Ana River for the Interceptor Pipeline, Prepared for Brown & Caldwell.

City of Anaheim. 2014. Project ViewFinder. [online]: http://gis.anaheim.net/ProjectViewFinder/. Accessed October 27, 2014.

City of Corona. 2014a. 2013 Average Daily Traffic Volumes. Existing Traffic Control With Average Daily Traffic Volumes. Created January 6, 2014. [online]: http://www.discovercorona.com/CityOfCorona/media/Media/Public%20Works/Documents/Traffic%20Engineering/ADT-20140106.pdf. Accessed August 8, 2014.

_____. 2014b. Interactive City Map. Fire Hazard Severity Zones. [online]: http://www.discovercorona.com/Online-Services/Interactive-City-Map.aspx. Accessed August 6, 2014.

_____. 2014c. Upcoming Projects. [online]: http://www.discovercorona.com/City-Departments/Public-Works/Construction-Projects.aspx. Accessed October 27, 2014.

_____. 2013. Municipal Code. [online]: http://www.amlegal.com/nxt/gateway.dll/California/corona/coronacaliforniamunicipalcode?f=templates$fn=default.htm$3.0$vid=amlegal:corona_ca. Accessed August 13, 2014.

_____. 2012. General Plan Atlas. January 25, 2012. [online]: http://www.discovercorona.com/CityOfCorona/media/Media/CommunityDevelopment/Maps/GPAtlas.pdf. Accessed April 17, 2014.

_____. 2009. Zoning Atlas. June 12, 2009. [online]: http://www.discovercorona.com/CityOfCorona/media/Media/CommunityDevelopment/Maps/Zoning.pdf. Accessed April 17, 2014.

_____. 2004. Corona General Plan Update. Adopted March 17, 2004.

City of Yorba Linda. 2014a. Municipal Code. [online]: https://library.municode.com/index.aspx?clientId=13406. Accessed August 13, 2014.

_____. 2014b. Parks and Recreation Department. Recreational Facility Locations. [online]: http://www.ci.yorba-linda.ca.us/images/stories/pdf/recreation/YL%20MAP-Facilities.pdf. Accessed April 9, 2014.

_____. 2014c. Road Construction – Yorba Linda Spur Construction Project. [online]: http://www.ci.yorba-linda.ca.us/index.php/city-departments/public-works/76-public/public-sp-151/128-road-construction. Accessed November 24, 2014.

_____. 2014d. Yorba Linda Trails Map. [online]: http://www.ci.yorba-linda.ca.us/images/stories/pdf/trails.pdf. Accessed November 24, 2014.

_____. 2012. Zoning Map. November 5, 2012. [online]: http://www.ci.yorba-linda.ca.us/~ci26/images/stories/pdf/planning/ZoningMap_2012.pdf. Accessed April 17, 2014.

_____. 2011. High and Moderate Fire Hazard Severity Zones (As Provided by CAL FIRE). November, 2011. [online]: http://www.ci.yorba-linda.ca.us/~ci26/images/stories/pdf/Building/yl_fireseverityhm.pdf. Accessed August 6, 2014.

_____. 2010. Land Use Diagram. June 24, 2010. [online]: http://www.ci.yorba-linda.ca.us/~ci26/images/stories/pdf/planning/Land_Use_06_24_2010.pdf. Accessed April 17, 2014.

_____. 2008. Average Daily Traffic Volumes, 2008. [online]: http://www.ci.yorba-linda.ca.us/images/stories/pdf/Traffic/ADT/2008flowtext.pdf. Accessed August 8, 2014.

_____. 1993. City of Yorba Linda General Plan. [online]: http://www.visionyorbalinda.info/pdf/1993%20General%20Plan.pdf. Accessed April 17, 2014.

Council on Environmental Quality (CEQ). 2010. Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions. February.

County of Orange. 2014a. Santa Ana River Interceptor (SARI) Relocation Project Home. [online]: http://ocflood.com/sarp/sari/. Accessed August 8, 2014.

_____. 2014b. Santa Ana River Canyon Habitat Management Plan Maintenance and Monitoring Report. Santa Ana River Canyon, California. February.

_____. 2013. Esperanza Hills Specific Plan Draft EIR. [online]: http://ocplanning.net/planning/land/projects/esperanza_hills. Accessed October 27, 2014.

Department of Toxic Substances Control EnviroStor website. 2014. [online]: http://www.envirostor.dtsc.ca.gov/public/. Accessed April 17, 2014.

WR-1, J.R. 1995. White-tailed Kite (*Elanus leucurus*). *In* The Birds of North America, No. 178 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.

England, A.S., M.J. Bechard, and C.S. Houston. 1997. Swainson's Hawk (*Buteo swainsonii*), *In:* A. Poole and F. Gill (eds.), The Birds of North America, No. 265. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.

Executive Order (EO) 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. 1994. 59 Federal Register 7629 (1994).

Federal Highway Administration (FHWA). 2006. Road Construction Noise Model. Version 1. February 2.

Greenfield, D.W., S.T. Ross, and G.D. Deckert. 1970. Some aspects of the life history of the Santa Ana sucker, *Catostomus* (*Pantosteus*) *santaanae* (Snyder). California Department of Fish and Game 56: 166-179.

Hays, L. 1987. The status and management of the least Bell's vireo within the Prado Basin, California, during 1987. Prepared for the California Department of Transportation, District 6

Heady, H.F. *et al.* 1977. Coastal prairie and northern coastal scrub. Pages 733-762 *in:* M.G. Barbour and J. Major (eds), terrestrial vegetation of California. Wile-Inter-Science, New York.

Hilty, J.A., W.Z. Lidicker, Jr., and A.M. Merenlender. 2006. Corridor Ecology: The Science and Practice of Linking Landscapes for Biodiversity Conservation. Washington, D.C.: Island Press.

Holland, R.F. 1986. Preliminary Descriptions of the Terrestrial Natural Communities of California. State of California, The Resources Agency, Department of Fish and Game. October.

Hubbard, J.P. 1987. The status of the willow flycatcher in New Mexico. Endangered Species Program, New Mexico Department of Game and Fish, Santa Fe, New Mexico.

Intergovernmental Panel on Climate Change (IPCC). 2013. Climate Change 2013 The Physical Science Basis. Working Group I Contribution to the Fifth Assessment Report of the IPCC.

Johnsgard, P.A. 1990. Hawks, eagles, and falcons of North America. Washington, D.C.: Smithsonian Institution Press.

Keeley, S.C. 1989. The California Chaparral: Paradigms re-examined. Natural History Museum of Los Angeles County

Kondolf, G.M. 1997. Profile -- Hungry Water: Effects of Dams and Gravel Mining on River Channels. *Environmental Management* 21:4. 533–551. Kondolf, G.M. and W.V.G. Matthews, 1993. Management of Coarse Sediment on Regulated Rivers. University of California, Water Resources Center, University of California Report No. 80, 123 pp.McKernan, R.L., and G. Braden. 1998. Status, distribution, and habitat affinities of the southwestern willow flycatcher along the lower Colorado River: Year 2 – 1997. U.S. Bureau of Reclamation Report.

Mills, G.S., J.B. Dunning, Jr., and J.M. Bates. 1989. Effects of urbanization on breeding bird community structure in southwestern desert habitats. Condor 91:416-428.

Moyle, P.B., R.M. Yoshiyama, J.E. Williams, and E.D. Wikramanayake. 1995. Fish species of special concern in California. Second edition. California Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California.

Natural Resources Conservation Services (NRCS). 2014. Web Soil Survey. [online]: http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

Ndubisi, F. *et al.* 1995. Environmentally sensitive areas: a template for developing greenway corridors. Landscape Urban Planning 33, 159-177.

NOAA. 2012. National Marine Fisheries Service Endangered Species Consultation Biological Opinion on U.S. Army Corps of Engineers' Nationwide Permit Program. U.S. Department o f Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Silver Spring, Maryland. February.

Noss, R.F. 1991. Landscape connectivity: different functions and different scales. Pages 27-39 in W,E, Hudson, editor. Landscape linkages and biodiversity. Island Press, Washington, D.C.

Orange County, 1992. Habitat Classification System Natural Resources Geographic Information System (GIS) Project. Prepared for the County of Orange, Environmental Management Agency, Planning by John Gray, Ph.D. (Dames & Moore) and David Bramlet. May.

_____. 2012a. Santa Ana River Canyon Habitat Management Plan Maintenance and Monitoring Report. Prepared for the County of Orange by LSA Associates, Inc. August.

_____. 2012b. OC Community Development. Codes and Regulations. [online]: http://ocplanning.net/CodesRegulations.aspx

Orange County Flood Control District (OCFCD). 2010. Santa Ana River Interceptor (SARI) Pipeline Relocation. Scour Study of the Santa Ana River Below Prado Dam. Prepared by Tetra Tech.

Orange County (OC) Parks. 2014. Featherly Regional Park. [online]: http://ocparks.com/parks/featherly. Accessed April 9, 2014.

Orange County Transportation Authority (OCTA). 2014. Orange County Bikeways Map. [online]: http://www.octa.net/Share-the-Ride/Bike/Riding-in-Orange-County/OC-Bikeways-Map/. Accessed April 9, 2014.

_____. 2014. Bus System Map. [online]: http://www.octa.net/pdf/OCTASystemMapjune14.pdf. Accessed December 15, 2014.

_____. 2013a. 2013 Master Plan of Arterial Highways. Map published August 20, 2013. [online]: http://octa.net/Freeways-and-Streets/Streets/Master-Road-Plan/Overview/. Accessed August 6, 2014.

_____. 2013b. 2012 Traffic Flow Map. Map published October 7, 2013. [online]: https://www.octa.net/pdf/2012trafficflow.pdf. Accessed August 8, 2014.

Orange County Water District (OCWD). 2014. OCWD Public Notices. [online]: http://www.ocwd.com/News/PublicNotices.aspx. Accessed October 27, 2014.

Pike, J., and L.R. Hays. 1992. The Status and Management of the Least Bell's Vireo within the Prado Basin, California, 1986-1992 (Final Report). Prepared for the Orange County Water District, Fountain Valley, CA, by the California State University Long Beach Foundation and the U.S. Fish and Wildlife Service, Laguna Niguel, CA.

Pike, J., S. Morris, V. Smith, and L.R. Hays. 1995. The Status and Management of the Least Bell's Vireo and Southwestern Willow Flycatcher Within the Prado Basin, California, 1986-1995. Prepared for The Nature Conservancy, Orange County Water District, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and California Department of Fish and Game.

Pike, J., D. Pellegrini, V. Smith, and L.R. Hays. 1997. The Status and Management of the Least Bell's Vireo and Southwestern Willow Flycatcher within the Prado Basin, California, 1986-1997. Prepared for The Nature Conservancy, Orange County Water District, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and California Department of Fish and Game.

Pike, J., D. Pellegrini, S. Reynolds, and L.R. Hays. 1999. The Status and Management of the Least Bell's Vireo and Southwestern Willow Flycatcher within the Prado Basin, California, 1986-1999. Prepared for the Orange County Water District, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and California Department of Fish and Game.

Pike, J., D. Pellegrini, L. Hays, and R. Zembal. 2003. Least Bell's Vireos and Southwestern Willow Flycatchers in Prado Basin of the Santa Ana River Watershed, CA. Unpublished report prepared for the Orange County Water District and U.S. Fish and Wildlife Service.

_____. 2005. Least Bell's Vireos and Southwestern Willow Flycatchers in the Prado Basin of the Santa Ana River Watershed, CA. Unpublished report prepared by the Orange County Water District and U.S. Fish and Wildlife Service.

Regional Water Quality Control Board (RWQCB) Geotracker website. 2014. [online]: http://geotracker.waterboards.ca.gov/. Accessed April 17, 2014.

Remsen, H.V. 1978. *Bird Species of Special Concern in California: An Annotated List of Declining or Vulnerable Bird Species*. California Department of Fish and Game, The Resources Agency.

Riverside County Transportation Commission (RCTC). 2014. 91 Project. [online]: http://sr91project.info/. Accessed October 27, 2014.

Rottenberry, J.T., and T.A. Scott. 1998. Biology of the California Gnatcatcher: filling in the gaps. Western Birds 29:237-241.

Rottenborn, S.C. 1997. The impacts of urbanization on riparian bird communities in central California. Dissertation. Stanford University, Stanford, California, USA.

_____. 1999. Predicting the impacts of urbanization on riparian bird communities. Biological Conservation 88:289-299.

Santa Ana Watershed Association (SAWA). 2008. Herpetofauna Surveys in Chino Hills State park 2007-2008. February 14.

Santa Ana Watershed Project Authority (SAWPA). 2011. Final Annual Report of Santa Ana River Water Quality. September.

Scherzinger, W. 1970. Zum Aktionssytem des Sperlingskauzes (*Glaucidium passerinum*). Zoologica, 118: 1-120.

Sedwick, J.A. 2000. Willow Flycatcher (*Empidonax traillii*). *In* The Birds of North America, No. 533 (A. Poole and F. Gill, eds.). The Birds of North America, Inc. Philadelphia, PA.

South Coast Air Quality Management District (SCAQMD). 2009. SCAQMD Air Quality Significance Thresholds. March

_____. 1993. CEQA Air Quality Handbook.

State of California Department of Transportation (Caltrans). 2012 Traffic Volumes on California State Highways. [online]: http://traffic-counts.dot.ca.gov/docs/2012_aadt_volumes.pdf. Accessed April 21, 2014.

State of California Employment Development Department (EDD). 2014. Orange County Industry Employment & Labor Force – by Annual Average, March 2013 Benchmark, July 18, 2014. [online]: http://www.labormarketinfo.edd.ca.gov/LMID/Employment_by_Industry_Data.html.

Swift, C.C., T. Haglund, M. Ruiz, and R. Fisher. 1993. The status and distribution of the freshwater fishes of southern California. Bull. Southern California Academy of Sciences 92: 101-167.

Swift, C.C. 2001. The Santa Ana sucker in the Santa Ana River: distribution, relative abundance, spawning areas, and impact of exotic predators. Submitted to the Santa Ana Water Project Authority, Riverside CA.

U.S. Army Corps of Engineers (Corps). 2014a. Hydraulic Engineering Basis for Reach 9 of the Lower Santa Ana River, Santa Ana River Mainstem, CA. February

_____. 2014b. Design Documentation Report (DDR). Lower Santa Ana River Mainstem Project, Reach 9, Phase 5A, Via Lomas de Yorba West Road to Upstream of Yorba Linda Blvd. November.

_____. 2014c. Geotechnical Appendix, Design Documentation Report Geotechnical Investigation for the Lower Santa Ana River, Reach 9-BNSF Railway Bridges. February 7.

_____. 2013a. Final Supplemental Environmental Assessment and Addendum to Environmental Impact Report (EIR) 583. Santa Ana River: Reach 9 Phase 3. March 2013.

_____. 2013b. Memorandum for Record. CESPL-ED-HH. Santa Ana River Project – Reach 9, Phase IIB – Proposed Pier Scour Protection and Calculations at Burlington Northern and Santa Fe Railroad Bridge. Los Angeles District. Los Angeles, CA.

_____. 2012a. Design Documentation Report (DDR): Hydrology, Hydraulics, and Sedimentation Appendix. Prepared by Tetra Tech. April.

_____. 2012b. Reinitiation of Formal Section 7 Consultation on the Prado Mainstem and Santa Ana River Reach 9 Flood Control Projects and Norco Bluffs Stabilization Project, Orange, Riverside, and San Bernardino Counties, California (FWS-SB-909.6). March 28.

_____. 2011. Geotechnical Appendix of Design Document Report (DDR), Lower Santa Ana River Channel, Reach 9-Phase 3, Orange County, California.

_____. 2009. Final Supplemental Environmental Assessment and Addendum to EIR 583. Santa Ana River: Reach 9 Phase II/Green River Golf Club Embankment Protection. Riverside and Orange Counties, California. September.

_____. 2008. Final Supplemental Environmental Assessment and Addendum to EIR 583. Santa Ana River: Reach Phase II Green River Golf Club Embankment Protection. September 2008

_____. 2001a. Prado Basin and Vicinity, Including Reach 9 and Stabilization of the Bluff Toe at Norco Bluffs, Supplemental Environmental Impact Statement/Environmental Impact Report, and Appendices. November.

_____. 2001b. Biological Opinion on the Prado Mainstem and Santa Ana River Reach 9 Flood Control Projects and Norco Bluffs Stabilization Project, Orange, Riverside, and San Bernardino Counties, California. December 5.

_____. 2000. Final Listing, Threatened Status for the Santa Ana sucker. Vol. 65, April 12, 2000.

_____. 1998. Draft recovery plan for the least Bell's vireo. U.S. Fish and Wildlife Service, Portland, OR.

_____. 1988. Santa Ana River Mainstem including Santiago Creek. Phase II General Design Memorandum and Supplemental Environmental Impact Statement (GDM/SEIS), Los Angeles District. Los Angeles, CA. August.

_____. 1985. Upstream Dam Alternatives SEIS, Los Angeles District, Los Angeles, CA.

_____. 1981. Memorandum for Record. CESPL-PM-S. Santa Ana River, Review of Plans for Proposed Lomas de Yorba-Sur Levee Flood Hazard No. C-06-406. Los Angeles District. Los Angeles, CA.

_____. 1980. Phase I General Design Memorandum and Supplemental Environmental Impact Statement (SEIS), Los Angeles District. Los Angeles, CA. September.

U.S. Department of Commerce. United States Census Bureau. American FactFinder. Community Facts. [online]: http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml. Accessed April 10. 2014.

_____. 2010 Demographic Profile [online]: http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml. Accessed April 10, 2014.

_____. 2010 Census [online]: http://factfinder2.census.gov/faces/nav/jsf/pages/programs.xhtml?program=dec. Accessed April 10, 2014.

_____. 2008-2012 American Community Survey [online]: http://www.census.gov/acs/www/data_documentation/summary_file/. Accessed April 10, 2014.

_____. 2008-2012 American Community Survey 5-Year Estimates [online]: http://www.census.gov/acs/www/data_documentation/summary_file/. Accessed April 10, 2014.

U.S. Environmental Protection Agency (USEPA). 2014a. Watershed Assessment, Tracking & Environmental Results. 2010 Waterbody Report for Santa Ana River, Reach 2. Available at: http://iaspub.epa.gov/tmdl_waters10/attains_waterbody.control?p_list_id=CAR801130001999 1014130438&p_cycle=2010&p_report_type=#attainments. Accessed November 25, 2014.

_____. 2014b. The Green Book Nonattainment Areas for Criteria Pollutants. Available at http://www.epa.gov/oar/oaqps/greenbk/index.html. Accessed August 7, 2014.

_____. 1972. USEPA Model Noise Ordinances.

U.S. Fish and Wildlife Service (USFWS). 2012. Reinitiation of Formal Section 7 Consultation on the Prado Mainstem and Santa Ana River Reach 9 Flood Control Projects and Norco Bluffs Stabilization Project, Orange, Riverside, and San Bernardino Counties, California (FWS-SB-909.6). March 28.

_____. 2001. Biological Opinion on the Prado Mainstem and Santa Ana River Reach 9 Flood Control Projects and Norco Bluffs Stabilization Project, Orange, Riverside, and San Bernardino Counties, California. December 5.

_____. 2000. Final Listing, Threatened Status for the Santa Ana sucker. Vol. 65, April 12, 2000.

_____. 1998. Draft recovery plan for the least Bell's vireo. U.S. Fish and Wildlife Service, Portland, OR.

U.S. Geological Survey (USGS). 2004. Inventory and Management Needs: Study of Chino Hills State Park Herpetofauna and Ants with Comments on Small Mammals, June 1998-June 2003.

_____. 2002. Ground-Water Quality in the Santa Ana Watershed, California: Overview and Data Summary. Water Resources Investigations Report 02-4243. National Water-Quality Assessment Program.

Unitt, P. 1987. Empidonax traillii extimus: An endangered subspecies. Western Birds 18:137-162.

Unitt, P. 1997. Winter range of Empidonax traillii extimus as documented by existing museum collections. Report to U.S. Bureau of Reclamation, Phoenix, Arizona

Williams, D.F. 1986. *Mammalian Species of Special Concern in California*. California Department of Fish and Game. Wildlife Management Division Administrative Report 86-1. 112 pp.

Walker, R., and L. Craighead. 1997. Analyzing wildlife movement corridors in Montana using GIS. Presented at the 1997 ESRI Users Conference and published in the Proceedings on CD-ROM. Also available at http://www.grizzlybear.org/col/ lcpcor.html.

Woodbridge, B., K.K. Finley, and S.T. Seager. 1995a. An investigation of the Swainson's Hawk in Argentina. Journal of Raptor Research 29:202-204.

Zeiner, D.C., W.F. Laudenslayer, and K.E. Mayer. 1988. California's Wildlife, Vol. 1: Amphibians and Reptiles. California Department of Fish and Game, Sacramento.

Zembal, R., K.J. Kramer, and R.J. Bransfield. 1985. Survey of vegetation and vertebrate fauna in the Prado Basin and the Santa Ana River Canyon, California. U.S. Fish and Wildlife Service, Laguna Niguel, CA.

This page intentionally left blank.

Appendix A

Memorandum for Record. Hydraulic Engineering Basis of Design for Reach 9 of the Lower Santa Ana River, Santa Ana River Mainstem, CA

CESPL-ED-H 10 February 2014

MEMORANDUM FOR RECORD

SUBJECT: Hydraulic Engineering Basis of Design for Reach 9 of the Lower Santa Ana River, Santa Ana River Mainstem, CA

1. References:

USACE Reports

a. USACE. 1975. Review Report on the Santa Ana River Mainstem Including Santiago Creek and Oak Street Drain. Los Angeles District. Los Angeles, California.
b. USACE. 1978. Santa Ana River Mainstem Including Santiago Creek and Oak Street Drain. Los Angeles District. Los Angeles, California.
c. USACE. 1980. Santa Ana River, Phase I General Design Memorandum (GDM) on the Santa Ana River Mainstem including Santiago Creek. Main Report and Supplemental Environmental Impact Statement. Los Angeles District. Los Angeles, California.
d. USACE. 1981. Memorandum for Record. CESPL-PM-S. Santa Ana River, Review of Plans for Proposed Lomas de Yorba-Sur Levee Flood Hazard No. C-06-406. Los Angeles District. Los Angeles, CA.
e. USACE. 1985. Supplement to the Phase I General Design Memorandum on the Santa Ana River Mainstem Including Santiago Creek. Los Angeles District. Los Angeles, California.
f. USACE. 1988. Santa Ana River Design Memorandum No. 1, Phase II GDM on the Santa Ana River Mainstem including Santiago Creek. Volume 7, Hydrology. Los Angeles District. Los Angeles, California.
g. USACE. 1996. Memorandum for Record. CESPL-PM-S. Santa Ana River Project – Reach 9 Results of Reevaluation Study. Los Angeles District. Los Angeles, CA.
h. USACE. 1996. Memorandum for Record. CESPL-ED-HH (1110-2-1150a). Santa Ana River – Reach 9, Results of Reevaluation Study, Paragraph 7. Los Angeles District. Los Angeles, California.
i. USACE. 1997. Memorandum for Record. CESPL-ED-D. Santa Ana River Project – Reach 9 Prado Dam to Weir Canyon Road, Addendum to Results of Re-evaluation Study. Los Angeles District. Los Angeles, CA.
j. USACE. 2007. Memorandum for Record. CESPL-OC. Santa Ana River Project – Reach 9 (Santa Ana Canyon), Santa Ana River Interceptor (SARI) Sewer Line. Los Angeles District. Los Angeles, CA.
k. USACE. April 2012. Design Documentation Report (DDR): Hydrology, Hydraulics, and Sedimentation Appendix. Prepared by Tetra Tech.

l. USACE. August 2012. Lower Santa Ana River Mainstem Project. Design Document Report – Reach 9, Phase 1, 2A, 2B, and 3. Los Angeles District. Los Angeles, California.
m. USACE. March 2013. Draft Memorandum for Record. CESPL-ED-HH. Inland Empire Brine Line Sheet Pile and Scour Depth Analysis. Los Angeles District. Los Angeles, California.
n. USACE. 2013. Final VE Study Report. Lower Santa Ana River Reach 9 Phase 4 and 5. Prepared by HDR CDM.
o. USACE. 2013. Memorandum for Record. CESPL-ED-HH. Santa Ana River Project – Reach 9, Phase II B – Proposed Pier Scour Protection and Calculations at Burlington Northern and Santa Fe Railroad Bridge. Los Angeles District. Los Angeles, CA.

USACE Manuals

p. USACE. 1969. Engineering and Design Certificate for Rip Rap Channel Protection. Engineer Technical Letter No. 1110-2-66. Washington D.C.
q. USACE. 1994. Hydraulic design of flood control channels. Engineer Manual 1110-2-1601. Washington D.C.

Others

r. Orange County Flood Control District (OCFDC). September 1972. Project Report, Santa Ana River, Facility No. EO-1, 3,000 feet downstream from the proposed Weir Canyon Road.
s. CHANLPRO, USACE Software. Coastal & Hydraulics Laboratory. 1994.
t. Chang, Howard. 2003 Scour Study of the Santa Ana River for the Interceptor Pipeline, Prepared for Brown & Caldwell.
u. Orange County Flood Control District. 2010. Santa Ana River Interceptor (SARI) Pipeline Relocation. Scour Study of Santa Ana River Below Prado Dam. Prepared by Tetra Tech.

2. **Purpose**. The purpose of this memorandum for record (MFR) is to document the Hydraulic Engineering Basis of Design for Reach 9 of the Lower Santa Ana River, Santa Ana River Mainstem (SARM), CA, including the existing and proposed improvements within the reach, and the justification for the project and its various phases. Figure 1 shows the Santa Ana River Watershed. The Reach 9 project area and the various phases of improvements are shown in Figure 2.

3. **General Description**. The project area is located in southern California, approximately 30 miles southeast of the City of Los Angeles. The Santa Ana River (SAR) within the project area

flows from Riverside County into Orange County between the City of Corona and the City of Yorba Linda. The SAR is impounded behind Prado Dam at the upstream end of the Lower Santa Ana River – Reach 9 (Reach 9). Reach 9 is geographically confined within the Santa Ana River Canyon. The downstream end of Reach 9 is marked by a grade control structure located approximately 350 feet downstream of Weir Canyon Road Bridge, where the river transitions from a relatively natural channel to an engineered channel, which conveys flows to the Pacific Ocean. The contributing watershed area to Prado Dam is approximately 2,250 square miles (See Figure 1). The length of the Reach 9 is approximately 8.3 miles (43,950 feet). The project area is the entire Reach 9, which consists of seven USACE phases: Phases 1, 2A, 2B, 3, 4, 5A, 5B, and the Green River Mobile Home Park Levee, which is a component of Phase 2A (See Figure 2).

4. **Prado Dam Flood Control**. The SAR has a history of medium to large scale flooding. One of the largest recorded floods occurred in March 1938 – the peak flow rate reached approximately 100,000 cubic feet per second (cfs) at Riverside Narrows (USACE 1980). In response to the damages caused by this flood, the U.S. Army Corps of Engineers (USACE) constructed Prado Dam. Following completion of construction in 1941, the peak discharge released from Prado Dam as measured by the U.S. Geological Survey (USGS) gage below Prado Dam (Gage No. 11074000, data collection initiated 1 October 1940) was 13,200 cfs on 15 January 2005. The Phase II General Design Memorandum (GDM) on the Santa Ana River (USACE 1988) shows the controlled outflow from Prado Dam for the reservoir design flood (approximately 0.53% annual chance exceedance or 190 year recurrence interval) under future watershed conditions with the influence of Seven Oaks Dam, which became operational in 1998, and the nearly completed upgrades to Prado Dam outlet works in 2008 is 30,000 cfs. Under these same conditions without Prado Dam, the peak flow for the design flood is 240,000 cfs (USACE 1988). It is apparent that Prado Dam provides significant flood risk reduction along the SAR.

5. **Prado Dam Sediment Storage**. In addition to providing flood control, Prado Reservoir is expected to trap nearly all bed material loads as well as a large portion of the wash load supplied from the contributing drainage area of approximately 2,250 square miles. Consequently, the river bed and banks downstream of the dam become sources of sediment to satisfy the deficit in sediment supply compared to the sediment transport capacity of the downstream channel. The progressive erosion and transport of sediment from the river bed and banks can lead to incision and widening of the channel. Both of these processes present risks to the long-term stability of existing bed and banks throughout Reach 9. As a result, long term sedimentation and degradation issues have been investigated within the SAR watershed, Reach 9, and the Prado Reservoir.

6. **Previous Studies**. A recommended plan to address flood control and related problems in the Santa Ana River Basin was submitted by the District Engineer in the 1975 *Review Report on the Santa Ana River Mainstem Including Santiago Creek and Oak Street Drain* (hereafter referred to as the "*Review Report*"; (USACE 1975). In 1980, the *Phase I General Design Memorandum on the Santa Ana River Including Santiago Creek* was completed to analyze major proposals for

flood control along the Santa Ana River Mainstem and Santiago Creek (USACE 1980). A *Supplement to the Phase I General Design Memorandum on the Santa Ana River Mainstem Including Santiago Creek* was completed in 1985 (USACE 1985). In 1988, USACE completed the *Phase II General Design Memorandum on the Santa Ana River Mainstem including Santiago Creek* to provide a basis for: (a) documentation of the SARM project authorization by the Water Resources Development Act (WRDA) of 1986, (b) a determination for the project rights-of-way, (c) updating the project costs, (d) a current assessment of environmental and social effects, and (e) preparation of plans and specifications (USACE 1988). In 2003, Howard Chang Consultants prepared *the Scour Study of the Santa Ana River for the Interceptor Pipeline* for Brown & Caldwell, which analyzed the scour development in the Santa Ana River along the SARI pipeline. In 2010, Tetra Tech prepared the *Santa Ana River Interceptor (SARI) Pipeline Relocation, Scour Study of Santa Ana River Below Prado Dam* (OCFCD 2010), which investigated the degradation in Reach 9, specifically in relation to the SARI pipeline for Orange County Flood Control District (OCFCD). In 2012, Tetra Tech prepared the *Lower Santa Ana River, Reach 9, Design Documentation Report, Hydrology, Hydraulics, and Sedimentation Appendix*, which included hydrologic, hydraulic, and scour analysis conducted for Reach 9 (USACE April 2012). These seven documents include most of the available information analyzed in preparation of this MFR.

7. **Prior Recommended Improvements as part of the SARM Flood Control Project**. The bank protection projects as originally recommended in the Phase I GDM (USACE 1980) include intermittent guide levees with rock side slopes to protect the Riverside Freeway (SR 91), the Atkinson, Topeka & Santa Fe (ATSF) railroad (currently the Burlington Northern Santa Fe (BNSF) railroad) bridges, the Green River Mobile Home Park (GRMHP), and other improvements along Reach 9. In the Phase II GDM (USACE 1988), the recommended flood control measures for the Reach 9 were limited to a levee that protected the GRMHP. The rationale for this recommendation was predicated on the GRMHP being the only location where property damage and/or loss of life would result from the design discharge from Prado Dam.

8. **Sedimentation Analysis and Scour Studies**. Sedimentation analysis and scour studies have been conducted on multiple occasions for the SAR and Reach 9. Limited sediment transport analysis was conducted in the Phase II GDM and no other USACE detailed analysis was performed for Reach 9 until 2010 when the SARI line analysis was conducted (OCFCD 2010). Further detailed analysis was conducted in 2012 (USACE April 2012). The estimated maximum scour profile at the time of design and construction governed the depth and methods of bank protection for the various project phases and features. In addition, the updated scour analysis (USACE April 2012) provided insight and rationale for improvements not previously identified within the Phase I or Phase II GDMs. The simulated general degradation in response to long-term flood series varied along the length of Reach 9. Figure 5 shows the potential maximum scour profile and required scour design profiles of Reach 9 from the Weir Canyon Road grade control structure to Prado Dam. The approximate locations of the various phases are shown in

the figure. Figure 6 shows the current conditions profiles and the potential maximum scour profile for Reach 9. Figure 7 shows the comparison of observed and simulated degradation during the 1978 and 2007 calibration period. The various phases (which are described in detail later herein) of bank protection are necessary because the potential maximum scouring is greater than the current toe depths. For Phase 1 the general degradation was simulated to range from 6.3 to 10.8 feet. Along Phase 3, the range is 1.3 to 3.1 feet. The range within Phase 2B is 7.2 to 17.9 feet. Within Phase 2A, the range of simulated general degradation is 0 to 17.8 feet. The general degradation does not include local scour components such as bend scour, contraction scour, and bedform scour, so these were calculated separately and added to the general degradation. The combined scour ranged from 0 to 26.9 feet (USACE April 2012). The relative sedimentation analysis for each phase or feature is cited within the respective description within this document. In addition, on-going regional sediment management studies are being conducted by USACE and various local stakeholders. There is a Prado Dam Ecosystem Feasibility Study in progress to investigate moving reservoir sediments to the downstream side of Prado Dam. There is also a proposed watershed geomorphology study from the upstream limit at Seven Oaks Dam to the downstream end of the Lower Santa Ana River Reach 9 at Weir Canyon Road. This study is intended to support environmental studies of both USACE and non-USACE proposed river projects in a comprehensive manner.

9. **Improvements Constructed by Others**. In addition to improvements constructed and proposed by USACE, there have also been local projects completed within Reach 9. Revetment placed by local agencies include: the Lomas De Yorba-Sur (LDY-S) Levee on the right bank that extends from the Sycamore Park Orange Grove to the Mercado Del Rio Plaza; the Santa Ana Valley Irrigation (SAVI) Ranch Levee on the left bank that stretches from Phase 1 to Weir Canyon Road; the Green River Valley Levee; and several reaches of the SR 91 soil cement embankment, which was completed by the California Department of Transportation (Caltrans). The details of the local revetment components are explained below in paragraphs 9a through 9e (See Figure 8). While the above structures are referred throughout the document as levees, USACE technically classifies these structures as bank protections.

a. Lomas de Yorba-Sur Levee. On the right riverbank, the LDY-S Levee is approximately 3 miles long and extends from approximately 3,600 feet downstream from Coal Canyon Road to approximately 3,000 feet upstream from the Weir Canyon Road Bridge (See Figure 2). In 1981 the levee was designed and constructed by the City of Yorba Linda, in coordination with USACE (USACE 1981). The levee was constructed with a minimum freeboard of 3 feet and a graded 2½H:1V slide slope. The riverside face of the levee was protected with a 33 inch thick layer of stone revetment. The revetment was designed to have a minimum toe depth penetration of 6 feet below the existing invert and a minimum top elevation of one foot above the water surface elevation. In the original guidelines that were provided by USACE to the City of Yorba Linda for the

construction of the levee, the revetment design requirements were based upon USACE recommendations for toe depths (See Paragraph 11h) (USACE 1981). Since toe depth is site specific related, the following general guidance on depth of revetment were recommended: Where the setback between the low flow riverbank to the revetment is greater than 400 feet, the revetment should be extended to at least 5 feet below the adjacent streambed. This specified depth was considered adequate because severe bank erosion would probably only occur mainly during long duration low flow releases from Prado Dam. With respect to the long duration time frame, it was anticipated that there would be sufficient time to flood fight. In addition, the low magnitude of the associated discharge will result in a water surface too low to flood the adjacent property even if the levee were to be breached. Hence, after completion of the proposed project, this particular levee would be considered as an integral bank protection feature of Reach 9 SAR Project (USACE 1981). Sedimentation and degradation analysis performed in 2012, however, indicates that the majority of the LDY-S Levee toe elevations are above the potential scour elevations, making it highly susceptible to future failure (USACE April 2012). In many cases the current thalweg elevation is equal or below the elevation of the toe (See Figure 9). In addition, Reach 9 of the SAR has proven to be a very dynamic and meandering stream (See Figures 3 and 4), which has resulted in some cases in the migration of the low flow channel towards the banks, where a larger setback may have existed. This is seen in Figure 11, which shows the horizontal distance from the LDY-S Levee toe to the thalweg. Furthermore, Figure 10 demonstrates a typical cross-section of Reach 9 along the LDY-S Levee, in which the 400 foot setback has been encroached upon. Proposed improvements in this area of Reach 9 are addressed in this document and will be known as Phase 5B.

b. Santa Ana Valley Irrigation Ranch Levee. The existing SAVI Ranch Levee, which is approximately 6,000 feet in length, ties-in to high ground on the downstream extent near Weir Canyon Road, while the upstream end ties into USACE bank protection constructed in 2003, known as Phase 1 (See Figure 2). Constructed on the left riverbank in 1980, the levee was designed to have a minimum freeboard of 3 feet and a minimum levee top width of 20 feet. Both faces of the levee were constructed with graded 2H:1V side slopes. A layer of 3 foot thick stone revetment was provided on the riverside face for bank protection. The toe of the revetment was set at a minimum of 5 feet below the estimated stable grade as defined by the Orange County Flood Control District (OCFCD) in the "Project Report, Santa Ana River, Facility No. EO-1, 3,000 feet downstream from the proposed Weir Canyon Road", dated September 1972 (OCFCD 1972). The SAVI Ranch Levee design was initially reviewed by USACE in 1996 as part of a study that reviewed and analyzed the existing bank protection (USACE

1996). The SAVI Ranch levee design was again reviewed following the updated maximum potential degradation profile developed in 2012 (USACE April 2012). The SAVI Ranch Levee provides adequate protection; however, regular maintenance and post-storm inspection will be needed for the life of the SARM project.

c. Green River Village Levee. The Green River Village Levee (GRVL) was constructed in two stages to protect the Green River Housing Estates club houses, aka Green River Homeowner's Association Estates. The GRVL extended upstream from the left abutment of the BNSF Railroad Bridge for approximately 3,000 feet. The upstream end of the levee tied-in to high ground, and was protected with a grouted stone groin, while the downstream end tied-in to the BNSF abutment. The levee revetment had a 2H:1V river face side slope with riprap thicknesses that vary from 36 to 54 inches. At the toe, the bank protection was constructed with a horizontal base having a minimum width of 20 feet and a thickness of 60 inches that was tied into the riverbed armor layer. Finally, there is a minimum vertical distance of 20 feet between the top of riprap to the top of the horizontal toe base. The GRVL was developed by the local entity and through USACE permit procedures. Construction was completed on the GRVL in 1987 (USACE 1988). Since this construction was done by others, the adequacy of the existing toe depth and structural soundness of the protection could not be verified, and additional bank protection was recommended by USACE to replace the GRVL bank protection (USACE April 2012). The replacement of the GRVL bank protection is included in the USACE Phase 2A bank protection and will from here on in be referred to as Phase 2A. Construction is expected to be completed in 2014.

d. SR 91 Bank Protection. In order to protect the Riverside Freeway (SR 91) from sustained impinging flows (damages from the SAR), Caltrans constructed and upgraded four sections of left channel bank protection. The first section is downstream of the drop structure and gaging station along SR 91 on the left bank, which consists of riprap bank protection with grouted stone slope immediately downstream of the Prado Dam drop structure. The second section is the low flow channel along the Green River Golf Course and SR 91. The original low flow channel was concrete lined with a patch work of soil-cement and grouted stone on the slopes of the left bank. The toe depth is 5 feet. The existing flow capacity is about 5,000 cfs. The third section is the soil-cement embankment at approximately 1309+00 that extends 5 feet below the surface in combination with sheet piles. The fourth section is along the current Phase 3 and Phase 4 areas which consist of soil cement bank protection where the river was close and an earth compacted bank where the bank was setback from the river. The structural

integrity of the bank protection for locations where there is no set back between the low flow riverbank and the freeway itself is unknown because the toe was submerged by the low flow adjacent to the highway embankment. Therefore the adequacy of the existing toe depth and structural soundness of the protection could not be verified, and additional bank protection has been recommended by USACE to replace the Caltrans bank protection (USACE April 2012).

e. BNSF Railroad. In 1938 the original BNSF Railroad Bridge was constructed as part of the relocation for the construction of the original Prado Dam. In 1995 the railroad bridge was widened from one track to three tracks. The widening involved the construction of two features including: (a) two additional bridges immediately south of the original bridge and (b) the design and construction of sheet pile retaining wall downstream of the Green River Golf Course at Coal Canyon, constructed by the AT&SF RR Co. (BNSF) to protect the railroad embankment downstream of the Green River Golf Course (See Figure 2). A USACE MFR dated 1996 states that the construction plans for the railway sheet pile retaining wall, which included profile lines of the bottom of the piles, ground surface, and bedrock elevations, were reviewed. According to said memorandum, "the piles extend at least 10 feet below the bedrock elevations, which meet USACE criteria (USACE 1996)." A geotechnical review of the stability of the sheet pile retaining wall was recommended at the time, but was not completed. As of current, the recommendation stands; however, due to accessibility limitations, a USACE geotechnical investigation and structural evaluation could not be conducted along the sheet pile retaining wall and along the right bank between the above mentioned sheet piles and the upstream extent of the LDY-S levee. The geotechnical investigation would require large equipment and there is no available access to the site. In addition, visual inspection of the sheet pile and surrounding ground indicates no adverse condition. Therefore, based on the 1996 evaluation, USACE is satisfied with the current sheet pile retaining wall and will formally notify BNSF to continue with regular maintenance and post-storm inspections for the life of the SARM project.

10. **Completed Improvements Constructed by USACE**. As of February 2014, Phase 1, Phase 2B, and the Green River Mobile Home Park (GRMHP) of Phase 2A has been constructed. Phase 1 is located upstream of Weir Canyon Road and downstream of Gypsum Canyon Road. Phase 1 improvements are in two locations: on the north bank adjacent to the Mercado Del Rio Plaza, and on the south bank adjacent to the SAVI Ranch Center. Phase 2B is located on the south bank of the river from Coal Canyon Road to the downstream extent of Phase 2A, which is a segment of Phase 2A that is commonly known as the GRMHP levee. The GRMHP levee is on the left bank and extends from the end of Green River Road to the BNSF (formally ATSF) Railroad bridge abutment. Within each phase of Reach 9, bank protection has been constructed or is

proposed to protect the existing infrastructure from potential damage due to the with-project peak outflows from Prado Dam expected to be 30,000 cfs. These phases are outlined in paragraphs 10a through 10g below (See Figure 2).

a. Phase 1 *Station 1278+00 to 1305+78*. On the south bank adjacent to the SAVI Ranch Center, approximately 2,800 feet of grouted stone with a riprap or sheet pile toe to a depth of 10 feet below the 2003 thalweg was placed to protect the slope. The upstream and downstream limits of the protection tie-in to existing high ground. The limits of the protection were set beyond the point where the active channel is located immediately adjacent to the bank. This portion of the project was constructed in 2003.

b. Phase 1 *Station 1227+65 to 1233+60*. On the north bank of the river, the Mercado Del Rio Plaza is threatened due to the low flow encroaching on the base of the slope. The bank has undergone erosion and the building has experienced settlement. Approximately 600 feet of grouted stone was constructed 5 to 8 feet below the thalweg at the time of construction to stabilize the bank and prevent further instability. The limits of bank protection tie-in to existing high ground and were set beyond the limits where erosion has occurred. Both banks of Phase 1 were designed using sediment transport analysis performed prior to the time of construction. This portion of the project was constructed in 2003.

c. Phase 1. Based upon the updated results of the sediment transport analysis (USACE April 2012) it was determined that the original toe depth of the protection along the south bank, described in paragraph 10a, was not sufficient to protect against future flows from eroding the bank and potentially impacting the SR 91. Approximately 2,800 feet of grouted stone with a riprap or sheet pile toe, which was placed to a depth of 10 feet below the thalweg at the time of construction, was constructed to protect the slope. The toe-down depth was selected to match adjacent Caltrans protection depth. However, it will not provide protection up to the adopted scour depth (See Figure 5). The maintenance of this facility will need to include regular post-storm surveys of the exposed length of sheet pile and mitigating measures will need to be employed once a certain depth is exposed. In summation, Phase 1 work was completed by USACE, but regular maintenance and post-storm inspection are needed, which will be added as a requirement to the Operation and Maintenance (O & M) Manual.

d. Phase 2A. The Phase 2A bank protection was originally cited as an area of concern within the Phase II GDM (USACE 1988) to protect the left bank, the GRMHP, and the Green River Homeowner's Association (GRHOA) from future flows. The design includes protection against the potential maximum degradation profile (See Figure 5). The upstream limit of the Phase 2A bank protection ties into

existing channel bank at the downstream limit of the Prado Dam Outlet Structure. The downstream limit of the Phase 2A bank protection ties into high ground near the SR 91. Paragraph 10e below describes the components of Phase 2A, which have been completed. The remaining components of Phase 2A are being designed and constructed by USACE and construction is expected to be completed in 2015 (See Paragraphs 11a through 11d).

e. Phase 2A *Station 1499+00 to Station 1513+15* (GRMHP Levee). This levee feature on the left bank is commonly known as the GRMHP Levee. In this reach the levee is approximately 1,400 feet in length and was designed to protect the GRMHP. The levee extends just downstream of the BNSF railroad east abutment and the bank protection consists of 24 inch thick grouted stone and a derrick stone toe. The toe of the grouted stone revetment will extend a vertical distance of 18 feet below the thalweg. According to Phase II GDM (USACE 1988), the levee was proposed because overflow analyses for existing conditions showed the Green River Mobile Home Park would be flooded when flows exceeded 22,000 cfs.

f. Phase 2B *Station 1339+57 to 1396+65.* Low flow channel at Green River Golf Course (GRGC). The existing low flow channel was concrete lined with soil cement on the slopes of the left bank. The existing toe depth was 5 feet. Based on the hydraulic and sediment transport analysis (USACE April 2012), it was determined that the linear extent and depth was not sufficient to protect against future flow from impacting the channel bank and theSR 91. To provide an increased toe depth of 20 feet, approximately 5,700 feet of bank protection was built consisting of 48 inch riprap, 24 inch grouted stone, and sheet piles. All types of protection included a derrick stone toe 5 to 10 feet thick. The upstream and downstream limits of bank protection were keyed into the high ground. The limits of bank protection extend beyond the points where bank erosion is anticipated. This portion of the project was completed by USACE in 2013, but regular maintenance and post-storm inspection will be required and specified in the O&M Manual.

11. **Proposed Remaining Improvements by USACE**. Through subsequent analysis since the GDM Phase II, the following phased bank protection has been proposed and is currently being designed by USACE within the Reach 9. Within each phase of Reach 9, bank protection has been proposed to protect the existing infrastructure from potential damage due to the with-project peak outflows from Prado Dam estimated to be 30,000 cfs. As of December 2013, Phase 2A is being constructed, except for the component at the BNSF Railroad Bridge; Phases 3, 4, 5A, and 5B are being designed by USACE. The Phase 5A improvements continue the Phase 1 improvements on the north bank to just upstream of Via Lomas De Yorba West Rd. Phase 5B is located immediately upstream of Phase 5A and continues on the north bank approximately 2.3 miles upstream, along the existing Yorba Sur Levee alignment. Phase 3 is located on the south

bank of the river between Gypsum Canyon Road and Coal Canyon Road, just upstream of the Canyon RV Park. Phase 4 improvement extends the Phase 3 improvement to just downstream of Coal Canyon Road. Phase 2A is located along the most upstream portion of Reach 9, between the Phase 2B and the outlet from Prado Dam, including the GRMHP levee. These phases are outlined in paragraphs 11a through 11i (See Figure 2).

a. Phase 2A *Station 1519+00 to 1524+00* (along GRHOA, upstream of BNSF Railroad Bridge), *Station 1557+00 to 1576+60* (along GRHOA), *Station 1585+81 to 1605+47.50* (along SR 91 Embankment). Bank protection consists of a 24 inch thick grouted stone on a 6 inch thick bedding stone, on a 2H:1V slope ratio constructed above the design maximum water surface, with a buried 8 feet thick launchable derrick stone toe for further protection against the estimated maximum scour erosion of 22.2 feet for Phase 2A. This maximum scour amount includes long term degradation, bend scour, and bedform scour. This maximum scour was developed in a HEC-6T model by Tetra Tech for USACE (USACE April 2012). At Station 1555+00 the design channel velocity is 7.5 fps, and the water surface elevation is 442.7 feet (USACE April 2012). In addition, an 18 feet wide maintenance road is provided for operation and maintenance access along the top of the grouted stone bank. Construction of the grouted stone bank and derrick stone toe design requires a wide construction easements and permanent structure right-of-way. Therefore, this design is used where there is sufficient land that could be acquired without encroachment into the active stream to minimize impact to sensitive environmental habitats and minimize impact to the existing GRHOA common area landscaped slopes.

b. Phase 2A *Layout Line (LOL) '2' Station 31+25 to 36+58.61* (along GRHOA) – Bank protection design consists of a 24 inch thick grouted stone on a 6 inch thick bedding stone revetment on a 1½H:1V slope constructed above the design maximum water surface with a buried 8 feet thick launchable derrick stone toe for further protection against the estimated maximum scour erosion of 22.2 feet for Phase 2A. This maximum scour amount includes long term degradation, bend scour, and bedform scour. This maximum scour was developed in a HEC-6T model by Tetra Tech for USACE (USACE April 2012). In addition, an 18 feet wide maintenance road is provided for operation and maintenance access along the top of the grouted stone bank. Construction of the grouted stone bank and derrick stone toe design requires a wide construction easements and permanent structure right-of-way. This design is used where there is limited land that could be acquired without encroachment into the active stream to minimize impact to sensitive environmental habitats and minimize impact to the existing GRHOA common area landscaped slopes.

c. Phase 2A *Station 1543+85to 1549+30* (along GRHOA), LOL '2' *Station 29+30 to 29+90* (along GRHOA). Bank protection design consists of a 24 inch thick grouted stone on a 6 inch thick bedding stone revetment on a 1½H:1V slope with the toe of the grouted stone slope keyed 3 to 4 feet vertically into vertical sheet piles. The 1½H:1V grouted stone slope is determined to be geotechnically stable. This design is utilized where there is limited right-of-way between the active river and the residential homes, and where there is presence of shallow bedrock near the existing ground surface based on geotechnical investigations. The bedrock is determined to be sustainable to anticipated scour erosion and would provide a stable foundation for the grouted stone slope (USACE August 2012).

d. Phase 2A *Station 1524+00 to 1540+90* (along GRHOA). Bank protection cross section transitions are provided from the 1½H:1V grouted stone revetment to the vertical sheet pile wall and from the sheet pile wall to the 2H:1V grouted stone bank at a transition of 10 to 1. This sheet pile feature for bank protection is utilized where there is very limited right-of-way between the active river and the residential homes and no encroachment into the active stream is allowed to minimize impact to sensitive environmental habitats. The depth of sheet piles are designed to accommodate the maximum anticipated long term riverbed degradation of 21.5 feet. Phase 2A, which is described in paragraphs 11a through 11d, is being designed and constructed by USACE and construction is expected to be completed in 2014.

e. Phase 3 *Station 1367+17 to 1382+40.* On the south bank, the existing soil-cement was built by Caltrans and extends 5 feet below the surface. Based upon the results of the hydraulic analysis and sediment transport study for the Santa Ana River Interceptor (SARI) Sewer Line in 2010 it was determined that the protected reach length and depth of toe-down was not sufficient to keep the bank from eroding and potentially impacting the freeway (USACE 2010). New soil cement bank protection 10 feet thick is proposed, which will provide protection below the estimated maximum potential scour depths (USACE April 2012). This protection alignment extends approximately 300 feet downstream beyond where the historic low-flow channel alignment migrates away from the bank and toward the center of the channel. Figures 3 and 4 show the historic alignment of the thalweg within Reach 9. It is in this portion of the reach where the river also widens to nearly 2,000 feet. The addition of a flange or flare-out at the downstream end of the protection to guide flows away from the bank was considered and was determined to not be necessary since the river in very wide and the sediment study results indicate much less degradation and potential for bank erosion just immediately downstream of reach 3 in the Featherly Park area of the river. Figure 5 shows the current profile and the maximum scour profile along the Reach 9, Phase 3 project area. The scouring in this area establishes the need for bank protection. The construction contract for this portion of the project

was awarded in September 2013; construction has begun, and is estimated to be complete in 2014.

f. Phase 4. Phase 4 proposes the extension of the Phase 3 protection upstream for another 3,150 feet. The existing river bank within the proposed Phase 4 project limits is not armored. As of current, an existing rock groin in the channel, which was constructed by the Orange County Sanitation District to protect the original SARI line alignment, is located at approximately 25,000 feet upstream of Weir Canyon Road. In addition to providing protection for the SARI line, the rock groin also currently prevents the low flow from meandering and thus prevents the low flow from potentially impinging on the left river bank. However, in coordination with the U.S. Fish and Wildlife Service (USFWS), the groin will be removed due to environmental requirements after the SARI line is relocated. As a result, it is proposed to extend the revetment on the south bank from the upstream end of Phase 3 (Station 1382+40) up to 1,400 feet downstream of Coal Canyon Road (Station 1470+00) to protect the bank against meandering and impinging flood flows eroding the bank. The recommended revetment type is soil cement. The anticipated long term scour in this area is approximately 25 feet below the top of the bank or approximately 7 feet below the current thalweg (USACE April 2012). As a result, the top of proposed protection line extends from elevation 390 ft NGVD 29 at station 1382+40 to elevation 403 feet NGVD 29 at station 1417+60. Similarly, in order to provide sufficient protection given future scour, the bottom of proposed protection line extends from elevation 364 ft NGVD at station 1382+40 to 376 feet NGVD 29 at station 1417+60. Figure 5 shows the current profile, general degradation, and the maximum scour profile along the Reach 9, Phase 4 project area. The potential maximum scour in this project area establishes the need for bank protection. The construction contract for portion of the project is scheduled to be awarded in September 2014 and is estimated to be complete in 2015.

g. Phase 5A. The Phase 5A bank protection project is proposed on the right bank along a portion of the existing alignment of the LDY-S Levee. Phase 5A extends upstream from approximately 2,745 feet upstream of Yorba Linda Boulevard (Weir Canyon Road) for approximately 4,140 feet in length. The thalweg of the river runs adjacent to the project area and parallel to La Palma Avenue. The project area is located where the river makes a sharp 90 degree bend, and therefore, has a higher potential for bank erosion. In addition, the current condition of the un-grouted riprap revetment of the LDY-S Levee has been evaluated by USACE, in accordance with EM 1110-2-1601, and with the aid of the revetment software, CHANLPRO (USACE 1994). The results of the riprap analysis indicate the revetment is insufficient for the design flood event. The recommended revetment type is soil cement in combination with sheet piles and tie backs to minimize the encroachment into environmentally

sensitive habitat areas. Specifically, the alignment includes 1,000 linear feet of soil cement and 3,140 linear feet of steel sheet piles, for a maximum depth of 35.5 feet (USACE 2013), which is below the maximum anticipated long term scour of 11.9 feet in this area (USACE April 2012). As a result, the top of protection line extends from elevation 344 feet NGVD 29 at Station 1233+60 to elevation 351 feet NGVD 29 at station 1263+80. Similarly, in order to provide sufficient protection given future scour, the bottom of proposed protection line extends from elevation 311 feet NGVD at 1233+60 to elevation 315 feet NGVD 29 at station 1263+80. Figure 5 shows the current profile and the maximum scour profile along the Reach 9, Phase 5A project area. The construction contract for portion of the project is scheduled to be awarded in January 2015 and is estimated to be complete in 2016.

h. Phase 5B. The Phase 5B bank protection project is proposed on the right bank, immediately upstream of Phase 5A, beginning near the Via Lomas De Yorba West Rd, and running upstream along the alignment of the existing LDY-S Levee for approximately 2.3 miles. The recommended revetment type is grouted stone or a comparable revetment material (such as soil cement) and sheet piles. In addition, the upstream limit of Phase 5B would be set at the same alignment and limit of the existing bank protection and upon further evaluation may be extended upstream to the BNSF sheet pile wall to protect the BNSF rail line. The current levee toe protection extends from elevation 331 feet NGVD 29 to elevation 375.6 feet NGVD 29, moving upstream. This same portion of the reach is expected to experience scour depths ranging from elevation 324 feet NGVD 29 to elevation 374 feet NGVD 29 (USACE April 2012). In some places the current thalweg invert is already equal to or below the toe elevation of the levee. Figure 5 shows the current profile and the maximum scour profile along the Reach 9, Phase 5B project area. Figure 9 displays the current profile, the maximum scour profile, and the protection toe depths of the existing Lomas De Yorba Sur Levee. In 1981, USACE prepared a MFR documenting the review of the local design of the Yorba Sur Levee. In the MFR, USACE recommended “Where the set back is greater than 400 feet, the revetment should be extended to at least the lowest adjacent streambed elevation; where the set back is less than 400 feet, the revetment should be extended to at least 5 feet below the adjacent streambed.” The USACE recommendation was based on the engineering judgment in 1981. However, given that varying historic low-flow channel alignments have a propensity to laterally migrate in this location, the existing levee condition is deemed deficient. An upgrade of the existing bank protection is recommended to prevent future lateral erosion into the bank line and protect the infrastructure consisting of roads, industrial development and residential housing. The construction contract for portion of the project is scheduled to be awarded in 2015 and is estimated to be complete in 2017.

i. BNSF Railroad. Further USACE investigations have focused on the BNSF bridge piers, which may be deficient in protection and susceptible to scour. The general degradation is estimated at 18 feet below the existing thalweg. As of current, a coordinated design effort between USACE and BNSF is proposing the addition of sloping nosed pier extensions to reduce the extent of the hydrodynamic forces acting at the front of the piers, which create local scour effects. It is anticipated that the turbulent flow and potential pier scour will be significantly reduced when it is shifted to upstream near the pier extension nose area. In addition, the abutments of the bridge would need to be protected against scour and high water. The Los Angeles District is currently working with the USACE Engineering Research and Design Center (ERDC) to develop a 2-D hydraulic model for the BNSF Bridge and the proposed pier modifications. The 2-D hydraulic modeling work shows that the simulated flow velocities are reasonably similar to the original 1-D HEC-RAS modeling results. Further studies of flow and potential scour effects are currently in progress by ERDC using a 3-D scaled physical model on a mobile bed. The construction contract for portion of the project is scheduled to be awarded in January 2015 and is estimated to be complete in 2017.

j. Phase 2A *Station 1513+15 to Station 1519+00* (GRMHP Levee to BNSF Railroad east abutment). This levee section is part of the GRMHP Levee. The bank protection feature in this reach is approximately 600 feet in length and is designed to protect the GRMHP and BNSF Railroad east abutment. The bank protection consists of 24 inch thick grouted stone with a derrick stone toe, except at the BNSF bridge abutment. At Station 1515+10 the design channel velocity is 5.6 feet per second (fps), and the water surface elevation is 432.4 feet (USACE 2012). As stated within paragraph 7, the component of Phase 2A known as the GRMHP Levee, which is addressed in paragraphs 10e and 11a, was originally authorized in the Phase II GDM (USACE 1988). This component of Phase 2A will be constructed as part of the BNSF bridge protection beginning in 2015.

12. **Additional Considerations**. In addition to the aforementioned constructed federal and local projects, as well as a number of proposed federal projects, additional coordination and consideration must be given to the existing Santa Ana River Interceptor (SARI Line) and existing bridges within Reach 9. Paragraphs 12a through 12c discuss the SARI Line and the Gypsum Canyon Road Bridge.

a. SARI Line. The SARI pipe line was originally constructed in 1975 and generally parallels the SAR from the Orange County/San Bernardino County Line to the Orange County Sanitation District (OCSD) Treatment Plant, which is a distance of approximately 23 miles. The segment of the SARI within the Reach 9 riverbed was constructed of reinforced concrete pipe (RCP) and vitrified clay pipe (VCP) with

diameters ranging from 39 to 51 inches. Concrete encasement was provided only at locations where the alignment crossed the SAR thalweg at the time of construction. In 1975 the line was buried 15 to 20 feet below the existing riverbed elevation. By 2007 the scour and erosion within Reach 9 had placed the SARI at risk of being ruptured. Orange County Public Works currently is in progress of relocating the SARI line out of the riverbed. The existing line will be abandoned in place. The SARI Line project is estimated to be completed in 2014.

b. SARI Line. The Riverside County Flood Control and Water Conservation District (RCFCWCD) has proposed a sheet pile barrier along the north bank of the Reach 9. The objective of the sheet pile wall is to protect the road and the Inland Empire Brine Line (SARI) from bank erosion and degradation from scour and flow impingement in the channel. The proposed sheet pile barrier along the north bank of the Reach 9 would span from approximately river station 1555+00 to 1575+00, as well as approximately 1532+00 to 1535+00, near the Aliso Creek confluence. The 90 percent design plans were submitted to the USACE Los Angeles District for review in 2013 and it was noted that the current design does not provide protection below the estimated maximum scour depth (USACE March 2013). The preliminary analysis was documented in a draft MFR dated 4 March 2013. This portion of the project is expected to be completed by RCFCWCD.

c. Gypsum Canyon Road Bridge. In 1987 the City of Yorba Linda constructed the Gypsum Canyon Road Bridge, which crossed the SAR in Reach 9. The bridge consists of six piers with foundations, which were constructed to an elevation of 331.0 feet NGVD 29. This is nearly 25 feet below the anticipated scour depths calculated in the 2012 scour analysis (USACE April 2012). A structural analysis will be conducted to determine if any pier protection is required for the anticipated scour depths. The embedment depths of the bridge abutments were constructed to a higher elevation and may be susceptible to the adopted scour influence. Further investigation and analysis for a protection design would be performed to determine if any additional abutment protection is needed.

13. **Summary of Recommendations**. To summarize, the following recommendations made within this MFR for both local and federal improvements include:

a. Lomas de Yorba-Sur Levee. The current condition of the LDY-S Levee includes a deficient bank protection and toe down depth, which is above the potential scour elevations. As a result, Phases 5A and 5B are proposed along the LDY-S alignment and incorporate the adequate toe depth and protection.

b. Santa Ana Valley Irrigation Ranch Levee. The SAVI Ranch Levee provides adequate protection; however, regular maintenance and post-storm inspection will be needed for the life of the SARM project.

c. Green River Village Levee. The GRVL revetment has been incorporated into the Phase 2A alignment design and construction. As stated later within paragraph 13g, Phase 2A is being designed and constructed by USACE and construction is expected to be completed in 2014.

d. SR 91 Bank Protection. The SR 91 bank protection is recommended and is included in Phases 2B, 3, and 4.

e. BNSF Railroad. BNSF Railroad features include: (1) sheet pile wall downstream of the Green River Golf Course at Coal Canyon and (2) current investigations on the BNSF bridge piers, which may be deficient in protection and susceptible to scour. For (1), USACE will notify BNSF to continue with regular maintenance and post-storm inspections for the life of the SARM project. For (2), the investigation of the bridge piers is a coordinated design effort between USACE and BNSF. USACE is proposing the addition of sloping nosed pier extensions to reduce the extent of the hydrodynamic forces acting at the front of the piers, which create local scour effects. The construction contract for portion of the project is scheduled to be awarded in January 2015 and is estimated to be completed in 2017.

f. Phase 1. Phase 1 work was completed by USACE, but regular maintenance and post-storm inspection are needed since recently completed sediment transport studies indicate possible deficient toe down protection in the out years of the project. The action is to notify the project sponsor and include specific requirements in the O & M Manual to monitor and, if necessary, mitigate.

g. Phase 2A. Phase 2A is being designed and constructed by USACE and construction is expected to be completed in 2014, except for the component of Phase 2A, which will be constructed as part of the BNSF bridge protection in 2015.

h. Phase 3. Phase 3 is being designed by USACE, the construction contract for this portion of the project was awarded in September 2013 and is estimated to be completed in 2014.

i. Phase 4. Phase 4 is being designed by USACE. The potential maximum scour in this project area and the need to protect the SARI line and SR 91 establishes the need for bank protection. The construction contract for portion of the project is scheduled to be awarded in September 2014 and is estimated to be complete in 2015.

j. Phase 5A. Phase 5A is recommended and being designed by USACE. The construction contract for portion of the project is scheduled to be awarded in 2015 and is estimated to be complete in 2016.

k. Phase 5B. Phase 5B is recommended and being designed by USACE. An upgrade of the existing bank protection, currently known as the LDY-S Levee, is recommended to prevent future lateral erosion into the bank line and protect infrastructure. The construction contract for portion of the project is scheduled to be awarded in 2015 and is estimated to be complete in 2017.

l. SARI Line. The SARI Line bank protection feature is a project to be done by the local sponsor, RCFCWCD. USACE will coordinate the design effort to ensure it meets USACE criteria. It is anticipated to be constructed in late 2014 or 2015.

m. Gypsum Canyon Road Bridge. A structural analysis will be conducted by USACE Structures Section to determine if any pier protection is required for the anticipated scour depths. The embedment depths of the bridge abutments were constructed to a higher elevation and may be susceptible to the adopted scour influence. Further investigation and analysis for a protection design would be performed to determine if any additional abutment protection is needed.

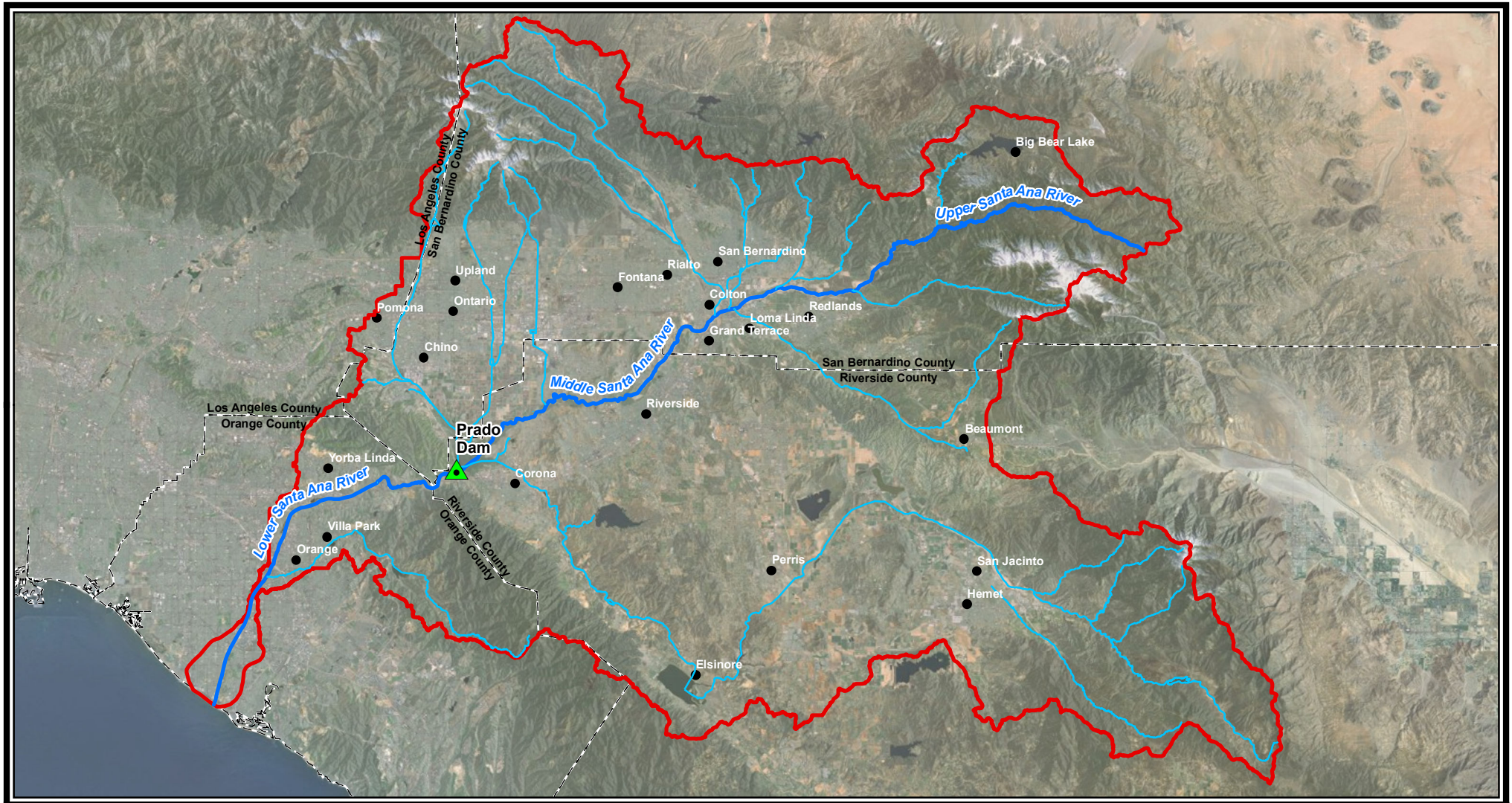
14. **Conclusion**. This MFR presents all the project features in Reach 9 of the Lower Santa Ana River in support of the SARM project to provide flood damage reduction. The features will allow Prado Dam storm water releases of up to 30,000 cfs without damaging infrastructure and will account for river bed degradation over time due to reduced sediment flows from the dam. There is no proposed invert stabilization in this reach from the downstream drop structure at Weir Canyon Road bridge upstream to the Prado Dam outlet channel. This was done to allow the Santa Ana Sucker fish, which is a listed endangered species, to migrate within this reach unrestricted.

In addition, the information herein will provide the project description in support of the environmental studies and documentation for projects proposed in this reach. The sediment transport study (USACE 2012) will also provide information on how the riverbed will respond to Prado Dam flow releases.

15. Any questions should be directed to David L. Silvertooth of the Hydraulics Section at (213) 452-3569 or David.L.Silvertooth@usace.army.mil

Encl

RENE VERMEEREN, P.E., D.WRE
Chief, Hydrology & Hydraulics Branch





Legend

- Santa Ana River
- Watercourses
- SAR Watershed Boundary
- Prado Dam
- Cities
- County Boundary

Sources:

Background is from the ESRI ArcGIS Online Basemap Sources

Coordinate System:
State Plane California VI (FIPS 0406, Feet)
Datum: NAD 1983

Map Created: January 2014

N

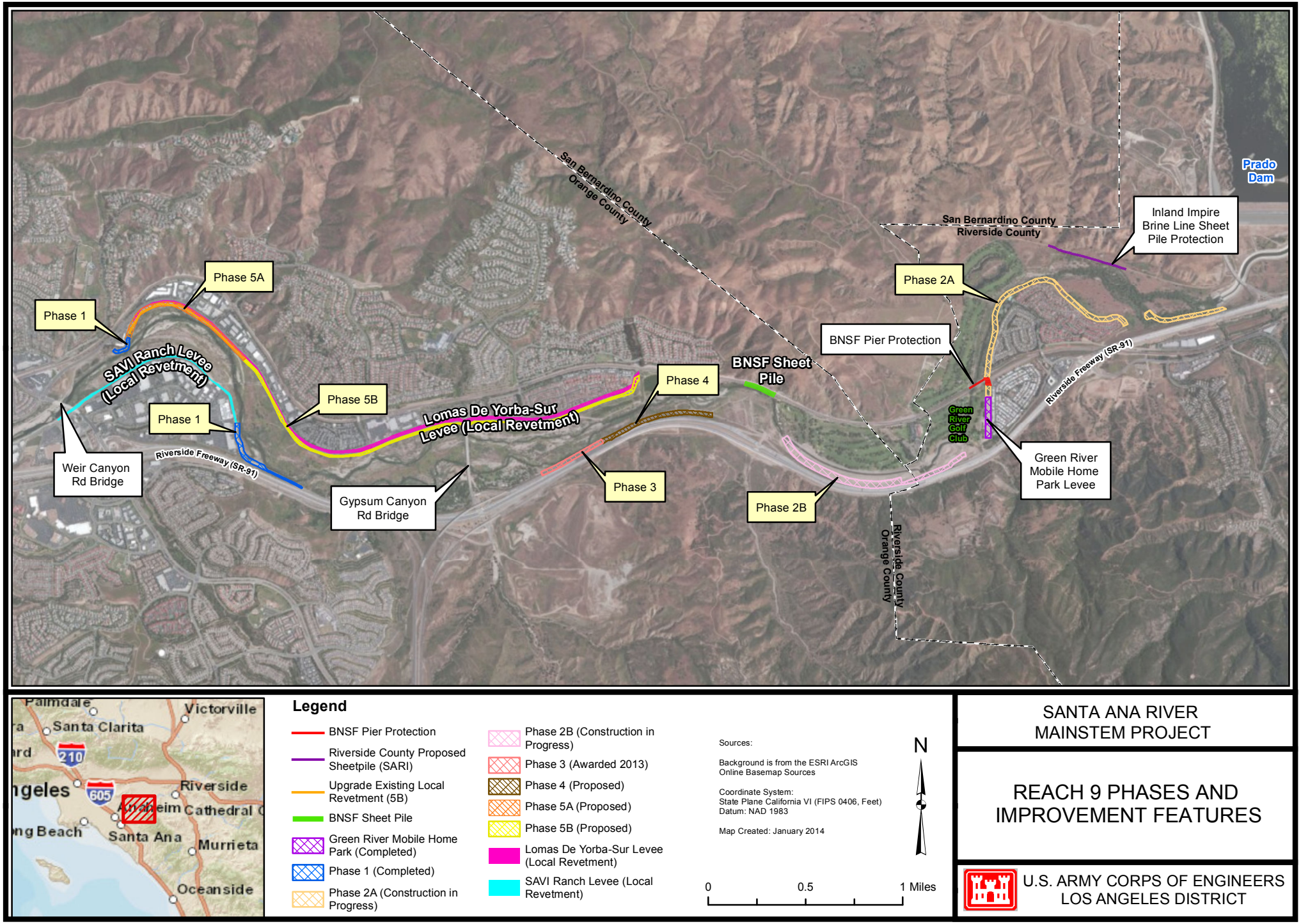
0 10 20 Miles

SANTA ANA RIVER
MAINSTEM PROJECT

SANTA ANA RIVER WATERSHED OVERVIEW

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Figure 1

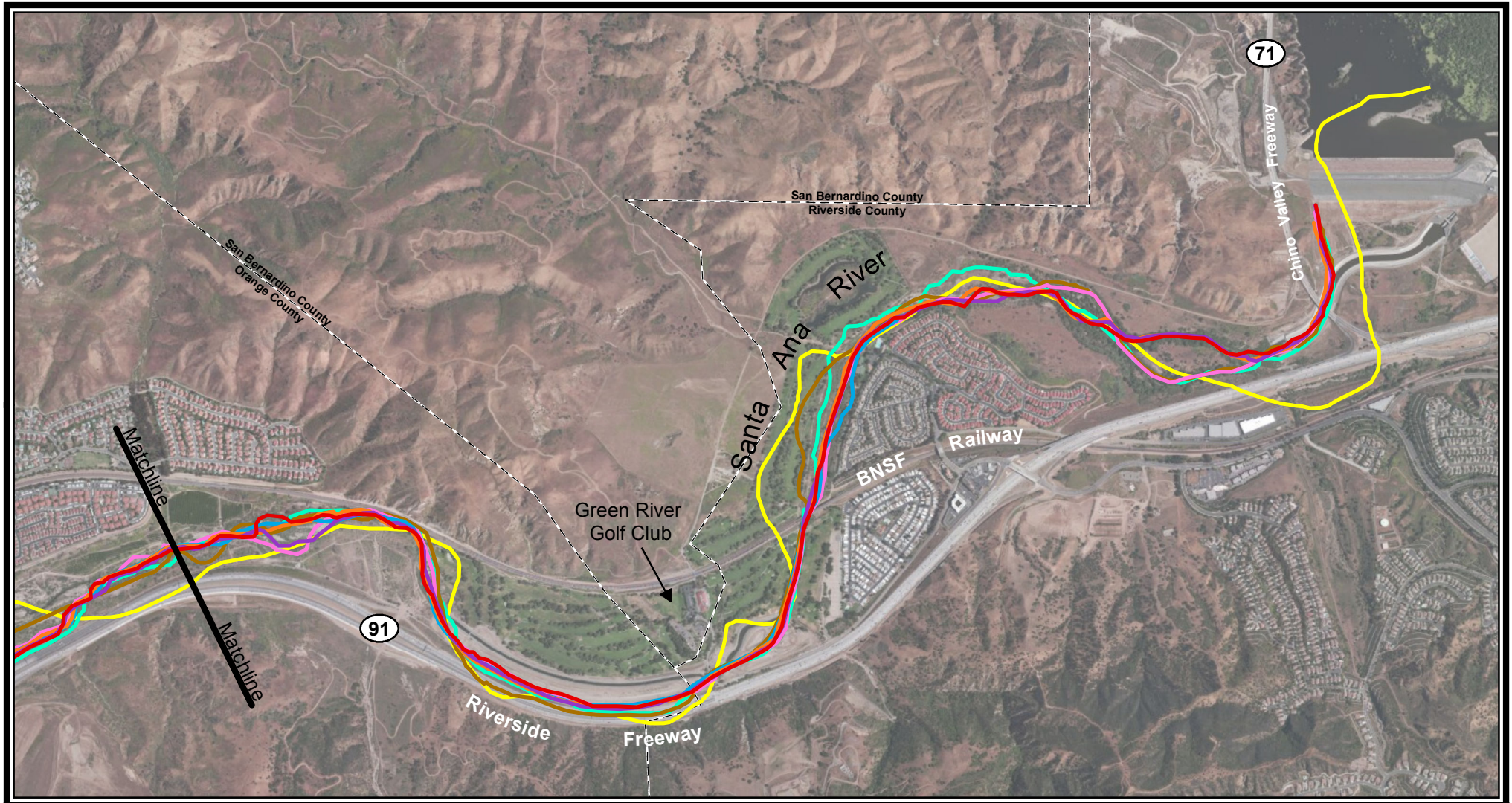


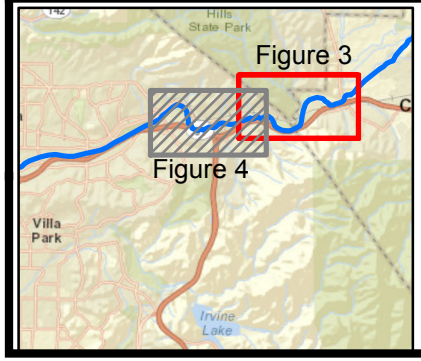
SANTA ANA RIVER MAINSTEM PROJECT

REACH 9 PHASES AND IMPROVEMENT FEATURES

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Figure 2





Legend
Low Flow Centerlines

- 1929
- 1968
- 1970
- 1979
- 1981
- 1990/1991
- 2004
- 2007

Sources:

Background is from the ESRI ArcGIS Online Basemap Sources

Coordinate System:
State Plane California VI (FIPS 0406, Feet)
Datum: NAD 1983

Map Created: January 2014

N

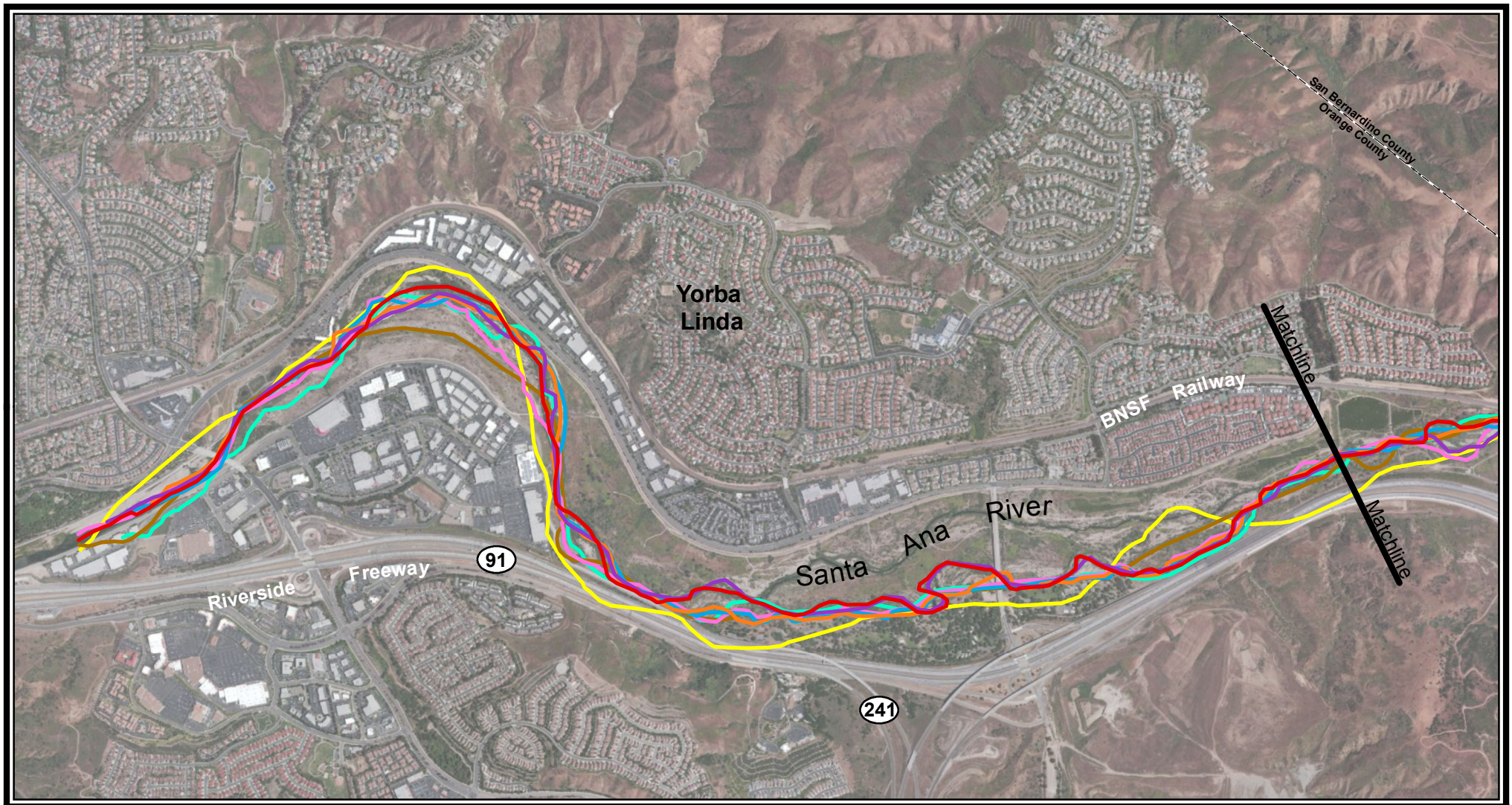
0 0.3 0.6 Miles

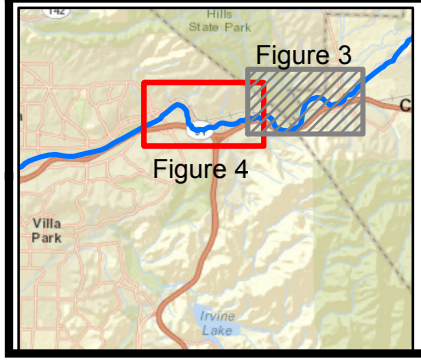
SANTA ANA RIVER
MAINSTEM PROJECT

REACH 9
HISTORIC THALWEG (1/2)
SAR CENTERLINE COMPARISON
(MAP 1 OF 2)

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Figure 3





Legend
Low Flow Centerlines

- 1929
- 1981
- 1968
- 1990/1991
- 1970
- 2004
- 1979
- 2007

Sources:

Background is from the ESRI ArcGIS Online Basemap Sources

Coordinate System:
State Plane California VI (FIPS 0406, Feet)
Datum: NAD 1983

Map Created: January 2014

N

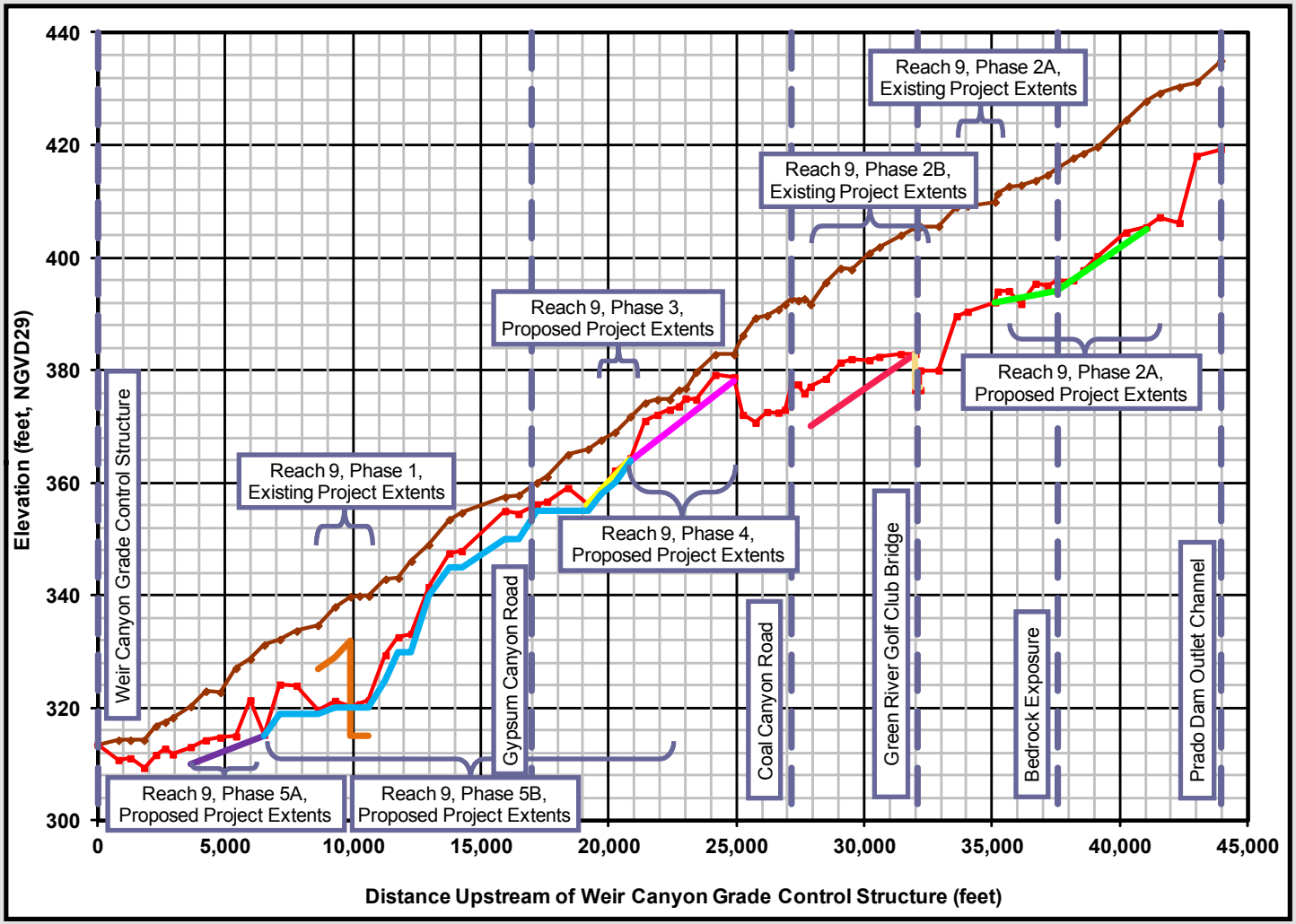
0 0.3 0.6 Miles

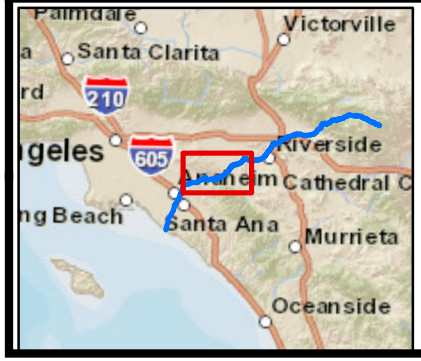
SANTA ANA RIVER
MAINSTEM PROJECT

REACH 9
HISTORIC THALWEG (2/2)
SAR CENTERLINE COMPARISON
(MAP 2 OF 2)

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Figure 4





Legend

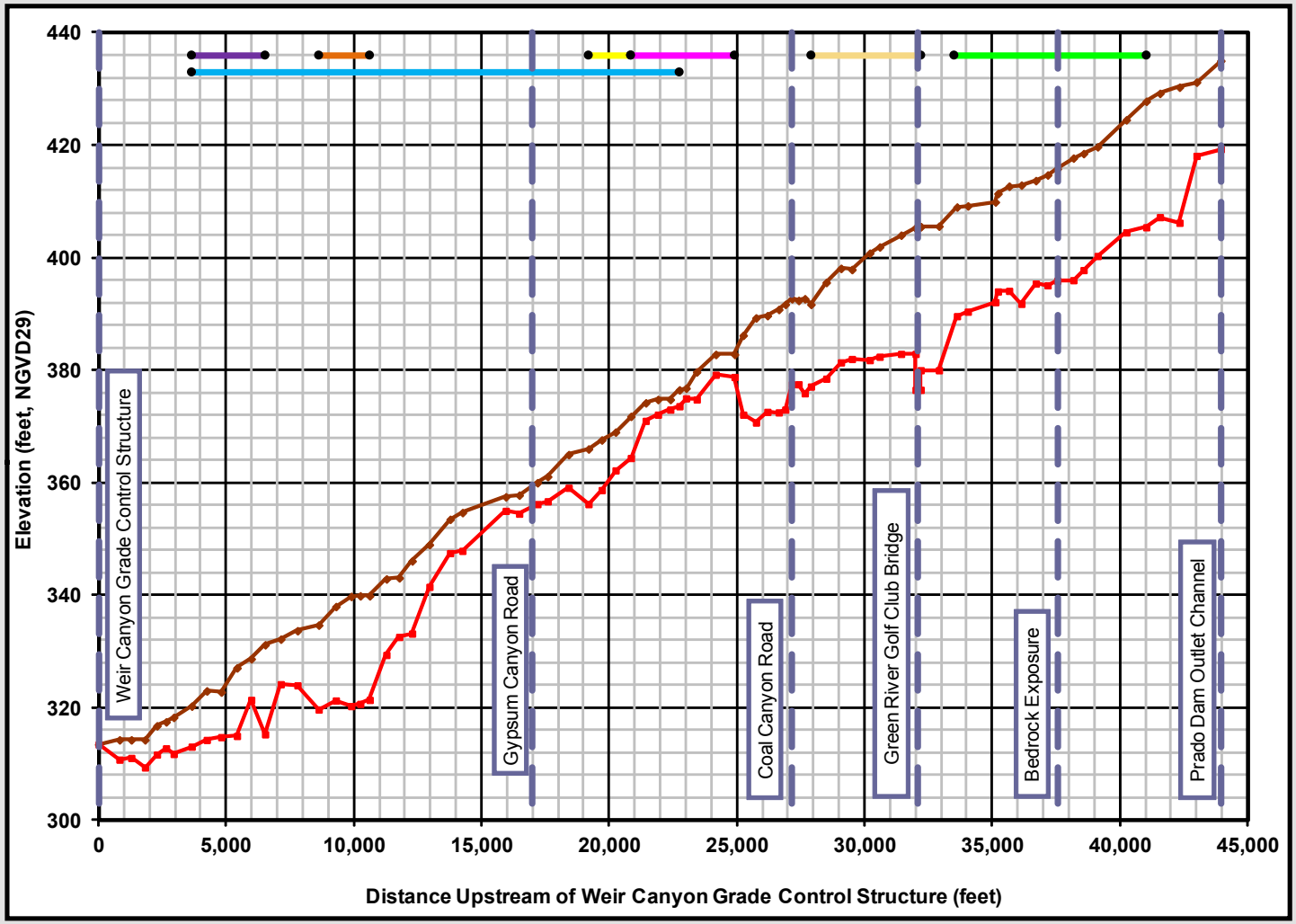
- 2007 Conditions Invert Profile
- Potential Maximum Invert Scour Profile
- Reach 9, Phase 1, Complete
- Reach 9, Phase 2A, Proposed
- Reach 9, Phase 2B, Complete
- Reach 9, Phase 3, Proposed
- Reach 9, Phase 4, Proposed
- Reach 9, Phase 5A, Proposed
- Reach 9, Phase 5B, Proposed

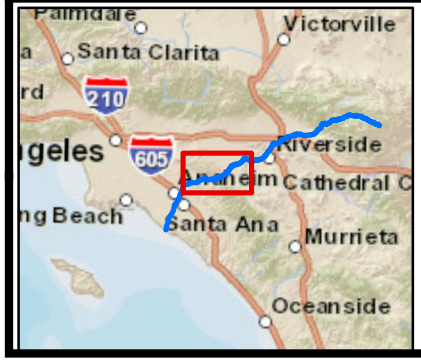
SANTA ANA RIVER
MAINSTEM PROJECT

POTENTIAL MAXIMUM SCOUR PROFILE AND REQUIRED SCOUR DESIGN PROFILES

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Figure 5





Legend

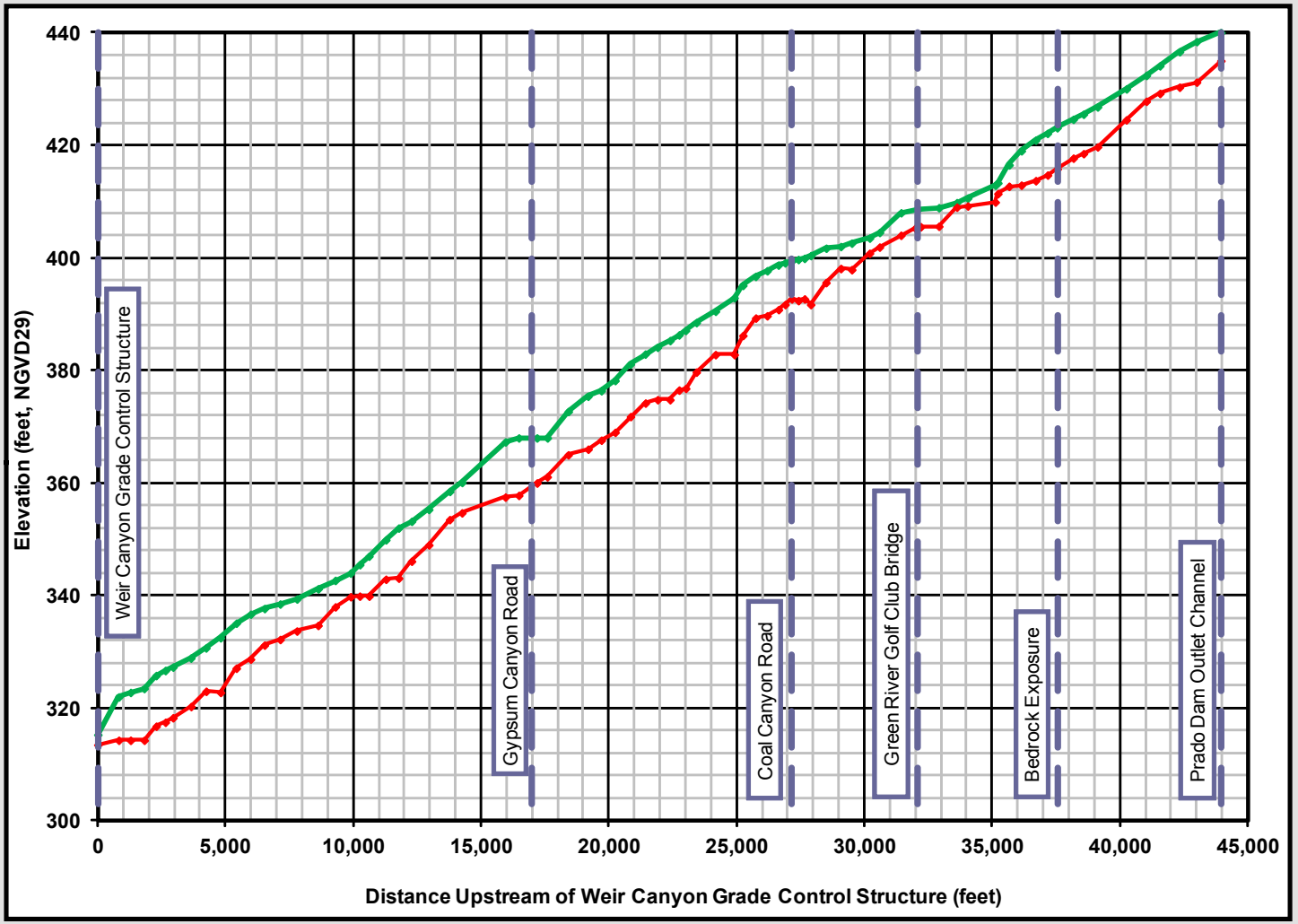
- 2007 Conditions Invert Profile
- Potential Maximum Invert Scour Profile
- Reach 9, Phase 1, Complete
- Reach 9, Phase 2A, Proposed
- Reach 9, Phase 2B, Complete
- Reach 9, Phase 3, Proposed
- Reach 9, Phase 4, Proposed
- Reach 9, Phase 5A, Proposed
- Reach 9, Phase 5B, Proposed

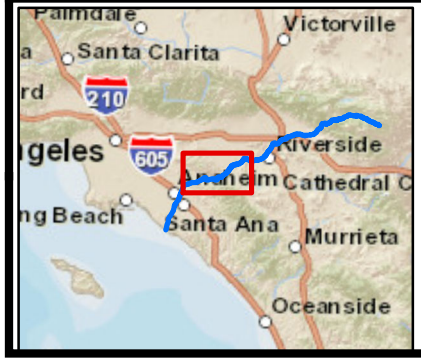
SANTA ANA RIVER
MAINSTEM PROJECT

POTENTIAL MAXIMUM SCOUR
PROFILE AND USACE
IMPROVEMENT PHASES

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Figure 6





Legend

1978 Conditions Invert Profile

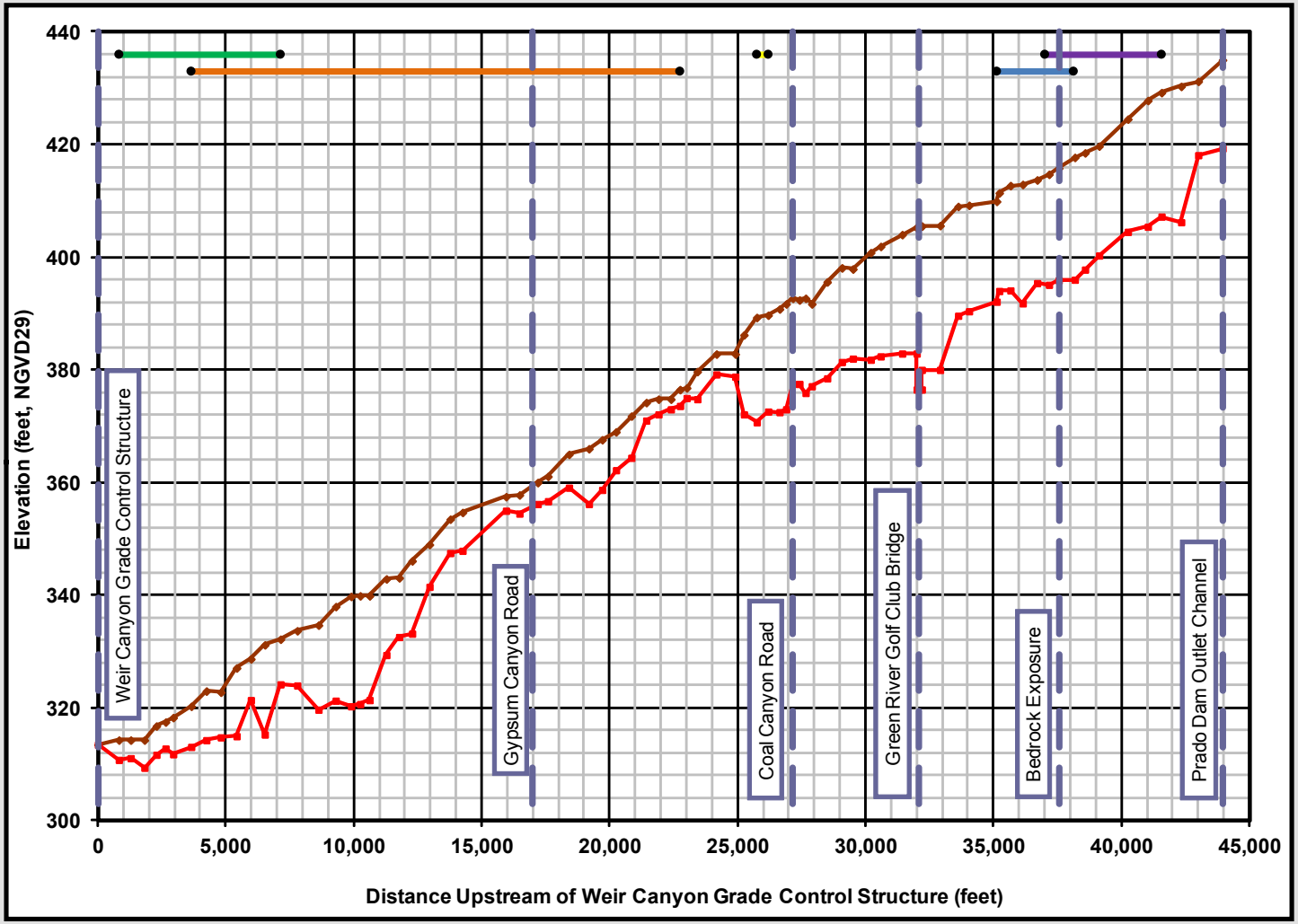
2007 Conditions Invert Profile

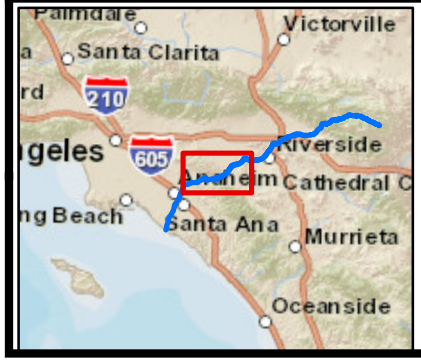
SANTA ANA RIVER
MAINSTEM PROJECT

REACH 9
HISTORIC PROFILES

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Figure 7





Legend

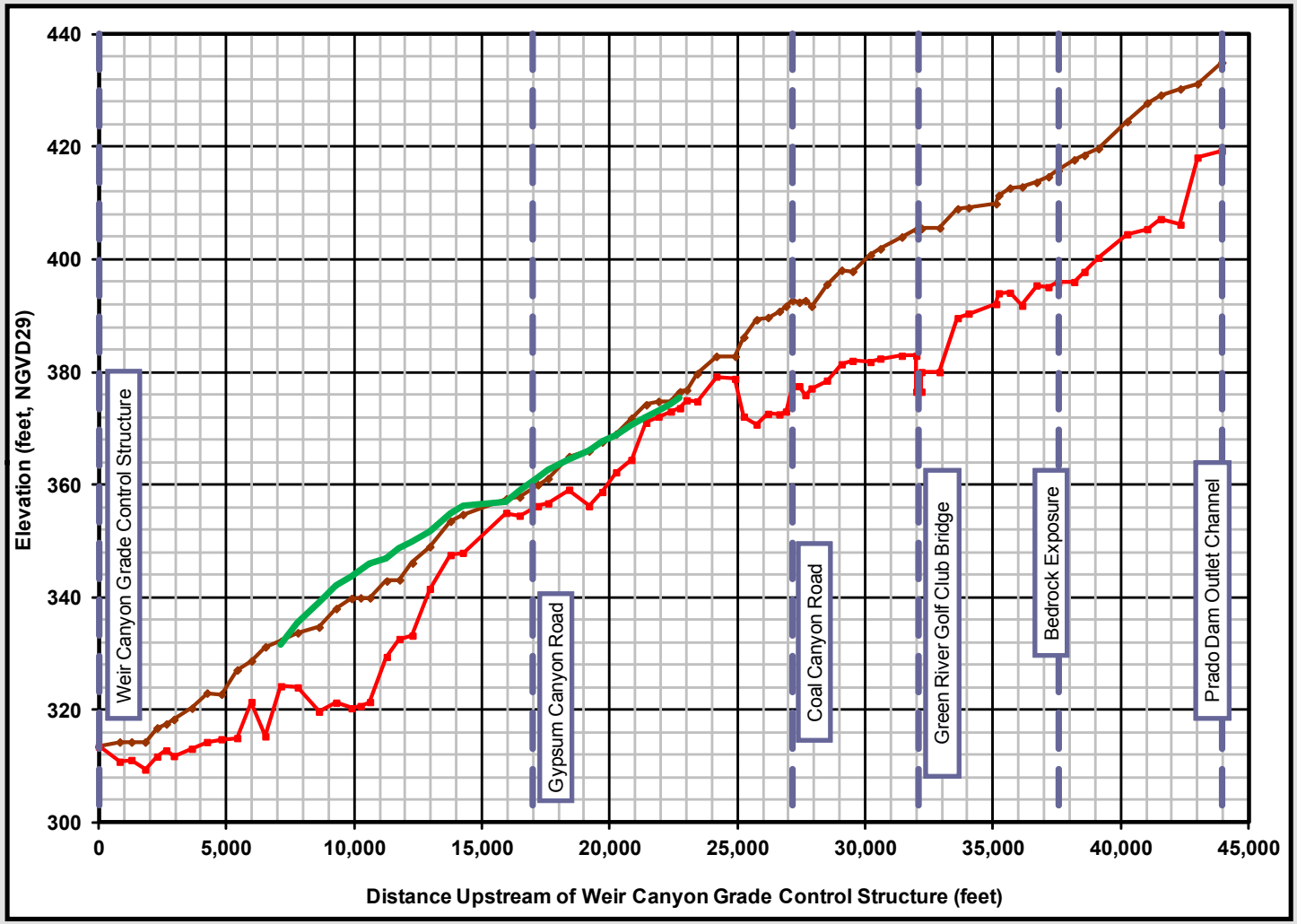
- 2007 Conditions Invert Profile
- Potential Maximum Invert Scour Profile
- Lomas De Yorba-Sur Levee, Existing
- SAVI Ranch Levee, Existing
- BNSF Sheetpiles, Existing
- SARI Sheetpiles, Proposed
- Green River Village Levee, Existing

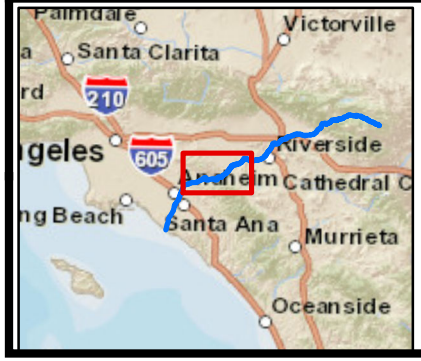
SANTA ANA RIVER
MAINSTEM PROJECT

POTENTIAL MAXIMUM SCOUR
PROFILE AND LOCAL
IMPROVEMENT FEATURES

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Figure 8





Legend

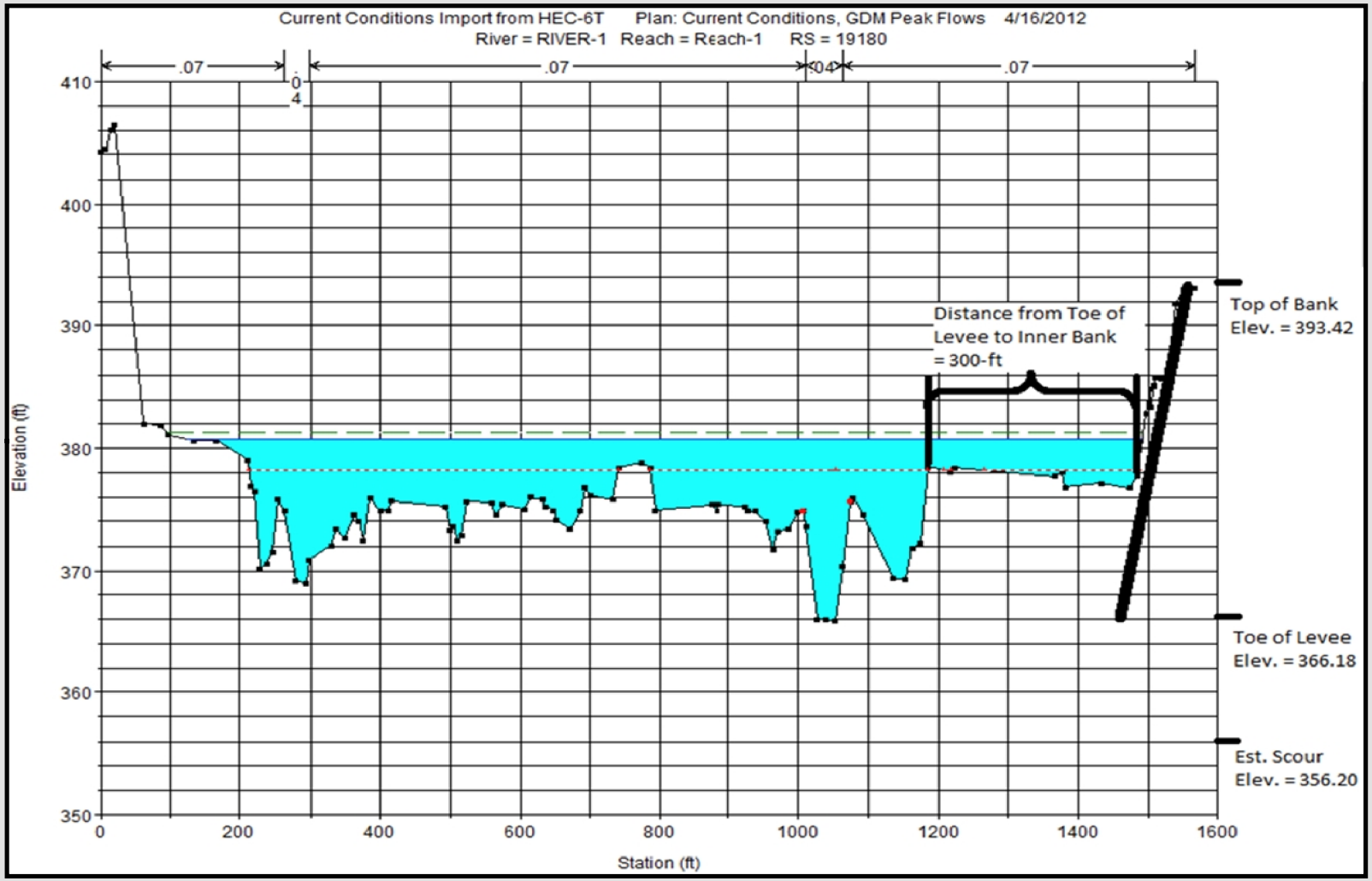
- 2007 Conditions Invert Profile
- Potential Maximum Invert Scour Profile
- Lomas De Yorba-Sur Levee, Existing

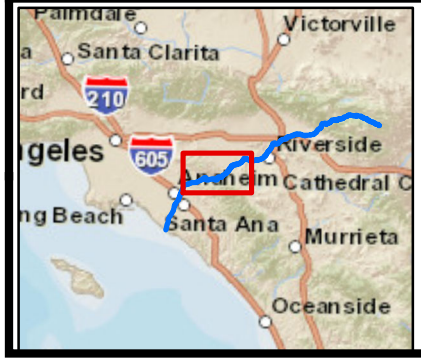
SANTA ANA RIVER
MAINSTEM PROJECT

POTENTIAL MAXIMUM SCOUR
PROFILE AND LOMAS DE YORBA-SUR
LEVEE PROTECTION

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Figure 9





Legend

EG 50-190-YR

WS 50-190-YR

Ground

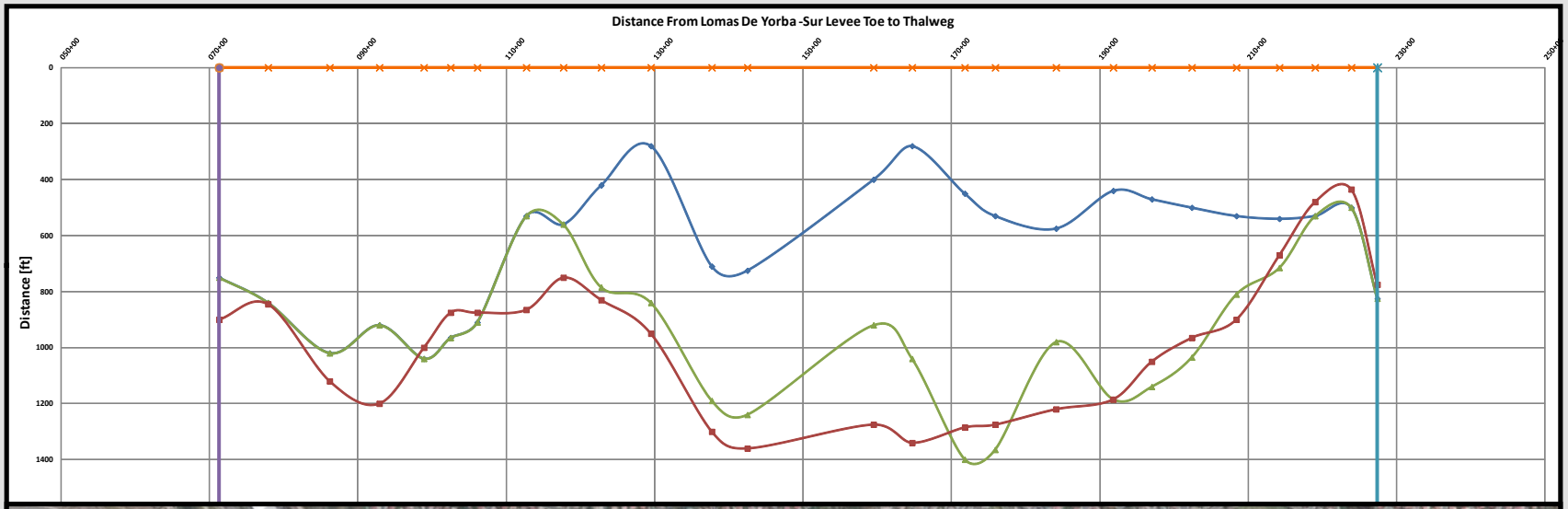
Bank Station

SANTA ANA RIVER
MAINSTEM PROJECT

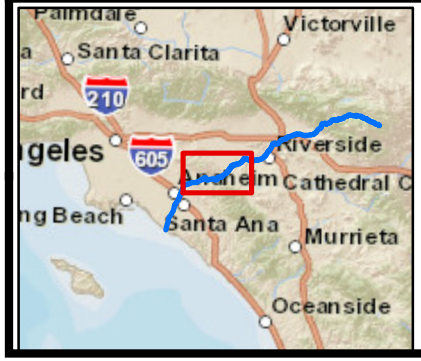
TYPICAL
CROSS-SECTION ALONG
LOMAS DE YORBA-SUR LEVEE

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Figure 10







Legend

- Current Thalweg Min Distance From Toe
- Current Thalweg Max Distance From Toe
- 1979 Thalweg Distance From Toe
- Lomas De Yorba-Sur Levee
- U/S Extent of Lomas De Yorba-Sur Levee
- D/S Extent of Lomas De Yorba-Sur Levee

SANTA ANA RIVER
MAINSTEM PROJECT

HORIZONTAL DISTANCE FROM
LOMAS DE YORBA-SUR LEVEE
TOE TO THALWEG

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Figure 11

Appendix B

2012 & 2015 Biological Opinions

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Carlsbad Fish and Wildlife Office
6010 Hidden Valley Road, Suite 101
Carlsbad, California 92011

In Reply Refer To:
FWS-SB/WRIV/OR-08B0408-11F0551

MAR 28 2012

Colonel R. Mark Toy
District Commander
U. S. Army Corps of Engineers, Los Angeles District
P.O. Box 532711
Los Angeles, California 90053-2325

Attention: Josephine Axt, Ph.D. (Chief) and Hayley Lovan (Project Environmental Coordinator), Planning Division

Subject: Reinitation of Formal Section 7 Consultation on the Prado Mainstem and Santa Ana River Reach 9 Flood Control Projects and Norco Bluffs Stabilization Project, Orange, Riverside, and San Bernardino Counties, California (FWS-SB-909.6)

Dear Colonel Toy:

This letter is in response to your August 19, 2011, letter regarding proposed changes to the "mitigation approach" for the Santa Ana River Mainstem Flood Control Project (SARP). Our biological opinion dated December 5, 2001, addressed the effects of the SARP on the federally threatened Santa Ana sucker (*Catostomus santaanae*), endangered least Bell's vireo (*Vireo bellii pusillus*, "vireo") and its designated critical habitat, and endangered southwestern willow flycatcher (*Empidonax traillii extimus*, "flycatcher"), in accordance with section 7 of the Endangered Species Act of 1973 (Act), as amended (16 U.S.C. 1531 *et seq.*). During the consultation period, we requested additional information and clarification regarding implementation of the SARP. On February 9, 2012, we received the final information necessary to prepare a response to your request. This amendment modifies the original biological opinion to address the requested changes to the project.

Santa Ana River Mainstem Project Consultation History and Current Status

We issued the first biological opinion for the SARP and its effects on federally listed species on October 1, 1980 (1-1-80-F-75). Consultation has since been reinitiated five times to address modifications to the project and/or effects to listed species or critical habitat not previously considered [i.e., U.S. Fish and Wildlife Service (Service) 1989, 2000, 2001, 2003, 2004]. Your agency has completed the following SARP components to date: Seven Oaks Dam, Mill Creek Levees, Oak Street Drain, San Timoteo Creek Flood Control Project, Reaches 1-8 and 10 of the Lower Santa Ana River Channel, the raising of Prado Dam, Prado Dam Outlet Channel, Green River Mobile Home Park Levee, Lower Highway 91 Embankment, Car Wash/Strip Mall Bluff

Stabilization, National Housing Tract Dike, and the Corona Sewage Treatment Plant Dike. The Reach 9 Phase 2A Embankment Project (including the Upper Highway 91 Embankment and Green River Housing Estate Embankment), Green River Golf Club Embankment, and Auxiliary Dike projects are currently under construction. Remaining project components that were addressed in the 2001 biological opinion include Norco Bluffs Toe Stabilization, Prado Petroleum Tank Farm Levee, Alcoa Aluminum Plant Dike, River Road Floodwall, River Road Dike, California Institute for Women Dike, and Yorba Slaughter Adobe Protection.

Changes in the Conservation Measures

The SARP, as described in the 2001 biological opinion, included conservation measures to offset impacts to riparian vegetation for the vireo and perennial stream for Santa Ana sucker. One option to offset impacts to riparian vegetation was to contribute funding to the Trust Fund established by the Santa Ana Watershed Association of Resource Conservation Districts (SAWA) to remove giant reed (*Arundo donax*) from the Santa Ana River watershed and to actively monitor and manage restored habitat for the life of the project. Beginning in 2006, your agency, the U.S. Army Corps of Engineers (Corps), issued contracts to implement the conservation measures pertaining to habitat restoration in a manner that was inconsistent with the 2001 biological opinion. Laws and regulations governing Corps contracts prohibited the release of funding for monitoring and management to be conducted over the life of the project, as originally intended (Lovan 2011, pers. comm.). In addition, a significant portion of the anticipated funding for giant reed removal did not go to the Trust Fund.

Although the Corps informally coordinated with the Service regarding proposed changes in the distribution of funding beginning in 2005, we remained concerned with the apparent lack of a mechanism for ensuring habitat would continue to be maintained after funds were expended. This document identifies and analyzes changes made by the Corps with respect to implementation of specific conservation measures addressing giant reed removal options and other measures that offset impacts to vireo and additional changes in the project's conservation measures that minimize or offset impacts to the Santa Ana sucker.

Changes in the conservation measures addressed by this amendment to the 2001 biological opinion are identified below with deletions in strikeout and additions underlined. To facilitate future reference and implementation of all conservation measures addressed by the 2001 biological opinion and its amendments, Attachment 1 presents a complete description of the conservation measures, including the changes incorporated below.

Specific Conservation Measures Revised by this Reinitiation and Amendment to the 2001 Biological Opinion.

Temporary Disturbance of Riparian/Wetland Habitat (excluding unvegetated perennial stream) (page 12 of the 2001 biological opinion)

- ~~Contribute sufficient funds to the Trust Fund to r~~Remove one acre of giant reed from the upper Santa Ana River watershed and/or action area for each acre of riparian/wetland vegetation that is temporarily disturbed during construction-related activities; actively monitor and manage this acreage for a period of 1 year; and then arrange for the local sponsors (i.e., the County of Orange, County of Riverside, and County of San Bernardino) and/or another approved entity such as the SAWA to ~~until riparian habitat is completely restored; and~~ maintain this acreage giant reed~~*Arundo*~~-free for the life of the project; OR

- Remove three acres of giant reed for each acre of temporary impact and maintain this acreage giant reed-free for a minimum of 5 years.

Permanent Loss of Non-riparian Habitat Within the Flood Plain (page 13 of the 2001 biological opinion)

- ~~Contribute sufficient funds to the Trust Fund to r~~Remove 3 acres of giant reed from the upper Santa Ana River watershed and/or action area for each acre of non-riparian habitat that is permanently destroyed or isolated from the flood plain during construction-related activities; actively monitor and manage this acreage for a period of 5 years; and then arrange for the local sponsors and/or another approved entity such as the SAWA to maintain this acreage giant reed~~*Arundo*~~-free for the life of the project; and conduct cowbird removal trapping in the vicinity of the restored habitat for the life of the project.

Permanent Loss of Riparian Habitat (page 13 of the 2001 biological opinion)

- ~~Contribute sufficient funds to the Trust Fund to r~~Remove 5 acres of giant reed from the upper Santa Ana River watershed and/or action area for each acre of riparian vegetation that is permanently destroyed or isolated from the flood plain during construction-related activities; actively monitor and manage this acreage for a period of 5 years; and then arrange for the local sponsors and/or another approved entity such as the SAWA to maintain this acreage giant reed-free for the life of the project; and conduct cowbird removal trapping in the vicinity of the restored habitat for the life of the project.

General Habitat Creation/Restoration Measures, Mitigation Option for Permanent Impacts (page 14 of the 2001 biological opinion)

- Creation and restoration of riparian habitat will be considered successful when the following target/threshold objectives are met: 1) a minimum of 30 percent absolute ground

cover of native plant species; 2) less than 10 percent absolute ground cover of exotic plant species (including 0 percent giant reed); 3) the absolute ground cover of native species must be represented by~~,~~ at least~~,~~ five dominant or co-dominant plant species; 4) the recruitment of native plant seedlings must be documented to occur within the replanted areas; 5) a positive trend in the diversity and absolute ground cover of native plant species must be observed based on appropriate statistical analyses that account for natural, year to year variations; and 6) the structure and composition of the revegetated area is statistically similar (i.e., not significantly different) to habitat occupied by vireos in the vicinity. Alternatively, riparian revegetation efforts can be considered successful if the habitat is occupied by a breeding pair of vireos, flycatchers, and/or yellow-breasted chats (*Icteria virens*). In addition, habitat must sustain itself for 2 consecutive years without supplemental water.

- All acres of created ~~or restored~~ riparian habitat will be protected in perpetuity through proper legal instruments for the conservation of Federal and State listed species and their habitats.

- ~~Prior to the creation of habitat for the vireo, sufficient funds will be contributed to the OCWD, Trust Fund, or other organization approved by the CDFG and our agency to~~If the habitat creation option is selected, the Corps will ensure that the local sponsors commit to funding a ~~conduct~~ cowbird ~~removal~~ trapping program in the vicinity of the created riparian habitat for the life of the project. Program specifics (e.g., number and locations of traps) will be determined in conjunction with permitting processes for the CDFG and our agency.

- ~~If funding is available, then your agency will make a lump sum payment to the Trust Fund prior to the initiation of project-related activities that disturb habitat for federally listed species. Alternately,~~Mitigation will be initiated as soon as practicable for impacts that occur during the first year of construction~~, funds will be contributed to the Trust Fund within one year of the initiation of construction activities~~. Afterwards, mitigation will be initiated ~~contributions to the Trust Fund will occur~~ prior to construction of individual project features. ~~If for whatever reason the Trust Fund becomes insolvent at a future date and is unable to~~ For restoration options that include management for the life of the project, the Corps will continue exotic species removal (e.g., giant reed) and cowbird control~~s~~) until such time as the Service receives written documentation that the local sponsors and/or another approved entity (such as SAWA) have accepted responsibility for management of the restored area(s). Written documentation will include an estimate of costs associated with management responsibilities and a description of the funding mechanism(s) that will be used to ensure management will continue for the life of the project. If SAWA or another non-public entity accepts management responsibility and then becomes unwilling or unable to continue, then responsibility for continued management will revert to the local sponsors.~~and monitoring and management activities in the upper Santa Ana River watershed and/or action area, then your agency will transfer remaining funding and/or resources to another administrator/contractor or otherwise ensure that the proposed~~

~~conservation measures are continued for the life of the project.~~ Any advance mitigation that exceeds the requirements of the project (i.e., if actual project impacts are less than what was anticipated when the mitigation was initiated), ~~funds contributed above and beyond the amounts prescribed herein~~ may be credited as compensation for the effects of future projects.

- ~~Ensure that the administrator of the Trust Fund identifies~~ Identify and delineates on well-labeled maps the specific areas in the upper Santa Ana River watershed and/or action area from which giant reed will be or has been removed, and riparian vegetation restored, as compensation ~~using funding contributed by your agency~~ for the proposed action. These areas must be approved by the local sponsors, CDFG, and our agencies. An annual report will be prepared for the Service by the approved management entity (e.g., SAWA) ~~required~~ that addresses the following information: 1) accomplishments during the previous year; 2) what is anticipated to be accomplished during the upcoming year; 3) results of monitoring and management; and 4) updated mapping that delineates areas in the upper Santa Ana River watershed and/or action area from which giant reed has been removed~~; and 5) an itemized financial accounting/report~~.

- Request that the administrator of the Trust Fund identify those acres within the ~~San Timoteo Creek system~~Santa Ana Watershed where ~~within which~~ giant reed was previously removed and/or habitat restored using the $1,000,000 contributed by the OCWD in lieu of restoring 133 acres of riparian habitat in the Prado Basin. This acreage ~~must~~will be actively monitored and managed until riparian habitat is completely restored, and then maintained giant reed-free for the life of the project.

Maintenance and Management of Riparian Habitat Downstream of Prado Dam (page 15 of the 2001 biological opinion)

- Prior to initiating construction-related activities downstream of Prado Dam, provide written documentation that 1,~~233~~100 acres of land, including 789 acres of land within the flood plain along the Santa Ana River as depicted in Figure 1, ~~have been obtained in fee title and protected via conservation easement, deed restriction, or other protection mechanism to provide for the conservation of the vireo and other Federal and State listed speciesis~~are held in public domain as property of Orange County, California State Parks, or other public entities "for floodplain management in keeping with open space and wildlife habitat values" (Corps 1988, page SEIS-V-66). The County of Orange will provide additional information concerning the status of the *Habitat Management Plan* area and a map of the area delineating vegetation types, acreages, and land use activities (including potential recreational uses and areas where the conservation of listed species and their habitats will be the primary land use).

Specific Conservation Measures for the Sucker: (page 18 of the 2001 biological opinion)

- ~~Implement a "trap and haul" program to periodically trap suckers from existing pools downstream of existing drop structures (i.e., impediments or barriers to upstream movement) and transport and release the fish in favorable habitat upstream (e.g., upstream of the Prado Dam reservoir). Your agency has agreed to meet with the CDFG, our agency, and other experts on the species to design an efficient, cost-effective program. Non-native predators of the sucker that are caught during trapping bouts will be destroyed rather than released. This conservation measure is intended to provide "out-of-kind" compensation for the destruction of 1,850 feet of unvegetated perennial streambed habitat (i.e., current outlet structure) for the sucker.~~The "trap and haul" program that was included in the 2001 Biological Opinion shall be discontinued and replaced with an additional three acres of stream restoration as described below, for a total of 10.9 acres of created/enhanced streambed.

- Create and/or enhance one acre of perennial stream habitat within the Santa Ana River or its tributaries for each acre of unvegetated perennial stream that is temporarily or permanently disturbed during construction-related activities. ~~(~~The estimated total of disturbed habitat is approximately ~~13.2~~7.9 acres ~~[9.0~~(4.4 acres of permanent effects and ~~4.2~~3.5 acres of temporary effects~~]~~, not including the previously concreted portion of the Green River Golf Course channel[1]). A conceptual habitat creation plan will be reviewed and approved by ~~our agency~~the Service prior to initiating construction activities that will affect perennial stream habitat for the sucker. Creation/enhancement activities could include but are not limited to the following:

  - The development of pool-riffle complexes by placing clusters of various sized boulders within the river channel to provide limited cover and areas of reduced water velocity.

  - The creation of potential spawning/larval habitat downstream of Prado Dam. For example, San Marino Environmental Associates identified Aliso Creek, which is a tributary downstream of Prado Dam within Chino Hills State Park, as a possible restoration site for sucker spawning habitat in their *Conservation Program for the Santa Sucker in the Santa Ana River, Southern California, December 1999.*

  - The creation of lateral stream habitats (i.e., very shallow areas along the stream margin with little current) that are ~~apparently~~believed to be essential for the survival of larval suckers.

---

[1] At the time the 2001 biological opinion was issued, a 4.7-acre section of perennial stream habitat within the Green River Golf Club Embankment Project area was lined with concrete, and it was assumed the concrete channel would remain in that area. Although the concrete washed out during the winter storm season in early 2005, the Corps is not proposing to offset impacts to this section of stream. In the Corps' view, the replacement of this section with permanent soft-bottom channel (in lieu of repairing the broken concrete to the previous designed condition) is self-mitigating.

Effects of Proposed Changes in Conservation Measures on the Vireo

An estimated 59.2 acres of riparian vegetation were temporarily or permanently impacted and 6.2 acres of upland vegetation were permanently impacted from construction of SARP components that were addressed in the 2001 biological opinion (Table 1). Refinements to the design of individual project components and updated vegetation mapping have resulted in a 20.4-acre increase in impacts to riparian vegetation relative to what was anticipated in Table 6 of the 2001 biological opinion. Compensation for impacts based on the original conservation measures would have resulted in the removal of 133 acres of giant reed. The area containing the 133 acres would then be actively monitored and maintained (including cowbird trapping and giant reed control) for the life of the project at an estimated cost of approximately $50,000 per acre or a total of about $6,650,000. The $6,650,000 was to be deposited in the Trust Fund and managed by SAWA to generate interest adequate to cover monitoring and management costs.

Funding provided by the Corps in accordance with applicable contracting laws and regulations allowed for treatment of a much larger area within the watershed than originally anticipated, but no additional funds remain to maintain these areas beyond the contract period. A total of $1,959,000 was provided to SAWA for giant reed removal and control in Mystic Lake (San Jacinito Wash) and several areas along the main channel of the Santa Ana River ("mainstem") between La Cadena Avenue and Hamner Avenue. The Corps also contracted with Agri Chemical and Supply, Inc. to remove approximately 131 acres of giant reed from a 250-acre area between Hamner Avenue and River Road and to maintain and monitor this area for a 5-year period. In total, funding provided by the Corps supported the removal of 154.4 acres of giant reed from areas that had not been previously treated, the maintenance of 1,341 acres of previously treated areas for 1 year, and the maintenance of 250 acres for 5 years (Table 1). Additional funding, equivalent to the costs of operating 15 cowbird traps per year for 7 years, was provided by the Corps to offset temporary impacts to riparian vegetation in Reach 9.

Monitoring conducted in the watershed by SAWA demonstrates that giant reed removal is contributing to an increase in functional riparian habitat for the vireo (SAWA 2010) and that cowbird trapping is contributing to an increase in vireo productivity by keeping nest parasitism levels low (Hoffman and Zembel 2011); however, on-going management is necessary to ensure the quality of habitat for the vireo is maintained over the long term. Cowbird parasitism is a continuing threat where riparian habitats are located adjacent to urban areas, dairies, livestock operations, and/or agricultural fields. Trapping efforts in the watershed are coordinated by SAWA to ensure appropriate trap placement (i.e., concentrated in areas with high densities of cowbirds). SAWA has removed over 90,000 cowbirds from the watershed since 2000, and only 3 percent of observed nests failed due to parasitism in 2010 (Hoffman and Zembel 2011).

Table 1. Impacts to riparian and non-riparian (i.e., upland) vegetation associated with construction of SARP project features that resulted in giant reed removal/maintenance (* - impacts not mitigated with giant reed removal).

Project Feature	Riparian Vegetation Impacts (acres)		Non-Riparian Floodplain Impacts (acres)	Contribution to SAWA	Giant Reed Removal and Maintenance
	Permanent	Temporary	Permanent		
Car Wash Strip Mall[1]	0.4	6.7	0.2	$1,434,500	1 year of maintenance of 1,217 acres within the Santa Ana River Watershed (previously treated areas) including Norco Burn site (485 acres), mainstem between La Cadena and Mission Avenues (500 acres), and Mystic Lake Phase 3 (232 acres)
Lower Highway 91[2]	0.8	8.2	0.0		
Prado Outlet[3]	0	5.6	*		
Sewage Treatment Plant and National Housing Tract Dikes[3]	0.6	2.2	*		
Mobile Home Park[4]	0.3	0.7	1.0	$525,000	23.4 acres of giant reed removed and 124 acres maintained for 1 year within Hidden Valley Wildlife Area
Green River Golf Club (Reach 9 Phase 2B)[5]	0.0	9.4	0.0	Contract to Agri Chemical and Supply	131 acres of giant reed removed and 250 acres maintained for 5 years.
Upper Highway 91, Green River Housing Estates (Reach 9 Phase 2A)[4]	10.2	12.6	5.0		
Auxiliary Dike[4]	1.5	*	*		
Total	13.8	45.4	6.2	$1,959,000 to SAWA plus contract to Agri Chemical and Supply	154.4 acres of giant reed removed, 1,341 acres maintained for 1 year, 250 acres maintained for 5 years.
Anticipated Giant Reed Removal using conservation measures from 2001 biological opinion	5:1 = 69.0	1:1 = 45.4	3:1 = 18.6	133.0 acres at $50,000 per acre = $6,650,000	133.0 acres restored and maintained giant reed-free in perpetuity

[1] Actual impacts based on Apsen Environmental Group (2010a, b).
[2] Actual impacts based on Apsen Environmental Group (2010a).
[3] Actual impacts based on Apsen Environmental Group (2011). Includes only impacts beyond what was anticipated in Corps (1988).
[4] Estimated impacts based on Jones (2011, pers. comm.). Auxiliary Dike includes only impacts beyond what was anticipated in Corps (1988).
[5] Estimated impacts based on Jones (2012a, pers. comm.).

Giant reed is difficult to completely eradicate, and the potential for re-infestation from upstream sources is high. For example, the number of vireo territories located in the mainstem between Goose Creek Golf Club (upstream from Interstate 15) and River Road increased from 28 in 2004 to 101 in 2010, following the removal of giant reed in 2003 (i.e., 485-acre Norco Burn site) and subsequent re-colonization with native riparian vegetation (Hoffman and Zembel 2011). Funding provided by the Corps assisted in maintaining this area for 1 year, but a new $54,000 spray contract was issued for the Norco Burn site using alternative funding sources in 2011 to treat re-infestations of giant reed, tree of heaven (*Ailanthus altissima)*, tree tobacco (*Nicotiana glauca*), and castor bean (*Ricinus communis*) that continue to wash in from untreated areas immediately upstream (Reeder 2011, pers. comm.). SAWA regularly works with private landowners to gain access for treatment and successfully gained access to remove invasive plants upstream from the Norco Burn site in 2011. Without substantial funding for on-going monitoring and management, we expect the quality of habitat for the vireo will rapidly decline in previously managed areas.

Proposed changes in the conservation measures implemented to offset project impacts on vireo include the transfer of responsibility for long-term management of habitat from the Corps to the local sponsors or another Service-approved entity (such as SAWA). To ensure management will continue for the life of the project, the Corps has agreed to provide written documentation that the proposed entity has accepted responsibility for management of the restored area(s) and a description of the funding mechanism(s) that will be used to cover management costs. Orange County Flood Control District is ultimately responsible for the costs of mitigation related to SARP construction at Prado Dam and Basin, and Reach 9 as described in *Local Cooperative Agreement Among the Department of the Army, Orange County Flood Control District, San Bernardino County Flood Control District and Riverside County Flood Control and Water Conservation District for the Contruction of the Santa Ana River Mainstem, Including Santiago Creek, California Flood Control Project* (Version 12/13/89).

At present, SAWA has agreed to accept responsibility for long-term management (including giant reed control and cowbird trapping), for as long as it has sufficient funding to do so. In response to a request from the Corps that SAWA manage the 250-acre area in Norco, SAWA provided a letter dated August 22, 2011, documenting their willingness to manage not only the 250-acre area, but all of the Corps' previous mitigation areas. Long-term management of the 250-acre area (from which 131 acres of giant reed was removed) is sufficient to offset all of the SARP-related impacts included in Table 1. Because Orange County Flood Control District is obligated to take responsibility for long-term management should SAWA request to be released from its management obligations in the future, we consider the proposed measures sufficient to ensure long-term management will continue for the life of the project.

Proposed changes in the conservation measures also include an alternative to reduce long-term management obligations associated with temporary impacts to riparian habitat. The proposed alternative increases the ratio for temporary impacts from 1:1 to 3:1 and decreases the maintenance period to 5 years. Because monitoring conducted by the Corps has demonstrated

that vireos recolonized temporary impact areas less than 5 years following the completion of project impacts, 5 years of giant reed control will contribute to improving the overall quality of habitat for vireo in the watershed until vegetation within temporary impact areas is restored. For example, the Car Wash Strip Mall Embankment Project site was initially impacted in 2002/2003. Quantitative vegetation surveys documented 52 percent cover of native vegetation in 2008. Vireo began nesting on the site in 2007, and four pairs were observed in and adjacent to the site by 2008 (Aspen 2010c).

Effects of Proposed Changes in Conservation Measures on the Santa Ana Sucker

An estimated 12.6 acres of perennial stream have been impacted from construction of SARP components in Reach 9 (Table 2). Compensation for impacts based on the original conservation measures would have resulted in the creation and/or enhancement of 1 acre of stream habitat for each acre temporarily or permanently impacted for a total of 12.6 acres. Proposed changes in the conservation measures implemented to offset project impacts on Santa Ana suckers include: 1) restoring 3 acres of additional stream habitat in lieu of implementing a "trap and haul" program and 2) not offsetting impacts to a 4.7-acre section of stream channel within the Green River Golf Club Embankment project area that was concrete-lined prior to the 2005 winter storm season. Based on the proposed measures, the Corps would enhance/create 10.9 acres.

Table 2. Impacts and enhancement to perennial stream habitat (Corps 2012, Jones 2012a, pers. comm.).

Project Feature	Perennial Stream Impacts (acres)			Proposed Habitat Enhancement/Creation (acres)
	Permanent	Temporary	Total	
Car Wash/Strip Mall	0.0	1.1	1.1	1.1
Green River Golf Club	0.0	7.1[1]	7.1	2.4
Outlet Works	4.4	0.0	4.4	4.4
Trap and Haul Program	N/A	N/A	N/A	3.0
Total	4.4	8.2	12.6	10.9

[1] Includes 4.7 acres of channel that was lined with cement prior to 2005.

Temporary impacts to habitat for construction of the Car Wash Strip Mall Embankment (1.1 acre) were offset by enhancing the site with a meandering channel construction and the placement of gravel, cobble, and boulders in the new channel. The site was monitored for approximately 1 year to evaluate restoration efforts. Monitoring demonstrated the newly created channel provided more diverse fish habitat than the original channel (SMEA 2005). Created habitat features were short-lived, however, as high velocity flows during winter storm events in 2005 straightened the channel and flushed the substrate downstream. The availability of habitat for the Santa Ana sucker in the Car Wash Strip Mall project reach has since been dictated by hydrological processes.

The remaining 9.9 acres will be restored/created adjacent to the Green River Golf Club Embankment Project (Corps 2012). The proposed Reach 9, Phase 2B Perennial Stream Restoration Project will improve the channel condition by increasing the total aquatic habitat on the site by 2.8 acres and increasing the buffer of riparian/upland vegetation surrounding the creek by 6.5 acres. The Corps has estimated the 9.3-acre increase in habitat will expand the potential stream meander width by an average of 136 feet (Jones 2012b, pers. comm.). The increase in channel width will reduce velocities through the restoration reach during high flow events relative to the baseline condition.

In addition, the restoration project includes several features to increase the habitat complexity for the Santa Ana sucker. Side drains will outlet into the habitat in a way that will allow access for Santa Ana suckers and will provide potential refugia during high flow events (Corps 2012). Boulders placed around the side drains will help to maintain meanders in the stream channel, and shallow gravel bars will be placed along the low flow channel to provide potential spawning and foraging habitat. Boulders will also be arranged in the channel to encourage the development of riffle/pool complexes along the length of the restoration area. The habitat features, particularly the substrates, are not all expected to remain on the site over the long term, and the length of time they will remain in place is dependent on the magnitude and timing of storm flows (Corps 2012). Therefore, the restoration project will provide a short-term benefit for the Santa Ana sucker but will not contribute to the long-term recovery of the species. To effect recovery, we anticipate changes in the operations and maintenance of Prado Dam and reservoir will be necessary to address hydrological conditions that are currently limiting the suitability of habitat below Prado Dam for Santa Ana sucker.

The intended purpose of the "trap and haul" program was to maintain genetic connectivity between populations of Santa Ana suckers above and below Prado Dam in lieu of providing a fish passageway through the dam. The design of the new outlet structure (i.e., baffles, cement lined channel, and drop structure) was anticipated to significantly increase the potential for injury or death of Santa Ana suckers moving downstream past Prado Dam (Service 2001). Santa Ana suckers were to be collected from areas downstream of existing barriers with no known spawning habitat (e.g., below Weir Canyon Road) and released into favorable habitat upstream (e.g., upstream of Prado Dam reservoir).

Given the extremely low numbers of Santa Ana suckers captured below Prado Dam since the species was listed, it is not certain that there is a viable breeding population supported in Reach 9. Despite numerous survey efforts below Prado Dam (e.g., Haglund and Baskin 2004; RCRCD 2005, 2010; Baskin and Haglund 2008; ECORP 2009), only six Santa Ana suckers have been captured since 2001, all in conjunction with monitoring for the SARP. Five Santa Ana suckers were collected in the old Prado Dam outlet channel, immediately upstream from the Reach 9, Phase 2A project area, and one was located in the Green River Golf Club Embankment Project area.

While Prado Dam is limiting connectivity with the population upstream, there are several other important factors (e.g., altered hydrology, non-native fish, and water quality) that are reducing the potential for Reach 9 to support Santa Ana sucker (Service 2011). Until habitat conditions for the Santa Ana sucker are improved to the point where a viable breeding population is established, there is little benefit to the species from implementing a "trap and haul" program. There are too few fish available to be captured. The creation/enhancement of an additional 3 acres of habitat will provide a greater benefit to the species at this time. Once a viable population is again established below the dam, then the question of maintaining connectively may need to be readdressed, potentially as part of a future consultation with the Corps on the operation of Prado Dam.

Conclusion

With the proposed changes in conservation measures, management of habitat for the vireo will continue for the life of the project as anticipated. We also anticipate that the proposed restoration achieved by the project will be equivalent to what was anticipated for the vireo and Santa Ana sucker. Therefore, the conclusions in our 2001 biological opinion that the proposed action is not likely to jeopardize the continued existence of the vireo or Santa Ana sucker remain valid. The proposed changes in conservation measures will not affect the anticipated level of take associated with the project, so the incidental take statement, reasonable and prudent measures, and terms and conditions remain unchanged.

Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. These recommendations are intended to supplement those included in the 2001 biological opinion.

- Although 4.7 acres of perennial stream habitat within the Green River Golf Club Embankment Project area was concrete lined in early 2005, we disagree that this impact should be discounted. Winter storms broke apart the concrete in early 2005, and aquatic habitat was in the process of returning to a more natural condition when the habitat was impacted in the fall of 2009. Therefore, we recommend the Corps offsets impacts to 4.7 acres of stream habitat that resulted from construction of the project.

- Specific project features included in the proposed Reach 9, Phase 2B Perennial Stream Restoration Project are expected to increase the diversity of habitats within the reach; however, the longevity of these features will be dependent on hydrological processes of the river system. Because the hydrological processes play an overarching role in the availability of habitats for the Santa Ana sucker, understanding the processes necessary to

maintain habitat diversity over time will play a crucial role in the recovery of the species. Until such time as these larger processes can be fully understood and addressed, we recommend the Corps continue to monitor and manage habitat within the Reach 9, Phase 2B Perennial Stream Restoration Project area to ensure quality habitat for the Santa Ana sucker is maintained.

Reinitiation Notice

This concludes formal consultation on the modified "mitigation approach" for the Santa Ana River Mainstem Flood Control Project as outlined in materials submitted to us. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; and (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Should you have any questions regarding this letter, please contact Christine Medak of my staff at (760) 431-9440, extension 298.

Sincerely,

Karen A. Goebel

Karen A. Goebel
Assistant Field Supervisor

cc:
Kimberly Freeburn-Marquez, California Department of Fish and Game (Ontario)

LITERATURE CITED

Aspen Environmental Group. 2010a. Project memorandum USACE Prado Basin and Santa Ana River Maintstem (Reach 9) Project, Prado Basin/Reach 9 Santa Ana River Annual Report for 2002. Prepared for U.S. Army Corps of Engineers, Los Angeles District. June 7.

Aspen Environmental Group. 2010b. Project memorandum USACE Prado Basin and Santa Ana River Maintstem (Reach 9) Project, Prado Basin Annual Report for 2003. Prepared for U.S. Army Corps of Engineers, Los Angeles District. July 27.

Aspen Environmental Group. 2010c. Project memorandum USACE Prado Basin and Santa Ana River Maintstem (Reach 9) Project, Prado Basin Annual Report for 2008. Prepared for U.S. Army Corps of Engineers, Los Angeles District.

Aspen Environmental Group. 2011. Project memorandum USACE Prado Basin and Santa Ana River Maintstem (Reach 9) Project, Recalculation of Acreage Impacts at the Prado Embankment and Dikes. Prepared for U.S. Army Corps of Engineers, Los Angeles District.

Baskin, J. N. and T. R. Haglund. 2008. Fish Protection Activities at Prado Dam, Corona, California. Prepared for U.S. Army Corps of Engineers, Los Angeles District.

Corps (U.S. Army Corps of Engineers). 1988. Santa Ana River Design Memorandum No. 1 Phase II GDM on the Santa Ana River Maintstem including Santiago Creek. Main Report & Supplemental Environmental Impact Statement, dated August 1988.

Corps (U.S. Army Corps of Engineers). 2012. Santa Ana River Main Stem Project Reach 9, Phase 2B Perennial Stream Restoration Project. Planning Division, Army Corps of Engineers, Los Angeles District, Los Angeles, California. January.

ECORP Consulting, Inc. 2009. 45-day survey report on pre-construction presence/absence surveys for the Santa Ana sucker (*Catostomus santaanae*) at three locations on the Santa Ana River.

Haglund, T. R. and Baskin, J. N. 2004. Santa Ana sucker protection during stream re-diversion in Reach 9 of the Santa Ana River. Prepared for U.S. Army Corps of Engineers, Los Angeles District. February 2004.

Hoffman, M. S. and D. Zembal. 2011. Status and management of the least Bell's vireo and southwestern willow flycatcher in the Santa Ana River Watershed, 2010, and summary data by site and watershed-wide, 2000-2010. Prepared by the Santa Ana Watershed Association for Orange County Water District and U.S. Fish and Wildlife Service.

RCRCD (Riverside-Corona Resource Conservation District). 2005. Prado Dam channel improvement project native fish protection and relocation. Summary Report for first and second diversions, April 25-28 and May 3, 2005.

RCRCD (Riverside-Corona Resource Conservation District). 2010. Field report for native fish relocation for ACOE Reach 9 channel diversions.

SAWA (Santa Ana Watershed Association). 2010. Santa Ana Watershed Association 2010 Annual Report, Reach 3B Mitigation Project, San Timoteo Canyon.

Service (U.S. Fish and Wildlife Service). 1989. Biological opinion and conference on the Corps of Engineers Santa Ana River Project in San Bernardino, Riverside, and Orange Counties, California (#1-6-88-F-6). June 22, 1989.

Service (U.S. Fish and Wildlife Service). 2000. Amendment to formal section 7 consultation, Santa Ana Mainstem Project, Orange County, California (1-88-F-6-R1). On file, U.S. Fish and Wildlife Service Carlsbad Fish and Wildlife Office, Carlsbad, California.

Service (U.S. Fish and Wildlife Service). 2001. Biological opinion on the Prado Mainstem and Santa Ana River Reach 9 Flood Control Projects and Norco Bluffs Stabilization Project, Orange, Riverside, and San Bernardino Counties, California. On file, U.S. Fish and Wildlife Service Carlsbad Fish and Wildlife Office, Carlsbad, California.

Service (U.S. Fish and Wildlife Service). 2003. Biological opinion on the Car Wash Strip Mall Project feature, Santa Ana River Mainstem Flood Control and Norco Bluffs Toe Stabilization Projects, Orange, Riverside, and San Bernardino Counties, California. On file, U.S. Fish and Wildlife Service Carlsbad Fish and Wildlife Office, Carlsbad, California.

Service (U.S. Fish and Wildlife Service). 2004. Reinitiation of formal section 7 consultation for the Prado Mainstem and Santa Ana River Reach 9 Flood Control Projects and Norco Bluffs Stabilization Project, Orange, Riverside, and San Bernardino Counties, California (FWS-SB-909.6). On file, U.S. Fish and Wildlife Service Carlsbad Fish and Wildlife Office, Carlsbad, California.

Service (U.S. Fish and Wildlife Service). 2011. Santa Ana sucker (*Catostomus santaanae*) 5-Year Review: Summary and Evaluation. Carlsbad Fish and Wildlife Office, Carlsbad, California.

SMEA (San Marino Environmental Associates). 2005 Monitoring of the Santa Ana River Reach 9 Diversion: April-December 2004. Prepared for the U.S. Army Corps of Engineers, Los Angeles District, Los Angeles, California.

Personal Communication

Jones, C. 2011. Corps, electronic message to C. Medak, Carlsbad Fish and Wildlife Office, November 30, 2011.

Jones, C. 2012a. Corps, electronic message to C. Medak, Carlsbad Fish and Wildlife Office, February 9, 2012.

Jones, C. 2012b. Corps, electronic message to C. Medak, Carlsbad Fish and Wildlife Office, February 16, 2012.

Lovan , H. 2011. Corps, electronic message to C. Medak, Carlsbad Fish and Wildlife Office, August 29, 2011.

Reeder, L. 2011. Executive Director, Santa Ana Watershed Association, SAWA Mainstem Restoration Efforts 2010-2011, provided in an electronic message to C. Medak, Carlsbad Fish and Wildlife Office, November 23, 2011.

Attachment 1

Conservation Measures[2]

As part of the project description for the original biological opinion (#1-6-88-F-6; June 22, 1989) regarding the Mainstem project, your agency agreed to restore 133 acres of riparian forest to compensate for impacts resulting to the vireo from the construction of haul roads and berm placements and the periodic loss and disruption of a total of 133 acres of habitat between 490 and 500 feet elevation due to inundation (1989). Also, the County of Orange provided $450,000 to fund a vireo monitoring and management program in the Prado Basin and environs (Letter dated May 20, 1992, from Elayne Rail of the County Orange, Environmental Management Agency, to the Corps).

This initial commitment to restore 133 acres of riparian habitat was apparently later superseded by a 1994 Cooperative Agreement between and among the OCWD, the Department of Interior, and your agency (Corps 2001a, c). In 1994, the OCWD and your agency proposed to implement seasonal water conservation to an elevation of 505 feet within the Prado Basin (as indicated in the project description of biological opinion #1-6-95-F-28) that would adversely affect many of the same acres of riparian habitat for the vireo that were evaluated in the 1989 biological opinion regarding the Mainstem project. Because the water conservation activities were implemented prior to the Prado Basin portion of the Mainstem Project, and the estimated cost of restoration of 133 acres of upland habitat within the Prado Basin to riparian vegetation was higher than anticipated, the OCWD agreed to contribute $1,000,000 to the Santa Ana Watershed Association of Resource Conservation Districts (Trust Fund) in lieu of restoring the previously mentioned 133 acres. The monetary contribution was to be used for the removal of exotic species along the Santa Ana River and its tributaries, and the restoration of riparian habitat for the vireo and other species.

The 1988 SEIS required that 1,100 acres of post-project flood plain in the Santa Ana River canyon be acquired or kept in public ownership and managed for open space and wildlife habitat values (County of Orange 2001). The acquisition and management of these lands was intended to offset adverse impacts to wildlife to a level of non-significance, and was to be implemented prior to the completion of construction. Since the circulation of the SEIS, Orange County has begun to acquire lands within the post-project, 100-year flood plain from Prado Dam to Weir Canyon Road bridge for flood plain management. Approximately 789 acres of land within the floodplain have been obtained in fee title. These lands total approximately 1,100 acres and will be operated and maintained for open space and wildlife habitat in accordance with the *Santa Ana River Canyon Habitat Management Plan* (County of Orange 2000). This plan was developed by your agency and the Orange County Flood Control District in consultation with numerous public resource agencies including the Service and CDFG, citizens, and public interest groups at the Federal, State and local levels. The Local Sponsors are responsible for implementing management commitments for the habitat resources and flood plain within their respective

[2] Refer to 2001 biological opinion for literature cited in the Conservation Measures

jurisdictions. Though an estimated 1,233 acres of the Santa Ana River Canyon are currently held in public domain, including 789 acres of floodway and 444 acres of non-floodway property, a golf course in the floodway has not yet been purchased (Corps 2001c).

The primary management commitment of the *Santa Ana River Canyon Habitat Management Plan* is the retention of existing habitat as permanent open space. The local sponsors are responsible for implementing management commitments for the habitat resources and flood plain within their respective jurisdictions. The *Santa Ana River Canyon Habitat Management Plan* (County of Orange 2000; Volumes I, II, and III) provides a detailed list of commitments, reference maps, and supporting documentation, including biological surveys.

Per commitments made in the EIS for the 1980 Phase I GDM and the 1988 EIS for the Phase II GDM, the objectives of commitments related to flood control and water resources within the *Habitat Management Plan* area are to maintain and protect existing facilities and not change or modify the natural streambed and flood plain (Corps 2001a). In addition, the *Habitat Management Plan* area will be allowed to revegetate through natural processes following storm events, and flow rates and water quality will be monitored (Corps 2001a).

As part of the proposed project-related activities, your agency and/or your agents and sponsors have agreed to implement the following measures to avoid or minimize effects to the vireo and its designated critical habitat, flycatcher, sucker, and yellow-billed cuckoo, which is a State-listed species and a Federal candidate species (Agency Agreement 2001; BA; Corps 2001a, b, c). Acreages of disturbance and compensation were estimated based on the best available project designs. If less acreage is actually disturbed, then compensation will be commensurably reduced (Agency Agreement 2001):

<u>Temporary Disturbance of Riparian/Wetland Habitat (excluding unvegetated perennial stream)</u>

- Successfully restore each acre of riparian vegetation that is temporarily disturbed during construction-related activities. Keep all temporarily disturbed areas free of exotic plants until riparian vegetation is re-established. If the site(s) have not begun to recover within 5 years (i.e., 50 percent of the disturbed areas are not vegetated with young riparian vegetation), then the site(s) will be replanted with cuttings from native riparian species.

- Non-riparian areas that are temporarily disturbed will be maintained free of exotic plants for 8 years.

- Remove 1 acre of giant reed from the upper Santa Ana River watershed and/or action area for each acre of riparian/wetland vegetation that is temporarily disturbed during construction-related activities; actively monitor and manage this acreage for a period of 1 year; and then arrange for the local sponsors (i.e., the County of Orange, County of Riverside, and County of San Bernardino) and/or another approved entity such as the SAWA to maintain this acreage giant reed-free for the life of the project;

OR

Remove 3 acres of giant reed for each acre of temporary impact and maintain this acreage giant reed-free for a minimum of 5 years.

- Conduct brown-headed cowbird (*Molothrus ater*, "cowbird") removal trapping at a minimum of 5 sites in the Norco Bluffs area and 15 sites in the Reach 9 for at least 7 years during and following construction. Alternatively, a cash contribution will be made to the Trust Fund for the equivalent amount of cowbird trapping in the upper Prado Basin and Reach 9. Trapping will occur during the vireo and flycatcher egg-laying season (March 15 to July 30). This effort is intended to supplement on-going cowbird trapping activities elsewhere in the Prado Basin;

Permanent Loss of Non-riparian Habitat Within the Flood Plain

- Successfully create one acre of flood plain within the action area for each acre of non-riparian habitat that is permanently destroyed or isolated from the flood plain during construction-related activities (estimated total of destroyed or isolated non-riparian habitat is approximately 24 acres, excluding unvegetated perennial stream, Corps 2001g). These areas will be kept free of exotic plants for 8 years.

OR

Remove 3 acres of giant reed from the upper Santa Ana River watershed and/or action area for each acre of non-riparian habitat that is permanently destroyed or isolated from the flood plain during construction-related activities; actively monitor and manage this acreage for a period of 5 years; and then arrange for the local sponsors and/or another approved entity such as the SAWA to maintain this acreage giant reed-free for the life of the project; and conduct cowbird removal trapping in the vicinity of the restored habitat for the life of the project.

Note: A combination of these alternatives can be used to fulfill the requirements of this conservation measure.

Permanent Loss of Riparian Habitat

- Successfully create 3 acres of riparian vegetation within the action area for each acre of riparian vegetation that is permanently destroyed or isolated from the flood plain during construction-related activities.

OR

Remove 5 acres of giant reed from the upper Santa Ana River watershed and/or action area for each acre of riparian vegetation that is permanently destroyed or isolated from the flood plain during construction-related activities; actively monitor and manage this acreage for a period of 5 years; and then arrange for the local sponsors and/or another approved entity such as the SAWA to maintain this acreage giant reed-free for the life of the project; and conduct cowbird removal trapping in the vicinity of the restored habitat for the life of the project.

Note: A combination of these alternatives can be used to fulfill the requirements of this conservation measure.

General Habitat Creation/Restoration Measures, Mitigation Option for Permanent Impacts

- Creation activities will be initiated as soon as project activities within the creation area are completed. Restoration activities will be initiated immediately following the completion of project activities within the restoration area. Creation and restoration activities will occur during the non-breeding season for vireos (if adjacent to occupied vireo habitat).

- Creation and restoration of riparian habitat will be considered successful when the following target/threshold objectives are met: 1) a minimum of 30 percent absolute ground cover of native plant species; 2) less than 10 percent absolute ground cover of exotic plant species (including 0 percent giant reed); 3) the absolute ground cover of native species must be represented by, at least, five dominant or co-dominant plant species; 4) the recruitment of native plant seedlings must be documented to occur within the replanted areas; 5) a positive trend in the diversity and absolute ground cover of native plant species must be observed based on appropriate statistical analyses that account for natural, year to year variations; and 6) the structure and composition of the revegetated area is statistically similar (i.e., not significantly different) to habitat occupied by vireos in the vicinity. Alternatively, riparian revegetation efforts can be considered successful if the habitat is occupied by a breeding pair of vireos, flycatchers, and/or yellow-breasted chats (*Icteria virens*). In addition, habitat must sustain itself for 2 consecutive years without supplemental water.

- All acres of created riparian habitat will be protected in perpetuity through proper legal instruments for the conservation of Federal and State listed species and their habitats.

- If the habitat creation option is selected, the Corps will ensure that the local sponsors commit to funding a cowbird trapping program in the vicinity of the created riparian habitat for the life of the project. Program specifics (e.g., number and locations of traps) will be determined in conjunction with permitting processes for the CDFG and our agency.

- Mitigation will be initiated as soon as practicable for impacts that occur during the first year of construction. Afterwards, mitigation will be initiated-prior to construction of

individual project features. For restoration options that include management for the life of the project, the Corps will continue exotic species removal (e.g., giant reed) and cowbird control until such time as the Service receives written documentation that the local sponsors and/or another approved entity (such as SAWA) have accepted responsibility for management of the restored area(s). Written documentation will include an estimate of costs associated with management responsibilities and a description of the funding mechanism(s) that will be used to ensure management will continue for the life of the project. If SAWA or another non-public entity accepts management responsibility and then becomes unwilling or unable to continue, then responsibility for continued management will revert to the local sponsors. Any advance mitigation that exceeds the requirements of the project (i.e., if actual project impacts are less than what was anticipated when the mitigation was initiated), may be credited as compensation for the effects of future projects.

- Identify and delineates on well-labeled maps the specific areas in the upper Santa Ana River watershed and/or action area from which giant reed will be or has been removed, and riparian vegetation restored, as compensation for the proposed action. These areas must be approved by the local sponsors, CDFG, and our agencies. An annual report will be prepared for the Service by the approved management entity (e.g., SAWA) that addresses the following information: 1) accomplishments during the previous year; 2) what is anticipated to be accomplished during the upcoming year; 3) results of monitoring and management; and 4) updated mapping that delineates areas in the upper Santa Ana River watershed and/or action area from which giant reed has been removed.

- Request that the administrator of the Trust Fund identify those acres within the Santa Ana Watershed where giant reed was previously removed and/or habitat restored using the $1,000,000 contributed by the OCWD in lieu of restoring 133 acres of riparian habitat in the Prado Basin. This acreage will be actively monitored and managed until riparian habitat is completely restored, and then maintained giant reed-free for the life of the project.

Maintenance and Management of Riparian Habitat Downstream of Prado Dam

- Prior to initiating construction-related activities in Reach 9, quantify and delineate the existing riparian habitat in this reach. Provide an accounting of the amount of habitat that is being, or has been, used for other mitigation projects.

- Prior to initiating construction-related activities downstream of Prado Dam, provide written documentation that 1,100 acres of land, including 789 acres of land within the flood plain along the Santa Ana River as depicted in Figure 1, are held in public domain as property of Orange County, California State Parks, or other public entities "for floodplain management in keeping with open space and wildlife habitat values" (Corps 1988, page SEIS-V-66). The County of Orange will provide additional information concerning the status of the *Habitat Management Plan* area and a map of the area delineating vegetation types,

acreages, and land use activities (including potential recreational uses and areas where the conservation of listed species and their habitats will be the primary land use).

- Maintain the baseline acreage of riparian vegetation within the *Habitat Management Plan* area as averaged over 10 years. The current estimate of riparian vegetation is between 350 and 380 acres.

- Vegetation mapping will occur every 10 years to document long-term trends and monitor post-flood recovery. Actions will be taken to re-establish the baseline if post-flood recovery does not occur within 10 years or does not meet the criteria that will be established in the *Habitat Management Plan.*

- Within 1 year after initiation of construction activities, finalize a *Habitat Management Plan* for the areas where your agency and/or the local sponsors have legal rights/jurisdiction. The *Habitat Management Plan* will be coordinated with the CDFG and our agency, provide assurances of funding, and address how the baseline amount of riparian habitat will be maintained or increased. Your agency and the local sponsors have agreed to gain consensus with our agency and the CDFG throughout the development and implementation of the *Habitat Management Plan*. The *Habitat Management Plan* will define the composition and structure of the management oversight committee and the explicit decision-making process. The *Habitat Management Plan* will include rules for timely resolution of disagreements to avoid biologically costly delays in management responses, "trigger points" for implementing management actions and a clearly defined mechanism (e.g., consensus among agencies; one agency with full authority) for modifying the trigger points.

- At a minimum, the *Habitat Management Plan* will address the following: 1) measurable conservation goals that clearly articulate a measurable standard, desired state, threshold value, amount of change, or trend that you are striving to achieve for the particular species; 2) measurable sampling objectives; 3) quantitative monitoring methodologies; 4) a strategy to determine the effectiveness and feasibility of possible alternate management, restoration, and/or translocation methods; 5) a strategy to evaluate the proposed monitoring and quantitatively establish the existing status (i.e., baseline) of covered species; 6) well-defined initial management thresholds (i.e., triggers) and a range of alternate, feasible responses; 7) an explicit process for evaluating monitoring data; 8) a defined management committee and decision-making process for implementing management responses (i.e., explicitly defined feedback loops that link implementation and monitoring to a decision-making process and, thereby, result in appropriate changes in management); and 9) reporting requirements, contents, and review procedures.

- The Corps will consult with the Service prior to initiating any actions that have not been explicitly defined as part of this project and may affect federally listed species or designated critical habitat. Actions that have not been defined as part of this project include, but are

not limited to, the development of recreational trails, the protection or relocation of the Santa Ana River Interceptor (SARI) line, and the maintenance of existing or planned utilities.

General Conservation Measures for the Vireo and Flycatcher

- Construction-related activities will not occur in the eastern third of borrow site #1A during April 29 to September 25 during each calendar year or at any other time while flycatchers are present in habitats adjacent to the borrow site in the southern portion of the Prado Basin.

- A monitoring program will be developed and implemented at Norco Bluffs and in Reach 9 that entails surveys for the vireo during spring and early summer of the year prior to construction and, also, during the year of construction. Construction activities will be monitored to assure that vegetation is removed only in the designated areas. Riparian areas not to be disturbed will be flagged.

- Vegetation clearing associated with project construction will take place only during periods when the vireo and flycatcher are not nesting (August 15 through February 28).

- Vegetation trimming and clearance within Prado Basin required for haul road maintenance and upkeep will be done when the vireo and flycatcher are not present.

- To the maximum extent practicable, haul routes and staging areas will be located outside of the flood plain (e.g., along bike trails, levees, and roads). Bank protection in Reach 9 will occur only in those locations that would otherwise be jeopardized by 30,000 cfs flows.

- To the extent that construction and hauling of embankment materials must take place during the vireo nesting season, noise curtains will be employed to shield nesting vireos from excessive noise generated by construction vehicles and equipment entering and leaving the construction sites at Norco Bluffs and at the upper Highway 91 embankment and Green River Housing Estate in Reach 9.

- Noise barriers will also be constructed by February 28 of each year during construction in or near habitat for the vireo and/or flycatcher. For example, a noise barrier will be installed at the extreme downstream end of the access road to Norco Bluffs to shield nesting vireos from excessive noise generated by construction vehicles and equipment entering and leaving the staging area. Also, noise barriers will be installed along the perimeter of Borrow Site 1A to address potential noise impacts at that locale. Furthermore, a dirt berm will be placed between Borrow Sites 1 and 2 and adjacent habitat for the vireo to abate construction noise.

- During construction, riparian vegetation adjacent to de-watering areas will be monitored. Supplemental water will be added to this vegetation as necessary to avoid water stress.

- To reduce fire hazards, a water truck will always be present during construction activities. Construction activities will comply with the fire prevention and protection practices set forth in your agency's Safety and Health Requirements Manual (EM 385-1-1). The provisions of EM 385-1-1 will be incorporated into all construction specifications, and the contractor will be required to prepare a fire prevention and protection plan for the construction project.

- Excavated materials will be backfilled over the toe stabilization structures. The contractor will replace surface material and re-grade disturbed soft-bottomed substrate areas, in particular the low-flow river channel, to replicate pre-project conditions. Your agency will continue to coordinate with us to develop and improve measures for re-establishing habitat values within the construction area.

Specific Conservation Measures for the Sucker:

- Re-design the drop structure and associated baffles at the gauging station below Prado Dam to minimize the risk of injury or death owing to collision and not reduce connectivity. If this re-design results in additional disturbances to habitat, then your agency will contribute funds to the Trust Fund at a 1:1 ratio of disturbed to restored habitat for each additional acre affected.

- The "trap and haul" program that was included in the 2001 Biological Opinion shall be discontinued and replaced with an additional three acres of stream restoration as described below, for a total of 10.9 acres of created/enhanced streambed.

- Successfully restore each acre of perennial stream that is temporarily disturbed during construction-related activities. Restoration will include: 1) replacement of pre-construction substrates and microhabitat features; 2) maintenance or re-establishment of natural channel morphology (e.g., stream meanders, pool-riffle complexes); 3) maintenance or re-establishment of perennial flows; and 4) verification that the structure and composition of the restored area is similar to pre-construction conditions. A conceptual habitat restoration plan will be reviewed and approved by our agency prior to initiating construction activities that will affect perennial stream habitat for the sucker.

- Create and/or enhance 1 acre of perennial stream habitat within the Santa Ana River or its tributaries for each acre of unvegetated perennial stream that is temporarily or permanently disturbed during construction-related activities. The estimated total of disturbed habitat is approximately 7.9 acres (4.4 acres of permanent effects and 3.5 acres of temporary effects,

not including the previously concreted portion of the Green River Golf Course channel[3]). A conceptual habitat creation plan will be reviewed and approved by the Service prior to initiating construction activities that will affect perennial stream habitat for the sucker. Creation/enhancement activities could include but are not limited to the following:

- The development of pool-riffle complexes by placing clusters of various sized boulders within the river channel to provide limited cover and areas of reduced water velocity.

- The creation of potential spawning/larval habitat downstream of Prado Dam. For example, San Marino Environmental Associates identified Aliso Creek, which is a tributary downstream of Prado Dam within Chino Hills State Park, as a possible restoration site for sucker spawning habitat in their *Conservation Program for the Santa Sucker in the Santa Ana River, Southern California, December 1999.*

- The creation of lateral stream habitats (i.e., very shallow areas along the stream margin with little current) that are believed to be essential for the survival of larval suckers.

- Roughen the surface of the low flow portion of the concrete-lined outlet channel and revegetate along both sides of the channel with native trees.

- During construction, the construction contractor will implement measures to control sedimentation, including recontouring, sandbagging, sediment basins, and other appropriate erosion control measures developed on a site-specific basis.

- To minimize adverse effects to the sucker, your agency will ensure that the construction contractor diverts the stream channel away from the initial project construction area. The construction area will then be de-watered to lower the water table. Discharge will be directed into a stilling basin and allow flow through existing vegetation and into the river downstream of the construction area. Ground water will be introduced into the stream as necessary to avoid excess turbidity.

- Prior to diverting any water or de-watering a reach of the river, biologists approved by our agency will conduct a preliminary survey of the affected reach(es) to assess the probability of capturing suckers, potential hazards to survey personnel, and to identify areas within the reach(es) that are most likely to contain suckers. Prior to initiating any activities associated with the diversion and/or de-watering, your agency and/or your representative will submit for our review and approval a complete, detailed, comprehensive description of these actions and conservation measures necessary to minimize any adverse effects to the sucker. This document should also include the results and recommendations of the preliminary biological survey of the affected reach(es).

---

[3] At the time the 2001 biological opinion was issued, a 4.7-acre section of perennial stream habitat within the Green River Golf Club Embankment Project area was lined with concrete. Although the concrete washed out during the winter storm season in early 2005, the Corps is not proposing to offset impacts to this section of stream.

A qualified sucker biologist will implement and oversee the execution of the diversion, survey and relocation efforts, and construction monitoring of the project site. Diversions and dewatering must be accomplished in such a manner to prevent the stranding or harm of suckers. The affected reach(es) will be surveyed for fishes throughout the duration of the project using seining, traps, or electrofishing, as necessary. Captured suckers will be retained in river water in insulated, aerated, and covered containers, as necessary. Temperature, dissolved oxygen, and observation of fish behavior will be recorded once per hour until suckers have been relocated. Captured suckers will be measured, weighed, sexed, and relocated to appropriate areas in the vicinity of the affected reach(es) or other locations as specified by our agency. The physical condition of the suckers will be recorded including the presence of external parasites or lesions. Suckers should be relocated to appropriate areas in the vicinity of the affected reach(es) or other locations specified by the Service within four hours of capture.

Any Santa Ana speckled dace (*Rhinichthys osculus* spp.), arroyo chubs (*Gila orcutti*), or other native fish that are captured will be retained in river water in insulated, aerated, and covered containers, as necessary. The fish will be relocated to appropriate areas in the vicinity of the affected reach(es) or other locations as specified by our agency. Any exotic fish that are captured will not be released back into affected reach(es) or other areas supporting native fish.

- River diversion activities within the Norco Bluffs area will occur between August and December to reduce disturbance to the spawning and nursery habitat for suckers. Additionally, construction activities within Reach 9 will be performed between August 15 and February 28, thereby avoiding the majority of the sucker spawning season.

- The banks along the new outlet channel will be planted with native non-riparian vegetation to provide a partial canopy over the channel.

<u>General Conservation Measures to Maintain Wildlife Movement Through the Action Area</u>:

- Native plant species will be used to revegetate disturbed upland areas.

- The area between the dam and the downstream end of the new outlet channel will be revegetated, thereby providing additional cover for any wildlife that may be attempting to cross through that area. If necessary, the vehicle bridge over the outlet channel may be modified to be more conducive for wildlife crossing. Native upland vegetation could be planted at the approaches to the bridge, and soil could be placed on the surface.

- Place soil on the face of the dam along the western end near State Route 71 to provide a more natural surface and allow for enhanced wildlife movement over the structure. Native grasses and other shallow-rooted vegetation will be planted on this surface.

- Construction of the upper Highway 91 bank stabilization and the outlet channel will occur only during daylight hours to minimize disturbance to wildlife species that move primarily at night.

Instead of noise reduction or abatement measures proposed in the Agency Agreement (2001), the Corps (2001f) has proposed the following:

"For construction activities within or adjacent to occupied vireo or flycatcher habitat, the following measures shall be implemented to reduce or avoid noise impacts:

1. Prior to the commencement of construction activities, ambient noise levels will be measured at 50 feet and 100 feet from the proposed boundaries of the construction sites and recorded in a graphic format.

2. Sound walls shall be constructed at the boundary of the proposed construction site and/or haul route prior to March 1. Sound walls will probably consist of ½"-thick, 8'-high plywood sheets. The construction contractor may use other materials or procedures that attenuate sound to acceptable levels, defined below.

3. Where ambient noise is less than 60dBA and it is determined that construction-related noise levels may exceed 60dBA: monitoring shall be conducted at 50 feet and 100 feet from the sound wall, or at the boundary of occupied habitat (if habitat areas are more than 100 feet from the construction site), to ensure that construction-related noise does not exceed 60dBA within these areas. If construction noise levels exceed authorized limits, the contractor shall modify the sound barriers, equipment, or procedures (including construction schedules) as necessary to meet these conditions.

4. Where pre-construction ambient noise is greater than 60dBA: monitoring shall be conducted at 50 feet and 100 feet from the sound wall, or at the boundary of occupied habitat (if habitat areas are more than 100 feet from the construction site), to ensure that construction does not result in a significant increase over ambient conditions (i.e., noise level increases shall not exceed 5dBA over ambient.) If construction noise levels exceed authorized limits, the contractor shall modify the sound barriers, equipment, or procedures (including construction schedules) as necessary to meet these conditions.

5. Sound curtains and noise monitoring shall <u>not</u> be required at the following locations:

    a) Reach 9 haul route to the lower Highway 91 bank stabilization construction area, from Crystal Drive. The proposed haul route is on top of the levee on the south side of the river; the levee road is not wide enough to accommodate both construction traffic and a sound barrier. Noise would be intermittent, as only 30-35 round trips per day are expected to be required during construction of this feature.

b) Dam and outlet channel. Construction vehicles and equipment used for raising the dam will be working adjacent to and above the outlet channel. To be effective, a sound wall would have to span the channel (to block the sound of vehicles driving along the base of the dam) and reach the height of the dam itself (as vehicles and equipment reach progressively higher elevations up the face of the dam). As this is not feasible, and because this area is already subject to sound intrusion from SR71, additional construction impacts are considered insignificant and unavoidable.

6. The area behind the dam, around the new outlet works, may still be inundated on March 1. This could preclude establishment of a sound barrier in this area prior to the nesting season. In that case, a sound barrier will be placed around the perimeter of the cleared area as soon as conditions are dry enough to permit construction.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Carlsbad Fish and Wildlife Office
6010 Hidden Valley Road, Suite 101
Carlsbad, California 92011

In Reply Refer To:
FWS-OR-08B0408-15F0592

JUL 23 2015

Colonel Kimberly M. Colloton
District Commander
U. S. Army Corps of Engineers, Los Angeles District
915 Wilshire Boulevard, Suite 930
Los Angeles, California 90017-3409

Attention: Eduardo DeMesa
Hayley Lovan

Subject: Reinitiation of Formal Section 7 Consultation on the Santa Ana River Mainstem Flood Control Project to Address Proposed Reach 9 Bank and Bridge Protection Components (Phases 4, 5A, 5B, and BNSF Bridge Project) along the Santa Ana River in San Bernardino, Riverside and Orange Counties, California

Dear Colonel Colloton:

This document responds to your letter dated January 23, 2015, requesting reinitiation of formal consultation on the Santa Ana River Mainstem Flood Control Project (SARP) to address the addition of the Reach 9 Bank and Bridge Protection Project to the overall SARP and the associated effects of the additional project components on the endangered least Bell's vireo (*Vireo bellii pusillus*; vireo) and the threatened Santa Ana sucker (*Catostomus santaanae*) and its designated critical habitat, in accordance with section 7 of the Endangered Species Act of 1973 (Act), as amended (16 U.S.C. 1531 *et seq.*).

Your January 23, 2015, letter requesting reinitiation of formal consultation was received by us on January 30, 2015. The additional project components consist of a series of bank and bridge protection measures associated with the SARP, also often termed the Santa Ana River: Reach 9 Phases 4, 5A, 5B, and BNSF Bridge Project. The proposed project and associated environmental documentation supplements a previous Federal Project, the SARP, which is designed to provide flood risk reduction to areas susceptible to floods ranging from 100-year to 190-year frequencies in San Bernardino, Riverside, and Orange counties, as described in the Final Supplemental Environmental Impact Statement/Environmental Impact Report for Prado Basin and Vicinity, Including Reach 9 and Stabilization of the Bluff Toe at Norco Bluffs [2001 SEIS/EIR; U.S. Army Corps of Engineers (Corps) 2001].

Your request for consultation also included the federally threatened coastal California gnatcatcher (*Polioptila californica californica*; gnatcatcher). Based on our review of the *Draft Supplemental*

Reach 9 Phases 4, 5A, 5B and BNSF Bridge Project (Draft SEA; Corps 2013a) and additional information provided during the consultation period, we have determined that the proposed action is not likely to adversely affect the gnatcatcher or its designated critical habitat. We reached this conclusion for the following reasons:

1. Although gnatcatchers have been observed in the project vicinity, no gnatcatchers have been reportedly observed within 300 feet of the construction direct footprint (including staging areas or haul and access routes); therefore, none will likely be directly affected. Expected construction noise and other disturbances (e.g., dust) are not expected to disrupt gnatcatchers in the area. The Corps will perform directed protocol surveys in advance of construction. If gnatcatchers are detected within the project footprint or project-related high noise areas, the Corps will consult informally with our agency, the U.S. Fish and Wildlife Service (Service), to determine whether additional measures can be implemented to prevent gnatcatchers from being adversely affected. If adverse effects to gnatcatchers cannot be avoided, the Corps will reinitiate formal consultation to address these impacts.

2. The construction area in or near potential gnatcatcher habitat areas is already high in ambient continuous noise due to its proximity to the SR-91 freeway and other road and railroad infrastructure. As such, most construction noise reaching any nearby gnatcatchers will be at least partially masked by existing noise. Conservation measures that will be implemented to minimize the potential for disturbance to nesting vireo in the area (e.g., installation of sound walls adjacent to the construction boundary and haul routes) will further reduce the potential for disturbance to any gnatcatchers in the project vicinity;

3. The proposed project will permanently impact 13.90 acres of gnatcatcher designated critical habitat, including about 11.16 acres of primary constituent elements (PCEs)[1], in Unit 9, East Los Angeles County-Matrix/NCCP Subregion of Orange County, which includes a portion of the Santa Ana River Canyon (72 FR 72010). The 13.90 acres of permanent impact is a fraction (0.08 percent) of the total acreage in Unit 9 (17,552 acres). The primary noted function of critical habitat within the Santa Ana River Canyon is to maintain connectivity and genetic interchange between significant gnatcatcher populations in the Santa Ana Mountains and those in the Chino/Puente Hills (72 FR 72010). The project will permanently impact narrow strips of habitat along the edges of the Santa Ana River floodplain and is anticipated to have an insignificant effect (i.e., one that cannot be meaningfully measured, detected, or evaluated) on connectivity and genetic interchange between gnatcatcher populations in the Santa Ana Mountains and those in the Chino/Puente Hills.

4. The proposed project will temporarily impact 45.26 acres of critical habitat, including 39.49 acres of PCEs for the gnatcatcher. Although the overall acreage of PCEs will be temporarily reduced in Unit 9, the temporary impact area will be restored following completion of the project using a native seed mix, irrigated native sage scrub container plants, and exotic plant

[1] Gnatcatcher PCEs include sage scrub and non-sage scrub vegetation communities that support gnatcatcher foraging, nesting, rearing of young, intra-specific communication, roosting, dispersal, genetic exchange, or sheltering. For this consultation, we included all areas of undeveloped open space other than perennial rivers and streams. Bare areas affected by previous projects are included as PCEs because they would have been restored with native vegetation suitable for supporting the gnatcatcher behaviors identified above.

> control to expedite the restoration process. Because existing non-native upland vegetation and bare ground in the project footprint will be relatively quickly replaced with higher-function native scrub vegetation, there will likely be an overall increase in the function, carrying capacity, and area of available PCEs in Unit 9. Thus, the proposed action will not diminish the primary functions of Unit 9 or the value of designated critical habitat for recovery of the species.

This reinitiation of the SARP December 5, 2001, biological opinion does not consider or cover the newly identified effects of operations of Prado Dam that were not addressed by 2001 SARP biological opinion or subsequent amendments. During the period between 2008 and 2011, it became apparent to the Corps and Service that new information existed regarding predicted long-term scour and riverbed degradation to portions of the river channel within Reach 9 that were likely to result from high flow releases from Prado Dam planned to occur during infrequent flood events [e.g., see Department of the Interior (DOI) 2008, Orange County Flood Control District (OCFCD) 2010, Medak 2010 pers. comm., Corps 2011, Corps 2012c, Corps 2013b, Corps 2015a]. For example, Chang (2008) estimated in Reach 9 "that upwards of 26 feet of the Santa Ana River will down cut due to lack of sediment replenishing the area." Similarly, an estimated scour depth of 16 feet below the current river thalweg[2] resulting from a future 30,000 cubic feet per second release from Prado Dam (Figures 27 and 28) was provided by the Corps for a design flood event for the Phase 5A portion of the proposed project in Reach 9 (Corps 2015a).

While some degradation of the river channel in Reach 9 over time was predicted in our 2001 SARP opinion, the extent of potential additional scour and degradation noted above, and its potential scope of effects on listed species, were not known to the Service in 2001 and have not as yet been analyzed or formally consulted upon. While estimates of maximum scour depths during storm flow events in several point locations in Reach 9 have been provided to the Service, overall effects of long-term degradation across the morphology and ecosystems of Reach 9 have not been predicted, modeled, or quantified. Additionally, new information on increased and/or accelerated sediment deposition in the river upstream of Prado Dam have not been analyzed for effects on listed species or formally consulted upon. Similarly, the potential effects of operations of Seven Oaks Dam on fluvial processes and water flows downstream and these effects on Santa Ana sucker and its critical habitat have not been formally consulted upon.

Per 50 CFR 402.16, reinitiation of formal consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered. As such, we recommend that the Corps develop an analysis of these effects on listed species and critical habitat, identify appropriate conservation measures, and then request reinitiation of formal consultation on the effects of operations under the SARP not previously addressed by the 2001 SARP biological opinion or its amendments.

The analysis and conclusions provided herein are based on: (1) your January 23, 2015, letter requesting reinitiation of consultation; your letter dated April 15, 2015, providing additional project

[2] Thalweg is the deepest portion of a river channel

information; and an email messages dated May 5 and 29, 2015, from your staff with additional project conservation measures; (2) information provided in the Draft SEA dated January 2015 for the proposed project; (3) a series of meetings, conference calls, and email exchanges between Corps and Service staff between April and July 2015; and (4) correspondence, notes, and information compiled during the course of our consultation with the Corps on the subject project. The information and other references cited in this biological opinion constitute the best available scientific information on the status and biology of the species considered. The complete project file for this consultation is maintained at the Service's Carlsbad Fish and Wildlife Office (CFWO).

CONSULTATION HISTORY

The Service has issued a series of biological opinions (i.e., Service 1980, 1989, 1993, 2000a, 2000b, 2001a, 2001b, 2002a, 2002b, 2003, 2004, 2012, 2013a, 2013b, 2013c) addressing the effects of constructing, operating, and maintaining the SARP on federally listed species and their critical habitat. In 2012, the Service expressed significant concerns to the Corps regarding potential effects of ongoing operations at Prado Dam and proposed changes to the operations of Seven Oaks Dam on the Santa Ana sucker and its designated critical habitat.

As a result of discussions with the Service and others, the Corps committed to work with the Service to assess how operations of these dams are potentially affecting geomorphology, hydrology, sediment transport, and other factors important to maintaining suitable habitat conditions for the Santa Ana sucker. The Corps also committed to coordinate with the Service on management measures that may be implemented to avoid and minimize adverse effects to sucker and its designated critical habitat (Corps 2012b). The Corps initiated the Prado Basin Feasibility Study, in part, to determine if bypassing sediment around Prado Dam could improve the aquatic environment and help ameliorate the substantial bed degradation downstream of Prado Dam that is known to be due in large part to the presence and long-term operation of the dam (Corps 2012b). However, no management measures have yet been implemented and habitat conditions for the Santa Ana sucker within the river have continued to degrade to the point where the species is increasingly vulnerable to extirpation on the river (Service 2011, 2014a, 2014b).

The SARP was addressed initially in a biological opinion issued on October 1, 1980 (Service 1980). As noted above, a subsequent series of biological opinions and amendments have been issued. On 5 December 2001, we issued a biological opinion (2001 biological opinion) that addressed, in part, components of the SARP that were added to protect existing infrastructure in Reach 9 of the Santa Ana River (floodplain between Prado Dam and Weir Canyon Road Bridge). These project components are generally referred to as "Reach 9 Projects" (also referred to as Reach 9 features and Santa Ana River Reach 9 Flood Control Projects). The Corps has completed the following Reach 9 Projects to date: Green River Mobile Home Park Levee, Lower Highway 91 Embankment, Car Wash/Strip Mall Bluff Stabilization, the Reach 9 Phase 2A Project (including the Upper Highway 91 Embankment and Green River Housing Estate Embankment), the Reach 9 Phase 2B Project (Green River Golf Club Embankment), and the Reach 9 Phase 3 (replacement of existing soil cement embankment located adjacent to State Route 91).

On March 27, 2012, we issued an amendment (2012 amendment) to the 2001 biological opinion to address proposed changes to the mitigation approach for the SARP[3] that will be applied to the remaining SARP components (Service 2012a); that document is incorporated by reference herein.

On January 23, 2015, we received a letter from your agency requesting reinitiation of formal consultation to address the addition of the proposed Reach 9 Bank and Bridge Protection Project to the SARP; we initiated formal consultation on this date. On March 5, 2015, your staff confirmed by an email that formal consultation was requested for the preferred alternative identified in the Draft SEA as the herein proposed project. On March 31, 2015, we responded to your January 23, 2015, letter with a request for additional information. On April 15, 2015, you responded by letter with additional information.

On April 23, 2015, our staffs met to discuss aspects of the proposed project, including conservation measures. On May 29, 2015, we were provided a revised project description by email. In May and June 2015 our respective staffs held several conference calls and exchanged emails regarding project measures and likely impacts; these included modifications to the proposed project to reduce impacts (such as modified slope protection alignments/types/boundaries) and improve conservation measures (including changes in minimization and offsetting measures and expected funding/costs).

The Corps had previously been coordinating with the Service on potential Santa Ana River red algae eradication strategies to offset impacts to federally listed species from the recently completed Reach 9 Phase 3 project. During consultation on the herein proposed project, the Corps determined in coordination with the Service that substitution of the measure “2.54 Acre Scour Enhancement” (within the Description of the Proposed Action, Specific Conservation Measures for the Santa Ana Sucker, below) will provide equal or greater benefits to the Santa Ana sucker as compared to algae control and is more closely aligned with Corps capabilities.

A draft of the 2015 amendment to the 2001 SARP biological opinion was provided to the Corps for review and comment on July 15, 2015. Comments were received on July 17, 21, and 22, 2015, and incorporated or addressed, as appropriate, in this final 2015 amendment to the 2001 SARP biological opinion.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

A detailed description of the SARP may be found in the Supplemental Final Environmental Impact Statement/ Environmental Impact Report (Corps 2001) and 2001 biological opinion, which are herein incorporated by reference. This 2015 amendment to the 2001 biological opinion concerns the potential effects of the proposed Santa Ana River Reach 9 Phases 4, 5A, and 5B projects and the BNSF Railroad Bridge Protection Project, also known as the Reach 9 Bank and Bridge Protection Project, on the vireo and Santa Ana sucker and its designated critical habitat. As indicated in your January 23, 2015, letter, the proposed project footprint will begin about 2.25 miles downstream of Prado Dam at the Burlington Northern and Santa Fe (BNSF) Railroad Bridge crossing in

[3] The revised Conservation Measures are included in Service (2012a).

Riverside County and continue another 5 miles downstream along the Santa Ana River into Orange County (Figure 1).

Proposed Corps Project and Non-Federal Sponsors

The Corps and non-Federal sponsors: OCFCD, Riverside County Flood Control and Water Conservation District (RCFC&WCD), and San Bernardino County Flood Control District entered into a local cooperation agreement (LCA) on December 13, 1989, to implement the SARP and provide flood damage reduction along the Santa Ana River. The Corps is the lead agency under the National Environmental Policy Act, and the OCFCD is the lead agency under the California Environmental Quality Act. RCFC&WCD will primarily be responsible for maintenance of the BNSF Bridge project segment and will also take subsequent discretionary actions including, but not limited to: utility relocation, property acquisition, obtaining easements, issuing encroachment permits, and entering into cooperative agreements (Corps 2015a).

Project Background

The Santa Ana River flows through Orange, Riverside and San Bernardino counties in California. Several major modifications to flood risk management features on the Santa Ana River were approved as part of the Corps Los Angeles District's SARP (Corps 2013b). The SARP is a flood risk management system located along a 75-mile reach of the Santa Ana River (Figure 2). The purpose of the overall SARP is to extend the flood risk management to areas within the watershed that are susceptible to flooding during storm events ranging from 100-year through 190-year frequencies.

The segment of the Santa Ana River between the mouth of the river at the Pacific Ocean and Prado Dam - about 30.5 miles in length - is known as the Lower Santa Ana River channel. The SARP includes various project features within the Prado Dam Basin and along the Lower Santa Ana River channel. These project features, most of which have been implemented already, are part of a flood risk management system to: increase the storage capacity within the Prado basin; release higher flows through the dam's outlet works; convey higher flows through the Lower Santa Ana River channel; and provide additional bank protection, as required, to withstand the erosion forces caused by flow impingement and higher velocities (Corps 2013b). The Lower Santa Ana River channel is divided into 10 reaches (Reach 1 through Reach 10). Reach 1 begins at the Pacific Ocean, and Reach 9 ends at the Prado dam outlet works (Corps 2013b).

Reach 9 extends about 8.3 miles from Prado Dam in Riverside County, California, downstream to the Weir Canyon Road/Yorba Linda Boulevard Bridge, in the City of Yorba Linda, Orange County (Figure 1). Phase 1, Phase 2A, Phase 2B, and Phase 3 have been constructed. Phase 4, Phase 5A, Phase 5B, and the BNSF railroad bridge constitute the proposed project addressed by this 2015 amendment to the 2001 biological opinion. Technical studies completed since the 2001 SEIS/EIR indicate that the potential for riverbed degradation and scour in the Reach 9 area is more severe than contemplated in 2001 (Corps 2015a). An Engineering Document Report (EDR) for the Santa Ana River Mainstem Project Lower Santa Ana River Channel – Reach 9 Orange and Riverside Counties, CA (Corps 2013b) was prepared by the Corps to evaluate technical solutions to fortify and stabilize the Santa Ana River banks to reduce the risks to life, safety or property damage that could result from the additional bed degradation in Reach 9. The proposed project will implement structural measures in Reach 9 as described in the EDR.

In 2012, a Corps study evaluating the hydrology, hydraulics, and sedimentation in Reach 9 identified that planned Reach 9 improvements were not sufficient to withstand a release of 30,000 cubic feet per second from Prado Dam (Corps 2015a). The Corps determined that existing local flood risk management measures (bank protection) composed largely of soil cement and riprap within Reach 9 did not provide the sufficient fortifications necessary to withstand the potential 30,000 cubic feet per second releases from Prado Dam and related long-term scour (Corps 2015a).

Proposed Project

The purpose of the proposed project phases is to prevent undercutting or erosion of Santa Ana River embankments and railroad bridge piers. High-velocity discharges from Prado Dam could undermine the toe of existing channel embankments in certain locations and could erode foundation materials underneath the BNSF bridge piers. To operate the SARP as designed, it is necessary to be able to release 30,000 cubic feet per second from Prado Dam (Corps 2015a). Protection is reportedly needed in areas where existing bank armoring does not exist (i.e., portions of Phase 4 and Phase 5B) or where the buried toe of existing bank protection does not extend deep enough (i.e., Phases 5A and 5B and portions of Phase 4) to withstand the design flow (Corps 2015a). At the BNSF Bridge, the piers do not extend deep enough to withstand design flow releases from Prado Dam (Corps 2015a).

The January 2015 Draft SEA provides details for various elements and tasks associated with the proposed action, including construction phasing; water diversion and dewatering; staging areas; access; roads; storm drain outlets; construction equipment; construction schedule; site preparation; and operations and maintenance of the proposed facilities.

All staging areas and temporary work areas (outside of the river low-flow diversion needed for construction of the proposed BNSF bridge segment) will be modified in the field so as to be located out of the existing low-flow channel and well-outside of any recent low-flow channels so as to reduce the potential for flooding of these areas and associated potential impacts during the construction period.

This consultation considers future maintenance of the proposed slope and bridge protection structures and habitat restoration areas, subject to the conservation measures included in the 2012 amendment, as modified below. Identified maintenance roads at the base or top of the structures will be used to access the sites for maintenance purposes. Structure maintenance involves routine inspections, structural repairs, and vegetation removal from the structure surfaces and identified maintenance roads. All proposed project operations and maintenance will be limited to the above-ground portions of proposed structures and maintenance roads occurring within the project permanent footprints shown in Figures 3 through 25.

A summary of each proposed phase or segment is provided below.

Phase 4

Phase 4 is proposed to be located along the south bank of the Santa Ana River, beginning about 3.5 miles downstream of the outlet from Prado Dam, in the vicinity of Coal Canyon Road, and will extend 3,150 feet (0.59 mile) downstream (Figures 3-10). At its downstream limit, Phase 4 will tie

into Reach 9, Phase 3, which was recently constructed, and at its upstream limit will tie into State of California, Department of Parks and Recreation (State Parks) land downstream of Reach 9, Phase 2B.

To protect SR-91 from sustained impinging flows from the Santa Ana River, California Department of Transportation (Caltrans) constructed and upgraded four sections of bank protection along the south bank of the Santa Ana River (Corps 2015a). The structural integrity of the existing bank protection for locations where there is no river setback between the low-flow riverbank and the freeway is unknown because the toe is submerged by the low-flow adjacent to the freeway embankment. Therefore, the adequacy of the existing toe depth and structural soundness of the Caltrans constructed measures against maximum scour, estimated at 16 feet below the current thalweg, could not be verified (Corps 2015a). Thus, the purpose of Phase 4 is to provide additional bank protection to replace the Caltrans bank protection (Corps 2015a).

As proposed, an approximate 3,150-foot-long soil cement structure will be constructed as part of Phase 4. The structure will be about 30 feet in height and 10 feet in width and placed at a 1:1 slope. About 10 feet of the structure will be exposed above-ground, with the remaining buried. Areas of the exposed and buried portions of the soil cement structure will each be about 1.5 acres. A trapezoidal cut will be excavated to place the soil cement structure. The excavation footprint will be about 100 feet wide along the 3,150-foot span. Excavated material will be temporarily stored in staging areas during construction before being replaced within the excavated trench.

Existing soil cement structures may be encountered during excavation for Phase 4. If encountered, soil cement will be demolished with the option to dispose offsite or process it for reuse as backfill, if it is deemed suitable for construction. Any excavated material that is not suitable for the soil cement mix or for backfill will be disposed of offsite. The temporary construction easement (which, along the identified staging area boundaries, constitute the project footprint limits; Figures 3 and 4) for Phase 4 is about 35 acres and will include the footprint of the new soil cement structure, haul roads, staging areas, stockpile areas, location of batch plant, the temporary bike path during construction, and the restored bike path (Figures 3 and 4).

A 16-foot wide road of decomposed granite will be installed immediately along the south side of the soil cement structure (Figure 11). The road will serve dual purposes – it will be used for future operations and maintenance (O&M) and as a pedestrian trail. The road will traverse both Phase 4 and Phase 3, which was completed just west of Phase 4. Installation of the road through both of these phases will occur under the Phase 4 construction contract. Additionally, a 12-foot wide paved bike trail will be installed adjacent and south of the new road (Figure 11). This permanent trail will replace the temporary bike trail that currently passes through Phases 3 and 4. Installation of the new road and trail will occur within the temporary construction easement of Phase 4 (Figures 3 and 4). No maintenance road or future vegetation clear zone is proposed north of the base (river flow side) of the proposed bank protection.

Equipment anticipated to be used for construction of the soil cement structure will include excavators, front-end loaders, bulldozers, dump trucks, soil cement compactors (e.g., sheep-foot and smooth-wheel rollers), a grader, concrete pump trucks, water trucks, and a soil cement batch plant. Additionally, delivery trucks will be associated with imported materials.

Clearing and grubbing is expected to begin in fall or winter 2015. The installation of the dewatering system and excavation will begin mid-April 2016, or later. Excavation and stockpiling will require about 3 months, and the placement of soil cement will require about 5 months. Backfilling and compaction of the toe will require about 2 months. Construction of the restored permanent bike path and demolition of the temporary bike path will have an expected duration of 3 months, followed by about 4 months of hydroseeding and replanting. Construction is expected to continue until about December 2017. Daily construction will occur between 8:00 a.m. and 5:00 p.m.

The project will require dewatering during excavation, placement of soil cement, and backfilling, but diversion of the river's low-flow is not anticipated as part of Phase 4 (Corps 2015a). About 5.7 acres of land will be used for staging, stockpiling, and the soil cement batch plant. Staging areas are proposed to be located parallel to the proposed soil cement alignment, on the river side of the project inside the channel.

During formal consultation on the proposed action, the Corps in June 2015 committed to reduce the length of the Phase 4 project by removing about 450 feet from the upstream end of the proposed bank protection structure. This upstream portion will be reanalyzed and may be redesigned by the Corps, at which time it would be addressed under a separate consultation/amendment. The project's permanent and temporary footprints have been reduced accordingly.

Additional Work to Be Conducted under Phase 4 -- State Parks, Phase 2B Gully Erosion Repair:

During Reach 9, Phase 2B construction (already completed), the construction contractor encroached upon State Parks property in the vicinity of Coal Canyon. As reparation for the encroachment, OCFCD, State Parks, and the Corps agreed that the Corps will repair two off-site gully erosion areas just east of Phase 4 (Figures 4, 5, and 7). This repair will take place as part of the Phase 4 construction contract.

Repair of the two gully erosion areas will cover about 0.35 acre and will include: stabilizing; grading areas to 2:1 slopes or flatter; revegetating; establishing vegetation; monitoring; and removing non-natives for a total of 5 years.

Phase 5A

Phase 5A is proposed to be located along the north bank of the Santa Ana River, parallel to East La Palma Avenue. It will extend from the recently completed Reach 9, Phase 1 (existing bank protection) at the Mercado Del Rio Plaza, 4,083 feet (0.77 mile) upstream to the vicinity of Via Lomas De Yorba-West Road (Figures 12-15). Phase 5A will include a 90-degree bend in the embankment of the Santa Ana River currently protected by ungrouted riprap revetment of the Lomas De Yorba-Sur (LDY-S) Levee.

Fortification and deepening of the existing bank protection within the Phase 5A is proposed by the Corps to prevent future lateral erosion into the north river bank and protect adjacent infrastructure consisting of East La Palma Road, the Santa Ana River Trail, industrial facilities, and existing commercial and residential development (Corps 2015a). An existing 4,083-foot section of the LDY-S Levee consisting of ungrouted stone bank protection will be replaced by 980 feet of a grouted stone

structure and 3,273 feet of steel sheet pile wall. The excavation footprint for grouted stone protection will be about 80 feet wide along the 980-foot reach.

No diversion or control of water in the active river channel (e.g., low-flow) of the Santa Ana River will be required during construction of Phase 5A. Dewatering will occur for the proposed grouted stone construction but not for the proposed Phase 5A sheet pile construction.

Equipment to be used for construction of the grouted stone structure will include excavators, front-end loaders, bulldozers, dump trucks, a grader, concrete pump trucks, and water trucks. Additionally, delivery trucks will be associated with imported materials. Equipment to be used for construction of the sheet pile protection will include a hydraulic hammer and heavy-duty cranes. Construction is expected to take 24 months to complete beginning with clearing and grubbing in about August 2015. Construction is expected to continue to about August 2017. Daily construction will occur between 8:00 a.m. and 5:00 p.m.

Staging areas for Phase 5A will be located at the upstream and downstream ends of Phase 5A as shown in Figures 12 through 15 and occupy areas of 1. 4 and 1.38 acres of the river channel, respectively. Staging areas will be used for storage of construction equipment and materials and as turnaround areas.

Access routes will occur within the temporary construction easement (noted on Figures 12 through 14), and no new haul roads will be developed for construction. The existing Santa Ana River Trail at the top of the north bank will be used for routine inspections and O&M. The existing dirt access road along the base of the levee will remain upon construction completion and will be used for O&M on the new grouted stone and sheet pile structures. This dirt road will also be extended from its terminus at the downstream (west) end of the project, for about 300 feet to the west (Figures 12-14). The road extension will be installed on top of the buried toe of the grouted stone structure.

Sheet Pile

The proposed sheet pile wall will be situated along the top edge of the existing north bank to minimize excavation for installation of tiebacks and minimize environmental impacts. Installation of tiebacks requires an approximate 8-foot vertical excavation of the existing bank, from the top of the existing bank. The sheet pile will be a 2-foot-wide “Z”-shaped steel wall with tiebacks, and will be driven vertically down into the existing bank to a design elevation; height of the sheet pile varies from 45 to 50.5 feet (Figure 16). Removal and reuse of the existing riprap stone and compacted earth fill will be required and needed for sheet pile tieback installation. Backfill to restore the compacted earth fill embankment will be required after completion of sheet pile tieback installation. The final configuration of backfill will match the original embankment configuration. It is anticipated that most, if not all, excavated material will be used for construction of Phase 5A.

Grouted Stone

The proposed grouted stone structure, which will be placed against the existing bank, will be 24 inches thick and have a 2:1 slope (Figure 17). The grouted stone structure will be about 37.5 feet tall, measured vertically from 1 foot below the design scour line to top of the structure, and buried about 18 to 20 feet below the channel invert. In addition, a minimum 3-foot-thick riprap stone will be

installed at the toe of the 24-inch-thick stone for additional scour protection. Existing riprap stone along the bank will be re-used. Construction of riprap stone and 24-inch grouted stone revetment will require excavation of a trapezoidal trench about 80 feet wide by 980 feet long. Stone will be transported to the site from a quarry site near Prado Dam; 16 daily truck trips are anticipated. Excess excavated material will be hauled to appropriate disposal sites.

Phase 5B

Phase 5B, as proposed, will extend from Phase 5A upstream about 3.7 miles to an existing locally constructed existing sheet pile wall that functions to protect the BNSF rail line (Figures 8, 9, 10, 11, and 12). Phase 5B will extend nearly 3,000 feet upstream of the limit of the existing LDY-S Levee (Corps 2015a).

In Phase 5B, bank protection is reportedly necessary to prevent future lateral erosion into the bank line and protect infrastructure consisting of East La Palma Avenue; the Santa Ana River Trail; industrial, commercial, and residential development; and the BNSF rail line (Corps 2015a). Maximum scour in this area is anticipated to reach a depth of 14 feet below the current thalweg during this design release (Corps 2015a). Bank protection in Phase 5B is reportedly necessary to replace the LDY-S Levee through Phase 5B and extend beyond the current upstream limit of the LDY-S Levee (Corps 2015a).

As proposed, grouted stone will replace existing riprap of the LDY-S Levee and be installed on the river bank upstream of the existing levee, where the river bank is currently unprotected. The new grouted stone structure will be 24 inches thick and have a 2:1 slope. The grouted stone structure will range in height from 30 to 45 ft., with the buried portion of the grouted stone slope about 25 feet deep. Construction of grouted stone revetment will require excavation of a trapezoidal trench about 80 feet wide by about 19,700 feet long (the length of the proposed protection). Excess excavated material and unsuitable stone will be hauled to appropriate disposal sites.

No diversion or control of water in the active river (e.g., low-flow) channel of the Santa Ana River will be required during construction of Phase 5B. Dewatering will occur for grouted stone construction within the project footprint for Phase 5B.

Equipment to be used for construction of the grouted stone structure will include excavators, front-end loaders, bulldozers, dump trucks, a grader, concrete pump trucks, and water trucks. Additionally, delivery trucks will be associated with imported stone; 20-40 daily truck trips are anticipated. Construction is expected to take about 24 months to complete. Clearing and grubbing is proposed to begin in August 2016. Construction is expected to continue to about August 2018. Daily construction will occur between 7:00 a.m. and 5:00 p.m.

Three staging areas will be required for Phase 5B: two along the main Phase 5B construction area, and a third location for the extension of bank protection near the BNSF rail line is at the upstream end of the Phase 5B segment (Figures 18 and 20). Precise locations of the staging areas have not yet been determined, although each will be about 1 acre in size or less. The Corps is exploring ways to potentially eliminate or reduce the size of at least one of the three staging areas. Staging areas will be placed out of the way of higher river flows, and new disturbance will primarily be limited to communities composed of non-native plant species. Access to the Phase 5B construction area will

occur via East La Palma Avenue and the Santa Ana River Trail along the top of the LDY-S Levee. Existing ramps off East La Palma will provide access to an existing dirt access road at the base of the levee. No new access roads will be required. The existing 15-foot-wide dirt access road along the base of the levee will be restored upon completion of construction and used for subsequent O&M activities for Phase 5B structures.

Along the upstream 2,900 feet of the proposed Phase 5B structures no dirt access road will be constructed or maintained along the base of the slope protection (directly parallel to the railroad tracks), to reduce impacts overall and to wildlife movement, including Brush Canyon.

During formal consultation on the proposed action, the Corps in June 2015 committed to modify the designs for Phase 5B for the upstream end of the proposed bank protection structure; the proposed plans for about 300-400 feet of the upstream end of Phase 5B (along the BNSF railroad tracks) was changed from grouted stone to the use of sheetpile (Figures 18-20). The project's permanent and temporary footprints at the upstream end of Phase 5B will be reduced proportionately with the noted modification (since both the permanent and temporary footprints for use of sheetpile are typically narrower than those for grouted stone). This modification was proposed by the Corps due to concerns expressed by the Service regarding potential impacts to aquatic and wildlife movement resources at the upstream end of Phase 5B with the original design. This redesign will allow the Corps to construct slope protection at the upstream area of Phase 5B without diverting the nearby active low-flow of the Santa Ana River (as will likely be necessary if a grouted stone design was used in this location). If sheetpile is utilized for slope protection more than 300 feet west from the current upstream end of the proposed Phase 5B structure, then a series of access ramps over the new sheetpile will be constructed to maintain important wildlife movement across the slope (to/from the Santa Ana River area and the Chino Hills). These wildlife movement ramps will be constructed in such as fashion to accommodate predicted channel degradation and erosion for the area, including the potential for ramps to be constructed out of a combination of rip-rap, cobble, and a covering of river-gravel. The proposed project footprint area for all of these substitute measures will be smaller than shown for the grouted stone slope protection.

BNSF Railroad Bridge

The proposed BNSF bridge project segment consists of 3 separate bridges with one railroad track per bridge. These BNSF railroad bridges cross the Santa Ana River and bisect the recently completed Phase 2A bank protection project. The Green River Housing Estates/Green River Home Owners Association property (GRHE/GRHOA) is just upstream/north of the BNSF bridge and the Green River Mobile Home Park (GRMHP) is south of the bridge. Both residential areas are on the left bank of the river. The Corps' 2011 hydraulic analysis revealed new potential impacts to the existing BNSF bridge pier and abutment foundations (Corps 2013b). This analysis provided revised scour estimates to the Corps that indicated increased local pier scour and abutment scour in addition to increased long term general scour that could expose the bridge foundation to an unacceptable level and result in bridge stability concerns (Corps 2013b).

The purpose of the proposed BNSF bridge project segment is to provide additional scour protection measures to maintain bridge stability and avoid catastrophic collapse of the BNSF bridge during a 30,000 cubic feet per second design flow release (Corps 2015a).

Reinforced concrete walls, sheet pile and reinforced concrete diaphragm walls, and grouted stone protection will be constructed to provide additional scour protection to the BNSF bridge piers and abutments, and tie previously constructed bank protection along the east bank of the channel into the existing eastern bridge abutment (Figure 22, 23, and 25). Reinforced concrete enclosure walls will be installed around Pier Nos. 2 through 5 and reinforced concrete pier nose extension walls will be constructed immediately upstream of these piers. Construction will include sheet pile and reinforced concrete diaphragm walls with tieback anchors parallel to existing Pier Nos. 1 and 6 to guide the design flow safely under the bridge. Additionally, 24-inch grouted stone bank protection will be installed to tie the existing bridge abutment along the east bank of the river channel (Pier No. 1) into bank protection installed upstream (Phase 2A) and downstream (Phase 2B) of the BNSF bridge.

The active river channel and a high groundwater table occur in the BNSF Bridge project area, which will require dewatering to install proposed bridge protection features. The active channel of the Santa Ana River currently flows between Pier Nos. 4 and 5 and a water diversion will be required to dewater the active channel for installation of bridge pier nose walls and enclosure walls at these piers. The specific method and location of the river diversion will be proposed by the contractor. Staging will occur within and throughout the temporary construction easement as needed to construct the project (Figure 22-25).

Construction access to the BNSF bridge project area will occur via SR-91 and Green River Road, and on temporary access/haul roads on the golf course adjacent to the Green River Mobile Home Park levee.

A new emergency ingress and egress road will be provided for the Green River Home Owner's Association under the railroad bridge during and after construction.

The portion of the existing Green River Mobile Home Park bank protection temporary access road within the southern portion of the project footprint will be removed and restored following project construction. Permanent access to the southern portion of the project segment and the Green River Mobile Home Park levee for maintenance will occur from: (a) the Green River Mobile Home Park itself (through new gated access developed between interior roads within the Mobile Home Park and the existing bank protection road); (b) the existing Phase 2A project access road to the north and the new emergency ingress and egress road under the BNSF bridge; or (c) through development of a new permanent access road between the existing bank protection road and Green River Road, with a new alignment for this access road at the southern end that is more than 200 feet northeast of the current access road alignment (Figures 23-25).[4] The temporary access road removal and restoration would be done with the goal of restoring and reducing disturbance to the B Canyon wildlife corridor that traverse the southern end of the footprint of this project segment (Undercrossing 91-17 in Figure 33).[5] The former temporary access road alignment in this area would be restored with native upland vegetation, including vegetation appropriate for enhancement of the B Canyon wildlife corridor where appropriate.

[4] While shown as a permanent feature in Figures 23-25, the current temporary access road alignment will be removed and revegetated. Permanent access for O&M will be provided as described herein.

[5] The culvert entrance/exit for the B Canyon wildlife corridor is about 80 feet west of the junction of the existing temporary access road and Green River Road.

Equipment to be used for construction of bridge and bank protection features will include cranes, bulldozers, excavators, compactors, dump trucks, rollers, pickup trucks, earth augers, vacuum trucks, pile drivers, low overhead drill rigs, and low headroom hydromill. Additionally, delivery trucks will be associated with imported materials; 20 daily truck trips are anticipated on average. Construction is expected to take about 3 years to complete. Clearing and grubbing is proposed to begin in 2016 and will be completed outside of the bird breeding season (February 15 through August 15). Construction is expected to continue to about 2019. Daily construction will occur between 7:00 a.m. and 4:00 p.m.

Additional Project Work

A portion or all of the following activities may be conducted at the same time as construction of the above-listed features, and small portions may be included in Corps construction contracts where work limits overlap. This consultation does not address any of the following activities that would occur outside the mapped temporary or permanent footprint of the proposed project (i.e., Figures 3-25), nor those that will include any permanent features outside of mapped project permanent footprint areas.

Santa Ana River Interceptor (SARI) Line Abandonment/Severing

SARI Line relocation construction is nearing completion and the contractor is scheduled to proceed with pipe abandonment of the existing SARI Line. The activity consists of sewer pipe abandonment procedures such as cleaning and flushing the system and sand or slurry fill of the abandoned pipeline. However, due to concerns associated with potential impacts on river flow by leaving the pipeline intact, the Corps has required that the existing pipeline be severed at five locations where it crosses the low-flow channel as part of the abandonment plan. The severing process will likely employ steel piles driven into the pipeline to fracture the concrete and sections will be filled with sand and slurry plugs. In addition, the top section of existing manholes will be removed, the shaft filled with sand or slurry, and the base of the manhole shaft perforated (Corps 2015a).

SARI Line Emergency Rock Removal

For many years, the potential for erosion-related damage to the existing SARI Line has been a cause of concern for the California Regional Water Quality Control Board and for Orange County Sanitation District (OCSD), the owner of the SARI Line. In 2005, rock riprap was placed in the river by OCSD initially as an emergency measure to protect the SARI Line from riverbed degradation/scour. Over the ensuing years, OCSD has added more rock to the river as a maintenance activity to protect the SARI Line. OCSD has placed about 30,000 tons of large rock in the river at five major locations between Weir Canyon Road and the Green River Golf Course. The Corps – Regulatory Division issued a Clean Water Act section 404 Permit to OCSD for the emergency and maintenance work, which included a condition that requires the removal of all rock after the completion of the SARI Line Project. OCSD is continuing to coordinate the details and timing of rock removal with the Corps and other agencies. It is anticipated that one of the emergency rock piles located inside the footprint of the Phase 4 project will be removed by the Corps as part of proposed construction site preparation (Corps 2015a).

Changes to the Conservation Measures

Conservation measures previously identified in the 2012 amendment will be implemented to offset impacts to habitat for vireo, Santa Ana sucker, and gnatcatcher and to minimize construction-related impacts, including: 1) the size of the construction footprint, 2) disturbance to nesting birds, 3) impacts to water quality, and 4) soil contamination. The Draft SEA includes numerous environmental commitments, best management practices and mitigation measures to avoid, minimize or offset environmental impacts; however, a few of these measures were not fully consistent with the conservation measures in the 2012 amendment. Measures concerning noise impacts, cowbird trapping, Santa Ana sucker, and critical habitat have been modified subsequent to release of the Draft SEA in coordination with the Service.

The following measures from the 2012 amendment will be modified specifically for the proposed Reach 9 Phase 4, 5A, 5B and BNSF Bridge Protection Projects [**deletions are in ~~strikeout~~, additions are <u>underlined</u> below**]. To facilitate implementation of conservation measures as addressed by the 2012 amendment and modified below, Enclosure 1 presents a complete description of the conservation measures pertinent to section 7 consultation on the proposed Reach 9 Phase 4, 5A, 5B and BNSF Bridge Protection Projects. All of the measures from the 2001 SEIS/EIR and Supplemental EA/EIR Addendum, as modified by our 2001 biological opinion, 2012 amendment, and herein, remain in effect and are herein incorporated by reference and will be used for developing and implementing the contract for the proposed project.

Temporary Disturbance of Riparian/Wetland Habitat (excluding unvegetated perennial stream)

- Non-riparian areas that are temporarily disturbed will be maintained free of exotic plants for 8 years. <u>Container plants will be planted and irrigated in upland areas to expedite the restoration process.</u>

- Conduct brown-headed cowbird (*Molothrus ater*; cowbird) removal trapping at a minimum of ~~5 sites in the Norco Bluffs area and 15~~ <u>10 sites in the Reach 9 (or other areas along the Santa Ana River and environs where trapping would likely be more effective for vireo production, subject to review and approval by the Service) during all years when construction of the proposed project is occurring and 5 years following construction.</u> ~~for at least 2 years during construction and 5 years following construction.~~ Alternatively, a cash contribution will be made to the Trust Fund for the equivalent amount of cowbird trapping in the upper Prado Basin and Reach 9. Trapping will occur during the vireo and flycatcher egg-laying season (March 15 to July 30). This effort is intended to supplement on-going cowbird trapping activities elsewhere in the Prado Basin;

General Conservation Measures for the Vireo and Flycatcher

- <u>Imported soil will be tested for compatibility with native soil, re-vegetation palette, and the ecology of the project area and vicinity. Samples shall be tested from the project site, the proposed import source, and any combinations of mixtures of the native soil and imported</u>

soil desired for use within the site. The results of the tests must show compatibility with existing soil, re-vegetation palette and ecology of the project area and vicinity, as determined by the project biologist and soils/geology team members.

- For construction activities within or adjacent to occupied vireo or flycatcher habitat, the following measures shall be implemented to reduce or avoid noise impacts:

    1. Prior to the commencement of construction activities, ambient noise levels will be measured at 50 feet and 100 feet from the proposed boundaries of the construction sites and recorded in a graphic format.

    2. Sound walls shall be constructed at the boundary of the proposed construction site and/or haul route prior to March 1. Sound walls will probably consist of ½"-thick, 8'-high plywood sheets. The construction contractor may use other materials or procedures that attenuate sound to acceptable levels, defined below.

    3. Where ambient noise is less than 60 dBA and it is determined that construction-related noise levels may exceed 60 dBA: monitoring shall be conducted at 50 feet and 100 feet from the sound wall, or at the boundary of occupied habitat (if habitat areas are more than 100 feet from the construction site), to ensure that construction-related noise does not exceed 60 dBA within these areas. If construction noise levels exceed authorized limits, the contractor shall modify the sound barriers, equipment, or procedures (including construction schedules) as necessary to meet these conditions, to the extent practicable. If construction noise levels within riparian habitat areas outside the project footprint cannot be reduced below 60 dBA L_{eq} hourly during the period of February 28 through August 15 of any year, the Corps will offset impacts at a 1:1 ratio per breeding season affected by such noise levels. This 1:1 ratio will be based on the acreage of riparian habitat outside the project footprint[6] subject to noise levels over 60 dBA L_{eq} hourly during the noted period, per the number of breeding seasons affected (e.g., 1 acre of riparian habitat affected by noise in two breeding seasons will result in 2 acres of restoration; 1 acre of riparian habitat affected by two separate project phases or segments in a single breeding season will result in 1 acre of restoration). The area affected will be determined by periodic project noise monitoring. This offsetting measure will consist of riparian habitat restoration (non-native invasive vegetation control) for 5 years, from the upper Santa Ana River watershed and/or action area.

    4. Where pre-construction ambient noise is greater than 60 dBA: monitoring shall be conducted at 50 feet and 100 feet from the sound wall, or at the boundary of occupied habitat (if habitat areas are more than 100 feet from the construction site), to ensure that construction does not result in a significant increase over ambient conditions (i.e., noise level increases shall not exceed 5 dBA over ambient). If construction noise levels exceed authorized limits, the contractor shall modify the sound barriers, equipment, or

[6] This includes all riparian habitat areas outside of the mapped project footprint (Figures 3-25). L_{eq} hourly noise level contours for project construction activities during the vireo nesting and breeding season will be calculated and reported for the areas adjacent to the project footprint based on noise monitoring to be performed, as appropriate.

procedures (including construction schedules) as necessary to meet these conditions, to the extent practicable. If construction noise levels within riparian habitat areas outside the project footprint cannot be reduced to or below 5 dBA L_{eq} hourly over ambient noise levels during the period of February 28 through August 15 of any year, the Corps will offset impacts at a 1:1 ratio per vireo breeding season affected by such noise levels. This 1:1 ratio will be based on the acreage of riparian habitat subject to noise levels more than 5 dBA L_{eq} hourly over ambient during the noted period, as determined by periodic project noise monitoring.. This offsetting measure will consist of riparian habitat restoration (non-native invasive vegetation control) for 5 years, from the upper Santa Ana River watershed and/or action area.

Specific Conservation Measures for the Santa Ana Sucker

1. Restoration activities for the Santa Ana sucker will be conducted between August 15 and February 28, outside the vireo breeding and nesting season, or in a manner that otherwise avoids adverse effects to the vireo.

2. ~~Create and/or enhance 1 acre of perennial stream habitat within the Santa Ana River or its tributaries for each acre of unvegetated perennial stream that is temporarily or permanently disturbed during construction-related activities. The estimated total of disturbed habitat is approximately 7.9 acres (4.4 acres of permanent effects and 3.5 acres of temporary effects, not including the previously concreted portion of the Green River Golf Course channel). A conceptual habitat creation plan will be reviewed and approved by the Service prior to initiating construction activities that will affect perennial stream habitat for the sucker. Creation/enhancement activities could include but are not limited to the following:~~

    1. ~~The development of pool-riffle complexes by placing clusters of various sized boulders within the river channel to provide limited cover and areas of reduced water velocity.~~

    2. ~~The creation of potential spawning/larval habitat downstream of Prado Dam. For example, San Marino Environmental Associates identified Aliso Creek, which is a tributary downstream of Prado Dam within Chino Hills State Park, as a possible restoration site for sucker spawning habitat in their Conservation Program for the Santa Sucker in the Santa Ana River, Southern California, December 1999.~~

    3. ~~The creation of lateral stream habitats (i.e., very shallow areas along the stream margin with little current) that are believed to be essential for the survival of larval suckers.~~

3. **2.54 Acre Scour Enhancement** -- To offset temporary impacts to 2.54 acres of perennial stream habitat from the completed Reach 9 Phase 3 project, the Corps will create six or more 'habitat nodes' in the reach of the Santa Ana River between Rialto Drain and Mission

Boulevard (or other areas subject to review and approval of the Service), to improve the viability of the extant population of Santa Ana suckers this area. Boulders, large woody debris, or other materials will be placed in the low-flow channel to promote scour of fine sediments, consistent exposure of course sediment substrates, river meander, and pool formation. Substrate augmentation (e.g., river gravel and cobble) may also occur in the same area to enhance perennial stream habitat function. A small, one-person suction dredge may also be used to expose existing gravel and cobble within the riverbed. Suction dredge operators will be accompanied by Service-approved biologists familiar with Santa Ana suckers and their habitats in order to avoid negative impacts to suckers.

This measure is expected to enhance perennial stream habitat within at least 2.54 acres of occupied habitat along about 4 miles of river, as measured by the area of pools created, gravel/cobble substrates exposed, and other functional Santa Ana sucker habitat features created/enhanced. Monitoring will be conducted for 5 years and will include water quality, visual observations of substrate, and other surface topography and fish surveys. Any non-native aquatic predators encountered during the surveys will be removed from the system. A conceptual habitat restoration plan will be reviewed and approved by the Service prior to initiating these habitat restoration activities. The restoration activities noted herein will be initiated prior to the initiation of construction for the BNSF Bridge project segment.

4. **Reintroduction of Captively Bred Santa Ana Sucker or Gravel/Cobble Augmentation** – To offset impacts to Santa Ana sucker from the BNSF bridge protection segment and to help to sustain and enhance the viability of the overall population in the river into the future, the Corps will either (A) expand the range of the species through active reintroduction of captively bred Santa Ana sucker to suitable unoccupied habitat within its historical range in the Santa Ana River; OR (B) perform gravel/cobble augmentation within Reach 9.

    1. (A) The Corps, within its contractual authorities, will contract with a Service-approved entity that can demonstrate the ability to re-introduce captively-bred Santa Ana suckers over a period of 5 years to a suitable unoccupied location(s) with the intent of establishing a new self-sustaining population within the former range of the species on the Santa Ana River. The contract will be awarded and a plan of action, including identification of target re-introduction area(s), will be developed prior to initiation of construction of the BNSF bridge project and no later than 1 year after the date of this Biological Opinion, unless otherwise approved by the Service. The Contract requirements will include the following: (1) rearing and maintaining a sufficient number of breeding adults to support re-introduction of a minimum of about 500 juvenile suckers into the target area per year (or alternate numbers proposed in the Plan of Action and agreed to by the Corps and Service); (2) annual relocations for up to 5 years; and (3) monitoring, adaptive management, and reporting during the 5-year re-introduction period. Task 1 will be completed within 3 years of the date of initiation of the contract, or within 2 years of completion of any necessary approvals/permits, whichever is later. Task 2 will be

initiated within 4 years of the date of initiation of the contract, or within 3 years of completion of any necessary approvals/permits, whichever is later. Reporting will occur annually to the Service following initiation of relocations.

If it becomes infeasible to re-introduce captively-bred Santa Ana suckers (e.g., if prior to reintroduction of suckers it becomes clear that no suitable re-introduction site is available, and/or that landowner/stakeholder opposition cannot be overcome), no further funding will be obligated to captive breeding or re-introduction efforts. Instead, the Corps will coordinate with the Service to initiate the option identified below.

OR:

~~2.~~ (B) The Corps will implement gravel and cobble augmentation within Reach 9 for sediment management improvement and Santa Ana sucker habitat enhancement.[7] Gravel (0.04 to 2.5 inch diameter rock which may include some sand, with about half of the material larger than 0.2 inch) and cobble (2.5 to 10 inch diameter rock), all river-rounded and otherwise appropriate for Santa Ana sucker spawning will be placed by the Corps within the low-flow channel within select locations in Reach 9 to provide available fluvial sediment to the river and to enhance habitats for Santa Ana sucker. It is expected that at least 2 acres of riverbed will be enhanced by direct placement[8] of river gravel and cobble to an average depth of 2 feet, or through other methods developed by the Corps in a Plan of Action, subject to the review and approval of the Service. Additional appropriate locations will be selected for a passive gravel augmentation.[9] Total river gravel to be placed will be about 25,000 tons; total river cobble to be placed will be about 10,000 tons. The river cobble and about half of the augmented river gravel will be immediately placed as bars within the river's low-flow appropriate locations in Reach 9 (per the 2 acres of direct gravel and cobble placement noted above). The remaining half of the river gravel will be placed as passive augmentation along river channel in the upper portion of Reach 9 for future fluvial transport and natural deposition downstream.[10]

5. **Channel Complexity Enhancement** -- Along the base of the Phase 4 soil cement structure, large rock will be irregularly placed to increase the morphological complexity of the lower

[7] The goal of this measure is improve geomorphological and biological functioning of the river in a portion of Reach 9 for Santa Ana sucker and least Bell's vireo for several decades.
[8] In the direct gravel and cobble placement augmentation project approach, spawning-sized gravel is placed mechanically onto a riffle, a group of riffles, or individual riffles within a longer reach, using heavy construction equipment for gravel placement and distribution. The aim is to create a riffle surface that immediately provides good spawning habitat.
[9] Passive gravel augmentation project approaches rely on stream storm flows to distribute and form gravel deposits suitable for spawning, from gravel artificially supplied from upstream (see Bunte 2004).
[10] The goal of this measure is to enhance the continuity of sediment transport in Reach 9, help ameliorate sediment starvation in the project area, and provide for natural gravel bar development (see Kondolf 1997 and Bunte 2004 for more detail).

embankment area.[11] At the interface of the soil cement slope with the final earthen fill surface, 0.5- to 2-ton rocks in groupings of 5 to 15 rocks each will be loosely placed on the soil surface, semi-randomly every 100-200 feet along the 3,150-foot length of the Phase 4 embankment. Placement of this rock (locations, arrangement, etc., per the expected channel complexity needs of the Santa Ana sucker) will be directed in the field by a fish biologist approved by the Service.

General Conservation Measures to Maintain Wildlife Movement Through the Action Area:

6. In order to maintain wildlife movement in the project area at existing or better conditions, the Corps will develop a plan of action for wildlife movement-related ramps, culvert exit-entrance structures/features/substrate enhancements, corridor cover vegetation, and other features associated with the project structures where appropriate, subject to the review and approval of the Service (Figures 18-20). Many of these features are outlined in the Corps' Environmental Assessment (Corps 2015a). The Corps will implement this plan of action in construction/development of these features as part of project construction and operations/maintenance.

Action Area

According to 50 CFR § 402.02 pursuant to section 7 of the Act, the "action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. Subsequent analyses of the environmental baseline, effects of the action, and levels of incidental take are based upon the action area. The action area for the proposed Reach 9 Phases 4, 5A, 5B, and BNSF Bridge Project includes Reach 9 of the Santa Ana River, which extends about 7.4 miles between Prado Dam in Riverside County and Weir Canyon Road Bridge in Orange County (Figure 26). Reach 9 encompasses the project area, where we anticipate project-related effects such as increased noise, light, dust levels, and human activity during construction of the project. It also encompasses the range of the vireo below Prado Dam where temporary changes in the distribution of the species may occur in association with the project.

Some proposed restoration/enhancement activities areas will occur in the Santa Ana River upstream of Prado Basin (Figure 2) between Riverside Ave and Mission Avenue (Specific Conservation Measures for the Santa Ana Sucker, "2.54 Acre Scour Enhancement" above) and sporadically throughout Reach 9 ("Gravel/Cobble Augmentation" above); the footprint for these activities is undetermined, but would predominantly occur within unvegetated river channel and disturbed bank areas. Most proposed restoration and enhancement activities will occur within the project footprint (general restoration activities and "Channel Complexity Enhancement" above). Santa Ana sucker captive propagation activities will occur in disturbed/developed locations and existing facilities

[11] The goal of this measure is to partially restore channel embankment complexity along the new armored slope feature where future river low-flows will potentially contact the slope following natural meander of the river. It is expected that the Santa Ana River in the project area will naturally meander into different locations between the slope protection embankments in Reach 9, resulting in different positions over time for the river low-flow channel. This will likely include varying future places and periods where the low-flow will be directly against portions of the Phase 4 slope protection such that the hard surface of the armored slope will form one side of the low-flow channel.

("Reintroduction of Captively Bred Santa Ana Sucker" above). Santa Ana sucker re-introduction locations ("Reintroduction of Captively Bred Santa Ana Sucker" above) will occur on the Santa Ana River or its tributaries, likely upstream of Seven Oaks Dam (Figure 2); the footprint for these activities will be very small and not involve ground disturbance and will only use hand-carried equipment.

STATUS OF THE SPECIES

Detailed information on the status of the vireo and Santa Ana sucker was included in our 2001 biological opinion. Also (and more recently), the status of the vireo was described in the *Least Bell's Vireo (Vireo bellii pusillus) 5-Year Review: Summary and Evaluation* (Service 2006) at: http://ecos.fws.gov/docs/five_year_review/doc781.pdf, and the status of the Santa Ana sucker was described in the *Santa Ana sucker (Catostomus santaanae) 5-Year Review: Summary and Evaluation* (Service 2011a) at: http://ecos.fws.gov/docs/five_year_review/doc3616.pdf, and *Recovery outline for Santa Ana sucker (Catostomus santaanae)* (Service 2012b) at: http://ecos.fws.gov/docs/recovery_plan/Recovery%20Outline%20for%20Santa%20Ana%20Sucker_3-30-2012.pdf. The draft recovery plan for the least Bell's vireo can be found at: http://ecos.fws.gov/docs/recovery_plan/980506.pdf.
The draft recovery plan for the Santa Ana sucker can be located at: http://ecos.fws.gov/docs/recovery_plan/Draft%20Recovery%20Plan%20for%20the%20Santa%20Ana%20Sucker.pdf. The final rule for designated critical habitat for the Santa Ana sucker can be found at http://www.gpo.gov/fdsys/pkg/FR-2010-12-14/pdf/2010-30447.pdf#page=2.
Please refer to these documents for updated specific information on the life history requirements, threats, and conservation needs of each species. These documents are herein incorporated by reference.

General information on the status of vireo

The vireo population in the U.S. increased 10-fold from 1986 to 2010, numbering from 291 to 3,280 territories (Kus *et al.* 2015). The population grew substantially during this period since the original listing (1986) and then reversed after a peak in 2010 (Service 2006, Kus *et al.* 2015). From 2010 to 2014 the known vireo population rangewide declined about 15 percent to roughly 2,790 territories, likely primarily due to an ongoing drought in California and related reduced vireo breeding productivity during that period (Kus *et al.* 2015). Historically, this species was widespread and moderately common throughout riparian woodlands in the Central Valley and low elevation riverine valleys of California, ranging from Tehama County in northern California to northern Baja California. Most of the current vireo breeding sites are located in southern California between the Tehachapi Mountains in Kern and Ventura counties south to northwestern Baja California, Mexico (Service 2006). Thus, despite a significant increase in overall population numbers since listing, the population remains restricted to about the southern half of its historic range. Critical habitat was designated for the vireo in 1994; none occurs in the project action area.

The overall positive population trend for vireo since its listing is primarily due to efforts to reduce threats such as brown-headed cowbird parasitism and wholesale loss and degradation of riparian habitats. The control of giant reed (*Arundo donax*) has been effective at improving vireo habitat in many drainages since the original listing of the vireo. Continued control will be needed to achieve local giant reed eradications and to address invasions by other exotic plants [e.g., *Tamarix* species,

perennial pepperweed (*Lepidium latifolium*)] that continue to degrade riparian habitats for the species. Brown-headed cowbirds substantially expanded into the historic and current range of the vireo about 100 years ago, and brood parasitism by brown-headed cowbirds remains a primary threat to vireo recovery (Service 1998). Cowbird trapping has proven to be an effective technique for improving vireo populations where it is implemented; however, Kus and Whitfield (2005) argue that trapping programs are a stop-gap measure and may not be the best way to achieve long-term recovery of the vireo. The expansion and continued brown-headed cowbird propagation is closely related to human land use that is proximal to riparian areas that are existing/potential vireo breeding areas within the species historic and current range (Robinson *et al.* 1995, Service 1998, Jewell and Arcese 2008). Cowbird abundance and parasitism rates of hosts are typically distributed as a declining gradient based on distance from cowbird feeding sites and that reduction or isolation from feeding sites can reduce the effects of parasitism on host populations (Goguen and Mattews 2000), Additional research is needed to identify the best way to manage this threat over the long term.

The draft recovery plan for the vireo identifies a minimum of 11 metapopulations to be conserved in order to recover the species, including the Santa Ana River metapopulation. The primary goals of the draft recovery plan are to: 1) maintain stable or increasing vireo metapopulations, each consisting of several hundred or more breeding pairs, 2) protect and manage riparian and adjacent upland habitats within the historic range of the vireo, 3) control non-native plant species, 4) control cowbird parasitism, and 5) conduct habitat restoration.

General Information on the status of Santa Ana sucker, and its designated critical habitat

The listed entity of Santa Ana sucker is confined to three watersheds in southern California: 1) Santa Ana River in San Bernardino, Riverside, and Orange counties; 2) San Gabriel River in Los Angeles County; and 3) Big Tujunga Creek, a tributary to the Los Angeles River in Los Angeles County (Service 2000b). At the time of listing we estimated that the historical range of the species had been reduced by at least 70 percent in each watershed and that the range and distribution of Santa Ana sucker was primarily limited by habitat modifications attributed to urbanization (e.g., dams, road crossings, concrete-lined channels) (Service 2000b). The threats identified at the time of listing have not abated but have continued to increase, thereby making the species more vulnerable to extinction (Service 2011a).

The Santa Ana sucker is a benthic fish that feeds predominantly on algae and detritus found on cobble, gravel, and other hard surfaces (Greenfield *et al.* 1970). The distribution of the population in the Santa Ana River is not random, but has been shown to be mostly represented in a reach along the Santa Ana River with cobble and gravel [Haglund *et al.* 2001, Thompson *et al.* 2010, Santa Ana Watershed Association (SAWA) 2014]. Although Santa Ana sucker is a highly fecund species, breeding and foraging areas have been reduced, fragmented, and modified to an extent that is inhibiting the proliferation of the species (Service 2011a).

The Santa Ana sucker's ability to live in perennial streams that are subject to periodic, severe flooding is linked primarily to their high fecundity and early maturity (Greenfield et al 1970). These factors allow the fish to repopulate quickly following a flood (Moyle 2002). Habitat requirements of gravel and cobble have been shown to relate not only to their feeding habits, but also to their spawning, as fertilized eggs of the sucker adhere to the gravelly substrate (Greenfield *et al.* 1970). The water volume and flow of the river plays an important role in shaping its habitat; at times of high

river flow, new sources of gravel and cobble are mobilized/distributed along the river, whereas maintaining a constant low flow in areas that are occupied by Santa Ana suckers allows undesired sand and silt to be moved out of the area (Service 2012b). Besides the need for a constant flow of water, suckers are affected by several factors including, but not limited to, off-highway vehicles, water quality, nonnative vegetation (mainly giant reed), and nonnative predators (Service 2012b).

The draft recovery plan for Santa Ana sucker identifies and prioritizes specific recovery actions necessary to achieve Santa Ana sucker recovery in each of three Recovery Units (Santa Ana River Watershed, San Gabriel River Watershed, and Los Angeles River Watershed). In general, the highest priority for recovery is the implementation of management actions to restore and improve habitat conditions throughout the current range of the species. In addition, given the substantial reduction in the range of the species, the currently occupied areas, particularly in the Santa Ana River, will likely not be sufficient to provide the resiliency and redundancy necessary for recovery. To reduce the risk of extirpation, while determining appropriate actions to manage threats within the current range, areas not currently accessible to the fish should be assessed for potential reintroduction. Increasing the extent of occupied habitat will improve the representation, resiliency, and redundancy of Santa Ana sucker, thereby improving the status of the species (Service 2014a).

Critical habitat for Santa Ana sucker was designated on December 14, 2010 (75 FR 77962). Three designated critical habitat units exist that include about 9,331 acres of Federal, State, local, and private land in the Santa Ana River (San Bernardino, Riverside, and Orange counties), the San Gabriel River (Los Angeles County), and Big Tujunga Creek (Los Angeles County). Individual critical habitat units are each intended to independently support a population of Santa Ana sucker in a functioning hydrologic system that provides suitable water quality, water supply, and coarse sediments. The proposed project is located within critical habitat Unit 1, which includes 7,097 acres within the Santa Ana River and its watershed.

PCEs for the Santa Ana sucker are those physical and biological features that support life history functions essential to the conservation of the species including primarily a functioning hydrological system that provides sources of water and course sediment necessary to maintain all life stages (i.e., adults, juveniles, larvae, and eggs) of the species. They include hydrology (PCE 1), sediment (PCE 2), water depth and velocity (PCE 3), water clarity (PCE 4), temperature (PCE 5), instream habitat, such as food resources and shelter (PCE 6), and movement corridors (PCE 7). A detailed description of the PCEs and the function of critical habitat for the species can be found within the 2010 final rule designating critical habitat (75 FR 77962).

ENVIRONMENTAL BASELINE

Regulations implementing the Act (50 CFR §402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area that have undergone section 7 consultation and the impacts of State and private actions that are contemporaneous with the consultation in progress.

The Santa Ana River Basin is the largest watershed in southern California with a drainage area of about 2,670 square miles. The Santa Ana River watershed is separated into an upper and a lower basin divided by Prado Dam. The Reach 9 project areas occur in the lower Santa Ana River basin,

between about 2 and 6 miles downstream of Prado Dam. River hydrology in Reach 9 largely reflects the water release regime from Prado Dam into the lower Santa Ana River. Releases are dictated by the Prado Dam water control manual. Since the modifications to Prado Dam in 2008, average outflows have been about 450 cubic feet per second from October to February and about 275 cubic feet per second from March to May. Outflows during summer months, averaging around 150 cubic feet per second, are usually unconstrained base flows of the river (averages based on flow records from USGS 2012). The average outflows from March to May are lower due to water conservation agreements with Orange County Water District (OCWD) that limit outflows to match OCWD processing (e.g., water percolation) capacity.

The SARP is a flood risk management system on the Santa Ana River that was originally authorized for construction by the Water Resources Development Act (WRDA) of 1986. Reach 9 is a soft bottom portion of the Santa Ana River, which in 1986 was bounded by undeveloped land with the SR-91 (Riverside Freeway) to the south and low elevation mountains and a railroad to the north. Since that time, residential, commercial, and industrial developments, as well utilities and facilities, have been constructed on portions of the Santa Ana River floodplain and river meander zone of Reach 9, which has resulted in construction of local flood risk management measures (Corps 2015a). The Corps determined in the 2002 that additional measures were necessary to support the authorized level of releases from Prado Dam (Corps 2015a). Accordingly, the Corps constructed Phases 1, 2A, and 2B in Reach 9 (Figure 1). As noted above, subsequent evaluations by the Corps dictated that additional bank protection was warranted, beginning with Phase 3 in Reach 9 (recently completed) (Corps 2015a).

Prado Dam has effectively cut off the supply of coarse sediment delivered to the lower Santa Ana River from upstream sources and has greatly altered geomorphic processes and aquatic natural community conditions in the channel and floodplain downstream of the dam. Without additional coarse sediment delivery to the channel, the existing alluvial sediments in the bed and river terraces/bars (including sand and gravel) have decreased as these sediments are transported downstream and not replaced (e.g., see Chang 2003, Fulton 2008, Pasternak 2008). Channel and floodplain sediments have been scoured away by both long-duration low-flows and infrequent flood flows that affected channel landforms after the dam cut off the resupply of sediment. This has, and will probably continue to cause, degradation/incision/narrowing of the channel, reduction of high-function spawning sand and gravel for native aquatic species, and reduction of riparian ecosystem functions (e.g., see Pasternak *et al.* 2010). This reduction in coarse sediment supply has been compounded by the armoring of channel embankments along much of Reach 9, with the resultant "capping" of alluvial sediments deposited in the former outer floodplain and meander zone of the river. These alluvial sediments would otherwise be available for fluvial erosion-transport-deposition (mobilized) during flood flows and following natural meander of the river over time.

The river within the action area in Reach 9 ranges in width between about 400 and 2,000 ft. The river in Reach 9 is paralleled by SR-91 beginning at the Prado Dam outlet in Riverside County, downstream to the vicinity of the South Weir Canyon Road/Yorba Linda Boulevard bridge in the City of Yorba Linda, Orange County (Corps 2015a). At that point, the Santa Ana River transitions from a somewhat natural soft-bottomed channel to an engineered channel that conveys larger flows to the Pacific Ocean.

Natural Communities and Aquatic Ecosystem in the Action Area

Reach 9

About 1,100 acres of floodplain in Reach 9, including the project area, are contained within the Santa Ana River Canyon Habitat Management Area (HMA), which is "operated and maintained for open space and wildlife habitat values" by the County of Orange (Corps 1988). Vegetation/natural community mapping of the HMA was completed in 2012 using the Orange County Habitat Classification System (LSA 2012). Riparian natural communities within Reach 9 are composed primarily of native cottonwood-willow forest, mulefat, and willow scrub plant communities, interspersed to varying degrees with non-native plants such as giant reed, castor bean (*Ricinus communis*), and tree tobacco (*Nicotiana glauca*). Mexican elderberry and oak woodland communities are relatively common on the upper benches of Reach 9. Upland areas of the Reach 9 floodplain and adjacent areas are dominated by ornamental landscaping, non-native/ruderal grassland communities, and disturbed or barren areas associated with human uses. Native upland natural community areas consist of a mixture of scrub (e.g., coastal sage, scale-broom, buckwheat, and Yerba Santa) and grassland (e.g., salt grass) natural communities.

The Santa Ana River historically and currently flows perennially though Reach 9. Stream surveys to evaluate the function of habitat, relative to Santa Ana sucker life history requirements, have not been completed in Reach 9. High river flows and turbid water conditions make systematic surveys of habitat for Santa Ana sucker difficult in Reach 9; nevertheless, some gravel and cobble substrate is often present whenever the riverbed is evaluated (Swift 2001). For example, temporary diversion of river flows into a diversion channel in conjunction with construction of the Green River Golf Club Embankment Project revealed substantial gravel/cobble substrates within the natural riverbed of that area (Russell 2010).

Shallow water, riparian, and upland areas adjacent to the river banks of Reach 9 have been substantially altered over the last several decades. These areas include the river's low-flow, the water's edge, the slope to the top of the channel bank, the floodplain, and associated riparian areas. The shallow water areas are primary places where native aquatic species find refuge, food, and passage. These important rearing, feeding, and migration areas are the result of natural processes that erode, move, and deposit sediments within the river's bed, banks, and floodplain and provide nutrients, organic matter, and woody debris from plants adjacent and near the river.

Much of the shallow water and stream bank environments of Reach 9 have been collectively altered directly or indirectly with levees, slope protection, floodplain fill, meander zone fill, and railroad/road/recreational/commercial/residential development. Significant portions of the stream banks and floodplain/meander zone embankments of Reach 9 are now armored with soil cement, riprap, grouted stone, and other measures. In addition, several bridge structures over the river have caused a series of constrictions in the river's floodplain and floodway; recreational land uses have also confined and narrowed the effective riparian zone of the river in some locations. The physical attributes of rivers control the quantity and ecological functions of energy sources available to biological consumers such as invertebrates and fish (Smits *et al.* 2015); the noted modifications to Reach 9 have partially degraded the ecosystem conditions depended upon by Santa Ana sucker and vireo.

Santa Ana River Channel Upstream of Prado Basin Between Rialto Drain and Mission Boulevard

Riparian vegetation along the mainstem of the Santa Ana River occurs where surface and/or subsurface water is available (e.g., groundwater within about 6 to 9 feet of the ground surface). It is composed of native southern cottonwood/willow woodland, interspersed to varying degrees with giant reed and other invasive species [e.g., pepper trees (*Schnius sp.*), tree of heaven (*Ailanthus altissima*), castor bean, tree tobacco, and California fan palm, (*Washingtonia filfera*)]. Habitat restoration projects, consisting primarily of giant reed removal, have contributed to an increase the function and quantity of native riparian communities in this area since 2001 (see *Factors Affecting the Species in the Action Area*).

The floodplain and meander zone of the Santa Ana River between Rialto Drain and Mission Boulevard is confined by levees to a width of about 800 to 900 feet for the majority of the reach. Rainfall and snowmelt periodically provide flows during the winter/spring months under current conditions, while perennial flows are substantially supported in the summer months by the wastewater releases from the City of Rialto Municipal Waste Water Treatment Plant and Regional Tertiary Treatment Rapid Infiltration and Extraction Facility.

Surveys conducted annually since 2006 indicated the river channel is predominantly gravel and cobble between Rialto Drain and Riverside Avenue with a considerable covering of sand (Service 2014b). Between Riverside Avenue and Mission Boulevard the composition of substrate fluctuates annually, with gravel and cobble extending downstream from Mission Boulevard four times between 2006 and 2014 (Service 2014b). Sediment transport through the system is currently limited by drought conditions that have contributed to a reduction in the average monthly flow levels in the Santa Ana River by more than half.[12] About 26 river miles of the Santa Ana River above Prado Dam are accessible to Santa Ana sucker; however, the vast majority of this reach has a uniform, shallow depth and consists of greater than 90 percent silt/sand substrate (Service 2014b). Habitat utilization studies conducted in 2003 and 2004 indicate that habitat preferred by adult Santa Ana suckers (i.e., runs with depths of about 28 inches and greater) is extremely limited above Prado Dam (Haglund *et al.* 2003, Haglund and Baskin 2004a).

Status of the Species in the Action Area

Least Bell's vireo

Regular surveys conducted by SAWA have documented a substantial increase in the vireo population in the Santa Ana River watershed since 2001 (Hoffman and Zembel 2012). In Reach 9, the number of territories increased from 23 in 2001 to 81 in 2005 and then fluctuated between 2006 and 2011 from a low of 61 and a high of 75 territories. Information for 2012 indicated 65 vireo territories in the Reach 9 action area (Reeser 2012, pers. comm.). Vireo protocol surveys in Reach 9 reported a total of 114 territories in 2013 and 112 territories during 2014 (Hoffman *et al.* 2014). Data from 2015 is not yet available.

[12] Data retrieved from USGS Surface-Water Monthly Statistics for gage station 11066460 (Santa Ana River at MWD Crossing) on July 14, 2105: URL: http://waterdata.usgs.gov/ca/nwis/monthly?

As the vireo numbers have increased rangewide, the species has both expanded its range and occupied habitat at higher densities in some locations, such as within the action area. In 2001, all 23 territories detected in Reach 9 were located between Prado Dam and the Green River Golf Club. Beginning in 2002, vireos established territories downstream from the Green River Golf Club in the "Featherly Park" survey reach (Hoffman and Zembel 2012, Hoffman *et al.* 2014). About 59 out of 112 territories observed in Reach 9 were located downstream of the Green River Golf Club in 2014 (Hoffman *et al.* 2014).

Overall nesting success in Reach 9 from 2001 to 2014 was 58 percent (163 of 282 nests); the overall productivity rate of well-tracked pairs during the same time was 1.7 (Hoffman *et al.* 2014), which is less than the estimated minimum replacement rate of 2.0 for the species (Kus *et al.* 2015). In 2014, nesting success for 28 well-tracked nests in the Reach 9 was 50 percent (Hoffman *et al.* 2014). Twelve of the 28 tracked nests were lost to depredation (43 percent), and two were lost to reproductive failure (7 percent) (Hoffman *et al.* 2014). No tracked nests were lost due to parasitism in 2014 (Hoffman *et al.* 2014), which was likely related to the cowbird trapping that has been ongoing in the Reach 9 area.

The number of fledgling observations since 2001 in Reach 9 has fluctuated between a high of 97 in 2013 to a low of 29 recorded in 2012 (Hoffman *et al.* 2014). A total of 887 fledglings have been produced in Reach 9 over the last 14 years (Hoffman *et al.* 2014). In 2014, 92 fledglings were documented in Reach 9 (Hoffman *et al.* 2014).

The Freeway Complex Fire of November 2008 temporarily eliminated habitat for an estimated 43 territories in Reach 9 (as detailed below) (Hoffman *et al.* 2014). However, only moderate vireo number decreases were reported for this general portion of Reach 9 (i.e., in the Upper Canyon and Featherly Park areas) in 2009 (Hoffman *et al.* 2014). In 2014, Phase 3 of the Corps project was initiated, which disturbed the habitat of about 10 vireo territories (Hoffman *et al.* 2014). Additional disturbances in Reach 9 in 2014 included the on-going County of Orange SARI-line project activities in Featherly Park and Green River Golf Club (Hoffman *et al.* 2014). Work from all of these projects continued throughout the 2014 nesting season, which reportedly affected nesting vireo in some areas (Hoffman *et al.* 2014).

Surveys for the vireo between Rialto Drain and Mission Boulevard have been conducted annually by the San Bernardino Flood Control District and SAWA. Between Rialto Drain and Riverside Avenue, surveys for the vireo were conducted by the San Bernardino Flood Control District between 2001 and 2011. The number of vireos increased during this period from 0 pairs in 2001 to 21 pairs in 2011, with a high of 24 pairs observed in 2010 (Romich 2012). Low fledgling success was observed in this reach (an average of 0.94 fledglings per pair); however, this was attributed in part to the level of survey effort and in part to the increase in population density resulting in lower nesting attempts per pair. Surveys conducted by SAWA between Riverside Avenue and Van Buren Boulevard (about 4.5 miles downstream from Mission Boulevard) in 2013 and 2014 documented 77 and 66 territories, respectively (Hoffman *et al.* 2014). The reduction in territories was attributed to limitations in survey effort in 2014 that were associated with an increase in the number of homeless camps within the survey reach.

Santa Ana sucker

Despite several survey efforts (e.g., Haglund and Baskin 2004b; Russell 2005, 2010; Baskin and Haglund 2008; Entrix, Inc. 2005; ECORP 2009; Mills 2012 pers. comm.), only six Santa Ana suckers have been captured in Reach 9 since 2001, all in conjunction with monitoring for the SARP. Five Santa Ana suckers were collected in the old Prado Dam outlet channel, upstream from the proposed project area, and one was collected in the Reach 9, Phase 2B project area, downstream of the BNSF bridge project segment upstream of Phases 4, 5A, and 5B (Figure 1).

Surveys were conducted annually for Santa Ana sucker in three 100-meter reaches above Prado Dam between 2001 and 2011 (Haglund and Baskin 2011). Population estimates during this time period ranged from 475 fish per mile in 2009 to 1,975 fish per mile in 2002. Between 2005 and 2011, the greatest numbers of fish were collected at the upstream most survey site (above Riverside Avenue Bridge), where appropriate substrate for spawning and foraging was consistently present. In 2013, surveys for Santa Ana sucker were conducted in 32 locations above Prado Dam (SAWA 2014). While the results are not directly comparable to previous surveys due to differences in survey methodology, the majority of Santa Ana suckers were captured in the upper survey reaches, from the Rialto Channel confluence to just downstream from Mission Boulevard. Santa Ana suckers have previously been captured below Mission Boulevard in numbers similar to what is currently found above Mission Boulevard (e.g., Chadwick and Associates1992, Swift 2002, Tennant 2003); however, the prevalence of sand substrate and lack of habitat complexity are likely factors limiting the distribution of the species between Mission Boulevard and Prado Dam.

The action area is located in Unit 1 (Santa Ana River) of the final designated critical habitat for the Santa Ana sucker (75 FR 77962). The purpose of this unit is to independently support a population of Santa Ana sucker in a functioning hydrologic system that provides suitable water quality, supply, and coarse sediment. The proposed Reach 9 Bank and Bridge Protection Project is located in Subunit 1C (Lower Santa Ana River) of designated critical habitat for the Santa Ana sucker, which extends about 10.7 miles from below the Prado Dam outlet to 0.6 mile downstream of the State Route 90 (Imperial Highway) bridge over the river in Orange County. The perennial stream restoration will occur in Subunit 1B, which extends about 22 miles from near Tippecanoe Avenue in San Bernardino County to the Prado Basin in Riverside County (75 Fr 77962). The critical habitat final rule recognizes that special management considerations or protection may be required in this subunit to address habitat degradation associated with reduced water quality, altered hydrology, and channel constrictions (e.g., bridges, levees, channelization) occurring in conjunction with urban development (75 FR 77962).

Factors Affecting the Species in the Action Area

Reach 9

<u>Altered Fluvial Processes, Geomorphology, and Hydrology</u>

Streams and rivers are shaped by a combination of “forming forces” that include: gravity, or the slope of the channel banks; friction, which is a function of vegetation, the soil types and particle sizes, and the channel patterns and profiles; velocity, the speed of the water flow; and quantity, the volume of water flowing and sediment moving through the stream (Santa Clara Valley Water District 2006). Over time, stream channels move and shift in response to changes in these forming forces. As

such, streams do not naturally tend to flow in a straight line. Instead, they meander in "search" of equilibrium with their forming forces, adjusting to changes in water flow and sediment transport (Santa Clara Valley Water District 2006). These changes can have both natural and non-natural causes.

The amount of material (other than water) transported by a stream is described as the stream load (Leopold 1994). Stream load is directly proportional to stream velocity and stream gradient/slope and relates the amount of material transported past a point during a specified time interval. The greater the stream velocity is, the greater the mass that can be transported by a stream (stream load). Broad, slow moving streams are highly depositional and have low stream competence, while high velocity streams have are capable of moving large rocks and have high stream competence.[13]

Prado Dam regulates the water flow in Reach 9 and is a significant impediment to the transport of sediment to the streambed below the dam (Chang 2008). Similar to most other dams, Prado Dam upstream of the Reach 9 action area cuts-off the great majority of coarse sediment supply downstream, such that river bed scour, bank erosion, and tributary supply from the areas downstream of the dam become the only post-dam gravel and cobble sources (Kondolf and Matthews 1993). Prado Dam also alters the timing of the water flow regime.

Because the majority of the sediment carried by the Santa Ana River below Seven Oaks Dam is captured above Prado Dam, the channel bed in Reach 9 has been in a state of degradation since the dam was constructed in 1940 (Mostafa and Rashedi 1991). Larger floods on the river that have occurred over the last several decades in the post-dam flow regime have normally scoured and transported coarse sediment from the river bed in Reach 9 for which there was stream competence. This erosion and transport of finer sediments eventually left behind a lowered/eroded streambed in Reach 9 (Chang 2008). Additionally, gravel in the size suitable for spawning of Santa Ana sucker has not been fully replenished by remaining upstream supplies (from the riverbed, banks, and tributaries) and is becoming increasingly scarce.

Many of the floodplain embankments within Reach 9 have been armored with soil cement, grouted stone, sheetpile, or rip-rap in varying configurations. Much of this armoring is well-back from the current river low-flow channel and provides for a remaining floodplain of moderate width (compared to what occurs along other rivers in the region and the floodplain that occurred historically in Reach 9). Nevertheless, substantial areas of bank armoring are adjacent to the river's current low-flow and bank full channel. Additionally, other areas of bank armoring are within the river's former meander zone and are expected to be contacted by future low-flows following natural river meander, as well as areas that are normally contacted by river flows during periodic moderate flood events. This armoring has partially modified the natural conditions that are important for the continued creation and maintenance of aquatic species habitats, including potential erosion and supply of alluvial sediment and substrates stored in these former meander and floodplain zones. Sediment erosion and deposition of channel banks, particularly during periodic moderate flow events, are major natural factors influencing native aquatic species habitats. When sediment supply and fluvial movement of sediments is reduced because of bank armoring, the aquatic area and physical complexity of the

[13] Stream competence reflects the ability of a stream flow to transport a particular size of particle, e.g., boulder, pebble, etc.

stream are generally reduced, and potentially make the aquatic-riparian geomorphology less suitable for the native plants and animals that normally live there, including native aquatic species. This is even more important considering the compounding modification associated with Prado Dam noted above, particularly the bank and bed supplies of sediment that are normally available to the river during and following normal flood events and natural river migration/meander. Armored embankments often have the following impacts on the aquatic stream ecosystem (e.g., Service 2001b; NOAA 2012a; NOAA 2012b):

1. Placement of hard, steep bank structures or rip-rap slope protection often results in reduction in available shallow water in locations where those slope features are contacted by river low-flows, thereby forcing native aquatic species into other areas or deeper water where they can be more likely to be eaten by exotic fish;

2. Bank protection normally limits productivity for some native aquatic species by taking away potential production of invertebrate prey; and

3. Covering of embankments with armoring normally eliminates riparian or upland vegetation communities within the armoring footprint and reduces the associated aquatic-riparian connectivity, channel complexity, and primary production within the adjacent existing and future potential low-flow channels.

As part of the SARP, Prado Dam was raised 28.4 feet, and the outlet was redesigned to allow controlled releases of 30,000 cubic feet per second. A net loss of about 5,000 cubic yards of sediment (on average) are anticipated to be eroded from the Santa Ana River bed downstream of Prado Dam and delivered to the ocean each year as a result of operations enabled by the new outlet (Corps 1988). Bed profile modeling conducted to determine the requirements for protection of the Santa Ana River Interceptor (a buried wastewater/brine line) estimated that about 26 feet of the Santa Ana River thalweg near Prado Dam will be downcut (eroded) in predicted locations due to lack of sediment replenishing the area (Chang 2008). A grade control structure at the downstream end of Reach 9, just below Weir Canyon Road Bridge, prevents local degradation of the channel bed in this area (Tetra Tech 2012).

The extent to which future predicted geomorphological changes (particularly channel degradation) in Reach 9 will alter habitats for the vireo and Santa Ana sucker has not yet been substantially evaluated. Typically associated effects that result from long-term scour and degradation of rivers and streams in this region are: scour and net long-term erosion of fine and moderate-sized sediments, exposure of coarse sediments, channel incision/degradation, narrowing and deepening of the river's low-flow, increased main channel flow capacity, reduced overbank flow to floodplain areas for any given flood event, "hanging" or perched floodplain terraces, drained and lowered groundwater levels, modified channel gradients, and reduced riparian ecosystem functions, etc. These effects have been and continue to be realized in Reach 9, though they have only been generally analyzed. The Corps has initiated a study (*Proposed Prado Basin, California Feasibility Study*) to, in part, evaluate issues related to alteration of the natural sediment transport regime in the Santa Ana River (77 FR 68749). In a letter dated August 3, 2012, to the Service, the Corps requested initiation of informal consultation on the potential effects to the Santa Ana sucker and its critical habitat from ongoing operations at Prado Dam and proposed changes in the operations of Seven Oaks Dam. The Service and Corps are working together to develop and assess information on the factors that will

likely influence Santa Ana sucker and vireo habitats and conditions in the Santa Ana River and its tributaries.

Construction and Habitat Restoration

Vireos in Reach 9 are likely currently affected by habitat loss and function reductions associated with ongoing and recent construction projects (e.g., Service 2012a, c; Hoffman *et al.* 2014). Construction of SARP components in Reach 9 to date have resulted in direct impacts to about 61 acres of riparian vegetation and about 14 acres of upland vegetation that have been offset through the removal of giant reed from locations outside of Reach 9, but within the Santa Ana River watershed, as described in the 2012 amendment (Service 2012a, Service 2013a). Temporarily affected areas in riparian and upland natural communities from these projects have been restored in-place in many areas where Reach 9 construction projects are complete (e.g., Lower Highway 91 Embankment and Car Wash/Strip Mall Bluff Stabilization); however, some areas that were recently under construction (e.g., an estimated 116 acres associated with Reach 9 Phase 2A and 2B) are generally disturbed, barren, or in initial stages of restoration (LSA 2012). Additional barren or ruderal areas are associated with the recently completed Santa Ana River Interceptor Line Protection/Relocation Project (SARI Project), which affected about 28 acres in Reach 9 (OCFCD and Corps 2010). The reduction in riparian and adjacent upland habitats, combined with the disturbance associated with construction of some recent SARP components during the breeding season, has likely contributed to the low vireo productivity recorded in Reach 9 in 2012 (Service 2013a) and has probably affected productivity in subsequent years (Hoffman *et al.* 2014). We anticipate that vireo productivity in Reach 9 will increase as the various project temporary impact areas are restored and mature. Depending on the nature of the impacts (e.g., removal of above-ground vegetation only or removal of all vegetation, including root systems), riparian and upland natural communities (and associated habitats) should typically recover to a useable condition for vireos in about 5 years or less following initiation of restoration activities (Aspen 2010).

We initially exempted incidental take of 31 pairs of vireos residing downstream of Prado Dam, due to the potential for noise impacts during construction and the loss or degradation of habitat resulting from construction and operation of the SARP over the life of the project (Service 2001a) and an additional 10 pairs in association with the Reach 9 Phase 3 component of the SARP (Service 2013b). We exempted incidental take of an additional 3 pairs of vireos due to the potential for noise impacts during construction of the SARI Project in the 2012 vireo nesting season (Service 2012c). Because vegetation clearing occurred outside of the breeding season, no vireos were likely directly injured or killed during construction, and many of the displaced pairs likely returned to adjacent remaining habitat (either eventually finding unoccupied habitat or competing for occupied habitat with other vireos) in the following breeding season. A substantial (but undetermined) portion of the riparian areas temporarily disturbed by the completed Phase 2B project are under restoration and recovering; these areas of habitat will likely be increasingly productive for vireos over the next few years. All previously exempted incidental take of vireos from the 2001 biological opinion and subsequent amendments has been exhausted.

The Santa Ana sucker is also affected by construction-related degradation of habitats in Reach 9 (Service 2012a). A total of 15.14 acres of aquatic habitat for the Santa Ana sucker was disturbed in Reach 9 during construction of the Prado Dam Outlet Works and Phases 1, 2, and 3 projects. Impacts to Santa Ana sucker habitat were partially offset through enhancement of the stream within the

Phase 1 project area and expansion of aquatic habitat in the Phase 2 project area, adjacent to Green River Golf Club. However, the habitat features constructed within Reach 9 are not all expected to persist on the site over the long term due to the likely effects of high flows expected to be released from Prado Dam (Corps 2012a). Impacts to habitat in the (completed) Phase 3 project area will be offset on the Santa Ana River upstream from Prado Dam with enhancement measures included in the current project description ("2.54 Acre Scour Enhancement" above).

We exempted incidental take of 13 Santa Ana suckers residing downstream of Prado Dam for the completion of these projects, including 4 as a result of stranding and 9 as a result of pre-construction capture and relocation efforts. Based on our review of construction projects completed to date, a total of 6 Santa Ana suckers have been captured downstream from Prado Dam during project related diversions (Baskin and Haglund 2008, Russell 2010). Therefore, the incidental take exemption for completion of the remaining project features in Reach 9 is still valid for 4 Santa Ana suckers as a result of stranding and 3 as a result of capture and relocation.

The new Prado Dam outlet structure (i.e., baffles, cement lined channel, and drop structure), completed in 2008, was anticipated to significantly increase the potential for injury or death of Santa Ana suckers moving downstream past Prado Dam, essentially precluding connectivity between the upstream and downstream segments of the Santa Ana sucker population in the Santa Ana River (Service 2001a). A "trap and haul" program was originally included as part of the SARP to maintain genetic connectivity between populations of Santa Ana suckers above and below Prado Dam, in lieu of providing fish passage through the dam. This program was replaced with additional habitat enhancement below Prado Dam in 2012 because it was determined that habitat restoration would provide a greater benefit to Santa Ana suckers until other important factors limiting a viable breeding population in Reach 9 (e.g., altered hydrology, non-native fish, and water quality) could be addressed (Service 2012a).

Fire

Vireo habitat in the action area was degraded by the 28,889-acre Freeway Complex Fire in November 2008 (California Office of Emergency Services 2008). Habitat within about 43 vireo territories was burned in Reach 9 (Hoffman and Zembal 2011). Riparian natural communities that were burned have since been recovering, and vireos have re-established territories within these areas. The continued recovery of vireo habitat in this area may be contributing to the observed increases in vireo productivity in Reach 9 since 2012 (Hoffman *et al.* 2014). The Highway Fire burned about 1,050 acres in nearby Prado Basin in April 2015 and likely caused some vireos from Prado Basin to temporarily or permanently move to Reach 9 in search of functional territories, likely increasing interspecific competition in the area during the 2015 breeding season.

Invasive Aquatic Species

Increased predation and competition from invasive species was recognized as a threat impacting the Santa Ana sucker in our 2001 biological opinion. Construction of SARP project components downstream from Prado Dam (i.e., Prado Dam outlet channel and Reach 9 Phases 1, 2B, and 3) has resulted in diversions within the Santa Ana River, and monitoring during the diversions resulted in the collection of over 5,000 non-native fish of 13 different species (Aspen 2013a, 2013b, 2014, 2015; Haglund and Baskin 2004b; Russell 2005, 2010, 2012). Altered habitat conditions that favor non-

native fish in Reach 9 include deep slower moving water, warmer water temperatures, increased suspended solids in the water column, and more regulated flows (Aspen 2014, 2015).

Cowbird and Habitat Management

Cowbird trapping conducted with funding provided in large part by the Corps as part of the SARP has helped to offset impacts to vireo breeding productivity in the action area by keeping nest parasitism levels in Reach 9 quite low. SAWA cowbird trapping began in the Reach 9 in 2001 when parasitism was detected in 5 of 19 nests (26 percent) (Hoffman *et al.* 2014). As an indicator of the effects of these trapping efforts, parasitism was detected in only one nest within Reach 9 between 2004 and 2011. Parasitism was detected in 1 of 21 nests (5 percent) in 2009 after 5 years of no detections. In 2014, 112 cowbirds were removed over 509 trap days in Reach 9. Since 2001, 2,044 cowbirds have been removed by SAWA from Reach 9 over 10,206 trap days during the vireo's breeding seasons (Hoffman *et al.* 2014).

Giant reed removal projects have also increased the function of habitat for the vireo in Reach 9. Orange County Public Works is maintaining about 130 acres of vireo habitat in Reach 9 as mitigation for impacts to Corps jurisdictional areas associated with construction of flood control projects in Orange County (Paster 2012, pers. comm.). In addition, the vireo will benefit from management actions that will be implemented by the Corps and local sponsors as part of the SARP to ensure the baseline acreage of riparian vegetation is maintained within the 1,100-acre HMA (Service 2001a). Management actions are anticipated to include proactive implementation of habitat restoration (e.g., invasive plant removal) to address non-flood related reductions in riparian vegetation below the established baseline condition (e.g., spread of invasive plants) (LSA 2014). Giant reed removal is expected to increase functional riparian habitat for the vireo in Reach 9 (SAWA 2010) as long as maintenance continues to prevent re-infestation of the treated areas.

Wildlife Movement

Our 2001 biological opinion discusses the importance of maintaining wildlife linkages[14] and corridors[15] within and across Reach 9 for preserving the ecological integrity and functions that sustain the local population of vireos and other sensitive species. These corridors and linkages are important, in part, for maintaining keystone predators and controlling meso-predators that prey on avifauna (Crooks and Soule 1999). Reach 9 provides very important corridors and linkages for wildlife movement between the Santa Ana Mountains to the south and the Chino Hills and Prado Basin to the north and northeast (e.g., Service 2001a, Lyren 2001, Service 2013a, Alonso 2014).

The U.S. Geological Survey (USGS) recently completed a study for the California Department of Transportation to evaluate connectivity for carnivores across SR-91, which runs parallel to and south of the Santa Ana River. From 2008-2010, 29 underpasses on SR-91 between Gypsum Canyon Road and Auto Center Drive were monitored using remotely-triggered cameras, GPS tracking of bobcats

[14] Linkage refers to broader regions of connectivity important to facilitate the movement of multiple species and maintain ecological processes.
[15] Wildlife corridors are components of the landscape that facilitate the movement of organisms and processes between areas of intact habitat.

and coyotes, and mortality surveys (Lyren 2011, pers. comm.). Results indicate that "hot spots" (underpasses or road segments animals preferred or selected for crossing SR-91) for indicator mammal crossing (e.g., bobcat, coyote, mule deer) activity occur at a number of locations in the Reach 9 area, including B Canyon (Undercrossing 91-17 on Figure 33), Starr Ranch drive-through, Fresno Canyon, and several unnamed culverts under the 91 freeway (Figure 33). Overall, bobcats and coyotes use most of the underpasses in the action area (Lyren 2012, pers. comm.). Viable north-south underpasses are highly limited along SR-91 due to development adjacent to the Santa Ana River (Lyren 2015, pers. comm.).

Much of the Santa Ana River floodplain and surrounding natural upland areas in the action area function as an east-west linkage, but the relatively deep water of the current Santa Ana River low flow in most of Reach 9 restricts wildlife movement across the Santa Ana River, as many animals try to avoid locations where they will need to swim across the river (Lyren 2015, pers. comm.). Continual incision of the river channel in Reach 9 has likely increased this limitation over the last few decades (Lyren 2015, pers. comm.). Vertical structures (walls, exposed sheetpile, etc.), steep smooth surfaces (e.g., some slope protection types), barriers (e.g., fences), extreme relief (large rip-rap), lack of vegetative cover (e.g., railroad, roads, residential and commercial development, mowed/disturbed areas), human activities, noise (e.g., SR-91 freeway), nighttime lighting, and hard surfaces (concrete, asphalt) all very likely contribute to significant constraints to wildlife movement within the Reach 9 area (Lyren 2015, pers. comm.). From 2013 to the present, camera traps indicate bobcats and coyotes using three bridges over the Santa Ana River intended for golf carts and automobiles (Lyren 2015, pers. comm.).

To increase the probability of maintaining wildlife movement through an underpass, Lyren *et al.* (2006) recommend wildlife underpasses be surrounded by native vegetation, located along primary wildlife travel routes (away from areas containing noise and light pollution), and serve only wildlife needs. Bobcats are more likely to use underpasses surrounded by vegetation (Haas 2000). On the other hand, crossing areas should have somewhat open trail routes to and through them that are not densely vegetated, so as to facilitate finding underpasses and to avoid blocking wildlife movement (Lyren 2015, pers. comm.). Surrounding vegetation provides important cover for the animals as they enter or exit the underpasses. In addition, underpass openness[16] influences the frequency of use by bobcats and coyotes (Haas 2000, Clevenger and Waltho 2005). In general, the frequency of underpass use by mountain lions, bobcats, and coyotes increases as underpass height, width, and/or openness increases (Haas 2000).

As part of the SARP, the Corps is required to develop a plan to maintain wildlife movement and habitat connectivity commensurate with baseline conditions (Term and Condition 2.8 of the 2001 biological opinion). A draft of this plan was reviewed by our agency in 2003, but the plan has not been finalized. Instead, specific design features to facilitate wildlife movement have been developed for each project component during project design. An evaluation of the efficacy of these measures to maintain baseline movement levels in Reach 9 will be complicated by a number of road improvement projects that are anticipated to further constrain wildlife movement: Eastbound SR-91 Lane Addition from SR-241 to SR-71 (Service 2007), State Route 91 and SR 71 Interchange Improvement Project (Service 2011b), State Route 91 Corridor Improvement Project (Service 2011c), and the Green River

[16] Openness is calculated as: (height x width)/length of the underpass in feet/meters (Lyren *et al.* 2006).

Road Widening Project (RCA 2010). These road projects are anticipated to limit wildlife movement through several of the underpasses in the action area by extending the length of the underpasses (reducing openness), reducing or eliminating vegetation near the entrance to the underpasses, and/or limiting animal access to the underpasses.

A switchback trail was constructed on the grouted stone face of the Reach 9 Phase 2A embankment with the intention of providing wildlife movement opportunities to Reach 9 commensurate with baseline conditions. However, it is expected that once the soil placed over the embankment to create the ramp erodes away (as is likely to occur with predicted future channel erosion and degradation during predicted river flow releases), the remaining lack of vegetation and grouted stone substrate on the steep slope embankment will likely discourage movement by species such as bobcats.

Several highly important underpasses and crossings occur in the project area, some of which have entries/exits occurring in the project footprint. For example, the Brush Canyon wildlife corridor is traversed by Phase 5B; the Coal Canyon wildlife corridor connects with the larger linkage area of the Santa Ana River (with connections to the Chino Hills) upstream of Phase 4 and 5B; several important culverts have entries/exits in Phase 4; an important unnamed crossing traverses the upper 700 feet of Phase 5B (connecting the Santa Ana River linkage area to the Chino Hills); the B Canyon wildlife corridor connects to the Santa Ana River at the downstream portion of the BNSF bridge project footprint (proposed access road area); and the BNSF bridge crosses the Santa Ana River linkage area.

Santa Ana River Channel Upstream of Prado Basin between Mission Boulevard and Rialto Drain

Several factors are contributing to degraded habitat conditions for both the vireo and Santa Ana sucker in the Santa Ana River upstream from Mission Boulevard. Reductions in surface flows –are limiting the extent of aquatic habitat available for the Santa Ana sucker and riparian vegetation available for the vireo. Several additional stressors identified in the draft recovery plan for the Santa Ana sucker in this reach include intermittent wastewater discharge, increased depth to groundwater, loss of high flows, loss of river gradient, off-road vehicle use, and the recent invasion of a non-native filamentous alga (Service 2014a). Many of these stressors are also likely to affect the vireo by degrading habitat conditions.

Giant reed was originally removed from this section of the river in 2004 (SAWA 2006). The Santa Ana Watershed Association continued to maintain this area through 2012, in part with funds provided by Corps to offset SARP-related impacts to habitat in Reach 9. A rapid assessment conducted in 2012 documented less than one percent of the following non-natives in this reach: giant reed, Peruvian pepper tree, castor bean, saltcedar and short-podded mustard (SAWA 2012). The lack of available surface water, combined with unauthorized off-road vehicle use has contributed to the limited extent of native riparian vegetation that has re-established in the 10 years since non-native plants were removed between Riverside Avenue and Rialto Drain; however, downstream from Riverside Avenue native riparian vegetation is much more extensive.

Cowbird trapping is conducted annually in the Santa Ana River above Riverside Avenue by San Bernardino County Flood Control District. Between 2003 and 2011 a total of 2054 cowbirds were removed (Romich 2012). The rate of parasitism was not monitored; however, the trapping program is likely contributing to the increase in vireo pairs observed in the Santa Ana River in San Bernardino County (Romich 2012). Cowbird trapping has been conducted by SAWA annually since 2002

between Riverside Avenue and Mission Boulevard. A total of 624 cowbirds were removed between 2002 and 2014 (Hoffman *et al.* 2014). No cowbird parasitism was observed in 2014.

The majority of the reach between Rialto Drain and Mission Boulevard is located in Riverside County within the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP) plan area boundary. For the Santa Ana sucker, the MSHCP specifically identifies conservation objectives to: 1) provide long-term conservation for the species, 2) develop a management and monitoring plan for the species, and 3) mitigate for impacts to Santa Ana sucker habitat that are associated with permittee activities (Dudek and Associates, Inc. 2003).

EFFECTS OF THE ACTION

Effects of the action refer to the direct and indirect effects of an action on the species, together with the effects of other activities that are interrelated and interdependent with that action, which would be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action, are later in time, and still reasonably certain to occur.

This analysis focuses on the effects of the proposed action that are due to changes/additions to the SARP from the Reach 9 Phases 4, 5A, 5B, and BNSF Bridge Project (e.g., additional project footprint, modification of geomorphology/hydrology) that would result in different effects compared to the consultations that have occurred on the SARP to date. Unless otherwise stated, we do not anticipate changes in effects relative to what was previously analyzed.

Least Bell's Vireo

Direct Effects

Removal and/or disturbance of habitat during construction

Construction of the Reach 9 Phases 4, 5A, 5B, and BNSF Bridge Project will directly impact about 38.17 acres of breeding, sheltering, and foraging habitat used by 13 pairs of vireo.[17] These impacts to riparian habitat consist of about 28.52 acres of temporary impacts and about 9.65 acres of permanent impacts. The clearing of vireo habitat for project construction will only occur outside of the vireo breeding season; therefore, we do not expect that vireo adults, eggs, or nestlings will be killed or injured during the habitat removal.

Although riparian habitat removal will be conducted outside the vireo breeding season, vireo pairs usually attempt to return to the same breeding territory each year, and removal of a substantial portion of a vireo pair's territory will force the pair to expand their existing territory or establish a new territory. Vireos are distributed throughout much of the suitable habitat within Reach 9

[17] This estimate includes the substitution of sheetpile for grouted stone slope protection in a portion Phase 5B (Figures 18-20), which is anticipated to reduce the number of vireo pairs in the construction footprint from 14 to 13.

(Hoffman *et al.* 2014); therefore, it is likely that displaced vireos will be forced to compete with resident vireos when attempting to expand an existing territory or establish a new territory.

If displaced birds cannot establish themselves in suitable habitat to forage and shelter in, we anticipate they will be more vulnerable to predation, otherwise may die, be injured (including failure to develop sufficient fat reserves for migration), and/or fail to reproduce. Vireos that successfully establish territories in adjacent habitat are expected to experience reduced productivity (e.g., delayed initiation or prevention of nest building, fewer nesting attempts per season, and/or overall reduction in reproductive output) due to reduced availability of foraging and breeding habitat and increased territorial interactions

For example, surveys conducted during the 2004 and 2005 breeding seasons on San Diego Creek in Orange County found that when vireo breeding habitat was removed to address flood risk, vireos returning to the affected area had lower productivity than vireos occupying a portion of the creek where the vegetation was unaltered. Four territories where habitat was removed produced a total of 5 young (1.25 young/pair). Two other territories, which did not have habitat removed, produced a total of 8 young (4 young/pair) (Chambers Group, Inc. 2005). Similarly, low vireo productivity recorded in Reach 9 in 2012 and subsequent years is likely associated with the loss of riparian habitat during construction of recent SARP components (see *Factors Affecting the Species in the Action Area, Construction and Habitat Restoration*).

The proposed project will directly impact about 12 percent of the vireos in the action area (i.e., 13 out of about 112 pairs in Reach 9 in 2014). Permanent impacts to 9.65 acres of vireo habitat will limit the number of vireos that can be supported within Reach 9 during the overall project timeframe, spanning completion of construction and restoration activities. Taking into account the staggered initiation of construction activities for the different projects and a period of about 2 to 3 years for construction of each project and about 5 years for successful restoration of habitat following project completion, the loss of vireo territories and impacts to reproduction are anticipated to persist for about 8 to 10 years.

The greatest loss of vireo territories will occur within about 2 to 3 years when all of the projects are anticipated to be under construction; however, consistent with the 2001 biological opinion, Orange County Flood Control District will be required to maintain riparian habitat in Reach 9 that is equivalent to 2001 baseline conditions, and following the restoration of temporary impacts, the habitat function within the project footprint is anticipated to increase and the number of vireo territories and reproductive output is anticipated to gradually return to pre-project levels. The implications of this temporary loss of vireo territories and reproduction for the persistence of vireos in Reach 9 and rangewide are discussed in more detail below in “Combined effects of habitat loss and noise-related disturbance on the local vireo population.”

In addition to the above restoration efforts, the Corps will conduct additional restoration outside the construction footprint to offset the temporary and permanent loss of vireo habitat from the project. Consistent with the 2012 amendment (see Enclosure 1), the Corps and non-Federal sponsors will restore 164.40 acres of riparian vegetation (through exotic plant removal) (Jones 2015a, pers. comm.). The Corps has indicated this will occur in areas adjacent to an existing 250-acre SARP mitigation site, upstream from Prado Dam on the Santa Ana River (Corps 2015a). In addition to conducting habitat restoration, the Corps and/or local sponsor will conduct cowbird trapping in the

vicinity of the project during project construction and for 5 years following project completion. Cowbird trapping is anticipated to maintain and enhance vireo reproduction within Reach 9, which will help offset the loss of vireo reproduction from habitat loss.
Routine maintenance of the proposed embankments and structures is not expected to require disturbance to vireo habitat; therefore, maintenance involving removal of vireo habitat is not addressed in this biological opinion.

Increased noise and vibration during construction

Because construction activities (other than habitat clearing and grading) are scheduled to occur during the vireo breeding season, the noise and vibrations associated with the operation of heavy equipment is likely to affect nesting success of vireos in adjacent habitat. A distance of 500 feet was used by the Corps to determine potential noise impacts from proposed pile driving activities associated with Phase 5A, and a distance of 200 feet from the project footprint activity areas was otherwise used where no pile driving is proposed (Figures 29-32) (Corps 2015a). The total amount of riparian vegetation within the 200/500-foot noise impact area is 98.43 acres. Although vireo territories outside of the 200/500-foot noise impact area may be exposed to increased noise and disruption during breeding season, it is our assessment that impacts outside this area will not have a meaningful impact on survival and reproduction (i.e., the effects will be insignificant; unable to meaningfully be measured, detected or evaluated).

Using this approach, we estimate that vireo nesting activities within the sound impact area may be disrupted as a result of this project and may include up to 37 vireo territories[18] based on 2014 surveys (Figures 29-32). Since the initiation of construction for the projects will be staggered over the next 2 years and construction of each project phase/segment will take 2 to 3 years, the impacts from noise may extend over 3 to 5 years. However, because construction activities will be staggered over time, it is likely that only a portion of the 37 vireo territories within the noise impact area will be adversely affected in any given year.

Sound walls will be erected adjacent to the construction footprint and haul roads, where appropriate, to reduce noise levels in adjacent extant riparian habitat, but because we do not have any information regarding the number, location, and effectiveness of the sound walls, we conservatively estimate that all vireos within the sound impact area will be subject to effects as described above. Sound walls will be constructed before the vireos arrive in the action area for the breeding and nesting season for each project phase/segment as construction is initiated; as such, sound wall installation will not increase noise levels for the vireo.

The 37 vireo territories that may be adversely affected by increased noise and vibrations represent about 33 percent of the 112 territories observed in 2014. Although this is a substantial proportion of the vireos in Reach 9, we expect that the affected individuals will experience reduced reproductive output rather than be killed or directly injured. Thus, the individuals affected by construction-related noise and vibration will likely remain in the Reach 9 region, and following project completion, will

[18] This estimate includes the substitution of sheetpile for grouted stone slope protection in a portion Phase 5B (as discussed with the Corps during consultation), which could increase the noise impacts to vireo territories to 37 (Jones 2015b, pers. comm.).

contribute to the repopulation of the areas permanently and temporarily affected by construction. The implications of this loss of vireo reproduction for the persistence of vireos in Reach 9 and rangewide are discussed in more detail below in "Combined effects of habitat loss and noise-related disturbance on the local vireo population."

The Corps has proposed to offset impacts from noise through riparian habitat restoration (control of exotic invasive plants in riparian areas offsite) at a 1:1 ratio based on the acres of riparian habitat actually affected by noise, multiplied by the number of breeding seasons that habitat is affected. As noted in the *Description of the Action* section above (General Conservation Measures for the Vireo and Flycatcher), where construction noise levels within adjacent riparian habitat areas cannot be reduced below 60 dBA L_{eq} hourly during the vireo breeding season of any year, the Corps will offset impacts at a 1:1 ratio per breeding season affected by such noise levels. Similarly, where pre-construction ambient noise is greater than 60 dBA and where construction noise levels within riparian habitat areas outside the project footprint cannot be reduced to or below 5 dBA L_{eq} hourly over ambient noise levels during the breeding season, the Corps will offset impacts at a 1:1 ratio per breeding season affected by such noise levels.

The restoration to be performed to offset noise-related impacts will occur outside of Reach 9, but it is anticipated to offset the short-term loss of vireo reproduction from construction-related noise disturbance with a longer term increase in vireo survival and reproduction, resulting from a net increase in habitat function and quantity within the Santa Ana River watershed. In addition, the Corps and/or local sponsor will conduct cowbird trapping in the vicinity of the project during project construction and for 5 years following project completion. Cowbird trapping is anticipated to maintain and enhance vireo reproduction within Reach 9, which will help offset the loss of vireo reproduction from noise-related impacts.

Conservation measures that will be implemented to minimize the potential for disruption of vireo breeding activities during construction will also be implemented during routine maintenance activities; therefore, noise-related effects to vireo reproduction resulting from routine maintenance activities are anticipated to be avoided or minimized to a level of insignificance.

Combined effects of habitat loss and noise-related disturbance on the local vireo population

The project will result in removal of habitat supporting up to 13 vireo pairs and noise-related disruption of vireo reproduction within up to 37 additional vireo territories. The effects of habitat loss are anticipated to persist for about 8 to 10 years, and noise-related impacts will occur during construction of the various projects, which will occur over an approximately 5-year period. Thus, it is possible that up to 45 percent of the vireo pairs in Reach 9 (50 of 112 territories) may be displaced or experience reduced reproduction due to noise-related impacts. Because construction activities will be staggered, it is unlikely that all 37 vireo territories within the noise impact area will be impacted each year. Nevertheless, the project will impact a substantial portion of the vireos in this stretch of the Santa Ana River.

Despite the substantial impact to vireos in Reach 9, we anticipate that vireos will persist in Reach 9 during the life of the project and return to pre-project levels following habitat restoration for the following reasons: 1) vireo pairs displaced by the loss of breeding, feeding, and sheltering habitat will be limited to an estimated 12 percent of the vireo population (13 of 112 territories) in Reach 9;

2) vireos impacted by construction-related noise are anticipated to experience reduced reproductive output, but this loss will be spread over a 5-year period, and reproductive output is expected to recover in years following completion of individual construction projects; 3) cowbird trapping along Reach 9 will maintain and enhance vireo reproduction within this stretch, partially offsetting the negative impacts of habitat removal and noise-related disturbance; 4) although the project could adversely affect up to 50 of the 112 territories in Reach 9, there are a total of 1,582 vireo territories in the Santa Ana watershed, including 520 in the Prado Basin (Hoffman *et al.* 2014); thus, there is a large stable vireo population in the Santa Ana River watershed that will continue to contribute to the overall population numbers and reproduction of the species, including helping to populate restored habitat areas.

In addition to impacting vireos in Reach 9, there is the potential for the project to reduce reproduction and dispersal to surrounding habitat. Although the project will result in temporary reduction in vireo reproduction within Reach 9, the longer-term effect of project-associated restoration activities will result in a net increase in habitat function and vireo reproduction within the Santa Ana River watershed and a corresponding increase in vireo dispersal to surrounding habitat.

In summary, while the project could reduce the number of vireos supported within Reach 9 for up to about 8 to 10 years and vireo reproduction for 5 of these years, the minimization measures and planned restoration activities are expected to significantly lessen the time-period and overall impact of the project on the vireo population in the action area. Thus, the vireo population in Reach 9 is expected to remain viable over the life of the project, and no appreciable reduction in the numbers, reproduction, or distribution of vireos in the action area or rangewide is anticipated.

Indirect Effects

Increased invasion of exotic species and nest parasites due to disturbance of habitats

The project will increase the amount of bare ground and expose remaining intact habitat to increased "edge effects" following habitat removal. This will increase the potential for non-native plants to become established in the disturbed areas and provide increased access for cowbird foraging and nest parasitism adjacent to the project area. The extent of disturbance of vireo habitat from the proposed project was likely reduced by using a substantial portion of the areas cleared as part of the SARI Project and other recently completed projects for staging and construction; however, temporary construction impacts of the proposed project in these same areas will extend the period of time before riparian and upland potential habitat areas in these previous project footprints are restored, allowing additional time for potential invasions of exotic plant species.[19]

To minimize impacts to vireo associated with disturbance of habitats in Reach 9, the Corps and/or local sponsor will use temporarily irrigated container plants in the restoration areas (temporary project footprint areas) , perform periodic weeding during plant establishment, extend cowbird trapping throughout the project construction period of about 3-5 years (for all projects combined), and continue cowbird trapping for 5 years following construction. The use of container plants and

[19] Also, permanent construction impacts of the proposed project, in some areas of what were temporary impact areas for the previous projects, will make these impacts permanent.

weeding of exotic plants, in addition to applying a native hydroseed mix, will reduce the period of time required to restore the disturbed upland areas back to functional natural communities. The existing cowbird trapping program in Reach 9 has been very effective at reducing cowbird parasitism in the area; therefore, we expect the continuation of trapping during construction of the project and for five years following, will minimize the potential for increased cowbird parasitism to a level of insignificance and will help to offset impacts to vireo productivity associated with the project..

Impacts to wildlife movement and meso-predator release

The project will likely affect movement of top predators responsible for controlling vireo predators by constructing long linear and steep hard structures (slope protection), introducing construction-related noise, lighting, and human activity; modifying vegetative cover near culvert openings; placing hard structures or surfaces (e.g., rock) at culvert entrances; lengthening existing culverts; introducing bends or curves into existing culverts; placing slope protection across existing wildlife corridors and linkages; and creating or maintaining access roads near culvert openings. Potential impacts to wildlife connectivity are primarily associated with Phase 4, which will impact four important culverts under SR-91 (91-04, 91-05, 91-06, and 91-07 on Figure 33); with Phase 5B at Brush Canyon and wildlife crossing areas of the railroad along the upstream 950 feet of Phase 5B (Figure 18); and with the BNSF Bridge project footprint, which will occur across the linkage along the Santa Ana River as well as along the B Canyon wildlife corridor (Figure 25), one of the last remaining relatively large crossings connecting the Chino/Puente Hills and Santa Ana River to large areas of conserved habitat of the Santa Ana Mountains to the south.

Ongoing construction activities will likely reduce wildlife movement for the duration of each construction project (2-3 years), but impacts to wildlife movement from noise, lighting, and human activity will be minimized by limiting construction to daylight hours and providing no nighttime lighting to the construction area.

The three culverts under SR-91 that will be lengthened by the Phase 4 project (91-04, 91-05, and 91-06; Figure 33) will extend through the soil cement structures and will daylight on a 1:1 soil cement slope. Soil will be placed on the soil cement slopes and will be revegetated with appropriate native vegetation following project completion. We anticipate that the vegetated soil will be suitable for wildlife movement and will provide adequate cover, but a high likelihood exists that Santa Ana River flows or surface runoff will eventually remove this soil and expose the soil cement slope. The project will include switchback ramps at the openings of the two 5-foot by 5-foot culverts (91-05 and 91-06); the switchback ramps will be covered with soil that will be revegetated following project completion, but the ramps will also be exposed if flows remove this layer of soil. We anticipate that the exposed ramps may not support regular movement over the embankment due to the lack of vegetative cover, but they may support some movement and will provide a potential escape route during catastrophic events such as flooding or wildfire. However, if the ramps or embankment are exposed, the eroded soil will be replaced and revegetated to maintain wildlife movement over the embankment.

In addition to modifying the substrate and cover at the north end of the culverts under SR-91, the project will lengthen the culverts. Lengthening the culverts will reduce their openness, which is a primary factor in determining wildlife use of the culverts. The fourth culvert impacted by the Phase 4 project (91-07) will not be directly altered, but a new drain will be placed near the northern exit/entrance, which could create an additional barrier for wildlife movement.

The BNSF Bridge project has the potential to impact wildlife crossing under the bridge and to disrupt wildlife movement through the B Canyon undercrossing under SR-91. However, the project will be designed in a manner to maintain existing connectivity under the BNSF Bridge along the Santa Ana River wildlife linkage. In addition, an existing temporary access road less than 50 feet from the B Canyon undercrossing will be removed and revegetated. Permanent access for O&M of existing structures will be provided using one of the following alternatives: 1) the existing Phase 2A project access road to the north; 2) through the Green River Mobile Home Park; or 3) creation of a new permanent access road that is located at least 200 feet from the entrance to the B Canyon undercrossing. Considering that the permanent access road will be used only for periodic access for O&M, we do not anticipate that it will result in substantial disruption of wildlife movement.

Phase 5B will result in the construction of a grouted stone barrier through Brush Canyon, which has the potential to reduce wildlife dispersal through this habitat linkage. Brush Canyon provides a linkage for wildlife to disperse from habitat around the Santa Ana River into the Chino/Puente Hills. Dispersal between the Santa Ana River and Chino/Puente Hills is constrained by development on the southern slopes of the Chino/Puente Hills, but dispersal opportunities under SR-91 are much more limited. Potential effects to wildlife movement through Brush Canyon will be minimized by creating a ramp over the grouted stone embankment and improving native vegetative cover south of the embankment (Figure 18).

The project has measures to reduce its impacts to wildlife movement, and measures such as proposed habitat restoration around the culvert entrances will benefit wildlife dispersal, but the increased impacts associated with the lengthening of existing culverts, installation of cement slopes beneath the culverts, and the installation of grouted rock across Brush Canyon is likely to have a net negative long-term effect on wildlife dispersal through the action area. Nevertheless, we anticipate that there will be sufficient dispersal by top predators to maintain meso-predators populations at levels that will not significantly impact vireo populations in the action area.

Effects on Recovery

Vireos in the action area are part of the Santa Ana River metapopulation identified in the draft recovery plan for the vireo (Service 1998). The Santa Ana River metapopulation is one of the two largest concentrations of vireo throughout its range and is considered a major source population providing for expansion of the vireo in southern California that has occurred since the species listing (Service 2006). The main short-term effects of the Reach 9 Projects on the vireo, including current proposed project, will be to reduce vireo productivity for several years during and following construction, which will likely temporarily limit the action area's contribution towards the expansion of the vireo population.

However, the restoration and management actions that will be implemented as part of the project are consistent with the recovery actions and goals described in the draft recovery plan for the vireo. Specifically, the proposed removal of non-native plants, restoration of adjacent upland habitat, and cowbird trapping will help accomplish recovery task 1 from the draft recovery plan, which is to protect and manage riparian and adjacent upland habitat within the vireo's historic range. Proposed restoration and management actions will likely result in an eventual net gain of native riparian habitat (and associated overall carrying capacity) in the watershed, which is anticipated to help support the survival and recovery of the species in the long-term.

Santa Ana sucker

Direct Effects

Construction and restoration-related impacts to sucker

Construction and maintenance of the Reach 9 Phase 4, 5A and 5B Projects are not anticipated to result in direct removal or disturbance of habitat for the Santa Ana sucker. Construction of the BNSF bridge project will require diversion of about 1,200 feet the Santa Ana River within the construction footprint and will result in impacts to 1.22 acres of perennial stream (0.95 acre temporary, 0.28 acre permanent). The effects of de-watering aquatic habitat for the Santa Ana sucker were previously evaluated in our 2001 biological opinion. Few Santa Ana suckers have been captured below Prado Dam since the species was listed, and it is not certain that a viable breeding population is currently supported in Reach 9. Thus, few Santa Ana suckers are likely to be adversely affected by the project. The 2001 biological opinion estimated that up to 13 Santa Ana suckers (4 due to stranding and 9 due to pre-construction surveys) will be affected in the action area by the SARP. Since only 6 Santa Ana suckers have been captured in Reach 9 in association with the SARP, the risk of exceeding the incidental take exemption established in the 2001 biological opinion is low.

While few Santa Ana suckers will likely be affected by direct construction impacts, the baseline conditions in the action area for the species have deteriorated relative to what was analyzed in the 2001 biological opinion. The distribution of the species is much more limited than was known in 2001 due to a lack of suitable habitat and while the full extent of habitat degradation due to operation of Seven Oaks and Prado Dams is under investigation, it is now expected to be greater than originally anticipated. As such, any impacts to Santa Ana sucker and its aquatic habitat in Reach 9 are of greater importance to the overall status of the species than we originally considered. The proposed measures to offset construction-related impacts to the Santa Ana sucker are expected to improve the short and mid-term status of the species in the Santa Ana River watershed while additional investigations are completed and measures to improve the long-term status of the species are developed.

The 2.54-acre restoration conservation measure proposed for the Santa Ana sucker (“2.54 Acre Scour Enhancement” above) will provide short-term improvement in the function of habitat in a portion of the Santa Ana River upstream of Prado by exposing coarse riverbed substrates (particularly gravel) that are essential to Santa Ana sucker productivity. The introduction of boulders and woody debris will improve habitat complexity by varying the water depths and velocities through the restoration areas. Deeper scour holes will also provide refuges from low flow conditions associated with the current drought. Improvements in the quality of habitat are expected to provide an immediate benefit to Santa Ana sucker that will remain in place until storm flows redirect the low flow channel to a new alignment, away from the restoration area. The increase in Santa Ana sucker productivity above Prado Dam is expected to offset the temporal loss of aquatic habitat function within the Reach 3 construction footprint until habitat is fully restored.

The operation of heavy equipment and the placement of boulders and woody debris in the Santa Ana River between Rialto Drain and Mission Boulevard have the potential to crush individual Santa Ana suckers and temporarily increase turbidity/sedimentation downstream from the restoration site. Although the methods to complete the restoration have not been fully developed, the Service will

review and approve the conceptual habitat restoration plan prior to its implementation. Our effects analysis is based on the incorporation of the following elements into the conceptual habitat restoration plan: 1) implementation of the project between August and December, to reduce disturbance to spawning and nursery habitat for Santa Ana suckers; 2) construction of six or more 'habitat nodes' in areas considered lower functioning aquatic habitat for the Santa Ana sucker (i.e., wider stream sections with a uniform, shallow bottom and prevalence of sand/silt substrate); 3) no diversion or dewatering of the stream channel; and 4) passive removal of Santa Ana suckers from the project area (i.e., flushing as opposed to capture and relocation) by a biologist familiar with Santa Ana suckers and their habitats. This analysis only addresses completion of the 2.54- Acre Scour Enhancement in areas between the Rialto Drain and Mission Boulevard.

Implementation of the restoration project outside the primary spawning season and in areas with lower quality habitat will minimize the number of Santa Ana suckers in the project area. In addition, passive removal of fish from the area of disturbance will minimize the handling of fish. Based on our aquatic surveys for Santa Ana suckers in this area, estimates of densities of Santa Ana suckers upstream from Mission Boulevard, the expected footprint of proposed restoration activities (about 2.54 acres), and the location of restoration in areas with lower quality aquatic habitat, we do not expect more than 15 Santa Ana suckers to be present in the proposed restoration area.

Because project-related increases in turbidity and sedimentation will be of short duration, they are not expected to result in death or injury to Santa Ana suckers, and based on the expected effectiveness of passive fish removal from the area of disturbance, the majority of the fish in the restoration area will be flushed from the site prior to boulder/woody debris placement; however, some may remain and be crushed (we estimate up to 3). Of the fish that remain, some may be buried in the substrate and will not be detected during construction monitoring activities. The potential increase in productivity associated with improving habitat conditions upstream of Mission Boulevard is anticipated to be substantially greater than the three Santa Ana suckers that may be injured or killed as a result of implementing the restoration project.

The captive breeding and reintroduction conservation measure for the Santa Ana sucker (“Reintroduction of Captively Bred Santa Ana Suckers” above) is intended to re-establish a population in an area formerly occupied by the species. If successfully established, this population will increase overall productivity and will improve the potential for the species to withstand a catastrophic event in the Santa Ana River watershed. Implementation of this measure will be contingent on landowner permission and on the completion of a Plan of Action that is consistent with our *Region 8 Guidance of Captive Propagation and Release Programs.*[20] This measure will provide a benefit to the Santa Ana sucker in the mid-term due to the time it will take to develop and implement the Plan of Action (i.e., 4 or more years). Maintaining a population in captivity until reintroduction occurs would also provide some interim protection for Santa Ana suckers from catastrophic events.

The gravel and cobble augmentation conservation measure option (“Gravel/Cobble Augmentation”

[20] Guidance developed by D. Marquez, Regional Recovery Permits Coordinator, Pacific Southwest Region, dated July 11, 2012, which includes the requirement to address the effects of the overall program on the listed species affected and any required section 10(a)(1)(A) recovery permits through an intra-service section 7 consultation.

above), if implemented, will enhance spawning habitat for Santa Ana sucker in Reach 9 and may increase productivity. The potential for increased productivity in Reach 9 will be dependent on the extent to which productivity is otherwise limited by other factors (i.e., non-native predators and turbid water conditions). Gravel and cobble augmentation is also expected to help bring Reach 9 into increased fluvial sediment balance (see *Critical Habitat* section below for discussion of general habitat-related benefits).

The operation of heavy equipment and the placement of gravel and cobble in the Santa Ana River have the potential to crush individual Santa Ana suckers and temporarily increase turbidity/sedimentation downstream from the restoration site. We anticipate the Plan of Action developed for this measure will include biological monitoring and measures to minimize the potential for death or injury of Santa Ana sucker. As discussed above, few Santa Ana suckers are expected to be adversely affected by proposed construction in Reach 9 due to the low numbers of Santa Ana suckers observed since the species was listed. Similarly we expect few Santa Ana suckers are likely to occur within the 2 to 3-acre footprint of proposed restoration activities within the wetted channel (0 to 1). Due to the low numbers of Santa Ana suckers and baseline turbidity levels in Reach 9, it is unlikely that any Santa Ana sucker crushed as a result of gravel and cobble placement will be detected during construction monitoring activities.

In summary, the proposed project will result in disturbance to 1.22 acres of perennial stream in Reach 9 and 2.54 acres of perennial stream above Prado Dam. An additional 2 to 3 acres in Reach 9 may also be disturbed if the gravel and cobble augmentation conservation measure is implemented. Very few Santa Ana suckers are expected to be injured or killed as a result of the proposed activities in Reach 9 because very few individuals are expected to be present under baseline conditions. Thus, no appreciable reduction in the numbers, reproduction, or distribution of Santa Ana suckers in the action area is expected in the short or mid-term. We anticipate impacts to individuals will be offset by conservation measures that result in an overall increase productivity in the action area. In addition, captive rearing and reintroduction of Santa Ana suckers will provide some protection from catastrophic events. Given the limited numbers and distribution of the species, the proposed conservation measures play a crucial role in maintaining the stability of the Santa Ana sucker in the Santa Ana River.

Critical Habitat

The proposed project will impact about 133.27 acres (22.59 acres permanent and 110.68 acres temporary) of Santa Ana sucker designated critical habitat in Subunit 1C of Unit 1. The impact area is located within the Santa Ana River floodplain, which contains the PCEs for the Santa Ana sucker.

Associated with the BNSF project segment, the proposed project diversion of the river to a new temporary channel will result in a temporary modification to the PCEs contained within the low flow channel including substrate (PCE 2), water depth and velocity (PCE 3), water clarity (PCE 4), and instream habitat (PCE 6). All other temporary impacts to critical habitat will occur in upland areas of the Santa Ana River floodplain (outside the current alignment of the low flow channel) that are considered a component of a fully functioning hydrological system (PCE 1) and a source of loose sand, gravel, cobble, and boulder substrates (PCE 2). All temporary impact areas within critical habitat will be restored. Project-associated disturbed land areas will be restored with native riparian or upland scrub vegetation (in appropriate areas), and perennial stream areas will be restored to pre-

construction conditions as described in the 2001 biological opinion (e.g., re-establishment of natural channel morphology, pre-construction substrates, and microhabitat features). In addition, the proposed improvements to 2.54 acres of habitat for Santa Ana sucker upstream from Prado Dam will increase the quality of critical habitat in Subunit 1B, as described above (see *Construction-related impacts to sucker*).

Based on their review of the proposed design for the BNSF Bridge project, the Corps has determined that the channel capacity will not be permanently reduced and the water surface elevation and velocity will not be increased as a result of construction (Corps 2015b)[21]. As such, we do not anticipate the project to significantly alter hydrology (PCE 1) through the proposed project reach, and we do not anticipate impacts to habitat restored for the Santa Ana sucker in the Reach 9 Phase 2B project area. Similarly, the Corps does not anticipate remaining components of the project to alter hydrology in Reach 9 (Corps 2015b).

By eliminating sources of sediment (PCE 2) that would otherwise provide a replacement for sediment washed downstream, the proposed project may expedite the rate of sediment loss and incision in Reach 9. Permanent impacts to about 22.59 acres of designated critical habitat will result in a reduction in the width of the floodplain or potential river meander zone along the length of the proposed embankment protection (a maximum of about 10 percent). In addition, bank armoring associated with the proposed project will reduce coarse sediment supply to the streambed. This will likely occur though reduced flood access and supply to the river from alluvial sediment deposits within the previously unprotected areas (bank, floodplain, and potential meander zones) that would otherwise be available for river fluvial processes (Kondolf 1997). Additionally, the regular armored surface of the project's slope protection features will cause reductions in natural channel complexity where river low-flow channels contact these armored slopes, both initially upon construction completion and following expected future low-flow channel migration/meander (NOAA 2012). Despite the incremental reduction in sediment supply associated with this project, it will not substantially change the baseline conditions, which include an estimated a loss of about 5,000 cubic yards of sediment from Reach 9 each year.

If implemented, we estimate the proposed 35,000 tons of cobble and gravel will maintain or improve channel conditions for about 7 years. While a much greater sediment input will be required to counteract the reduction in stream gradient that has already occurred and anticipated to occur in Reach 9, the proposal will temporarily arrest the ongoing channel degradation. Gravel bars formed as a result of the sediment augmentation and sediment release from the floodplain will increase the extent of spawning habitat for adults and shallow edge water available to support juvenile Santa Ana suckers.

The proposed enhancement of channel complexity ("Channel Complexity Enhancement" above) for Santa Ana suckers will likely improve the mid- and long-term aquatic functions (PCE 6) of the portion of Reach 9 that will be adjacent to the Phase 4 project. Because the Phase 4 embankment will

[21] Prior to finalizing the design of the BNSF Bridge project, we anticipate the Corps will provide additional information confirming that reduction in channel width under the BNSF Bridge will not result in reduced channel capacity, increased water surface elevation or increased velocities during future operations of Prado Dam (Lovan 2015, pers. comm.).

be constructed with a 1:1 slope, a high probability exists that soil backfilled on top of the embankment will erode, particularly if the river channel meanders adjacent to the embankment. As the Santa Ana River meanders over time, the large rock that will be placed along the Phase 4 slope protection will cause local reductions in flow velocity and provide increased complexity of the southern channel bank wherever the low-flow contacts the rather uniform surface, aspect, angle, and lack of gravel substrates of the proposed project slope armoring. It is likely that wherever the future Santa Ana River low flow contacts the new armored slope of Phase 4, small gravel deposits and pools will develop within the immediate areas of the new large rock to be placed as part of this conservation measure. Sediment deposited around the large rock during smaller storm events (i.e., 1 to 2 year storms) will help to anchor the rock and prevent it from moving downstream during larger storm events (i.e., 5 to 10 year storms). The complex habitat formed between the rock and the embankment may provide an important refuge for Santa Ana suckers during high flow events and will help to minimize the potential for erosion of soil adjacent to the embankment until the rock is displaced during a rare large storm event (i.e., greater than 10-year storm).

Although the project will result in an incremental reduction in long-term sediment deposition in Reach 9, with implementation of the proposed conservation measures, we do not anticipate the proposed project to appreciably diminish or preclude the function of Unit 1 to independently support a population of Santa Ana sucker in a functioning hydrologic system. Additional measures to minimize future channel degradation, decrease non-native predatory fish, and increase water quality will be needed to support the stated goal of Unit 1 of supporting a population of Santa Ana suckers in the Santa Ana River, including Reach 9 (Service 2014a).

Effects on Recovery

Santa Ana suckers in the action area are considered part of the Santa Ana River Watershed Recovery Unit in the draft recovery plan for the Santa Ana sucker (Service 2014a). A healthy viable population within this defined Recovery Unit will be necessary to recovery the species (Service 2014a). High priority actions (Priority 1) identified for the Santa Ana River Watershed Recovery Unit include ameliorating hydrological modifications due to flood control and water conservation operations, implementing range expansion plans (includes habitat restoration in accessible areas and reintroduction to inaccessible areas), and managing nonnative vegetation (Service 2014a).

Implementation of the proposed project will result in permanent and temporary impacts to Santa Ana sucker habitat in a section of the Santa Ana River that is currently occupied at very low densities. Several important factors (e.g., altered hydrology and fluvial geomorphology, non-native fish, and water quality) are reducing the potential for Reach 9 to support Santa Ana sucker (Service 2011a). Until the primary limiting factors are more fully discerned and habitat conditions for the Santa Ana sucker are improved, the action area is likely to continue to support few individuals with poor breeding success. Therefore, although the project will cause a temporary degradation of habitat and may limit the use of the area by Santa Ana suckers, it is not likely to limit overall Santa Ana sucker population growth in Reach 9 over baseline conditions. In addition, proposed conservation measures for the Santa Ana sucker will address a high priority recovery action identified for the Santa Ana Watershed Recovery Unit. Specifically implementation of the 2.54-Acre Scour Enhancement, and Gravel/Cobble Augmentation or Reintroduction of Captively Bred Santa Ana Suckers will help to accomplish task 4 from the draft recovery plan, which is to increase the range of the Santa Ana sucker by restoring habitat and reestablishing occurrences within its historical range. Thus, the

anticipated project impacts will not affect Santa Ana sucker recovery over the short-term, but the conservation actions associated with the project will contribute to sucker recovery over the long-term.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. We are unaware of any non-Federal actions in the action area of the proposed project that will likely affect the species considered in this biological opinion.

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is our opinion that the action, as proposed, is not likely to jeopardize the continued existence of the vireo or Santa Ana sucker or to result in the destruction or adverse modification of designated critical habitat for the Santa Ana sucker. We reached these conclusions by considering the following:

Vireo

1. Implementation of the proposed conservation measures will ensure the restoration achieved as part of the Reach 9 Phases 4, 5A, 5B, and BNSF Bridge Project is consistent with the conservation anticipated in the 2001 biological opinion and 2012 amendment;

2. 13 vireo pairs will be removed by the proposed project. These vireo pairs represent about 12 percent of the vireos in Reach 9 of the Santa Ana River but less than 1 percent of the total vireo population (about 1,582 pairs) in the Santa Ana River watershed, and about 0.5 percent of the estimated 2,790 pairs rangewide. Because vireos will persist in Reach 9 outside the project footprint and upstream of Reach 9, we anticipate that the areas temporarily affected by the project will be repopulated by vireos following successful restoration;

3. Habitat supporting up to 37 vireo pairs will be affected by noise from adjacent construction and will likely suffer from a reduction in fitness and productivity. These vireo pairs represent about 33 percent of the vireos in Reach 9 of the Santa Ana River, 2 percent of the total population in the Santa Ana River watershed, and 1.3 percent of the vireo pairs rangewide. The temporary reduction in fitness and productivity, which will occur over a period of about 3 to 5 years, will have a short-term effect on reproduction and dispersal from Reach 9, but following project completion, vireo distribution and reproductive output in Reach 9 is anticipated to return to pre-project levels.

4. Because the project includes substantial offsite restoration and temporarily affected habitat will likely be restored to better than pre-project condition, we anticipate that the project will result in an overall increase in the number and productivity of vireos sustained in the Santa Ana River watershed over the long-term and will contribute to recovery of the species;

Santa Ana sucker

1. While aquatic habitat for the Santa Ana sucker within the BNSF Bridge project area will be adversely affected, the impacts will not increase the anticipated level of take exempted in the 2001 biological opinion, with the exception of impacts to Santa Ana sucker from proposed habitat restoration activities. These activities are anticipated to result in a net increase in productivity of Santa Ana suckers in the action area.

2. Permanent and temporary impacts to Santa Ana sucker critical habitat PCEs in Reach 9 will largely be offset by restoring all temporary impact areas; the overall project impacts are not expected to substantially diminish or preclude the function of the critical habitat designation to support a population of Santa Ana suckers within the Santa Ana River.

3. At least 2.54 acres of perennial stream habitat will be enhanced by the project for the Santa Ana sucker upstream of Prado Basin and outside of Reach 9 (as an offsetting measure for the separate and completed Reach 9, Phase 3 project), within Santa Ana sucker critical habitat Unit 1B ("2.54 Acre Scour Enhancement" above).

4. The proposed project includes conservation measures for the Santa Ana sucker that will contribute to recovery of the species through implementation of a reintroduction program using captively-bred fish with the goal of re-establishing an important new population within an unoccupied portion of the species historic range on the Santa Ana River ("Reintroduction of Captively Bred Santa Ana Suckers", above) or alternatively will provide substantial river gravel and cobble augmentation (25,000 tons and 10,000 tons, respectively) to a portion of Reach 9 to help arrest river degradation, temporarily improve fluvial processes, offset lost access to floodplain and river meander zone alluvial sediment deposits by river processes from armoring, and provide enhanced Santa Ana sucker spawning substrates ("Gravel/Cobble Augmentation" above). The proposed enhancement of channel complexity ("Channel Complexity Enhancement" above) for Santa Ana suckers will likely improve the mid- and long-term aquatic functions of the portion of Reach 9 that will be adjacent to the Phase 4 project. The large rock that will be placed along the Phase 4 slope protection will provide increased complexity of the southern channel bank wherever the low-flow contacts the proposed project slope armoring in the future.

INCIDENTAL TAKE STATEMENT

AMOUNT OR EXTENT OF TAKE

Vireo

The 2001 biological opinion exempted take of 31 pairs of vireo below Prado Dam in association with the Reach 9 projects. This number included all those vireos known to occur in Reach 9 at the time the 2001 biological opinion was issued to address impacts associated with both construction and operation of the SARP. Because SARP components completed to date have exhausted the anticipated level of incidental take, additional take exemption is necessary for the Reach 9 Phases 4, 5A, 5B, and BNSF Bridge Project.

Direct impacts to vireo habitat caused by proposed project activities will likely lead to increased mortality and reduced breeding success for vireos in the vicinity of the project over about an 8-10 year period. The estimated level of take for vireo is based on the number of vireo pairs in the project direct activity footprint and within the predicted noise impact area and the amount of vireo habitat that will be subject to these impacts. Because construction activities will occur over a period of about 5 years, and all vireo habitat will be removed outside the breeding season, the estimated number of vireo pairs affected is based on 2014 vireo survey data, and pre-project surveys will not be completed on an annual basis. In addition, monitoring of vireos within the noise impact area will not be conducted to determine potential effects of noise on vireo reproduction. Therefore, take limits for vireo are defined in terms of acres of vireo habitat impacted. If the amount or extent of incidental take is exceeded (i.e., amount of habitat affected), it will trigger reinitiation of consultation. Take for the proposed Reach 9 Phases 4, 5A, 5B, and BNSF Bridge Project is exempted as follows:

- Harm to up to 13 pairs of vireos due to the direct loss of up to 38.17 acres of riparian vegetation within the identified project footprint that includes a significant portion of the use areas for these pairs. These birds are not expected to be directly killed by construction activity but are anticipated to suffer an increase in mortality and reduction in fitness and productivity due to loss of breeding, feeding, and sheltering habitat. If more than 38.17 acres of riparian habitat is cleared or graded, the take exemption will be exceeded.

- Harm to up to 37 pairs of vireos is expected, due to noise from adjacent construction, as identified by the Corps. The riparian habitat predicted to be affected by this noise includes a significant portion of the predicted use areas for each of these pairs. These birds are not expected to be killed but are anticipated to suffer a reduction in fitness and productivity occurring during project construction, for up to 3 years for each pair. After construction is completed, these extant riparian habitat areas that were affected by noise are expected to be used again by vireos in following years. The take exemption will be exceeded if more than 98.43 acres of riparian habitat are subjected to project-related increases in noise levels annually through 2019 that result in greater than 60 dBA L_{eq} hourly, or in increases greater than 5 dBA L_{eq} hourly above ambient noise levels (if ambient noise levels are greater than 60 dBA L_{eq} hourly), during the vireo breeding season.

Santa Ana sucker

No incidental take of Santa Ana suckers beyond that authorized in the 2001 biological opinion is anticipated with implementation of the proposed construction activities, and none is authorized; however, the take statement is revised as follows to address the addition of the BNSF railroad bridge project and potential effects of proposed restoration activities:

2. Suckers may be missed during pre-construction capture efforts and subsequently stranded in de-watered sections of the Santa Ana River in the following areas: (1) 2,000-foot reach along the upper State Highway 91 embankment in Reach 9; (2) 550-foot reach along the car wash and strip mall area in Reach 9; (3) 5,500-foot reach along the low flow channel at Green River Housing Estates in Reach 9; (4) 1,850-foot reach immediately downstream of Prado Dam (i.e., from the old outlet works to the confluence with the new outlet channel); (5) 3,270-foot reach along the Reach 9 Phase 3 area; (6) 2,578-foot reach within Zone 3 of the Norco Bluffs area; and (7) 350-foot reach under and on both sides of the BNSF railroad

bridge in Reach 9 area. Based on the best available scientific information, we anticipate that this number will be less than 5 suckers downstream of the dam and 10 suckers upstream of the dam. [22]

In addition, incidental take of Santa Ana suckers is authorized in association with the 2.54 acre enhancement as follows:

- We anticipate that 3 suckers may be missed during passive relocation efforts and subsequently killed or injured during aquatic substrate habitat restoration efforts in the 4-mile long reach of the river downstream of Rialto Drain and upstream of Mission Boulevard. Not all suckers injured or killed will be detected; thus, if more than 2 Santa Ana suckers are observed dead or injured as a result of these restoration activities, the take exemption will be exceeded.

- We anticipate that the gravel augmentation project could result in the death or injury of few (0-1) Santa Ana suckers, but due to high turbidity levels in Reach 9, it is highly unlikely that any Santa Ana suckers killed in this manner would be detected; thus, if more than one dead or injured Santa Ana suckers is observed during placement of gravel and cobble, the take exemption will be exceeded.

EFFECT OF TAKE

In the accompanying biological opinion, we determined that this level of anticipated take is not likely to result in jeopardy to the vireo or Santa Ana sucker.

REASONABLE AND PRUDENT MEASURES

To minimize the effects of incidental take on the vireo and Santa Ana sucker, the Corps and/or local sponsor will continue to fully implement the reasonable and prudent measures established in the 2001 biological opinion and 2012 amendment.

TERMS AND CONDITIONS

To be exempt from the prohibitions of section 9 of the Act, the Corps and/or the local sponsor will continue to comply with the terms and conditions established in the 2001 biological opinion and 2012 amendment.

DISPOSITION OF SICK, INJURED, OR DEAD SPECIMENS

Upon locating dead, injured, or sick individuals of threatened or endangered species, initial notification must be made to our Division of Law Enforcement in either San Diego, California, at 619-557-5063 or in Torrance, California, at 310-328-6307 within 3 working days. Notification should also be sent by telephone and writing to this office in Carlsbad, California, at 2177 Salk Avenue, Suite 250, Carlsbad, California 92008, 760-431-9440, within 1 business day. Written notification should include the collection date and time, where the animal was collected, and an

[22] The numbering of this paragraph is based on the 2001 biological opinion (Service 2001a).

explanation of the likely cause of the mortality. Care must be taken in handling sick or injured animals to ensure effective treatment and care and in handling dead specimens to preserve biological material in the best possible state. The remains of intact specimens shall be placed with educational or research institutions holding the appropriate State and Federal permits. Remains shall be placed with the San Diego Natural History Museum, San Diego. Arrangements regarding proper disposition of potential museum specimens shall be made with the institution by the authorized biologist prior to implementation of the action.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. These recommendations are intended to supplement those included in the 2001 biological opinion and the associated 2012 amendment.

1. The Corps, Service, SARP local sponsors, and other appropriate parties should enter into a memorandum of agreement regarding management of the Santa Ana River for conservation of listed species, flood risk management, and water conservation. The Corps plays an important role in assisting with coordination among stakeholders where activities require Corps assistance or approval (e.g., modifications in dam operations or the manner that riparian vegetation is managed within the river, etc.).

2. Seven Oaks Dam and Prado Dam block most of the influx of coarse sediment (i.e., gravel, cobble, sand) into the river reaches below these dams, and water extraction and diversions of the river have left much of the river dry for much of the year, with remaining aquatic and riparian areas substantially reduced. To the extent practicable, the Corps and its applicants should manage (and coordinate the management of) the Santa Ana River, in part, for listed species and the ecosystems upon which they depend. This should include the following:

    a) Maintain/restore river base flows through an increased number of reaches of the river to restore habitats for the Santa Ana sucker, vireo, and flycatcher. This should include the provision of consistent wastewater flows where they are important to the Santa Ana sucker and other river base flows have been largely or completely diverted.

    b) Provide periodic “flushing” high flows through reaches of the river important to the Santa Ana sucker to temporarily displace exotic aquatic species, move and expose coarse riverbed substrates, and give a competitive advantage to listed species over exotic species. For example, strategically timed surges of water, released from Seven Oaks Dam to create artificial flood flows (such as have been utilized on the Colorado River as a management tool), could help move fine sediments and build/expose gravel bars in downstream portions of the river occupied by Santa Ana sucker.

    c) Maintain channel slope gradients (channel steepness) in areas potentially important to the Santa Ana sucker throughout the middle reaches of the river, through bypassing sediments past Prado Basin or other means.

d) If gravel/cobble augmentation is not implemented in association with this project or after the augmentation project is complete, we recommend that the Corps and/or applicant use periodic river (river-rounded) gravel/cobble augmentation in various locations along the channel below Prado Dam to maintain and enhance coarse sediment availability, eliminate long-term scour and channel degradation, and reverse river low-flow deepening (e.g., see: Pasternak 2008, 2009; Bunte 2004, Bunte *et al.* 2007). Gravel augmentation or gravel replenishment means artificially adding river gravel suitable in size distribution for native fish to a streambed that lacks sufficient gravel; an additional goal is the improvement of the geomorphological and biological functioning of the stream (Bunte 2004). Gravel augmentation in Reach 9 would entail initially and periodically adding river gravel and cobble to appropriate locations in the channel to reduce "hungry water" outflow conditions caused by Prado Dam and bank armoring and the associated erosion (e.g., Corps 2013c). Gravel augmentation would minimize degradation of the channel surface throughout most of Reach 9 as a result of the coarse sediments being transported and deposited downstream during higher flows. Additionally, these river gravel and cobble materials would immediately improve substrate conditions in the reach for native fish such as the sucker (e.g., Pasternak *et al.* 2010). Maintenance or improvement of the channel surface elevations (through elimination or reversal of channel degradation/deepening) would help maintain indicator and key species wildlife movement (e.g., larger mammals) through the Reach 9 area, by arresting further increases the river low-flow water depth (that is currently a restriction on wildlife movement).

e) Within Prado Basin and in Reach 9 evaluate potential water quality issues as they potentially relate to the life history of Santa Ana sucker viable occupation within Reach 9, including turbidity.

f) The Corps should develop or contract for a program to conduct baseline studies comparing the ecophysical processes and landforms at highly functional sites for the Santa Ana sucker with those remaining in the Santa Ana River. Studies should include historical analysis, detailed topographic mapping, substrate characterization, spawning surveys, 2D hydrodynamic modeling, sediment entrainment assessment over a wide range of discharges, turbidity sensitivity and causes, and other studies.

3. Existing structures in the Reach 9 area include substantial linear wildlife movement partial barriers, such as the SR-91 freeway and nearby developments. Several SARP slope stabilization projects (e.g., for scour protection and channel bank protection) have or are planned to be constructed in the Reach 9 area. These stabilization projects combined with otherwise generally predicted channel degradation in Reach 9 will likely further reduce potential important wildlife movement across and along the river by development of linear hard structures, reduction and fragmentation of vegetative cover, steepening/covering of channel slopes in some areas, fencing, and deepening the channel and associated low-flow water crossing depth in many locations. Our Term and Condition #2.8 from our 2001 SARP biological opinion (2001) requires a plan that enables wildlife movement and habitat connectivity commensurate with then baseline conditions. In consideration of the limitations on wildlife movement that have already occurred in the area and would otherwise be expected to occur, we recommend the Corps incorporate of the following specific features

into the required wildlife movement and connectivity plan, as well as within the design or maintenance of SARP projects in Reach 9:

a) Re-soil exposed (ungrouted) rip rap in Reach 9 to allow for growth of native woody vegetation, wildlife movement and to provide appropriate surface substrates for native fish, as practicable and appropriate, for each location. At higher slope elevations (such as above normal high water level), exposed rip rap should be re-soiled with soil and sand to a vertical depth of at least 3 feet to allow for development of sage scrub or riparian scrub plant cover. At lower elevations of exposed rip rap close to or within the low-flow channel, river gravel and sand matrices should be used to completely cover rip rap to provide for unvegetated sand and gravel stream substrates and some fundamental riparian vegetative growth.

b) Include measures to ensure the entrances to the underpasses otherwise usable by wildlife will remain at channel grade for the life of the project. For example, embankments could be designed with features to deflect river flows away from underpasses and/or management measures could be included to restore riparian vegetation (at grade) following storm events that scour or denude the soil covering the adjacent embankment. Vegetative features that prevent scour immediately adjacent to the embankment may also protect the embankment from damage associated with scoring flows.

c) Reconfigure fencing, access road/trails, and vegetation, and remove or screen lighting, as practicable, to direct and enhance larger mammal (e.g., bobcat, mountain lion, fox, deer) movement north-south and east-west across the Reach 9 area, particularly at important wildlife corridor crossings and underpass entrances/exits such as B Canyon, Coal Canyon, and Brush Canyon wildlife corridors.

d) To ensure native wildlife connectivity is maintained as anticipated following completion of the Corps Reach 9 projects, cooperate and coordinate with the transportation agencies (e.g., Caltrans) on a post-construction wildlife movement study. This study should be used to evaluate the efficacy of the design features intended to accommodate continued wildlife movement and also to identify additional management measures that could increase the probability of movement and use.

4. The Corps should ensure that quarry, salvage, borrow sites, and borrow and waste material used for this and other Corps projects are free of invasive exotic plants and associated propagules to the maximum extent practicable. The Corps should endeavor to eliminate potential invasive plant propagules from being transported out of such sites along with quarry/salvage/borrow materials, so as to prevent potential exotic plant invasions into new locations.

5. The Corps should develop all pertinent contracts for Reach 9 projects that include the specific applicable conservation measures from the associated National Environmental Policy Act documents as modified by the controlling 2001 biological opinion, the 2012 amendment, and

this amendment, as appropriate for each contract, in order to avoid confusion and help ensure project compliance.

6. The Corps should fund and/or implement some of the following Priority 1 recovery actions from the draft recovery plan for the Santa Ana Sucker:

   a) Evaluate hydrological processes: In areas with modified hydrology, determine hydrological processes necessary to maintain breeding, feeding, and sheltering habitat for the species. Research should also focus on the timing and magnitude of flows that will maintain the complex diversity of habitat variables necessary to support each life stage (for example, sufficient sediment with appropriate grain size for spawning, pools, riffles, shallow stream margins, undercut banks, emergent aquatic vegetation, and riparian vegetation). The historical flow regime should be evaluated to determine the hydrological conditions that led to the creation of suitable habitat for the species and should be restored to the extent possible.

   b) Evaluate sediment transport: In areas with modified hydrology, evaluate sediment sources and transport to determine if sufficient sediment is available to maintain appropriate gradient and substrate composition for the species. The Corps should consider fully funding a pilot sediment project currently proposed and partially funding by the OCWD.

   c) Investigate the extent of impacts of invasive red algae (*Compsopogon coeruleus*) to Sana Ana sucker habitat within the Santa Ana River Recovery Unit. If impacts are found to be significant, investigate management actions to remove or treat this nonnative to reduce impacts to the sucker where it occurs.

   d) Prepare and implement a management plan to address flood control and water conservation operations that may affect Santa Ana sucker conservation.

   e) Prepare and implement a range expansion plan: The draft recovery plan lists specific information that needs to be included in a reintroduction plan.

REINITIATION NOTICE

This concludes formal consultation on the Reach 9 Bank and Bridge Protection (Phases 4, 5A, 5B, and BNSF Bridge) Project as outlined herein and in the noted materials submitted to us. As noted above, no coverage is provided herein or otherwise for potential effects to the listed species or critical habitat from recently predicted long-term scour or riverbed degradation in Reach 9 (from planned releases from Prado Dam) or recently observed accelerated riverbed aggradation upstream of Prado Basin. Additionally, no coverage is provided herein or otherwise for fluvial or water flow related effects to Santa Ana sucker from operations of Seven Oaks Dam. These effects were not considered in the 2001 SARP biological opinion or subsequent amendments. We recommend the Corps analyze these effects, develop minimization measures, and request reinitiation of formal consultation with the Service.

As provided in 50 CFR §402.16 reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; and (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

The effects analysis and conclusions of this biological opinion are based on the Corps' commitment to implement the Reintroduction of Captively Bred Santa Ana Suckers conservation measure and allows flexibility per the conditions and sequencing identified. Per number (3) above, if it is determined that this measure cannot be implemented because it is not within the Corps contractual authorities, reinitiation of consultation will be warranted.

We appreciate the Corps working closely with us to develop and implement conservation measures anticipated to improve the conservation status of the Santa Ana sucker and vireo on the Santa Ana River. Should you have any questions regarding this consultation, please contact Jon Avery of my staff at 760-431-9440, extension 309.

Sincerely,

G. Mendel Stewart

G. Mendel Stewart
Field Supervisor

Appendix

Enclosure

LITERATURE CITED

Alonso, R. S., L. M. Lyren, E. E. Boydston, C. D. Haas, and K. R. Crooks. 2014. Evaluation of road expansion and connectivity mitigation for wildlife in southern California. *The Southwestern Naturalist* 59(2):181–187. June.

[Aspen] Aspen Environmental Group. 2010. Project Memorandum USACE Prado Basin and Santa Ana River Maintstem (Reach 9) Project, Prado Basin Annual Report for 2008. Prepared for U.S. Army Corps of Engineers, Los Angeles District.

[Aspen] Aspen Environmental Group. 2013a. Santa Ana River Reach 9, Phase 2B Project Fish Monitoring and Relocation Report. Prepared for U.S. Army Corps of Engineers, Los Angeles District, Prado Dam Field Office, Corona, California. January 31, 2013.

[Aspen] Aspen Environmental Group. 2013b. Santa Ana River Reach 9, Phase 2B Project Fish Monitoring and Relocation Report. Prepared for U.S. Army Corps of Engineers, Los Angeles District, Prado Dam Field Office, Corona, California. August 26, 2013.

[Aspen] Aspen Environmental Group. 2014. Santa Ana River Reach 9, Phase 3 Project Fish Monitoring and Relocation Report. Prepared for U.S. Army Corps of Engineers, Los Angeles District, Prado Dam Field Office, Corona, California. March 4, 2014.

[Aspen] Aspen Environmental Group. 2015. Santa Ana River Reach 9, Phase 3 Project Fish Monitoring and Relocation Report. Prepared for U.S. Army Corps of Engineers, Los Angeles District, Prado Dam Field Office, Corona, California. January 28, 2015.

Baskin, J. N. and T. R. Haglund. 2008. Fish Protection Activities at Prado Dam, Corona, CA. Prepared for U.S. Army Corps of Engineers, Los Angeles District.

Bunte, K. 2004. State of the Science Review, Gravel Mitigation and Augmentation Below Hydroelectric Dams: A Geomorphological Perspective. USDA Forest Service, Rocky Mountain Research Station, Report submitted to the Stream Systems Technology Center, Fort Collins, CO. 234 p. http://www.stream.fs.fed.us/publications/PDFs/Gravel Augmentation Report.pdf).

Bunte, K., J. P. Potyondy, and D. A. Cenderelli. 2007. A Geomorphic Perspective on Things to Think About Before Starting a Gravel Augmentation Project. *Stream Notes*. April.

California Office of Emergency Services. 2008. Data Archive. Dated 19 November.

Chang, H. H. 2003. Scour Study of the Santa Ana River for the Interceptor Pipeline. Prepared for Brown & Caldwell.

Chang, H. H. 2008. Hydraulic Requirements for SARI Pipeline Protection along Channel Bank and at River Crossing of the Santa Ana River below Prado Dam. Prepared for County of Orange Resources and Development Management Department, Santa Ana, California.

Clevenger, A. P. and N. Waltho. 2005. Performance indices to identify attributes of highway crossing structures facilitating movement of large mammals. Biological Conservation, 121, 453-464.

[Corps] U.S. Army Corps of Engineers. 1988. Santa Ana River Design Memorandum No. 1 Phase II GDM on the Santa Ana River Maintstem including Santiago Creek. Main Report & Supplemental Environmental Impact Statement. August 1988.

[Corps] U.S. Army Corps of Engineers. 2001. Prado Basin and Vicinity, including Reach 9 and Stabilization of the Bluff Toe at Norco Bluffs Supplemental Final Environmental Impact Statement/Environmental Impact Report (State Clearinghouse No. 97071087) Riverside, San Bernardino and Orange Counties, California. Planning Division, Army Corps of Engineers, Los Angeles District, Los Angeles, California. November.

[Corps] U.S. Army Corps of Engineers. 2011. Review Plan Santa Ana River Mainstem, Including Santiago Creek, California Lower Santa Ana River Weir Canyon Road to Prado Dam Reach 9 - Phase 2A, 2B and Phase 3. Planning Division, Army Corps of Engineers, Los Angeles District, Los Angeles, California. June.

[Corps] U.S. Army Corps of Engineers. 2012a. Santa Ana River Main Stem Project Reach 9, Phase 2B Perennial Stream Restoration Project. Planning Division, Army Corps of Engineers, Los Angeles District, Los Angeles, California. January.

[Corps] U.S. Army Corps of Engineers. 2012b. Letter from Josephine Axt, Chief, Planning Division of Corps, Los Angeles District to James Bartel, Field Supervisor, Carlsbad Fish and Wildlife Office, requesting informal consultation on potential effects to Santa Ana sucker, and its critical habitat, from ongoing operations at Prado and proposed Seven Oaks Dam water quality and seasonal water conservation initiatives. August 3, 2012.

[Corps] U.S. Army Corps of Engineers. 2012c. Design Documentation Report (DDR): Hydrology, Hydraulics, and Sedimentation Appendix. Prepared by Tetra Tech. April.

[Corps] U.S. Army Corps of Engineers. 2013a. Draft Supplemental Environmental Assessment and Addendum to Environmental Impact Report 583 Santa Ana River: Reach 9 Phase 3, County of Orange, California. Planning Division, Army Corps of Engineers, Los Angeles District, Los Angeles, California. March.

[Corps] U.S. Army Corps of Engineers. 2013b. Review Plan (Addendum No. 01). Santa Ana River Mainstem, Including Santiago Creek, California Lower Santa Ana River (Weir Canyon Road to Prado Dam) Reach 9 – EDR, BNSF Railroad Bridge and Phases 1, 2A, 2B, 3, 4 and 5A. Planning Division, Army Corps of Engineers, Los Angeles District, Los Angeles, California. 15 November.

[Corps] U.S. Army Corps of Engineers. 2013c. Lower Yuba River gravel augmentation project, Yuba and Nevada Counties, California. Supplemental Environmental Assessment. Army Corps of Engineers, Sacramento District.

[Corps] U.S. Army Corps of Engineers. 2015a. Santa Ana River: Reach 9 Phases 4, 5a, 5b, & BNSF Bridge, Counties of Orange And Riverside, California, Draft Supplemental Environmental Assessment and Addendum to Environmental Impact Report. Planning Division, Army Corps of Engineers, Los Angeles District, Los Angeles, California. January.

[Corps] U.S. Army Corps of Engineers. 2015b. Letter from Josepine Axt, Army Corps, to Mendel Stewart, U.S. Fish and Wildlife Service, regarding requested additional information about implementation of the proposed Santa Ana River Reach 9 Bank and Bridge Protection Measures project. Planning Division, Army Corps of Engineers, Los Angeles District, Los Angeles, California. 15 April.

Crooks, K. R., and M. E. Soule. 1999. Mesopredator release and avifaunal extinctions in a fragmented system: Nature 400:563-566.

[DOI] Department of the Interior. 2008. Letter from Patricia Port, Regional Environmental Officer, Office of the Secretary;Office of Environmental Compliance and Policy, to Corrice Farrar, U.S. Army Corps, Project Manager, Regulatory Division, LA District. Dated 14 May.

Dudek and Associates, Inc. 2003. Western Riverside County Final Multiple Species Habitat Conservation Plan, Volumes I -V. Dudek and Associates, Inc., Encinitas, California.

Entrix, Inc. 2005. Monitoring for Santa Ana suckers during emergency work in the Santa Ana River floodplain to protect various parts of the SARI line. Prepared for Jamison Engineering, Fountain Valley, California.

ECORP Consulting, Inc. 2009. 45-day survey report on pre-construction presence/absence surveys for the Santa Ana sucker (*Catostomus santaanae*) at three locations on the Santa Ana River.

Fulton, A. A. 2008. Gravel for Salmon in Bedrock Channels: Elucidating Mitigation Efficacy Through Site Characterization, 2D-Modeling, and Comparison Along the Yuba River, CA. University of California.

Greenfield, D. W., S. T. Ross, and D. G. Deckert. 1970. Some aspects of the life history of the Santa Ana Sucker, *Catostomus (Pantosteus) santaanae* (Snyder). California Department of Fish and Game 56:166-179.

Haas, C. D. 2000. Distribution, relative abundance, and roadway underpass responses of carnivores throughout the Puente-Chino Hills. 110 pp. Master's Thesis, Pomona: California State Polytechnic University.

Haglund, T. R., Baskin, J. N., and C. C. Swift. 2001. Results of the Year 1 Implementation of the Santa Ana Sucker Conservation Program for the Santa Ana River. Unpublished report prepared by San Marino Environmental Associates for Santa Ana Watershed Project Authority. 66 pp.

Haglund, T. R., Baskin, J. N., and C. C. Swift. 2003. Results of the Year 3 (2003) Implementation of the Santa Ana Sucker Conservation Program for the Santa Ana River. Unpublished report prepared by San Marino Environmental Associates for Santa Ana Sucker Conservation Team. 142 pp.

Haglund, T. R., and J. N. Baskin. 2004a. Results of the Year 4 (2004) Implementation of the Santa Ana Sucker Conservation Program for the Santa Ana River. Unpublished report prepared by San Marino Environmental Associates for Santa Ana Sucker Conservation Team. 39 pp.

Haglund, T. R. and Baskin, J. N. 2004b. Santa Ana sucker protection during stream re-diversion in Reach 9 of the Santa Ana River. Prepared by San Marino Environmental Associates for U.S. Army Corps of Engineers, Los Angeles District. February 2004.

Haglund, T. R. and Baskin, J. N. 2011. Memorandum regarding results of the 2011 Santa Ana sucker population monitoring. Prepared by San Marino Environmental Associates for the Santa Ana Watershed Project Authority. November 17, 2011.

Hoffman, S. M. and R. Zembal. 2005. Status and management of the least Bell's vireo and southwestern willow flycatcher in Santa Ana River Watershed 2004. Prepared by the Santa Ana Watershed Association for Orange County Water District and U.S. Fish and Wildlife Service.

Hoffman, S. M. and R. Zembal. 2011. Status and management of the least Bell's vireo and southwestern willow flycatcher in the Santa Ana River Watershed, 2010, and summary data by site and watershed-wide, 2000-2010. Prepared by the Santa Ana Watershed Association for Orange County Water District and U.S. Fish and Wildlife Service.

Hoffman, S. M. and R. Zembal. 2012. Status and management of the least Bell's vireo and southwestern willow flycatcher in Santa Ana River Watershed, 2011, and summary data by site and watershed-wide, 2000-2011. Prepared by the Santa Ana Watershed Association for Orange County Water District and U.S. Fish and Wildlife Service.

Hoffman, S., R. Zembal, N. Housel. 2014. Status and Management of the Least Bell's Vireo and Southwestern Willow Flycatcher in the Santa Ana River Watershed, 2014, and Summary Data by Site and Watershed-wide, 2000-2014. Prepared by the Santa Ana Watershed Association for Orange County Water District and U.S. Fish and Wildlife Service.

Jewell, K. J., and P. Arcese. 2008. Consequences of parasite invasion and land use on the spatial dynamics of host populations. *Journal of Applied Ecology* 45:4:1180-1188.

Kondolf, G. M. 1997. Profile -- Hungry Water: Effects of Dams and Gravel Mining on River Channels. *Environmental Management* 21:4. Pp. 533–551.

Kondolf, G. M. and W. V. G. Matthews. 1993. Management of Coarse Sediment on Regulated Rivers. University of California, Water Resources Center, University of California Report No. 80. 123 pp.

Kus, B., and M. Whitfield. 2005. Parasitism, productivity, and population growth: response of least Bell's vireos (*Vireo bellii pusillus*) and southwestern willow flycatchers (*Empidonax traillii extimus*) to cowbird (*Molothrus* spp.) control. *Ornithological Monographs* 57:16-27.

Kus, B., S. Howell, R. Pottinger, K. Allen, M. Madden. 2015. Recent Population Trends in Least Bell's Vireos and Southwestern Willow Flycatchers: 2014 Update. USGS Western Ecological Research Center, San Diego Field Station. Riparian Working Group Presentation.

Leopold, L. B. 1994. A View of the River. Harvard University Press, Cambridge, MA. 298 pp.

[LSA] LSA Associates, Inc. 2012. Draft Santa Ana River Canyon Habitat Management Plan Maintenance and Monitoring Report. Prepared for County of Orange, Santa Ana, California. August.

[LSA] LSA Associates, Inc. 2014. Letter regarding riparian habitat restoration "triggers" for the Santa Ana River Canyon Habitat Management Area, Orange County, California. Prepared for U.S. Fish and Wildlife Service, Carlsbad, California.

Lyren, L.M. 2001. Movement patterns of coyotes and bobcats relative to roads and underpasses in the Chino Hills area of southern California. M.S. thesis, California State Polytechnic University, Pomona.

Lyren, L. M, G. M. Turschak, E. S. Ambat, C. D. Haas, J. A. Tracey, E. E. Boydston, S. A. Hathaway, R. N. Fisher, and K. R. Crooks. 2006. Carnivore activity and movement in a southern California protected area, the North/Central Irvine Ranch. Prepared by U. S. Geological Survey, Western Ecological Research Center and Colorado State University for The Nature Conservancy, Newport Beach, California.

Mostafa, M.G. and N. Rashedi. 1991. Low Santa Ana River canyon sediment yield study, Volume I. Prepared for County of Orange Environmental Management Agency, Santa Ana, California.

Moyle, P. B. 2002. Inland Fishes of California: Revised and Expanded. University of California Press. Berkeley, California.

[NOAA] National Oceanic and Atmospheric Administration. 2012a. National Marine Fisheries Service Endangered Species Consultation Biological Opinion on U.S. Army Corps of Engineers' Nationwide Permit Program. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Silver Spring, Maryland. February.

[NOAA] National Oceanic and Atmospheric Administration. 2012b. Nearshore Habitat – How Bank Armoring & Overwater Structures Shape the Health of Pacific Salmon & Steelhead. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Spring. http://www.westcoast.fisheries.noaa.gov/publications/habitat/fact_sheets/nearshore_habitat.pdf

[OCFD] Orange County Flood Control District. 2010. Santa Ana River Interceptor (SARI) Pipeline Relocation. Scour Study of the Santa Ana River Below Prado Dam. Prepared by Tetra Tech.

OCFCD and Corps. 2010. Santa Ana River Interceptor Line (SARI) Protection/Relocation Project Final Supplemental Environmental Assessment and Addendum to Environmental Impact Report IP 03-226. September.

Pasternack, G. B. 2008. SHIRA-Based River analysis and field-based manipulative sediment transport experiments to balance habitat and geomorphic goals on the lower Yuba River. Cooperative Ecosystems Studies Unit (CESU) 81332 6 J002 Final Report, University of California at Davis, Davis, CA, 569 pp.

Pasternack, G. B. 2009. Current Status of an On-going Gravel Injection Experiment on the Lower Yuba River, CA. Prepared for the U.S. Army Corps of Engineers, Sacramento District.

Pasternack, G. B., A. A. Fulton, and S. L. Morford. 2010. Yuba River analysis aims to aid spring-run Chinook salmon habitat rehabilitation. *California Agriculture* 64:2:69-77.

[RCA] Regional Conservation Authority. 2010. Western Riverside County Regional Conservation Authority. Joint project review 10-02-16-01: City of Corona Green River Road Widening Project. 6 pp.

Robinson, S. K., S. I. Rothstein, M. C. Brittingham, L. J. Petit, and J. A. Grzybowski. 1995. Ecology and behavior of cowbirds and their impact on host populations. Pp. 428–60 ***in***: T.E. Martin & D.M. Finch (eds.). Ecology and Management of Neotropical Migratory Landbirds. Oxford University Press, New York.

Russell, K. 2005. Prado Dam channel improvement project native fish protection and relocation. Summary Report for first and second diversions, Prepared by Riverside-Corona Resource Conservation District for U.S Army Corps of Engineers. April 25-28 and May 3, 2005.

Russell, K. 2010. Field report for native fish relocation ACOE Reach 9 Channel Diversions. Prepared by Riverside-Corona Resource Conservation District. March 2010.

Russell, K. 2012. Draft Field report for native fish relocation ACOE Reach 9 – Phase 2 Channel Diversions. Prepared by Riverside-Corona Resource Conservation District for U.S Army Corps of Engineers and Aspen Environmental. April 12 and 30/May 1 and 2, 2012.

Santa Clara Valley Water District. 2006. User Manual: Guidelines and Standards for Land Use Near Streams -- A Manual of Tools, Standards and Procedures to Protect Streams and Streamside Resources in Santa Clara County. Prepared by the Santa Clara Valley Water Resources Protection Collaborative. Revised July.

[SAWA] Santa Ana Watershed Association. 2010. Santa Ana Watershed Association 2010 Annual Report, Reach 3B Mitigation Project, San Timoteo Canyon.

[SAWA] Santa Ana Watershed Association. 2014. Habitat variability and distribution of the Santa Ana sucker, *Catostomus santaanae*, in the Santa Ana River from the confluence of the Rialto channel to the Prado Basin. Santa Ana Watershed Project Authority. September. 26 pp.

[Service] U.S. Fish and Wildlife Service. 1980. Biological opinion on the effects of the Santa Ana River Flood Control Project in the Counties of Orange, Riverside, and San Bernardino, California, on endangered species and their habitat (1-1-80-F-75). On file, U.S. Fish and Wildlife Service Carlsbad Fish and Wildlife Office, Carlsbad, California.

[Service] U.S. Fish and Wildlife Service. 1998. Draft recovery plan for the least Bell's vireo. U.S. Fish and Wildlife Service, Portland, Oregon. 139 pp.

[Service] U.S. Fish and Wildlife Service. 2000a. Amendment to formal section 7 consultation, Santa Ana Mainstem Project, Orange County, California (1-88-F-6-R1). On file, U. S. Fish and Wildlife Service Carlsbad Fish and Wildlife Office, Carlsbad, California.

[Service] U.S. Fish and Wildlife Service. 2000b. Endangered and threatened wildlife and plants; Threatened status for the Santa Ana sucker. Federal Register 65:19686-19698.

[Service] U.S. Fish and Wildlife Service. 2001a. Biological opinion on the Prado Mainstem and Santa Ana River Reach 9 Flood Control Projects and Norco Bluffs Stabilization Project, Orange, Riverside, and San Bernardino Counties, California (FWS-SB-909.6). On file, U. S. Fish and Wildlife Service Carlsbad Fish and Wildlife Office, Carlsbad, California.

[Service] U.S. Fish and Wildlife Service. 2001b. Regional Policy Regarding Streambank Stabilization Projects. Memorandum to Project Leaders, Region 6, from Deputy Regional Director. 28 February. http://www.fws.gov/southdakotafieldoffice/Bank%20Stabilization%20Policy.pdf

[Service] U.S. Fish and Wildlife Service. 2003. Biological opinion on the Car Wash Strip Mall Project feature, Santa Ana River Mainstem Flood Control and Norco Bluffs Toe Stabilization Projects, Orange, Riverside, and San Bernardino Counties, California. On file, U. S. Fish and Wildlife Service Carlsbad Fish and Wildlife Office, Carlsbad, California.

[Service] U.S. Fish and Wildlife Service. 2004. Reinitiation of formal section 7 consultation for the Prado Mainstem and Santa Ana River Reach 9 Flood Control Projects and Norco Bluffs Stabilization Project, Orange, Riverside, and San Bernardino Counties, California (FWS-SB-909.13). On file, U. S. Fish and Wildlife Service Carlsbad Fish and Wildlife Office, Carlsbad, California.

[Service] U.S. Fish and Wildlife Service. 2006. Least Bell's Vireo (*Vireo bellii pusillus*) 5-Year Review: Summary and Evaluation. Unpublished document prepared by the Carlsbad Fish and Wildlife Office. September 20, 2006.

[Service] U.S. Fish and Wildlife Service. 2007. Formal section 7 consultation and conference for the Eastbound SR-91 Lane Additions from SR-241 to SR-71, Orange and Riverside Counties, California (FWS-OR/WRIV-08B0054-08F0081). Carlsbad Fish and Wildlife Office, Carlsbad, California.

[Service] U.S. Fish and Wildlife Service. 2011a. Santa Ana sucker (*Catostomus santaanae*) 5-Year Review: Summary and Evaluation. Unpublished document prepared by the Carlsbad Fish and Wildlife Office, Carlsbad, California.

[Service] U.S. Fish and Wildlife Service. 2011b. Formal section 7 consultation for State Route 91 and State Route 71 Interchange Improvement Project, City of Corona, Riverside County, California (FWS-WRIV-09B0057-11F0421). Carlsbad Fish and Wildlife Office, Carlsbad, California.

[Service] U.S. Fish and Wildlife Service. 2011c. Formal and streamlined section 7 consultation for State Route 91 Corridor Improvement Project, Orange and Riverside Counties, California (FWS-OR/WRIV-08B0733-11F0547). Carlsbad Fish and Wildlife Office, Carlsbad, California

[Service] U.S. Fish and Wildlife Service. 2012a. Reinitiation of Formal Section 7 Consultation on the Prado Mainstem and Santa Ana River Reach 9 Flood Control Projects and Norco Bluffs Stabilization Project, Orange, Riverside, and San Bernardino Counties, California (FWS-SB/WRIV/OR-08B0408-11F0551). Carlsbad Fish and Wildlife Office, Carlsbad, California.

[Service] U.S. Fish and Wildlife Service. 2012b. Recovery outline for Santa Ana sucker (*Catostomus santaanae*). Unpublished document prepared by the Carlsbad Fish and Wildlife Office.

[Service] U.S. Fish and Wildlife Service. 2012c. Formal section 7 consultation for the Santa Ana River Interceptor Line Protection/Relocation Project, Orange County, California (FWS-OR-08B0408-12F0298). Carlsbad Fish and Wildlife Office, Carlsbad, California.

[Service] U.S. Fish and Wildlife Service. 2013a. Reinitiation of Formal Section 7 Consultation on the Santa Ana River Project, Reach 9 Phase 3, San Bernardino, Riverside and Orange Counties, California (FWS-OR-08B0408-13F0036). Carlsbad Fish and Wildlife Office, Carlsbad, California.

[Service] U.S. Fish and Wildlife Service. 2013b. Reinitiation of Formal Section 7 Consultation on the Santa Ana River Project, Reach 9 Phase 3, San Bernardino, Riverside and Orange Counties, California (FWS-OR-14B0408-14F0059). Carlsbad Fish and Wildlife Office, Carlsbad, California.

[Service] U.S. Fish and Wildlife Service. 2014a. Draft Recovery Plan for the Santa Ana sucker. U.S. Fish and Wildlife Service, Pacific Southwest Region, Sacramento, California. v + 61 pp.

[Service] U.S. Fish and Wildlife Service. 2014b. Data compiled from 2006-2014 Riverwalk Survey data sheets. On file in the Carlsbad Fish and Wildlife Office, Carlsbad, California.

Smits, A. P., D. E. Schindler, M. T. Brett. 2015. Geomorphology controls the trophic base of stream food webs in a boreal watershed. *Ecology* 96:7:1775–1782.

Swift, C. C. 2001. The Santa Ana sucker in the Santa Ana River: distribution, relative abundance, spawning areas and impact of exotic predators. Final report submitted to the Ad-Hoc Santa Ana Sucker Discussion Team. June.

Swift, C. 2002. Memorandum on the removal of young Santa Ana suckers from below the River Road Bridge and Translocation upstream to above the Mission Road Bridge on June 13, 2002 (dated June 17, 2002).

Tennant, P. 2003. Summary of surveys conducted for the Santa Ana sucker (*Catostomus santaanae*) at the River Road Bridge from November 2001 to November 2002.

Tetra Tech. 2012. Lower Santa Ana River, Reach 9, Design Documentation Report Hydrology, Hydraulics, & Sedimentation Appendix Orange County, California. Prepared for U.S. Army Corps of Engineers, Los Angeles District, Los Angeles, California. April.

Thompson, A. R., J. N. Baskin, C. C. Swift, T. R. Haglund, and R .J. Nagel. 2010. Influence of habitat dynamics on the distribution and abundance of the federally threatened Santa Ana sucker, *Catostomus santaanae*, in the Santa Ana River. Environmental Biology of Fishes 87:321-332.

Personal Communication

Jones, C. 2015a. Biologist, Ecosystem Planning Section, U.S. Army Corps of Engineers, Los Angeles District. Email message to Jon Avery, Carlsbad Fish and Wildlife Office, Carlsbad, California. July 21.

Jones, C. 2015b. Biologist, Ecosystem Planning Section, U.S. Army Corps of Engineers, Los Angeles District. Email message to Jon Avery, Carlsbad Fish and Wildlife Office, Carlsbad, California. July 9.

Lovan, H. 2015. Biologist, Ecosystem Planning Section, U.S. Army Corps of Engineers, Los Angeles District. personal communication to Jon Avery, U.S. Fish and Wildlife Service, regarding BNSF Bridge project. July 21.

Lyren, L. 2011. Biologist, U. S. Geological Survey, electronic message to C. Medak, Carlsbad Fish and Wildlife Office. January 11.

Lyren, L. 2012. Biologist, U. S. Geological Survey, personal communication to C. Medak, Carlsbad Fish and Wildlife Office. December 3.

Lyren, L. 2015. Biologist, U. S. Geological Survey, personal communication to Jon Avery, Carlsbad Fish and Wildlife Office. June 3.

Medak, C. M. 2010. Electronic mail message from C. Medak, U.S. Fish and Wildlife Service, to

Chris Jones, U.S. Army Corps, regarding Chang 2008 report indicating that 26 ft of scour was predicted for Reach 9. September 17.

Mills, B. 2012. Riverside-Corona Resource Conservation District , electronic mail received by C. Medak, Carlsbad Fish and Wildlife Office. 8 November.

Paster, R. 2012. Orange County Public Works, Regulatory Permits Section, electronic mail received by C. Medak, Carlsbad Fish and Wildlife Office. 5 March.

Reeser, T. 2012. Santa Ana Watershed Association, electronic mail received by C. Medak, Carlsbad Fish and Wildlife Office. 2 October.

APPENDIX
Figures 1-33

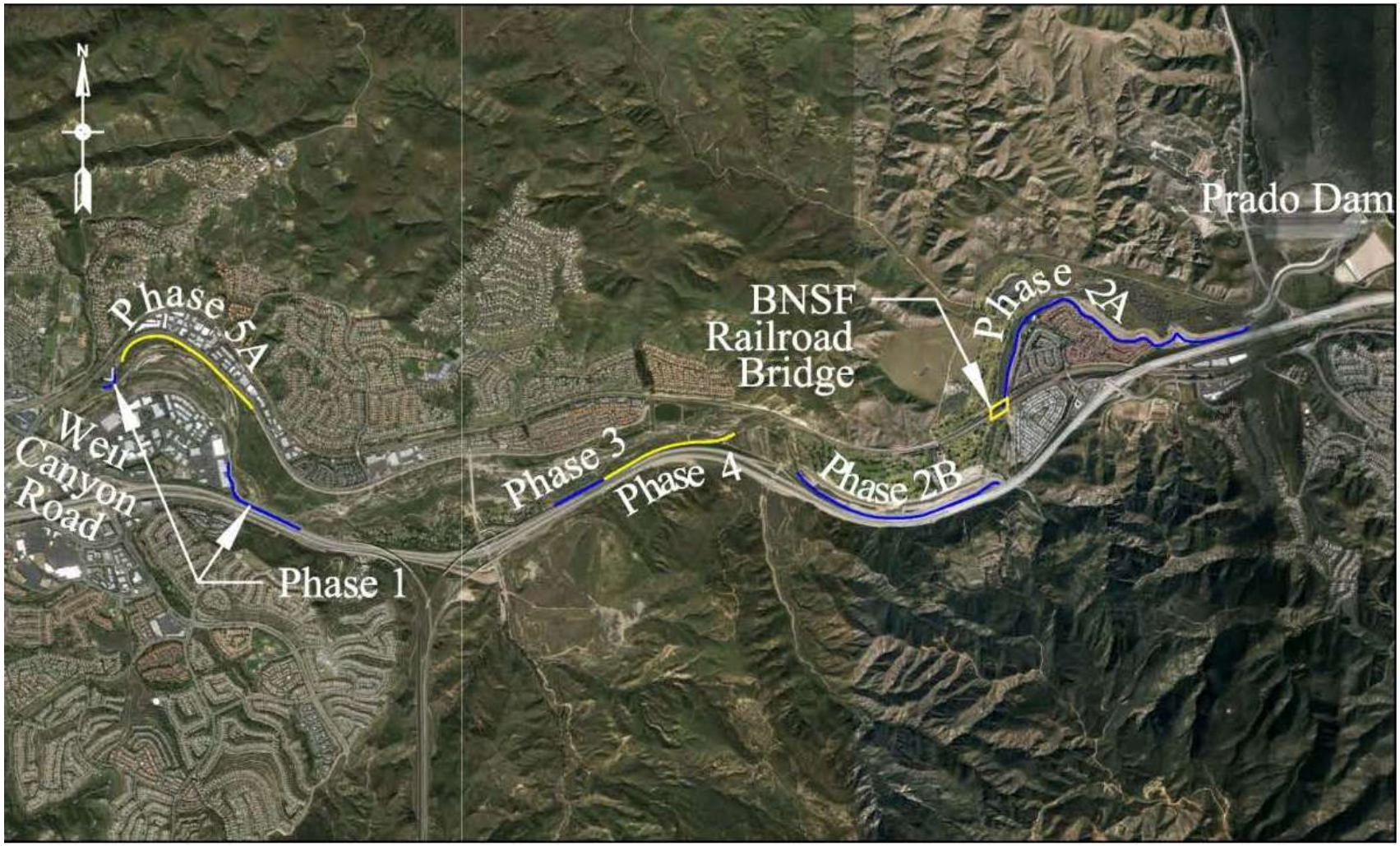


Figure 1. Santa Ana River Reach 9 Project Segments.

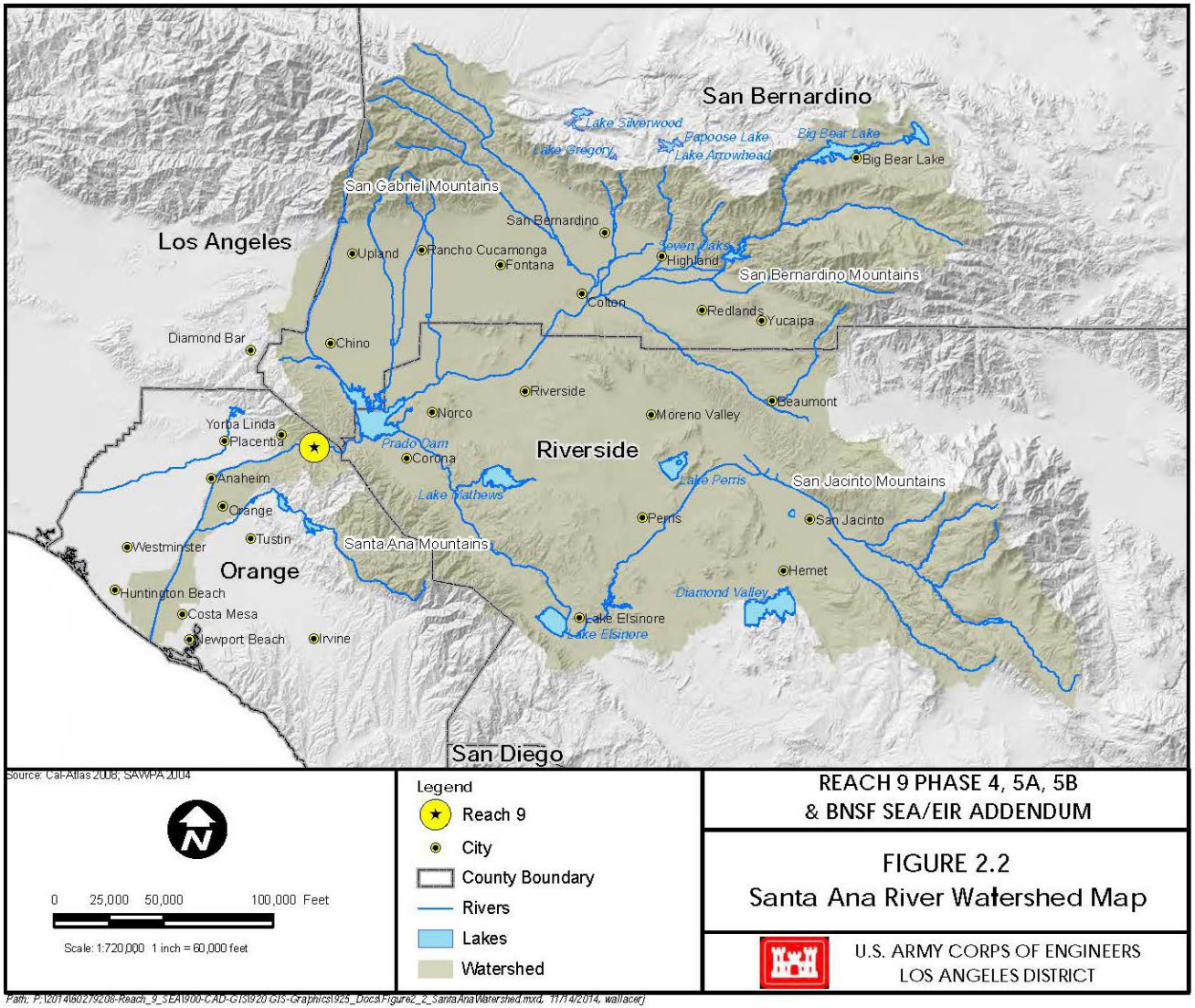

San Bernardino
Lake Silverwood
Lake Gregory
Papoose Lake
Lake Arrowhead
Big Bear Lake
Big Bear Lake
San Gabriel Mountains
San Bernardino
Los Angeles
Upland
Rancho Cucamonga
Fontana
Seven Oaks
Highland
San Bernardino Mountains
Colton
Redlands
Yucaipa
Diamond Bar
Chino
Riverside
Beaumont
Norco
Moreno Valley
Yorba Linda
Placentia
Prado Dam
Corona
Riverside
Anaheim
Lake Mathews
Lake Perris
San Jacinto Mountains
Orange
Perris
San Jacinto
Tustin
Westminster
Santa Ana Mountains
Orange
Hemet
Huntington Beach
Diamond Valley
Costa Mesa
Lake Elsinore
Lake Elsinore
Newport Beach
Irvine
San Diego
Source: Cal-Atlas 2008; SAWPA 2004
0 25,000 50,000 100,000 Feet
Scale: 1:720,000 1 inch = 60,000 feet
Legend
Reach 9
City
County Boundary
Rivers
Lakes
Watershed
REACH 9 PHASE 4, 5A, 5B
& BNSF SEA/EIR ADDENDUM
FIGURE 2.2
Santa Ana River Watershed Map
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT
Path: P:\2014\80279208-Reach_9_SEA1900-CAD-GIS\920 GIS-Graphics\925_Docs\Figure2_2_SantaAnaWatershed.mxd, 11/14/2014, wallacerj

Figure 2.

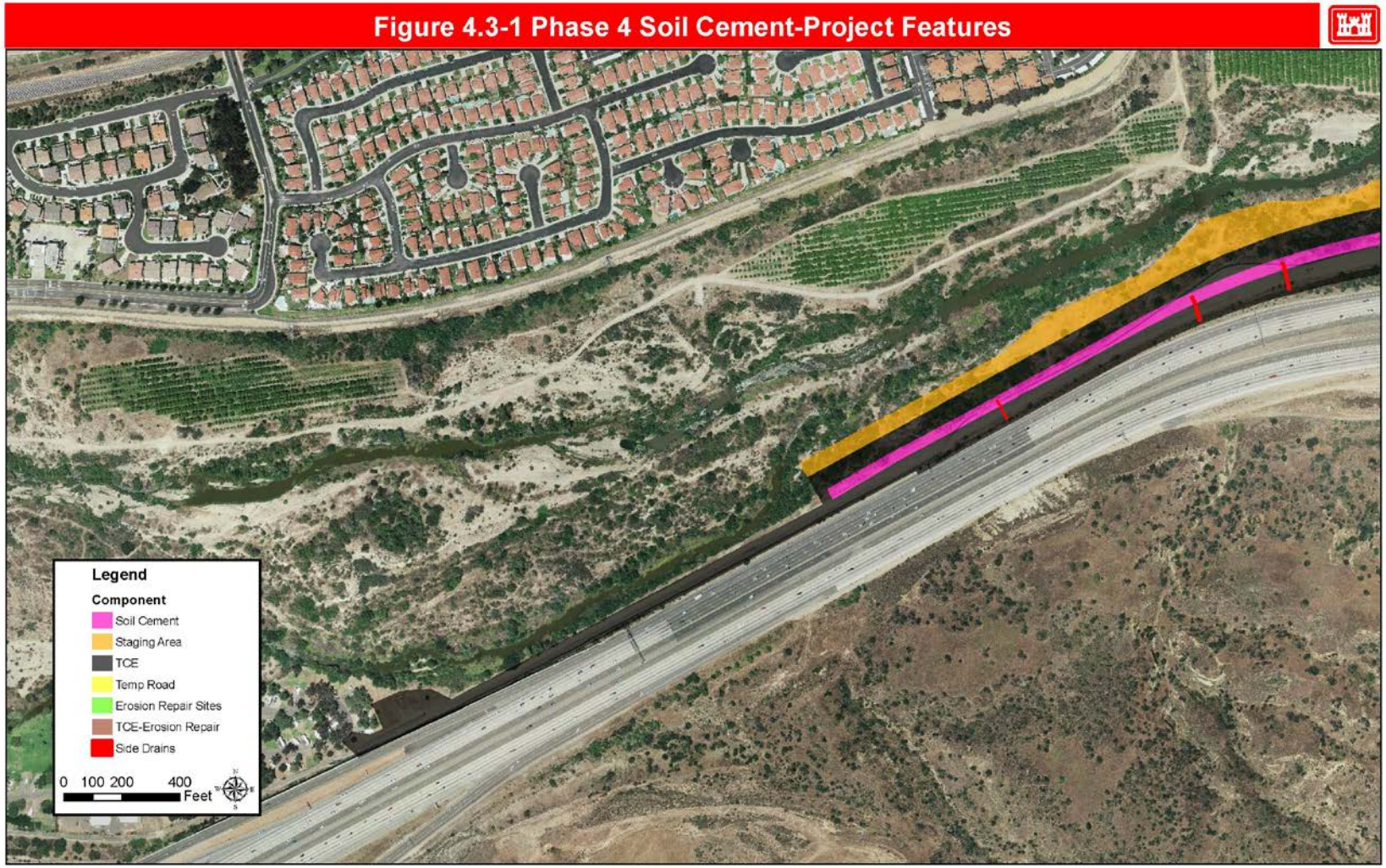

Figure 4.3-1 Phase 4 Soil Cement-Project Features
Legend
Component
Soil Cement
Staging Area
TCE
Temp Road
Erosion Repair Sites
TCE-Erosion Repair
Side Drains
0 100 200 400
Feet

Figure 3.

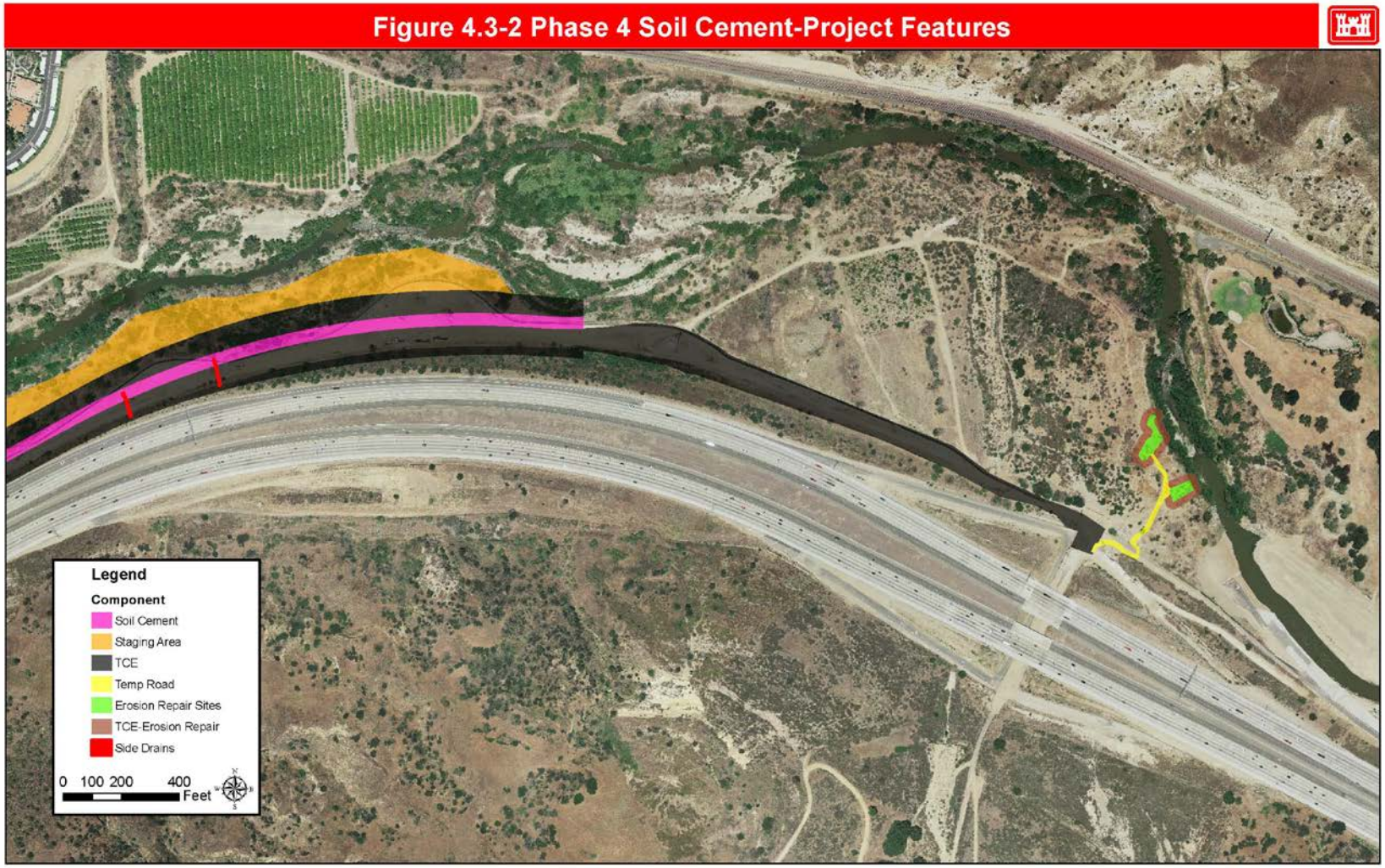

Figure 4.3-2 Phase 4 Soil Cement-Project Features
Legend
Component
Soil Cement
Staging Area
TCE
Temp Road
Erosion Repair Sites
TCE-Erosion Repair
Side Drains
0 100 200 400
Feet

Figure 4.

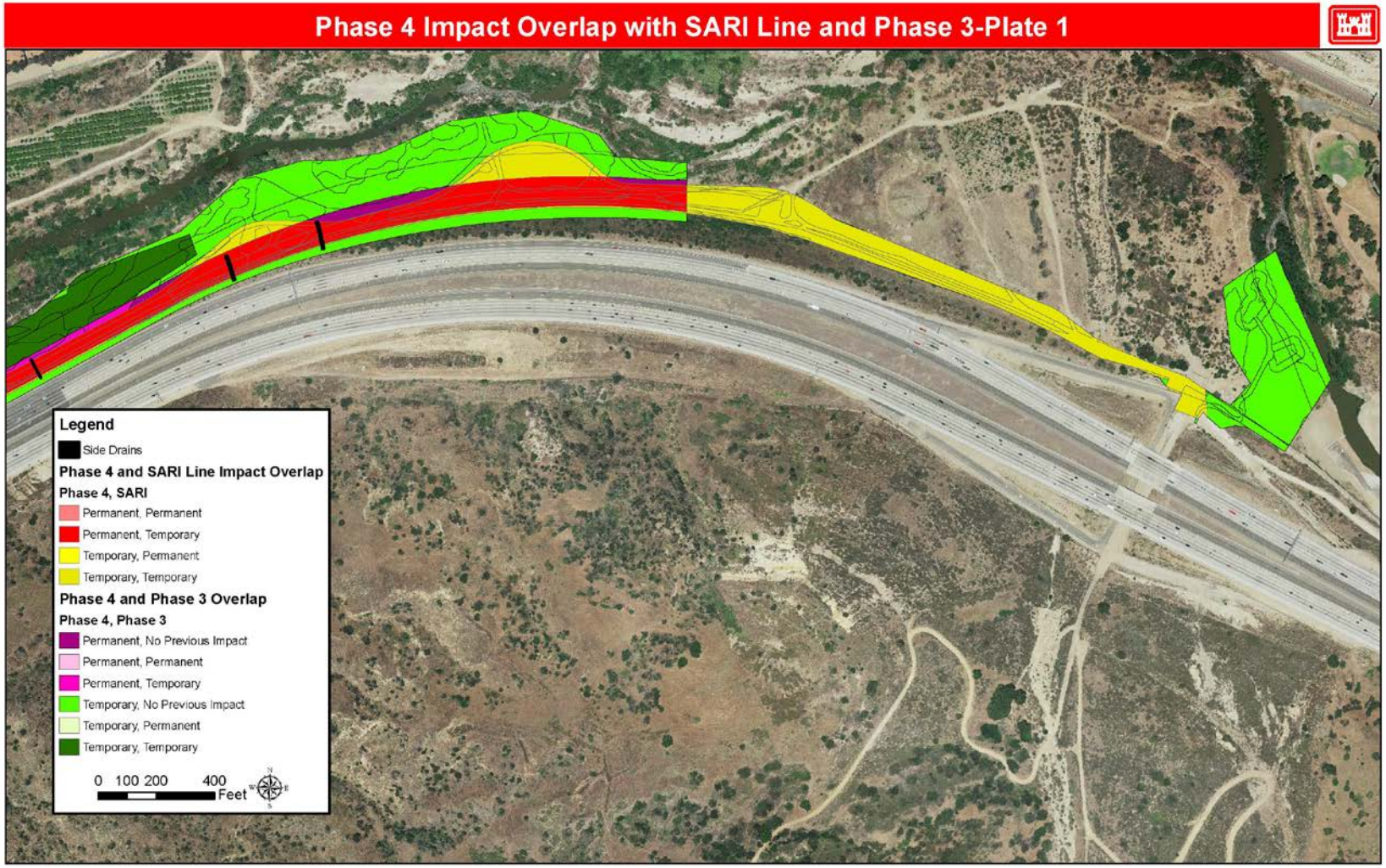

Phase 4 Impact Overlap with SARI Line and Phase 3-Plate 1
Legend
Side Drains
Phase 4 and SARI Line Impact Overlap
Phase 4, SARI
Permanent, Permanent
Permanent, Temporary
Temporary, Permanent
Temporary, Temporary
Phase 4 and Phase 3 Overlap
Phase 4, Phase 3
Permanent, No Previous Impact
Permanent, Permanent
Permanent, Temporary
Temporary, No Previous Impact
Temporary, Permanent
Temporary, Temporary
0 100 200 400
Feet

Figure 5.

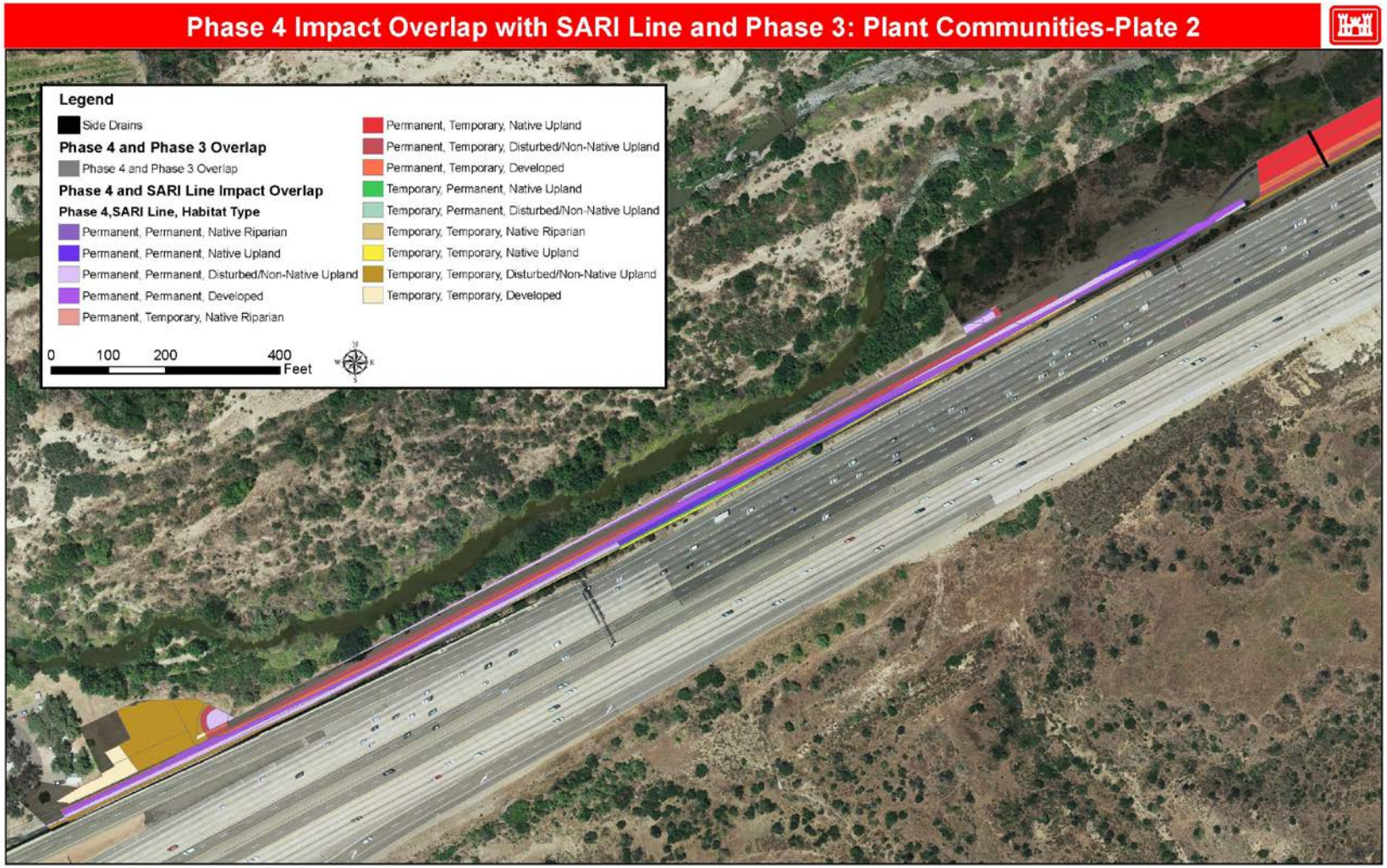

Phase 4 Impact Overlap with SARI Line and Phase 3: Plant Communities-Plate 2
Legend
Side Drains
Phase 4 and Phase 3 Overlap
Phase 4 and Phase 3 Overlap
Phase 4 and SARI Line Impact Overlap
Phase 4,SARI Line, Habitat Type
Permanent, Permanent, Native Riparian
Permanent, Permanent, Native Upland
Permanent, Permanent, Disturbed/Non-Native Upland
Permanent, Permanent, Developed
Permanent, Temporary, Native Riparian
Permanent, Temporary, Native Upland
Permanent, Temporary, Disturbed/Non-Native Upland
Permanent, Temporary, Developed
Temporary, Permanent, Native Upland
Temporary, Permanent, Disturbed/Non-Native Upland
Temporary, Temporary, Native Riparian
Temporary, Temporary, Native Upland
Temporary, Temporary, Disturbed/Non-Native Upland
Temporary, Temporary, Developed
0 100 200 400
Feet

Figure 6.

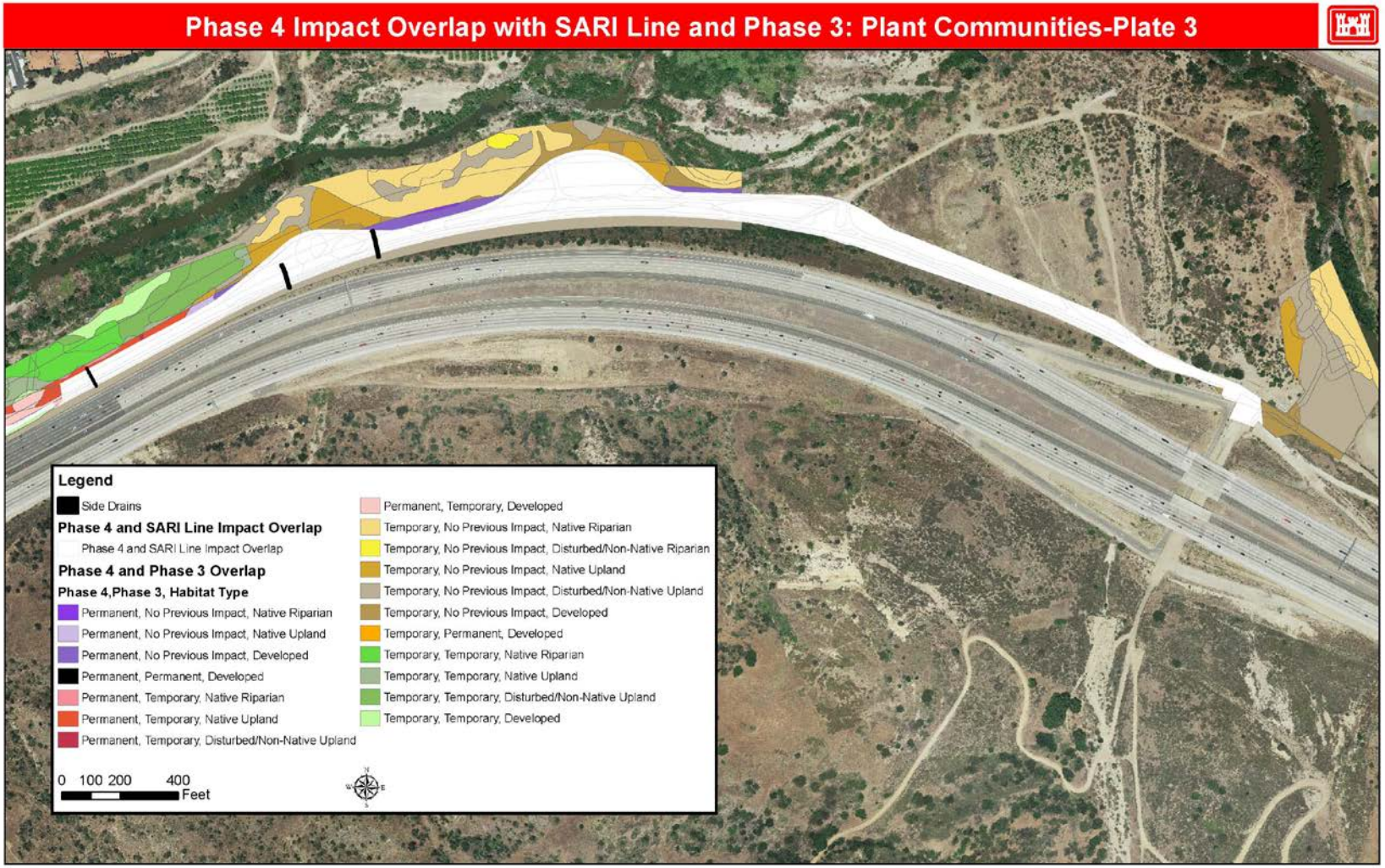

Phase 4 Impact Overlap with SARI Line and Phase 3: Plant Communities-Plate 3
Legend
Side Drains
Phase 4 and SARI Line Impact Overlap
Phase 4 and SARI Line Impact Overlap
Phase 4 and Phase 3 Overlap
Phase 4,Phase 3, Habitat Type
Permanent, No Previous Impact, Native Riparian
Permanent, No Previous Impact, Native Upland
Permanent, No Previous Impact, Developed
Permanent, Permanent, Developed
Permanent, Temporary, Native Riparian
Permanent, Temporary, Native Upland
Permanent, Temporary, Disturbed/Non-Native Upland
Permanent, Temporary, Developed
Temporary, No Previous Impact, Native Riparian
Temporary, No Previous Impact, Disturbed/Non-Native Riparian
Temporary, No Previous Impact, Native Upland
Temporary, No Previous Impact, Disturbed/Non-Native Upland
Temporary, No Previous Impact, Developed
Temporary, Permanent, Developed
Temporary, Temporary, Native Riparian
Temporary, Temporary, Native Upland
Temporary, Temporary, Disturbed/Non-Native Upland
Temporary, Temporary, Developed
0 100 200 400
Feet

Figure 7.

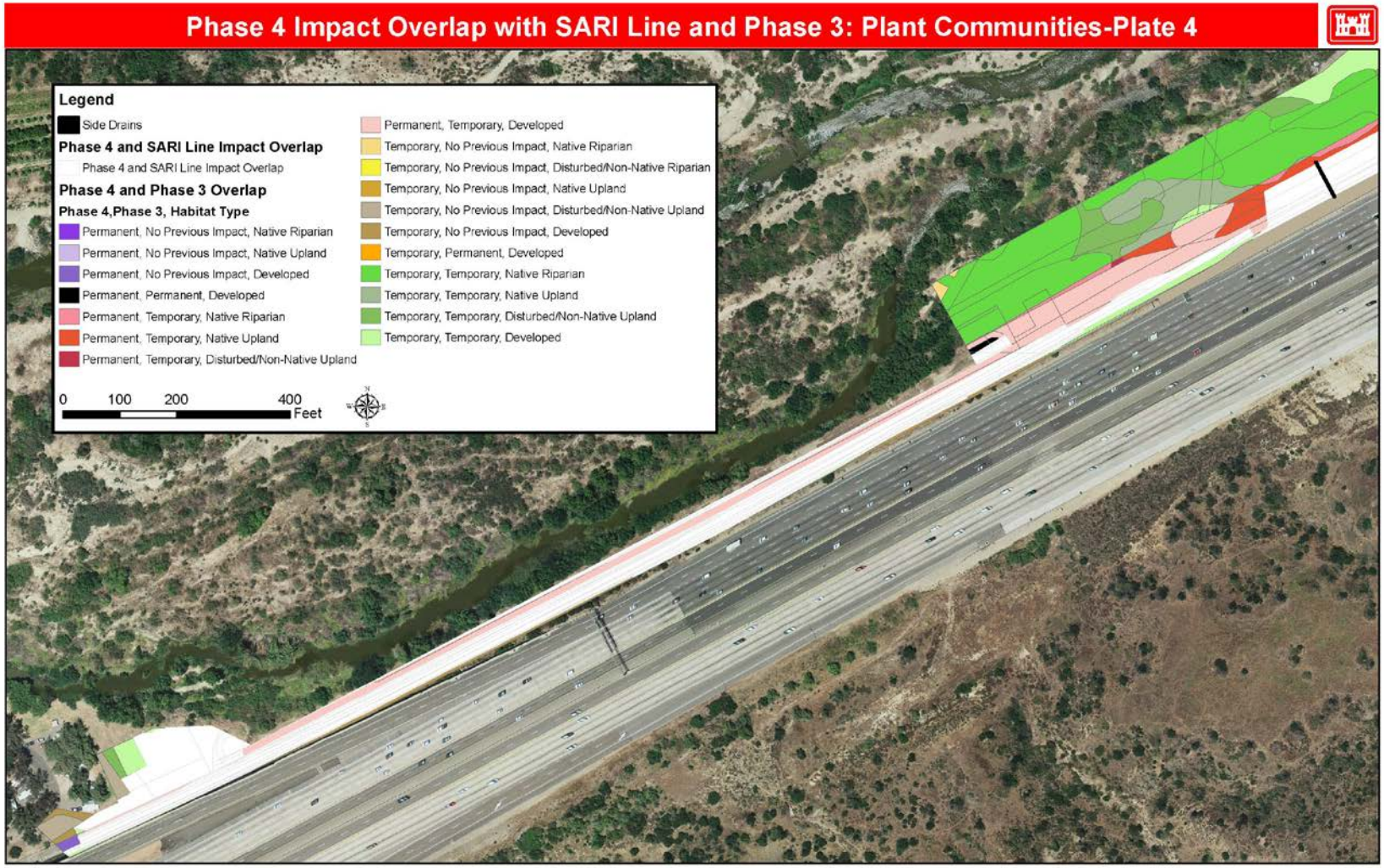

Phase 4 Impact Overlap with SARI Line and Phase 3: Plant Communities-Plate 4
Legend
Side Drains
Phase 4 and SARI Line Impact Overlap
Phase 4 and SARI Line Impact Overlap
Phase 4 and Phase 3 Overlap
Phase 4,Phase 3, Habitat Type
Permanent, No Previous Impact, Native Riparian
Permanent, No Previous Impact, Native Upland
Permanent, No Previous Impact, Developed
Permanent, Permanent, Developed
Permanent, Temporary, Native Riparian
Permanent, Temporary, Native Upland
Permanent, Temporary, Disturbed/Non-Native Upland
Permanent, Temporary, Developed
Temporary, No Previous Impact, Native Riparian
Temporary, No Previous Impact, Disturbed/Non-Native Riparian
Temporary, No Previous Impact, Native Upland
Temporary, No Previous Impact, Disturbed/Non-Native Upland
Temporary, No Previous Impact, Developed
Temporary, Permanent, Developed
Temporary, Temporary, Native Riparian
Temporary, Temporary, Native Upland
Temporary, Temporary, Disturbed/Non-Native Upland
Temporary, Temporary, Developed
0 100 200 400
Feet

Figure 8.

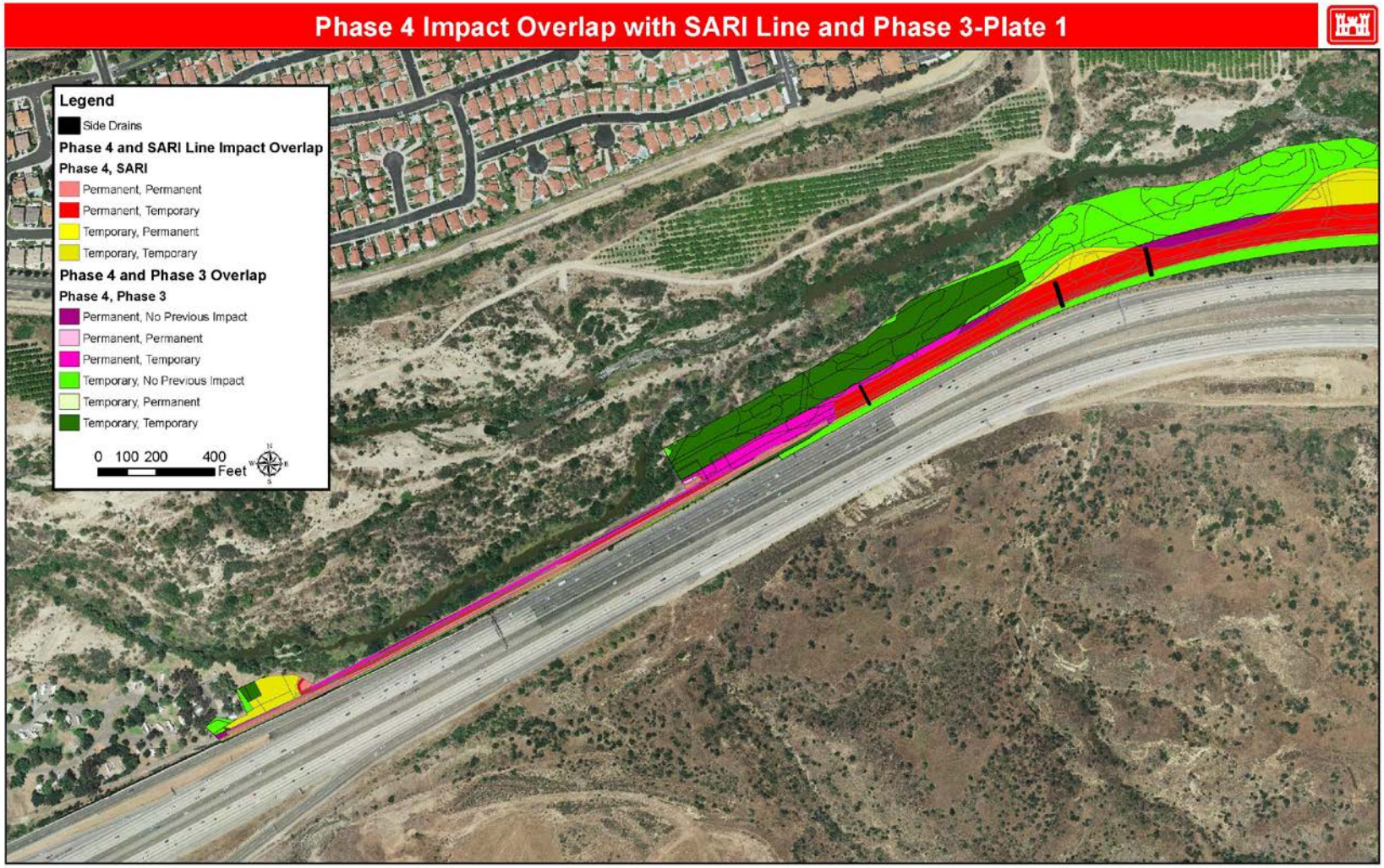

Phase 4 Impact Overlap with SARI Line and Phase 3-Plate 1
Legend
Side Drains
Phase 4 and SARI Line Impact Overlap
Phase 4, SARI
Permanent, Permanent
Permanent, Temporary
Temporary, Permanent
Temporary, Temporary
Phase 4 and Phase 3 Overlap
Phase 4, Phase 3
Permanent, No Previous Impact
Permanent, Permanent
Permanent, Temporary
Temporary, No Previous Impact
Temporary, Permanent
Temporary, Temporary
0 100 200 400
Feet

Figure 9.

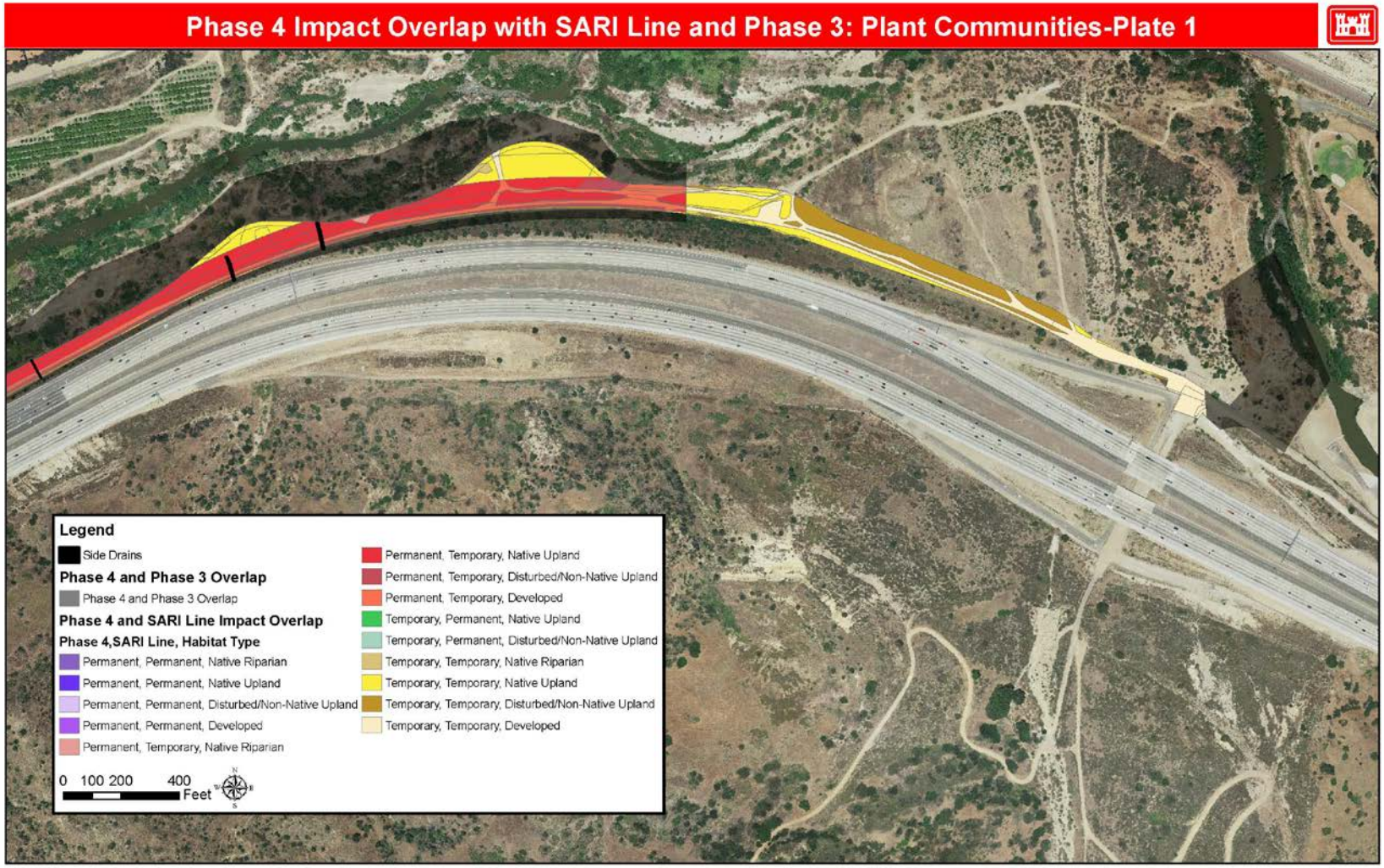

Phase 4 Impact Overlap with SARI Line and Phase 3: Plant Communities-Plate 1
Legend
Side Drains
Phase 4 and Phase 3 Overlap
Phase 4 and Phase 3 Overlap
Phase 4 and SARI Line Impact Overlap
Phase 4,SARI Line, Habitat Type
Permanent, Permanent, Native Riparian
Permanent, Permanent, Native Upland
Permanent, Permanent, Disturbed/Non-Native Upland
Permanent, Permanent, Developed
Permanent, Temporary, Native Riparian
Permanent, Temporary, Native Upland
Permanent, Temporary, Disturbed/Non-Native Upland
Permanent, Temporary, Developed
Temporary, Permanent, Native Upland
Temporary, Permanent, Disturbed/Non-Native Upland
Temporary, Temporary, Native Riparian
Temporary, Temporary, Native Upland
Temporary, Temporary, Disturbed/Non-Native Upland
Temporary, Temporary, Developed
0 100 200 400
Feet

Figure 10.

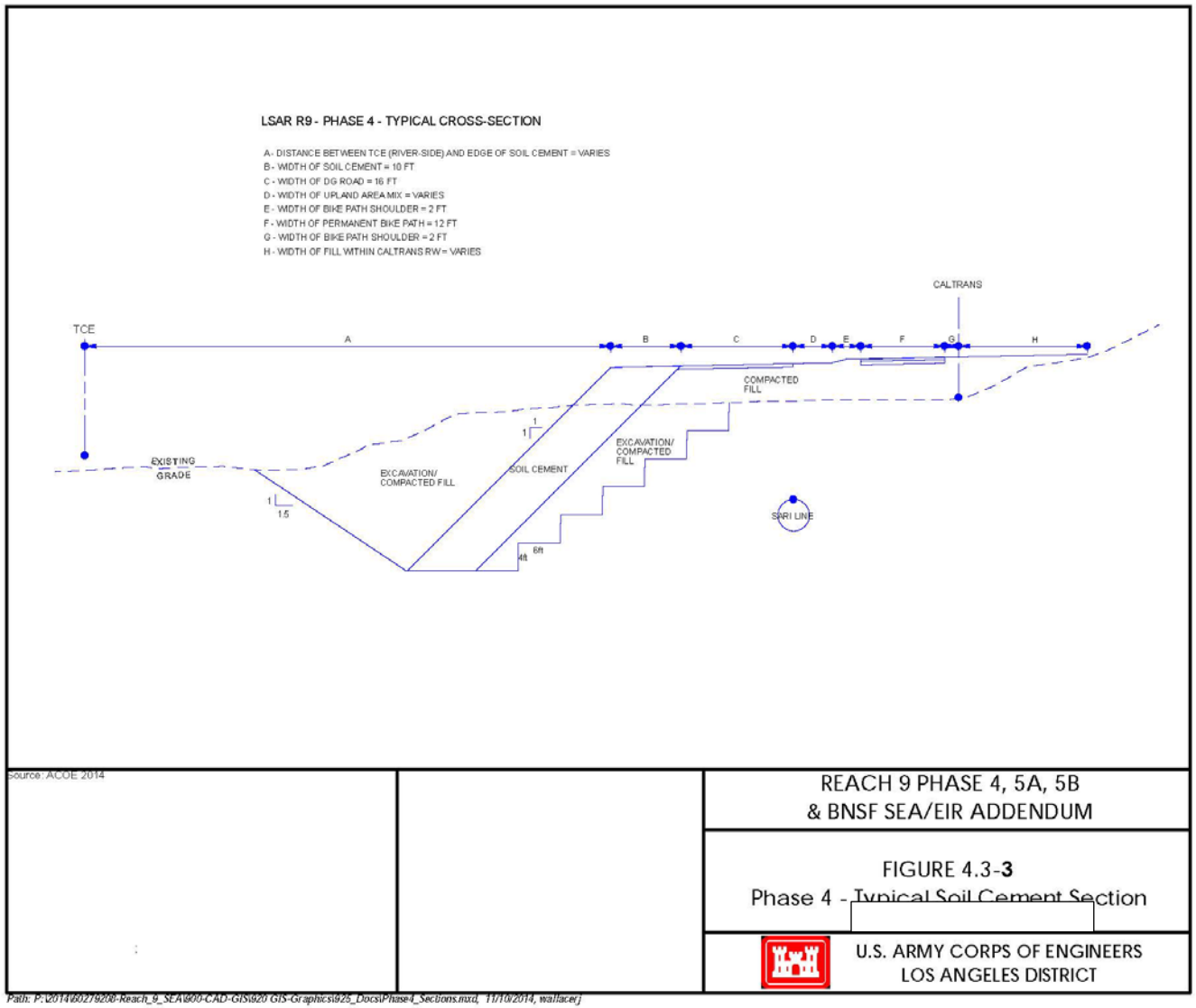

LSAR R9 - PHASE 4 - TYPICAL CROSS-SECTION
A - DISTANCE BETWEEN TCE (RIVER-SIDE) AND EDGE OF SOIL CEMENT = VARIES
B - WIDTH OF SOIL CEMENT = 10 FT
C - WIDTH OF DG ROAD = 16 FT
D - WIDTH OF UPLAND AREA MIX = VARIES
E - WIDTH OF BIKE PATH SHOULDER = 2 FT
F - WIDTH OF PERMANENT BIKE PATH = 12 FT
G - WIDTH OF BIKE PATH SHOULDER = 2 FT
H - WIDTH OF FILL WITHIN CALTRANS R/W = VARIES
CALTRANS
TCE
A
B
C
D
E
F
G
H
COMPACTED FILL
EXISTING GRADE
EXCAVATION/ COMPACTED FILL
SOIL CEMENT
EXCAVATION/ COMPACTED FILL
SP/I LINE
1
1
1
1.5
6ft
4ft
Source: ACOE 2014
REACH 9 PHASE 4, 5A, 5B
& BNSF SEA/EIR ADDENDUM
FIGURE 4.3-3
Phase 4 - Typical Soil Cement Section
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT
Path: P:\2014\60279208-Reach_9_SEA\900-CAD-GIS\920 GIS-Graphics\925_Docs\Phase4_Sections.mxd, 11/10/2014, wallace

Figure 11.

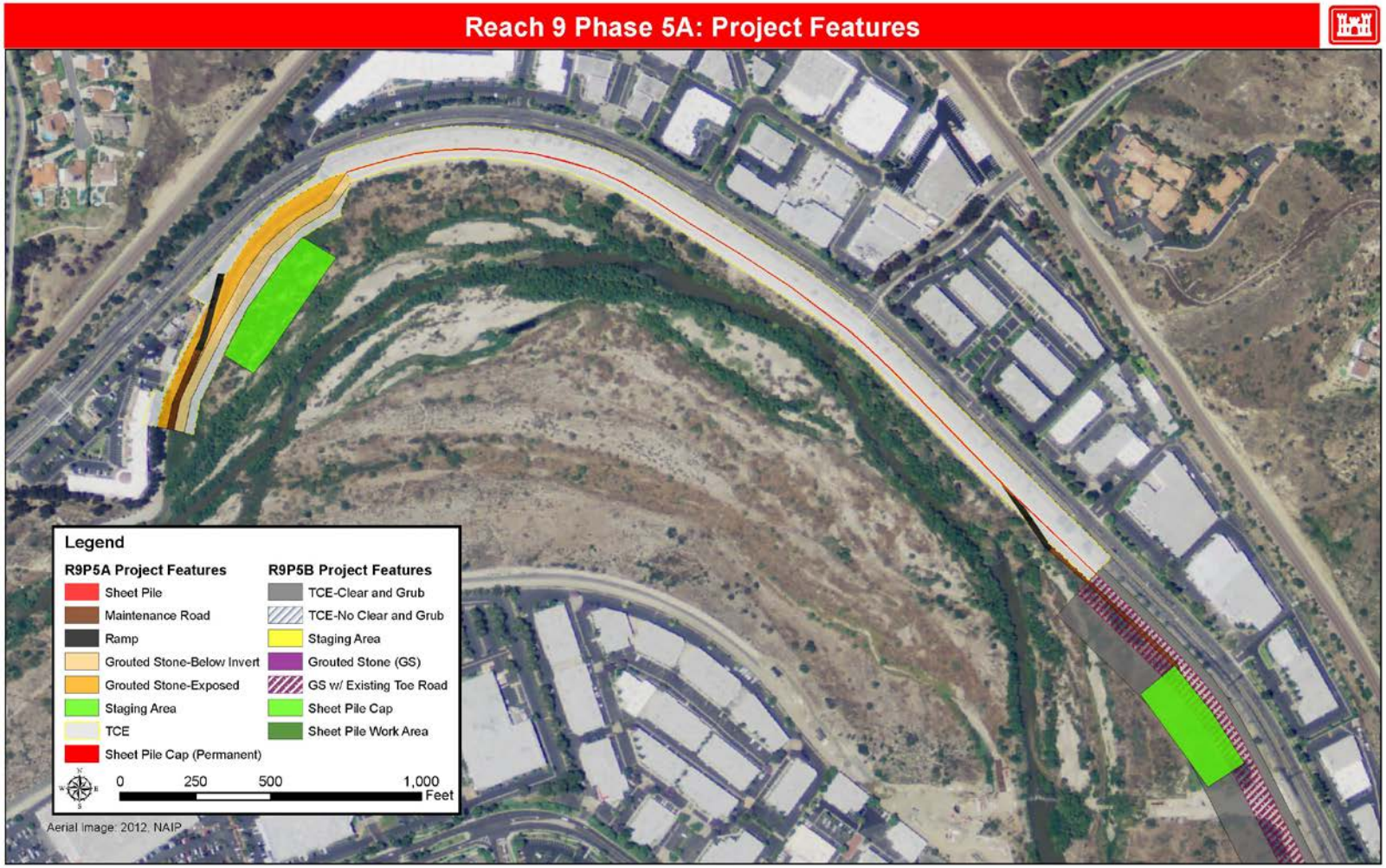

Reach 9 Phase 5A: Project Features
Legend
R9P5A Project Features
Sheet Pile
Maintenance Road
Ramp
Grouted Stone-Below Invert
Grouted Stone-Exposed
Staging Area
TCE
Sheet Pile Cap (Permanent)
R9P5B Project Features
TCE-Clear and Grub
TCE-No Clear and Grub
Staging Area
Grouted Stone (GS)
GS w/ Existing Toe Road
Sheet Pile Cap
Sheet Pile Work Area
0 250 500 1,000
Feet
Aerial Image: 2012, NAIP

Figure 12.

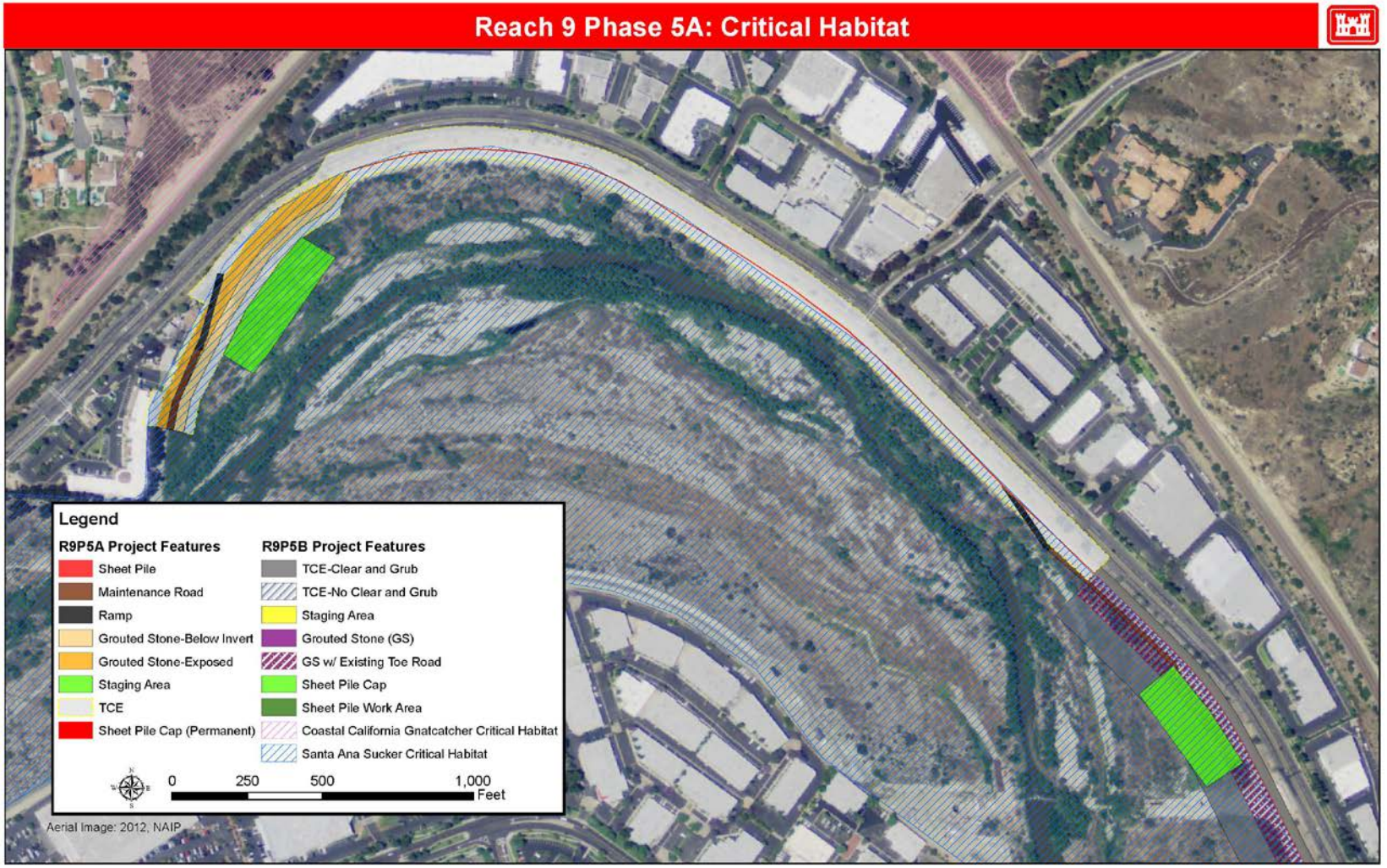

Reach 9 Phase 5A: Critical Habitat
Legend
R9P5A Project Features
Sheet Pile
Maintenance Road
Ramp
Grouted Stone-Below Invert
Grouted Stone-Exposed
Staging Area
TCE
Sheet Pile Cap (Permanent)
R9P5B Project Features
TCE-Clear and Grub
TCE-No Clear and Grub
Staging Area
Grouted Stone (GS)
GS w/ Existing Toe Road
Sheet Pile Cap
Sheet Pile Work Area
Coastal California Gnatcatcher Critical Habitat
Santa Ana Sucker Critical Habitat
0 250 500 1,000
Feet
Aerial Image: 2012, NAIP

Figure 13.

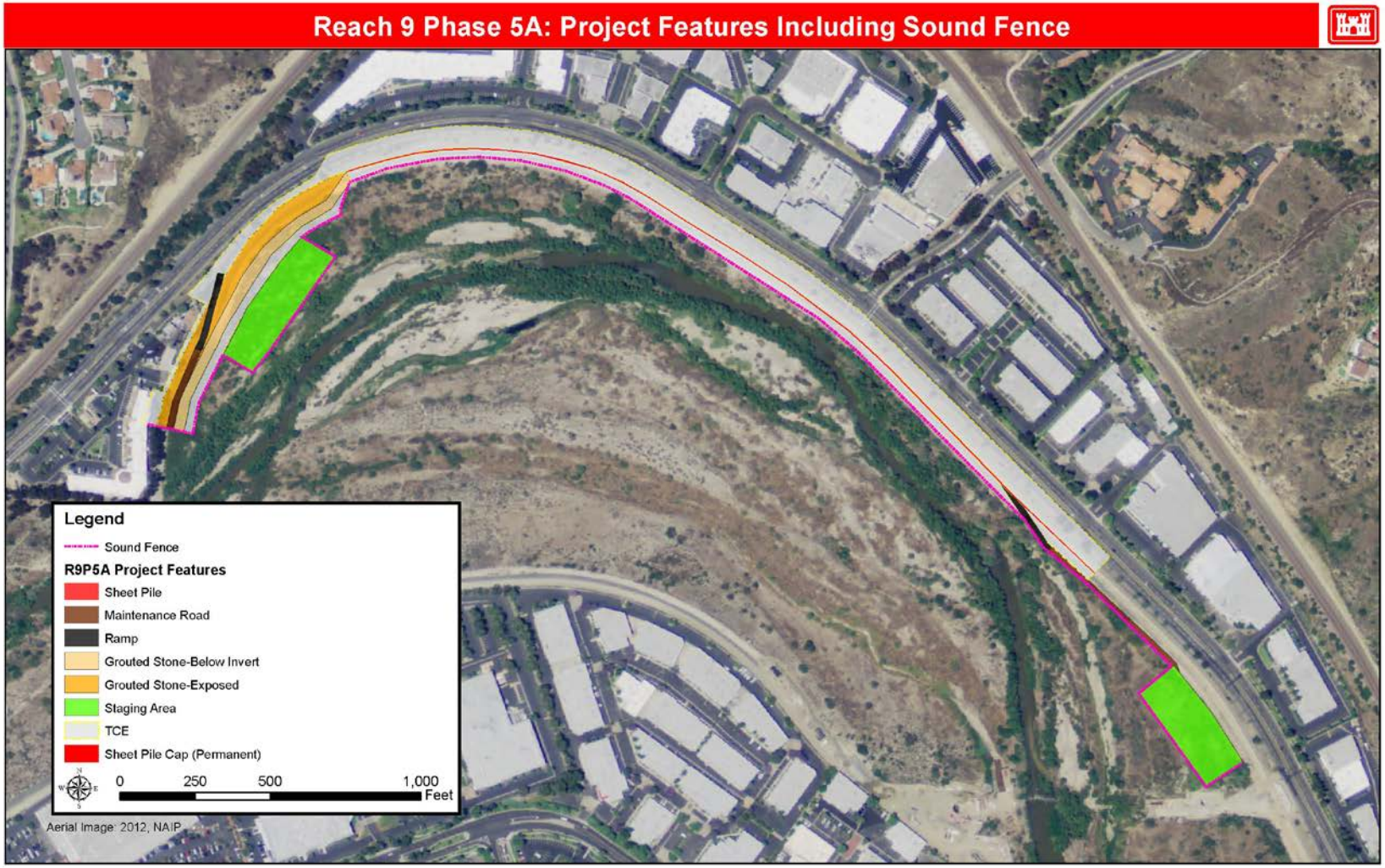

Reach 9 Phase 5A: Project Features Including Sound Fence
Legend
Sound Fence
R9P5A Project Features
Sheet Pile
Maintenance Road
Ramp
Grouted Stone-Below Invert
Grouted Stone-Exposed
Staging Area
TCE
Sheet Pile Cap (Permanent)
0
250
500
1,000
Feet
Aerial Image: 2012, NAIP

Figure 14.

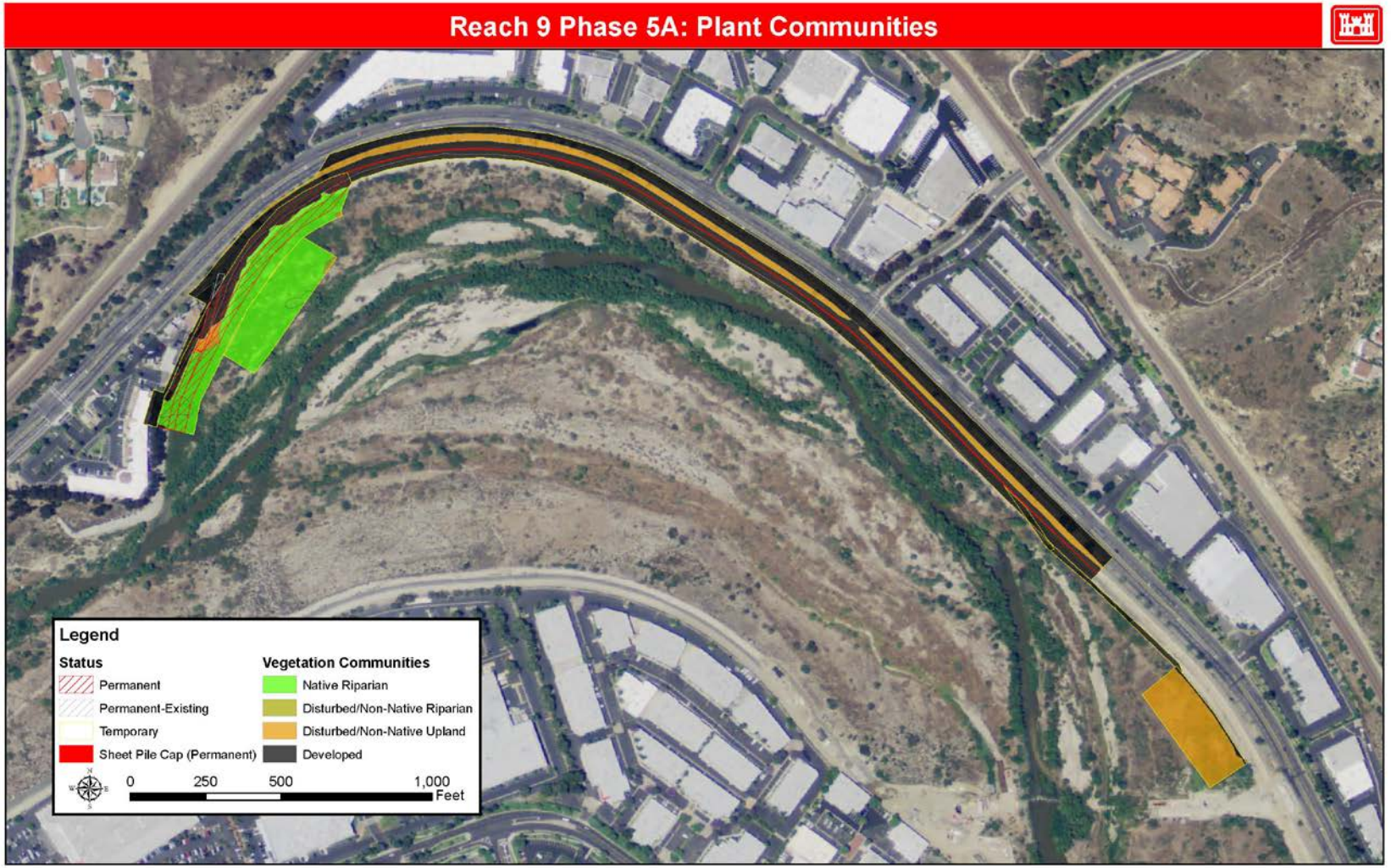

Reach 9 Phase 5A: Plant Communities
Legend
Status
Permanent
Permanent-Existing
Temporary
Sheet Pile Cap (Permanent)
Vegetation Communities
Native Riparian
Disturbed/Non-Native Riparian
Disturbed/Non-Native Upland
Developed
0
250
500
1,000
Feet

Figure 15.

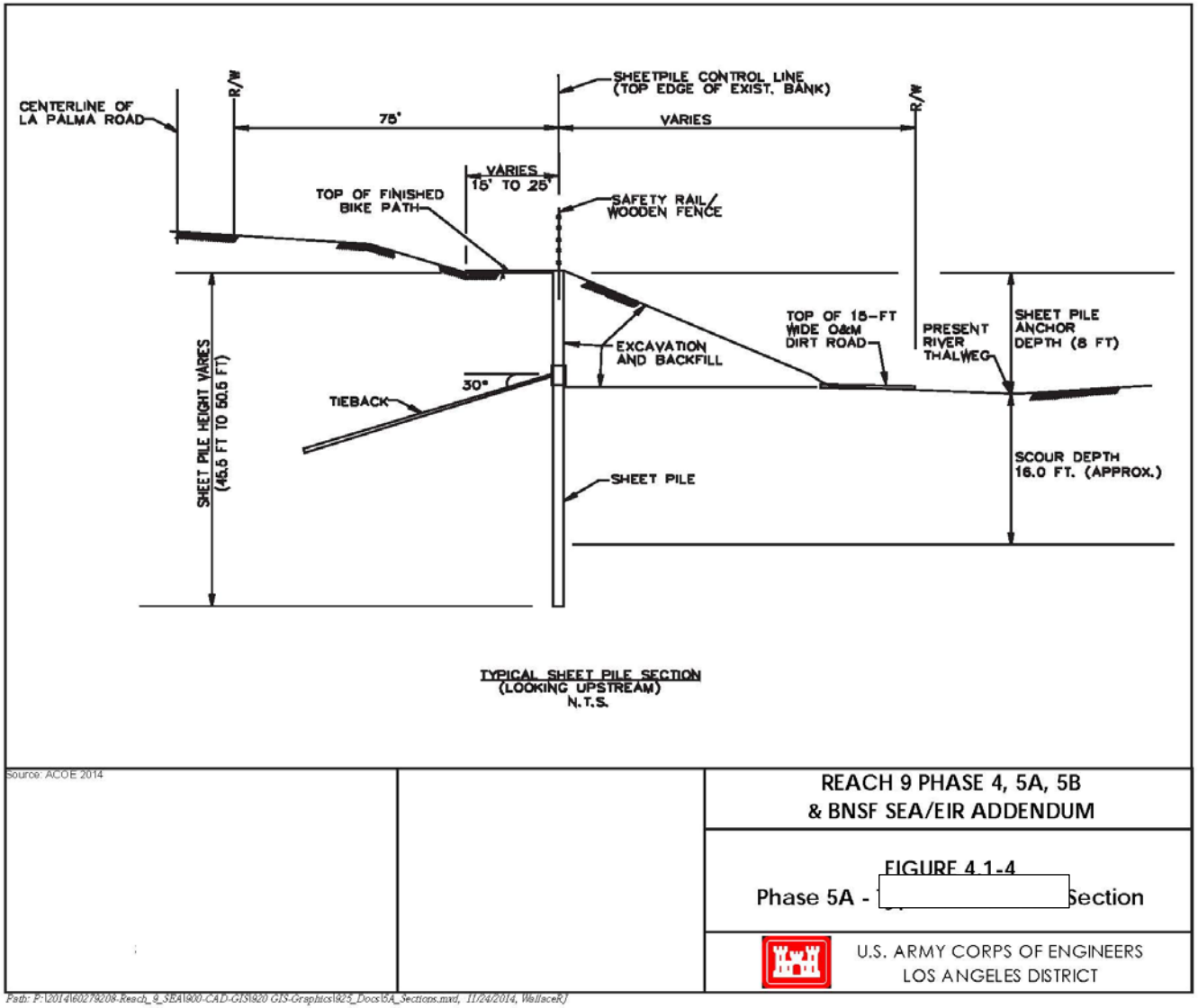

CENTERLINE OF LA PALMA ROAD
R/W
75'
SHEETPILE CONTROL LINE (TOP EDGE OF EXIST. BANK)
VARIES
R/W
VARIES 15' TO 25'
TOP OF FINISHED BIKE PATH
SAFETY RAIL / WOODEN FENCE
TOP OF 15-FT WIDE O&M DIRT ROAD
PRESENT RIVER THALWEG
SHEET PILE ANCHOR DEPTH (8 FT)
EXCAVATION AND BACKFILL
30°
TIEBACK
SHEET PILE HEIGHT VARIES (45.5 FT TO 60.5 FT)
SHEET PILE
SCOUR DEPTH 16.0 FT. (APPROX.)
TYPICAL SHEET PILE SECTION (LOOKING UPSTREAM) N.T.S.
Source: ACOE 2014
REACH 9 PHASE 4, 5A, 5B & BNSF SEA/EIR ADDENDUM
FIGURE 4.1-4
Phase 5A - Section
U.S. ARMY CORPS OF ENGINEERS LOS ANGELES DISTRICT
Path: P:\2014\60279208-Reach_9_SEA\900-CAD-GIS\920 GIS-Graphics\925_Docs\5A_Sections.mxd, 11/24/2014, WallaceR]

Figure 16.

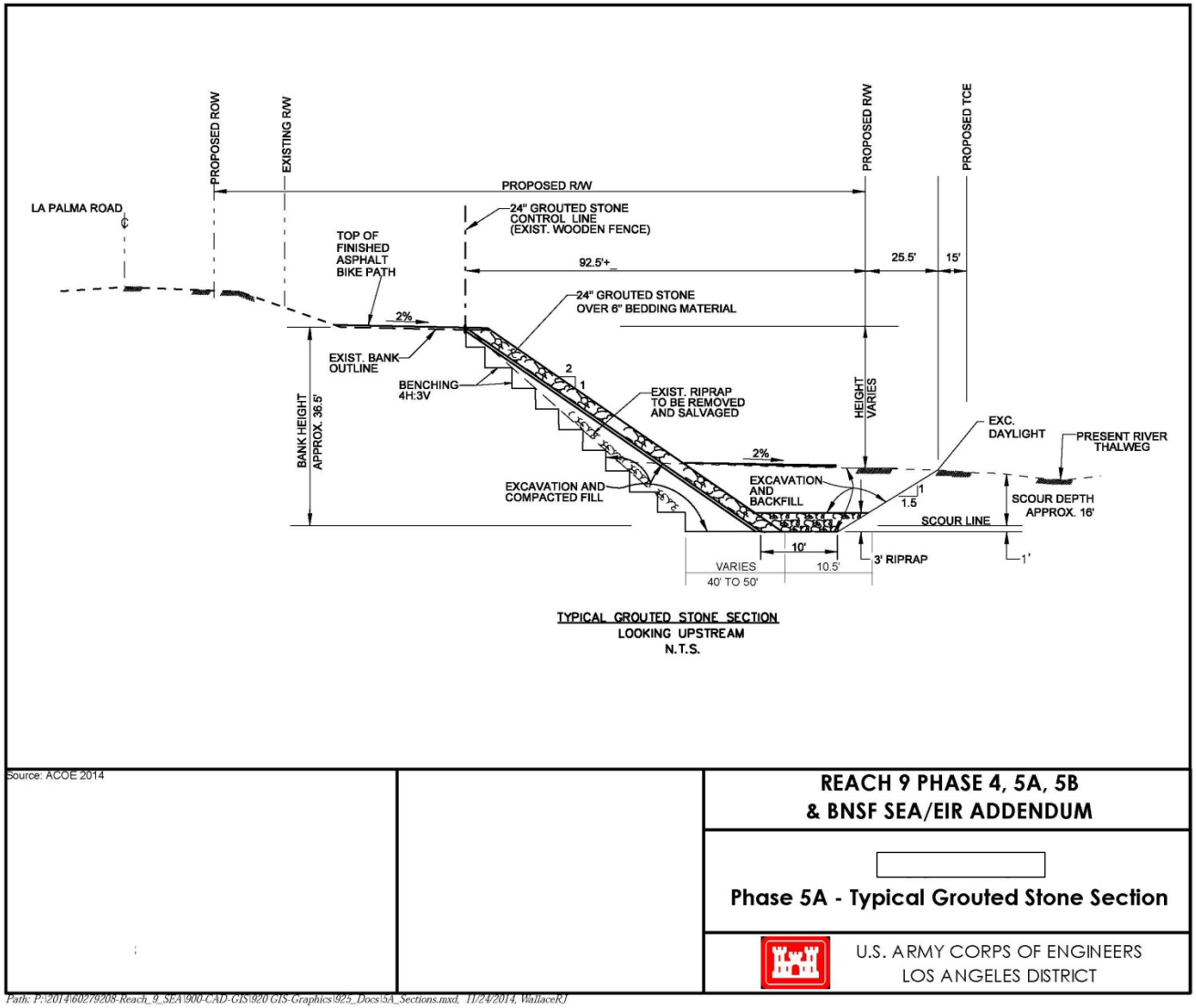

PROPOSED ROW
EXISTING R/W
PROPOSED R/W
PROPOSED TOE
LA PALMA ROAD
PROPOSED R/W
24" GROUTED STONE CONTROL LINE (EXIST. WOODEN FENCE)
TOP OF FINISHED ASPHALT BIKE PATH
92.5'+
25.5'
15'
24" GROUTED STONE OVER 6" BEDDING MATERIAL
2%
EXIST. BANK OUTLINE
BENCHING 4H:3V
2
1
EXIST. RIPRAP TO BE REMOVED AND SALVAGED
BANK HEIGHT APPROX. 36.5'
HEIGHT VARIES
EXC. DAYLIGHT
PRESENT RIVER THALWEG
2%
EXCAVATION AND BACKFILL
EXCAVATION AND COMPACTED FILL
1
1.5
SCOUR DEPTH APPROX. 16'
SCOUR LINE
10'
3' RIPRAP
1'
VARIES
40' TO 50'
10.5'
TYPICAL GROUTED STONE SECTION
LOOKING UPSTREAM
N.T.S.
Source: ACOE 2014
REACH 9 PHASE 4, 5A, 5B
& BNSF SEA/EIR ADDENDUM
Phase 5A - Typical Grouted Stone Section
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT
Path: P:\2014\60279208-Reach_9_SEA\900-CAD-GIS\920 GIS-Graphics\925_Docs\5A_Sections.mxd, 11/24/2014, WallaceRJ

Figure 17.

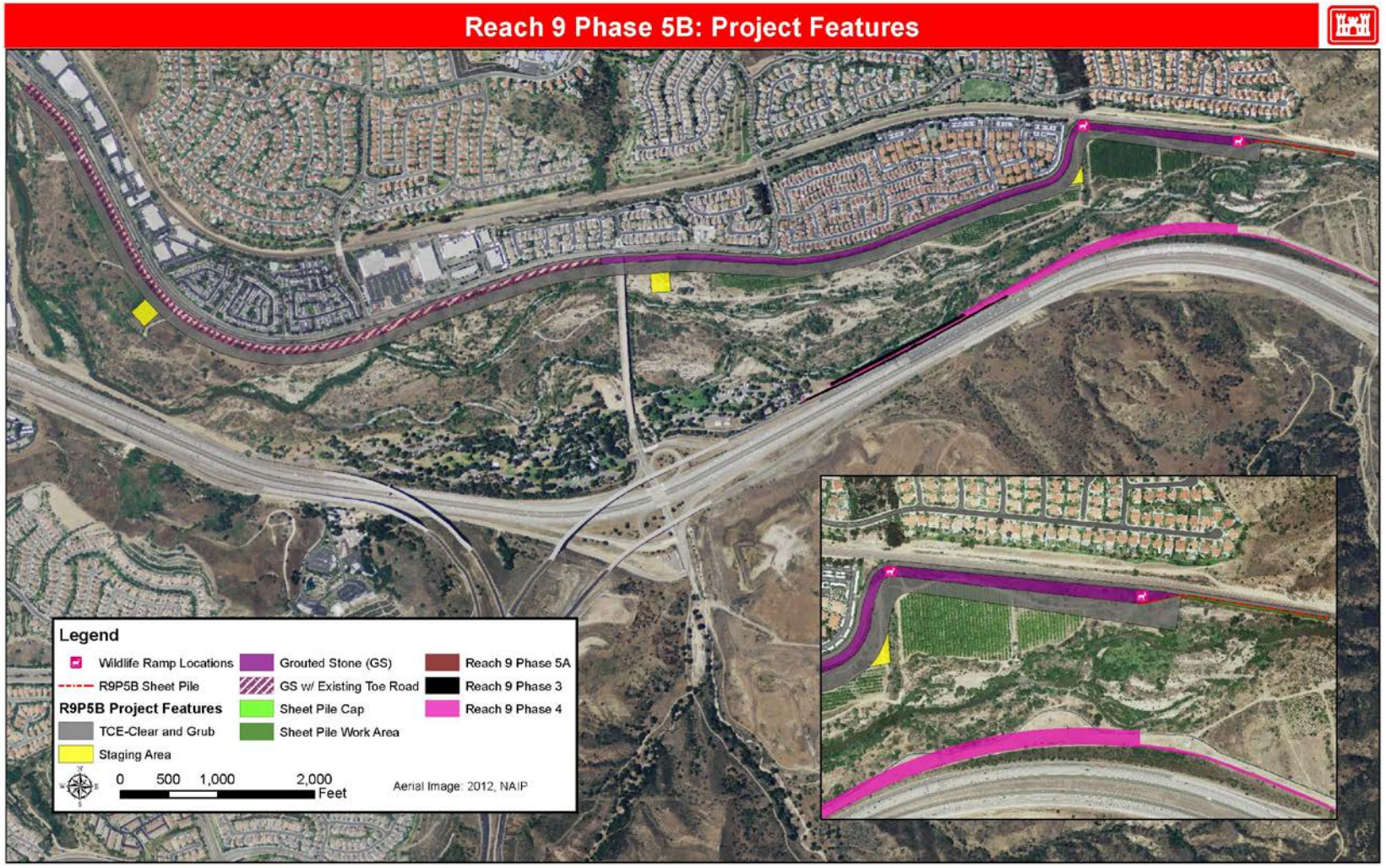

Reach 9 Phase 5B: Project Features
Legend
Wildlife Ramp Locations
R9P5B Sheet Pile
R9P5B Project Features
TCE-Clear and Grub
Staging Area
Grouted Stone (GS)
GS w/ Existing Toe Road
Sheet Pile Cap
Sheet Pile Work Area
Reach 9 Phase 5A
Reach 9 Phase 3
Reach 9 Phase 4
0 500 1,000 2,000
Feet
Aerial Image: 2012, NAIP

Figure 18.

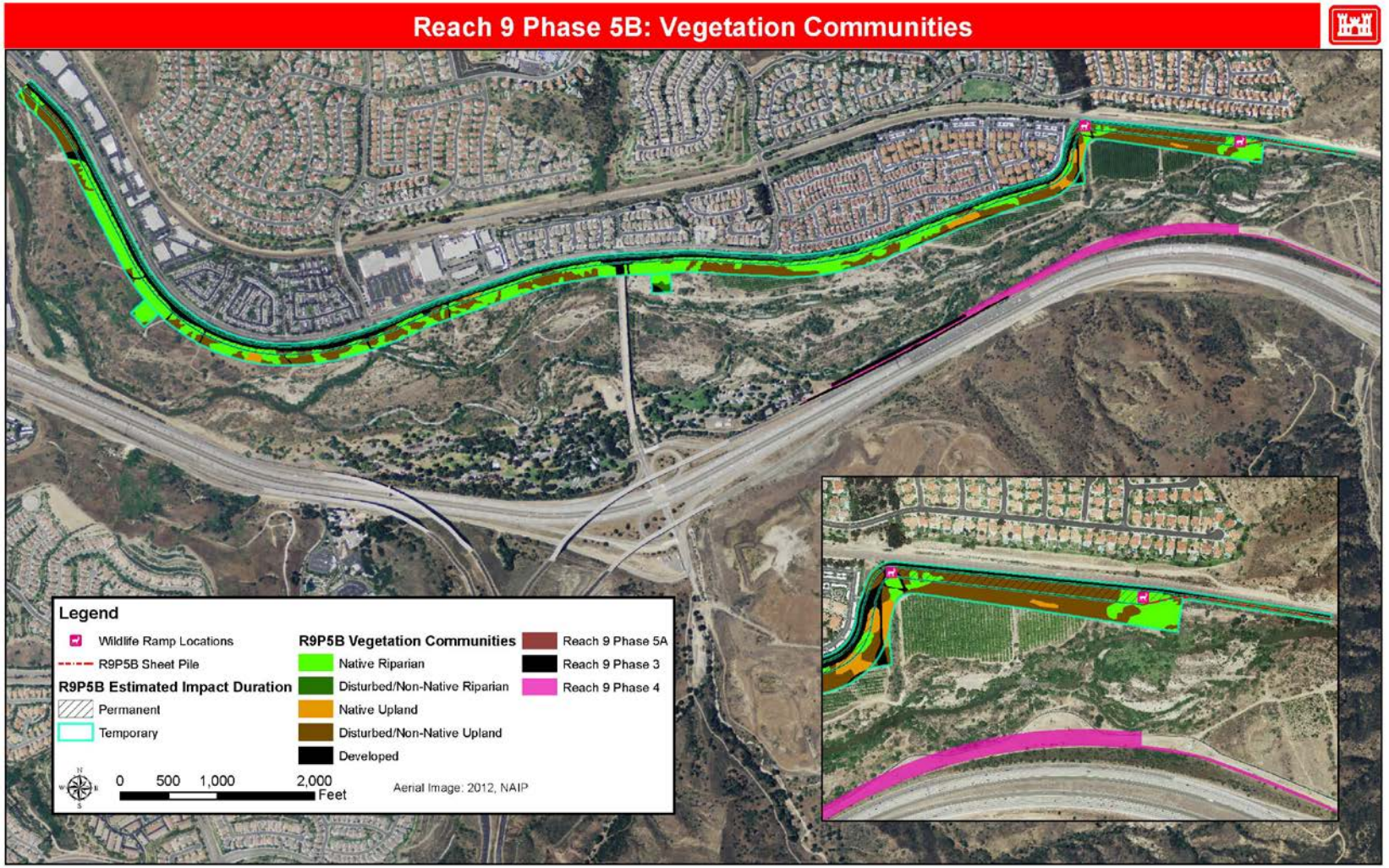

Reach 9 Phase 5B: Vegetation Communities
Legend
Wildlife Ramp Locations
R9P5B Sheet Pile
R9P5B Estimated Impact Duration
Permanent
Temporary
R9P5B Vegetation Communities
Native Riparian
Disturbed/Non-Native Riparian
Native Upland
Disturbed/Non-Native Upland
Developed
Reach 9 Phase 5A
Reach 9 Phase 3
Reach 9 Phase 4
0 500 1,000 2,000
Feet
Aerial Image: 2012, NAIP

Figure 19.

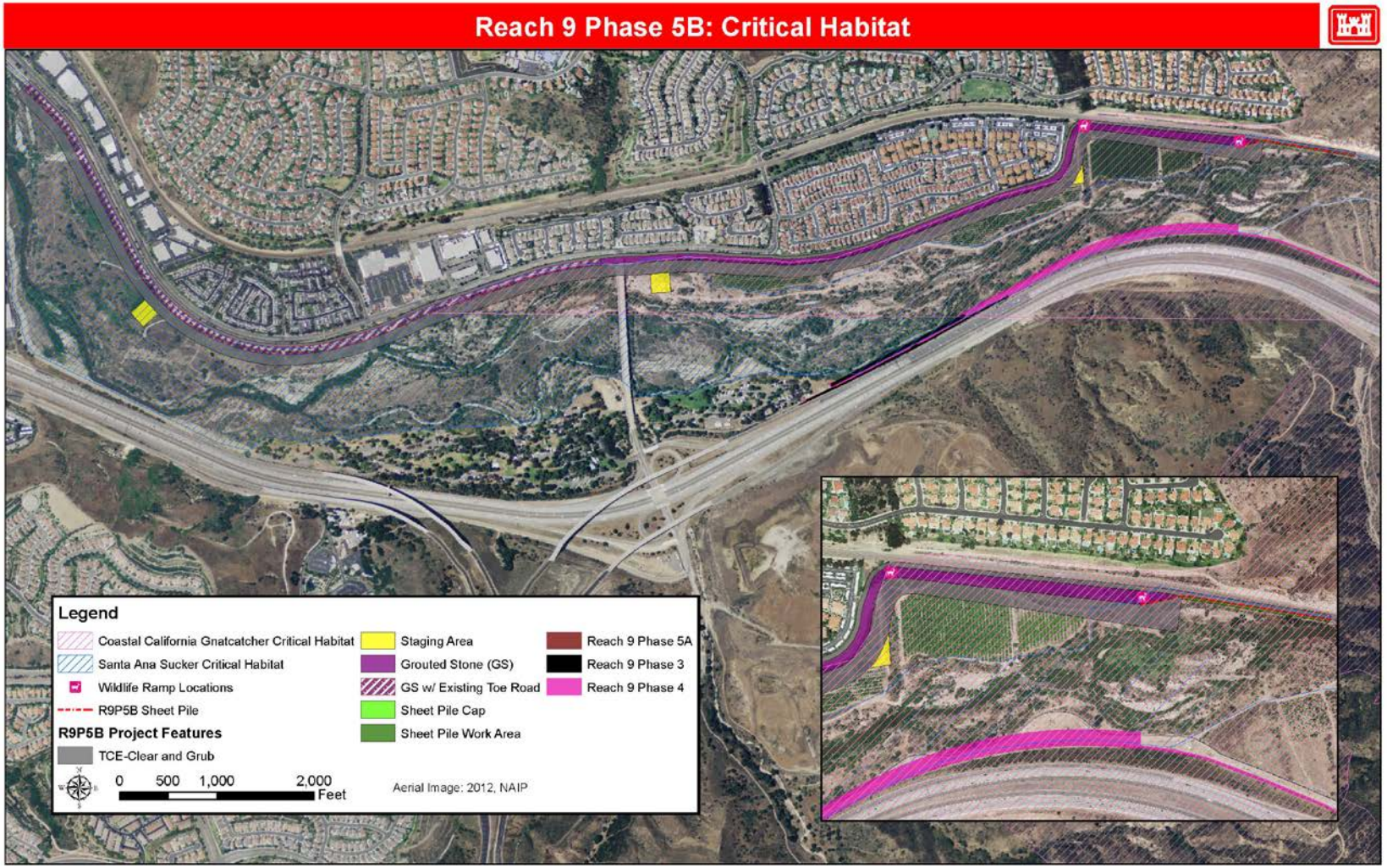

Reach 9 Phase 5B: Critical Habitat
Legend
Coastal California Gnatcatcher Critical Habitat
Santa Ana Sucker Critical Habitat
Wildlife Ramp Locations
R9P5B Sheet Pile
R9P5B Project Features
TCE-Clear and Grub
Staging Area
Grouted Stone (GS)
GS w/ Existing Toe Road
Sheet Pile Cap
Sheet Pile Work Area
Reach 9 Phase 5A
Reach 9 Phase 3
Reach 9 Phase 4
0 500 1,000 2,000
Feet
Aerial Image: 2012, NAIP

Figure 20.

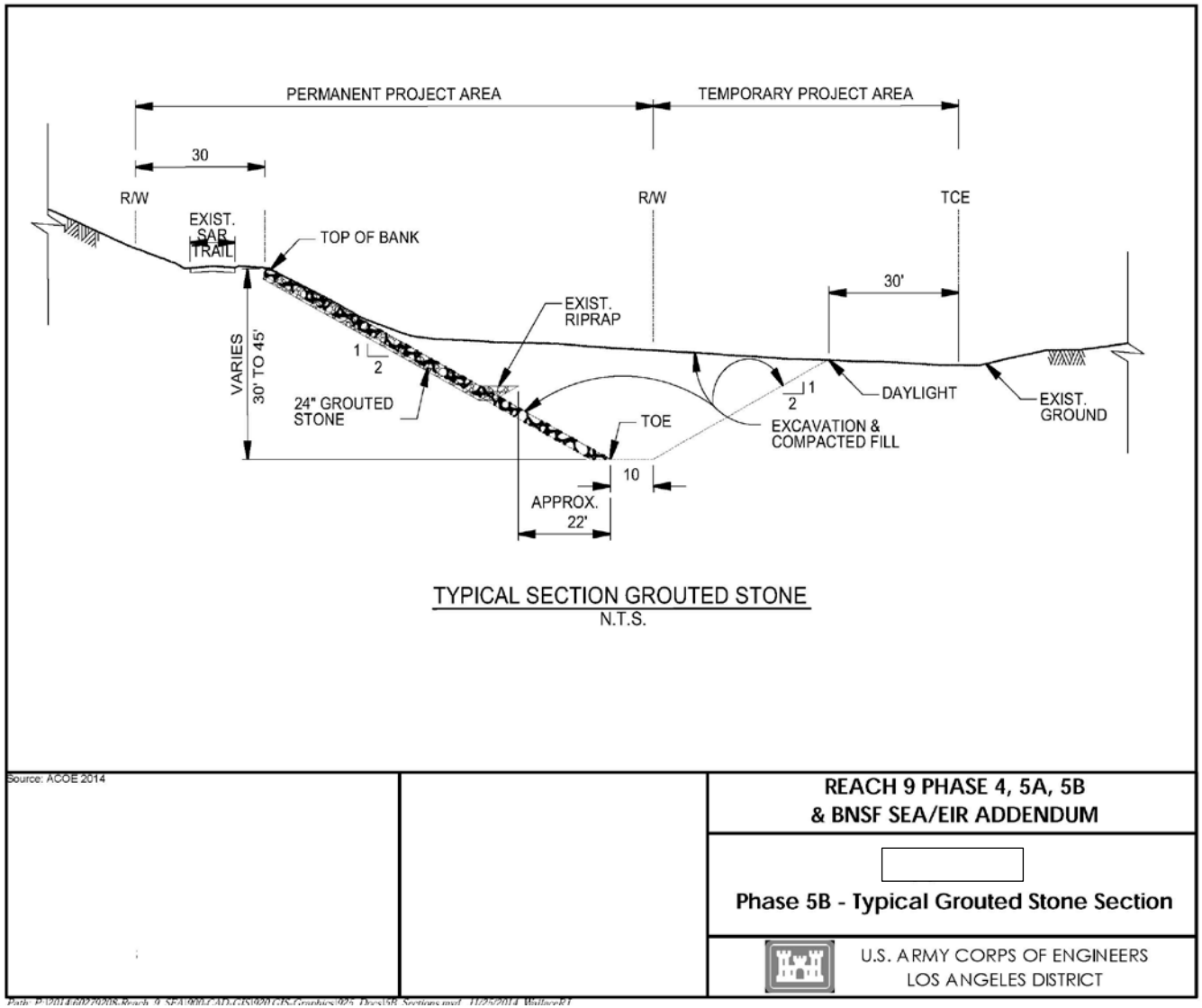

PERMANENT PROJECT AREA
TEMPORARY PROJECT AREA
30
R/W
R/W
TCE
EXIST.
SAR
TRAIL
TOP OF BANK
EXIST.
RIPRAP
30'
VARIES
30' TO 45'
1
2
24" GROUTED
STONE
TOE
1
2
DAYLIGHT
EXIST.
GROUND
EXCAVATION &
COMPACTED FILL
10
APPROX.
22'
TYPICAL SECTION GROUTED STONE
N.T.S.
Source: ACOE 2014
REACH 9 PHASE 4, 5A, 5B
& BNSF SEA/EIR ADDENDUM
Phase 5B - Typical Grouted Stone Section
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Figure 21.

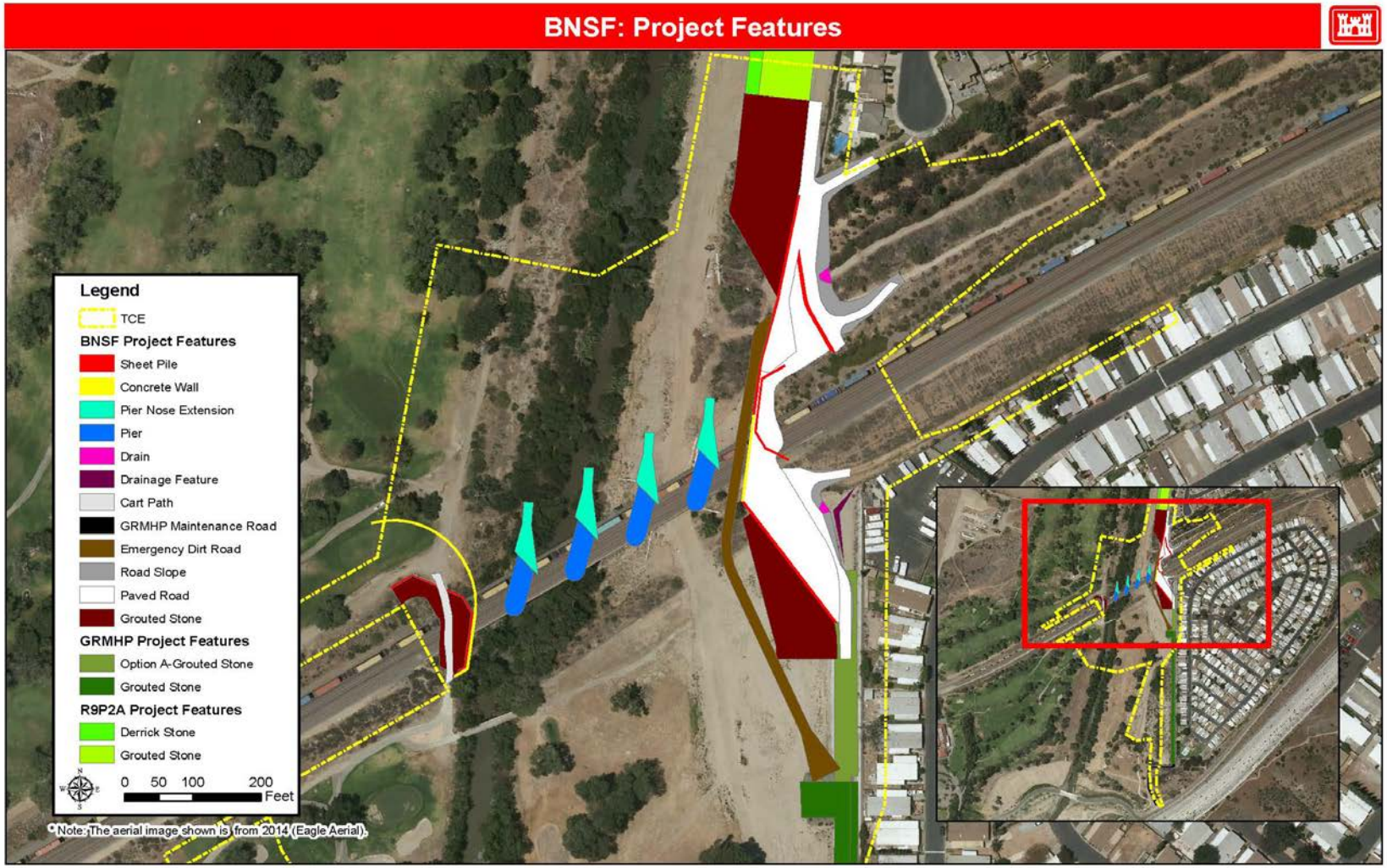

BNSF: Project Features
Legend
TCE
BNSF Project Features
Sheet Pile
Concrete Wall
Pier Nose Extension
Pier
Drain
Drainage Feature
Cart Path
GRMHP Maintenance Road
Emergency Dirt Road
Road Slope
Paved Road
Grouted Stone
GRMHP Project Features
Option A-Grouted Stone
Grouted Stone
R9P2A Project Features
Derrick Stone
Grouted Stone
0 50 100 200
Feet
Note: The aerial image shown is from 2014 (Eagle Aerial).

Figure 22.

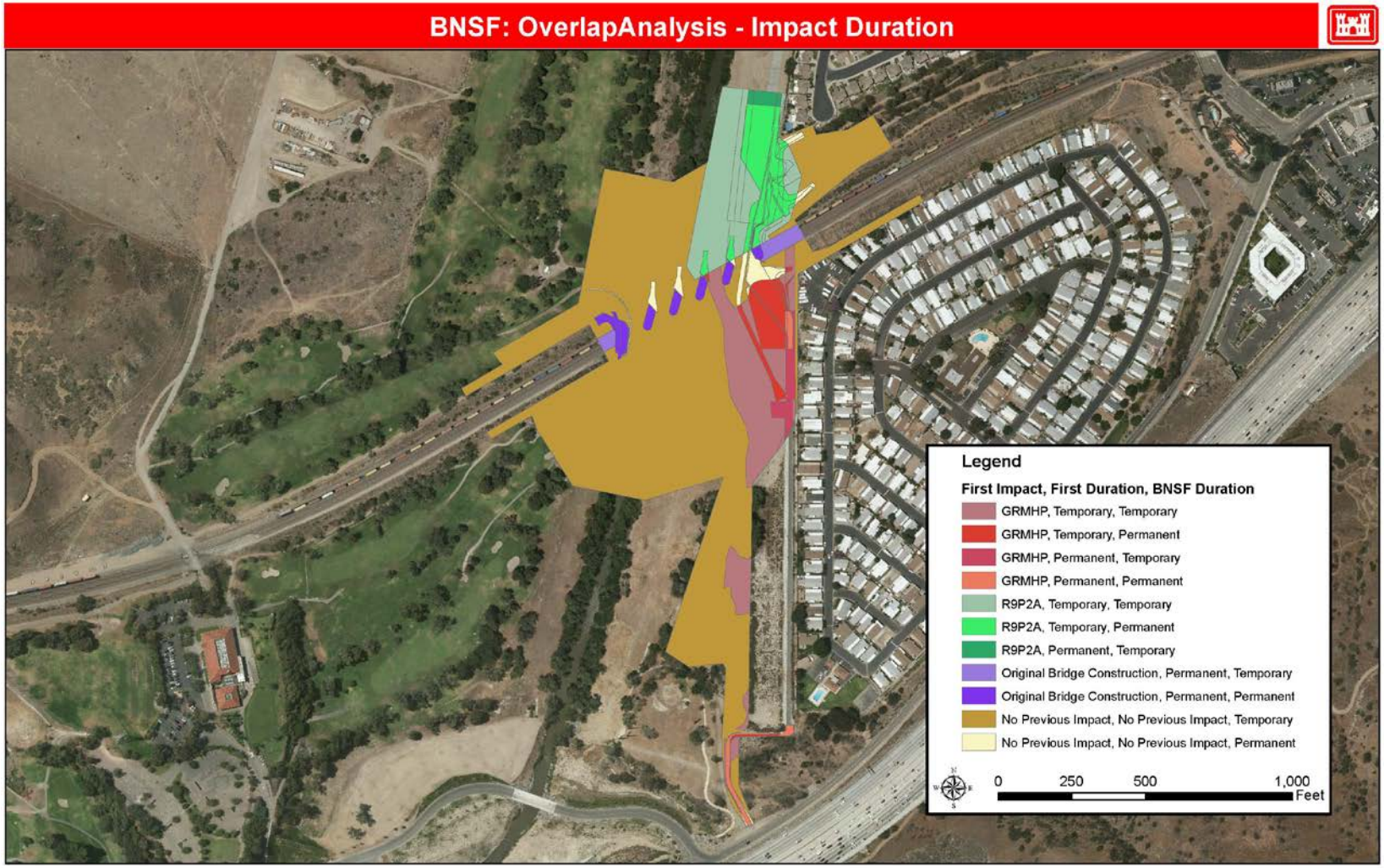

BNSF: OverlapAnalysis - Impact Duration
Legend
First Impact, First Duration, BNSF Duration
GRMHP, Temporary, Temporary
GRMHP, Temporary, Permanent
GRMHP, Permanent, Temporary
GRMHP, Permanent, Permanent
R9P2A, Temporary, Temporary
R9P2A, Temporary, Permanent
R9P2A, Permanent, Temporary
Original Bridge Construction, Permanent, Temporary
Original Bridge Construction, Permanent, Permanent
No Previous Impact, No Previous Impact, Temporary
No Previous Impact, No Previous Impact, Permanent
0 250 500 1,000
Feet

Figure 23.

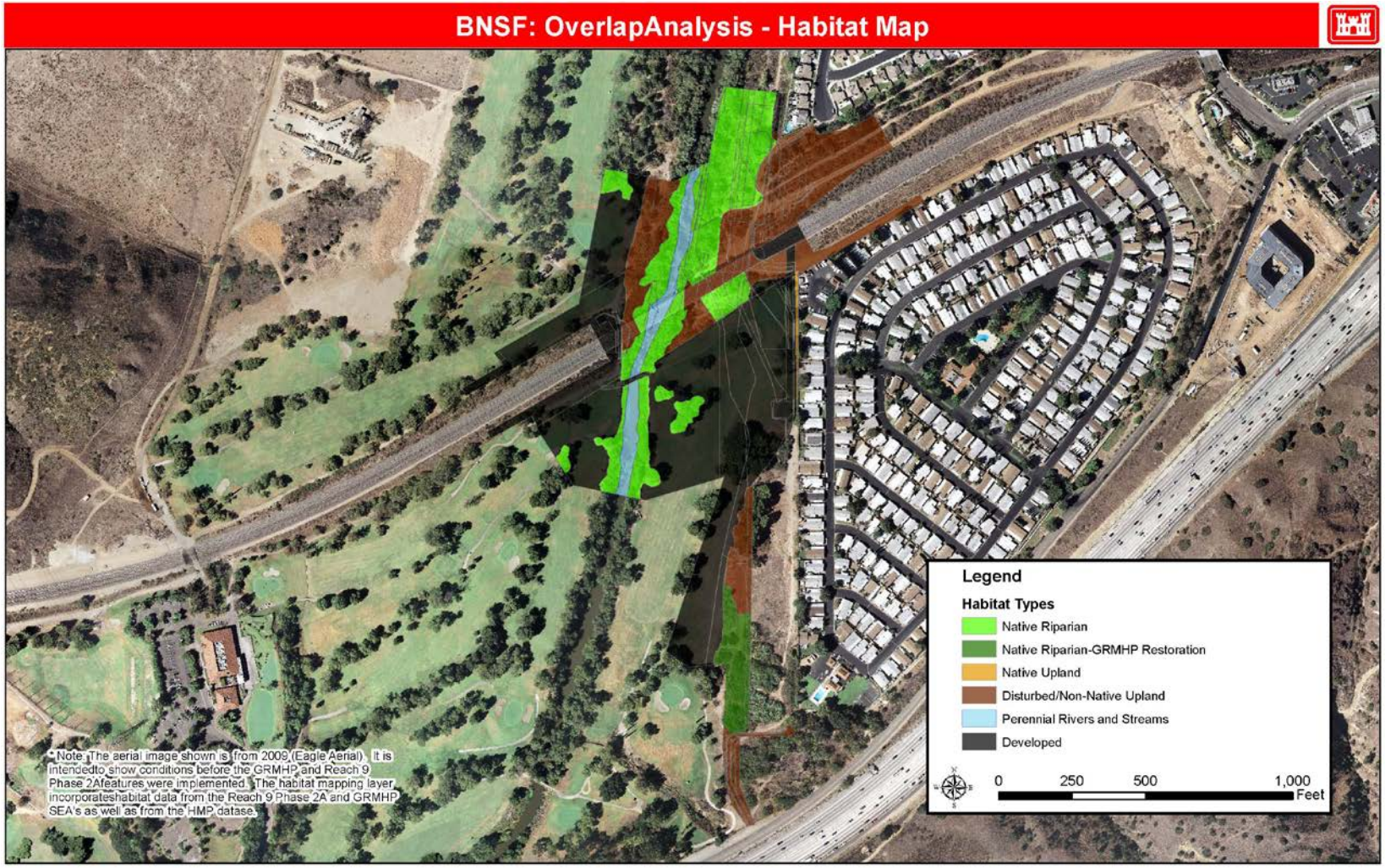

BNSF: OverlapAnalysis - Habitat Map
Legend
Habitat Types
Native Riparian
Native Riparian-GRMHP Restoration
Native Upland
Disturbed/Non-Native Upland
Perennial Rivers and Streams
Developed
0
250
500
1,000
Feet
Note: The aerial image shown is from 2009 (Eagle Aerial). It is intended to show conditions before the GRMHP and Reach 9 Phase 2A features were implemented. The habitat mapping layer incorporates habitat data from the Reach 9 Phase 2A and GRMHP SEA's as well as from the HMP dataset.

Figure 24.

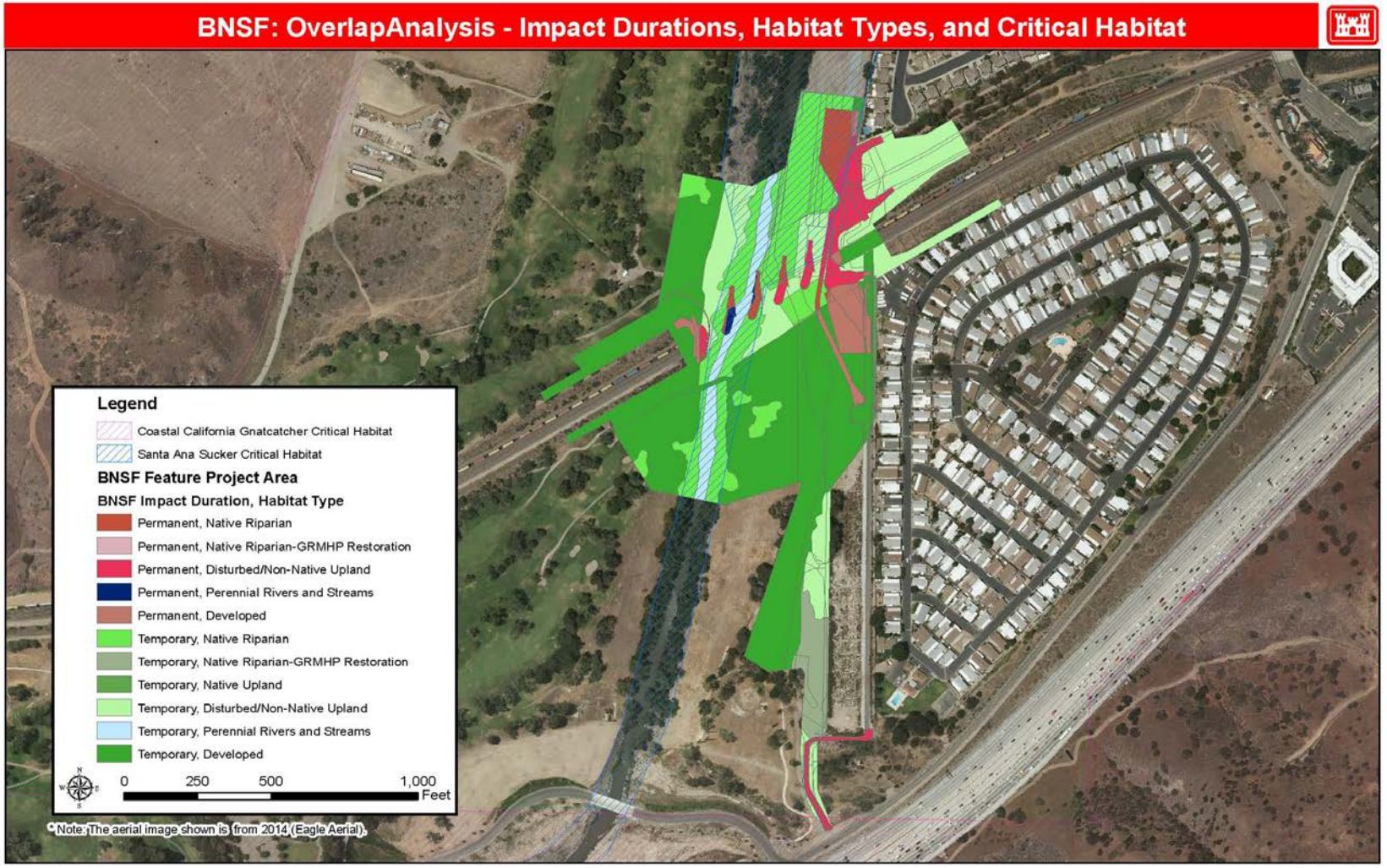

BNSF: OverlapAnalysis - Impact Durations, Habitat Types, and Critical Habitat
Legend
Coastal California Gnatcatcher Critical Habitat
Santa Ana Sucker Critical Habitat
BNSF Feature Project Area
BNSF Impact Duration, Habitat Type
Permanent, Native Riparian
Permanent, Native Riparian-GRMHP Restoration
Permanent, Disturbed/Non-Native Upland
Permanent, Perennial Rivers and Streams
Permanent, Developed
Temporary, Native Riparian
Temporary, Native Riparian-GRMHP Restoration
Temporary, Native Upland
Temporary, Disturbed/Non-Native Upland
Temporary, Perennial Rivers and Streams
Temporary, Developed
0 250 500 1,000
Feet
Note: The aerial image shown is from 2014 (Eagle Aerial).

Figure 25.

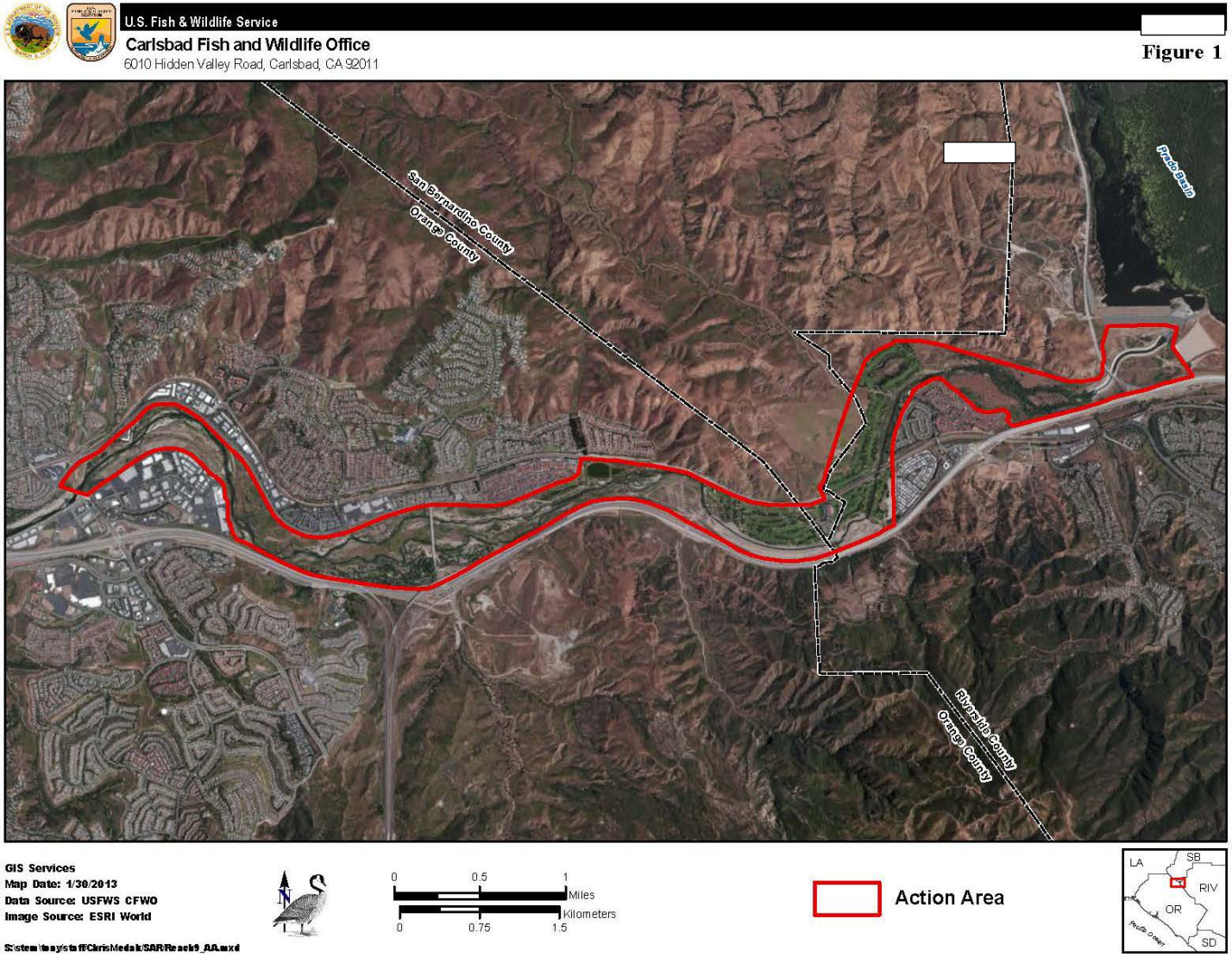

U.S. Fish & Wildlife Service
Carlsbad Fish and Wildlife Office
6010 Hidden Valley Road, Carlsbad, CA 92011
Figure 1
San Bernardino County
Orange County
Pacific Ocean
Riverside County
Orange County
GIS Services
Map Date: 1/30/2013
Data Source: USFWS CFWO
Image Source: ESRI World
S:\sten\bay\staff\ChrisMedak\SAR\Reach9_AA.mxd
0 0.5 1
Miles
0 0.75 1.5
Kilometers
Action Area
LA
SB
RIV
OR
SD

Figure 26.

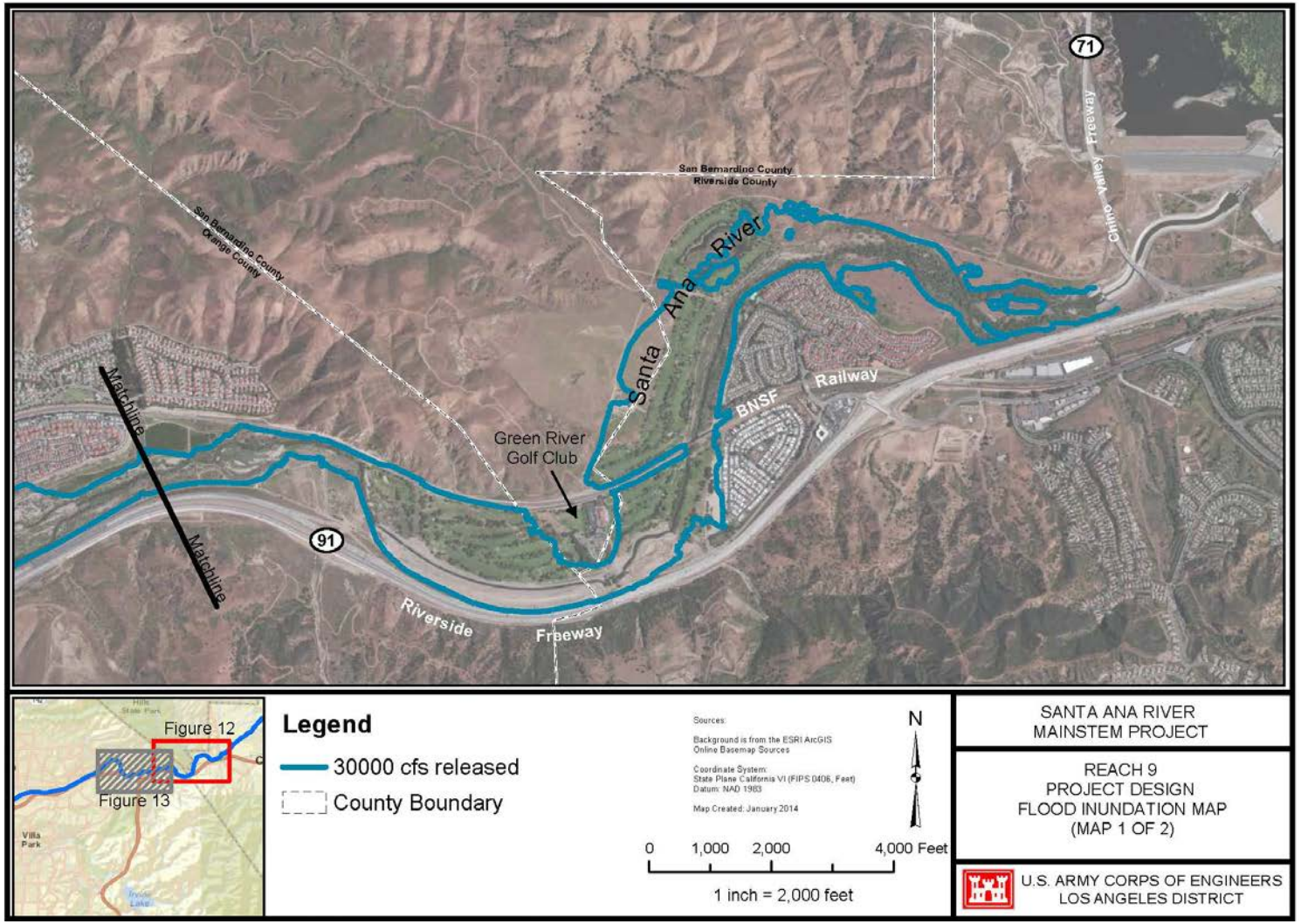

71
Chino Valley Freeway
San Bernardino County
Riverside County
San Bernardino County
Orange County
Santa Ana River
BNSF
Railway
Green River
Golf Club
Matchline
Matchline
91
Riverside
Freeway
Figure 12
Figure 13
Legend
30000 cfs released
County Boundary
Sources:
Background is from the ESRI ArcGIS Online Basemap Sources
Coordinate System:
State Plane California VI (FIPS 0406, Feet)
Datum: NAD 1983
Map Created: January 2014
N
0 1,000 2,000 4,000 Feet
1 inch = 2,000 feet
SANTA ANA RIVER
MAINSTEM PROJECT
REACH 9
PROJECT DESIGN
FLOOD INUNDATION MAP
(MAP 1 OF 2)
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Figure 27

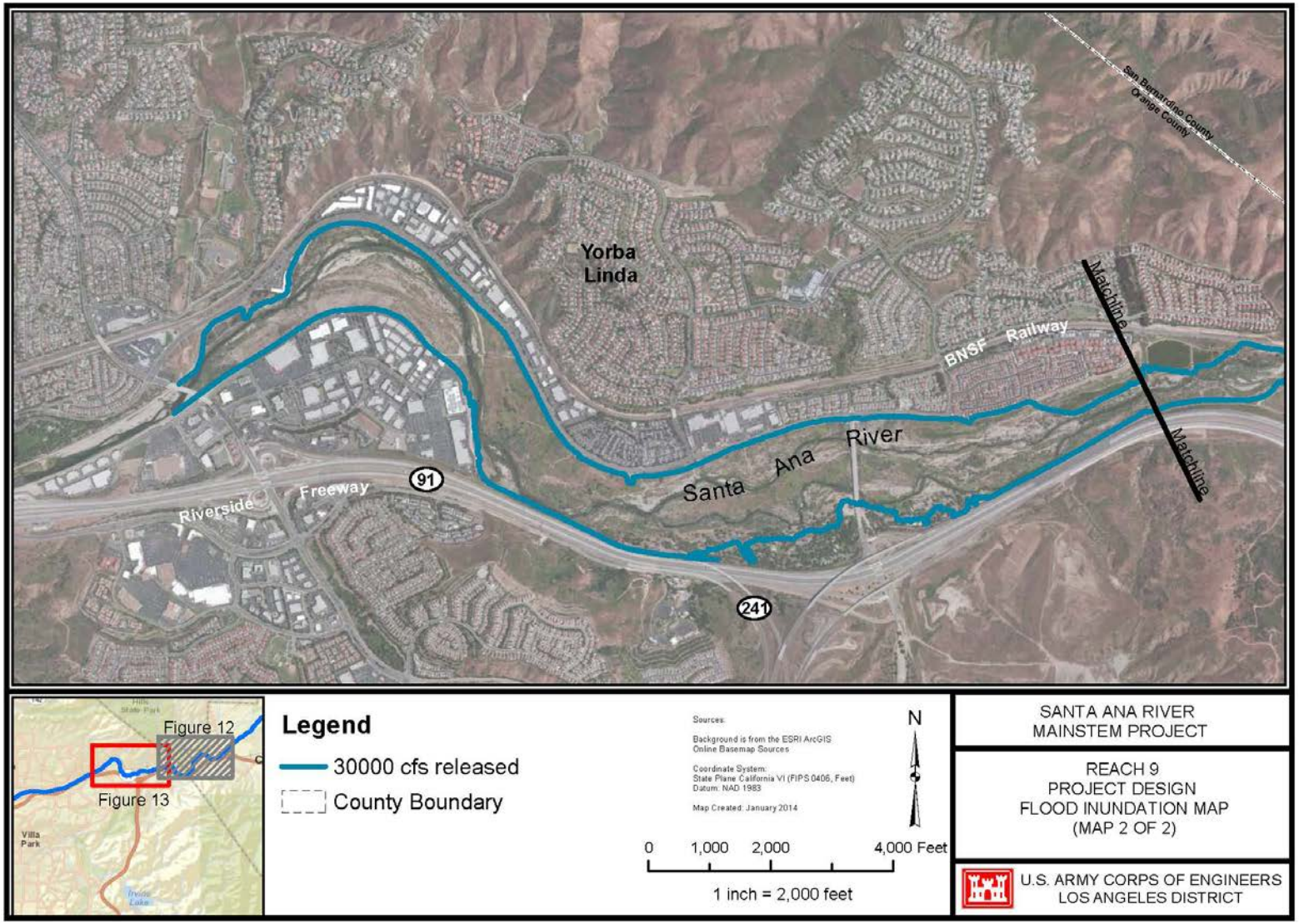

Yorba Linda
San Bernardino County
Orange County
BNSF Railway
Matchline
Matchline
Santa Ana River
Riverside Freeway
91
241
Figure 12
Figure 13
Villa Park
Legend
30000 cfs released
County Boundary
Sources:
Background is from the ESRI ArcGIS Online Basemap Sources
Coordinate System: State Plane California VI (FIPS 0406, Feet)
Datum: NAD 1983
Map Created: January 2014
N
0 1,000 2,000 4,000 Feet
1 inch = 2,000 feet
SANTA ANA RIVER MAINSTEM PROJECT
REACH 9
PROJECT DESIGN
FLOOD INUNDATION MAP
(MAP 2 OF 2)
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Figure 28

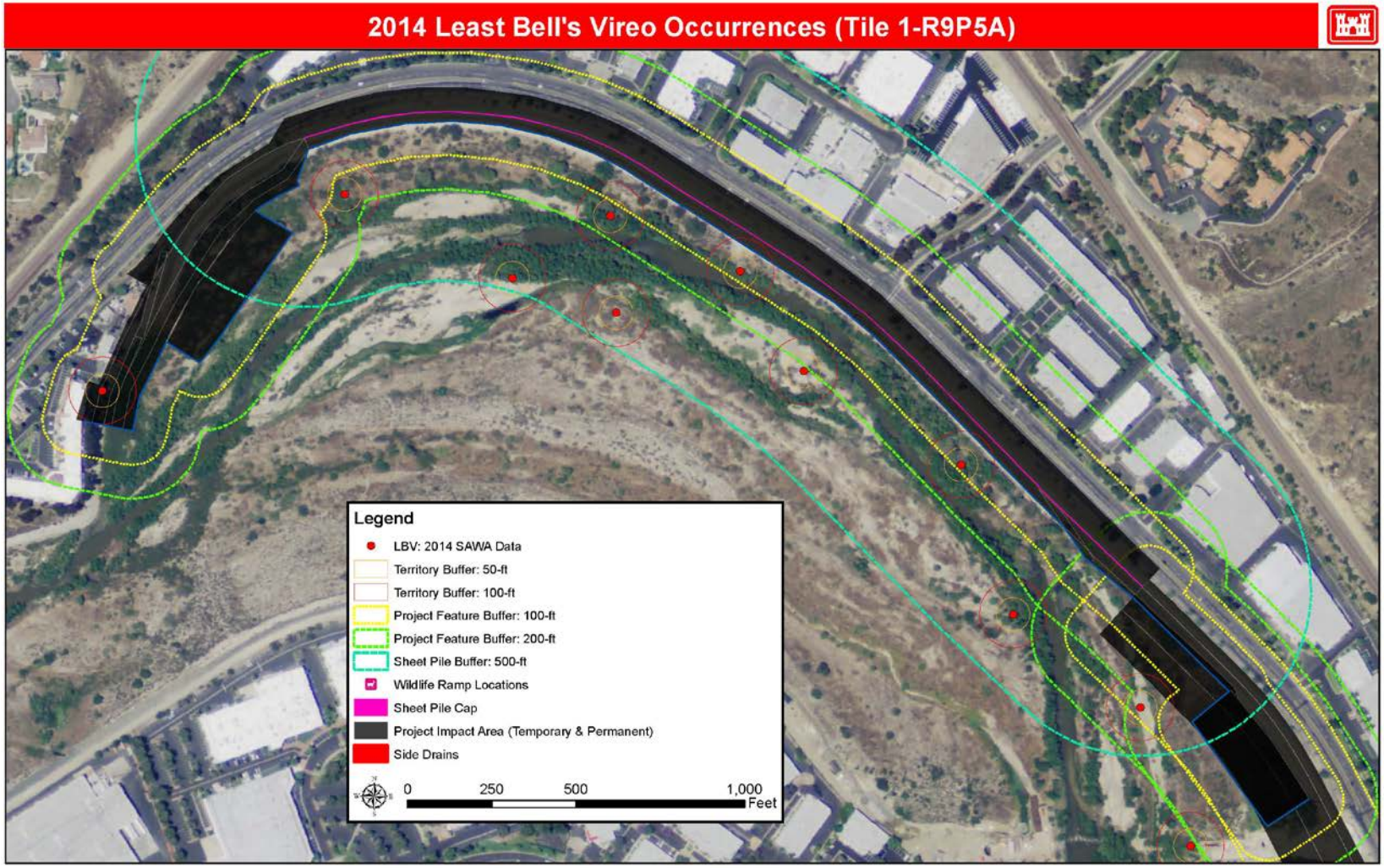

2014 Least Bell's Vireo Occurrences (Tile 1-R9P5A)
Legend
LBV: 2014 SAWA Data
Territory Buffer: 50-ft
Territory Buffer: 100-ft
Project Feature Buffer: 100-ft
Project Feature Buffer: 200-ft
Sheet Pile Buffer: 500-ft
Wildlife Ramp Locations
Sheet Pile Cap
Project Impact Area (Temporary & Permanent)
Side Drains
0
250
500
1,000
Feet

Figure 29.

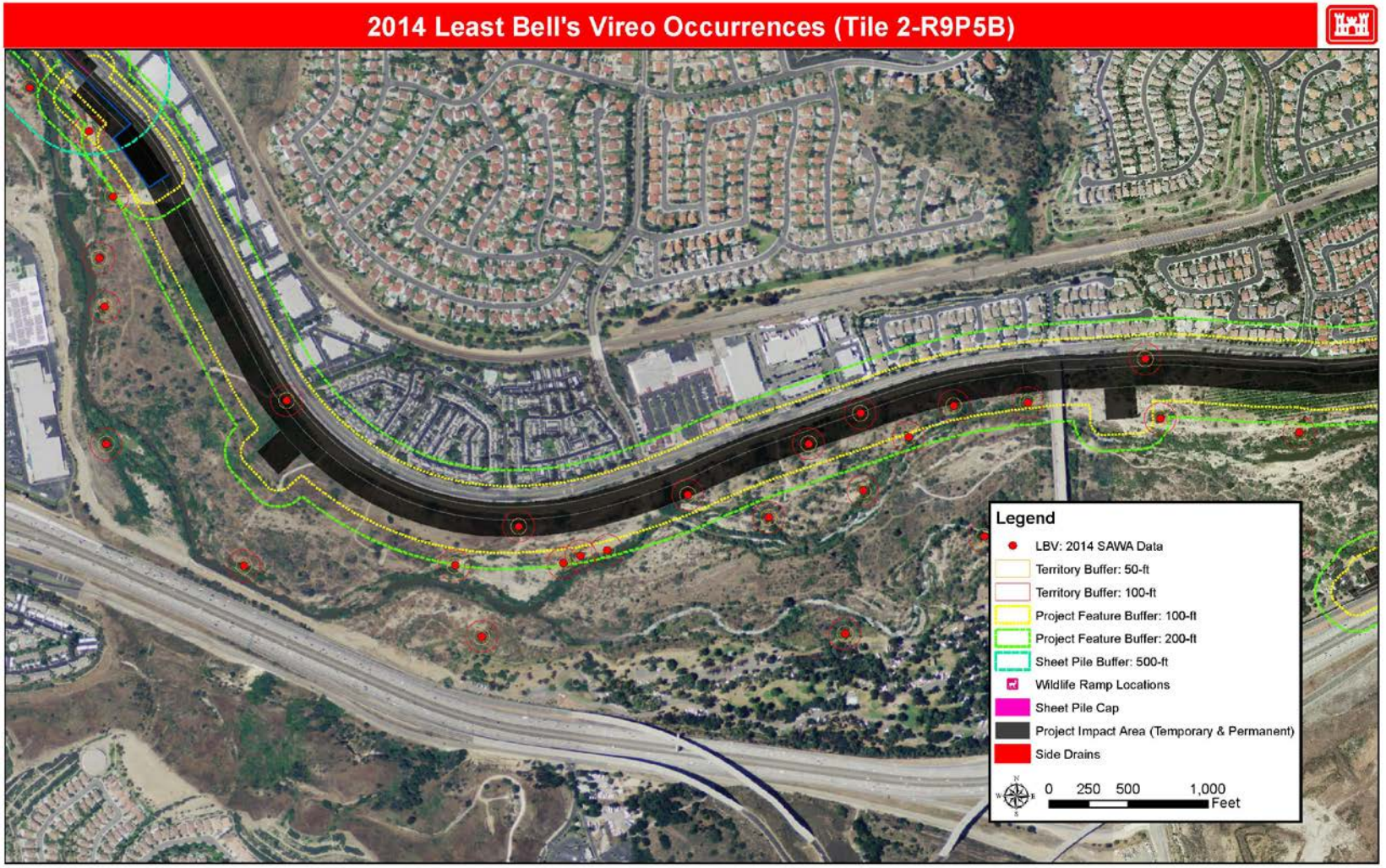

2014 Least Bell's Vireo Occurrences (Tile 2-R9P5B)
Legend
LBV: 2014 SAWA Data
Territory Buffer: 50-ft
Territory Buffer: 100-ft
Project Feature Buffer: 100-ft
Project Feature Buffer: 200-ft
Sheet Pile Buffer: 500-ft
Wildlife Ramp Locations
Sheet Pile Cap
Project Impact Area (Temporary & Permanent)
Side Drains
0 250 500 1,000
Feet

Figure 30.

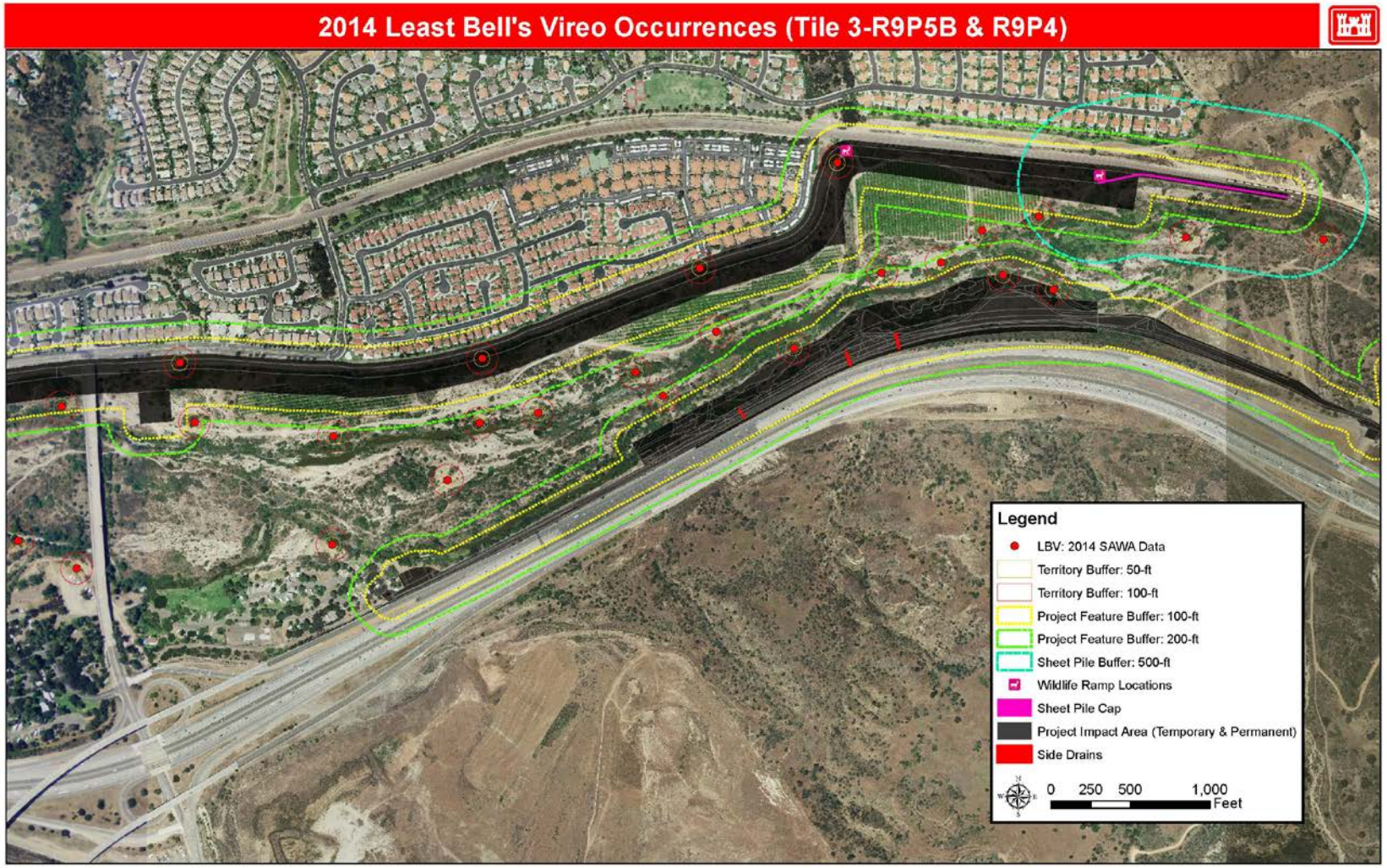

2014 Least Bell's Vireo Occurrences (Tile 3-R9P5B & R9P4)
Legend
LBV: 2014 SAWA Data
Territory Buffer: 50-ft
Territory Buffer: 100-ft
Project Feature Buffer: 100-ft
Project Feature Buffer: 200-ft
Sheet Pile Buffer: 500-ft
Wildlife Ramp Locations
Sheet Pile Cap
Project Impact Area (Temporary & Permanent)
Side Drains
0 250 500 1,000
Feet

Figure 31.

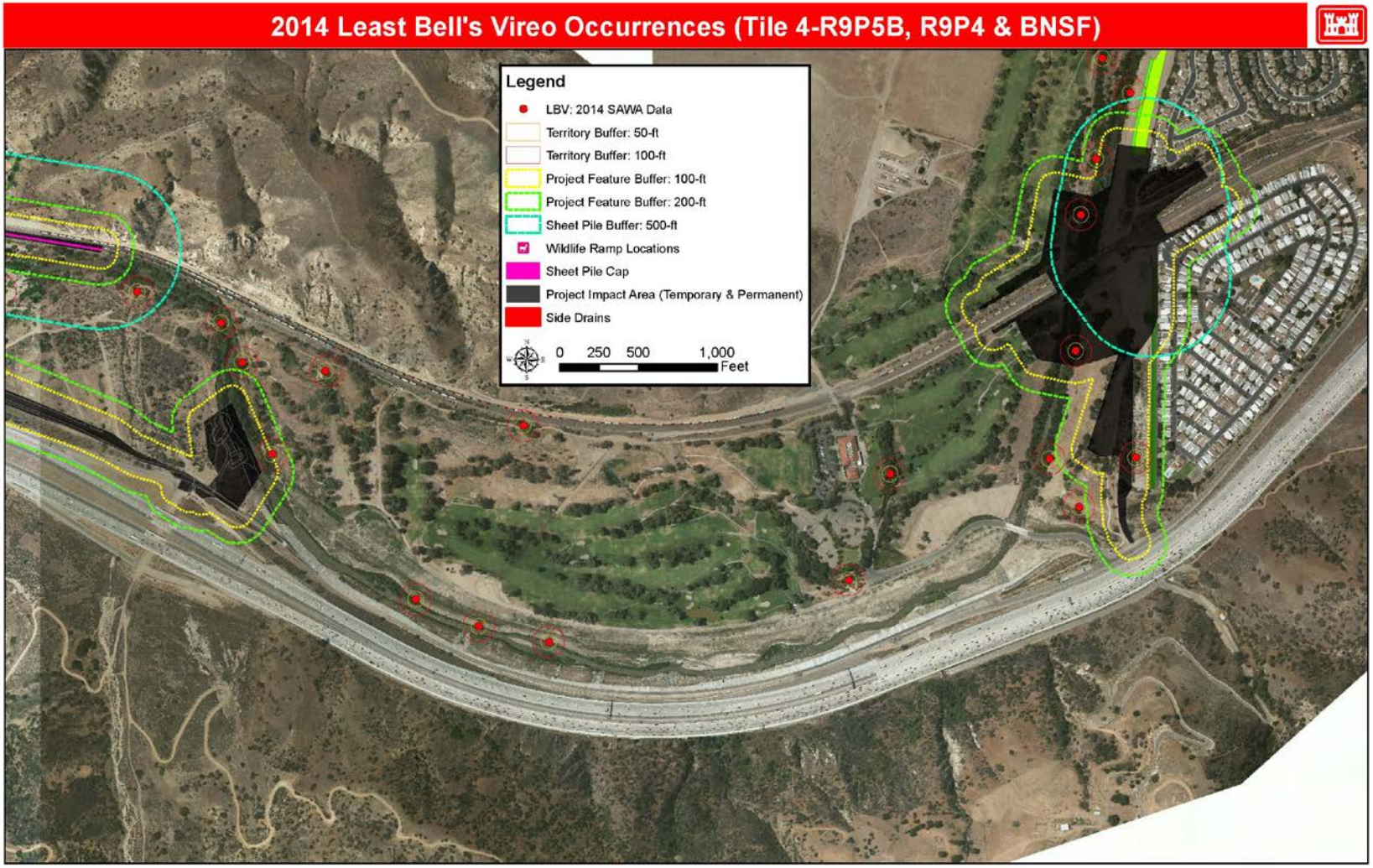

2014 Least Bell's Vireo Occurrences (Tile 4-R9P5B, R9P4 & BNSF)
Legend
LBV: 2014 SAWA Data
Territory Buffer: 50-ft
Territory Buffer: 100-ft
Project Feature Buffer: 100-ft
Project Feature Buffer: 200-ft
Sheet Pile Buffer: 500-ft
Wildlife Ramp Locations
Sheet Pile Cap
Project Impact Area (Temporary & Permanent)
Side Drains
0 250 500 1,000
Feet

Figure 32.

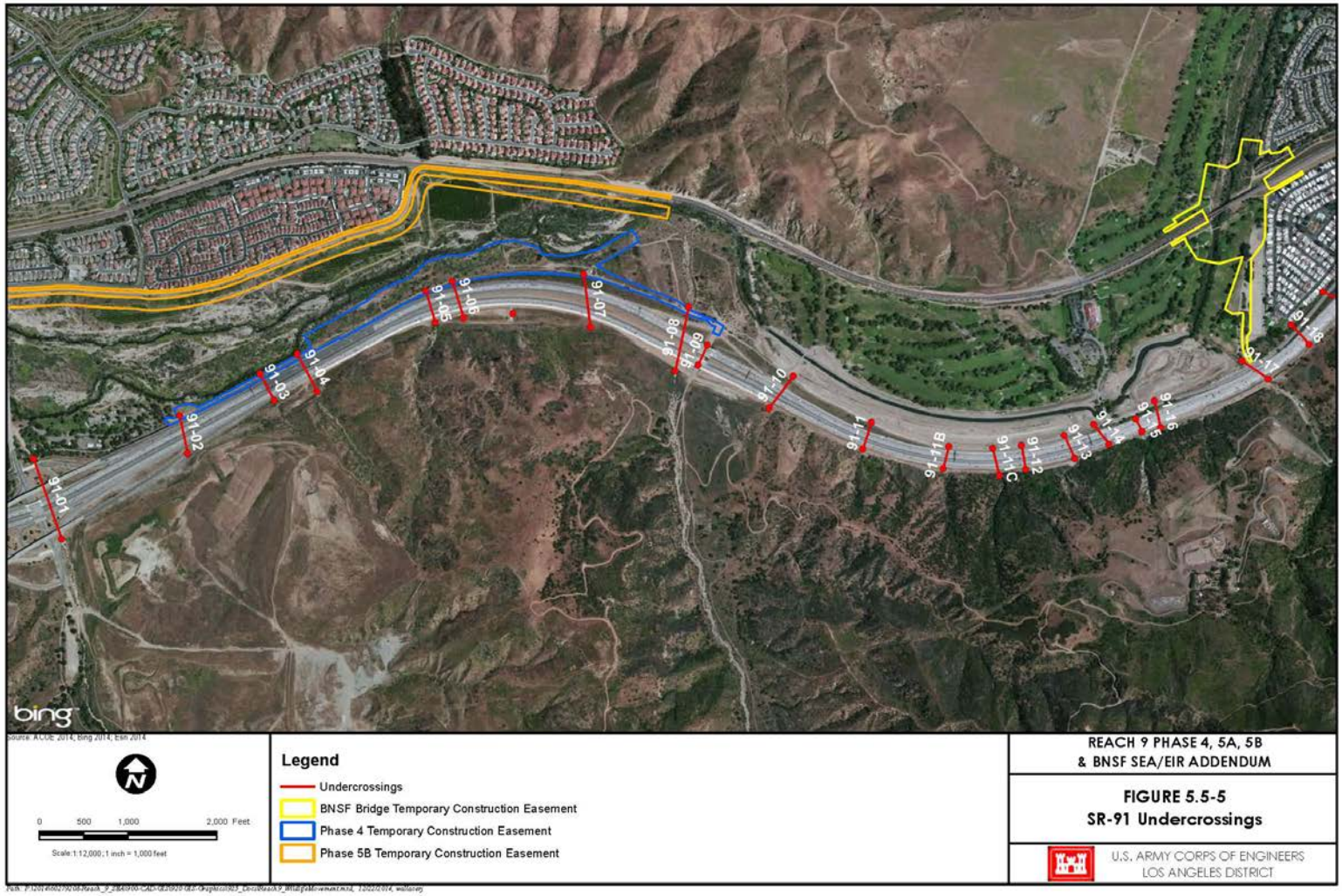

91-01
91-02
91-03
91-04
91-05
91-06
91-07
91-08
91-09
91-10
91-11
91-11B
91-11C
91-12
91-13
91-14
91-15
91-16
91-17
91-18
bing
Legend
Undercrossings
BNSF Bridge Temporary Construction Easement
Phase 4 Temporary Construction Easement
Phase 5B Temporary Construction Easement
0 500 1,000 2,000 Feet
Scale: 1:12,000 ; 1 inch = 1,000 feet
REACH 9 PHASE 4, 5A, 5B
& BNSF SEA/EIR ADDENDUM
FIGURE 5.5-5
SR-91 Undercrossings
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Figure 33.

ENCLOSURE 1

Conservation Measures[1]

The SARP, as described in the 2001 biological opinion, included conservation measures to offset impacts to riparian vegetation for the vireo and perennial stream for Santa Ana sucker. Several of these measures were changed in our 2012 amendment and a complete description of the conservation measures was included as Attachment 1 to that document. The following is a complete updated list of conservation measures, as modified specifically for the Reach 9 Phase 4, 5A, 5B, & BNSF Bridge Projects

Temporary Disturbance of Riparian/Wetland Habitat (excluding unvegetated perennial stream)

- Successfully restore each acre of riparian vegetation that is temporarily disturbed during construction-related activities. Keep all temporarily disturbed areas free of exotic plants until riparian vegetation is re-established. If the site(s) have not begun to recover within 5 years (i.e., 50 percent of the disturbed areas are not vegetated with young riparian vegetation), then the site(s) will be replanted with cuttings from native riparian species.

- Non-riparian areas that are temporarily disturbed will be maintained free of exotic plants for 8 years. Container plants will be planted and irrigated in upland areas to expedite the restoration process.

- Remove 1 acre of giant reed from the upper Santa Ana River watershed and/or action area for each acre of riparian/wetland vegetation that is temporarily disturbed during construction-related activities; actively monitor and manage this acreage for a period of 1 year; and then arrange for the local sponsors (i.e., the County of Orange, County of Riverside, and County of San Bernardino) and/or another approved entity such as the SAWA to maintain this acreage giant reed-free for the life of the project;
  OR

  Remove 3 acres of giant reed for each acre of temporary impact and maintain this acreage giant reed-free for a minimum of 5 years.

- Conduct brown-headed cowbird (*Molothrus ater*, "cowbird") removal trapping at a minimum of 10 sites in the Reach 9 (or other areas along the Santa Ana River and environs where trapping would likely be more effective for vireo production, subject to review and approval by the Service) during all years when construction of the proposed project is occurring and 5 years following construction. Alternatively, a cash contribution will be made to the Trust Fund for the equivalent amount of cowbird trapping in the upper Prado Basin and Reach 9. Trapping will occur during the vireo and flycatcher egg-laying season (March 15 to July 30). This effort is intended to supplement on-going cowbird trapping activities elsewhere in the Prado Basin[2];

[1] Refer to 2001 biological opinion (Service 2001a) for literature cited in the Conservation Measures. The 2012 amendment refers to Service (2012a). Measures followed by (*) refer to project components not addressed in this biological opinion.

[2] This measure was rewritten specifically for the Reach 9 Phase 4, 5A, 5B, & BNSF Bridge Projects. Although deleted from the measure here, we anticipate a minimum of 5 cowbird traps will be operated for at least 7 years

Permanent Loss of Non-riparian Habitat Within the Flood Plain

- Successfully create one acre of flood plain within the action area for each acre of non-riparian habitat that is permanently destroyed or isolated from the flood plain during construction-related activities (estimated total of destroyed or isolated non-riparian habitat is approximately 24 acres, excluding unvegetated perennial stream, Corps 2001g). These areas will be kept free of exotic plants for 8 years.

  OR

  Remove 3 acres of giant reed from the upper Santa Ana River watershed and/or action area for each acre of non-riparian habitat that is permanently destroyed or isolated from the flood plain during construction-related activities; actively monitor and manage this acreage for a period of 5 years; and then arrange for the local sponsors and/or another approved entity such as the SAWA to maintain this acreage giant reed-free for the life of the project; and conduct cowbird removal trapping in the vicinity of the restored habitat for the life of the project.

  Note: A combination of these alternatives can be used to fulfill the requirements of this conservation measure.

Permanent Loss of Riparian Habitat

- Successfully create 3 acres of riparian vegetation within the action area for each acre of riparian vegetation that is permanently destroyed or isolated from the flood plain during construction-related activities.

  OR

  Remove 5 acres of giant reed from the upper Santa Ana River watershed and/or action area for each acre of riparian vegetation that is permanently destroyed or isolated from the flood plain during construction-related activities; actively monitor and manage this acreage for a period of 5 years; and then arrange for the local sponsors and/or another approved entity such as the SAWA to maintain this acreage giant reed-free for the life of the project; and conduct cowbird removal trapping in the vicinity of the restored habitat for the life of the project.

  Note: A combination of these alternatives can be used to fulfill the requirements of this conservation measure.

General Habitat Creation/Restoration Measures, Mitigation Option for Permanent Impacts

- Creation activities will be initiated as soon as project activities within the creation area are completed. Restoration activities will be initiated immediately following the completion of

---

during and following construction of the Norco Bluffs project, as described in the 2001 biological opinion and 2012 amendment.

project activities within the restoration area. Creation and restoration activities will occur during the non-breeding season for vireos (if adjacent to occupied vireo habitat).

- Creation and restoration of riparian habitat will be considered successful when the following target/threshold objectives are met: 1) a minimum of 30 percent absolute ground cover of native plant species; 2) less than 10 percent absolute ground cover of exotic plant species (including 0 percent giant reed); 3) the absolute ground cover of native species must be represented by~~,~~ at least~~,~~ five dominant or co-dominant plant species; 4) the recruitment of native plant seedlings must be documented to occur within the replanted areas; 5) a positive trend in the diversity and absolute ground cover of native plant species must be observed based on appropriate statistical analyses that account for natural, year to year variations; and 6) the structure and composition of the revegetated area is statistically similar (i.e., not significantly different) to habitat occupied by vireos in the vicinity. Alternatively, riparian revegetation efforts can be considered successful if the habitat is occupied by a breeding pair of vireos, flycatchers, and/or yellow-breasted chats (*Icteria virens*). In addition, habitat must sustain itself for 2 consecutive years without supplemental water.

- All acres of created riparian habitat will be protected in perpetuity through proper legal instruments for the conservation of Federal and State listed species and their habitats.

- If the habitat creation option is selected, the Corps will ensure that the local sponsors commit to funding a cowbird trapping program in the vicinity of the created riparian habitat for the life of the project. Program specifics (e.g., number and locations of traps) will be determined in conjunction with permitting processes for the CDFG and our agency.

- Mitigation will be initiated as soon as practicable for impacts that occur during the first year of construction. Afterwards, mitigation will be initiated prior to construction of individual project features. For restoration options that include management for the life of the project, the Corps will continue exotic species removal (e.g., giant reed) and cowbird control until such time as the Service receives written documentation that the local sponsors and/or another approved entity (such as SAWA) have accepted responsibility for management of the restored area(s). Written documentation will include an estimate of costs associated with management responsibilities and a description of the funding mechanism(s) that will be used to ensure management will continue for the life of the project. If SAWA or another non-public entity accepts management responsibility and then becomes unwilling or unable to continue, then responsibility for continued management will revert to the local sponsors. Any advance mitigation that exceeds the requirements of the project (i.e., if actual project impacts are less than what was anticipated when the mitigation was initiated), may be credited as compensation for the effects of future projects.

- Identify and delineate~~s~~ on well-labeled maps the specific areas in the upper Santa Ana River watershed and/or action area from which giant reed will be or has been removed, and riparian vegetation restored, as compensation for the proposed action. These areas must be approved by the local sponsors, CDFG, and our agencies. An annual report will be prepared for the Service by the approved management entity (e.g., SAWA) that addresses the following information: 1) accomplishments during the previous year; 2) what is anticipated to be accomplished during

the upcoming year; 3) results of monitoring and management; and 4) updated mapping that delineates areas in the upper Santa Ana River watershed and/or action area from which giant reed has been removed.

- Request that the administrator of the Trust Fund identify those acres within the Santa Ana Watershed where giant reed was previously removed and/or habitat restored using the $1,000,000 contributed by the OCWD in lieu of restoring 133 acres of riparian habitat in the Prado Basin. This acreage will be actively monitored and managed until riparian habitat is completely restored, and then maintained giant reed-free for the life of the project.

Maintenance and Management of Riparian Habitat Downstream of Prado Dam

- Prior to initiating construction-related activities in Reach 9, quantify and delineate the existing riparian habitat in this reach. Provide an accounting of the amount of habitat that is being, or has been, used for other mitigation projects.

- Prior to initiating construction-related activities downstream of Prado Dam, provide written documentation that 1,100 acres of land, including 789 acres of land within the flood plain along the Santa Ana River as depicted in Figure 1, are held in public domain as property of Orange County, California State Parks, or other public entities "for floodplain management in keeping with open space and wildlife habitat values" (Corps 1988, page SEIS-V-66). The County of Orange will provide additional information concerning the status of the *Habitat Management Plan* area and a map of the area delineating vegetation types, acreages, and land use activities (including potential recreational uses and areas where the conservation of listed species and their habitats will be the primary land use).

- Maintain the baseline acreage of riparian vegetation within the *Habitat Management Plan* area as averaged over 10 years. The current estimate of riparian vegetation is between 350 and 380 acres.

- Vegetation mapping will occur every 10 years to document long-term trends and monitor post-flood recovery. Actions will be taken to re-establish the baseline if post-flood recovery does not occur within 10 years or does not meet the criteria that will be established in the *Habitat Management Plan*.

- Within 1 year after initiation of construction activities, finalize a *Habitat Management Plan* for the areas where your agency and/or the local sponsors have legal rights/jurisdiction. The *Habitat Management Plan* will be coordinated with the CDFG and our agency, provide assurances of funding, and address how the baseline amount of riparian habitat will be maintained or increased. Your agency and the local sponsors have agreed to gain consensus with our agency and the CDFG throughout the development and implementation of the *Habitat Management Plan*. The *Habitat Management Plan* will define the composition and structure of the management oversight committee and the explicit decision-making process. The *Habitat Management Plan* will include rules for timely resolution of disagreements to avoid biologically costly delays in management responses, "trigger points" for implementing

management actions and a clearly defined mechanism (e.g., consensus among agencies; one agency with full authority) for modifying the trigger points.

- At a minimum, the *Habitat Management Plan* will address the following: 1) measurable conservation goals that clearly articulate a measurable standard, desired state, threshold value, amount of change, or trend that you are striving to achieve for the particular species; 2) measurable sampling objectives; 3) quantitative monitoring methodologies; 4) a strategy to determine the effectiveness and feasibility of possible alternate management, restoration, and/or translocation methods; 5) a strategy to evaluate the proposed monitoring and quantitatively establish the existing status (i.e., baseline) of covered species; 6) well-defined initial management thresholds (i.e., triggers) and a range of alternate, feasible responses; 7) an explicit process for evaluating monitoring data; 8) a defined management committee and decision-making process for implementing management responses (i.e., explicitly defined feedback loops that link implementation and monitoring to a decision-making process and, thereby, result in appropriate changes in management); and 9) reporting requirements, contents, and review procedures.

- The Corps will consult with the Service prior to initiating any actions that have not been explicitly defined as part of this project and may affect federally listed species or designated critical habitat. Actions that have not been defined as part of this project include, but are not limited to, the development of recreational trails, the protection or relocation of the Santa Ana River Interceptor (SARI) line, and the maintenance of existing or planned utilities.

<u>General Conservation Measures for the Vireo and Flycatcher</u>

- Construction-related activities will not occur in the eastern third of borrow site #1A during April 29 to September 25 during each calendar year or at any other time while flycatchers are present in habitats adjacent to the borrow site in the southern portion of the Prado Basin.*

- A monitoring program will be developed and implemented at Norco Bluffs and in Reach 9 that entails surveys for the vireo during spring and early summer of the year prior to construction and, also, during the year of construction. Construction activities will be monitored to assure that vegetation is removed only in the designated areas. Riparian areas not to be disturbed will be flagged.*

- Vegetation clearing associated with project construction will take place only during periods when the vireo and flycatcher are not nesting (August 15 through February 28).

- Vegetation trimming and clearance within Prado Basin required for haul road maintenance and upkeep will be done when the vireo and flycatcher are not present.*

- To the maximum extent practicable, haul routes and staging areas will be located outside of the flood plain (e.g., along bike trails, levees, and roads). Bank protection in Reach 9 will occur only in those locations that would otherwise be jeopardized by 30,000 cfs flows.

- To the extent that construction and hauling of embankment materials must take place during the vireo nesting season, noise curtains will be employed to shield nesting vireos from excessive noise generated by construction vehicles and equipment entering and leaving the construction sites at Norco Bluffs and at the upper Highway 91 embankment and Green River Housing Estate in Reach 9.

- Noise barriers will also be constructed by February 28 of each year during construction in or near habitat for the vireo and/or flycatcher. For example, a noise barrier will be installed at the extreme downstream end of the access road to Norco Bluffs to shield nesting vireos from excessive noise generated by construction vehicles and equipment entering and leaving the staging area. Also, noise barriers will be installed along the perimeter of Borrow Site 1A to address potential noise impacts at that locale. Furthermore, a dirt berm will be placed between Borrow Sites 1 and 2 and adjacent habitat for the vireo to abate construction noise.

- During construction, riparian vegetation adjacent to de-watering areas will be monitored. Supplemental water will be added to this vegetation as necessary to avoid water stress.

- To reduce fire hazards, a water truck will always be present during construction activities. Construction activities will comply with the fire prevention and protection practices set forth in your agency's Safety and Health Requirements Manual (EM 385-1-1). The provisions of EM 385-1-1 will be incorporated into all construction specifications, and the contractor will be required to prepare a fire prevention and protection plan for the construction project.

- Excavated materials will be backfilled over the toe stabilization structures. The contractor will replace surface material and re-grade disturbed soft-bottomed substrate areas, in particular the low-flow river channel, to replicate pre-project conditions. Your agency will continue to coordinate with us to develop and improve measures for re-establishing habitat values within the construction area.

- Imported soil will be tested for compatibility with native soil, re-vegetation palette, and the ecology of the project area and vicinity. Samples shall be tested from the project site, the proposed import source, and any combinations of mixtures of the native soil and imported soil desired for use within the site. The results of the tests must show compatibility with existing soil, re-vegetation palette and ecology of the project area and vicinity, as determined by the project biologist and soils/geology team members.

<u>Specific Conservation Measures for the Sucker</u>:

- Restoration activities for the Santa Ana sucker will be conducted between August 15 and February 28, outside the vireo breeding and nesting season, or in a manner that otherwise avoids adverse effects to the vireo.

- Re-design the drop structure and associated baffles at the gauging station below Prado Dam to minimize the risk of injury or death owing to collision and not reduce connectivity. If this re-design results in additional disturbances to habitat, then your agency will contribute funds to the Trust Fund at a 1:1 ratio of disturbed to restored habitat for each additional acre affected.*

- The “trap and haul” program that was included in the 2001 Biological Opinion shall be discontinued and replaced with an additional three acres of stream restoration as described below, for a total of 10.9 acres of created/enhanced streambed.*

- Successfully restore each acre of perennial stream that is temporarily disturbed during construction-related activities. Restoration will include: 1) replacement of pre-construction substrates and microhabitat features; 2) maintenance or re-establishment of natural channel morphology (e.g., stream meanders, pool-riffle complexes); 3) maintenance or re-establishment of perennial flows; and 4) verification that the structure and composition of the restored area is similar to pre-construction conditions. A conceptual habitat restoration plan will be reviewed and approved by our agency prior to initiating construction activities that will affect perennial stream habitat for the sucker.

- **2.54 Acre Scour Enhancement** – To offset temporary impacts to 2.54 acres of perennial stream habitat from the completed Reach 9 Phase 3 project, the Corps will create six or more 'habitat nodes' in the reach of the Santa Ana River between Rialto Drain and Mission Boulevard (or other areas subject to review and approval of the Service), to improve the viability of the extant population of Santa Ana suckers this area. Boulders, large woody debris, or other materials will be placed in the low-flow channel to promote scour of fine sediments, consistent exposure of course sediment substrates, river meander, and pool formation. Substrate augmentation (e.g., river gravel and cobble) may also occur in the same area to enhance perennial stream habitat function. A small, one-person suction dredge may also be used to expose existing gravel and cobble within the riverbed. Suction dredge operators will be accompanied by Service-approved biologists familiar with Santa Ana suckers and their habitats in order to avoid negative impacts to suckers.

  This measure is expected to enhance perennial stream habitat within at least 2.54 acres of occupied habitat along about 4 miles of river, as measured by the area of pools created, gravel/cobble substrates exposed, and other functional Santa Ana sucker habitat features created/enhanced. Monitoring will be conducted for 5 years and will include water quality, visual observations of substrate, and other surface topography and fish surveys. Any non-native aquatic predators encountered during the surveys will be removed from the system. A conceptual habitat restoration plan will be reviewed and approved by the Service prior to initiating these habitat restoration activities. The restoration activities noted herein will be initiated prior to the initiation of construction for the BNSF Bridge project segment.

- **Reintroduction of Captively Bred Santa Ana Sucker or Gravel/Cobble Augmentation or Gravel/Cobble Augmentation** – To offset impacts to Santa Ana sucker from the BNSF bridge protection segment and to help to sustain and enhance the viability of the overall population in the river into the future, the Corps will either (A) expand the range of the species through active reintroduction of captively-bred Santa Ana sucker to suitable unoccupied habitat within its historical range in the Santa Ana River; OR (B) perform gravel/cobble augmentation within Reach 9.

- (A) The Corps, within its contractual authorities will contract with a Service-approved entity that can demonstrate the ability to re-introduce captively-bred Santa Ana suckers over a period of 5 years to a suitable unoccupied location(s) with the intent of establishing a new self-sustaining population within the former range of the species on the Santa Ana River. The contract would be awarded and a plan of action, including identification of target re-introduction area(s), will be developed prior to initiation of construction of the BNSF bridge project and no later than 1 year after the date of this Biological Opinion. The Contract requirements will include the following: (1) rearing and maintaining a sufficient number of breeding adults to support re-introduction of a minimum of about 500 juvenile suckers into the target area per year (or alternate numbers proposed in the Plan of Action and agreed to by the Corps and Service); (2) annual relocations for up to 5 years; and (3) monitoring, adaptive management, and reporting during the 5-year re-introduction period. Task 1 will be completed within 3 years of the date of initiation of the contract, or within 2 years of completion of any necessary approvals/permits, whichever is later. Task 2 will be initiated within 4 years of the date of initiation of the contract, or within 3 years of completion of any necessary approvals/permits, whichever is later. Reporting will occur annually to the Service following initiation of relocations.

  If it becomes infeasible to re-introduce captively-bred Santa Ana suckers (e.g., if prior to reintroduction of suckers it becomes clear that no suitable re-introduction site is available, and/or that landowner/stakeholder opposition cannot be overcome), no further funding will be obligated to captive breeding or re-introduction efforts. Instead, the Corps will coordinate with the Service to initiate the option identified below.

  OR:

- (B) The Corps will implement gravel and cobble augmentation within Reach 9 for sediment management improvement and Santa Ana sucker habitat enhancement.[3] Gravel (0.04 to 2.5 inch diameter rock which may include some sand, with about half of the material larger than 0.2 inch) and cobble (2.5 to 10 inch diameter rock), all river-rounded and otherwise appropriate for Santa Ana sucker spawning will be placed by the Corps within the low-flow channel within select locations in Reach 9 to provide available fluvial sediment to the river and to enhance habitats for Santa Ana sucker. It is expected that at least 2 acres of riverbed will be enhanced by direct placement[4] of river gravel and cobble to an average depth of 2 feet, or through other methods developed by the Corps in a Plan of Action, subject to the review and approval of the Service. Additional appropriate locations will be selected for a passive gravel augmentation.[5] Total river gravel to be placed will be about 25,000 tons; total river cobble to be placed will be about 10,000 tons. The river cobble and about half of

[3] The goal of this measure is improve geomorphological and biological functioning of the river in a portion of Reach 9 for Santa Ana sucker and least Bell's vireo for several decades.

[4] In the direct gravel and cobble placement augmentation project approach, spawning-sized gravel is placed mechanically onto a riffle, a group of riffles, or individual riffles within a longer reach, using heavy construction equipment for gravel placement and distribution. The aim is to create a riffle surface that immediately provides good spawning habitat.

[5] Passive gravel augmentation project approaches rely on stream storm flows to distribute and form gravel deposits suitable for spawning, from gravel artificially supplied from upstream (see Bunte 2004).

the augmented river gravel will be immediately placed as bars within the river's low-flow appropriate locations in Reach 9 (per the 2 acres of direct gravel and cobble placement noted above). The remaining half of the river gravel will be placed as passive augmentation along river channel in the upper portion of Reach 9 for future fluvial transport and natural deposition downstream.[6]

- **Channel Complexity Enhancement** – Along the base of the Phase 4 soil cement structure, large rock will be irregularly placed to increase the morphological complexity of the lower embankment area.[7] At the interface of the soil cement slope with the final earthen fill surface, 0.5- to 2-ton rocks in groupings of 5 to 15 rocks each will be loosely placed on the soil surface, semi-randomly every 100-200 feet along the 3,150-foot length of the Phase 4 embankment. Placement of this rock (locations, arrangement, etc., per the expected channel complexity needs of the Santa Ana sucker) will be directed in the field by a fish biologist approved by the Service.

- Roughen the surface of the low flow portion of the concrete-lined outlet channel and revegetate along both sides of the channel with native trees.*

- During construction, the construction contractor will implement measures to control sedimentation, including recontouring, sandbagging, sediment basins, and other appropriate erosion control measures developed on a site-specific basis.

- To minimize adverse effects to the sucker, your agency will ensure that the construction contractor diverts the stream channel away from the initial project construction area. The construction area will then be de-watered to lower the water table. Discharge will be directed into a stilling basin and allow flow through existing vegetation and into the river downstream of the construction area. Ground water will be introduced into the stream as necessary to avoid excess turbidity.

- Prior to diverting any water or de-watering a reach of the river, biologists approved by our agency will conduct a preliminary survey of the affected reach(es) to assess the probability of capturing suckers, potential hazards to survey personnel, and to identify areas within the reach(es) that are most likely to contain suckers. Prior to initiating any activities associated with the diversion and/or de-watering, your agency and/or your representative will submit for our review and approval a complete, detailed, comprehensive description of these actions and conservation measures necessary to minimize any adverse effects to the sucker. This document

[6] The goal of this measure is to enhance the continuity of sediment transport in Reach 9, help ameliorate sediment starvation in the project area, and provide for natural gravel bar development (see Kondolf 1997 and Bunte 2004 for more detail).

[7] The goal of this measure is to partially restore channel embankment complexity along the new armored slope feature where future river low-flows will potentially contact the slope following natural meander of the river. It is expected that the Santa Ana River in the project area will naturally meander into different locations between the slope protection embankments in Reach 9, resulting in different positions over time for the river low-flow channel. This will likely include varying future places and periods where the low-flow will be directly against portions of the Phase 4 slope protection such that the hard surface of the armored slope will form one side of the low-flow channel.

should also include the results and recommendations of the preliminary biological survey of the affected reach(es).

A qualified sucker biologist will implement and oversee the execution of the diversion, survey and relocation efforts, and construction monitoring of the project site. Diversions and dewatering must be accomplished in such a manner to prevent the stranding or harm of suckers. The affected reach(es) will be surveyed for fishes throughout the duration of the project using seining, traps, or electrofishing, as necessary. Captured suckers will be retained in river water in insulated, aerated, and covered containers, as necessary. Temperature, dissolved oxygen, and observation of fish behavior will be recorded once per hour until suckers have been relocated. Captured suckers will be measured, weighed, sexed, and relocated to appropriate areas in the vicinity of the affected reach(es) or other locations as specified by our agency. The physical condition of the suckers will be recorded including the presence of external parasites or lesions. Suckers should be relocated to appropriate areas in the vicinity of the affected reach(es) or other locations specified by the Service within four hours of capture.

Any Santa Ana speckled dace (*Rhinichthys osculus* spp.), arroyo chubs (*Gila orcutti*), or other native fish that are captured will be retained in river water in insulated, aerated, and covered containers, as necessary. The fish will be relocated to appropriate areas in the vicinity of the affected reach(es) or other locations as specified by our agency. Any exotic fish that are captured will not be released back into affected reach(es) or other areas supporting native fish.

- River diversion activities within the Norco Bluffs area will occur between August and December to reduce disturbance to the spawning and nursery habitat for suckers. Additionally, construction activities within Reach 9 will be performed between August 15 and February 28, thereby avoiding the majority of the sucker spawning season.*

- The banks along the new outlet channel will be planted with native non-riparian vegetation to provide a partial canopy over the channel.*

<u>General Conservation Measures to Maintain Wildlife Movement Through the Action Area</u>:

- In order to maintain wildlife movement in the project area at existing or better conditions, the Corps will develop a plan of action for wildlife movement-related ramps, culvert exit-entrance structures/features/substrate enhancements, corridor cover vegetation, and other features associated with the project structures where appropriate, subject to the review and approval of the Service. Many of these features are outlined in the Corps' Environmental Assessment (Corps 2015a). The Corps will implement this plan of action in construction/development of these features as part of project construction and operations/maintenance.

- Native plant species will be used to revegetate disturbed upland areas.

- The area between the dam and the downstream end of the new outlet channel will be revegetated, thereby providing additional cover for any wildlife that may be attempting to cross through that area. If necessary, the vehicle bridge over the outlet channel may be modified to

be more conducive for wildlife crossing. Native upland vegetation could be planted at the approaches to the bridge, and soil could be placed on the surface.*

- Place soil on the face of the dam along the western end near State Route 71 to provide a more natural surface and allow for enhanced wildlife movement over the structure. Native grasses and other shallow-rooted vegetation will be planted on this surface.*

- Construction of the upper Highway 91 bank stabilization and the outlet channel will occur only during daylight hours to minimize disturbance to wildlife species that move primarily at night.*

Instead of noise reduction or abatement measures proposed in the Agency Agreement (2001), the Corps (2001f) has proposed the following:

"For construction activities within or adjacent to occupied vireo or flycatcher habitat, the following measures shall be implemented to reduce or avoid noise impacts:

1. Prior to the commencement of construction activities, ambient noise levels will be measured at 50 feet and 100 feet from the proposed boundaries of the construction sites and recorded in a graphic format.

2. Sound walls shall be constructed at the boundary of the proposed construction site and/or haul route prior to March 1. Sound walls will probably consist of ½"-thick, 8'-high plywood sheets. The construction contractor may use other materials or procedures that attenuate sound to acceptable levels, defined below.

3. Where ambient noise is less than 60dBA and it is determined that construction-related noise levels may exceed 60dBA: monitoring shall be conducted at 50 feet and 100 feet from the sound wall, or at the boundary of occupied habitat (if habitat areas are more than 100 feet from the construction site), to ensure that construction-related noise does not exceed 60dBA within these areas. If construction noise levels exceed authorized limits, the contractor shall modify the sound barriers, equipment, or procedures (including construction schedules) as necessary to meet these conditions, to the extent practicable. If construction noise levels within riparian habitat areas outside the project footprint cannot be reduced below 60 dBA L_{eq} hourly during the period of February 28 through August 15 of any year, the Corps will offset impacts at a 1:1 ratio per breeding season affected by such noise levels. This 1:1 ratio will be based on the acreage of riparian habitat outside the project footprint[8] subject to noise levels over 60 dBA L_{eq} hourly during the noted period, per the number of breeding seasons affected (e.g., 1 acre of riparian habitat affected by noise in two breeding seasons will result in 2 acres of restoration; 1 acre of riparian habitat affected by two separate project phases or segments in a single breeding season will result in 1 acre of restoration). The area affected will be determined by periodic project noise monitoring. This offsetting measure will consist of riparian habitat restoration (non-native

[8] This includes all riparian habitat areas outside of the mapped project footprint (Figures 3-25). L_{eq} hourly noise level contours for project construction activities during the vireo nesting and breeding season will be calculated and reported for the areas adjacent to the project footprint based on noise monitoring to be performed, as appropriate.

invasive vegetation control) for 5 years, from the upper Santa Ana River watershed and/or action area.

4. Where pre-construction ambient noise is greater than 60dBA: monitoring shall be conducted at 50 feet and 100 feet from the sound wall, or at the boundary of occupied habitat (if habitat areas are more than 100 feet from the construction site), to ensure that construction does not result in a significant increase over ambient conditions (i.e., noise level increases shall not exceed 5dBA over ambient.) If construction noise levels exceed authorized limits, the contractor shall modify the sound barriers, equipment, or procedures (including construction schedules) as necessary to meet these conditions, to the extent practicable. If construction noise levels within riparian habitat areas outside the project footprint cannot be reduced to or below 5 dBA L_{eq} hourly over ambient noise levels during the period of February 28 through August 15 of any year, the Corps will offset impacts at a 1:1 ratio per vireo breeding season affected by such noise levels. This 1:1 ratio will be based on the acreage of riparian habitat subject to noise levels more than 5 dBA L_{eq} hourly over ambient during the noted period, as determined by periodic project noise monitoring.. This offsetting measure will consist of riparian habitat restoration (non-native invasive vegetation control) for 5 years, from the upper Santa Ana River watershed and/or action area.

5. Sound curtains and noise monitoring shall <u>not</u> be required at the following locations:

    a) Reach 9 haul route to the lower Highway 91 bank stabilization construction area, from Crystal Drive. The proposed haul route is on top of the levee on the south side of the river; the levee road is not wide enough to accommodate both construction traffic and a sound barrier. Noise would be intermittent, as only 30-35 round trips per day are expected to be required during construction of this feature.

    b) Dam and outlet channel. Construction vehicles and equipment used for raising the dam will be working adjacent to and above the outlet channel. To be effective, a sound wall would have to span the channel (to block the sound of vehicles driving along the base of the dam) and reach the height of the dam itself (as vehicles and equipment reach progressively higher elevations up the face of the dam). As this is not feasible, and because this area is already subject to sound intrusion from SR71, additional construction impacts are considered insignificant and unavoidable.*

6. The area behind the dam, around the new outlet works, may still be inundated on March 1. This could preclude establishment of a sound barrier in this area prior to the nesting season. In that case, a sound barrier will be placed around the perimeter of the cleared area as soon as conditions are dry enough to permit construction.*

Appendix C

Air Quality Calculations

Phase 5A - Grouted Stone and Sheet Pile Alternative

Daily

	VOC	NOX	CO	PM10	PM2.5
2015	19.95	149.37	82.18	92.35	26.32
2016	19.95	149.37	82.18	92.35	26.32
2017	19.95	149.37	82.18	92.35	26.32
Maximum Daily Emissions	19.95	149.37	82.18	92.35	26.32

Annual

	VOC	NOX	CO	PM10	PM2.5	CO2e
2015	1.19	10.08	4.71	6.02	1.70	1,693.47
2016	2.13	17.88	8.41	11.01	3.09	2,993.72
2017	1.19	10.30	4.78	5.99	1.69	1,760.67
Total	4.51	38.26	17.91	23.02	6.48	6,447.87
Annualized GHG Emissions						128.96

Phase 5A - Soil Cement and Sheet Pile Alternative

Daily

	VOC	NOX	CO	PM10	PM2.5
2015	37.68	308.31	148.93	85.19	29.07
2016	37.68	308.31	148.93	85.19	29.07
2017	37.68	308.31	148.93	85.19	29.07
Maximum Daily Emissions	37.68	308.31	148.93	85.19	29.07

Annual

	VOC	NOX	CO	PM10	PM2.5	CO2e
2015	2.36	20.34	9.11	5.55	1.88	3,323.29
2016	4.28	37.08	16.49	10.16	3.43	6,084.12
2017	3.08	26.97	11.96	7.26	2.45	4,458.56
Total	9.72	84.39	37.57	22.97	7.76	13,865.97
Annualized GHG Emissions						277.32

Phase 5B - Grouted Stone Alternative

Daily

	VOC	NOX	CO	PM10	PM2.5
2016	16.80	125.50	69.87	147.54	34.08
2017	16.80	125.50	69.87	147.54	34.08
2018	16.80	125.50	69.87	147.54	34.08
Maximum Daily Emissions	16.80	125.50	69.87	147.54	34.08

Annual

	VOC	NOX	CO	PM10	PM2.5	CO2e
2016	0.17	1.05	0.74	9.37	1.99	192.15
2017	1.83	15.49	7.37	17.67	4.05	2,519.90
2018	1.03	9.04	4.22	9.59	2.21	1,513.16
Total	3.03	25.59	12.32	36.62	8.24	4,225.21
Annualized GHG Emissions						84.50

Phase 5B - Soil Cement Alternative

Daily

	VOC	NOX	CO	PM10	PM2.5
2016	34.53	284.44	136.63	144.31	36.63
2017	34.53	284.44	136.63	144.31	36.63
2018	34.53	284.44	136.63	144.31	36.63
Maximum Daily Emissions	34.53	284.44	136.63	144.31	36.63

Annual

	VOC	NOX	CO	PM10	PM2.5	CO2e
2016	2.20	19.08	8.55	9.44	2.39	3,075.78
2017	3.98	34.79	15.47	17.29	4.36	5,631.88
2018	2.85	25.19	11.16	12.26	3.10	4,112.96
Total	9.03	79.06	35.17	38.99	9.85	12,820.62
Annualized GHG Emissions						256.41

Phase 4 - Soil Cement Alternative

Daily

	VOC	NOX	CO	PM10	PM2.5
2015	17.74	155.55	86.37	107.22	28.67
2016	32.88	271.58	131.02	111.15	31.91
Maximum Daily Emissions	32.88	271.58	131.02	111.15	31.91

Annual

	VOC	NOX	CO	PM10	PM2.5	CO2e
2015	0.04	0.31	0.25	6.60	1.54	77.13
2016	2.33	19.38	9.28	8.34	2.36	3,182.81
Total	2.36	19.69	9.52	14.94	3.90	3,259.94
Annualized GHG Emissions						65.20

Phase 4 - Grouted Stone Alternative

Daily

	VOC	NOX	CO	PM10	PM2.5
2015	17.74	155.55	86.37	76.57	24.10
2016	15.15	112.64	64.26	74.60	22.60
Maximum Daily Emissions	17.74	155.55	86.37	76.57	24.10

Annual

	VOC	NOX	CO	PM10	PM2.5	CO2e
2015	0.04	0.31	0.25	4.59	1.24	77.13
2016	0.98	7.30	4.20	5.58	1.66	1,237.16
Total	1.01	7.61	4.44	10.17	2.90	1,314.29
Annualized GHG Emissions						26.29

BNSF Bridge - Emissions Summary

Daily

	VOC	NOX	CO	PM10	PM2.5
2016	56.36	431.20	206.06	86.55	32.43
2107	56.36	431.20	206.06	86.55	32.43
2018	56.36	431.20	206.06	86.55	32.43
Maximum Daily Emissions	56.36	431.20	206.06	86.55	32.43

Annual

	VOC	NOX	CO	PM10	PM2.5	CO2e
2016	0.51	3.48	1.89	4.33	1.24	582.31
2107	0.67	4.27	2.48	8.57	2.40	681.44
2018	0.53	3.69	2.01	4.69	1.34	615.44
Total	1.72	11.44	6.38	17.59	4.98	1,879.18
Annualized GHG Emissions						37.58

Phase 5A - Grouted Stone and Sheet Pile Alternative - 2015

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons per phase) VOC	NOX	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Clearing and Grubbing																				
Dozers < = 175	Dozer - D7	1	8	240	1	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.01	0.00	0.00	0.00	0.52	0.00	0.47
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	2	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.00	0.00	0.00	1.37	0.00	1.25
Dozers > 250 and < = 500	Dozer - D8	1	8	310	1	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.00	0.01	0.00	0.00	0.00	1.06	0.00	0.97
Other Construction Equipment > 120 and < = 175	Brush Chipper	1	8	174	1	0.58	4.68	4.69	0.23	0.19	852	0.05	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.39
	Highway Truck (25,000 lbs)	11	1,320	330	2,640	0.66	19.33	3.00	0.52	0.32	4,789	0.01	0.00	0.02	0.00	0.00	0.00	4.79	0.00	4.36
	Pickup Truck	1	120	330	240	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.10
Total						**5.79**	**58.75**	**26.81**	**2.30**	**1.82**	**10,276.78**	**0.48**	**0.00**	**0.04**	**0.02**	**0.00**	**0.00**	**8.27**	**0.00**	**7.54**
Remove Santa Ana Trail																				
Remove rails																				
	Highway Truck (10,000 lbs)	1	120	180	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
	Dump Truck (35,000 lbs)	1	120	265	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
Remove existing bike path (asphalt)																				
Tractors/Loaders/Backhoes > 50 and < = 120	Loader - 1.25 CY	1	8	95	2	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.38
Graders > 120 and < = 175	Grader - Articulated	1	8	135	2	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	0.99	0.00	0.90
	Street Sweeper	1	8	80	2	0.00	0.12	0.02	0.00	0.00	29	0.00	0.00	0.00	0.00	0.00	0.00	1.16	0.00	1.06
	Highway Truck (10,000 lbs)	1	120	330	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
Total						**1.58**	**15.11**	**9.45**	**0.73**	**0.57**	**2,740.34**	**0.13**	**0.00**	**0.02**	**0.01**	**0.00**	**0.00**	**4.53**	**0.00**	**4.12**
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	131	1.84	6.90	6.78	0.49	0.41	824	0.17	0.12	0.45	0.44	0.03	0.03	53.97	0.01	49.39
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.12**	**0.45**	**0.44**	**0.03**	**0.03**	**53.97**	**0.01**	**49.39**
Remove Rip-Rap																				
Excavators > 250 and < = 500	Excavator - 3.5 CY	1	8	384	131	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.08	0.54	0.25	0.02	0.02	122.48	0.01	111.63
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
Dozers < = 175	Dozer - D6	1	8	145	131	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.10	0.69	0.43	0.04	0.03	67.85	0.01	61.96
	Highway Truck (25,000 lbs)	10	1,200	330	157,200	0.07	0.40	3.19	0.12	0.05	1,069	0.08	0.04	1.15	0.18	0.03	0.02	285.17	0.00	259.53
Load/Haul/Place Grouted Stone																				
Scrapers > 250 < = 500	CAT 627 Scraper	1	8	330	131	2.19	17.75	8.09	0.68	0.57	2,571	0.20	0.14	1.16	0.53	0.04	0.04	168.43	0.01	153.60
Dozers > 250 and < = 500	Dozer - D8	1	8	310	131	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.15	1.17	0.61	0.05	0.04	138.79	0.01	126.64
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
Graders > 120 and < = 175	Grader - 120	1	8	135	131	0.97	6.90	5.85	0.38	0.32	991	0.09	0.06	0.45	0.38	0.02	0.02	64.93	0.01	59.24
Pumps > 175 and < = 250	Concrete pump	1	8	210	131	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.05	0.62	0.20	0.02	0.01	105.52	0.00	96.14
Water Truck	3,000 gal water truck	1	8	230	131	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.06	0.45	0.19	0.02	0.01	87.27	0.01	79.56
	Truck - 250 Articulated	1	120	330	15,720	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.12	0.02	0.00	0.00	28.52	0.00	25.95
Haul away excess																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
	Belly Dump Truck	1	120	330	15,720	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.12	0.02	0.00	0.00	28.52	0.00	25.95
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	7	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.01	0.04	0.02	0.00	0.00	3.63	0.00	3.31
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Install Sheet Piles																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	3	8	211	131	2.46	18.99	8.48	0.62	0.51	4,122	0.22	0.16	1.24	0.56	0.04	0.03	269.97	0.01	246.04
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Total						**18.05**	**141.83**	**73.90**	**5.75**	**4.72**	**24,724.51**	**1.69**	**1.02**	**9.03**	**3.98**	**0.33**	**0.27**	**1,647.31**	**0.09**	**1,501.32**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.04**	**0.49**	**0.17**	**0.02**	**0.01**	**105.52**	**0.00**	**96.09**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	50	16.8	840	131	110,040	0.07	0.64	1.50	0.11	0.06	586	0.05	0.00	0.04	0.10	0.01	0.00	38.38	0.00	35.01

Note: Assumes a total of 25 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**19.95**	**149.37**	**82.18**	**6.35**	**5.19**	**26,134.48**	**1.91**								
Maximum Annual Emissions								**1.19**	**10.08**	**4.71**	**0.39**	**0.31**	**1,857.98**	**0.11**	**1,693.47**

Phase 5A - Grouted Stone and Sheet Pile Alternative - 2016

Off-Road Construction Equipment

						Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
Equipment Type	**Equipment Category**	**Number**	**Usage Factor (hrs/day or miles/day)**	**Power Rating (hp)**	**Total Days/VMT**	**VOC**	**NOX**	**CO**	**PM10**	**PM2.5**	**CO2**	**CH4**	**VOC**	**NOX**	**CO**	**PM10**	**PM2.5**	**CO_2**	**CH4**	**Total GHG Emissions (MT CO2e)**
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	240	1.84	6.90	6.78	0.49	0.41	824	0.17	0.22	0.83	0.81	0.06	0.05	98.88	0.02	90.49
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.22**	**0.83**	**0.81**	**0.06**	**0.05**	**98.88**	**0.02**	**90.49**
Remove Rip-Rap																				
Excavators > 250 and < = 500	Excavator - 3.5 CY	1	8	384	240	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.14	0.98	0.47	0.04	0.03	224.39	0.01	204.52
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
Dozers < = 175	Dozer - D6	1	8	145	240	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.18	1.26	0.79	0.07	0.06	124.30	0.02	113.52
	Highway Truck (25,000 lbs)	10	1,200	330	288,000	0.07	0.40	3.19	0.12	0.05	1,069	0.08	0.07	2.11	0.33	0.06	0.04	522.45	0.00	475.47
Load/Haul/Place Grouted Stone																				
Scrapers > 250 < = 500	CAT 627 Scraper	1	8	330	240	2.19	17.75	8.09	0.68	0.57	2,571	0.20	0.26	2.13	0.97	0.08	0.07	308.57	0.02	281.40
Dozers > 250 and < = 500	Dozer - D8	1	8	310	240	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.27	2.15	1.12	0.09	0.07	254.28	0.02	232.01
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
Graders > 120 and < = 175	Grader - 120	1	8	135	240	0.97	6.90	5.85	0.38	0.32	991	0.09	0.12	0.83	0.70	0.05	0.04	118.96	0.01	108.53
Pumps > 175 and < = 250	Concrete pump	1	8	210	240	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.10	1.14	0.38	0.03	0.03	193.31	0.01	176.14
Water Truck	3,000 gal water truck	1	8	230	240	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.11	0.83	0.35	0.03	0.02	159.88	0.01	145.75
	Truck - 250 Articulated	1	120	330	28,800	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.21	0.03	0.01	0.00	52.24	0.00	47.55
Haul away excess																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
	Belly Dump Truck	1	120	330	28,800	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.21	0.03	0.01	0.00	52.24	0.00	47.55
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	7	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.01	0.04	0.02	0.00	0.00	3.63	0.00	3.31
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Install Sheet Piles																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	3	8	211	240	2.46	18.99	8.48	0.62	0.51	4,122	0.22	0.30	2.28	1.02	0.07	0.06	494.60	0.03	450.77
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Total						**18.05**	**141.83**	**73.90**	**5.75**	**4.72**	**24,724.51**	**1.69**	**1.87**	**16.48**	**7.25**	**0.60**	**0.49**	**3,009.73**	**0.16**	**2,743.00**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.04**	**0.49**	**0.17**	**0.02**	**0.01**	**105.52**	**0.00**	**96.09**

On Road Construction Emissions

						Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
	Total Trips	**Distance**	**Average Daily Mileage**	**Calculated Time - Rounded (days)**	**Total Mileage**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO2**	**CH_4**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO_2**	**CH_4**	**Total GHG Emissions (MT CO2e)**
Worker Trips	50	16.8	840	240	201,600	0.07	0.64	1.50	0.11	0.06	586	0.05	0.01	0.08	0.18	0.01	0.01	70.31	0.01	64.15

Note: Assumes a total of 25 workers per day.

	Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
Total	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO2**	**CH_4**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO_2**	**CH_4**	**Total GHG Emissions (MT CO2e)**
Maximum Daily Emissions	**19.95**	**149.37**	**82.18**	**6.35**	**5.19**	**26,134.48**	**1.91**								
Maximum Annual Emissions								**2.13**	**17.88**	**8.41**	**0.69**	**0.56**	**3,284.45**	**0.19**	**2,993.72**

Phase 5A - Grouted Stone and Sheet Pile Alternative - 2017

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons per phase) VOC	NOX	CO	PM10	PM2.5	CO_2	CH4	Total GHG Emissions (MT CO2e)
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	130	1.84	6.90	6.78	0.49	0.41	824	0.17	0.12	0.45	0.44	0.03	0.03	53.56	0.01	49.02
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.12**	**0.45**	**0.44**	**0.03**	**0.03**	**53.56**	**0.01**	**49.02**
Remove Rip-Rap																				
Excavators > 250 and < = 500	Excavator - 3.5 CY	1	8	384	130	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.08	0.53	0.25	0.02	0.02	121.54	0.01	110.78
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	130	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.18	0.01	0.01	89.30	0.00	81.39
Dozers < = 175	Dozer - D6	1	8	145	130	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.10	0.68	0.43	0.04	0.03	67.33	0.01	61.49
	Highway Truck (25,000 lbs)	10	1,200	330	156,000	0.07	0.40	3.19	0.12	0.05	1,069	0.08	0.04	1.14	0.18	0.03	0.02	282.99	0.00	257.54
Load/Haul/Place Grouted Stone																				
Scrapers > 250 < = 500	CAT 627 Scraper	1	8	330	130	2.19	17.75	8.09	0.68	0.57	2,571	0.20	0.14	1.15	0.53	0.04	0.04	167.14	0.01	152.43
Dozers > 250 and < = 500	Dozer - D8	1	8	310	130	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.15	1.16	0.61	0.05	0.04	137.73	0.01	125.67
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	130	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.18	0.01	0.01	89.30	0.00	81.39
Graders > 120 and < = 175	Grader - 120	1	8	135	130	0.97	6.90	5.85	0.38	0.32	991	0.09	0.06	0.45	0.38	0.02	0.02	64.44	0.01	58.78
Pumps > 175 and < = 250	Concrete pump	1	8	210	130	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.05	0.62	0.20	0.02	0.01	104.71	0.00	95.41
Water Truck	3,000 gal water truck	1	8	230	130	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.06	0.45	0.19	0.02	0.01	86.60	0.01	78.95
	Truck - 250 Articulated	1	120	330	15,600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.11	0.02	0.00	0.00	28.30	0.00	25.75
Haul away excess																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	130	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.18	0.01	0.01	89.30	0.00	81.39
	Belly Dump Truck	1	120	330	15,600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.11	0.02	0.00	0.00	28.30	0.00	25.75
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	7	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.01	0.04	0.02	0.00	0.00	3.63	0.00	3.31
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Install Sheet Piles																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	3	8	211	131	2.46	18.99	8.48	0.62	0.51	4,122	0.22	0.16	1.24	0.56	0.04	0.03	269.97	0.01	246.04
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Total						**18.05**	**141.83**	**73.90**	**5.75**	**4.72**	**24,724.51**	**1.69**	**1.02**	**8.97**	**3.95**	**0.33**	**0.27**	**1,636.87**	**0.09**	**1,491.81**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.04**	**0.49**	**0.17**	**0.02**	**0.01**	**105.52**	**0.00**	**96.09**
Replace Santa Ana Trail																				
Install Rails																				
Welders > 25 and < = 50	Welder (enginer driven)	1	8	48	1	0.57	1.81	1.99	0.14	0.12	207.66	0.05	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.10
Tractors/Loaders/Backhoes > 250 and < = 500	Post Driver	1	8	260	1	1.59	11.27	5.57	0.40	0.32	2,758.83	0.14	0.00	0.01	0.00	0.00	0.00	1.38	0.00	1.26
	Highway Truck (25,000 lbs)	1	120	330	120	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
	Pickup Truck	1	120	330	120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.01	0.05	0.00	0.00	17.63	0.00	16.08
Replace bike path																				
Graders > 120 and < = 175	Grader - Articulated	1	8	135	4	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	1.98	0.00	1.81
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	1	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.00	0.00	0.00	0.00	0.61	0.00	0.56
Paving Equipment > 175 and < = 250	Paver - Asphalt	1	8	224	6	0.86	7.76	2.64	0.29	0.24	978	0.08	0.00	0.02	0.01	0.00	0.00	2.93	0.00	2.68
Water Truck	3,000 gal water truck	1	8	230	1	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.61
	Pickup Truck	1	120	330	720	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.29
Total						**5.85**	**44.49**	**22.65**	**1.78**	**1.45**	**8,142.38**	**0.54**	**0.02**	**0.35**	**0.12**	**0.01**	**0.01**	**97.47**	**0.00**	**88.75**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	50	16.8	840	131	110,040	0.07	0.64	1.50	0.11	0.06	586	0.05	0.00	0.04	0.10	0.01	0.00	38.38	0.00	35.01

Note: Assumes a total of 25 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**12.32**	**91.97**	**57.13**	**4.31**	**3.49**	**15,140.89**	**1.15**								
Maximum Annual Emissions								**1.19**	**10.30**	**4.78**	**0.40**	**0.32**	**1,931.80**	**0.11**	**1,760.67**

Phase 5A - Soil Cement and Sheet Pile Alternative - 2015

Off-Road Construction Equipment

						Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
Equipment Type	**Equipment Category**	**Number**	**Usage Factor (hrs/day or miles/day)**	**Power Rating (hp)**	**Total Days/VMT**	**VOC**	**NOX**	**CO**	**PM10**	**PM2.5**	**CO2**	**CH4**	**VOC**	**NOX**	**CO**	**PM10**	**PM2.5**	**CO_2**	**CH4**	**Total GHG Emissions (MT CO2e)**
Clearing and Grubbing																				
Dozers < = 175	Dozer - D7	1	8	240	1	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.01	0.00	0.00	0.00	0.52	0.00	0.47
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	2	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.00	0.00	0.00	1.37	0.00	1.25
Dozers > 250 and < = 500	Dozer - D8	1	8	310	1	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.00	0.01	0.00	0.00	0.00	1.06	0.00	0.97
Other Construction Equipment > 120 and < = 175	Brush Chipper	1	8	174	1	0.58	4.68	4.69	0.23	0.19	852	0.05	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.39
	Highway Truck (25,000 lbs)	11	1,320	330	2,640	0.66	19.33	3.00	0.52	0.32	4,789	0.01	0.00	0.02	0.00	0.00	0.00	4.79	0.00	4.36
	Pickup Truck	1	120	330	240	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.10
Total						**5.79**	**58.75**	**26.81**	**2.30**	**1.82**	**10,276.78**	**0.48**	**0.00**	**0.04**	**0.02**	**0.00**	**0.00**	**8.27**	**0.00**	**7.54**
Remove Santa Ana Trail																				
Remove rails																				
	Highway Truck (10,000 lbs)	1	120	180	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
	Dump Truck (35,000 lbs)	1	120	265	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
Remove existing bike path (asphalt)																				
Tractors/Loaders/Backhoes > 50 and < = 120	Loader - 1.25 CY	1	8	95	2	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.38
Graders > 120 and < = 175	Grader - Articulated	1	8	135	2	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	0.99	0.00	0.90
	Street Sweeper	1	8	80	2	0.00	0.12	0.02	0.00	0.00	29	0.00	0.00	0.00	0.00	0.00	0.00	1.16	0.00	1.06
	Highway Truck (10,000 lbs)	1	120	330	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
Total						**1.58**	**15.11**	**9.45**	**0.73**	**0.57**	**2,740.34**	**0.13**	**0.00**	**0.02**	**0.01**	**0.00**	**0.00**	**4.53**	**0.00**	**4.12**
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	131	1.84	6.90	6.78	0.49	0.41	824	0.17	0.12	0.45	0.44	0.03	0.03	53.97	0.01	49.39
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.12**	**0.45**	**0.44**	**0.03**	**0.03**	**53.97**	**0.01**	**49.39**
Remove Rip-Rap																				
Excavators > 250 and < = 500	Excavator - 3.5 CY	1	8	384	131	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.08	0.54	0.25	0.02	0.02	122.48	0.01	111.63
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
Dozers < = 175	Dozer - D6	1	8	145	131	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.10	0.69	0.43	0.04	0.03	67.85	0.01	61.96
	Highway Truck (25,000 lbs)	10	1,200	330	157,200	0.07	0.40	3.19	0.12	0.05	1,069	0.08	0.04	1.15	0.18	0.03	0.02	285.17	0.00	259.53
Excavation (for placement of soil cement)																				
Load and haul with scrapers, dozer																				
Scrapers > 250 < = 500	CAT 627 Scraper	4	8	330	131	8.76	70.99	32.34	2.72	2.29	10,286	0.79	0.57	4.65	2.12	0.18	0.15	673.71	0.05	614.40
Dozers > 250 and < = 500	Dozer - D8	1	8	310	131	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.15	1.17	0.61	0.05	0.04	138.79	0.01	126.64
	Pickup Truck	1	120	330	15,720	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.02	0.00	0.00	7.00	0.00	6.38
Soil Cement																				
Excavate/Load/Haul from Borrow site to Soil Screening Plant																				
Dozers < = 175	Dozer - D6	1	8	145	131	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.10	0.69	0.43	0.04	0.03	67.85	0.01	61.96
Tractors/Loaders/Backhoes > 250 and < = 500	Loader 980	1	8	349	131	1.59	11.27	5.57	0.40	0.32	2,759	0.14	0.10	0.74	0.36	0.03	0.02	180.70	0.01	164.68
Water Truck	3,000 gal water truck	1	8	230	131	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.06	0.45	0.19	0.02	0.01	87.27	0.01	79.56
	Truck - 250 Articulated	14	1,680	330	220,080	0.84	24.60	3.82	0.67	0.41	6,095	0.02	0.06	1.61	0.25	0.04	0.03	399.24	0.00	363.34
Load/Haul Unsuitable Soil																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
	Truck - 20 CY (75,000 lbs)	4	480	330	62,880	0.24	7.03	1.09	0.19	0.12	1,741	0.01	0.02	0.46	0.07	0.01	0.01	114.07	0.00	103.81
Process excavated soil through Soil Screening Plant																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
Mix at Soil Cement Batch Plant																				
Generator Sets > 25 and < = 50	Generator	1	8	375	131	0.50	2.03	1.91	0.14	0.11	245	0.05	0.03	0.13	0.13	0.01	0.01	16.05	0.00	14.68
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
Load/Haul/Place Soil Cement																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	2	8	211	131	1.64	12.66	5.65	0.42	0.34	2,748	0.15	0.11	0.83	0.37	0.03	0.02	179.98	0.01	164.03
Graders > 120 and < = 175	Grader - 120	1	8	135	131	0.97	6.90	5.85	0.38	0.32	991	0.09	0.06	0.45	0.38	0.02	0.02	64.93	0.01	59.24
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	131	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.05	0.52	0.18	0.02	0.01	80.22	0.00	73.12
	Truck - 250 Articulated	2	240	330	31,440	0.12	3.51	0.55	0.10	0.06	871	0.00	0.01	0.23	0.04	0.01	0.00	57.03	0.00	51.91
Spread Fill Material																				
Dozers > 250 and < = 500	Dozer - D9	1	8	410	131	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.15	1.17	0.61	0.05	0.04	138.79	0.01	126.64
Compact Soil																				
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	131	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.05	0.52	0.18	0.02	0.01	80.22	0.00	73.12
Water Truck	3,000 gal water truck	1	8	230	131	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.06	0.45	0.19	0.02	0.01	87.27	0.01	79.56
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	22	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.02	0.12	0.07	0.01	0.01	11.39	0.00	10.41
Water Truck	3,000 gal water truck	1	8	230	22	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.01	0.08	0.03	0.00	0.00	14.66	0.00	13.36
Install Sheet Piles																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	3	8	211	131	2.46	18.99	8.48	0.62	0.51	4,122	0.22	0.16	1.24	0.56	0.04	0.03	269.97	0.01	246.04
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Total						**35.78**	**300.78**	**140.66**	**11.64**	**9.46**	**52,833.50**	**3.22**	**2.20**	**19.57**	**8.42**	**0.72**	**0.58**	**3,506.21**	**0.19**	**3,195.52**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	1.09	0.00	0.99
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.03**	**0.21**	**0.12**	**0.01**	**0.01**	**34.77**	**0.00**	**31.70**

On Road Construction Emissions

						Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
	Total Trips	**Distance**	**Average Daily Mileage**	**Calculated Time - Rounded (days)**	**Total Mileage**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO2**	**CH_4**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO_2**	**CH_4**	**Total GHG Emissions (MT CO2e)**
Worker Trips	50	16.8	840	131	110,040	0.07	0.64	1.50	0.11	0.06	586	0.05	0.00	0.04	0.10	0.01	0.00	38.38	0.00	35.01

Note: Assumes a total of 25 workers per day.

	Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
Total	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO2**	**CH_4**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO_2**	**CH_4**	**Total GHG Emissions (MT CO2e)**
Maximum Daily Emissions	**37.68**	**308.31**	**148.93**	**12.24**	**9.92**	**54,243.47**	**3.44**								
Maximum Annual Emissions								**2.36**	**20.34**	**9.11**	**0.77**	**0.62**	**3,646.13**	**0.21**	**3,323.29**

Phase 5A - Soil Cement and Sheet Pile Alternative - 2016

Off-Road Construction Equipment

						Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
Equipment Type	**Equipment Category**	**Number**	**Usage Factor (hrs/day or miles/day)**	**Power Rating (hp)**	**Total Days/VMT**	**VOC**	**NOX**	**CO**	**PM10**	**PM2.5**	**CO2**	**CH4**	**VOC**	**NOX**	**CO**	**PM10**	**PM2.5**	**CO_2**	**CH4**	**Total GHG Emissions (MT CO2e)**
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	240	1.84	6.90	6.78	0.49	0.41	824	0.17	0.22	0.83	0.81	0.06	0.05	98.88	0.02	90.49
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.22**	**0.83**	**0.81**	**0.06**	**0.05**	**98.88**	**0.02**	**90.49**
Remove Rip-Rap																				
Excavators > 250 and < = 500	Excavator - 3.5 CY	1	8	384	240	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.14	0.98	0.47	0.04	0.03	224.39	0.01	204.52
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
Dozers < = 175	Dozer - D6	1	8	145	240	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.18	1.26	0.79	0.07	0.06	124.30	0.02	113.52
	Highway Truck (25,000 lbs)	10	1,200	330	288,000	0.07	0.40	3.19	0.12	0.05	1,069	0.08	0.07	2.11	0.33	0.06	0.04	522.45	0.00	475.47
Excavation (for placement of soil cement)																				
Load and haul with scrapers, dozer																				
Scrapers > 250 < = 500	CAT 627 Scraper	4	8	330	240	8.76	70.99	32.34	2.72	2.29	10,286	0.79	1.05	8.52	3.88	0.33	0.27	1,234.29	0.09	1,125.62
Dozers > 250 and < = 500	Dozer - D8	1	8	310	240	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.27	2.15	1.12	0.09	0.07	254.28	0.02	232.01
	Pickup Truck	1	120	330	28,800	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.04	0.00	0.00	12.82	0.00	11.69
Soil Cement																				
Excavate/Load/Haul from Borrow site to Soil Screening Plant																				
Dozers < = 175	Dozer - D6	1	8	145	240	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.18	1.26	0.79	0.07	0.06	124.30	0.02	113.52
Tractors/Loaders/Backhoes > 250 and < = 500	Loader 980	1	8	349	240	1.59	11.27	5.57	0.40	0.32	2,759	0.14	0.19	1.35	0.67	0.05	0.04	331.06	0.02	301.70
Water Truck	3,000 gal water truck	1	8	230	240	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.11	0.83	0.35	0.03	0.02	159.88	0.01	145.75
	Truck - 250 Articulated	14	1,680	330	403,200	0.84	24.60	3.82	0.67	0.41	6,095	0.02	0.10	2.95	0.46	0.08	0.05	731.43	0.00	665.65
																				-
Load/Haul Unsuitable Soil																				-
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
	Truck - 20 CY (75,000 lbs)	4	480	330	115,200	0.24	7.03	1.09	0.19	0.12	1,741	0.01	0.03	0.84	0.13	0.02	0.01	208.98	0.00	190.19
Process excavated soil through Soil Screening Plant																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
Mix at Soil Cement Batch Plant																				
Generator Sets > 25 and < = 50	Generator	1	8	375	240	0.50	2.03	1.91	0.14	0.11	245	0.05	0.06	0.24	0.23	0.02	0.01	29.40	0.01	26.89
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
Load/Haul/Place Soil Cement																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	2	8	211	240	1.64	12.66	5.65	0.42	0.34	2,748	0.15	0.20	1.52	0.68	0.05	0.04	329.74	0.02	300.51
Graders > 120 and < = 175	Grader - 120	1	8	135	240	0.97	6.90	5.85	0.38	0.32	991	0.09	0.12	0.83	0.70	0.05	0.04	118.96	0.01	108.53
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	240	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.10	0.96	0.33	0.03	0.03	146.97	0.01	133.97
	Truck - 250 Articulated	2	240	330	57,600	0.12	3.51	0.55	0.10	0.06	871	0.00	0.01	0.42	0.07	0.01	0.01	104.49	0.00	95.09
Spread Fill Material																				
Dozers > 250 and < = 500	Dozer - D9	1	8	410	240	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.27	2.15	1.12	0.09	0.07	254.28	0.02	232.01
Compact Soil																				
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	240	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.10	0.96	0.33	0.03	0.03	146.97	0.01	133.97
Water Truck	3,000 gal water truck	1	8	230	240	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.11	0.83	0.35	0.03	0.02	159.88	0.01	145.75
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	22	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.02	0.12	0.07	0.01	0.01	11.39	0.00	10.41
Water Truck	3,000 gal water truck	1	8	230	22	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.01	0.08	0.03	0.00	0.00	14.66	0.00	13.36
Install Sheet Piles																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	3	8	211	240	2.46	18.99	8.48	0.62	0.51	4,122	0.22	0.30	2.28	1.02	0.07	0.06	494.60	0.03	450.77
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Total						**35.78**	**300.78**	**140.66**	**11.64**	**9.46**	**52,833.50**	**3.22**	**4.01**	**35.68**	**15.33**	**1.32**	**1.06**	**6,400.57**	**0.35**	**5,833.39**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.04**	**0.49**	**0.17**	**0.02**	**0.01**	**105.52**	**0.00**	**96.09**

On Road Construction Emissions

						Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
	Total Trips	**Distance**	**Average Daily Mileage**	**Calculated Time - Rounded (days)**	**Total Mileage**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO2**	**CH_4**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO_2**	**CH_4**	**Total GHG Emissions (MT CO2e)**
Worker Trips	50	16.8	840	240	201,600	0.07	0.64	1.50	0.11	0.06	586	0.05	0.01	0.08	0.18	0.01	0.01	70.31	0.01	64.15

Note: Assumes a total of 25 workers per day.

	Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
Total	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO2**	**CH_4**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO_2**	**CH_4**	**Total GHG Emissions (MT CO2e)**
Maximum Daily Emissions	**37.68**	**308.31**	**148.93**	**12.24**	**9.92**	**54,243.47**	**3.44**								
Maximum Annual Emissions								**4.28**	**37.08**	**16.49**	**1.41**	**1.13**	**6,675.29**	**0.38**	**6,084.12**

Phase 5A - Soil Cement and Sheet Pile Alternative - 2017

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons per phase) VOC	NOX	CO	PM10	PM2.5	CO_2	CH4	Total GHG Emissions (MT CO2e)
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	171	1.84	6.90	6.78	0.49	0.41	824	0.17	0.16	0.59	0.58	0.04	0.03	70.46	0.01	64.47
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.16**	**0.59**	**0.58**	**0.04**	**0.03**	**70.46**	**0.01**	**64.47**
Remove Rip-Rap																				
Excavators > 250 and < = 500	Excavator - 3.5 CY	1	8	384	171	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.10	0.70	0.33	0.03	0.02	159.87	0.01	145.72
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	171	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.07	0.54	0.24	0.02	0.01	117.47	0.01	107.06
Dozers < = 175	Dozer - D6	1	8	145	171	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.13	0.89	0.57	0.05	0.04	88.56	0.01	80.88
	Highway Truck (25,000 lbs)	10	1,200	330	205,200	0.07	0.40	3.19	0.12	0.05	1,069	0.08	0.05	1.50	0.23	0.04	0.03	372.24	0.00	338.77
Excavation (for placement of soil cement)																				
Load and haul with scrapers, dozer																				
Scrapers > 250 < = 500	CAT 627 Scraper	4	8	330	171	8.76	70.99	32.34	2.72	2.29	10,286	0.79	0.75	6.07	2.77	0.23	0.20	879.43	0.07	802.00
Dozers > 250 and < = 500	Dozer - D8	1	8	310	171	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.19	1.53	0.80	0.06	0.05	181.17	0.02	165.31
	Pickup Truck	1	120	330	20,520	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.03	0.00	0.00	9.14	0.00	8.33
Soil Cement																				
Excavate/Load/Haul from Borrow site to Soil Screening Plant																				
Dozers < = 175	Dozer - D6	1	8	145	171	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.13	0.89	0.57	0.05	0.04	88.56	0.01	80.88
Tractors/Loaders/Backhoes > 250 and < = 500	Loader 980	1	8	349	171	1.59	11.27	5.57	0.40	0.32	2,759	0.14	0.14	0.96	0.48	0.03	0.03	235.88	0.01	214.96
Water Truck	3,000 gal water truck	1	8	230	171	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.08	0.59	0.25	0.02	0.02	113.92	0.01	103.85
	Truck - 250 Articulated	14	1,680	330	287,280	0.84	24.60	3.82	0.67	0.41	6,095	0.02	0.07	2.10	0.33	0.06	0.04	521.14	0.00	474.28
Load/Haul Unsuitable Soil																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	171	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.07	0.54	0.24	0.02	0.01	117.47	0.01	107.06
	Truck - 20 CY (75,000 lbs)	4	480	330	82,080	0.24	7.03	1.09	0.19	0.12	1,741	0.01	0.02	0.60	0.09	0.02	0.01	148.90	0.00	135.51
Process excavated soil through Soil Screening Plant																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	171	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.07	0.54	0.24	0.02	0.01	117.47	0.01	107.06
Mix at Soil Cement Batch Plant																				
Generator Sets > 25 and < = 50	Generator	1	8	375	171	0.50	2.03	1.91	0.14	0.11	245	0.05	0.04	0.17	0.16	0.01	0.01	20.95	0.00	19.16
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	171	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.07	0.54	0.24	0.02	0.01	117.47	0.01	107.06
Load/Haul/Place Soil Cement																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	2	8	211	171	1.64	12.66	5.65	0.42	0.34	2,748	0.15	0.14	1.08	0.48	0.04	0.03	234.94	0.01	214.11
Graders > 120 and < = 175	Grader - 120	1	8	135	171	0.97	6.90	5.85	0.38	0.32	991	0.09	0.08	0.59	0.50	0.03	0.03	84.76	0.01	77.32
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	171	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.07	0.68	0.24	0.02	0.02	104.71	0.01	95.45
	Truck - 250 Articulated	2	240	330	41,040	0.12	3.51	0.55	0.10	0.06	871	0.00	0.01	0.30	0.05	0.01	0.01	74.45	0.00	67.75
Spread Fill Material																				
Dozers > 250 and < = 500	Dozer - D9	1	8	410	171	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.19	1.53	0.80	0.06	0.05	181.17	0.02	165.31
Compact Soil																				
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	171	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.07	0.68	0.24	0.02	0.02	104.71	0.01	95.45
Water Truck	3,000 gal water truck	1	8	230	171	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.08	0.59	0.25	0.02	0.02	113.92	0.01	103.85
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	22	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.02	0.12	0.07	0.01	0.01	11.39	0.00	10.41
Water Truck	3,000 gal water truck	1	8	230	22	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.01	0.08	0.03	0.00	0.00	14.66	0.00	13.36
Install Sheet Piles																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	3	8	211	171	2.46	18.99	8.48	0.62	0.51	4,122	0.22	0.21	1.62	0.73	0.05	0.04	352.40	0.02	321.17
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Total						**35.78**	**300.78**	**140.66**	**11.64**	**9.46**	**52,833.50**	**3.22**	**2.87**	**25.48**	**10.96**	**0.94**	**0.76**	**4,568.36**	**0.25**	**4,163.54**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.04**	**0.49**	**0.17**	**0.02**	**0.01**	**105.52**	**0.00**	**96.09**
Replace Santa Ana Trail																				
Install Rails																				
Welders > 25 and < = 50	Welder (enginer driven)	1	8	48	1	0.57	1.81	1.99	0.14	0.12	207.66	0.05	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.10
Tractors/Loaders/Backhoes > 250 and < = 500	Post Driver	1	8	260	1	1.59	11.27	5.57	0.40	0.32	2,758.83	0.14	0.00	0.01	0.00	0.00	0.00	1.38	0.00	1.26
	Highway Truck (25,000 lbs)	1	120	330	120	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
	Pickup Truck	1	120	330	120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.01	0.05	0.00	0.00	17.63	0.00	16.08
Replace bike path																				
Graders > 120 and < = 175	Grader - Articulated	1	8	135	4	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	1.98	0.00	1.81
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	1	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.00	0.00	0.00	0.00	0.61	0.00	0.56
Paving Equipment > 175 and < = 250	Paver - Asphalt	1	8	224	6	0.86	7.76	2.64	0.29	0.24	978	0.08	0.00	0.02	0.01	0.00	0.00	2.93	0.00	2.68
Water Truck	3,000 gal water truck	1	8	230	1	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.61
	Pickup Truck	1	120	330	720	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.29
Total						**5.85**	**44.49**	**22.65**	**1.78**	**1.45**	**8,142.38**	**0.54**	**0.02**	**0.35**	**0.12**	**0.01**	**0.01**	**97.47**	**0.00**	**88.75**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	50	16.8	840	171	143,640	0.07	0.64	1.50	0.11	0.06	586	0.05	0.01	0.05	0.13	0.01	0.00	50.10	0.00	45.70

Note: Assumes a total of 25 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**37.68**	**308.31**	**148.93**	**12.24**	**9.92**	**54,243.47**	**3.44**								
Maximum Annual Emissions								**3.08**	**26.97**	**11.96**	**1.02**	**0.82**	**4,891.90**	**0.27**	**4,458.56**

Phase 5B - Grouted Stone Alternative - 2016

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons per phase) VOC	NOX	CO	PM10	PM2.5	CO_2	CH4	Total GHG Emissions (MT CO2e)
Clearing and Grubbing																				
Dozers < = 175	Dozer - D7	1	8	240	1	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.01	0.00	0.00	0.00	0.52	0.00	0.47
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	2	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.00	0.00	0.00	1.37	0.00	1.25
Dozers > 250 and < = 500	Dozer - D8	1	8	310	1	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.00	0.01	0.00	0.00	0.00	1.06	0.00	0.97
Other Construction Equipment > 120 and < = 175	Brush Chipper	1	8	174	1	0.58	4.68	4.69	0.23	0.19	852	0.05	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.39
	Highway Truck (25,000 lbs)	11	1,320	330	2,640	0.66	19.33	3.00	0.52	0.32	4,789	0.01	0.00	0.02	0.00	0.00	0.00	4.79	0.00	4.36
	Pickup Truck	1	120	330	240	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.10
Total						**5.79**	**58.75**	**26.81**	**2.30**	**1.82**	**10,276.78**	**0.48**	**0.00**	**0.04**	**0.02**	**0.00**	**0.00**	**8.27**	**0.00**	**7.54**
Remove Santa Ana Trail																				
Remove rails																				
	Highway Truck (10,000 lbs)	1	120	180	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
	Dump Truck (35,000 lbs)	1	120	265	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
Remove existing bike path (asphalt)																				
Tractors/Loaders/Backhoes > 50 and < = 120	Loader - 1.25 CY	1	8	95	2	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.38
Graders > 120 and < = 175	Grader - Articulated	1	8	135	2	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	0.99	0.00	0.90
	Street Sweeper	1	8	80	2	0.00	0.12	0.02	0.00	0.00	29	0.00	0.00	0.00	0.00	0.00	0.00	1.16	0.00	1.06
	Highway Truck (10,000 lbs)	1	120	330	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
Total						**1.58**	**15.11**	**9.45**	**0.73**	**0.57**	**2,740.34**	**0.13**	**0.00**	**0.02**	**0.01**	**0.00**	**0.00**	**4.53**	**0.00**	**4.12**
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	131	1.84	6.90	6.78	0.49	0.41	824	0.17	0.12	0.45	0.44	0.03	0.03	53.97	0.01	49.39
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.12**	**0.45**	**0.44**	**0.03**	**0.03**	**53.97**	**0.01**	**49.39**
Remove Rip-Rap																				
Excavators > 250 and < = 500	Excavator - 3.5 CY	1	8	384	131	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.08	0.54	0.25	0.02	0.02	122.48	0.01	111.63
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
Dozers < = 175	Dozer - D6	1	8	145	131	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.10	0.69	0.43	0.04	0.03	67.85	0.01	61.96
	Highway Truck (25,000 lbs)	10	1,200	330	157,200	0.07	0.40	3.19	0.12	0.05	1,069	0.08	0.04	1.15	0.18	0.03	0.02	285.17	0.00	259.53
Load/Haul/Place Grouted Stone																				
Scrapers > 250 < = 500	CAT 627 Scraper	1	8	330	131	2.19	17.75	8.09	0.68	0.57	2,571	0.20	0.14	1.16	0.53	0.04	0.04	168.43	0.01	153.60
Dozers > 250 and < = 500	Dozer - D8	1	8	310	131	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.15	1.17	0.61	0.05	0.04	138.79	0.01	126.64
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
Graders > 120 and < = 175	Grader - 120	1	8	135	131	0.97	6.90	5.85	0.38	0.32	991	0.09	0.06	0.45	0.38	0.02	0.02	64.93	0.01	59.24
Pumps > 175 and < = 250	Concrete pump	1	8	210	131	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.05	0.62	0.20	0.02	0.01	105.52	0.00	96.14
Water Truck	3,000 gal water truck	1	8	230	131	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.06	0.45	0.19	0.02	0.01	87.27	0.01	79.56
	Truck - 250 Articulated	1	120	330	15,720	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.12	0.02	0.00	0.00	28.52	0.00	25.95
Haul away excess																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
	Belly Dump Truck	1	120	330	15,720	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.12	0.02	0.00	0.00	28.52	0.00	25.95
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	7	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.01	0.04	0.02	0.00	0.00	3.63	0.00	3.31
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Total						**14.90**	**117.96**	**61.59**	**4.85**	**3.98**	**19,960.07**	**1.40**	**0.86**	**7.77**	**3.41**	**0.29**	**0.23**	**1,375.73**	**0.07**	**1,253.81**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.04**	**0.49**	**0.17**	**0.02**	**0.01**	**105.52**	**0.00**	**96.09**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	50	16.8	840	131	110,040	0.07	0.64	1.50	0.11	0.06	586	0.05	0.00	0.04	0.10	0.01	0.00	38.38	0.00	35.01

Note: Assumes a total of 25 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**16.80**	**125.50**	**69.87**	**5.45**	**4.45**	**21,370.04**	**1.62**								
Maximum Annual Emissions								**0.17**	**1.05**	**0.74**	**0.06**	**0.04**	**210.67**	**0.02**	**192.15**

Phase 5B - Grouted Stone Alternative - 2017

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons per phase) VOC	NOX	CO	PM10	PM2.5	CO_2	CH4	Total GHG Emissions (MT CO2e)
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	240	1.84	6.90	6.78	0.49	0.41	824	0.17	0.22	0.83	0.81	0.06	0.05	98.88	0.02	90.49
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.22**	**0.83**	**0.81**	**0.06**	**0.05**	**98.88**	**0.02**	**90.49**
Remove Rip-Rap																				
Excavators > 250 and < = 500	Excavator - 3.5 CY	1	8	384	240	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.14	0.98	0.47	0.04	0.03	224.39	0.01	204.52
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
Dozers < = 175	Dozer - D6	1	8	145	240	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.18	1.26	0.79	0.07	0.06	124.30	0.02	113.52
	Highway Truck (25,000 lbs)	10	1,200	330	288,000	0.07	0.40	3.19	0.12	0.05	1,069	0.08	0.07	2.11	0.33	0.06	0.04	522.45	0.00	475.47
Load/Haul/Place Grouted Stone																				
Scrapers > 250 < = 500	CAT 627 Scraper	1	8	330	240	2.19	17.75	8.09	0.68	0.57	2,571	0.20	0.26	2.13	0.97	0.08	0.07	308.57	0.02	281.40
Dozers > 250 and < = 500	Dozer - D8	1	8	310	240	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.27	2.15	1.12	0.09	0.07	254.28	0.02	232.01
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
Graders > 120 and < = 175	Grader - 120	1	8	135	240	0.97	6.90	5.85	0.38	0.32	991	0.09	0.12	0.83	0.70	0.05	0.04	118.96	0.01	108.53
Pumps > 175 and < = 250	Concrete pump	1	8	210	240	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.10	1.14	0.38	0.03	0.03	193.31	0.01	176.14
Water Truck	3,000 gal water truck	1	8	230	240	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.11	0.83	0.35	0.03	0.02	159.88	0.01	145.75
	Truck - 250 Articulated	1	120	330	28,800	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.21	0.03	0.01	0.00	52.24	0.00	47.55
Haul away excess																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
	Belly Dump Truck	1	120	330	15,720	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.12	0.02	0.00	0.00	28.52	0.00	25.95
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	7	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.01	0.04	0.02	0.00	0.00	3.63	0.00	3.31
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Total						**14.90**	**117.96**	**61.59**	**4.85**	**3.98**	**19,960.07**	**1.40**	**1.57**	**14.09**	**6.21**	**0.53**	**0.42**	**2,489.79**	**0.14**	**2,269.17**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.04**	**0.49**	**0.17**	**0.02**	**0.01**	**105.52**	**0.00**	**96.09**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	50	16.8	840	240	201,600	0.07	0.64	1.50	0.11	0.06	586	0.05	0.01	0.08	0.18	0.01	0.01	70.31	0.01	64.15

Note: Assumes a total of 25 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**16.80**	**125.50**	**69.87**	**5.45**	**4.45**	**21,370.04**	**1.62**								
Maximum Annual Emissions								**1.83**	**15.49**	**7.37**	**0.61**	**0.49**	**2,764.51**	**0.16**	**2,519.90**

Phase 5B - Grouted Stone Alternative - 2018

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons per phase) VOC	NOX	CO	PM10	PM2.5	CO_2	CH4	Total GHG Emissions (MT CO2e)
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	130	1.84	6.90	6.78	0.49	0.41	824	0.17	0.12	0.45	0.44	0.03	0.03	53.56	0.01	49.02
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.12**	**0.45**	**0.44**	**0.03**	**0.03**	**53.56**	**0.01**	**49.02**
Remove Rip-Rap																				
Excavators > 250 and < = 500	Excavator - 3.5 CY	1	8	384	130	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.08	0.53	0.25	0.02	0.02	121.54	0.01	110.78
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	130	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.18	0.01	0.01	89.30	0.00	81.39
Dozers < = 175	Dozer - D6	1	8	145	130	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.10	0.68	0.43	0.04	0.03	67.33	0.01	61.49
	Highway Truck (25,000 lbs)	10	1,200	330	156,000	0.07	0.40	3.19	0.12	0.05	1,069	0.08	0.04	1.14	0.18	0.03	0.02	282.99	0.00	257.54
Load/Haul/Place Grouted Stone																				
Scrapers > 250 < = 500	CAT 627 Scraper	1	8	330	130	2.19	17.75	8.09	0.68	0.57	2,571	0.20	0.14	1.15	0.53	0.04	0.04	167.14	0.01	152.43
Dozers > 250 and < = 500	Dozer - D8	1	8	310	130	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.15	1.16	0.61	0.05	0.04	137.73	0.01	125.67
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	130	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.18	0.01	0.01	89.30	0.00	81.39
Graders > 120 and < = 175	Grader - 120	1	8	135	130	0.97	6.90	5.85	0.38	0.32	991	0.09	0.06	0.45	0.38	0.02	0.02	64.44	0.01	58.78
Pumps > 175 and < = 250	Concrete pump	1	8	210	130	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.05	0.62	0.20	0.02	0.01	104.71	0.00	95.41
Water Truck	3,000 gal water truck	1	8	230	130	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.06	0.45	0.19	0.02	0.01	86.60	0.01	78.95
	Truck - 250 Articulated	1	120	330	15,600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.11	0.02	0.00	0.00	28.30	0.00	25.75
Haul away excess																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	130	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.18	0.01	0.01	89.30	0.00	81.39
	Belly Dump Truck	1	120	330	15,600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.11	0.02	0.00	0.00	28.30	0.00	25.75
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	7	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.01	0.04	0.02	0.00	0.00	3.63	0.00	3.31
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Total						**14.90**	**117.96**	**61.59**	**4.85**	**3.98**	**19,960.07**	**1.40**	**0.85**	**7.71**	**3.39**	**0.29**	**0.23**	**1,365.29**	**0.07**	**1,244.30**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.04**	**0.49**	**0.17**	**0.02**	**0.01**	**105.52**	**0.00**	**96.09**
Replace Santa Ana Trail																				
Install Rails																				
Welders > 25 and < = 50	Welder (enginer driven)	1	8	48	1	0.57	1.81	1.99	0.14	0.12	207.66	0.05	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.10
Tractors/Loaders/Backhoes > 250 and < = 500	Post Driver	1	8	260	1	1.59	11.27	5.57	0.40	0.32	2,758.83	0.14	0.00	0.01	0.00	0.00	0.00	1.38	0.00	1.26
	Highway Truck (25,000 lbs)	1	120	330	120	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
	Pickup Truck	1	120	330	120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.01	0.05	0.00	0.00	17.63	0.00	16.08
Replace bike path																				
Graders > 120 and < = 175	Grader - Articulated	1	8	135	4	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	1.98	0.00	1.81
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	1	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.00	0.00	0.00	0.00	0.61	0.00	0.56
Paving Equipment > 175 and < = 250	Paver - Asphalt	1	8	224	6	0.86	7.76	2.64	0.29	0.24	978	0.08	0.00	0.02	0.01	0.00	0.00	2.93	0.00	2.68
Water Truck	3,000 gal water truck	1	8	230	1	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.61
	Pickup Truck	1	120	330	720	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.29
Total						**5.85**	**44.49**	**22.65**	**1.78**	**1.45**	**8,142.38**	**0.54**	**0.02**	**0.35**	**0.12**	**0.01**	**0.01**	**97.47**	**0.00**	**88.75**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	50	16.8	840	131	110,040	0.07	0.64	1.50	0.11	0.06	586	0.05	0.00	0.04	0.10	0.01	0.00	38.38	0.00	35.01

Note: Assumes a total of 25 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**16.80**	**125.50**	**69.87**	**5.45**	**4.45**	**21,370.04**	**1.62**								
Maximum Annual Emissions								**1.03**	**9.04**	**4.22**	**0.36**	**0.28**	**1,660.22**	**0.09**	**1,513.16**

Phase 5B - Soil Cement Alternative - 2016

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons per phase) VOC	NOX	CO	PM10	PM2.5	CO_2	CH4	Total GHG Emissions (MT CO2e)
Clearing and Grubbing																				
Dozers < = 175	Dozer - D7	1	8	240	1	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.01	0.00	0.00	0.00	0.52	0.00	0.47
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	2	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.00	0.00	0.00	1.37	0.00	1.25
Dozers > 250 and < = 500	Dozer - D8	1	8	310	1	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.00	0.01	0.00	0.00	0.00	1.06	0.00	0.97
Other Construction Equipment > 120 and < = 175	Brush Chipper	1	8	174	1	0.58	4.68	4.69	0.23	0.19	852	0.05	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.39
	Highway Truck (25,000 lbs)	11	1,320	330	2,640	0.66	19.33	3.00	0.52	0.32	4,789	0.01	0.00	0.02	0.00	0.00	0.00	4.79	0.00	4.36
	Pickup Truck	1	120	330	240	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.10
Total						**5.79**	**58.75**	**26.81**	**2.30**	**1.82**	**10,276.78**	**0.48**	**0.00**	**0.04**	**0.02**	**0.00**	**0.00**	**8.27**	**0.00**	**7.54**
Remove Santa Ana Trail																				
Remove rails																				
	Highway Truck (10,000 lbs)	1	120	180	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
	Dump Truck (35,000 lbs)	1	120	265	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
Remove existing bike path (asphalt)																				
Tractors/Loaders/Backhoes > 50 and < = 120	Loader - 1.25 CY	1	8	95	2	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.38
Graders > 120 and < = 175	Grader - Articulated	1	8	135	2	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	0.99	0.00	0.90
	Street Sweeper	1	8	80	2	0.00	0.12	0.02	0.00	0.00	29	0.00	0.00	0.00	0.00	0.00	0.00	1.16	0.00	1.06
	Highway Truck (10,000 lbs)	1	120	330	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
Total						**1.58**	**15.11**	**9.45**	**0.73**	**0.57**	**2,740.34**	**0.13**	**0.00**	**0.02**	**0.01**	**0.00**	**0.00**	**4.53**	**0.00**	**4.12**
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	131	1.84	6.90	6.78	0.49	0.41	824	0.17	0.12	0.45	0.44	0.03	0.03	53.97	0.01	49.39
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.12**	**0.45**	**0.44**	**0.03**	**0.03**	**53.97**	**0.01**	**49.39**
Remove Rip-Rap																				
Excavators > 250 and < = 500	Excavator - 3.5 CY	1	8	384	131	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.08	0.54	0.25	0.02	0.02	122.48	0.01	111.63
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
Dozers < = 175	Dozer - D6	1	8	145	131	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.10	0.69	0.43	0.04	0.03	67.85	0.01	61.96
	Highway Truck (25,000 lbs)	10	1,200	330	157,200	0.07	0.40	3.19	0.12	0.05	1,069	0.08	0.04	1.15	0.18	0.03	0.02	285.17	0.00	259.53
Excavation (for placement of soil cement)																				
Load and haul with scrapers, dozer																				
Scrapers > 250 < = 500	CAT 627 Scraper	4	8	330	131	8.76	70.99	32.34	2.72	2.29	10,286	0.79	0.57	4.65	2.12	0.18	0.15	673.71	0.05	614.40
Dozers > 250 and < = 500	Dozer - D8	1	8	310	131	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.15	1.17	0.61	0.05	0.04	138.79	0.01	126.64
	Pickup Truck	1	120	330	15,720	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.02	0.00	0.00	7.00	0.00	6.38
Soil Cement																				
Excavate/Load/Haul from Borrow site to Soil Screening Plant																				
Dozers < = 175	Dozer - D6	1	8	145	131	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.10	0.69	0.43	0.04	0.03	67.85	0.01	61.96
Tractors/Loaders/Backhoes > 250 and < = 500	Loader 980	1	8	349	131	1.59	11.27	5.57	0.40	0.32	2,759	0.14	0.10	0.74	0.36	0.03	0.02	180.70	0.01	164.68
Water Truck	3,000 gal water truck	1	8	230	131	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.06	0.45	0.19	0.02	0.01	87.27	0.01	79.56
	Truck - 250 Articulated	14	1,680	330	220,080	0.84	24.60	3.82	0.67	0.41	6,095	0.02	0.06	1.61	0.25	0.04	0.03	399.24	0.00	363.34
Load/Haul Unsuitable Soil																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
	Truck - 20 CY (75,000 lbs)	4	480	330	62,880	0.24	7.03	1.09	0.19	0.12	1,741	0.01	0.02	0.46	0.07	0.01	0.01	114.07	0.00	103.81
Process excavated soil through Soil Screening Plant																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
Mix at Soil Cement Batch Plant																				
Generator Sets > 25 and < = 50	Generator	1	8	375	131	0.50	2.03	1.91	0.14	0.11	245	0.05	0.03	0.13	0.13	0.01	0.01	16.05	0.00	14.68
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
Load/Haul/Place Soil Cement																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	2	8	211	131	1.64	12.66	5.65	0.42	0.34	2,748	0.15	0.11	0.83	0.37	0.03	0.02	179.98	0.01	164.03
Graders > 120 and < = 175	Grader - 120	1	8	135	131	0.97	6.90	5.85	0.38	0.32	991	0.09	0.06	0.45	0.38	0.02	0.02	64.93	0.01	59.24
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	131	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.05	0.52	0.18	0.02	0.01	80.22	0.00	73.12
	Truck - 250 Articulated	2	240	330	31,440	0.12	3.51	0.55	0.10	0.06	871	0.00	0.01	0.23	0.04	0.01	0.00	57.03	0.00	51.91
Spread Fill Material																				
Dozers > 250 and < = 500	Dozer - D9	1	8	410	131	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.15	1.17	0.61	0.05	0.04	138.79	0.01	126.64
Compact Soil																				
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	131	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.05	0.52	0.18	0.02	0.01	80.22	0.00	73.12
Water Truck	3,000 gal water truck	1	8	230	131	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.06	0.45	0.19	0.02	0.01	87.27	0.01	79.56
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	22	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.02	0.12	0.07	0.01	0.01	11.39	0.00	10.41
Water Truck	3,000 gal water truck	1	8	230	22	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.01	0.08	0.03	0.00	0.00	14.66	0.00	13.36
Total						**32.63**	**276.90**	**128.35**	**10.74**	**8.72**	**48,069.06**	**2.94**	**2.04**	**18.31**	**7.86**	**0.68**	**0.55**	**3,234.63**	**0.18**	**2,948.01**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	1.09	0.00	0.99
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.03**	**0.21**	**0.12**	**0.01**	**0.01**	**34.77**	**0.00**	**31.70**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	50	16.8	840	131	110,040	0.07	0.64	1.50	0.11	0.06	586	0.05	0.00	0.04	0.10	0.01	0.00	38.38	0.00	35.01

Note: Assumes a total of 25 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**34.53**	**284.44**	**136.63**	**11.34**	**9.19**	**49,479.03**	**3.16**								
Maximum Annual Emissions								**2.20**	**19.08**	**8.55**	**0.73**	**0.59**	**3,374.55**	**0.19**	**3,075.78**

Phase 5B - Soil Cement Alternative - 2017

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons per phase) VOC	NOX	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	240	1.84	6.90	6.78	0.49	0.41	824	0.17	0.22	0.83	0.81	0.06	0.05	98.88	0.02	90.49
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.22**	**0.83**	**0.81**	**0.06**	**0.05**	**98.88**	**0.02**	**90.49**
Remove Rip-Rap																				
Excavators > 250 and < = 500	Excavator - 3.5 CY	1	8	384	240	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.14	0.98	0.47	0.04	0.03	224.39	0.01	204.52
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
Dozers < = 175	Dozer - D6	1	8	145	240	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.18	1.26	0.79	0.07	0.06	124.30	0.02	113.52
	Highway Truck (25,000 lbs)	10	1,200	330	288,000	0.07	0.40	3.19	0.12	0.05	1,069	0.08	0.07	2.11	0.33	0.06	0.04	522.45	0.00	475.47
Excavation (for placement of soil cement)																				
Load and haul with scrapers, dozer																				
Scrapers > 250 < = 500	CAT 627 Scraper	4	8	330	240	8.76	70.99	32.34	2.72	2.29	10,286	0.79	1.05	8.52	3.88	0.33	0.27	1,234.29	0.09	1,125.62
Dozers > 250 and < = 500	Dozer - D8	1	8	310	240	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.27	2.15	1.12	0.09	0.07	254.28	0.02	232.01
	Pickup Truck	1	120	330	28,800	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.04	0.00	0.00	12.82	0.00	11.69
Soil Cement																				
Excavate/Load/Haul from Borrow site to Soil Screening Plant																				
Dozers < = 175	Dozer - D6	1	8	145	240	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.18	1.26	0.79	0.07	0.06	124.30	0.02	113.52
Tractors/Loaders/Backhoes > 250 and < = 500	Loader 980	1	8	349	240	1.59	11.27	5.57	0.40	0.32	2,759	0.14	0.19	1.35	0.67	0.05	0.04	331.06	0.02	301.70
Water Truck	3,000 gal water truck	1	8	230	240	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.11	0.83	0.35	0.03	0.02	159.88	0.01	145.75
	Truck - 250 Articulated	14	1,680	330	403,200	0.84	24.60	3.82	0.67	0.41	6,095	0.02	0.10	2.95	0.46	0.08	0.05	731.43	0.00	665.65
Load/Haul Unsuitable Soil																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
	Truck - 20 CY (75,000 lbs)	4	480	330	115,200	0.24	7.03	1.09	0.19	0.12	1,741	0.01	0.03	0.84	0.13	0.02	0.01	208.98	0.00	190.19
Process excavated soil through Soil Screening Plant																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
Mix at Soil Cement Batch Plant																				
Generator Sets > 25 and < = 50	Generator	1	8	375	240	0.50	2.03	1.91	0.14	0.11	245	0.05	0.06	0.24	0.23	0.02	0.01	29.40	0.01	26.89
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
Load/Haul/Place Soil Cement																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	2	8	211	240	1.64	12.66	5.65	0.42	0.34	2,748	0.15	0.20	1.52	0.68	0.05	0.04	329.74	0.02	300.51
Graders > 120 and < = 175	Grader - 120	1	8	135	240	0.97	6.90	5.85	0.38	0.32	991	0.09	0.12	0.83	0.70	0.05	0.04	118.96	0.01	108.53
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	240	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.10	0.96	0.33	0.03	0.03	146.97	0.01	133.97
	Truck - 250 Articulated	2	240	330	57,600	0.12	3.51	0.55	0.10	0.06	871	0.00	0.01	0.42	0.07	0.01	0.01	104.49	0.00	95.09
Spread Fill Material																				
Dozers > 250 and < = 500	Dozer - D9	1	8	410	240	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.27	2.15	1.12	0.09	0.07	254.28	0.02	232.01
Compact Soil																				
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	240	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.10	0.96	0.33	0.03	0.03	146.97	0.01	133.97
Water Truck	3,000 gal water truck	1	8	230	240	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.11	0.83	0.35	0.03	0.02	159.88	0.01	145.75
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	22	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.02	0.12	0.07	0.01	0.01	11.39	0.00	10.41
Water Truck	3,000 gal water truck	1	8	230	22	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.01	0.08	0.03	0.00	0.00	14.66	0.00	13.36
Total						**32.63**	**276.90**	**128.35**	**10.74**	**8.72**	**48,069.06**	**2.94**	**3.71**	**33.39**	**14.31**	**1.24**	**1.00**	**5,904.36**	**0.32**	**5,381.16**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.04**	**0.49**	**0.17**	**0.02**	**0.01**	**105.52**	**0.00**	**96.09**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	50	16.8	840	240	201,600	0.07	0.64	1.50	0.11	0.06	586	0.05	0.01	0.08	0.18	0.01	0.01	70.31	0.01	64.15

Note: Assumes a total of 25 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**34.53**	**284.44**	**136.63**	**11.34**	**9.19**	**49,479.03**	**3.16**								
Maximum Annual Emissions								**3.98**	**34.79**	**15.47**	**1.33**	**1.07**	**6,179.08**	**0.35**	**5,631.88**

Phase 5B - Soil Cement Alternative - 2018

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons per phase) VOC	NOX	CO	PM10	PM2.5	CO_2	CH4	Total GHG Emissions (MT CO2e)
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	170	1.84	6.90	6.78	0.49	0.41	824	0.17	0.16	0.59	0.58	0.04	0.03	70.04	0.01	64.10
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.16**	**0.59**	**0.58**	**0.04**	**0.03**	**70.04**	**0.01**	**64.10**
Remove Rip-Rap																				
Excavators > 250 and < = 500	Excavator - 3.5 CY	1	8	384	170	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.10	0.70	0.33	0.02	0.02	158.94	0.01	144.87
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	170	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.07	0.54	0.24	0.02	0.01	116.78	0.01	106.43
Dozers < = 175	Dozer - D6	1	8	145	170	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.13	0.89	0.56	0.05	0.04	88.04	0.01	80.41
	Highway Truck (25,000 lbs)	10	1,200	330	204,000	0.07	0.40	3.19	0.12	0.05	1,069	0.08	0.05	1.49	0.23	0.04	0.02	370.07	0.00	336.79
Excavation (for placement of soil cement)																				
Load and haul with scrapers, dozer																				
Scrapers > 250 < = 500	CAT 627 Scraper	4	8	330	170	8.76	70.99	32.34	2.72	2.29	10,286	0.79	0.74	6.03	2.75	0.23	0.19	874.29	0.07	797.31
Dozers > 250 and < = 500	Dozer - D8	1	8	310	170	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.19	1.52	0.79	0.06	0.05	180.11	0.02	164.34
	Pickup Truck	1	120	330	20,400	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.03	0.00	0.00	9.08	0.00	8.28
Soil Cement																				
Excavate/Load/Haul from Borrow site to Soil Screening Plant																				
Dozers < = 175	Dozer - D6	1	8	145	170	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.13	0.89	0.56	0.05	0.04	88.04	0.01	80.41
Tractors/Loaders/Backhoes > 250 and < = 500	Loader 980	1	8	349	170	1.59	11.27	5.57	0.40	0.32	2,759	0.14	0.13	0.96	0.47	0.03	0.03	234.50	0.01	213.71
Water Truck	3,000 gal water truck	1	8	230	170	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.08	0.59	0.25	0.02	0.02	113.25	0.01	103.24
	Truck - 250 Articulated	14	1,680	330	285,600	0.84	24.60	3.82	0.67	0.41	6,095	0.02	0.07	2.09	0.33	0.06	0.03	518.09	0.00	471.51
Load/Haul Unsuitable Soil																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	170	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.07	0.54	0.24	0.02	0.01	116.78	0.01	106.43
	Truck - 20 CY (75,000 lbs)	4	480	330	81,600	0.24	7.03	1.09	0.19	0.12	1,741	0.01	0.02	0.60	0.09	0.02	0.01	148.03	0.00	134.72
Process excavated soil through Soil Screening Plant																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	170	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.07	0.54	0.24	0.02	0.01	116.78	0.01	106.43
Mix at Soil Cement Batch Plant																				-
Generator Sets > 25 and < = 50	Generator	1	8	375	170	0.50	2.03	1.91	0.14	0.11	245	0.05	0.04	0.17	0.16	0.01	0.01	20.82	0.00	19.05
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	170	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.07	0.54	0.24	0.02	0.01	116.78	0.01	106.43
Load/Haul/Place Soil Cement																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	2	8	211	170	1.64	12.66	5.65	0.42	0.34	2,748	0.15	0.14	1.08	0.48	0.04	0.03	233.56	0.01	212.86
Graders > 120 and < = 175	Grader - 120	1	8	135	170	0.97	6.90	5.85	0.38	0.32	991	0.09	0.08	0.59	0.50	0.03	0.03	84.27	0.01	76.87
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	170	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.07	0.68	0.24	0.02	0.02	104.10	0.01	94.89
	Truck - 250 Articulated	2	240	330	40,800	0.12	3.51	0.55	0.10	0.06	871	0.00	0.01	0.30	0.05	0.01	0.00	74.01	0.00	67.36
Spread Fill Material																				
Dozers > 250 and < = 500	Dozer - D9	1	8	410	170	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.19	1.52	0.79	0.06	0.05	180.11	0.02	164.34
Compact Soil																				
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	170	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.07	0.68	0.24	0.02	0.02	104.10	0.01	94.89
Water Truck	3,000 gal water truck	1	8	230	170	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.08	0.59	0.25	0.02	0.02	113.25	0.01	103.24
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	22	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.02	0.12	0.07	0.01	0.01	11.39	0.00	10.41
Water Truck	3,000 gal water truck	1	8	230	22	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.01	0.08	0.03	0.00	0.00	14.66	0.00	13.36
Total						**32.63**	**276.90**	**128.35**	**10.74**	**8.72**	**48,069.06**	**2.94**	**2.64**	**23.71**	**10.16**	**0.88**	**0.71**	**4,189.85**	**0.23**	**3,818.58**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.04**	**0.49**	**0.17**	**0.02**	**0.01**	**105.52**	**0.00**	**96.09**
Replace Santa Ana Trail																				
Install Rails																				
Welders > 25 and < = 50	Welder (enginer driven)	1	8	48	1	0.57	1.81	1.99	0.14	0.12	207.66	0.05	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.10
Tractors/Loaders/Backhoes > 250 and < = 500	Post Driver	1	8	260	1	1.59	11.27	5.57	0.40	0.32	2,758.83	0.14	0.00	0.01	0.00	0.00	0.00	1.38	0.00	1.26
	Highway Truck (25,000 lbs)	1	120	330	120	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
	Pickup Truck	1	120	330	120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.01	0.00	0.00	17.63	0.00	16.08
Replace bike path																				
Graders > 120 and < = 175	Grader - Articulated	1	8	135	4	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	1.98	0.00	1.81
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	1	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.00	0.00	0.00	0.00	0.61	0.00	0.56
Paving Equipment > 175 and < = 250	Paver - Asphalt	1	8	224	6	0.86	7.76	2.64	0.29	0.24	978	0.08	0.00	0.02	0.01	0.00	0.00	2.93	0.00	2.68
Water Truck	3,000 gal water truck	1	8	230	1	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.61
	Pickup Truck	1	120	330	720	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.29
Total						**5.85**	**44.49**	**22.65**	**1.78**	**1.45**	**8,142.38**	**0.54**	**0.02**	**0.35**	**0.12**	**0.01**	**0.01**	**97.47**	**0.00**	**88.75**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	50	16.8	840	170	142,800	0.07	0.64	1.50	0.11	0.06	586	0.05	0.01	0.05	0.13	0.01	0.00	49.80	0.00	45.44

Note: Assumes a total of 25 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**34.53**	**284.44**	**136.63**	**11.34**	**9.19**	**49,479.03**	**3.16**								
Maximum Annual Emissions								**2.85**	**25.19**	**11.16**	**0.96**	**0.77**	**4,512.69**	**0.25**	**4,112.96**

Phase 4 - Soil Cement Alternative - 2015

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons per phase) VOC	NOX	CO	PM10	PM2.5	CO_2	CH4	Total GHG Emissions (MT CO2e)
Clearing and Grubbing																				
Dozers < = 175	Dozer - D7	1	8	240	1	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.01	0.00	0.00	0.00	0.52	0.00	0.47
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	2	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.00	0.00	0.00	1.37	0.00	1.25
Dozers > 250 and < = 500	Dozer - D8	1	8	310	1	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.00	0.01	0.00	0.00	0.00	1.06	0.00	0.97
Other Construction Equipment > 120 and < = 175	Brush Chipper	1	8	174	1	0.58	4.68	4.69	0.23	0.19	852	0.05	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.39
	Highway Truck (25,000 lbs)	11	1,320	330	2,640	0.66	19.33	3.00	0.52	0.32	4,789	0.01	0.00	0.02	0.00	0.00	0.00	4.79	0.00	4.36
	Pickup Truck	1	120	330	240	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.10
Total						**5.79**	**58.75**	**26.81**	**2.30**	**1.82**	**10,276.78**	**0.48**	**0.00**	**0.04**	**0.02**	**0.00**	**0.00**	**8.27**	**0.00**	**7.54**
Bike Path																				
Tractors/Loaders/Backhoes > 50 and < = 120	Loader - 1.25 CY	1	8	95	2	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.38
Graders > 120 and < = 175	Grader - Articulated	1	8	135	2	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	0.99	0.00	0.90
	Street Sweeper	1	8	80	2	0.00	0.12	0.02	0.00	0.00	29	0.00	0.00	0.00	0.00	0.00	0.00	1.16	0.00	1.06
	Highway Truck (10,000 lbs)	1	120	330	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
Total						**1.46**	**11.60**	**8.91**	**0.63**	**0.51**	**1,869.59**	**0.13**	**0.00**	**0.02**	**0.01**	**0.00**	**0.00**	**3.22**	**0.00**	**2.93**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	1.09	0.00	0.99
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.03**	**0.21**	**0.12**	**0.01**	**0.01**	**34.77**	**0.00**	**31.70**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	60	16.8	1,008	109	109,872	0.08	0.76	1.80	0.13	0.07	703	0.06	0.00	0.04	0.10	0.01	0.00	38.32	0.00	34.96

Note: Assumes a total of 30 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**17.74**	**155.55**	**86.37**	**6.77**	**5.42**	**26,580.41**	**1.61**								
Maximum Annual Emissions								**0.04**	**0.31**	**0.25**	**0.02**	**0.01**	**84.59**	**0.01**	**77.13**

Phase 4 - Soil Cement Alternative - 2016

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons per phase) VOC	NOX	CO	PM10	PM2.5	CO_2	CH4	Total GHG Emissions (MT CO2e)
Diversion and Water Control																				
Divert and Control Water from the River at Both Ends of the Project Reach																				
Dozers < = 175	Dozer - D6 (remove)	1	8	145	10	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.01	0.05	0.03	0.00	0.00	5.18	0.00	4.73
Total						**1.48**	**10.46**	**6.62**	**0.59**	**0.51**	**1,035.81**	**0.13**	**0.01**	**0.05**	**0.03**	**0.00**	**0.00**	**5.18**	**0.00**	**4.73**
Dewatering																				
Bore/Drill Rigs > 250 and < = 500	Drill, earth auger for deep wells - 8" (7k ft-lb)	1	10	375	151	1.03	6.25	5.51	0.19	0.13	3,113	0.09	0.08	0.47	0.42	0.01	0.01	235.04	0.01	214.06
Cranes > 120 and < = 175	Crane, 30 Ton	1	10	152	151	0.86	6.10	4.78	0.35	0.29	803	0.08	0.07	0.46	0.36	0.03	0.02	60.66	0.01	55.35
Pumps > 25 and < = 50	Pump	1	24	50	151	1.84	6.90	6.78	0.49	0.41	824	0.17	0.14	0.52	0.51	0.04	0.03	62.21	0.01	56.93
	Pickup Truck	1	120	330	18,120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.02	0.00	0.00	8.07	0.00	7.36
Total						**3.74**	**19.29**	**17.39**	**1.04**	**0.83**	**4,847.43**	**0.34**	**0.28**	**1.46**	**1.31**	**0.08**	**0.06**	**365.98**	**0.03**	333.70
Excavation (for placement of soil cement)																				
Load and haul with scrapers, dozer																				
Scrapers > 250 < = 500	CAT 627 Scraper	4	8	330	151	8.76	70.99	32.34	2.72	2.29	10,286	0.79	0.66	5.36	2.44	0.21	0.17	776.57	0.06	708.20
Dozers > 250 and < = 500	Dozer - D8	1	8	310	151	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.17	1.35	0.71	0.06	0.05	159.98	0.02	145.97
	Pickup Truck	1	120	330	18,120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.02	0.00	0.00	8.07	0.00	7.36
Soil Cement																				
Excavate/Load/Haul from Borrow site to Soil Screening Plant																				
Dozers < = 175	Dozer - D6	1	8	145	151	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.11	0.79	0.50	0.04	0.04	78.20	0.01	71.42
Tractors/Loaders/Backhoes > 250 and < = 500	Loader 980	1	8	349	151	1.59	11.27	5.57	0.40	0.32	2,759	0.14	0.12	0.85	0.42	0.03	0.02	208.29	0.01	189.82
Water Truck	3,000 gal water truck	1	8	230	151	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.07	0.52	0.22	0.02	0.01	100.59	0.01	91.70
	Truck - 250 Articulated	14	1,680	330	253,680	0.84	24.60	3.82	0.67	0.41	6,095	0.02	0.06	1.86	0.29	0.05	0.03	460.19	0.00	418.81
Load/Haul Unsuitable Soil																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	151	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.06	0.48	0.21	0.02	0.01	103.73	0.01	94.54
	Truck - 20 CY (75,000 lbs)	4	480	330	72,480	0.24	7.03	1.09	0.19	0.12	1,741	0.01	0.02	0.53	0.08	0.01	0.01	131.48	0.00	119.66
Process excavated soil through Soil Screening Plant																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	151	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.06	0.48	0.21	0.02	0.01	103.73	0.01	94.54
Mix at Soil Cement Batch Plant																				
Generator Sets > 25 and < = 50	Generator	1	8	375	151	0.50	2.03	1.91	0.14	0.11	245	0.05	0.04	0.15	0.14	0.01	0.01	18.50	0.00	16.92
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	151	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.06	0.48	0.21	0.02	0.01	103.73	0.01	94.54
Load/Haul/Place Soil Cement																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	2	8	211	151	1.64	12.66	5.65	0.42	0.34	2,748	0.15	0.12	0.96	0.43	0.03	0.03	207.46	0.01	189.07
Graders > 120 and < = 175	Grader - 120	1	8	135	151	0.97	6.90	5.85	0.38	0.32	991	0.09	0.07	0.52	0.44	0.03	0.02	74.85	0.01	68.28
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	151	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.06	0.60	0.21	0.02	0.02	92.47	0.01	84.29
	Truck - 250 Articulated	2	240	330	36,240	0.12	3.51	0.55	0.10	0.06	871	0.00	0.01	0.27	0.04	0.01	0.00	65.74	0.00	59.83
Spread Fill Material																				
Dozers > 250 and < = 500	Dozer - D9	1	8	410	151	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.17	1.35	0.71	0.06	0.05	159.98	0.02	145.97
Compact Soil																				
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	151	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.06	0.60	0.21	0.02	0.02	92.47	0.01	84.29
Water Truck	3,000 gal water truck	1	8	230	151	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.07	0.52	0.22	0.02	0.01	100.59	0.01	91.70
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	22	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.02	0.12	0.07	0.01	0.01	11.39	0.00	10.41
Water Truck	3,000 gal water truck	1	8	230	22	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.01	0.08	0.03	0.00	0.00	14.66	0.00	13.36
Total						**29.06**	**251.53**	**111.83**	**9.52**	**7.75**	**42,720.80**	**2.55**	**2.04**	**17.87**	**7.83**	**0.67**	**0.54**	**3,072.67**	**0.18**	**2,800.67**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	60	16.8	1,008	151	152,208	0.08	0.76	1.80	0.13	0.07	703	0.06	0.01	0.06	0.14	0.01	0.01	53.09	0.00	48.43

Note: Assumes a total of 25 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**32.88**	**271.58**	**131.02**	**10.69**	**8.66**	**48,271.36**	**2.95**								
Maximum Annual Emissions								**2.33**	**19.38**	**9.28**	**0.75**	**0.61**	**3,491.74**	**0.21**	**3,182.81**

Phase 4 - Grouted Stone Alternative - 2015

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons per phase) VOC	NOX	CO	PM10	PM2.5	CO_2	CH4	Total GHG Emissions (MT CO2e)
Clearing and Grubbing																				
Dozers < = 175	Dozer - D7	1	8	240	1	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.01	0.00	0.00	0.00	0.52	0.00	0.47
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	2	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.00	0.00	0.00	1.37	0.00	1.25
Dozers > 250 and < = 500	Dozer - D8	1	8	310	1	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.00	0.01	0.00	0.00	0.00	1.06	0.00	0.97
Other Construction Equipment > 120 and < = 175	Brush Chipper	1	8	174	1	0.58	4.68	4.69	0.23	0.19	852	0.05	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.39
	Highway Truck (25,000 lbs)	11	1,320	330	2,640	0.66	19.33	3.00	0.52	0.32	4,789	0.01	0.00	0.02	0.00	0.00	0.00	4.79	0.00	4.36
	Pickup Truck	1	120	330	240	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.10
Total						**5.79**	**58.75**	**26.81**	**2.30**	**1.82**	**10,276.78**	**0.48**	**0.00**	**0.04**	**0.02**	**0.00**	**0.00**	**8.27**	**0.00**	**7.54**
Bike Path																				
Tractors/Loaders/Backhoes > 50 and < = 120	Loader - 1.25 CY	1	8	95	2	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.38
Graders > 120 and < = 175	Grader - Articulated	1	8	135	2	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	0.99	0.00	0.90
	Street Sweeper	1	8	80	2	0.00	0.12	0.02	0.00	0.00	29	0.00	0.00	0.00	0.00	0.00	0.00	1.16	0.00	1.06
	Highway Truck (10,000 lbs)	1	120	330	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
Total						**1.46**	**11.60**	**8.91**	**0.63**	**0.51**	**1,869.59**	**0.13**	**0.00**	**0.02**	**0.01**	**0.00**	**0.00**	**3.22**	**0.00**	**2.93**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	1.09	0.00	0.99
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.03**	**0.21**	**0.12**	**0.01**	**0.01**	**34.77**	**0.00**	**31.70**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	60	16.8	1,008	109	109,872	0.08	0.76	1.80	0.13	0.07	703	0.06	0.00	0.04	0.10	0.01	0.00	38.32	0.00	34.96

Note: Assumes a total of 30 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**17.74**	**155.55**	**86.37**	**6.77**	**5.42**	**26,580.41**	**1.61**								
Maximum Annual Emissions								**0.04**	**0.31**	**0.25**	**0.02**	**0.01**	**84.59**	**0.01**	**77.13**

Phase 4 -Grouted Stone Alternative - 2016

Off-Road Construction Equipment

						Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
Equipment Type	**Equipment Category**	**Number**	**Usage Factor (hrs/day or miles/day)**	**Power Rating (hp)**	**Total Days/VMT**	**VOC**	**NOX**	**CO**	**PM10**	**PM2.5**	**CO2**	**CH4**	**VOC**	**NOX**	**CO**	**PM10**	**PM2.5**	**CO_2**	**CH4**	**Total GHG Emissions (MT CO2e)**
Diversion and Water Control																				
Divert and Control Water from the River at Both Ends of the Project Reach																				
Dozers < = 175	Dozer - D6 (remove)	1	8	145	10	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.01	0.05	0.03	0.00	0.00	5.18	0.00	4.73
Total						**1.48**	**10.46**	**6.62**	**0.59**	**0.51**	**1,035.81**	**0.13**	**0.01**	**0.05**	**0.03**	**0.00**	**0.00**	**5.18**	**0.00**	**4.73**
Dewatering																				
Bore/Drill Rigs > 250 and < = 500	Drill, earth auger for deep wells - 8" (7k ft-lb)	1	10	375	151	1.03	6.25	5.51	0.19	0.13	3,113	0.09	0.08	0.47	0.42	0.01	0.01	235.04	0.01	214.06
Cranes > 120 and < = 175	Crane, 30 Ton	1	10	152	151	0.86	6.10	4.78	0.35	0.29	803	0.08	0.07	0.46	0.36	0.03	0.02	60.66	0.01	55.35
Pumps > 25 and < = 50	Pump	1	24	50	151	1.84	6.90	6.78	0.49	0.41	824	0.17	0.14	0.52	0.51	0.04	0.03	62.21	0.01	56.93
	Pickup Truck	1	120	330	18,120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.02	0.00	0.00	8.07	0.00	7.36
Total						**3.74**	**19.29**	**17.39**	**1.04**	**0.83**	**4,847.43**	**0.34**	**0.28**	**1.46**	**1.31**	**0.08**	**0.06**	**365.98**	**0.03**	**333.70**
Load/Haul/Place Grouted Stone																				
Scrapers > 250 < = 500	CAT 627 Scraper	1	8	330	151	2.19	17.75	8.09	0.68	0.57	2,571	0.20	0.17	1.34	0.61	0.05	0.04	194.14	0.01	177.05
Dozers > 250 and < = 500	Dozer - D8	1	8	310	151	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.17	1.35	0.71	0.06	0.05	159.98	0.02	145.97
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	151	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.06	0.48	0.21	0.02	0.01	103.73	0.01	94.54
Graders > 120 and < = 175	Grader - 120	1	8	135	151	0.97	6.90	5.85	0.38	0.32	991	0.09	0.07	0.52	0.44	0.03	0.02	74.85	0.01	68.28
Pumps > 175 and < = 250	Concrete pump	1	8	210	151	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.06	0.72	0.24	0.02	0.02	121.63	0.01	110.82
Water Truck	3,000 gal water truck	1	8	230	151	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.07	0.52	0.22	0.02	0.01	100.59	0.01	91.70
	Truck - 250 Articulated	1	120	330	18,120	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.13	0.02	0.00	0.00	32.87	0.00	29.91
Haul away excess																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	151	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.06	0.48	0.21	0.02	0.01	103.73	0.01	94.54
	Belly Dump Truck	1	120	330	18,120	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.13	0.02	0.00	0.00	32.87	0.00	29.91
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	7	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.01	0.04	0.02	0.00	0.00	3.63	0.00	3.31
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Total						**11.33**	**92.58**	**45.07**	**3.63**	**3.02**	**14,611.81**	**1.01**	**0.68**	**5.74**	**2.72**	**0.21**	**0.18**	**932.68**	**0.06**	**850.29**

On Road Construction Emissions

						Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
	Total Trips	**Distance**	**Average Daily Mileage**	**Calculated Time - Rounded (days)**	**Total Mileage**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO2**	**CH_4**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO_2**	**CH_4**	**Total GHG Emissions (MT CO2e)**
Worker Trips	60	16.8	1,008	151	152,208	0.08	0.76	1.80	0.13	0.07	703	0.06	0.01	0.06	0.14	0.01	0.01	53.09	0.00	48.43

Note: Assumes a total of 25 workers per day.

	Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
Total	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO2**	**CH_4**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO_2**	**CH_4**	**Total GHG Emissions (MT CO2e)**
Maximum Daily Emissions	**15.15**	**112.64**	**64.26**	**4.80**	**3.92**	**20,162.37**	**1.42**								
Maximum Annual Emissions								**0.98**	**7.30**	**4.20**	**0.31**	**0.25**	**1,356.93**	**0.09**	**1,237.16**

BNSF Bridge - 2016

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons) VOC	NOX	CO	PM10	PM2.5	CO_2	CH4	Total GHG Emissions (MT CO2e)
Clearing and Grubbing																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	2	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.00	0.00	0.00	1.37	0.00	1.25
Dozers > 250 and < = 500	Dozer - D8	1	8	310	1	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.00	0.01	0.00	0.00	0.00	1.06	0.00	0.97
	Highway Truck (25,000 lbs)	2	240	330	480	0.12	3.51	0.55	0.10	0.06	871	0.00	0.00	0.00	0.00	0.00	0.00	0.87	0.00	0.79
	Pickup Truck	1	120	330	240	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.10
Total						**3.18**	**27.79**	**13.03**	**1.05**	**0.86**	**4,470.49**	**0.29**	**0.00**	**0.02**	**0.01**	**0.00**	**0.00**	**3.41**	**0.00**	**3.11**
Diversion of Water and Dewatering Associated with Piers 1, 2 and 3																				
Cranes > 250 and < = 500	Crawler Crane - LS-208H	1	10	263	10	1.32	10.72	4.43	0.39	0.32	1,801	0.12	0.01	0.05	0.02	0.00	0.00	9.01	0.00	8.21
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	2	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.00	0.00	0.00	0.00	0.81	0.00	0.74
Dozers < = 175	Dozer - D4	1	8	80	2	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.01	0.01	0.00	0.00	1.04	0.00	0.95
Rollers > 175 and < = 250	Roller - BW151AD	1	8	108	2	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.01	0.00	0.00	0.00	1.22	0.00	1.12
	10-CY Dump Truck	2	240	130	960	0.12	3.51	0.55	0.10	0.06	871	0.00	0.00	0.01	0.00	0.00	0.00	1.74	0.00	1.58
	Pickup Truck	1	120	330	360	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.15
Total						**4.40**	**37.16**	**19.37**	**1.59**	**1.31**	**5,850.25**	**0.40**	**0.01**	**0.08**	**0.04**	**0.00**	**0.00**	**13.98**	**0.00**	**12.74**
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	120	1.84	6.90	6.78	0.49	0.41	824	0.17	0.11	0.41	0.41	0.03	0.02	49.44	0.01	45.25
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.11**	**0.41**	**0.41**	**0.03**	**0.02**	**49.44**	**0.01**	**45.25**
Work on Pier 1																				
Below Grade Diaphragm Wall																				
Graders > 120 and < = 175	Grader	1	10	135	1	1.22	8.62	7.31	0.48	0.40	1,239	0.11	0.00	0.00	0.00	0.00	0.00	0.62	0.00	0.57
Rollers > 175 and < = 250	Roller, 20 ton	1	10	195	1	1.04	9.96	3.46	0.33	0.28	1,531	0.09	0.00	0.00	0.00	0.00	0.00	0.77	0.00	0.70
Dozers < = 175	Dozer - D6	1	10	145	1	1.85	13.07	8.28	0.74	0.64	1,295	0.17	0.00	0.01	0.00	0.00	0.00	0.65	0.00	0.59
Excavators > 50 and < = 120	Hydraulic Excavator, PC160	1	8	110	1	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.27
Other Construction Equipment > 175 and < = 500	Low-Headroom Hydromill	1	8	375	35	0.99	8.33	3.89	0.28	0.23	2,034	0.09	0.02	0.15	0.07	0.00	0.00	35.59	0.00	32.43
Excavators > 250 and < = 500	Hydraulic Excavator, 5080	1	8	424	35	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.02	0.14	0.07	0.01	0.00	32.72	0.00	29.83
Excavators > 500 and < = 750	Hydraulic Excavator, PC1100	1	8	611	35	1.99	14.04	6.43	0.49	0.40	3,099	0.18	0.03	0.25	0.11	0.01	0.01	54.24	0.00	49.44
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	35	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.01	0.11	0.05	0.00	0.00	24.04	0.00	21.91
Dozers < = 175	Dozer - D6	1	8	145	35	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.03	0.18	0.12	0.01	0.01	18.13	0.00	16.55
Cranes > 250 and < = 500	Crane, 100 ton	1	8	350	50	1.06	8.58	3.54	0.31	0.26	1,441	0.10	0.03	0.21	0.09	0.01	0.01	36.02	0.00	32.84
Cranes > 250 and < = 500	Crane. 40 ton	1	10	350	5	1.32	10.72	4.43	0.39	0.32	1,801	0.12	0.00	0.03	0.01	0.00	0.00	4.50	0.00	4.10
Dozers > 175 and < = 250	Dozer - D7	1	10	240	1	2.10	17.08	6.07	0.71	0.60	1,835	0.19	0.00	0.01	0.00	0.00	0.00	0.92	0.00	0.84
Off-Highway Trucks Composite	Off-hwy trucks	4	8	214	35	5.81	42.63	18.66	1.47	1.20	8,322	0.52	0.10	0.75	0.33	0.03	0.02	145.63	0.01	132.76
Off-Highway Trucks Composite	Vacuum trucks	3	8	177	10	4.36	31.97	13.99	1.10	0.90	6,241	0.39	0.02	0.16	0.07	0.01	0.00	31.21	0.00	28.45
	10-CY Dump Truck	2	240	130	240	0.12	3.51	0.55	0.10	0.06	871	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.00	0.40
	Pickup Truck	1	120	130	1,200	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.53	0.00	0.49
Tiebacks for Diaphragm Walls																				
Dozers > 175 and < = 250	Dozer - D7	1	8	240	4	1.68	13.67	4.85	0.57	0.48	1,468	0.15	0.00	0.03	0.01	0.00	0.00	2.94	0.00	2.68
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	4	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.01	0.00	0.00	2.75	0.00	2.50
Bore/Drill Rigs > 175 and < = 250	Drill, Hydraulic Track	1	8	215	4	0.50	3.11	2.74	0.09	0.06	1,505	0.05	0.00	0.01	0.01	0.00	0.00	3.01	0.00	2.74
Rollers > 175 and < = 250	Roller - BW190AD-4	1	8	205	2	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.01	0.00	0.00	0.00	1.22	0.00	1.12
Off-Highway Trucks Composite	Off-hwy trucks - D250D	3	8	214	8	4.36	31.97	13.99	1.10	0.90	6,241	0.39	0.02	0.13	0.06	0.00	0.00	24.96	0.00	22.76
Water Truck	Water Truck	1	8	230	2	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.01	0.00	0.00	0.00	1.33	0.00	1.21
	Pickup Truck	1	120	130	1,200	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.53	0.00	0.49
Total						**35.19**	**267.82**	**124.75**	**10.29**	**8.48**	**47,935.67**	**3.18**	**0.30**	**2.19**	**1.01**	**0.08**	**0.07**	**423.05**	**0.03**	**385.65**
Work on Piers 2 and 3																				
Below Grade Diaphragm Wall																				
Excavators > 250 and < = 500	Hydraulic Excavator - PC600LC	1	8	384	4	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.00	0.02	0.01	0.00	0.00	3.74	0.00	3.41
Dozers > 250 and < = 500	Dozer - D9	1	8	410	12	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.01	0.11	0.06	0.00	0.00	12.71	0.00	11.60
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	8	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.03	0.01	0.00	0.00	5.50	0.00	5.01
Cranes > 250 and < = 500	Crawler Crane - LS-208H	1	10	263	12	1.32	10.72	4.43	0.39	0.32	1,801	0.12	0.01	0.06	0.03	0.00	0.00	10.81	0.00	9.85
Graders > 120 and < = 175	Gradall - PW170ES	1	8	123	2	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	0.99	0.00	0.90
Rollers > 175 and < = 250	Roller - BW190AD-4	1	8	205	4	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.02	0.01	0.00	0.00	2.45	0.00	2.23
Off-Highway Trucks Composite	Off-hwy trucks - D250D	3	8	214	8	4.36	31.97	13.99	1.10	0.90	6,241	0.39	0.02	0.13	0.06	0.00	0.00	24.96	0.00	22.76
	Bottom Dump Trucks	4	480	130	480	0.24	7.03	1.09	0.19	0.12	1,741	0.01	0.00	0.00	0.00	0.00	0.00	0.87	0.00	0.79
	Pickup Truck	1	120	130	360	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.15
Pier Wall Extension																				
Dozers > 250 and < = 500	Dozer - D9	1	8	410	18	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.02	0.16	0.08	0.01	0.01	19.07	0.00	17.40
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	6	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.02	0.01	0.00	0.00	4.12	0.00	3.76
Excavators > 50 and < = 120	Hydraulic Excavator, PC160	1	8	110	6	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	1.77	0.00	1.61
Rollers >25 and < = 50	Roller - 5 TON	1	8	47	12	0.64	1.86	2.14	0.15	0.13	208	0.06	0.00	0.01	0.01	0.00	0.00	1.25	0.00	1.14
Pumps > 175 and < = 250	Concrete Pump	1	8	210	16	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.01	0.08	0.03	0.00	0.00	12.89	0.00	11.74
Cranes > 250 and < = 500	Crane, 100 ton	1	8	350	10	1.06	8.58	3.54	0.31	0.26	1,441	0.10	0.01	0.04	0.02	0.00	0.00	7.20	0.00	6.57
Water Truck	Water Truck	1	8	230	12	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.01	0.04	0.02	0.00	0.00	7.99	0.00	7.29
	Dump Trucks, 20 CY	2	240	130	720	0.12	3.51	0.55	0.10	0.06	871	0.00	0.00	0.01	0.00	0.00	0.00	1.31	0.00	1.19
	Pickup Truck	1	120	130	360	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.15
Total						**19.28**	**155.98**	**73.34**	**5.90**	**4.82**	**27,120.92**	**1.73**	**0.09**	**0.74**	**0.35**	**0.03**	**0.02**	**117.95**	**0.01**	**107.55**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	40	16.8	672	131	88,032	0.05	0.51	1.20	0.09	0.05	469	0.04	0.00	0.03	0.08	0.01	0.00	30.70	0.00	28.01

Note: Assumes a total of 20 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**56.36**	**431.20**	**206.06**	**16.77**	**13.75**	**76,349.38**	**5.12**								
Maximum Annual Emissions								**0.51**	**3.48**	**1.89**	**0.15**	**0.12**	**638.53**	**0.05**	**582.31**

Note: Maximum daily emissions are based on overlapping activities for dewatering and work on Piers 1, 2, and 3.

BNSF Bridge - 2017

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons) VOC	NOX	CO	PM10	PM2.5	CO_2	CH4	Total GHG Emissions (MT CO2e)
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	240	1.84	6.90	6.78	0.49	0.41	824	0.17	0.22	0.83	0.81	0.06	0.05	98.88	0.02	90.49
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.22**	**0.83**	**0.81**	**0.06**	**0.05**	**98.88**	**0.02**	**90.49**
Work on Pier 1																				
Below Grade Diaphragm Wall																				
Graders > 120 and < = 175	Grader	1	10	135	1	1.22	8.62	7.31	0.48	0.40	1,239	0.11	0.00	0.00	0.00	0.00	0.00	0.62	0.00	0.57
Rollers > 175 and < = 250	Roller, 20 ton	1	10	195	1	1.04	9.96	3.46	0.33	0.28	1,531	0.09	0.00	0.00	0.00	0.00	0.00	0.77	0.00	0.70
Dozers < = 175	Dozer - D6	1	10	145	1	1.85	13.07	8.28	0.74	0.64	1,295	0.17	0.00	0.01	0.00	0.00	0.00	0.65	0.00	0.59
Excavators > 50 and < = 120	Hydraulic Excavator, PC160	1	8	110	1	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.27
Other Construction Equipment > 175 and < = 500	Low-Headroom Hydromill	1	8	375	35	0.99	8.33	3.89	0.28	0.23	2,034	0.09	0.02	0.15	0.07	0.00	0.00	35.59	0.00	32.43
Excavators > 250 and < = 500	Hydraulic Excavator, 5080	1	8	424	35	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.02	0.14	0.07	0.01	0.00	32.72	0.00	29.83
Excavators > 500 and < = 750	Hydraulic Excavator, PC1100	1	8	611	35	1.99	14.04	6.43	0.49	0.40	3,099	0.18	0.03	0.25	0.11	0.01	0.01	54.24	0.00	49.44
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	35	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.01	0.11	0.05	0.00	0.00	24.04	0.00	21.91
Dozers < = 175	Dozer - D6	1	8	145	35	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.03	0.18	0.12	0.01	0.01	18.13	0.00	16.55
Cranes > 250 and < = 500	Crane, 100 ton	1	8	350	50	1.06	8.58	3.54	0.31	0.26	1,441	0.10	0.03	0.21	0.09	0.01	0.01	36.02	0.00	32.84
Cranes > 250 and < = 500	Crane. 40 ton	1	10	350	5	1.32	10.72	4.43	0.39	0.32	1,801	0.12	0.00	0.03	0.01	0.00	0.00	4.50	0.00	4.10
Dozers > 175 and < = 250	Dozer - D7	1	10	240	1	2.10	17.08	6.07	0.71	0.60	1,835	0.19	0.00	0.01	0.00	0.00	0.00	0.92	0.00	0.84
Off-Highway Trucks Composite	Off-hwy trucks	4	8	214	35	5.81	42.63	18.66	1.47	1.20	8,322	0.52	0.10	0.75	0.33	0.03	0.02	145.63	0.01	132.76
Off-Highway Trucks Composite	Vacuum trucks	3	8	177	10	4.36	31.97	13.99	1.10	0.90	6,241	0.39	0.02	0.16	0.07	0.01	0.00	31.21	0.00	28.45
	10-CY Dump Truck	2	240	130	240	0.12	3.51	0.55	0.10	0.06	871	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.00	0.40
	Pickup Truck	1	120	130	1,200	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.53	0.00	0.49
Tiebacks for Diaphragm Walls																				
Dozers > 175 and < = 250	Dozer - D7	1	8	240	4	1.68	13.67	4.85	0.57	0.48	1,468	0.15	0.00	0.03	0.01	0.00	0.00	2.94	0.00	2.68
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	4	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.01	0.00	0.00	2.75	0.00	2.50
Bore/Drill Rigs > 175 and < = 250	Drill, Hydraulic Track	1	8	215	4	0.50	3.11	2.74	0.09	0.06	1,505	0.05	0.00	0.01	0.01	0.00	0.00	3.01	0.00	2.74
Rollers > 175 and < = 250	Roller - BW190AD-4	1	8	205	2	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.01	0.00	0.00	0.00	1.22	0.00	1.12
Off-Highway Trucks Composite	Off-hwy trucks - D250D	3	8	214	8	4.36	31.97	13.99	1.10	0.90	6,241	0.39	0.02	0.13	0.06	0.00	0.00	24.96	0.00	22.76
Water Truck	Water Truck	1	8	230	2	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.01	0.00	0.00	0.00	1.33	0.00	1.21
	Pickup Truck	1	120	130	1,200	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.53	0.00	0.49
Total						**35.19**	**267.82**	**124.75**	**10.29**	**8.48**	**47,935.67**	**3.18**	**0.30**	**2.19**	**1.01**	**0.08**	**0.07**	**423.05**	**0.03**	**385.65**
Work on Piers 2 and 3																				
Below Grade Diaphragm Wall																				
Excavators > 250 and < = 500	Hydraulic Excavator - PC600LC	1	8	384	4	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.00	0.02	0.01	0.00	0.00	3.74	0.00	3.41
Dozers > 250 and < = 500	Dozer - D9	1	8	410	12	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.01	0.11	0.06	0.00	0.00	12.71	0.00	11.60
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	8	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.03	0.01	0.00	0.00	5.50	0.00	5.01
Cranes > 250 and < = 500	Crawler Crane - LS-208H	1	10	263	12	1.32	10.72	4.43	0.39	0.32	1,801	0.12	0.01	0.06	0.03	0.00	0.00	10.81	0.00	9.85
Graders > 120 and < = 175	Gradall - PW170ES	1	8	123	2	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	0.99	0.00	0.90
Rollers > 175 and < = 250	Roller - BW190AD-4	1	8	205	4	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.02	0.01	0.00	0.00	2.45	0.00	2.23
Off-Highway Trucks Composite	Off-hwy trucks - D250D	3	8	214	8	4.36	31.97	13.99	1.10	0.90	6,241	0.39	0.02	0.13	0.06	0.00	0.00	24.96	0.00	22.76
	Bottom Dump Trucks	4	480	130	480	0.24	7.03	1.09	0.19	0.12	1,741	0.01	0.00	0.00	0.00	0.00	0.00	0.87	0.00	0.79
	Pickup Truck	1	120	130	360	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.15
Pier Wall Extension																				
Dozers > 250 and < = 500	Dozer - D9	1	8	410	18	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.02	0.16	0.08	0.01	0.01	19.07	0.00	17.40
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	6	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.02	0.01	0.00	0.00	4.12	0.00	3.76
Excavators > 50 and < = 120	Hydraulic Excavator, PC160	1	8	110	6	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	1.77	0.00	1.61
Rollers >25 and < = 50	Roller - 5 TON	1	8	47	12	0.64	1.86	2.14	0.15	0.13	208	0.06	0.00	0.01	0.01	0.00	0.00	1.25	0.00	1.14
Pumps > 175 and < = 250	Concrete Pump	1	8	210	16	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.01	0.08	0.03	0.00	0.00	12.89	0.00	11.74
Cranes > 250 and < = 500	Crane, 100 ton	1	8	350	10	1.06	8.58	3.54	0.31	0.26	1,441	0.10	0.01	0.04	0.02	0.00	0.00	7.20	0.00	6.57
Water Truck	Water Truck	1	8	230	12	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.01	0.04	0.02	0.00	0.00	7.99	0.00	7.29
	Dump Trucks, 20 CY	2	240	130	720	0.12	3.51	0.55	0.10	0.06	871	0.00	0.00	0.01	0.00	0.00	0.00	1.31	0.00	1.19
	Pickup Truck	1	120	130	360	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.15
Total						**19.28**	**155.98**	**73.34**	**5.90**	**4.82**	**27,120.92**	**1.73**	**0.09**	**0.74**	**0.35**	**0.03**	**0.02**	**117.95**	**0.01**	**107.55**
Diversion of Water and Dewatering Associated with Piers 4, 5, and 6																				
Dozers > 250 and < = 500	Dozer - D9	1	8	410	3	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.00	0.03	0.01	0.00	0.00	3.18	0.00	2.90
Cranes > 250 and < = 500	Crawler Crane - LS-208H	1	10	263	10	1.32	10.72	4.43	0.39	0.32	1,801	0.12	0.01	0.05	0.02	0.00	0.00	9.01	0.00	8.21
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	2	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.00	0.00	0.00	0.00	0.81	0.00	0.74
Dozers < = 175	Dozer - D4	1	8	80	2	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.01	0.01	0.00	0.00	1.04	0.00	0.95
Rollers > 175 and < = 250	Roller - BW151AD	1	8	108	2	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.01	0.00	0.00	0.00	1.22	0.00	1.12
	10-CY Dump Truck	2	240	130	960	0.12	3.51	0.55	0.10	0.06	871	0.00	0.00	0.01	0.00	0.00	0.00	1.74	0.00	1.58
	Pickup Truck	1	120	330	360	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.15
Total						**6.63**	**55.07**	**28.71**	**2.32**	**1.93**	**7,969.23**	**0.60**	**0.01**	**0.11**	**0.05**	**0.00**	**0.00**	**17.16**	**0.00**	**15.64**
Work on Pier 4																				
Below Grade Diaphragm Wall																				
Excavators > 250 and < = 500	Hydraulic Excavator - PC600LC	1	8	384	2	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.00	0.01	0.00	0.00	0.00	1.87	0.00	1.70
Dozers > 250 and < = 500	Dozer - D9	1	8	410	6	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.01	0.05	0.03	0.00	0.00	6.36	0.00	5.80
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	4	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.01	0.00	0.00	2.75	0.00	2.50
Cranes > 250 and < = 500	Crawler Crane - LS-208H	1	10	263	5	1.32	10.72	4.43	0.39	0.32	1,801	0.12	0.00	0.03	0.01	0.00	0.00	4.50	0.00	4.10
Graders > 120 and < = 175	Gradall - PW170ES	1	8	123	1	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.45
Rollers > 175 and < = 250	Roller - BW190AD-4	1	8	205	2	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.01	0.00	0.00	0.00	1.22	0.00	1.12
Off-Highway Trucks Composite	Off-hwy trucks - D250D	3	8	214	4	4.36	31.97	13.99	1.10	0.90	6,241	0.39	0.01	0.06	0.03	0.00	0.00	12.48	0.00	11.38
	Bottom Dump Trucks	4	480	130	480	0.24	7.03	1.09	0.19	0.12	1,741	0.01	0.00	0.00	0.00	0.00	0.00	0.87	0.00	0.79
	Pickup Truck	1	120	130	360	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.15
Pier Wall Extension																				
Dozers > 250 and < = 500	Dozer - D9	1	8	410	9	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.01	0.08	0.04	0.00	0.00	9.54	0.00	8.70
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	3	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.00	0.00	0.00	2.06	0.00	1.88
Excavators > 50 and < = 120	Hydraulic Excavator, PC160	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Rollers >25 and < = 50	Roller - 5 TON	1	8	47	6	0.64	1.86	2.14	0.15	0.13	208	0.06	0.00	0.01	0.01	0.00	0.00	0.62	0.00	0.57
Pumps > 175 and < = 250	Concrete Pump	1	8	210	8	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.00	0.04	0.01	0.00	0.00	6.44	0.00	5.87
Cranes > 250 and < = 500	Crane, 100 ton	1	8	350	5	1.06	8.58	3.54	0.31	0.26	1,441	0.10	0.00	0.02	0.01	0.00	0.00	3.60	0.00	3.28
Water Truck	Water Truck	1	8	230	6	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.00	0.00	3.64
	Dump Trucks, 20 CY	2	240	130	720	0.12	3.51	0.55	0.10	0.06	871	0.00	0.00	0.01	0.00	0.00	0.00	1.31	0.00	1.19
	Pickup Truck	1	120	130	360	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.15
Total						**19.28**	**155.98**	**73.34**	**5.90**	**4.82**	**27,120.92**	**1.73**	**0.05**	**0.37**	**0.17**	**0.01**	**0.01**	**59.32**	**0.00**	**54.09**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	40	16.8	672	131	88,032	0.05	0.51	1.20	0.09	0.05	469	0.04	0.00	0.03	0.08	0.01	0.00	30.70	0.00	28.01

Note: Assumes a total of 20 workers per day.

Total	ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**56.36**	**431.20**	**206.06**	**16.77**	**13.75**	**76,349.38**	**5.12**								
Maximum Annual Emissions								**0.67**	**4.27**	**2.48**	**0.19**	**0.16**	**747.07**	**0.06**	**681.44**

Note: Maximum daily emissions are based on overlapping activities for dewatering and work on Piers 1, 2, and 3.

BNSF Bridge - 2018

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons) VOC	NOX	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	130	1.84	6.90	6.78	0.49	0.41	824	0.17	0.12	0.45	0.44	0.03	0.03	53.56	0.01	49.02
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.12**	**0.45**	**0.44**	**0.03**	**0.03**	**53.56**	**0.01**	**49.02**
Work on Pier 5																				
Below Grade Diaphragm Wall																				
Excavators > 250 and < = 500	Hydraulic Excavator - PC600LC	1	8	384	2	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.00	0.01	0.00	0.00	0.00	1.87	0.00	1.70
Dozers > 250 and < = 500	Dozer - D9	1	8	410	6	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.01	0.05	0.03	0.00	0.00	6.36	0.00	5.80
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	4	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.01	0.00	0.00	2.75	0.00	2.50
Cranes > 250 and < = 500	Crawler Crane - LS-208H	1	10	263	5	1.32	10.72	4.43	0.39	0.32	1,801	0.12	0.00	0.03	0.01	0.00	0.00	4.50	0.00	4.10
Graders > 120 and < = 175	Gradall - PW170ES	1	8	123	1	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.45
Rollers > 175 and < = 250	Roller - BW190AD-4	1	8	205	2	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.01	0.00	0.00	0.00	1.22	0.00	1.12
Off-Highway Trucks Composite	Off-hwy trucks - D250D	3	8	214	4	4.36	31.97	13.99	1.10	0.90	6,241	0.39	0.01	0.06	0.03	0.00	0.00	12.48	0.00	11.38
	Bottom Dump Trucks	4	480	130	480	0.24	7.03	1.09	0.19	0.12	1,741	0.01	0.00	0.00	0.00	0.00	0.00	0.87	0.00	0.79
	Pickup Truck	1	120	130	360	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.15
Pier Wall Extension																				
Dozers > 250 and < = 500	Dozer - D9	1	8	410	9	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.01	0.08	0.04	0.00	0.00	9.54	0.00	8.70
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	3	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.00	0.00	0.00	2.06	0.00	1.88
Excavators > 50 and < = 120	Hydraulic Excavator, PC160	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Rollers >25 and < = 50	Roller - 5 TON	1	8	47	6	0.64	1.86	2.14	0.15	0.13	208	0.06	0.00	0.01	0.01	0.00	0.00	0.62	0.00	0.57
Pumps > 175 and < = 250	Concrete Pump	1	8	210	8	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.00	0.04	0.01	0.00	0.00	6.44	0.00	5.87
Cranes > 250 and < = 500	Crane, 100 ton	1	8	350	5	1.06	8.58	3.54	0.31	0.26	1,441	0.10	0.00	0.02	0.01	0.00	0.00	3.60	0.00	3.28
Water Truck	Water Truck	1	8	230	6	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.00	0.00	3.64
	Dump Trucks, 20 CY	2	240	130	720	0.12	3.51	0.55	0.10	0.06	871	0.00	0.00	0.01	0.00	0.00	0.00	1.31	0.00	1.19
	Pickup Truck	1	120	130	240	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.10
Total						**19.28**	**155.98**	**73.34**	**5.90**	**4.82**	**27,120.92**	**1.73**	**0.05**	**0.37**	**0.17**	**0.01**	**0.01**	**59.27**	**0.00**	**54.04**
Work on Pier 6																				
Below Grade Diaphragm Wall																				
Graders > 120 and < = 175	Grader	1	10	135	1	1.22	8.62	7.31	0.48	0.40	1,239	0.11	0.00	0.00	0.00	0.00	0.00	0.62	0.00	0.57
Rollers > 175 and < = 250	Roller, 20 ton	1	10	195	1	1.04	9.96	3.46	0.33	0.28	1,531	0.09	0.00	0.00	0.00	0.00	0.00	0.77	0.00	0.70
Dozers < = 175	Dozer - D6	1	10	145	1	1.85	13.07	8.28	0.74	0.64	1,295	0.17	0.00	0.01	0.00	0.00	0.00	0.65	0.00	0.59
Excavators > 50 and < = 120	Hydraulic Excavator, PC160	1	8	110	1	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.27
Other Construction Equipment > 175 and < = 500	Low-Headroom Hydromill	1	8	375	33	0.99	8.33	3.89	0.28	0.23	2,034	0.09	0.02	0.14	0.06	0.00	0.00	33.56	0.00	30.58
Excavators > 250 and < = 500	Hydraulic Excavator, 5080	1	8	424	33	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.02	0.14	0.06	0.00	0.00	30.85	0.00	28.12
Excavators > 500 and < = 750	Hydraulic Excavator, PC1100	1	8	611	33	1.99	14.04	6.43	0.49	0.40	3,099	0.18	0.03	0.23	0.11	0.01	0.01	51.14	0.00	46.61
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	33	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.01	0.10	0.05	0.00	0.00	22.67	0.00	20.66
Dozers < = 175	Dozer - D6	1	8	145	33	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.02	0.17	0.11	0.01	0.01	17.09	0.00	15.61
Cranes > 250 and < = 500	Crane, 100 ton	1	8	350	50	1.06	8.58	3.54	0.31	0.26	1,441	0.10	0.03	0.21	0.09	0.01	0.01	36.02	0.00	32.84
Cranes > 250 and < = 500	Crane, 40 ton	1	10	350	5	1.32	10.72	4.43	0.39	0.32	1,801	0.12	0.00	0.03	0.01	0.00	0.00	4.50	0.00	4.10
Dozers > 175 and < = 250	Dozer - D7	1	10	240	1	2.10	17.08	6.07	0.71	0.60	1,835	0.19	0.00	0.01	0.00	0.00	0.00	0.92	0.00	0.84
Off-Highway Trucks Composite	Off-hwy trucks	4	8	214	35	5.81	42.63	18.66	1.47	1.20	8,322	0.52	0.10	0.75	0.33	0.03	0.02	145.63	0.01	132.76
Off-Highway Trucks Composite	Vacuum trucks	3	8	177	10	4.36	31.97	13.99	1.10	0.90	6,241	0.39	0.02	0.16	0.07	0.01	0.00	31.21	0.00	28.45
	10-CY Dump Truck	2	240	130	240	0.12	3.51	0.55	0.10	0.06	871	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.00	0.40
	Pickup Truck	1	120	130	1,200	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.53	0.00	0.49
Tiebacks for Diaphragm Walls																				
Dozers > 175 and < = 250	Dozer - D7	1	8	240	6	1.68	13.67	4.85	0.57	0.48	1,468	0.15	0.01	0.04	0.01	0.00	0.00	4.40	0.00	4.02
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	6	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.02	0.01	0.00	0.00	4.12	0.00	3.76
Bore/Drill Rigs > 175 and < = 250	Drill, Hydraulic Track	1	8	215	5	0.50	3.11	2.74	0.09	0.06	1,505	0.05	0.00	0.01	0.01	0.00	0.00	3.76	0.00	3.43
Rollers > 175 and < = 250	Roller - BW190AD-4	1	8	205	2	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.01	0.00	0.00	0.00	1.22	0.00	1.12
Off-Highway Trucks Composite	Off-hwy trucks - D250D	3	8	214	10	4.36	31.97	13.99	1.10	0.90	6,241	0.39	0.02	0.16	0.07	0.01	0.01	31.21	0.00	28.45
Water Truck	Water Truck	1	8	230	2	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.01	0.00	0.00	0.00	1.33	0.00	1.21
	Pickup Truck	1	120	130	360	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.15
Total						**35.19**	**267.82**	**124.75**	**10.29**	**8.48**	**47,935.67**	**3.18**	**0.30**	**2.20**	**1.01**	**0.08**	**0.07**	**423.09**	**0.03**	**385.70**
Widening Low-Flow Channel																				
Dozers > 250 and < = 500	Dozer - D9	2	8	410	10	4.47	35.81	18.69	1.46	1.25	4,238	0.40	0.02	0.18	0.09	0.01	0.01	21.19	0.00	19.33
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	5	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.02	0.01	0.00	0.00	3.43	0.00	3.13
Off-Highway Trucks Composite	Off-hwy trucks - D250D	3	8	214	5	4.36	31.97	13.99	1.10	0.90	6,241	0.39	0.01	0.08	0.03	0.00	0.00	15.60	0.00	14.22
	Pickup Truck	1	120	130	240	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.10
24" Grouted Stone																				
Graders > 120 and < = 175	Gradall - PW170ES	1	8	123	9	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.03	0.03	0.00	0.00	4.46	0.00	4.07
Excavators > 250 and < = 500	Hydraulic Excavator - PC600LC	1	8	384	15	0.00	0.12	0.02	0.00	0.00	29	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.02
Pumps > 50 and < = 120	Concrete Pump 50 CY/HR	1	8	110	11	0.68	4.96	3.87	0.36	0.29	624	0.06	0.00	0.03	0.02	0.00	0.00	3.43	0.00	3.13
	10-CY Dump Truck	8	960	400	14,400	0.48	14.06	2.18	0.38	0.24	3,483	0.01	0.00	0.11	0.02	0.00	0.00	26.12	0.00	23.77
	Pickup Truck	1	120	130	600	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.27	0.00	0.24
6" Bedding Stone under the 24" Grouted Stone																				
Graders > 120 and < = 175	Gradall - PW170ES (Hyd Excvtr)	1	8	123	2	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	0.99	0.00	0.90
	Dump Trucks, 20 TON	6	720	400	1,440	0.36	10.54	1.64	0.29	0.18	2,612	0.01	0.00	0.01	0.00	0.00	0.00	2.61	0.00	2.38
	Pickup Truck	1	120	130	120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
Replace Concrete Golf Cart Path																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe/Loader	1	8	67	3	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.00	0.00	0.00	0.00	0.62	0.00	0.57
Pumps > 175 and < = 250	Concrete Pump	1	8	210	1	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.00	0.00	0.00	0.00	0.00	0.81	0.00	0.73
	10-CY Dump Truck	2	240	265	2	0.12	3.51	0.55	0.10	0.06	871	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Pickup Truck	1	120	130	120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
Replace CMU Block																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe/Loader	1	8	67	2	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.38
	10-CY Dump Truck	1	120	265	1,800	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.01	0.00	0.00	0.00	3.27	0.00	2.97
	Pickup Truck	1	120	130	120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
5-ft deep Cut-off Wall																				
Excavators > 50 and < = 120	Hydraulic Excavator, PC160	1	8	110	2	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.00	0.00	0.00	0.00	0.59	0.00	0.54
Pumps > 50 and < = 120	Concrete Pump 50 CY/HR	1	8	110	11	0.68	4.96	3.87	0.36	0.29	624	0.06	0.00	0.03	0.02	0.00	0.00	3.43	0.00	3.13
	10-CY Dump Truck	2	240	265	3,600	0.12	3.51	0.55	0.10	0.06	871	0.00	0.00	0.03	0.00	0.00	0.00	6.53	0.00	5.94
	Pickup Truck	1	120	130	120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
AC for Maintenance Road																				
Graders > 120 and < = 175	Grader	1	10	135	4	1.22	8.62	7.31	0.48	0.40	1,239	0.11	0.00	0.02	0.01	0.00	0.00	2.48	0.00	2.26
Rollers >50 and < = 120	Roller, 10 TON	1	10	78	4	0.80	5.11	3.97	0.42	0.35	590	0.07	0.00	0.01	0.01	0.00	0.00	1.18	0.00	1.08
Pavers Composite	Asphalt Finisher	1	10	158	1	1.27	7.13	5.13	0.49	0.42	779	0.11	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.36
Water Truck	Water Truck	1	8	230	1	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.61
	10-CY Dump Truck	3	360	265	360	0.18	5.27	0.82	0.14	0.09	1,306	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
	3.600 gal Asphalt Distribution Truck	1	120	265	120	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.20
	Pickup Truck	1	120	130	120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
3.5 ft Concrete flood wall																				
Excavators > 50 and < = 120	Hydraulic Excavator, PC160	1	8	110	2	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.00	0.00	0.00	0.00	0.59	0.00	0.54
Tractors/Loaders/Backhoes > 120 < = 175	Loader 924	1	8	128	2	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.00	0.00	0.00	0.00	0.81	0.00	0.74
Rollers >25 and < = 50	Roller - 5 TON	1	8	47	1	0.64	1.86	2.14	0.15	0.13	208	0.06	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.10
Pumps > 175 and < = 250	Concrete Pump	1	8	210	1	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.00	0.00	0.00	0.00	0.00	0.81	0.00	0.73
Water Truck	Water Truck	1	8	230	1	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.61
	Pickup Truck	1	120	130	120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
Landscape and Irrigation																				
Off-Highway Tractors	Agricultural Tractor	1	8	81	1	1.44	8.44	5.59	0.71	0.61	750	0.13	0.00	0.00	0.00	0.00	0.00	0.37	0.00	0.34
Trenchers	Trencher, Chain Type	1	8	18	30	0.32	2.01	1.08	0.07	0.07	263	0.03	0.00	0.03	0.02	0.00	0.00	3.95	0.00	3.61
Water Truck	Water Truck - Hydroseeding	1	8	230	2	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.01	0.00	0.00	0.00	1.33	0.00	1.21
	Pickup Truck	1	120	130	120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
Total						**27.33**	**230.31**	**122.70**	**10.30**	**8.25**	**39,952.66**	**2.43**	**0.07**	**0.64**	**0.31**	**0.03**	**0.02**	**108.50**	**0.01**	**98.88**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	40	16.8	672	130	87,360	0.05	0.51	1.20	0.09	0.05	469	0.04	0.00	0.03	0.08	0.01	0.00	30.47	0.00	27.80

Note: Assumes a total of 20 workers per day.

Total	ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**56.36**	**431.20**	**206.06**	**16.77**	**13.75**	**76,349.38**	**5.12**								
Maximum Annual Emissions								**0.53**	**3.69**	**2.01**	**0.16**	**0.13**	**674.89**	**0.05**	**615.44**

Note: Maximum daily emissions are based on overlapping activities for dewatering and work on Piers 5 and 6.

Fugitive Dust Summary

Phase 5A - Grouted Stone and Sheet Pile Alternative

	PM10	PM2.5
Daily	86.00	21.14
2015	5.63	1.38
2016	10.32	2.54
2017	5.59	1.37

Phase 5B - Grouted Stone Alternative

	PM10	PM2.5
Daily	142.09	29.63
2016	9.31	1.94
2017	17.05	3.56
2018	9.24	1.93

Phase 5A - Soil Cement and Sheet Pile Alternative

	PM10	PM2.5
Daily	72.95	19.14
2015	4.78	1.25
2016	8.75	2.30
2017	6.24	1.64

Phase 5B - Soil Cement Alternative

	PM10	PM2.5
Daily	132.97	27.45
2016	8.71	1.80
2017	15.96	3.29
2018	11.30	2.33

Phase 4 - Soil Cement Alternative

	PM10	PM2.5
Daily	100.45	23.25
2015	6.58	1.52
2016	7.58	1.76

BNSF Bridge

	PM10	PM2.5
Daily	69.78	18.68
2016	4.19	1.12
2016	8.37	2.24
2018	4.54	1.21

Phase 4 - Grouted Stone Alternative

	PM10	PM2.5
Daily	69.80	18.68
2015	4.57	1.22
2016	5.27	1.41

Fugitive Dust - Unpaved Roads

Daily On-Site Construction Motor Vehicle Fugitive Particulate Matter Emissions												
				Silt Loading (g/m^2)/ Silt Content (%)[a]		Uncontrolled Emission Factors (lb/mi)[b]		Uncontrolled Emissions (lb/day)[c]			Controlled Emissions (lb/day)[f]	
Vehicle Type	No.	Mi/Veh-Day[f]	Surface Type		Vehicle Weight (tons)	PM10	PM2.5	PM10	PM2.5	Control Efficiency[d]	PM10	PM2.5
Truck	50	0.5	Unpaved	6	25	3.97E+00	2.09E-01	99.2	5.2	60%	39.7	2.1

Note: Totals may not match sum of individual values because of rounding.

[a] Unpaved surface silt content from SCAQMD CEQA Handbook, (1993) Table A9-9-D-1 for city and county roads

[b] Equations:

EF (unpaved) = k_u $(s/12)^a$ $(W/3)^b$ Ref: AP-42, Section 13.2.2, "Unpaved Rods," November 2006

Constants:

k_u =	1.5	(Particle size multiplier for PM)
	0.15	(Particle size multiplier for PM2.5)
a =	0.9	for PM10
	0.9	for PM2.5
b =	0.45	for PM10
	0.45	for PM2.5

[c] Uncontrolled emissions [lb/day] = Emission factor [lb/mi] x Number x Daily miles traveled [mi/vehicle-day]

[d] Control efficiency from watering unpaved road twice a day (55%) and limiting maximum speed to 25 mph (44%), from Table XI-A, Mitigation Measure Examples, Fugitive Dust from Construction & Demolition, http://www.aqmd.gov/ceqa/handbook/mitigation/fugitive/MM_fugitive.html

[e] Controlled emissions [lb/day] = Uncontrolled emissions [lb/day] x (1 - Control efficiency [%])

Phase 5A - Soil Cement Plant - PM-10 Emissions

Maximum Quantity of Concrete Produced (yd/yr) =	20,000
Days of Operation =	480

Composition of Concrete

Material	lb/yd	ton/yr	
Soil	1,428	14,280	
Cement	491	4,910	
Cement Supplement	73	730	
Water	167	1,670	[167 = 20 gal/yd X 8.34 lb/gal]
Total Concrete Material Required	2,159	21,590	

Emissions from Concrete Batching

*water spray efficiency 60%

Process	lb/ton	controlled lb/ton	lb/yr	lb/day	tpy
Cement delivery to Silo (controlled)		0.00034	1.67		
Cement supplement delivery to silo (controlled)		0.0049	3.58		
Weigh hopper loading*	0.0024	0.00144	20.56		
Central Mix loading (controlled)		0.0048	27.07		
PM10 Emissions from Concrete Batching (lb/yr) =			52.88	0.110	0.026

Emissions from Unpaved Roads

Emission Factor of Unpaved Roads (lb/VMT) =	0.8				
# VMT/yr	-				
Abatement Efficiency (%) =	60				
PM10 Emissions from Unpaved Roads (lb/yr) =	-			0.000	0.000

Emissions from Storage Piles

Emission Factor of Storage Piles (lb/acre/day)	1.7				
Area of Storage Piles (acres) =	0				
# Days Storage Piles Exist =	231				
PM10 Emissions from Storage Piles (lb/yr) =	0			0.000	0.000
Total PM10 Emissions (lb/yr) =	52.88			0.110	0.026
Total PM10 Emissions (TPY) =	0.03				

Phase 5B - Soil Cement Plant - PM-10 Emissions

Maximum Quantity of Concrete Produced (yd/yr) =	959,000
Days of Operation per Year =	480

Composition of Concrete

Material	lb/yd	ton/yr	
Soil	1,428	684,726	
Cement	491	235,435	
Cement Supplement	73	35,004	
Water	167	80,077	[167 = 20 gal/yd X 8.34 lb/gal]
Total Concrete Material Required	2,159	1,035,241	

Emissions from Concrete Batching

*water spray efficiency 60%

Process	lb/ton	controlled lb/ton	lb/yr	lb/day	tpy
Cement delivery to Silo (controlled)		0.00034	80.05		
Cement supplement delivery to silo (controlled)		0.0049	171.52		
Weigh hopper loading*	0.0024	0.00144	986.01		
Central Mix loading (controlled)		0.0048	1298.10		
PM10 Emissions from Concrete Batching (lb/yr) =			2535.67	5.283	1.268

Emissions from Unpaved Roads

Emission Factor of Unpaved Roads (lb/VMT) =	0.8
# VMT/yr	-
Abatement Efficiency (%) =	60
PM10 Emissions from Unpaved Roads (lb/yr) =	-

0.000	0.000

Emissions from Storage Piles

Emission Factor of Storage Piles (lb/acre/day)	1.7
Area of Storage Piles (acres) =	0
# Days Storage Piles Exist =	231
PM10 Emissions from Storage Piles (lb/yr) =	0

0.000	0.000

Total PM10 Emissions (lb/yr) =	2535.67	5.283	1.268
Total PM10 Emissions (TPY) =	1.27		

Phase 4 - Soil Cement Plant - PM-10 Emissions

Maximum Quantity of Concrete Produced (yd/yr) =	45,000
Days of Operation per Year =	240

Composition of Concrete

Material	lb/yd	ton/yr	
Soil	1,428	32,130	
Cement	491	11,048	
Cement Supplement	73	1,643	
Water	167	3,758	[167 = 20 gal/yd X 8.34 lb/gal]
Total Concrete Material Required	2,159	48,578	

Emissions from Concrete Batching

*water spray efficiency 60%

Process	lb/ton	controlled lb/ton	lb/yr	lb/day	tpy
Cement delivery to Silo (controlled)		0.00034	3.76		
Cement supplement delivery to silo (controlled)		0.0049	8.05		
Weigh hopper loading*	0.0024	0.00144	46.27		
Central Mix loading (controlled)		0.0048	60.91		
PM10 Emissions from Concrete Batching (lb/yr) =			118.98	0.496	0.059

Emissions from Unpaved Roads

Emission Factor of Unpaved Roads (lb/VMT) =	0.8				
# VMT/yr	-				
Abatement Efficiency (%) =	60				
PM10 Emissions from Unpaved Roads (lb/yr) =	-			0.000	0.000

Emissions from Storage Piles

Emission Factor of Storage Piles (lb/acre/day)	1.7				
Area of Storage Piles (acres) =	0				
# Days Storage Piles Exist =	231				
PM10 Emissions from Storage Piles (lb/yr) =	0			0.000	0.000
Total PM10 Emissions (lb/yr) =	118.98			0.496	0.059
Total PM10 Emissions (TPY) =	0.06				

Fugitive Dust - Truck Loading Emissions

Truck Loading Fugitive Dust Emission Factors

$EF_D = k \times (0.0032) \times ((U/5)^{1.3})/((M/2)^{1.4})$

Variable	Amount	Units
EF (PM_{10})	0.056	lb/ton
EF ($PM_{2.5}$)	0.009	lb/ton
k (PM_{10})	0.35	factor
k ($PM_{2.5}$)	0.053	factor
U (mean wind speed)	4.92	miles/hr
M (moisture content)	12%	percent
Soil density (CalEEMod default)	1.26	tons/cy
Rip rap density	2.23	tons/cy
Derrick/Grouted stone density	1.96	tons/cy

E (lbs) = EF (lb/ton) x TP (tons)

					Unmitigated		Mitigated	
Construction Phase/Subphase	Work Days	Total Materials Moved (cy)	Total Materials Moved (tons)	Daily Materials Moved (tons/day)	Daily PM_{10} (lbs/day)	Daily $PM_{2.5}$ (lbs/day)	Daily PM_{10} (lbs/day)	Daily $PM_{2.5}$ (lbs/day)
Phase 5A (Alternative 1)								
Stone	200		17,200	86.00	4.84	0.73	1.94	0.29
Compact Backfill	200	100,300	126,796	633.98	35.71	5.41	14.28	2.16
Total							16.22	2.46
Phase 5A (Alternative 2)								
Excavate	200	20,000	25,283	126.42	7.12	1.08	2.85	0.43
Rip Rap Removal	200	850	1,893	9.47	0.53	0.08	0.21	0.03
Total							3.06	0.46
Phase 5B (Alternative 1)								
Grout Stone Fill	528	80,000	156,600	296.59	16.71	2.53	6.68	1.01
Compact Backfill	528	1,116,000	1,410,809	2,671.99	150.50	22.79	60.20	9.12
Removed Stone	528	65,000	127,238	240.98	13.57	2.06	5.43	0.82
Total							72.31	10.95
Phase 5B (Alternative 2)								
Excavate	528	959,000	1,212,335	2,296.09	129.33	19.58	51.73	7.83
RipRap Removal	528	65,000	144,788	274.22	15.45	2.34	6.18	0.94
Total							57.91	8.77
Phase 4 (Alternative 1)								
Excavate	151	160,000	202,267	1,339.51	75.45	11.42	30.18	4.57
Phase 4 (Alternative 2)								
Excavate	151	100	126	0.84	0.05	0.01	0.02	0.00

Rule 403 Control Measures	0.6	percent reduction

Earthwork Fugitive Particulate Matter Emissions

Activity	Activity Units	Daily Activity Level	Total Activity Level	PM10 Emission Factor (lb/activity)[1]	PM2.5 Emission Factor (lb/activity)[1]	PM10 (lb/day)[2]	PM2.5 (lb/day)[2]
Bulldozing, Scraping and Grading	hr	8.0	40.0	0.753	0.415	30.11	16.59
Total						**30.11**	**16.59**

1

2. Emissions [lb/day] = Emission factor [lb/activity unit] x Daily Activity level [units/day]

3. Soil handling during grading/excavation activities is assumed to occur over the first 3 of 18 months of the Proposed Project, or for a duration of 60 days.

3.2 Demolition - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2029	2.1763	1.6233	1.8000e-003		0.1103	0.1103		0.1029	0.1029	0.0000	168.4857	168.4857	0.0457	0.0000	169.4449
Total	**0.2029**	**2.1763**	**1.6233**	**1.8000e-003**		**0.1103**	**0.1103**		**0.1029**	**0.1029**	**0.0000**	**168.4857**	**168.4857**	**0.0457**	**0.0000**	**169.4449**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0525	0.9616	0.5532	2.1900e-003	4.0898	0.0162	4.1060	0.4168	0.0149	0.4317	0.0000	202.7390	202.7390	1.5600e-003	0.0000	202.7718
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0525**	**0.9616**	**0.5532**	**2.1900e-003**	**4.0898**	**0.0162**	**4.1060**	**0.4168**	**0.0149**	**0.4317**	**0.0000**	**202.7390**	**202.7390**	**1.5600e-003**	**0.0000**	**202.7718**

3.2 Demolition - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	4.5083	48.3629	36.0738	0.0399		2.4508	2.4508		2.2858	2.2858		4,127.1934	4,127.1934	1.1188		4,150.6886
Total	**4.5083**	**48.3629**	**36.0738**	**0.0399**		**2.4508**	**2.4508**		**2.2858**	**2.2858**		**4,127.1934**	**4,127.1934**	**1.1188**		**4,150.6886**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.1306	20.2470	11.2193	0.0488	99.2361	0.3597	99.5958	10.0974	0.3309	10.4282		4,969.5822	4,969.5822	0.0380		4,970.3811
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**1.1306**	**20.2470**	**11.2193**	**0.0488**	**99.2361**	**0.3597**	**99.5958**	**10.0974**	**0.3309**	**10.4282**		**4,969.5822**	**4,969.5822**	**0.0380**		**4,970.3811**

Phase 5A - Grouted Stone and Sheet Pile Alternative

Daily

	VOC	NOX	CO	PM10	PM2.5
2015	19.95	149.37	82.18	92.35	26.32
2016	19.95	149.37	82.18	92.35	26.32
2017	19.95	149.37	82.18	92.35	26.32
Maximum Daily Emissions	19.95	149.37	82.18	92.35	26.32

Annual

	VOC	NOX	CO	PM10	PM2.5	CO2e
2015	1.19	10.08	4.71	6.02	1.70	1,693.47
2016	2.13	17.88	8.41	11.01	3.09	2,993.72
2017	1.19	10.30	4.78	5.99	1.69	1,760.67
Total	4.51	38.26	17.91	23.02	6.48	6,447.87
Annualized GHG Emissions						128.96

Phase 5A - Soil Cement and Sheet Pile Alternative

Daily

	VOC	NOX	CO	PM10	PM2.5
2015	37.68	308.31	148.93	85.19	29.07
2016	37.68	308.31	148.93	85.19	29.07
2017	37.68	308.31	148.93	85.19	29.07
Maximum Daily Emissions	37.68	308.31	148.93	85.19	29.07

Annual

	VOC	NOX	CO	PM10	PM2.5	CO2e
2015	2.36	20.34	9.11	5.55	1.88	3,323.29
2016	4.28	37.08	16.49	10.16	3.43	6,084.12
2017	3.08	26.97	11.96	7.26	2.45	4,458.56
Total	9.72	84.39	37.57	22.97	7.76	13,865.97
Annualized GHG Emissions						277.32

Phase 5B - Grouted Stone Alternative

Daily

	VOC	NOX	CO	PM10	PM2.5
2016	16.80	125.50	69.87	147.54	34.08
2017	16.80	125.50	69.87	147.54	34.08
2018	16.80	125.50	69.87	147.54	34.08
Maximum Daily Emissions	16.80	125.50	69.87	147.54	34.08

Annual

	VOC	NOX	CO	PM10	PM2.5	CO2e
2016	0.17	1.05	0.74	9.37	1.99	192.15
2017	1.83	15.49	7.37	17.67	4.05	2,519.90
2018	1.03	9.04	4.22	9.59	2.21	1,513.16
Total	3.03	25.59	12.32	36.62	8.24	4,225.21
Annualized GHG Emissions						84.50

Phase 5B - Soil Cement Alternative

Daily

	VOC	NOX	CO	PM10	PM2.5
2016	34.53	284.44	136.63	144.31	36.63
2017	34.53	284.44	136.63	144.31	36.63
2018	34.53	284.44	136.63	144.31	36.63
Maximum Daily Emissions	34.53	284.44	136.63	144.31	36.63

Annual

	VOC	NOX	CO	PM10	PM2.5	CO2e
2016	2.20	19.08	8.55	9.44	2.39	3,075.78
2017	3.98	34.79	15.47	17.29	4.36	5,631.88
2018	2.85	25.19	11.16	12.26	3.10	4,112.96
Total	9.03	79.06	35.17	38.99	9.85	12,820.62
Annualized GHG Emissions						256.41

Phase 4 - Soil Cement Alternative

Daily

	VOC	NOX	CO	PM10	PM2.5
2015	17.74	155.55	86.37	107.22	28.67
2016	32.88	271.58	131.02	111.15	31.91
Maximum Daily Emissions	32.88	271.58	131.02	111.15	31.91

Annual

	VOC	NOX	CO	PM10	PM2.5	CO2e
2015	0.04	0.31	0.25	6.60	1.54	77.13
2016	2.33	19.38	9.28	8.34	2.36	3,182.81
Total	2.36	19.69	9.52	14.94	3.90	3,259.94
Annualized GHG Emissions						65.20

Phase 4 - Grouted Stone Alternative

Daily

	VOC	NOX	CO	PM10	PM2.5
2015	17.74	155.55	86.37	76.57	24.10
2016	15.15	112.64	64.26	74.60	22.60
Maximum Daily Emissions	17.74	155.55	86.37	76.57	24.10

Annual

	VOC	NOX	CO	PM10	PM2.5	CO2e
2015	0.04	0.31	0.25	4.59	1.24	77.13
2016	0.98	7.30	4.20	5.58	1.66	1,237.16
Total	1.01	7.61	4.44	10.17	2.90	1,314.29
Annualized GHG Emissions						26.29

BNSF Bridge - Emissions Summary

Daily

	VOC	NOX	CO	PM10	PM2.5
2016	56.36	431.20	206.06	86.55	32.43
2107	56.36	431.20	206.06	86.55	32.43
2018	56.36	431.20	206.06	86.55	32.43
Maximum Daily Emissions	56.36	431.20	206.06	86.55	32.43

Annual

	VOC	NOX	CO	PM10	PM2.5	CO2e
2016	0.51	3.48	1.89	4.33	1.24	582.31
2107	0.67	4.27	2.48	8.57	2.40	681.44
2018	0.53	3.69	2.01	4.69	1.34	615.44
Total	1.72	11.44	6.38	17.59	4.98	1,879.18
Annualized GHG Emissions						37.58

Phase 5A - Grouted Stone and Sheet Pile Alternative - 2015

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons per phase) VOC	NOX	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Clearing and Grubbing																				
Dozers < = 175	Dozer - D7	1	8	240	1	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.01	0.00	0.00	0.00	0.52	0.00	0.47
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	2	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.00	0.00	0.00	1.37	0.00	1.25
Dozers > 250 and < = 500	Dozer - D8	1	8	310	1	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.00	0.01	0.00	0.00	0.00	1.06	0.00	0.97
Other Construction Equipment > 120 and < = 175	Brush Chipper	1	8	174	1	0.58	4.68	4.69	0.23	0.19	852	0.05	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.39
	Highway Truck (25,000 lbs)	11	1,320	330	2,640	0.66	19.33	3.00	0.52	0.32	4,789	0.01	0.00	0.02	0.00	0.00	0.00	4.79	0.00	4.36
	Pickup Truck	1	120	330	240	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.10
Total						**5.79**	**58.75**	**26.81**	**2.30**	**1.82**	**10,276.78**	**0.48**	**0.00**	**0.04**	**0.02**	**0.00**	**0.00**	**8.27**	**0.00**	**7.54**
Remove Santa Ana Trail																				
Remove rails																				
	Highway Truck (10,000 lbs)	1	120	180	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
	Dump Truck (35,000 lbs)	1	120	265	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
Remove existing bike path (asphalt)																				
Tractors/Loaders/Backhoes > 50 and < = 120	Loader - 1.25 CY	1	8	95	2	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.38
Graders > 120 and < = 175	Grader - Articulated	1	8	135	2	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	0.99	0.00	0.90
	Street Sweeper	1	8	80	2	0.00	0.12	0.02	0.00	0.00	29	0.00	0.00	0.00	0.00	0.00	0.00	1.16	0.00	1.06
	Highway Truck (10,000 lbs)	1	120	330	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
Total						**1.58**	**15.11**	**9.45**	**0.73**	**0.57**	**2,740.34**	**0.13**	**0.00**	**0.02**	**0.01**	**0.00**	**0.00**	**4.53**	**0.00**	**4.12**
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	131	1.84	6.90	6.78	0.49	0.41	824	0.17	0.12	0.45	0.44	0.03	0.03	53.97	0.01	49.39
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.12**	**0.45**	**0.44**	**0.03**	**0.03**	**53.97**	**0.01**	**49.39**
Remove Rip-Rap																				
Excavators > 250 and < = 500	Excavator - 3.5 CY	1	8	384	131	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.08	0.54	0.25	0.02	0.02	122.48	0.01	111.63
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
Dozers < = 175	Dozer - D6	1	8	145	131	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.10	0.69	0.43	0.04	0.03	67.85	0.01	61.96
	Highway Truck (25,000 lbs)	10	1,200	330	157,200	0.07	0.40	3.19	0.12	0.05	1,069	0.08	0.04	1.15	0.18	0.03	0.02	285.17	0.00	259.53
Load/Haul/Place Grouted Stone																				
Scrapers > 250 < = 500	CAT 627 Scraper	1	8	330	131	2.19	17.75	8.09	0.68	0.57	2,571	0.20	0.14	1.16	0.53	0.04	0.04	168.43	0.01	153.60
Dozers > 250 and < = 500	Dozer - D8	1	8	310	131	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.15	1.17	0.61	0.05	0.04	138.79	0.01	126.64
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
Graders > 120 and < = 175	Grader - 120	1	8	135	131	0.97	6.90	5.85	0.38	0.32	991	0.09	0.06	0.45	0.38	0.02	0.02	64.93	0.01	59.24
Pumps > 175 and < = 250	Concrete pump	1	8	210	131	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.05	0.62	0.20	0.02	0.01	105.52	0.00	96.14
Water Truck	3,000 gal water truck	1	8	230	131	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.06	0.45	0.19	0.02	0.01	87.27	0.01	79.56
	Truck - 250 Articulated	1	120	330	15,720	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.12	0.02	0.00	0.00	28.52	0.00	25.95
Haul away excess																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
	Belly Dump Truck	1	120	330	15,720	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.12	0.02	0.00	0.00	28.52	0.00	25.95
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	7	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.01	0.04	0.02	0.00	0.00	3.63	0.00	3.31
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Install Sheet Piles																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	3	8	211	131	2.46	18.99	8.48	0.62	0.51	4,122	0.22	0.16	1.24	0.56	0.04	0.03	269.97	0.01	246.04
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Total						**18.05**	**141.83**	**73.90**	**5.75**	**4.72**	**24,724.51**	**1.69**	**1.02**	**9.03**	**3.98**	**0.33**	**0.27**	**1,647.31**	**0.09**	**1,501.32**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.04**	**0.49**	**0.17**	**0.02**	**0.01**	**105.52**	**0.00**	**96.09**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	50	16.8	840	131	110,040	0.07	0.64	1.50	0.11	0.06	586	0.05	0.00	0.04	0.10	0.01	0.00	38.38	0.00	35.01

Note: Assumes a total of 25 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**19.95**	**149.37**	**82.18**	**6.35**	**5.19**	**26,134.48**	**1.91**								
Maximum Annual Emissions								**1.19**	**10.08**	**4.71**	**0.39**	**0.31**	**1,857.98**	**0.11**	**1,693.47**

Phase 5A - Grouted Stone and Sheet Pile Alternative - 2016

Off-Road Construction Equipment

						Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
Equipment Type	**Equipment Category**	**Number**	**Usage Factor (hrs/day or miles/day)**	**Power Rating (hp)**	**Total Days/VMT**	**VOC**	**NOX**	**CO**	**PM10**	**PM2.5**	**CO2**	**CH4**	**VOC**	**NOX**	**CO**	**PM10**	**PM2.5**	**CO_2**	**CH4**	**Total GHG Emissions (MT CO2e)**
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	240	1.84	6.90	6.78	0.49	0.41	824	0.17	0.22	0.83	0.81	0.06	0.05	98.88	0.02	90.49
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.22**	**0.83**	**0.81**	**0.06**	**0.05**	**98.88**	**0.02**	**90.49**
Remove Rip-Rap																				
Excavators > 250 and < = 500	Excavator - 3.5 CY	1	8	384	240	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.14	0.98	0.47	0.04	0.03	224.39	0.01	204.52
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
Dozers < = 175	Dozer - D6	1	8	145	240	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.18	1.26	0.79	0.07	0.06	124.30	0.02	113.52
	Highway Truck (25,000 lbs)	10	1,200	330	288,000	0.07	0.40	3.19	0.12	0.05	1,069	0.08	0.07	2.11	0.33	0.06	0.04	522.45	0.00	475.47
Load/Haul/Place Grouted Stone																				
Scrapers > 250 < = 500	CAT 627 Scraper	1	8	330	240	2.19	17.75	8.09	0.68	0.57	2,571	0.20	0.26	2.13	0.97	0.08	0.07	308.57	0.02	281.40
Dozers > 250 and < = 500	Dozer - D8	1	8	310	240	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.27	2.15	1.12	0.09	0.07	254.28	0.02	232.01
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
Graders > 120 and < = 175	Grader - 120	1	8	135	240	0.97	6.90	5.85	0.38	0.32	991	0.09	0.12	0.83	0.70	0.05	0.04	118.96	0.01	108.53
Pumps > 175 and < = 250	Concrete pump	1	8	210	240	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.10	1.14	0.38	0.03	0.03	193.31	0.01	176.14
Water Truck	3,000 gal water truck	1	8	230	240	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.11	0.83	0.35	0.03	0.02	159.88	0.01	145.75
	Truck - 250 Articulated	1	120	330	28,800	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.21	0.03	0.01	0.00	52.24	0.00	47.55
Haul away excess																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
	Belly Dump Truck	1	120	330	28,800	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.21	0.03	0.01	0.00	52.24	0.00	47.55
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	7	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.01	0.04	0.02	0.00	0.00	3.63	0.00	3.31
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Install Sheet Piles																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	3	8	211	240	2.46	18.99	8.48	0.62	0.51	4,122	0.22	0.30	2.28	1.02	0.07	0.06	494.60	0.03	450.77
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Total						**18.05**	**141.83**	**73.90**	**5.75**	**4.72**	**24,724.51**	**1.69**	**1.87**	**16.48**	**7.25**	**0.60**	**0.49**	**3,009.73**	**0.16**	**2,743.00**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.04**	**0.49**	**0.17**	**0.02**	**0.01**	**105.52**	**0.00**	**96.09**

On Road Construction Emissions

						Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
	Total Trips	**Distance**	**Average Daily Mileage**	**Calculated Time - Rounded (days)**	**Total Mileage**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO2**	**CH_4**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO_2**	**CH_4**	**Total GHG Emissions (MT CO2e)**
Worker Trips	50	16.8	840	240	201,600	0.07	0.64	1.50	0.11	0.06	586	0.05	0.01	0.08	0.18	0.01	0.01	70.31	0.01	64.15

Note: Assumes a total of 25 workers per day.

	Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
Total	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO2**	**CH_4**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO_2**	**CH_4**	**Total GHG Emissions (MT CO2e)**
Maximum Daily Emissions	**19.95**	**149.37**	**82.18**	**6.35**	**5.19**	**26,134.48**	**1.91**								
Maximum Annual Emissions								**2.13**	**17.88**	**8.41**	**0.69**	**0.56**	**3,284.45**	**0.19**	**2,993.72**

Phase 5A - Grouted Stone and Sheet Pile Alternative - 2017

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons per phase) VOC	NOX	CO	PM10	PM2.5	CO_2	CH4	Total GHG Emissions (MT CO2e)
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	130	1.84	6.90	6.78	0.49	0.41	824	0.17	0.12	0.45	0.44	0.03	0.03	53.56	0.01	49.02
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.12**	**0.45**	**0.44**	**0.03**	**0.03**	**53.56**	**0.01**	**49.02**
Remove Rip-Rap																				
Excavators > 250 and < = 500	Excavator - 3.5 CY	1	8	384	130	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.08	0.53	0.25	0.02	0.02	121.54	0.01	110.78
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	130	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.18	0.01	0.01	89.30	0.00	81.39
Dozers < = 175	Dozer - D6	1	8	145	130	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.10	0.68	0.43	0.04	0.03	67.33	0.01	61.49
	Highway Truck (25,000 lbs)	10	1,200	330	156,000	0.07	0.40	3.19	0.12	0.05	1,069	0.08	0.04	1.14	0.18	0.03	0.02	282.99	0.00	257.54
Load/Haul/Place Grouted Stone																				
Scrapers > 250 < = 500	CAT 627 Scraper	1	8	330	130	2.19	17.75	8.09	0.68	0.57	2,571	0.20	0.14	1.15	0.53	0.04	0.04	167.14	0.01	152.43
Dozers > 250 and < = 500	Dozer - D8	1	8	310	130	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.15	1.16	0.61	0.05	0.04	137.73	0.01	125.67
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	130	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.18	0.01	0.01	89.30	0.00	81.39
Graders > 120 and < = 175	Grader - 120	1	8	135	130	0.97	6.90	5.85	0.38	0.32	991	0.09	0.06	0.45	0.38	0.02	0.02	64.44	0.01	58.78
Pumps > 175 and < = 250	Concrete pump	1	8	210	130	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.05	0.62	0.20	0.02	0.01	104.71	0.00	95.41
Water Truck	3,000 gal water truck	1	8	230	130	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.06	0.45	0.19	0.02	0.01	86.60	0.01	78.95
	Truck - 250 Articulated	1	120	330	15,600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.11	0.02	0.00	0.00	28.30	0.00	25.75
Haul away excess																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	130	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.18	0.01	0.01	89.30	0.00	81.39
	Belly Dump Truck	1	120	330	15,600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.11	0.02	0.00	0.00	28.30	0.00	25.75
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	7	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.01	0.04	0.02	0.00	0.00	3.63	0.00	3.31
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Install Sheet Piles																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	3	8	211	131	2.46	18.99	8.48	0.62	0.51	4,122	0.22	0.16	1.24	0.56	0.04	0.03	269.97	0.01	246.04
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Total						**18.05**	**141.83**	**73.90**	**5.75**	**4.72**	**24,724.51**	**1.69**	**1.02**	**8.97**	**3.95**	**0.33**	**0.27**	**1,636.87**	**0.09**	**1,491.81**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.04**	**0.49**	**0.17**	**0.02**	**0.01**	**105.52**	**0.00**	**96.09**
Replace Santa Ana Trail																				
Install Rails																				
Welders > 25 and < = 50	Welder (enginer driven)	1	8	48	1	0.57	1.81	1.99	0.14	0.12	207.66	0.05	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.10
Tractors/Loaders/Backhoes > 250 and < = 500	Post Driver	1	8	260	1	1.59	11.27	5.57	0.40	0.32	2,758.83	0.14	0.00	0.01	0.00	0.00	0.00	1.38	0.00	1.26
	Highway Truck (25,000 lbs)	1	120	330	120	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
	Pickup Truck	1	120	330	120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.01	0.05	0.00	0.00	17.63	0.00	16.08
Replace bike path																				
Graders > 120 and < = 175	Grader - Articulated	1	8	135	4	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	1.98	0.00	1.81
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	1	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.00	0.00	0.00	0.00	0.61	0.00	0.56
Paving Equipment > 175 and < = 250	Paver - Asphalt	1	8	224	6	0.86	7.76	2.64	0.29	0.24	978	0.08	0.00	0.02	0.01	0.00	0.00	2.93	0.00	2.68
Water Truck	3,000 gal water truck	1	8	230	1	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.61
	Pickup Truck	1	120	330	720	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.29
Total						**5.85**	**44.49**	**22.65**	**1.78**	**1.45**	**8,142.38**	**0.54**	**0.02**	**0.35**	**0.12**	**0.01**	**0.01**	**97.47**	**0.00**	**88.75**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	50	16.8	840	131	110,040	0.07	0.64	1.50	0.11	0.06	586	0.05	0.00	0.04	0.10	0.01	0.00	38.38	0.00	35.01

Note: Assumes a total of 25 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**12.32**	**91.97**	**57.13**	**4.31**	**3.49**	**15,140.89**	**1.15**								
Maximum Annual Emissions								**1.19**	**10.30**	**4.78**	**0.40**	**0.32**	**1,931.80**	**0.11**	**1,760.67**

Phase 5A - Soil Cement and Sheet Pile Alternative - 2015

Off-Road Construction Equipment

						Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
Equipment Type	**Equipment Category**	**Number**	**Usage Factor (hrs/day or miles/day)**	**Power Rating (hp)**	**Total Days/VMT**	**VOC**	**NOX**	**CO**	**PM10**	**PM2.5**	**CO2**	**CH4**	**VOC**	**NOX**	**CO**	**PM10**	**PM2.5**	**CO_2**	**CH4**	**Total GHG Emissions (MT CO2e)**
Clearing and Grubbing																				
Dozers < = 175	Dozer - D7	1	8	240	1	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.01	0.00	0.00	0.00	0.52	0.00	0.47
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	2	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.00	0.00	0.00	1.37	0.00	1.25
Dozers > 250 and < = 500	Dozer - D8	1	8	310	1	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.00	0.01	0.00	0.00	0.00	1.06	0.00	0.97
Other Construction Equipment > 120 and < = 175	Brush Chipper	1	8	174	1	0.58	4.68	4.69	0.23	0.19	852	0.05	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.39
	Highway Truck (25,000 lbs)	11	1,320	330	2,640	0.66	19.33	3.00	0.52	0.32	4,789	0.01	0.00	0.02	0.00	0.00	0.00	4.79	0.00	4.36
	Pickup Truck	1	120	330	240	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.10
Total						**5.79**	**58.75**	**26.81**	**2.30**	**1.82**	**10,276.78**	**0.48**	**0.00**	**0.04**	**0.02**	**0.00**	**0.00**	**8.27**	**0.00**	**7.54**
Remove Santa Ana Trail																				
Remove rails																				
	Highway Truck (10,000 lbs)	1	120	180	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
	Dump Truck (35,000 lbs)	1	120	265	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
Remove existing bike path (asphalt)																				
Tractors/Loaders/Backhoes > 50 and < = 120	Loader - 1.25 CY	1	8	95	2	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.38
Graders > 120 and < = 175	Grader - Articulated	1	8	135	2	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	0.99	0.00	0.90
	Street Sweeper	1	8	80	2	0.00	0.12	0.02	0.00	0.00	29	0.00	0.00	0.00	0.00	0.00	0.00	1.16	0.00	1.06
	Highway Truck (10,000 lbs)	1	120	330	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
Total						**1.58**	**15.11**	**9.45**	**0.73**	**0.57**	**2,740.34**	**0.13**	**0.00**	**0.02**	**0.01**	**0.00**	**0.00**	**4.53**	**0.00**	**4.12**
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	131	1.84	6.90	6.78	0.49	0.41	824	0.17	0.12	0.45	0.44	0.03	0.03	53.97	0.01	49.39
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.12**	**0.45**	**0.44**	**0.03**	**0.03**	**53.97**	**0.01**	**49.39**
Remove Rip-Rap																				
Excavators > 250 and < = 500	Excavator - 3.5 CY	1	8	384	131	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.08	0.54	0.25	0.02	0.02	122.48	0.01	111.63
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
Dozers < = 175	Dozer - D6	1	8	145	131	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.10	0.69	0.43	0.04	0.03	67.85	0.01	61.96
	Highway Truck (25,000 lbs)	10	1,200	330	157,200	0.07	0.40	3.19	0.12	0.05	1,069	0.08	0.04	1.15	0.18	0.03	0.02	285.17	0.00	259.53
Excavation (for placement of soil cement)																				
Load and haul with scrapers, dozer																				
Scrapers > 250 < = 500	CAT 627 Scraper	4	8	330	131	8.76	70.99	32.34	2.72	2.29	10,286	0.79	0.57	4.65	2.12	0.18	0.15	673.71	0.05	614.40
Dozers > 250 and < = 500	Dozer - D8	1	8	310	131	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.15	1.17	0.61	0.05	0.04	138.79	0.01	126.64
	Pickup Truck	1	120	330	15,720	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.02	0.00	0.00	7.00	0.00	6.38
Soil Cement																				
Excavate/Load/Haul from Borrow site to Soil Screening Plant																				
Dozers < = 175	Dozer - D6	1	8	145	131	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.10	0.69	0.43	0.04	0.03	67.85	0.01	61.96
Tractors/Loaders/Backhoes > 250 and < = 500	Loader 980	1	8	349	131	1.59	11.27	5.57	0.40	0.32	2,759	0.14	0.10	0.74	0.36	0.03	0.02	180.70	0.01	164.68
Water Truck	3,000 gal water truck	1	8	230	131	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.06	0.45	0.19	0.02	0.01	87.27	0.01	79.56
	Truck - 250 Articulated	14	1,680	330	220,080	0.84	24.60	3.82	0.67	0.41	6,095	0.02	0.06	1.61	0.25	0.04	0.03	399.24	0.00	363.34
Load/Haul Unsuitable Soil																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
	Truck - 20 CY (75,000 lbs)	4	480	330	62,880	0.24	7.03	1.09	0.19	0.12	1,741	0.01	0.02	0.46	0.07	0.01	0.01	114.07	0.00	103.81
Process excavated soil through Soil Screening Plant																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
Mix at Soil Cement Batch Plant																				
Generator Sets > 25 and < = 50	Generator	1	8	375	131	0.50	2.03	1.91	0.14	0.11	245	0.05	0.03	0.13	0.13	0.01	0.01	16.05	0.00	14.68
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
Load/Haul/Place Soil Cement																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	2	8	211	131	1.64	12.66	5.65	0.42	0.34	2,748	0.15	0.11	0.83	0.37	0.03	0.02	179.98	0.01	164.03
Graders > 120 and < = 175	Grader - 120	1	8	135	131	0.97	6.90	5.85	0.38	0.32	991	0.09	0.06	0.45	0.38	0.02	0.02	64.93	0.01	59.24
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	131	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.05	0.52	0.18	0.02	0.01	80.22	0.00	73.12
	Truck - 250 Articulated	2	240	330	31,440	0.12	3.51	0.55	0.10	0.06	871	0.00	0.01	0.23	0.04	0.01	0.00	57.03	0.00	51.91
Spread Fill Material																				
Dozers > 250 and < = 500	Dozer - D9	1	8	410	131	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.15	1.17	0.61	0.05	0.04	138.79	0.01	126.64
Compact Soil																				
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	131	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.05	0.52	0.18	0.02	0.01	80.22	0.00	73.12
Water Truck	3,000 gal water truck	1	8	230	131	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.06	0.45	0.19	0.02	0.01	87.27	0.01	79.56
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	22	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.02	0.12	0.07	0.01	0.01	11.39	0.00	10.41
Water Truck	3,000 gal water truck	1	8	230	22	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.01	0.08	0.03	0.00	0.00	14.66	0.00	13.36
Install Sheet Piles																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	3	8	211	131	2.46	18.99	8.48	0.62	0.51	4,122	0.22	0.16	1.24	0.56	0.04	0.03	269.97	0.01	246.04
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Total						**35.78**	**300.78**	**140.66**	**11.64**	**9.46**	**52,833.50**	**3.22**	**2.20**	**19.57**	**8.42**	**0.72**	**0.58**	**3,506.21**	**0.19**	**3,195.52**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	1.09	0.00	0.99
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.03**	**0.21**	**0.12**	**0.01**	**0.01**	**34.77**	**0.00**	**31.70**

On Road Construction Emissions

						Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
	Total Trips	**Distance**	**Average Daily Mileage**	**Calculated Time - Rounded (days)**	**Total Mileage**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO2**	**CH_4**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO_2**	**CH_4**	**Total GHG Emissions (MT CO2e)**
Worker Trips	50	16.8	840	131	110,040	0.07	0.64	1.50	0.11	0.06	586	0.05	0.00	0.04	0.10	0.01	0.00	38.38	0.00	35.01

Note: Assumes a total of 25 workers per day.

	Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
Total	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO2**	**CH_4**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO_2**	**CH_4**	**Total GHG Emissions (MT CO2e)**
Maximum Daily Emissions	**37.68**	**308.31**	**148.93**	**12.24**	**9.92**	**54,243.47**	**3.44**								
Maximum Annual Emissions								**2.36**	**20.34**	**9.11**	**0.77**	**0.62**	**3,646.13**	**0.21**	**3,323.29**

Phase 5A - Soil Cement and Sheet Pile Alternative - 2016

Off-Road Construction Equipment

						Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
Equipment Type	**Equipment Category**	**Number**	**Usage Factor (hrs/day or miles/day)**	**Power Rating (hp)**	**Total Days/VMT**	**VOC**	**NOX**	**CO**	**PM10**	**PM2.5**	**CO2**	**CH4**	**VOC**	**NOX**	**CO**	**PM10**	**PM2.5**	**CO_2**	**CH4**	**Total GHG Emissions (MT CO2e)**
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	240	1.84	6.90	6.78	0.49	0.41	824	0.17	0.22	0.83	0.81	0.06	0.05	98.88	0.02	90.49
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.22**	**0.83**	**0.81**	**0.06**	**0.05**	**98.88**	**0.02**	**90.49**
Remove Rip-Rap																				
Excavators > 250 and < = 500	Excavator - 3.5 CY	1	8	384	240	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.14	0.98	0.47	0.04	0.03	224.39	0.01	204.52
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
Dozers < = 175	Dozer - D6	1	8	145	240	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.18	1.26	0.79	0.07	0.06	124.30	0.02	113.52
	Highway Truck (25,000 lbs)	10	1,200	330	288,000	0.07	0.40	3.19	0.12	0.05	1,069	0.08	0.07	2.11	0.33	0.06	0.04	522.45	0.00	475.47
Excavation (for placement of soil cement)																				
Load and haul with scrapers, dozer																				
Scrapers > 250 < = 500	CAT 627 Scraper	4	8	330	240	8.76	70.99	32.34	2.72	2.29	10,286	0.79	1.05	8.52	3.88	0.33	0.27	1,234.29	0.09	1,125.62
Dozers > 250 and < = 500	Dozer - D8	1	8	310	240	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.27	2.15	1.12	0.09	0.07	254.28	0.02	232.01
	Pickup Truck	1	120	330	28,800	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.04	0.00	0.00	12.82	0.00	11.69
Soil Cement																				
Excavate/Load/Haul from Borrow site to Soil Screening Plant																				
Dozers < = 175	Dozer - D6	1	8	145	240	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.18	1.26	0.79	0.07	0.06	124.30	0.02	113.52
Tractors/Loaders/Backhoes > 250 and < = 500	Loader 980	1	8	349	240	1.59	11.27	5.57	0.40	0.32	2,759	0.14	0.19	1.35	0.67	0.05	0.04	331.06	0.02	301.70
Water Truck	3,000 gal water truck	1	8	230	240	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.11	0.83	0.35	0.03	0.02	159.88	0.01	145.75
	Truck - 250 Articulated	14	1,680	330	403,200	0.84	24.60	3.82	0.67	0.41	6,095	0.02	0.10	2.95	0.46	0.08	0.05	731.43	0.00	665.65
																				-
Load/Haul Unsuitable Soil																				-
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
	Truck - 20 CY (75,000 lbs)	4	480	330	115,200	0.24	7.03	1.09	0.19	0.12	1,741	0.01	0.03	0.84	0.13	0.02	0.01	208.98	0.00	190.19
Process excavated soil through Soil Screening Plant																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
Mix at Soil Cement Batch Plant																				
Generator Sets > 25 and < = 50	Generator	1	8	375	240	0.50	2.03	1.91	0.14	0.11	245	0.05	0.06	0.24	0.23	0.02	0.01	29.40	0.01	26.89
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
Load/Haul/Place Soil Cement																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	2	8	211	240	1.64	12.66	5.65	0.42	0.34	2,748	0.15	0.20	1.52	0.68	0.05	0.04	329.74	0.02	300.51
Graders > 120 and < = 175	Grader - 120	1	8	135	240	0.97	6.90	5.85	0.38	0.32	991	0.09	0.12	0.83	0.70	0.05	0.04	118.96	0.01	108.53
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	240	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.10	0.96	0.33	0.03	0.03	146.97	0.01	133.97
	Truck - 250 Articulated	2	240	330	57,600	0.12	3.51	0.55	0.10	0.06	871	0.00	0.01	0.42	0.07	0.01	0.01	104.49	0.00	95.09
Spread Fill Material																				
Dozers > 250 and < = 500	Dozer - D9	1	8	410	240	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.27	2.15	1.12	0.09	0.07	254.28	0.02	232.01
Compact Soil																				
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	240	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.10	0.96	0.33	0.03	0.03	146.97	0.01	133.97
Water Truck	3,000 gal water truck	1	8	230	240	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.11	0.83	0.35	0.03	0.02	159.88	0.01	145.75
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	22	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.02	0.12	0.07	0.01	0.01	11.39	0.00	10.41
Water Truck	3,000 gal water truck	1	8	230	22	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.01	0.08	0.03	0.00	0.00	14.66	0.00	13.36
Install Sheet Piles																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	3	8	211	240	2.46	18.99	8.48	0.62	0.51	4,122	0.22	0.30	2.28	1.02	0.07	0.06	494.60	0.03	450.77
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Total						**35.78**	**300.78**	**140.66**	**11.64**	**9.46**	**52,833.50**	**3.22**	**4.01**	**35.68**	**15.33**	**1.32**	**1.06**	**6,400.57**	**0.35**	**5,833.39**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.04**	**0.49**	**0.17**	**0.02**	**0.01**	**105.52**	**0.00**	**96.09**

On Road Construction Emissions

						Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
	Total Trips	**Distance**	**Average Daily Mileage**	**Calculated Time - Rounded (days)**	**Total Mileage**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO2**	**CH_4**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO_2**	**CH_4**	**Total GHG Emissions (MT CO2e)**
Worker Trips	50	16.8	840	240	201,600	0.07	0.64	1.50	0.11	0.06	586	0.05	0.01	0.08	0.18	0.01	0.01	70.31	0.01	64.15

Note: Assumes a total of 25 workers per day.

	Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
Total	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO2**	**CH_4**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO_2**	**CH_4**	**Total GHG Emissions (MT CO2e)**
Maximum Daily Emissions	**37.68**	**308.31**	**148.93**	**12.24**	**9.92**	**54,243.47**	**3.44**								
Maximum Annual Emissions								**4.28**	**37.08**	**16.49**	**1.41**	**1.13**	**6,675.29**	**0.38**	**6,084.12**

Phase 5A - Soil Cement and Sheet Pile Alternative - 2017

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons per phase) VOC	NOX	CO	PM10	PM2.5	CO_2	CH4	Total GHG Emissions (MT CO2e)
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	171	1.84	6.90	6.78	0.49	0.41	824	0.17	0.16	0.59	0.58	0.04	0.03	70.46	0.01	64.47
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.16**	**0.59**	**0.58**	**0.04**	**0.03**	**70.46**	**0.01**	**64.47**
Remove Rip-Rap																				
Excavators > 250 and < = 500	Excavator - 3.5 CY	1	8	384	171	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.10	0.70	0.33	0.03	0.02	159.87	0.01	145.72
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	171	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.07	0.54	0.24	0.02	0.01	117.47	0.01	107.06
Dozers < = 175	Dozer - D6	1	8	145	171	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.13	0.89	0.57	0.05	0.04	88.56	0.01	80.88
	Highway Truck (25,000 lbs)	10	1,200	330	205,200	0.07	0.40	3.19	0.12	0.05	1,069	0.08	0.05	1.50	0.23	0.04	0.03	372.24	0.00	338.77
Excavation (for placement of soil cement)																				
Load and haul with scrapers, dozer																				
Scrapers > 250 < = 500	CAT 627 Scraper	4	8	330	171	8.76	70.99	32.34	2.72	2.29	10,286	0.79	0.75	6.07	2.77	0.23	0.20	879.43	0.07	802.00
Dozers > 250 and < = 500	Dozer - D8	1	8	310	171	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.19	1.53	0.80	0.06	0.05	181.17	0.02	165.31
	Pickup Truck	1	120	330	20,520	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.03	0.00	0.00	9.14	0.00	8.33
Soil Cement																				
Excavate/Load/Haul from Borrow site to Soil Screening Plant																				
Dozers < = 175	Dozer - D6	1	8	145	171	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.13	0.89	0.57	0.05	0.04	88.56	0.01	80.88
Tractors/Loaders/Backhoes > 250 and < = 500	Loader 980	1	8	349	171	1.59	11.27	5.57	0.40	0.32	2,759	0.14	0.14	0.96	0.48	0.03	0.03	235.88	0.01	214.96
Water Truck	3,000 gal water truck	1	8	230	171	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.08	0.59	0.25	0.02	0.02	113.92	0.01	103.85
	Truck - 250 Articulated	14	1,680	330	287,280	0.84	24.60	3.82	0.67	0.41	6,095	0.02	0.07	2.10	0.33	0.06	0.04	521.14	0.00	474.28
Load/Haul Unsuitable Soil																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	171	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.07	0.54	0.24	0.02	0.01	117.47	0.01	107.06
	Truck - 20 CY (75,000 lbs)	4	480	330	82,080	0.24	7.03	1.09	0.19	0.12	1,741	0.01	0.02	0.60	0.09	0.02	0.01	148.90	0.00	135.51
Process excavated soil through Soil Screening Plant																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	171	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.07	0.54	0.24	0.02	0.01	117.47	0.01	107.06
Mix at Soil Cement Batch Plant																				
Generator Sets > 25 and < = 50	Generator	1	8	375	171	0.50	2.03	1.91	0.14	0.11	245	0.05	0.04	0.17	0.16	0.01	0.01	20.95	0.00	19.16
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	171	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.07	0.54	0.24	0.02	0.01	117.47	0.01	107.06
Load/Haul/Place Soil Cement																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	2	8	211	171	1.64	12.66	5.65	0.42	0.34	2,748	0.15	0.14	1.08	0.48	0.04	0.03	234.94	0.01	214.11
Graders > 120 and < = 175	Grader - 120	1	8	135	171	0.97	6.90	5.85	0.38	0.32	991	0.09	0.08	0.59	0.50	0.03	0.03	84.76	0.01	77.32
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	171	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.07	0.68	0.24	0.02	0.02	104.71	0.01	95.45
	Truck - 250 Articulated	2	240	330	41,040	0.12	3.51	0.55	0.10	0.06	871	0.00	0.01	0.30	0.05	0.01	0.01	74.45	0.00	67.75
Spread Fill Material																				
Dozers > 250 and < = 500	Dozer - D9	1	8	410	171	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.19	1.53	0.80	0.06	0.05	181.17	0.02	165.31
Compact Soil																				
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	171	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.07	0.68	0.24	0.02	0.02	104.71	0.01	95.45
Water Truck	3,000 gal water truck	1	8	230	171	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.08	0.59	0.25	0.02	0.02	113.92	0.01	103.85
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	22	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.02	0.12	0.07	0.01	0.01	11.39	0.00	10.41
Water Truck	3,000 gal water truck	1	8	230	22	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.01	0.08	0.03	0.00	0.00	14.66	0.00	13.36
Install Sheet Piles																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	3	8	211	171	2.46	18.99	8.48	0.62	0.51	4,122	0.22	0.21	1.62	0.73	0.05	0.04	352.40	0.02	321.17
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Total						**35.78**	**300.78**	**140.66**	**11.64**	**9.46**	**52,833.50**	**3.22**	**2.87**	**25.48**	**10.96**	**0.94**	**0.76**	**4,568.36**	**0.25**	**4,163.54**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.04**	**0.49**	**0.17**	**0.02**	**0.01**	**105.52**	**0.00**	**96.09**
Replace Santa Ana Trail																				
Install Rails																				
Welders > 25 and < = 50	Welder (enginer driven)	1	8	48	1	0.57	1.81	1.99	0.14	0.12	207.66	0.05	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.10
Tractors/Loaders/Backhoes > 250 and < = 500	Post Driver	1	8	260	1	1.59	11.27	5.57	0.40	0.32	2,758.83	0.14	0.00	0.01	0.00	0.00	0.00	1.38	0.00	1.26
	Highway Truck (25,000 lbs)	1	120	330	120	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
	Pickup Truck	1	120	330	120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.01	0.05	0.00	0.00	17.63	0.00	16.08
Replace bike path																				
Graders > 120 and < = 175	Grader - Articulated	1	8	135	4	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	1.98	0.00	1.81
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	1	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.00	0.00	0.00	0.00	0.61	0.00	0.56
Paving Equipment > 175 and < = 250	Paver - Asphalt	1	8	224	6	0.86	7.76	2.64	0.29	0.24	978	0.08	0.00	0.02	0.01	0.00	0.00	2.93	0.00	2.68
Water Truck	3,000 gal water truck	1	8	230	1	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.61
	Pickup Truck	1	120	330	720	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.29
Total						**5.85**	**44.49**	**22.65**	**1.78**	**1.45**	**8,142.38**	**0.54**	**0.02**	**0.35**	**0.12**	**0.01**	**0.01**	**97.47**	**0.00**	**88.75**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	50	16.8	840	171	143,640	0.07	0.64	1.50	0.11	0.06	586	0.05	0.01	0.05	0.13	0.01	0.00	50.10	0.00	45.70

Note: Assumes a total of 25 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**37.68**	**308.31**	**148.93**	**12.24**	**9.92**	**54,243.47**	**3.44**								
Maximum Annual Emissions								**3.08**	**26.97**	**11.96**	**1.02**	**0.82**	**4,891.90**	**0.27**	**4,458.56**

Phase 5B - Grouted Stone Alternative - 2016

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons per phase) VOC	NOX	CO	PM10	PM2.5	CO_2	CH4	Total GHG Emissions (MT CO2e)
Clearing and Grubbing																				
Dozers < = 175	Dozer - D7	1	8	240	1	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.01	0.00	0.00	0.00	0.52	0.00	0.47
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	2	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.00	0.00	0.00	1.37	0.00	1.25
Dozers > 250 and < = 500	Dozer - D8	1	8	310	1	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.00	0.01	0.00	0.00	0.00	1.06	0.00	0.97
Other Construction Equipment > 120 and < = 175	Brush Chipper	1	8	174	1	0.58	4.68	4.69	0.23	0.19	852	0.05	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.39
	Highway Truck (25,000 lbs)	11	1,320	330	2,640	0.66	19.33	3.00	0.52	0.32	4,789	0.01	0.00	0.02	0.00	0.00	0.00	4.79	0.00	4.36
	Pickup Truck	1	120	330	240	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.10
Total						**5.79**	**58.75**	**26.81**	**2.30**	**1.82**	**10,276.78**	**0.48**	**0.00**	**0.04**	**0.02**	**0.00**	**0.00**	**8.27**	**0.00**	**7.54**
Remove Santa Ana Trail																				
Remove rails																				
	Highway Truck (10,000 lbs)	1	120	180	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
	Dump Truck (35,000 lbs)	1	120	265	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
Remove existing bike path (asphalt)																				
Tractors/Loaders/Backhoes > 50 and < = 120	Loader - 1.25 CY	1	8	95	2	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.38
Graders > 120 and < = 175	Grader - Articulated	1	8	135	2	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	0.99	0.00	0.90
	Street Sweeper	1	8	80	2	0.00	0.12	0.02	0.00	0.00	29	0.00	0.00	0.00	0.00	0.00	0.00	1.16	0.00	1.06
	Highway Truck (10,000 lbs)	1	120	330	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
Total						**1.58**	**15.11**	**9.45**	**0.73**	**0.57**	**2,740.34**	**0.13**	**0.00**	**0.02**	**0.01**	**0.00**	**0.00**	**4.53**	**0.00**	**4.12**
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	131	1.84	6.90	6.78	0.49	0.41	824	0.17	0.12	0.45	0.44	0.03	0.03	53.97	0.01	49.39
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.12**	**0.45**	**0.44**	**0.03**	**0.03**	**53.97**	**0.01**	**49.39**
Remove Rip-Rap																				
Excavators > 250 and < = 500	Excavator - 3.5 CY	1	8	384	131	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.08	0.54	0.25	0.02	0.02	122.48	0.01	111.63
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
Dozers < = 175	Dozer - D6	1	8	145	131	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.10	0.69	0.43	0.04	0.03	67.85	0.01	61.96
	Highway Truck (25,000 lbs)	10	1,200	330	157,200	0.07	0.40	3.19	0.12	0.05	1,069	0.08	0.04	1.15	0.18	0.03	0.02	285.17	0.00	259.53
Load/Haul/Place Grouted Stone																				
Scrapers > 250 < = 500	CAT 627 Scraper	1	8	330	131	2.19	17.75	8.09	0.68	0.57	2,571	0.20	0.14	1.16	0.53	0.04	0.04	168.43	0.01	153.60
Dozers > 250 and < = 500	Dozer - D8	1	8	310	131	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.15	1.17	0.61	0.05	0.04	138.79	0.01	126.64
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
Graders > 120 and < = 175	Grader - 120	1	8	135	131	0.97	6.90	5.85	0.38	0.32	991	0.09	0.06	0.45	0.38	0.02	0.02	64.93	0.01	59.24
Pumps > 175 and < = 250	Concrete pump	1	8	210	131	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.05	0.62	0.20	0.02	0.01	105.52	0.00	96.14
Water Truck	3,000 gal water truck	1	8	230	131	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.06	0.45	0.19	0.02	0.01	87.27	0.01	79.56
	Truck - 250 Articulated	1	120	330	15,720	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.12	0.02	0.00	0.00	28.52	0.00	25.95
Haul away excess																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
	Belly Dump Truck	1	120	330	15,720	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.12	0.02	0.00	0.00	28.52	0.00	25.95
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	7	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.01	0.04	0.02	0.00	0.00	3.63	0.00	3.31
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Total						**14.90**	**117.96**	**61.59**	**4.85**	**3.98**	**19,960.07**	**1.40**	**0.86**	**7.77**	**3.41**	**0.29**	**0.23**	**1,375.73**	**0.07**	**1,253.81**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.04**	**0.49**	**0.17**	**0.02**	**0.01**	**105.52**	**0.00**	**96.09**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	50	16.8	840	131	110,040	0.07	0.64	1.50	0.11	0.06	586	0.05	0.00	0.04	0.10	0.01	0.00	38.38	0.00	35.01

Note: Assumes a total of 25 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**16.80**	**125.50**	**69.87**	**5.45**	**4.45**	**21,370.04**	**1.62**								
Maximum Annual Emissions								**0.17**	**1.05**	**0.74**	**0.06**	**0.04**	**210.67**	**0.02**	**192.15**

Phase 5B - Grouted Stone Alternative - 2017

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons per phase) VOC	NOX	CO	PM10	PM2.5	CO_2	CH4	Total GHG Emissions (MT CO2e)
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	240	1.84	6.90	6.78	0.49	0.41	824	0.17	0.22	0.83	0.81	0.06	0.05	98.88	0.02	90.49
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.22**	**0.83**	**0.81**	**0.06**	**0.05**	**98.88**	**0.02**	**90.49**
Remove Rip-Rap																				
Excavators > 250 and < = 500	Excavator - 3.5 CY	1	8	384	240	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.14	0.98	0.47	0.04	0.03	224.39	0.01	204.52
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
Dozers < = 175	Dozer - D6	1	8	145	240	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.18	1.26	0.79	0.07	0.06	124.30	0.02	113.52
	Highway Truck (25,000 lbs)	10	1,200	330	288,000	0.07	0.40	3.19	0.12	0.05	1,069	0.08	0.07	2.11	0.33	0.06	0.04	522.45	0.00	475.47
Load/Haul/Place Grouted Stone																				
Scrapers > 250 < = 500	CAT 627 Scraper	1	8	330	240	2.19	17.75	8.09	0.68	0.57	2,571	0.20	0.26	2.13	0.97	0.08	0.07	308.57	0.02	281.40
Dozers > 250 and < = 500	Dozer - D8	1	8	310	240	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.27	2.15	1.12	0.09	0.07	254.28	0.02	232.01
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
Graders > 120 and < = 175	Grader - 120	1	8	135	240	0.97	6.90	5.85	0.38	0.32	991	0.09	0.12	0.83	0.70	0.05	0.04	118.96	0.01	108.53
Pumps > 175 and < = 250	Concrete pump	1	8	210	240	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.10	1.14	0.38	0.03	0.03	193.31	0.01	176.14
Water Truck	3,000 gal water truck	1	8	230	240	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.11	0.83	0.35	0.03	0.02	159.88	0.01	145.75
	Truck - 250 Articulated	1	120	330	28,800	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.21	0.03	0.01	0.00	52.24	0.00	47.55
Haul away excess																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
	Belly Dump Truck	1	120	330	15,720	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.12	0.02	0.00	0.00	28.52	0.00	25.95
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	7	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.01	0.04	0.02	0.00	0.00	3.63	0.00	3.31
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Total						**14.90**	**117.96**	**61.59**	**4.85**	**3.98**	**19,960.07**	**1.40**	**1.57**	**14.09**	**6.21**	**0.53**	**0.42**	**2,489.79**	**0.14**	**2,269.17**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.04**	**0.49**	**0.17**	**0.02**	**0.01**	**105.52**	**0.00**	**96.09**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	50	16.8	840	240	201,600	0.07	0.64	1.50	0.11	0.06	586	0.05	0.01	0.08	0.18	0.01	0.01	70.31	0.01	64.15

Note: Assumes a total of 25 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**16.80**	**125.50**	**69.87**	**5.45**	**4.45**	**21,370.04**	**1.62**								
Maximum Annual Emissions								**1.83**	**15.49**	**7.37**	**0.61**	**0.49**	**2,764.51**	**0.16**	**2,519.90**

Phase 5B - Grouted Stone Alternative - 2018

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons per phase) VOC	NOX	CO	PM10	PM2.5	CO_2	CH4	Total GHG Emissions (MT CO2e)
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	130	1.84	6.90	6.78	0.49	0.41	824	0.17	0.12	0.45	0.44	0.03	0.03	53.56	0.01	49.02
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.12**	**0.45**	**0.44**	**0.03**	**0.03**	**53.56**	**0.01**	**49.02**
Remove Rip-Rap																				
Excavators > 250 and < = 500	Excavator - 3.5 CY	1	8	384	130	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.08	0.53	0.25	0.02	0.02	121.54	0.01	110.78
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	130	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.18	0.01	0.01	89.30	0.00	81.39
Dozers < = 175	Dozer - D6	1	8	145	130	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.10	0.68	0.43	0.04	0.03	67.33	0.01	61.49
	Highway Truck (25,000 lbs)	10	1,200	330	156,000	0.07	0.40	3.19	0.12	0.05	1,069	0.08	0.04	1.14	0.18	0.03	0.02	282.99	0.00	257.54
Load/Haul/Place Grouted Stone																				
Scrapers > 250 < = 500	CAT 627 Scraper	1	8	330	130	2.19	17.75	8.09	0.68	0.57	2,571	0.20	0.14	1.15	0.53	0.04	0.04	167.14	0.01	152.43
Dozers > 250 and < = 500	Dozer - D8	1	8	310	130	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.15	1.16	0.61	0.05	0.04	137.73	0.01	125.67
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	130	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.18	0.01	0.01	89.30	0.00	81.39
Graders > 120 and < = 175	Grader - 120	1	8	135	130	0.97	6.90	5.85	0.38	0.32	991	0.09	0.06	0.45	0.38	0.02	0.02	64.44	0.01	58.78
Pumps > 175 and < = 250	Concrete pump	1	8	210	130	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.05	0.62	0.20	0.02	0.01	104.71	0.00	95.41
Water Truck	3,000 gal water truck	1	8	230	130	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.06	0.45	0.19	0.02	0.01	86.60	0.01	78.95
	Truck - 250 Articulated	1	120	330	15,600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.11	0.02	0.00	0.00	28.30	0.00	25.75
Haul away excess																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	130	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.18	0.01	0.01	89.30	0.00	81.39
	Belly Dump Truck	1	120	330	15,600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.11	0.02	0.00	0.00	28.30	0.00	25.75
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	7	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.01	0.04	0.02	0.00	0.00	3.63	0.00	3.31
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Total						**14.90**	**117.96**	**61.59**	**4.85**	**3.98**	**19,960.07**	**1.40**	**0.85**	**7.71**	**3.39**	**0.29**	**0.23**	**1,365.29**	**0.07**	**1,244.30**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.04**	**0.49**	**0.17**	**0.02**	**0.01**	**105.52**	**0.00**	**96.09**
Replace Santa Ana Trail																				
Install Rails																				
Welders > 25 and < = 50	Welder (enginer driven)	1	8	48	1	0.57	1.81	1.99	0.14	0.12	207.66	0.05	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.10
Tractors/Loaders/Backhoes > 250 and < = 500	Post Driver	1	8	260	1	1.59	11.27	5.57	0.40	0.32	2,758.83	0.14	0.00	0.01	0.00	0.00	0.00	1.38	0.00	1.26
	Highway Truck (25,000 lbs)	1	120	330	120	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
	Pickup Truck	1	120	330	120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.01	0.05	0.00	0.00	17.63	0.00	16.08
Replace bike path																				
Graders > 120 and < = 175	Grader - Articulated	1	8	135	4	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	1.98	0.00	1.81
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	1	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.00	0.00	0.00	0.00	0.61	0.00	0.56
Paving Equipment > 175 and < = 250	Paver - Asphalt	1	8	224	6	0.86	7.76	2.64	0.29	0.24	978	0.08	0.00	0.02	0.01	0.00	0.00	2.93	0.00	2.68
Water Truck	3,000 gal water truck	1	8	230	1	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.61
	Pickup Truck	1	120	330	720	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.29
Total						**5.85**	**44.49**	**22.65**	**1.78**	**1.45**	**8,142.38**	**0.54**	**0.02**	**0.35**	**0.12**	**0.01**	**0.01**	**97.47**	**0.00**	**88.75**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	50	16.8	840	131	110,040	0.07	0.64	1.50	0.11	0.06	586	0.05	0.00	0.04	0.10	0.01	0.00	38.38	0.00	35.01

Note: Assumes a total of 25 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**16.80**	**125.50**	**69.87**	**5.45**	**4.45**	**21,370.04**	**1.62**								
Maximum Annual Emissions								**1.03**	**9.04**	**4.22**	**0.36**	**0.28**	**1,660.22**	**0.09**	**1,513.16**

Phase 5B - Soil Cement Alternative - 2016

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons per phase) VOC	NOX	CO	PM10	PM2.5	CO_2	CH4	Total GHG Emissions (MT CO2e)
Clearing and Grubbing																				
Dozers < = 175	Dozer - D7	1	8	240	1	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.01	0.00	0.00	0.00	0.52	0.00	0.47
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	2	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.00	0.00	0.00	1.37	0.00	1.25
Dozers > 250 and < = 500	Dozer - D8	1	8	310	1	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.00	0.01	0.00	0.00	0.00	1.06	0.00	0.97
Other Construction Equipment > 120 and < = 175	Brush Chipper	1	8	174	1	0.58	4.68	4.69	0.23	0.19	852	0.05	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.39
	Highway Truck (25,000 lbs)	11	1,320	330	2,640	0.66	19.33	3.00	0.52	0.32	4,789	0.01	0.00	0.02	0.00	0.00	0.00	4.79	0.00	4.36
	Pickup Truck	1	120	330	240	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.10
Total						**5.79**	**58.75**	**26.81**	**2.30**	**1.82**	**10,276.78**	**0.48**	**0.00**	**0.04**	**0.02**	**0.00**	**0.00**	**8.27**	**0.00**	**7.54**
Remove Santa Ana Trail																				
Remove rails																				
	Highway Truck (10,000 lbs)	1	120	180	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
	Dump Truck (35,000 lbs)	1	120	265	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
Remove existing bike path (asphalt)																				
Tractors/Loaders/Backhoes > 50 and < = 120	Loader - 1.25 CY	1	8	95	2	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.38
Graders > 120 and < = 175	Grader - Articulated	1	8	135	2	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	0.99	0.00	0.90
	Street Sweeper	1	8	80	2	0.00	0.12	0.02	0.00	0.00	29	0.00	0.00	0.00	0.00	0.00	0.00	1.16	0.00	1.06
	Highway Truck (10,000 lbs)	1	120	330	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
Total						**1.58**	**15.11**	**9.45**	**0.73**	**0.57**	**2,740.34**	**0.13**	**0.00**	**0.02**	**0.01**	**0.00**	**0.00**	**4.53**	**0.00**	**4.12**
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	131	1.84	6.90	6.78	0.49	0.41	824	0.17	0.12	0.45	0.44	0.03	0.03	53.97	0.01	49.39
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.12**	**0.45**	**0.44**	**0.03**	**0.03**	**53.97**	**0.01**	**49.39**
Remove Rip-Rap																				
Excavators > 250 and < = 500	Excavator - 3.5 CY	1	8	384	131	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.08	0.54	0.25	0.02	0.02	122.48	0.01	111.63
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
Dozers < = 175	Dozer - D6	1	8	145	131	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.10	0.69	0.43	0.04	0.03	67.85	0.01	61.96
	Highway Truck (25,000 lbs)	10	1,200	330	157,200	0.07	0.40	3.19	0.12	0.05	1,069	0.08	0.04	1.15	0.18	0.03	0.02	285.17	0.00	259.53
Excavation (for placement of soil cement)																				
Load and haul with scrapers, dozer																				
Scrapers > 250 < = 500	CAT 627 Scraper	4	8	330	131	8.76	70.99	32.34	2.72	2.29	10,286	0.79	0.57	4.65	2.12	0.18	0.15	673.71	0.05	614.40
Dozers > 250 and < = 500	Dozer - D8	1	8	310	131	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.15	1.17	0.61	0.05	0.04	138.79	0.01	126.64
	Pickup Truck	1	120	330	15,720	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.02	0.00	0.00	7.00	0.00	6.38
Soil Cement																				
Excavate/Load/Haul from Borrow site to Soil Screening Plant																				
Dozers < = 175	Dozer - D6	1	8	145	131	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.10	0.69	0.43	0.04	0.03	67.85	0.01	61.96
Tractors/Loaders/Backhoes > 250 and < = 500	Loader 980	1	8	349	131	1.59	11.27	5.57	0.40	0.32	2,759	0.14	0.10	0.74	0.36	0.03	0.02	180.70	0.01	164.68
Water Truck	3,000 gal water truck	1	8	230	131	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.06	0.45	0.19	0.02	0.01	87.27	0.01	79.56
	Truck - 250 Articulated	14	1,680	330	220,080	0.84	24.60	3.82	0.67	0.41	6,095	0.02	0.06	1.61	0.25	0.04	0.03	399.24	0.00	363.34
Load/Haul Unsuitable Soil																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
	Truck - 20 CY (75,000 lbs)	4	480	330	62,880	0.24	7.03	1.09	0.19	0.12	1,741	0.01	0.02	0.46	0.07	0.01	0.01	114.07	0.00	103.81
Process excavated soil through Soil Screening Plant																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
Mix at Soil Cement Batch Plant																				
Generator Sets > 25 and < = 50	Generator	1	8	375	131	0.50	2.03	1.91	0.14	0.11	245	0.05	0.03	0.13	0.13	0.01	0.01	16.05	0.00	14.68
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	131	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.05	0.41	0.19	0.01	0.01	89.99	0.00	82.01
Load/Haul/Place Soil Cement																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	2	8	211	131	1.64	12.66	5.65	0.42	0.34	2,748	0.15	0.11	0.83	0.37	0.03	0.02	179.98	0.01	164.03
Graders > 120 and < = 175	Grader - 120	1	8	135	131	0.97	6.90	5.85	0.38	0.32	991	0.09	0.06	0.45	0.38	0.02	0.02	64.93	0.01	59.24
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	131	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.05	0.52	0.18	0.02	0.01	80.22	0.00	73.12
	Truck - 250 Articulated	2	240	330	31,440	0.12	3.51	0.55	0.10	0.06	871	0.00	0.01	0.23	0.04	0.01	0.00	57.03	0.00	51.91
Spread Fill Material																				
Dozers > 250 and < = 500	Dozer - D9	1	8	410	131	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.15	1.17	0.61	0.05	0.04	138.79	0.01	126.64
Compact Soil																				
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	131	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.05	0.52	0.18	0.02	0.01	80.22	0.00	73.12
Water Truck	3,000 gal water truck	1	8	230	131	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.06	0.45	0.19	0.02	0.01	87.27	0.01	79.56
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	22	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.02	0.12	0.07	0.01	0.01	11.39	0.00	10.41
Water Truck	3,000 gal water truck	1	8	230	22	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.01	0.08	0.03	0.00	0.00	14.66	0.00	13.36
Total						**32.63**	**276.90**	**128.35**	**10.74**	**8.72**	**48,069.06**	**2.94**	**2.04**	**18.31**	**7.86**	**0.68**	**0.55**	**3,234.63**	**0.18**	**2,948.01**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	1.09	0.00	0.99
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.03**	**0.21**	**0.12**	**0.01**	**0.01**	**34.77**	**0.00**	**31.70**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	50	16.8	840	131	110,040	0.07	0.64	1.50	0.11	0.06	586	0.05	0.00	0.04	0.10	0.01	0.00	38.38	0.00	35.01

Note: Assumes a total of 25 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**34.53**	**284.44**	**136.63**	**11.34**	**9.19**	**49,479.03**	**3.16**								
Maximum Annual Emissions								**2.20**	**19.08**	**8.55**	**0.73**	**0.59**	**3,374.55**	**0.19**	**3,075.78**

Phase 5B - Soil Cement Alternative - 2017

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons per phase) VOC	NOX	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	240	1.84	6.90	6.78	0.49	0.41	824	0.17	0.22	0.83	0.81	0.06	0.05	98.88	0.02	90.49
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.22**	**0.83**	**0.81**	**0.06**	**0.05**	**98.88**	**0.02**	**90.49**
Remove Rip-Rap																				
Excavators > 250 and < = 500	Excavator - 3.5 CY	1	8	384	240	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.14	0.98	0.47	0.04	0.03	224.39	0.01	204.52
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
Dozers < = 175	Dozer - D6	1	8	145	240	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.18	1.26	0.79	0.07	0.06	124.30	0.02	113.52
	Highway Truck (25,000 lbs)	10	1,200	330	288,000	0.07	0.40	3.19	0.12	0.05	1,069	0.08	0.07	2.11	0.33	0.06	0.04	522.45	0.00	475.47
Excavation (for placement of soil cement)																				
Load and haul with scrapers, dozer																				
Scrapers > 250 < = 500	CAT 627 Scraper	4	8	330	240	8.76	70.99	32.34	2.72	2.29	10,286	0.79	1.05	8.52	3.88	0.33	0.27	1,234.29	0.09	1,125.62
Dozers > 250 and < = 500	Dozer - D8	1	8	310	240	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.27	2.15	1.12	0.09	0.07	254.28	0.02	232.01
	Pickup Truck	1	120	330	28,800	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.04	0.00	0.00	12.82	0.00	11.69
Soil Cement																				
Excavate/Load/Haul from Borrow site to Soil Screening Plant																				
Dozers < = 175	Dozer - D6	1	8	145	240	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.18	1.26	0.79	0.07	0.06	124.30	0.02	113.52
Tractors/Loaders/Backhoes > 250 and < = 500	Loader 980	1	8	349	240	1.59	11.27	5.57	0.40	0.32	2,759	0.14	0.19	1.35	0.67	0.05	0.04	331.06	0.02	301.70
Water Truck	3,000 gal water truck	1	8	230	240	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.11	0.83	0.35	0.03	0.02	159.88	0.01	145.75
	Truck - 250 Articulated	14	1,680	330	403,200	0.84	24.60	3.82	0.67	0.41	6,095	0.02	0.10	2.95	0.46	0.08	0.05	731.43	0.00	665.65
Load/Haul Unsuitable Soil																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
	Truck - 20 CY (75,000 lbs)	4	480	330	115,200	0.24	7.03	1.09	0.19	0.12	1,741	0.01	0.03	0.84	0.13	0.02	0.01	208.98	0.00	190.19
Process excavated soil through Soil Screening Plant																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
Mix at Soil Cement Batch Plant																				
Generator Sets > 25 and < = 50	Generator	1	8	375	240	0.50	2.03	1.91	0.14	0.11	245	0.05	0.06	0.24	0.23	0.02	0.01	29.40	0.01	26.89
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	240	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.10	0.76	0.34	0.02	0.02	164.87	0.01	150.26
Load/Haul/Place Soil Cement																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	2	8	211	240	1.64	12.66	5.65	0.42	0.34	2,748	0.15	0.20	1.52	0.68	0.05	0.04	329.74	0.02	300.51
Graders > 120 and < = 175	Grader - 120	1	8	135	240	0.97	6.90	5.85	0.38	0.32	991	0.09	0.12	0.83	0.70	0.05	0.04	118.96	0.01	108.53
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	240	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.10	0.96	0.33	0.03	0.03	146.97	0.01	133.97
	Truck - 250 Articulated	2	240	330	57,600	0.12	3.51	0.55	0.10	0.06	871	0.00	0.01	0.42	0.07	0.01	0.01	104.49	0.00	95.09
Spread Fill Material																				
Dozers > 250 and < = 500	Dozer - D9	1	8	410	240	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.27	2.15	1.12	0.09	0.07	254.28	0.02	232.01
Compact Soil																				
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	240	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.10	0.96	0.33	0.03	0.03	146.97	0.01	133.97
Water Truck	3,000 gal water truck	1	8	230	240	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.11	0.83	0.35	0.03	0.02	159.88	0.01	145.75
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	22	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.02	0.12	0.07	0.01	0.01	11.39	0.00	10.41
Water Truck	3,000 gal water truck	1	8	230	22	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.01	0.08	0.03	0.00	0.00	14.66	0.00	13.36
Total						**32.63**	**276.90**	**128.35**	**10.74**	**8.72**	**48,069.06**	**2.94**	**3.71**	**33.39**	**14.31**	**1.24**	**1.00**	**5,904.36**	**0.32**	**5,381.16**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.04**	**0.49**	**0.17**	**0.02**	**0.01**	**105.52**	**0.00**	**96.09**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	50	16.8	840	240	201,600	0.07	0.64	1.50	0.11	0.06	586	0.05	0.01	0.08	0.18	0.01	0.01	70.31	0.01	64.15

Note: Assumes a total of 25 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**34.53**	**284.44**	**136.63**	**11.34**	**9.19**	**49,479.03**	**3.16**								
Maximum Annual Emissions								**3.98**	**34.79**	**15.47**	**1.33**	**1.07**	**6,179.08**	**0.35**	**5,631.88**

Phase 5B - Soil Cement Alternative - 2018

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons per phase) VOC	NOX	CO	PM10	PM2.5	CO_2	CH4	Total GHG Emissions (MT CO2e)
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	170	1.84	6.90	6.78	0.49	0.41	824	0.17	0.16	0.59	0.58	0.04	0.03	70.04	0.01	64.10
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.16**	**0.59**	**0.58**	**0.04**	**0.03**	**70.04**	**0.01**	**64.10**
Remove Rip-Rap																				
Excavators > 250 and < = 500	Excavator - 3.5 CY	1	8	384	170	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.10	0.70	0.33	0.02	0.02	158.94	0.01	144.87
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	170	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.07	0.54	0.24	0.02	0.01	116.78	0.01	106.43
Dozers < = 175	Dozer - D6	1	8	145	170	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.13	0.89	0.56	0.05	0.04	88.04	0.01	80.41
	Highway Truck (25,000 lbs)	10	1,200	330	204,000	0.07	0.40	3.19	0.12	0.05	1,069	0.08	0.05	1.49	0.23	0.04	0.02	370.07	0.00	336.79
Excavation (for placement of soil cement)																				
Load and haul with scrapers, dozer																				
Scrapers > 250 < = 500	CAT 627 Scraper	4	8	330	170	8.76	70.99	32.34	2.72	2.29	10,286	0.79	0.74	6.03	2.75	0.23	0.19	874.29	0.07	797.31
Dozers > 250 and < = 500	Dozer - D8	1	8	310	170	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.19	1.52	0.79	0.06	0.05	180.11	0.02	164.34
	Pickup Truck	1	120	330	20,400	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.03	0.00	0.00	9.08	0.00	8.28
Soil Cement																				
Excavate/Load/Haul from Borrow site to Soil Screening Plant																				
Dozers < = 175	Dozer - D6	1	8	145	170	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.13	0.89	0.56	0.05	0.04	88.04	0.01	80.41
Tractors/Loaders/Backhoes > 250 and < = 500	Loader 980	1	8	349	170	1.59	11.27	5.57	0.40	0.32	2,759	0.14	0.13	0.96	0.47	0.03	0.03	234.50	0.01	213.71
Water Truck	3,000 gal water truck	1	8	230	170	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.08	0.59	0.25	0.02	0.02	113.25	0.01	103.24
	Truck - 250 Articulated	14	1,680	330	285,600	0.84	24.60	3.82	0.67	0.41	6,095	0.02	0.07	2.09	0.33	0.06	0.03	518.09	0.00	471.51
Load/Haul Unsuitable Soil																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	170	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.07	0.54	0.24	0.02	0.01	116.78	0.01	106.43
	Truck - 20 CY (75,000 lbs)	4	480	330	81,600	0.24	7.03	1.09	0.19	0.12	1,741	0.01	0.02	0.60	0.09	0.02	0.01	148.03	0.00	134.72
Process excavated soil through Soil Screening Plant																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	170	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.07	0.54	0.24	0.02	0.01	116.78	0.01	106.43
Mix at Soil Cement Batch Plant																				-
Generator Sets > 25 and < = 50	Generator	1	8	375	170	0.50	2.03	1.91	0.14	0.11	245	0.05	0.04	0.17	0.16	0.01	0.01	20.82	0.00	19.05
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	170	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.07	0.54	0.24	0.02	0.01	116.78	0.01	106.43
Load/Haul/Place Soil Cement																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	2	8	211	170	1.64	12.66	5.65	0.42	0.34	2,748	0.15	0.14	1.08	0.48	0.04	0.03	233.56	0.01	212.86
Graders > 120 and < = 175	Grader - 120	1	8	135	170	0.97	6.90	5.85	0.38	0.32	991	0.09	0.08	0.59	0.50	0.03	0.03	84.27	0.01	76.87
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	170	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.07	0.68	0.24	0.02	0.02	104.10	0.01	94.89
	Truck - 250 Articulated	2	240	330	40,800	0.12	3.51	0.55	0.10	0.06	871	0.00	0.01	0.30	0.05	0.01	0.00	74.01	0.00	67.36
Spread Fill Material																				
Dozers > 250 and < = 500	Dozer - D9	1	8	410	170	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.19	1.52	0.79	0.06	0.05	180.11	0.02	164.34
Compact Soil																				
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	170	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.07	0.68	0.24	0.02	0.02	104.10	0.01	94.89
Water Truck	3,000 gal water truck	1	8	230	170	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.08	0.59	0.25	0.02	0.02	113.25	0.01	103.24
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	22	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.02	0.12	0.07	0.01	0.01	11.39	0.00	10.41
Water Truck	3,000 gal water truck	1	8	230	22	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.01	0.08	0.03	0.00	0.00	14.66	0.00	13.36
Total						**32.63**	**276.90**	**128.35**	**10.74**	**8.72**	**48,069.06**	**2.94**	**2.64**	**23.71**	**10.16**	**0.88**	**0.71**	**4,189.85**	**0.23**	**3,818.58**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.04**	**0.49**	**0.17**	**0.02**	**0.01**	**105.52**	**0.00**	**96.09**
Replace Santa Ana Trail																				
Install Rails																				
Welders > 25 and < = 50	Welder (enginer driven)	1	8	48	1	0.57	1.81	1.99	0.14	0.12	207.66	0.05	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.10
Tractors/Loaders/Backhoes > 250 and < = 500	Post Driver	1	8	260	1	1.59	11.27	5.57	0.40	0.32	2,758.83	0.14	0.00	0.01	0.00	0.00	0.00	1.38	0.00	1.26
	Highway Truck (25,000 lbs)	1	120	330	120	0.06	1.76	0.27	0.05	0.03	435	0.00	0.01	0.29	0.05	0.01	0.00	71.84	0.00	65.38
	Pickup Truck	1	120	330	120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.01	0.00	0.00	17.63	0.00	16.08
Replace bike path																				
Graders > 120 and < = 175	Grader - Articulated	1	8	135	4	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	1.98	0.00	1.81
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	1	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.00	0.00	0.00	0.00	0.61	0.00	0.56
Paving Equipment > 175 and < = 250	Paver - Asphalt	1	8	224	6	0.86	7.76	2.64	0.29	0.24	978	0.08	0.00	0.02	0.01	0.00	0.00	2.93	0.00	2.68
Water Truck	3,000 gal water truck	1	8	230	1	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.61
	Pickup Truck	1	120	330	720	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.29
Total						**5.85**	**44.49**	**22.65**	**1.78**	**1.45**	**8,142.38**	**0.54**	**0.02**	**0.35**	**0.12**	**0.01**	**0.01**	**97.47**	**0.00**	**88.75**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	50	16.8	840	170	142,800	0.07	0.64	1.50	0.11	0.06	586	0.05	0.01	0.05	0.13	0.01	0.00	49.80	0.00	45.44

Note: Assumes a total of 25 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**34.53**	**284.44**	**136.63**	**11.34**	**9.19**	**49,479.03**	**3.16**								
Maximum Annual Emissions								**2.85**	**25.19**	**11.16**	**0.96**	**0.77**	**4,512.69**	**0.25**	**4,112.96**

Phase 4 - Soil Cement Alternative - 2015

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons per phase) VOC	NOX	CO	PM10	PM2.5	CO_2	CH4	Total GHG Emissions (MT CO2e)
Clearing and Grubbing																				
Dozers < = 175	Dozer - D7	1	8	240	1	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.01	0.00	0.00	0.00	0.52	0.00	0.47
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	2	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.00	0.00	0.00	1.37	0.00	1.25
Dozers > 250 and < = 500	Dozer - D8	1	8	310	1	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.00	0.01	0.00	0.00	0.00	1.06	0.00	0.97
Other Construction Equipment > 120 and < = 175	Brush Chipper	1	8	174	1	0.58	4.68	4.69	0.23	0.19	852	0.05	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.39
	Highway Truck (25,000 lbs)	11	1,320	330	2,640	0.66	19.33	3.00	0.52	0.32	4,789	0.01	0.00	0.02	0.00	0.00	0.00	4.79	0.00	4.36
	Pickup Truck	1	120	330	240	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.10
Total						**5.79**	**58.75**	**26.81**	**2.30**	**1.82**	**10,276.78**	**0.48**	**0.00**	**0.04**	**0.02**	**0.00**	**0.00**	**8.27**	**0.00**	**7.54**
Bike Path																				
Tractors/Loaders/Backhoes > 50 and < = 120	Loader - 1.25 CY	1	8	95	2	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.38
Graders > 120 and < = 175	Grader - Articulated	1	8	135	2	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	0.99	0.00	0.90
	Street Sweeper	1	8	80	2	0.00	0.12	0.02	0.00	0.00	29	0.00	0.00	0.00	0.00	0.00	0.00	1.16	0.00	1.06
	Highway Truck (10,000 lbs)	1	120	330	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
Total						**1.46**	**11.60**	**8.91**	**0.63**	**0.51**	**1,869.59**	**0.13**	**0.00**	**0.02**	**0.01**	**0.00**	**0.00**	**3.22**	**0.00**	**2.93**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	1.09	0.00	0.99
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.03**	**0.21**	**0.12**	**0.01**	**0.01**	**34.77**	**0.00**	**31.70**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	60	16.8	1,008	109	109,872	0.08	0.76	1.80	0.13	0.07	703	0.06	0.00	0.04	0.10	0.01	0.00	38.32	0.00	34.96

Note: Assumes a total of 30 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**17.74**	**155.55**	**86.37**	**6.77**	**5.42**	**26,580.41**	**1.61**								
Maximum Annual Emissions								**0.04**	**0.31**	**0.25**	**0.02**	**0.01**	**84.59**	**0.01**	**77.13**

Phase 4 - Soil Cement Alternative - 2016

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons per phase) VOC	NOX	CO	PM10	PM2.5	CO_2	CH4	Total GHG Emissions (MT CO2e)
Diversion and Water Control																				
Divert and Control Water from the River at Both Ends of the Project Reach																				
Dozers < = 175	Dozer - D6 (remove)	1	8	145	10	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.01	0.05	0.03	0.00	0.00	5.18	0.00	4.73
Total						**1.48**	**10.46**	**6.62**	**0.59**	**0.51**	**1,035.81**	**0.13**	**0.01**	**0.05**	**0.03**	**0.00**	**0.00**	**5.18**	**0.00**	**4.73**
Dewatering																				
Bore/Drill Rigs > 250 and < = 500	Drill, earth auger for deep wells - 8" (7k ft-lb)	1	10	375	151	1.03	6.25	5.51	0.19	0.13	3,113	0.09	0.08	0.47	0.42	0.01	0.01	235.04	0.01	214.06
Cranes > 120 and < = 175	Crane, 30 Ton	1	10	152	151	0.86	6.10	4.78	0.35	0.29	803	0.08	0.07	0.46	0.36	0.03	0.02	60.66	0.01	55.35
Pumps > 25 and < = 50	Pump	1	24	50	151	1.84	6.90	6.78	0.49	0.41	824	0.17	0.14	0.52	0.51	0.04	0.03	62.21	0.01	56.93
	Pickup Truck	1	120	330	18,120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.02	0.00	0.00	8.07	0.00	7.36
Total						**3.74**	**19.29**	**17.39**	**1.04**	**0.83**	**4,847.43**	**0.34**	**0.28**	**1.46**	**1.31**	**0.08**	**0.06**	**365.98**	**0.03**	333.70
Excavation (for placement of soil cement)																				
Load and haul with scrapers, dozer																				
Scrapers > 250 < = 500	CAT 627 Scraper	4	8	330	151	8.76	70.99	32.34	2.72	2.29	10,286	0.79	0.66	5.36	2.44	0.21	0.17	776.57	0.06	708.20
Dozers > 250 and < = 500	Dozer - D8	1	8	310	151	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.17	1.35	0.71	0.06	0.05	159.98	0.02	145.97
	Pickup Truck	1	120	330	18,120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.02	0.00	0.00	8.07	0.00	7.36
Soil Cement																				
Excavate/Load/Haul from Borrow site to Soil Screening Plant																				
Dozers < = 175	Dozer - D6	1	8	145	151	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.11	0.79	0.50	0.04	0.04	78.20	0.01	71.42
Tractors/Loaders/Backhoes > 250 and < = 500	Loader 980	1	8	349	151	1.59	11.27	5.57	0.40	0.32	2,759	0.14	0.12	0.85	0.42	0.03	0.02	208.29	0.01	189.82
Water Truck	3,000 gal water truck	1	8	230	151	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.07	0.52	0.22	0.02	0.01	100.59	0.01	91.70
	Truck - 250 Articulated	14	1,680	330	253,680	0.84	24.60	3.82	0.67	0.41	6,095	0.02	0.06	1.86	0.29	0.05	0.03	460.19	0.00	418.81
Load/Haul Unsuitable Soil																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	151	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.06	0.48	0.21	0.02	0.01	103.73	0.01	94.54
	Truck - 20 CY (75,000 lbs)	4	480	330	72,480	0.24	7.03	1.09	0.19	0.12	1,741	0.01	0.02	0.53	0.08	0.01	0.01	131.48	0.00	119.66
Process excavated soil through Soil Screening Plant																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	151	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.06	0.48	0.21	0.02	0.01	103.73	0.01	94.54
Mix at Soil Cement Batch Plant																				
Generator Sets > 25 and < = 50	Generator	1	8	375	151	0.50	2.03	1.91	0.14	0.11	245	0.05	0.04	0.15	0.14	0.01	0.01	18.50	0.00	16.92
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	151	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.06	0.48	0.21	0.02	0.01	103.73	0.01	94.54
Load/Haul/Place Soil Cement																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	2	8	211	151	1.64	12.66	5.65	0.42	0.34	2,748	0.15	0.12	0.96	0.43	0.03	0.03	207.46	0.01	189.07
Graders > 120 and < = 175	Grader - 120	1	8	135	151	0.97	6.90	5.85	0.38	0.32	991	0.09	0.07	0.52	0.44	0.03	0.02	74.85	0.01	68.28
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	151	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.06	0.60	0.21	0.02	0.02	92.47	0.01	84.29
	Truck - 250 Articulated	2	240	330	36,240	0.12	3.51	0.55	0.10	0.06	871	0.00	0.01	0.27	0.04	0.01	0.00	65.74	0.00	59.83
Spread Fill Material																				
Dozers > 250 and < = 500	Dozer - D9	1	8	410	151	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.17	1.35	0.71	0.06	0.05	159.98	0.02	145.97
Compact Soil																				
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	151	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.06	0.60	0.21	0.02	0.02	92.47	0.01	84.29
Water Truck	3,000 gal water truck	1	8	230	151	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.07	0.52	0.22	0.02	0.01	100.59	0.01	91.70
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	22	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.02	0.12	0.07	0.01	0.01	11.39	0.00	10.41
Water Truck	3,000 gal water truck	1	8	230	22	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.01	0.08	0.03	0.00	0.00	14.66	0.00	13.36
Total						**29.06**	**251.53**	**111.83**	**9.52**	**7.75**	**42,720.80**	**2.55**	**2.04**	**17.87**	**7.83**	**0.67**	**0.54**	**3,072.67**	**0.18**	**2,800.67**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	60	16.8	1,008	151	152,208	0.08	0.76	1.80	0.13	0.07	703	0.06	0.01	0.06	0.14	0.01	0.01	53.09	0.00	48.43

Note: Assumes a total of 25 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**32.88**	**271.58**	**131.02**	**10.69**	**8.66**	**48,271.36**	**2.95**								
Maximum Annual Emissions								**2.33**	**19.38**	**9.28**	**0.75**	**0.61**	**3,491.74**	**0.21**	**3,182.81**

Phase 4 - Grouted Stone Alternative - 2015

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons per phase) VOC	NOX	CO	PM10	PM2.5	CO_2	CH4	Total GHG Emissions (MT CO2e)
Clearing and Grubbing																				
Dozers < = 175	Dozer - D7	1	8	240	1	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.01	0.00	0.00	0.00	0.52	0.00	0.47
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	2	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.00	0.00	0.00	1.37	0.00	1.25
Dozers > 250 and < = 500	Dozer - D8	1	8	310	1	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.00	0.01	0.00	0.00	0.00	1.06	0.00	0.97
Other Construction Equipment > 120 and < = 175	Brush Chipper	1	8	174	1	0.58	4.68	4.69	0.23	0.19	852	0.05	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.39
	Highway Truck (25,000 lbs)	11	1,320	330	2,640	0.66	19.33	3.00	0.52	0.32	4,789	0.01	0.00	0.02	0.00	0.00	0.00	4.79	0.00	4.36
	Pickup Truck	1	120	330	240	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.10
Total						**5.79**	**58.75**	**26.81**	**2.30**	**1.82**	**10,276.78**	**0.48**	**0.00**	**0.04**	**0.02**	**0.00**	**0.00**	**8.27**	**0.00**	**7.54**
Bike Path																				
Tractors/Loaders/Backhoes > 50 and < = 120	Loader - 1.25 CY	1	8	95	2	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.38
Graders > 120 and < = 175	Grader - Articulated	1	8	135	2	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	0.99	0.00	0.90
	Street Sweeper	1	8	80	2	0.00	0.12	0.02	0.00	0.00	29	0.00	0.00	0.00	0.00	0.00	0.00	1.16	0.00	1.06
	Highway Truck (10,000 lbs)	1	120	330	360	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
Total						**1.46**	**11.60**	**8.91**	**0.63**	**0.51**	**1,869.59**	**0.13**	**0.00**	**0.02**	**0.01**	**0.00**	**0.00**	**3.22**	**0.00**	**2.93**
RCB and RCP Culverts and Extensions																				
Excavate Trench																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe - 1.12 CY	1	8	110	5	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.01	0.01	0.00	0.00	1.03	0.00	0.94
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 160	1	8	128	5	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.01	0.01	0.00	0.00	2.03	0.00	1.85
	Highway Truck (10,000 lbs)	1	120	330	600	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	1.09	0.00	0.99
Lay Sand Bedding																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Plate Compactors	Compactor	1	8	19	3	0.04	0.25	0.21	0.01	0.01	35	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
RCP pipe installation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	9	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.03	0.01	0.00	0.00	5.71	0.00	5.21
Cement and Mortar Mixers	Concrete mixer	1	8	2	9	0.06	0.37	0.31	0.01	0.01	51	0.01	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.21
Backfill Trench																				
Excavators > 50 and < = 120	Excavator - 1CY, 40,000 lbs	1	8	110	7	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	2.06	0.00	1.88
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	7	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.02	0.02	0.00	0.00	2.84	0.00	2.59
Rollers > 175 and < = 250	Roller BW 190AD4	1	8	205	7	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.03	0.01	0.00	0.00	4.29	0.00	3.91
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Outlet Structure																				
Concrete Work																				
Pumps > 175 and < = 250	Concrete pump	2	8	210	3	1.61	19.02	6.26	0.54	0.45	3,222	0.15	0.00	0.03	0.01	0.00	0.00	4.83	0.00	4.40
Flap gates																				
Cranes > 120 and < = 175	Crane - 30 Ton	1	8	152	5	0.69	4.88	3.83	0.28	0.23	643	0.06	0.00	0.01	0.01	0.00	0.00	1.61	0.00	1.47
Excavation																				
Excavators > 175 and < = 250	Excavator - 2CY, 70,000 lbs	1	8	238	3	0.84	6.29	2.71	0.21	0.17	1,269	0.08	0.00	0.01	0.00	0.00	0.00	1.90	0.00	1.74
Dozers < = 175	Dozer - D6	1	8	145	3	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.02	0.01	0.00	0.00	1.55	0.00	1.42
Total						**10.42**	**84.43**	**48.85**	**3.70**	**3.02**	**13,730.91**	**0.94**	**0.03**	**0.21**	**0.12**	**0.01**	**0.01**	**34.77**	**0.00**	**31.70**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	60	16.8	1,008	109	109,872	0.08	0.76	1.80	0.13	0.07	703	0.06	0.00	0.04	0.10	0.01	0.00	38.32	0.00	34.96

Note: Assumes a total of 30 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons per phase) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**17.74**	**155.55**	**86.37**	**6.77**	**5.42**	**26,580.41**	**1.61**								
Maximum Annual Emissions								**0.04**	**0.31**	**0.25**	**0.02**	**0.01**	**84.59**	**0.01**	**77.13**

Phase 4 -Grouted Stone Alternative - 2016

Off-Road Construction Equipment

						Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
Equipment Type	**Equipment Category**	**Number**	**Usage Factor (hrs/day or miles/day)**	**Power Rating (hp)**	**Total Days/VMT**	**VOC**	**NOX**	**CO**	**PM10**	**PM2.5**	**CO2**	**CH4**	**VOC**	**NOX**	**CO**	**PM10**	**PM2.5**	**CO_2**	**CH4**	**Total GHG Emissions (MT CO2e)**
Diversion and Water Control																				
Divert and Control Water from the River at Both Ends of the Project Reach																				
Dozers < = 175	Dozer - D6 (remove)	1	8	145	10	1.48	10.46	6.62	0.59	0.51	1,035.81	0.13	0.01	0.05	0.03	0.00	0.00	5.18	0.00	4.73
Total						**1.48**	**10.46**	**6.62**	**0.59**	**0.51**	**1,035.81**	**0.13**	**0.01**	**0.05**	**0.03**	**0.00**	**0.00**	**5.18**	**0.00**	**4.73**
Dewatering																				
Bore/Drill Rigs > 250 and < = 500	Drill, earth auger for deep wells - 8" (7k ft-lb)	1	10	375	151	1.03	6.25	5.51	0.19	0.13	3,113	0.09	0.08	0.47	0.42	0.01	0.01	235.04	0.01	214.06
Cranes > 120 and < = 175	Crane, 30 Ton	1	10	152	151	0.86	6.10	4.78	0.35	0.29	803	0.08	0.07	0.46	0.36	0.03	0.02	60.66	0.01	55.35
Pumps > 25 and < = 50	Pump	1	24	50	151	1.84	6.90	6.78	0.49	0.41	824	0.17	0.14	0.52	0.51	0.04	0.03	62.21	0.01	56.93
	Pickup Truck	1	120	330	18,120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.02	0.00	0.00	8.07	0.00	7.36
Total						**3.74**	**19.29**	**17.39**	**1.04**	**0.83**	**4,847.43**	**0.34**	**0.28**	**1.46**	**1.31**	**0.08**	**0.06**	**365.98**	**0.03**	**333.70**
Load/Haul/Place Grouted Stone																				
Scrapers > 250 < = 500	CAT 627 Scraper	1	8	330	151	2.19	17.75	8.09	0.68	0.57	2,571	0.20	0.17	1.34	0.61	0.05	0.04	194.14	0.01	177.05
Dozers > 250 and < = 500	Dozer - D8	1	8	310	151	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.17	1.35	0.71	0.06	0.05	159.98	0.02	145.97
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	151	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.06	0.48	0.21	0.02	0.01	103.73	0.01	94.54
Graders > 120 and < = 175	Grader - 120	1	8	135	151	0.97	6.90	5.85	0.38	0.32	991	0.09	0.07	0.52	0.44	0.03	0.02	74.85	0.01	68.28
Pumps > 175 and < = 250	Concrete pump	1	8	210	151	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.06	0.72	0.24	0.02	0.02	121.63	0.01	110.82
Water Truck	3,000 gal water truck	1	8	230	151	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.07	0.52	0.22	0.02	0.01	100.59	0.01	91.70
	Truck - 250 Articulated	1	120	330	18,120	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.13	0.02	0.00	0.00	32.87	0.00	29.91
Haul away excess																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	151	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.06	0.48	0.21	0.02	0.01	103.73	0.01	94.54
	Belly Dump Truck	1	120	330	18,120	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.13	0.02	0.00	0.00	32.87	0.00	29.91
Establish and maintain haul roads																				
Dozers < = 175	Dozer - D6	1	8	145	7	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.01	0.04	0.02	0.00	0.00	3.63	0.00	3.31
Water Truck	3,000 gal water truck	1	8	230	7	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.66	0.00	4.25
Total						**11.33**	**92.58**	**45.07**	**3.63**	**3.02**	**14,611.81**	**1.01**	**0.68**	**5.74**	**2.72**	**0.21**	**0.18**	**932.68**	**0.06**	**850.29**

On Road Construction Emissions

						Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
	Total Trips	**Distance**	**Average Daily Mileage**	**Calculated Time - Rounded (days)**	**Total Mileage**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO2**	**CH_4**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO_2**	**CH_4**	**Total GHG Emissions (MT CO2e)**
Worker Trips	60	16.8	1,008	151	152,208	0.08	0.76	1.80	0.13	0.07	703	0.06	0.01	0.06	0.14	0.01	0.01	53.09	0.00	48.43

Note: Assumes a total of 25 workers per day.

	Emissions Summary (lbs/day)							Emissions Summary (tons per phase)							
Total	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO2**	**CH_4**	**ROG**	**NO_x**	**CO**	**PM10**	**PM2.5**	**CO_2**	**CH_4**	**Total GHG Emissions (MT CO2e)**
Maximum Daily Emissions	**15.15**	**112.64**	**64.26**	**4.80**	**3.92**	**20,162.37**	**1.42**								
Maximum Annual Emissions								**0.98**	**7.30**	**4.20**	**0.31**	**0.25**	**1,356.93**	**0.09**	**1,237.16**

BNSF Bridge - 2016

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons) VOC	NOX	CO	PM10	PM2.5	CO_2	CH4	Total GHG Emissions (MT CO2e)
Clearing and Grubbing																				
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	2	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.00	0.00	0.00	1.37	0.00	1.25
Dozers > 250 and < = 500	Dozer - D8	1	8	310	1	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.00	0.01	0.00	0.00	0.00	1.06	0.00	0.97
	Highway Truck (25,000 lbs)	2	240	330	480	0.12	3.51	0.55	0.10	0.06	871	0.00	0.00	0.00	0.00	0.00	0.00	0.87	0.00	0.79
	Pickup Truck	1	120	330	240	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.10
Total						**3.18**	**27.79**	**13.03**	**1.05**	**0.86**	**4,470.49**	**0.29**	**0.00**	**0.02**	**0.01**	**0.00**	**0.00**	**3.41**	**0.00**	**3.11**
Diversion of Water and Dewatering Associated with Piers 1, 2 and 3																				
Cranes > 250 and < = 500	Crawler Crane - LS-208H	1	10	263	10	1.32	10.72	4.43	0.39	0.32	1,801	0.12	0.01	0.05	0.02	0.00	0.00	9.01	0.00	8.21
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	2	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.00	0.00	0.00	0.00	0.81	0.00	0.74
Dozers < = 175	Dozer - D4	1	8	80	2	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.01	0.01	0.00	0.00	1.04	0.00	0.95
Rollers > 175 and < = 250	Roller - BW151AD	1	8	108	2	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.01	0.00	0.00	0.00	1.22	0.00	1.12
	10-CY Dump Truck	2	240	130	960	0.12	3.51	0.55	0.10	0.06	871	0.00	0.00	0.01	0.00	0.00	0.00	1.74	0.00	1.58
	Pickup Truck	1	120	330	360	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.15
Total						**4.40**	**37.16**	**19.37**	**1.59**	**1.31**	**5,850.25**	**0.40**	**0.01**	**0.08**	**0.04**	**0.00**	**0.00**	**13.98**	**0.00**	**12.74**
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	120	1.84	6.90	6.78	0.49	0.41	824	0.17	0.11	0.41	0.41	0.03	0.02	49.44	0.01	45.25
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.11**	**0.41**	**0.41**	**0.03**	**0.02**	**49.44**	**0.01**	**45.25**
Work on Pier 1																				
Below Grade Diaphragm Wall																				
Graders > 120 and < = 175	Grader	1	10	135	1	1.22	8.62	7.31	0.48	0.40	1,239	0.11	0.00	0.00	0.00	0.00	0.00	0.62	0.00	0.57
Rollers > 175 and < = 250	Roller, 20 ton	1	10	195	1	1.04	9.96	3.46	0.33	0.28	1,531	0.09	0.00	0.00	0.00	0.00	0.00	0.77	0.00	0.70
Dozers < = 175	Dozer - D6	1	10	145	1	1.85	13.07	8.28	0.74	0.64	1,295	0.17	0.00	0.01	0.00	0.00	0.00	0.65	0.00	0.59
Excavators > 50 and < = 120	Hydraulic Excavator, PC160	1	8	110	1	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.27
Other Construction Equipment > 175 and < = 500	Low-Headroom Hydromill	1	8	375	35	0.99	8.33	3.89	0.28	0.23	2,034	0.09	0.02	0.15	0.07	0.00	0.00	35.59	0.00	32.43
Excavators > 250 and < = 500	Hydraulic Excavator, 5080	1	8	424	35	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.02	0.14	0.07	0.01	0.00	32.72	0.00	29.83
Excavators > 500 and < = 750	Hydraulic Excavator, PC1100	1	8	611	35	1.99	14.04	6.43	0.49	0.40	3,099	0.18	0.03	0.25	0.11	0.01	0.01	54.24	0.00	49.44
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	35	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.01	0.11	0.05	0.00	0.00	24.04	0.00	21.91
Dozers < = 175	Dozer - D6	1	8	145	35	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.03	0.18	0.12	0.01	0.01	18.13	0.00	16.55
Cranes > 250 and < = 500	Crane, 100 ton	1	8	350	50	1.06	8.58	3.54	0.31	0.26	1,441	0.10	0.03	0.21	0.09	0.01	0.01	36.02	0.00	32.84
Cranes > 250 and < = 500	Crane. 40 ton	1	10	350	5	1.32	10.72	4.43	0.39	0.32	1,801	0.12	0.00	0.03	0.01	0.00	0.00	4.50	0.00	4.10
Dozers > 175 and < = 250	Dozer - D7	1	10	240	1	2.10	17.08	6.07	0.71	0.60	1,835	0.19	0.00	0.01	0.00	0.00	0.00	0.92	0.00	0.84
Off-Highway Trucks Composite	Off-hwy trucks	4	8	214	35	5.81	42.63	18.66	1.47	1.20	8,322	0.52	0.10	0.75	0.33	0.03	0.02	145.63	0.01	132.76
Off-Highway Trucks Composite	Vacuum trucks	3	8	177	10	4.36	31.97	13.99	1.10	0.90	6,241	0.39	0.02	0.16	0.07	0.01	0.00	31.21	0.00	28.45
	10-CY Dump Truck	2	240	130	240	0.12	3.51	0.55	0.10	0.06	871	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.00	0.40
	Pickup Truck	1	120	130	1,200	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.53	0.00	0.49
Tiebacks for Diaphragm Walls																				
Dozers > 175 and < = 250	Dozer - D7	1	8	240	4	1.68	13.67	4.85	0.57	0.48	1,468	0.15	0.00	0.03	0.01	0.00	0.00	2.94	0.00	2.68
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	4	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.01	0.00	0.00	2.75	0.00	2.50
Bore/Drill Rigs > 175 and < = 250	Drill, Hydraulic Track	1	8	215	4	0.50	3.11	2.74	0.09	0.06	1,505	0.05	0.00	0.01	0.01	0.00	0.00	3.01	0.00	2.74
Rollers > 175 and < = 250	Roller - BW190AD-4	1	8	205	2	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.01	0.00	0.00	0.00	1.22	0.00	1.12
Off-Highway Trucks Composite	Off-hwy trucks - D250D	3	8	214	8	4.36	31.97	13.99	1.10	0.90	6,241	0.39	0.02	0.13	0.06	0.00	0.00	24.96	0.00	22.76
Water Truck	Water Truck	1	8	230	2	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.01	0.00	0.00	0.00	1.33	0.00	1.21
	Pickup Truck	1	120	130	1,200	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.53	0.00	0.49
Total						**35.19**	**267.82**	**124.75**	**10.29**	**8.48**	**47,935.67**	**3.18**	**0.30**	**2.19**	**1.01**	**0.08**	**0.07**	**423.05**	**0.03**	**385.65**
Work on Piers 2 and 3																				
Below Grade Diaphragm Wall																				
Excavators > 250 and < = 500	Hydraulic Excavator - PC600LC	1	8	384	4	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.00	0.02	0.01	0.00	0.00	3.74	0.00	3.41
Dozers > 250 and < = 500	Dozer - D9	1	8	410	12	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.01	0.11	0.06	0.00	0.00	12.71	0.00	11.60
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	8	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.03	0.01	0.00	0.00	5.50	0.00	5.01
Cranes > 250 and < = 500	Crawler Crane - LS-208H	1	10	263	12	1.32	10.72	4.43	0.39	0.32	1,801	0.12	0.01	0.06	0.03	0.00	0.00	10.81	0.00	9.85
Graders > 120 and < = 175	Gradall - PW170ES	1	8	123	2	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	0.99	0.00	0.90
Rollers > 175 and < = 250	Roller - BW190AD-4	1	8	205	4	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.02	0.01	0.00	0.00	2.45	0.00	2.23
Off-Highway Trucks Composite	Off-hwy trucks - D250D	3	8	214	8	4.36	31.97	13.99	1.10	0.90	6,241	0.39	0.02	0.13	0.06	0.00	0.00	24.96	0.00	22.76
	Bottom Dump Trucks	4	480	130	480	0.24	7.03	1.09	0.19	0.12	1,741	0.01	0.00	0.00	0.00	0.00	0.00	0.87	0.00	0.79
	Pickup Truck	1	120	130	360	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.15
Pier Wall Extension																				
Dozers > 250 and < = 500	Dozer - D9	1	8	410	18	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.02	0.16	0.08	0.01	0.01	19.07	0.00	17.40
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	6	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.02	0.01	0.00	0.00	4.12	0.00	3.76
Excavators > 50 and < = 120	Hydraulic Excavator, PC160	1	8	110	6	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	1.77	0.00	1.61
Rollers >25 and < = 50	Roller - 5 TON	1	8	47	12	0.64	1.86	2.14	0.15	0.13	208	0.06	0.00	0.01	0.01	0.00	0.00	1.25	0.00	1.14
Pumps > 175 and < = 250	Concrete Pump	1	8	210	16	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.01	0.08	0.03	0.00	0.00	12.89	0.00	11.74
Cranes > 250 and < = 500	Crane, 100 ton	1	8	350	10	1.06	8.58	3.54	0.31	0.26	1,441	0.10	0.01	0.04	0.02	0.00	0.00	7.20	0.00	6.57
Water Truck	Water Truck	1	8	230	12	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.01	0.04	0.02	0.00	0.00	7.99	0.00	7.29
	Dump Trucks, 20 CY	2	240	130	720	0.12	3.51	0.55	0.10	0.06	871	0.00	0.00	0.01	0.00	0.00	0.00	1.31	0.00	1.19
	Pickup Truck	1	120	130	360	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.15
Total						**19.28**	**155.98**	**73.34**	**5.90**	**4.82**	**27,120.92**	**1.73**	**0.09**	**0.74**	**0.35**	**0.03**	**0.02**	**117.95**	**0.01**	**107.55**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	40	16.8	672	131	88,032	0.05	0.51	1.20	0.09	0.05	469	0.04	0.00	0.03	0.08	0.01	0.00	30.70	0.00	28.01

Note: Assumes a total of 20 workers per day.

Total	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**56.36**	**431.20**	**206.06**	**16.77**	**13.75**	**76,349.38**	**5.12**								
Maximum Annual Emissions								**0.51**	**3.48**	**1.89**	**0.15**	**0.12**	**638.53**	**0.05**	**582.31**

Note: Maximum daily emissions are based on overlapping activities for dewatering and work on Piers 1, 2, and 3.

BNSF Bridge - 2017

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons) VOC	NOX	CO	PM10	PM2.5	CO_2	CH4	Total GHG Emissions (MT CO2e)
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	240	1.84	6.90	6.78	0.49	0.41	824	0.17	0.22	0.83	0.81	0.06	0.05	98.88	0.02	90.49
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.22**	**0.83**	**0.81**	**0.06**	**0.05**	**98.88**	**0.02**	**90.49**
Work on Pier 1																				
Below Grade Diaphragm Wall																				
Graders > 120 and < = 175	Grader	1	10	135	1	1.22	8.62	7.31	0.48	0.40	1,239	0.11	0.00	0.00	0.00	0.00	0.00	0.62	0.00	0.57
Rollers > 175 and < = 250	Roller, 20 ton	1	10	195	1	1.04	9.96	3.46	0.33	0.28	1,531	0.09	0.00	0.00	0.00	0.00	0.00	0.77	0.00	0.70
Dozers < = 175	Dozer - D6	1	10	145	1	1.85	13.07	8.28	0.74	0.64	1,295	0.17	0.00	0.01	0.00	0.00	0.00	0.65	0.00	0.59
Excavators > 50 and < = 120	Hydraulic Excavator, PC160	1	8	110	1	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.27
Other Construction Equipment > 175 and < = 500	Low-Headroom Hydromill	1	8	375	35	0.99	8.33	3.89	0.28	0.23	2,034	0.09	0.02	0.15	0.07	0.00	0.00	35.59	0.00	32.43
Excavators > 250 and < = 500	Hydraulic Excavator, 5080	1	8	424	35	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.02	0.14	0.07	0.01	0.00	32.72	0.00	29.83
Excavators > 500 and < = 750	Hydraulic Excavator, PC1100	1	8	611	35	1.99	14.04	6.43	0.49	0.40	3,099	0.18	0.03	0.25	0.11	0.01	0.01	54.24	0.00	49.44
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	35	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.01	0.11	0.05	0.00	0.00	24.04	0.00	21.91
Dozers < = 175	Dozer - D6	1	8	145	35	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.03	0.18	0.12	0.01	0.01	18.13	0.00	16.55
Cranes > 250 and < = 500	Crane, 100 ton	1	8	350	50	1.06	8.58	3.54	0.31	0.26	1,441	0.10	0.03	0.21	0.09	0.01	0.01	36.02	0.00	32.84
Cranes > 250 and < = 500	Crane. 40 ton	1	10	350	5	1.32	10.72	4.43	0.39	0.32	1,801	0.12	0.00	0.03	0.01	0.00	0.00	4.50	0.00	4.10
Dozers > 175 and < = 250	Dozer - D7	1	10	240	1	2.10	17.08	6.07	0.71	0.60	1,835	0.19	0.00	0.01	0.00	0.00	0.00	0.92	0.00	0.84
Off-Highway Trucks Composite	Off-hwy trucks	4	8	214	35	5.81	42.63	18.66	1.47	1.20	8,322	0.52	0.10	0.75	0.33	0.03	0.02	145.63	0.01	132.76
Off-Highway Trucks Composite	Vacuum trucks	3	8	177	10	4.36	31.97	13.99	1.10	0.90	6,241	0.39	0.02	0.16	0.07	0.01	0.00	31.21	0.00	28.45
	10-CY Dump Truck	2	240	130	240	0.12	3.51	0.55	0.10	0.06	871	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.00	0.40
	Pickup Truck	1	120	130	1,200	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.53	0.00	0.49
Tiebacks for Diaphragm Walls																				
Dozers > 175 and < = 250	Dozer - D7	1	8	240	4	1.68	13.67	4.85	0.57	0.48	1,468	0.15	0.00	0.03	0.01	0.00	0.00	2.94	0.00	2.68
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	4	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.01	0.00	0.00	2.75	0.00	2.50
Bore/Drill Rigs > 175 and < = 250	Drill, Hydraulic Track	1	8	215	4	0.50	3.11	2.74	0.09	0.06	1,505	0.05	0.00	0.01	0.01	0.00	0.00	3.01	0.00	2.74
Rollers > 175 and < = 250	Roller - BW190AD-4	1	8	205	2	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.01	0.00	0.00	0.00	1.22	0.00	1.12
Off-Highway Trucks Composite	Off-hwy trucks - D250D	3	8	214	8	4.36	31.97	13.99	1.10	0.90	6,241	0.39	0.02	0.13	0.06	0.00	0.00	24.96	0.00	22.76
Water Truck	Water Truck	1	8	230	2	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.01	0.00	0.00	0.00	1.33	0.00	1.21
	Pickup Truck	1	120	130	1,200	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.53	0.00	0.49
Total						**35.19**	**267.82**	**124.75**	**10.29**	**8.48**	**47,935.67**	**3.18**	**0.30**	**2.19**	**1.01**	**0.08**	**0.07**	**423.05**	**0.03**	**385.65**
Work on Piers 2 and 3																				
Below Grade Diaphragm Wall																				
Excavators > 250 and < = 500	Hydraulic Excavator - PC600LC	1	8	384	4	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.00	0.02	0.01	0.00	0.00	3.74	0.00	3.41
Dozers > 250 and < = 500	Dozer - D9	1	8	410	12	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.01	0.11	0.06	0.00	0.00	12.71	0.00	11.60
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	8	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.03	0.01	0.00	0.00	5.50	0.00	5.01
Cranes > 250 and < = 500	Crawler Crane - LS-208H	1	10	263	12	1.32	10.72	4.43	0.39	0.32	1,801	0.12	0.01	0.06	0.03	0.00	0.00	10.81	0.00	9.85
Graders > 120 and < = 175	Gradall - PW170ES	1	8	123	2	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	0.99	0.00	0.90
Rollers > 175 and < = 250	Roller - BW190AD-4	1	8	205	4	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.02	0.01	0.00	0.00	2.45	0.00	2.23
Off-Highway Trucks Composite	Off-hwy trucks - D250D	3	8	214	8	4.36	31.97	13.99	1.10	0.90	6,241	0.39	0.02	0.13	0.06	0.00	0.00	24.96	0.00	22.76
	Bottom Dump Trucks	4	480	130	480	0.24	7.03	1.09	0.19	0.12	1,741	0.01	0.00	0.00	0.00	0.00	0.00	0.87	0.00	0.79
	Pickup Truck	1	120	130	360	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.15
Pier Wall Extension																				
Dozers > 250 and < = 500	Dozer - D9	1	8	410	18	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.02	0.16	0.08	0.01	0.01	19.07	0.00	17.40
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	6	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.02	0.01	0.00	0.00	4.12	0.00	3.76
Excavators > 50 and < = 120	Hydraulic Excavator, PC160	1	8	110	6	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	1.77	0.00	1.61
Rollers >25 and < = 50	Roller - 5 TON	1	8	47	12	0.64	1.86	2.14	0.15	0.13	208	0.06	0.00	0.01	0.01	0.00	0.00	1.25	0.00	1.14
Pumps > 175 and < = 250	Concrete Pump	1	8	210	16	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.01	0.08	0.03	0.00	0.00	12.89	0.00	11.74
Cranes > 250 and < = 500	Crane, 100 ton	1	8	350	10	1.06	8.58	3.54	0.31	0.26	1,441	0.10	0.01	0.04	0.02	0.00	0.00	7.20	0.00	6.57
Water Truck	Water Truck	1	8	230	12	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.01	0.04	0.02	0.00	0.00	7.99	0.00	7.29
	Dump Trucks, 20 CY	2	240	130	720	0.12	3.51	0.55	0.10	0.06	871	0.00	0.00	0.01	0.00	0.00	0.00	1.31	0.00	1.19
	Pickup Truck	1	120	130	360	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.15
Total						**19.28**	**155.98**	**73.34**	**5.90**	**4.82**	**27,120.92**	**1.73**	**0.09**	**0.74**	**0.35**	**0.03**	**0.02**	**117.95**	**0.01**	**107.55**
Diversion of Water and Dewatering Associated with Piers 4, 5, and 6																				
Dozers > 250 and < = 500	Dozer - D9	1	8	410	3	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.00	0.03	0.01	0.00	0.00	3.18	0.00	2.90
Cranes > 250 and < = 500	Crawler Crane - LS-208H	1	10	263	10	1.32	10.72	4.43	0.39	0.32	1,801	0.12	0.01	0.05	0.02	0.00	0.00	9.01	0.00	8.21
Tractors/Loaders/Backhoes > 120 < = 175	Loader - 924	1	8	128	2	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.00	0.00	0.00	0.00	0.81	0.00	0.74
Dozers < = 175	Dozer - D4	1	8	80	2	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.00	0.01	0.01	0.00	0.00	1.04	0.00	0.95
Rollers > 175 and < = 250	Roller - BW151AD	1	8	108	2	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.01	0.00	0.00	0.00	1.22	0.00	1.12
	10-CY Dump Truck	2	240	130	960	0.12	3.51	0.55	0.10	0.06	871	0.00	0.00	0.01	0.00	0.00	0.00	1.74	0.00	1.58
	Pickup Truck	1	120	330	360	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.15
Total						**6.63**	**55.07**	**28.71**	**2.32**	**1.93**	**7,969.23**	**0.60**	**0.01**	**0.11**	**0.05**	**0.00**	**0.00**	**17.16**	**0.00**	**15.64**
Work on Pier 4																				
Below Grade Diaphragm Wall																				
Excavators > 250 and < = 500	Hydraulic Excavator - PC600LC	1	8	384	2	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.00	0.01	0.00	0.00	0.00	1.87	0.00	1.70
Dozers > 250 and < = 500	Dozer - D9	1	8	410	6	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.01	0.05	0.03	0.00	0.00	6.36	0.00	5.80
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	4	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.01	0.00	0.00	2.75	0.00	2.50
Cranes > 250 and < = 500	Crawler Crane - LS-208H	1	10	263	5	1.32	10.72	4.43	0.39	0.32	1,801	0.12	0.00	0.03	0.01	0.00	0.00	4.50	0.00	4.10
Graders > 120 and < = 175	Gradall - PW170ES	1	8	123	1	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.45
Rollers > 175 and < = 250	Roller - BW190AD-4	1	8	205	2	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.01	0.00	0.00	0.00	1.22	0.00	1.12
Off-Highway Trucks Composite	Off-hwy trucks - D250D	3	8	214	4	4.36	31.97	13.99	1.10	0.90	6,241	0.39	0.01	0.06	0.03	0.00	0.00	12.48	0.00	11.38
	Bottom Dump Trucks	4	480	130	480	0.24	7.03	1.09	0.19	0.12	1,741	0.01	0.00	0.00	0.00	0.00	0.00	0.87	0.00	0.79
	Pickup Truck	1	120	130	360	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.15
Pier Wall Extension																				
Dozers > 250 and < = 500	Dozer - D9	1	8	410	9	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.01	0.08	0.04	0.00	0.00	9.54	0.00	8.70
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	3	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.00	0.00	0.00	2.06	0.00	1.88
Excavators > 50 and < = 120	Hydraulic Excavator, PC160	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Rollers >25 and < = 50	Roller - 5 TON	1	8	47	6	0.64	1.86	2.14	0.15	0.13	208	0.06	0.00	0.01	0.01	0.00	0.00	0.62	0.00	0.57
Pumps > 175 and < = 250	Concrete Pump	1	8	210	8	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.00	0.04	0.01	0.00	0.00	6.44	0.00	5.87
Cranes > 250 and < = 500	Crane, 100 ton	1	8	350	5	1.06	8.58	3.54	0.31	0.26	1,441	0.10	0.00	0.02	0.01	0.00	0.00	3.60	0.00	3.28
Water Truck	Water Truck	1	8	230	6	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.00	0.00	3.64
	Dump Trucks, 20 CY	2	240	130	720	0.12	3.51	0.55	0.10	0.06	871	0.00	0.00	0.01	0.00	0.00	0.00	1.31	0.00	1.19
	Pickup Truck	1	120	130	360	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.15
Total						**19.28**	**155.98**	**73.34**	**5.90**	**4.82**	**27,120.92**	**1.73**	**0.05**	**0.37**	**0.17**	**0.01**	**0.01**	**59.32**	**0.00**	**54.09**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	40	16.8	672	131	88,032	0.05	0.51	1.20	0.09	0.05	469	0.04	0.00	0.03	0.08	0.01	0.00	30.70	0.00	28.01

Note: Assumes a total of 20 workers per day.

Total	ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**56.36**	**431.20**	**206.06**	**16.77**	**13.75**	**76,349.38**	**5.12**								
Maximum Annual Emissions								**0.67**	**4.27**	**2.48**	**0.19**	**0.16**	**747.07**	**0.06**	**681.44**

Note: Maximum daily emissions are based on overlapping activities for dewatering and work on Piers 1, 2, and 3.

BNSF Bridge - 2018

Off-Road Construction Equipment

Equipment Type	Equipment Category	Number	Usage Factor (hrs/day or miles/day)	Power Rating (hp)	Total Days/VMT	Emissions Summary (lbs/day) VOC	NOX	CO	PM10	PM2.5	CO2	CH4	Emissions Summary (tons) VOC	NOX	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Dewatering																				
Pumps > 25 and < = 50	Pump	1	24	50	130	1.84	6.90	6.78	0.49	0.41	824	0.17	0.12	0.45	0.44	0.03	0.03	53.56	0.01	49.02
Total						**1.84**	**6.90**	**6.78**	**0.49**	**0.41**	**824.04**	**0.17**	**0.12**	**0.45**	**0.44**	**0.03**	**0.03**	**53.56**	**0.01**	**49.02**
Work on Pier 5																				
Below Grade Diaphragm Wall																				
Excavators > 250 and < = 500	Hydraulic Excavator - PC600LC	1	8	384	2	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.00	0.01	0.00	0.00	0.00	1.87	0.00	1.70
Dozers > 250 and < = 500	Dozer - D9	1	8	410	6	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.01	0.05	0.03	0.00	0.00	6.36	0.00	5.80
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	4	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.01	0.00	0.00	2.75	0.00	2.50
Cranes > 250 and < = 500	Crawler Crane - LS-208H	1	10	263	5	1.32	10.72	4.43	0.39	0.32	1,801	0.12	0.00	0.03	0.01	0.00	0.00	4.50	0.00	4.10
Graders > 120 and < = 175	Gradall - PW170ES	1	8	123	1	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.45
Rollers > 175 and < = 250	Roller - BW190AD-4	1	8	205	2	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.01	0.00	0.00	0.00	1.22	0.00	1.12
Off-Highway Trucks Composite	Off-hwy trucks - D250D	3	8	214	4	4.36	31.97	13.99	1.10	0.90	6,241	0.39	0.01	0.06	0.03	0.00	0.00	12.48	0.00	11.38
	Bottom Dump Trucks	4	480	130	480	0.24	7.03	1.09	0.19	0.12	1,741	0.01	0.00	0.00	0.00	0.00	0.00	0.87	0.00	0.79
	Pickup Truck	1	120	130	360	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.15
Pier Wall Extension																				
Dozers > 250 and < = 500	Dozer - D9	1	8	410	9	2.23	17.91	9.34	0.73	0.62	2,119	0.20	0.01	0.08	0.04	0.00	0.00	9.54	0.00	8.70
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	3	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.01	0.00	0.00	0.00	2.06	0.00	1.88
Excavators > 50 and < = 120	Hydraulic Excavator, PC160	1	8	110	3	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.01	0.01	0.00	0.00	0.88	0.00	0.81
Rollers >25 and < = 50	Roller - 5 TON	1	8	47	6	0.64	1.86	2.14	0.15	0.13	208	0.06	0.00	0.01	0.01	0.00	0.00	0.62	0.00	0.57
Pumps > 175 and < = 250	Concrete Pump	1	8	210	8	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.00	0.04	0.01	0.00	0.00	6.44	0.00	5.87
Cranes > 250 and < = 500	Crane, 100 ton	1	8	350	5	1.06	8.58	3.54	0.31	0.26	1,441	0.10	0.00	0.02	0.01	0.00	0.00	3.60	0.00	3.28
Water Truck	Water Truck	1	8	230	6	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.02	0.01	0.00	0.00	4.00	0.00	3.64
	Dump Trucks, 20 CY	2	240	130	720	0.12	3.51	0.55	0.10	0.06	871	0.00	0.00	0.01	0.00	0.00	0.00	1.31	0.00	1.19
	Pickup Truck	1	120	130	240	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.10
Total						**19.28**	**155.98**	**73.34**	**5.90**	**4.82**	**27,120.92**	**1.73**	**0.05**	**0.37**	**0.17**	**0.01**	**0.01**	**59.27**	**0.00**	**54.04**
Work on Pier 6																				
Below Grade Diaphragm Wall																				
Graders > 120 and < = 175	Grader	1	10	135	1	1.22	8.62	7.31	0.48	0.40	1,239	0.11	0.00	0.00	0.00	0.00	0.00	0.62	0.00	0.57
Rollers > 175 and < = 250	Roller, 20 ton	1	10	195	1	1.04	9.96	3.46	0.33	0.28	1,531	0.09	0.00	0.00	0.00	0.00	0.00	0.77	0.00	0.70
Dozers < = 175	Dozer - D6	1	10	145	1	1.85	13.07	8.28	0.74	0.64	1,295	0.17	0.00	0.01	0.00	0.00	0.00	0.65	0.00	0.59
Excavators > 50 and < = 120	Hydraulic Excavator, PC160	1	8	110	1	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.27
Other Construction Equipment > 175 and < = 500	Low-Headroom Hydromill	1	8	375	33	0.99	8.33	3.89	0.28	0.23	2,034	0.09	0.02	0.14	0.06	0.00	0.00	33.56	0.00	30.58
Excavators > 250 and < = 500	Hydraulic Excavator, 5080	1	8	424	33	1.20	8.19	3.88	0.29	0.24	1,870	0.11	0.02	0.14	0.06	0.00	0.00	30.85	0.00	28.12
Excavators > 500 and < = 750	Hydraulic Excavator, PC1100	1	8	611	33	1.99	14.04	6.43	0.49	0.40	3,099	0.18	0.03	0.23	0.11	0.01	0.01	51.14	0.00	46.61
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	33	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.01	0.10	0.05	0.00	0.00	22.67	0.00	20.66
Dozers < = 175	Dozer - D6	1	8	145	33	1.48	10.46	6.62	0.59	0.51	1,036	0.13	0.02	0.17	0.11	0.01	0.01	17.09	0.00	15.61
Cranes > 250 and < = 500	Crane, 100 ton	1	8	350	50	1.06	8.58	3.54	0.31	0.26	1,441	0.10	0.03	0.21	0.09	0.01	0.01	36.02	0.00	32.84
Cranes > 250 and < = 500	Crane, 40 ton	1	10	350	5	1.32	10.72	4.43	0.39	0.32	1,801	0.12	0.00	0.03	0.01	0.00	0.00	4.50	0.00	4.10
Dozers > 175 and < = 250	Dozer - D7	1	10	240	1	2.10	17.08	6.07	0.71	0.60	1,835	0.19	0.00	0.01	0.00	0.00	0.00	0.92	0.00	0.84
Off-Highway Trucks Composite	Off-hwy trucks	4	8	214	35	5.81	42.63	18.66	1.47	1.20	8,322	0.52	0.10	0.75	0.33	0.03	0.02	145.63	0.01	132.76
Off-Highway Trucks Composite	Vacuum trucks	3	8	177	10	4.36	31.97	13.99	1.10	0.90	6,241	0.39	0.02	0.16	0.07	0.01	0.00	31.21	0.00	28.45
	10-CY Dump Truck	2	240	130	240	0.12	3.51	0.55	0.10	0.06	871	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.00	0.40
	Pickup Truck	1	120	130	1,200	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.53	0.00	0.49
Tiebacks for Diaphragm Walls																				
Dozers > 175 and < = 250	Dozer - D7	1	8	240	6	1.68	13.67	4.85	0.57	0.48	1,468	0.15	0.01	0.04	0.01	0.00	0.00	4.40	0.00	4.02
Tractors/Loaders/Backhoes > 175 and < = 250	Loader. 962	1	8	211	6	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.02	0.01	0.00	0.00	4.12	0.00	3.76
Bore/Drill Rigs > 175 and < = 250	Drill, Hydraulic Track	1	8	215	5	0.50	3.11	2.74	0.09	0.06	1,505	0.05	0.00	0.01	0.01	0.00	0.00	3.76	0.00	3.43
Rollers > 175 and < = 250	Roller - BW190AD-4	1	8	205	2	0.83	7.97	2.77	0.27	0.22	1,225	0.08	0.00	0.01	0.00	0.00	0.00	1.22	0.00	1.12
Off-Highway Trucks Composite	Off-hwy trucks - D250D	3	8	214	10	4.36	31.97	13.99	1.10	0.90	6,241	0.39	0.02	0.16	0.07	0.01	0.01	31.21	0.00	28.45
Water Truck	Water Truck	1	8	230	2	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.01	0.00	0.00	0.00	1.33	0.00	1.21
	Pickup Truck	1	120	130	360	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.15
Total						**35.19**	**267.82**	**124.75**	**10.29**	**8.48**	**47,935.67**	**3.18**	**0.30**	**2.20**	**1.01**	**0.08**	**0.07**	**423.09**	**0.03**	**385.70**
Widening Low-Flow Channel																				
Dozers > 250 and < = 500	Dozer - D9	2	8	410	10	4.47	35.81	18.69	1.46	1.25	4,238	0.40	0.02	0.18	0.09	0.01	0.01	21.19	0.00	19.33
Tractors/Loaders/Backhoes > 175 and < = 250	Loader - 962	1	8	211	5	0.82	6.33	2.83	0.21	0.17	1,374	0.07	0.00	0.02	0.01	0.00	0.00	3.43	0.00	3.13
Off-Highway Trucks Composite	Off-hwy trucks - D250D	3	8	214	5	4.36	31.97	13.99	1.10	0.90	6,241	0.39	0.01	0.08	0.03	0.00	0.00	15.60	0.00	14.22
	Pickup Truck	1	120	130	240	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.10
24" Grouted Stone																				
Graders > 120 and < = 175	Gradall - PW170ES	1	8	123	9	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.03	0.03	0.00	0.00	4.46	0.00	4.07
Excavators > 250 and < = 500	Hydraulic Excavator - PC600LC	1	8	384	15	0.00	0.12	0.02	0.00	0.00	29	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.02
Pumps > 50 and < = 120	Concrete Pump 50 CY/HR	1	8	110	11	0.68	4.96	3.87	0.36	0.29	624	0.06	0.00	0.03	0.02	0.00	0.00	3.43	0.00	3.13
	10-CY Dump Truck	8	960	400	14,400	0.48	14.06	2.18	0.38	0.24	3,483	0.01	0.00	0.11	0.02	0.00	0.00	26.12	0.00	23.77
	Pickup Truck	1	120	130	600	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.27	0.00	0.24
6" Bedding Stone under the 24" Grouted Stone																				
Graders > 120 and < = 175	Gradall - PW170ES (Hyd Excvtr)	1	8	123	2	0.97	6.90	5.85	0.38	0.32	991	0.09	0.00	0.01	0.01	0.00	0.00	0.99	0.00	0.90
	Dump Trucks, 20 TON	6	720	400	1,440	0.36	10.54	1.64	0.29	0.18	2,612	0.01	0.00	0.01	0.00	0.00	0.00	2.61	0.00	2.38
	Pickup Truck	1	120	130	120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
Replace Concrete Golf Cart Path																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe/Loader	1	8	67	3	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.00	0.00	0.00	0.00	0.62	0.00	0.57
Pumps > 175 and < = 250	Concrete Pump	1	8	210	1	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.00	0.00	0.00	0.00	0.00	0.81	0.00	0.73
	10-CY Dump Truck	2	240	265	2	0.12	3.51	0.55	0.10	0.06	871	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Pickup Truck	1	120	130	120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
Replace CMU Block																				
Tractors/Loaders/Backhoes > 50 and < = 120	Backhoe/Loader	1	8	67	2	0.42	2.82	2.77	0.20	0.16	414	0.04	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.38
	10-CY Dump Truck	1	120	265	1,800	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.01	0.00	0.00	0.00	3.27	0.00	2.97
	Pickup Truck	1	120	130	120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
5-ft deep Cut-off Wall																				
Excavators > 50 and < = 120	Hydraulic Excavator, PC160	1	8	110	2	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.00	0.00	0.00	0.00	0.59	0.00	0.54
Pumps > 50 and < = 120	Concrete Pump 50 CY/HR	1	8	110	11	0.68	4.96	3.87	0.36	0.29	624	0.06	0.00	0.03	0.02	0.00	0.00	3.43	0.00	3.13
	10-CY Dump Truck	2	240	265	3,600	0.12	3.51	0.55	0.10	0.06	871	0.00	0.00	0.03	0.00	0.00	0.00	6.53	0.00	5.94
	Pickup Truck	1	120	130	120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
AC for Maintenance Road																				
Graders > 120 and < = 175	Grader	1	10	135	4	1.22	8.62	7.31	0.48	0.40	1,239	0.11	0.00	0.02	0.01	0.00	0.00	2.48	0.00	2.26
Rollers >50 and < = 120	Roller, 10 TON	1	10	78	4	0.80	5.11	3.97	0.42	0.35	590	0.07	0.00	0.01	0.01	0.00	0.00	1.18	0.00	1.08
Pavers Composite	Asphalt Finisher	1	10	158	1	1.27	7.13	5.13	0.49	0.42	779	0.11	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.36
Water Truck	Water Truck	1	8	230	1	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.61
	10-CY Dump Truck	3	360	265	360	0.18	5.27	0.82	0.14	0.09	1,306	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.59
	3.600 gal Asphalt Distribution Truck	1	120	265	120	0.06	1.76	0.27	0.05	0.03	435	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.20
	Pickup Truck	1	120	130	120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
3.5 ft Concrete flood wall																				
Excavators > 50 and < = 120	Hydraulic Excavator, PC160	1	8	110	2	0.67	4.23	4.06	0.32	0.25	589	0.06	0.00	0.00	0.00	0.00	0.00	0.59	0.00	0.54
Tractors/Loaders/Backhoes > 120 < = 175	Loader 924	1	8	128	2	0.63	4.46	4.68	0.23	0.19	811	0.06	0.00	0.00	0.00	0.00	0.00	0.81	0.00	0.74
Rollers >25 and < = 50	Roller - 5 TON	1	8	47	1	0.64	1.86	2.14	0.15	0.13	208	0.06	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.10
Pumps > 175 and < = 250	Concrete Pump	1	8	210	1	0.80	9.51	3.13	0.27	0.22	1,611	0.07	0.00	0.00	0.00	0.00	0.00	0.81	0.00	0.73
Water Truck	Water Truck	1	8	230	1	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.61
	Pickup Truck	1	120	130	120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
Landscape and Irrigation																				
Off-Highway Tractors	Agricultural Tractor	1	8	81	1	1.44	8.44	5.59	0.71	0.61	750	0.13	0.00	0.00	0.00	0.00	0.00	0.37	0.00	0.34
Trenchers	Trencher, Chain Type	1	8	18	30	0.32	2.01	1.08	0.07	0.07	263	0.03	0.00	0.03	0.02	0.00	0.00	3.95	0.00	3.61
Water Truck	Water Truck - Hydroseeding	1	8	230	2	0.94	6.94	2.92	0.23	0.19	1,332	0.09	0.00	0.01	0.00	0.00	0.00	1.33	0.00	1.21
	Pickup Truck	1	120	130	120	0.01	0.04	0.32	0.01	0.01	107	0.01	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05
Total						**27.33**	**230.31**	**122.70**	**10.30**	**8.25**	**39,952.66**	**2.43**	**0.07**	**0.64**	**0.31**	**0.03**	**0.02**	**108.50**	**0.01**	**98.88**

On Road Construction Emissions

	Total Trips	Distance	Average Daily Mileage	Calculated Time - Rounded (days)	Total Mileage	Emissions Summary (lbs/day) ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	Emissions Summary (tons) ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Worker Trips	40	16.8	672	130	87,360	0.05	0.51	1.20	0.09	0.05	469	0.04	0.00	0.03	0.08	0.01	0.00	30.47	0.00	27.80

Note: Assumes a total of 20 workers per day.

Total	ROG	NO_x	CO	PM10	PM2.5	CO2	CH_4	ROG	NO_x	CO	PM10	PM2.5	CO_2	CH_4	Total GHG Emissions (MT CO2e)
Maximum Daily Emissions	**56.36**	**431.20**	**206.06**	**16.77**	**13.75**	**76,349.38**	**5.12**								
Maximum Annual Emissions								**0.53**	**3.69**	**2.01**	**0.16**	**0.13**	**674.89**	**0.05**	**615.44**

Note: Maximum daily emissions are based on overlapping activities for dewatering and work on Piers 5 and 6.

Fugitive Dust Summary

Phase 5A - Grouted Stone and Sheet Pile Alternative

	PM10	PM2.5
Daily	86.00	21.14
2015	5.63	1.38
2016	10.32	2.54
2017	5.59	1.37

Phase 5B - Grouted Stone Alternative

	PM10	PM2.5
Daily	142.09	29.63
2016	9.31	1.94
2017	17.05	3.56
2018	9.24	1.93

Phase 5A - Soil Cement and Sheet Pile Alternative

	PM10	PM2.5
Daily	72.95	19.14
2015	4.78	1.25
2016	8.75	2.30
2017	6.24	1.64

Phase 5B - Soil Cement Alternative

	PM10	PM2.5
Daily	132.97	27.45
2016	8.71	1.80
2017	15.96	3.29
2018	11.30	2.33

Phase 4 - Soil Cement Alternative

	PM10	PM2.5
Daily	100.45	23.25
2015	6.58	1.52
2016	7.58	1.76

BNSF Bridge

	PM10	PM2.5
Daily	69.78	18.68
2016	4.19	1.12
2016	8.37	2.24
2018	4.54	1.21

Phase 4 - Grouted Stone Alternative

	PM10	PM2.5
Daily	69.80	18.68
2015	4.57	1.22
2016	5.27	1.41

Fugitive Dust - Unpaved Roads

Daily On-Site Construction Motor Vehicle Fugitive Particulate Matter Emissions												
				Silt Loading (g/m^2)/ Silt Content (%)[a]		Uncontrolled Emission Factors (lb/mi)[b]		Uncontrolled Emissions (lb/day)[c]			Controlled Emissions (lb/day)[f]	
Vehicle Type	No.	Mi/Veh-Day[f]	Surface Type		Vehicle Weight (tons)	PM10	PM2.5	PM10	PM2.5	Control Efficiency[d]	PM10	PM2.5
Truck	50	0.5	Unpaved	6	25	3.97E+00	2.09E-01	99.2	5.2	60%	39.7	2.1

Note: Totals may not match sum of individual values because of rounding.

[a] Unpaved surface silt content from SCAQMD CEQA Handbook, (1993) Table A9-9-D-1 for city and county roads

[b] Equations:

EF (unpaved) = k_u $(s/12)^a$ $(W/3)^b$ Ref: AP-42, Section 13.2.2, "Unpaved Rods," November 2006

Constants:

k_u =	1.5	(Particle size multiplier for PM)
	0.15	(Particle size multiplier for PM2.5)
a =	0.9	for PM10
	0.9	for PM2.5
b =	0.45	for PM10
	0.45	for PM2.5

[c] Uncontrolled emissions [lb/day] = Emission factor [lb/mi] x Number x Daily miles traveled [mi/vehicle-day]

[d] Control efficiency from watering unpaved road twice a day (55%) and limiting maximum speed to 25 mph (44%), from Table XI-A, Mitigation Measure Examples, Fugitive Dust from Construction & Demolition, http://www.aqmd.gov/ceqa/handbook/mitigation/fugitive/MM_fugitive.html

[e] Controlled emissions [lb/day] = Uncontrolled emissions [lb/day] x (1 - Control efficiency [%])

Phase 5A - Soil Cement Plant - PM-10 Emissions

Maximum Quantity of Concrete Produced (yd/yr) =	20,000
Days of Operation =	480

Composition of Concrete

Material	lb/yd	ton/yr	
Soil	1,428	14,280	
Cement	491	4,910	
Cement Supplement	73	730	
Water	167	1,670	[167 = 20 gal/yd X 8.34 lb/gal]
Total Concrete Material Required	2,159	21,590	

Emissions from Concrete Batching

*water spray efficiency 60%

Process	lb/ton	controlled lb/ton	lb/yr	lb/day	tpy
Cement delivery to Silo (controlled)		0.00034	1.67		
Cement supplement delivery to silo (controlled)		0.0049	3.58		
Weigh hopper loading*	0.0024	0.00144	20.56		
Central Mix loading (controlled)		0.0048	27.07		
PM10 Emissions from Concrete Batching (lb/yr) =			52.88	0.110	0.026

Emissions from Unpaved Roads

Emission Factor of Unpaved Roads (lb/VMT) =	0.8				
# VMT/yr	-				
Abatement Efficiency (%) =	60				
PM10 Emissions from Unpaved Roads (lb/yr) =	-			0.000	0.000

Emissions from Storage Piles

Emission Factor of Storage Piles (lb/acre/day)	1.7				
Area of Storage Piles (acres) =	0				
# Days Storage Piles Exist =	231				
PM10 Emissions from Storage Piles (lb/yr) =	0			0.000	0.000
Total PM10 Emissions (lb/yr) =	52.88			0.110	0.026
Total PM10 Emissions (TPY) =	0.03				

Phase 5B - Soil Cement Plant - PM-10 Emissions

Maximum Quantity of Concrete Produced (yd/yr) =	959,000
Days of Operation per Year =	480

Composition of Concrete

Material	lb/yd	ton/yr	
Soil	1,428	684,726	
Cement	491	235,435	
Cement Supplement	73	35,004	
Water	167	80,077	[167 = 20 gal/yd X 8.34 lb/gal]
Total Concrete Material Required	2,159	1,035,241	

Emissions from Concrete Batching

*water spray efficiency 60%

Process	lb/ton	controlled lb/ton	lb/yr	lb/day	tpy
Cement delivery to Silo (controlled)		0.00034	80.05		
Cement supplement delivery to silo (controlled)		0.0049	171.52		
Weigh hopper loading*	0.0024	0.00144	986.01		
Central Mix loading (controlled)		0.0048	1298.10		
PM10 Emissions from Concrete Batching (lb/yr) =			2535.67	5.283	1.268

Emissions from Unpaved Roads

Emission Factor of Unpaved Roads (lb/VMT) =	0.8
# VMT/yr	-
Abatement Efficiency (%) =	60
PM10 Emissions from Unpaved Roads (lb/yr) =	-

0.000	0.000

Emissions from Storage Piles

Emission Factor of Storage Piles (lb/acre/day)	1.7
Area of Storage Piles (acres) =	0
# Days Storage Piles Exist =	231
PM10 Emissions from Storage Piles (lb/yr) =	0

0.000	0.000

Total PM10 Emissions (lb/yr) =	2535.67	5.283	1.268
Total PM10 Emissions (TPY) =	1.27		

Phase 4 - Soil Cement Plant - PM-10 Emissions

Maximum Quantity of Concrete Produced (yd/yr) =	45,000
Days of Operation per Year =	240

Composition of Concrete

Material	lb/yd	ton/yr	
Soil	1,428	32,130	
Cement	491	11,048	
Cement Supplement	73	1,643	
Water	167	3,758	[167 = 20 gal/yd X 8.34 lb/gal]
Total Concrete Material Required	2,159	48,578	

Emissions from Concrete Batching

*water spray efficiency 60%

Process	lb/ton	controlled lb/ton	lb/yr	lb/day	tpy
Cement delivery to Silo (controlled)		0.00034	3.76		
Cement supplement delivery to silo (controlled)		0.0049	8.05		
Weigh hopper loading*	0.0024	0.00144	46.27		
Central Mix loading (controlled)		0.0048	60.91		
PM10 Emissions from Concrete Batching (lb/yr) =			118.98	0.496	0.059

Emissions from Unpaved Roads

Emission Factor of Unpaved Roads (lb/VMT) =	0.8				
# VMT/yr	-				
Abatement Efficiency (%) =	60				
PM10 Emissions from Unpaved Roads (lb/yr) =	-			0.000	0.000

Emissions from Storage Piles

Emission Factor of Storage Piles (lb/acre/day)	1.7				
Area of Storage Piles (acres) =	0				
# Days Storage Piles Exist =	231				
PM10 Emissions from Storage Piles (lb/yr) =	0			0.000	0.000
Total PM10 Emissions (lb/yr) =	118.98			0.496	0.059
Total PM10 Emissions (TPY) =	0.06				

Fugitive Dust - Truck Loading Emissions

Truck Loading Fugitive Dust Emission Factors

$EF_D = k \times (0.0032) \times ((U/5)^{1.3})/((M/2)^{1.4})$

Variable	Amount	Units
EF (PM_{10})	0.056	lb/ton
EF ($PM_{2.5}$)	0.009	lb/ton
k (PM_{10})	0.35	factor
k ($PM_{2.5}$)	0.053	factor
U (mean wind speed)	4.92	miles/hr
M (moisture content)	12%	percent
Soil density (CalEEMod default)	1.26	tons/cy
Rip rap density	2.23	tons/cy
Derrick/Grouted stone density	1.96	tons/cy

E (lbs) = EF (lb/ton) x TP (tons)

					Unmitigated		Mitigated	
Construction Phase/Subphase	Work Days	Total Materials Moved (cy)	Total Materials Moved (tons)	Daily Materials Moved (tons/day)	Daily PM_{10} (lbs/day)	Daily $PM_{2.5}$ (lbs/day)	Daily PM_{10} (lbs/day)	Daily $PM_{2.5}$ (lbs/day)
Phase 5A (Alternative 1)								
Stone	200		17,200	86.00	4.84	0.73	1.94	0.29
Compact Backfill	200	100,300	126,796	633.98	35.71	5.41	14.28	2.16
Total							16.22	2.46
Phase 5A (Alternative 2)								
Excavate	200	20,000	25,283	126.42	7.12	1.08	2.85	0.43
Rip Rap Removal	200	850	1,893	9.47	0.53	0.08	0.21	0.03
Total							3.06	0.46
Phase 5B (Alternative 1)								
Grout Stone Fill	528	80,000	156,600	296.59	16.71	2.53	6.68	1.01
Compact Backfill	528	1,116,000	1,410,809	2,671.99	150.50	22.79	60.20	9.12
Removed Stone	528	65,000	127,238	240.98	13.57	2.06	5.43	0.82
Total							72.31	10.95
Phase 5B (Alternative 2)								
Excavate	528	959,000	1,212,335	2,296.09	129.33	19.58	51.73	7.83
RipRap Removal	528	65,000	144,788	274.22	15.45	2.34	6.18	0.94
Total							57.91	8.77
Phase 4 (Alternative 1)								
Excavate	151	160,000	202,267	1,339.51	75.45	11.42	30.18	4.57
Phase 4 (Alternative 2)								
Excavate	151	100	126	0.84	0.05	0.01	0.02	0.00

Rule 403 Control Measures	0.6	percent reduction

Earthwork Fugitive Particulate Matter Emissions

Activity	Activity Units	Daily Activity Level	Total Activity Level	PM10 Emission Factor (lb/activity)[1]	PM2.5 Emission Factor (lb/activity)[1]	PM10 (lb/day)[2]	PM2.5 (lb/day)[2]
Bulldozing, Scraping and Grading	hr	8.0	40.0	0.753	0.415	30.11	16.59
Total						**30.11**	**16.59**

1

2. Emissions [lb/day] = Emission factor [lb/activity unit] x Daily Activity level [units/day]

3. Soil handling during grading/excavation activities is assumed to occur over the first 3 of 18 months of the Proposed Project, or for a duration of 60 days.

3.2 Demolition - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2029	2.1763	1.6233	1.8000e-003		0.1103	0.1103		0.1029	0.1029	0.0000	168.4857	168.4857	0.0457	0.0000	169.4449
Total	**0.2029**	**2.1763**	**1.6233**	**1.8000e-003**		**0.1103**	**0.1103**		**0.1029**	**0.1029**	**0.0000**	**168.4857**	**168.4857**	**0.0457**	**0.0000**	**169.4449**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0525	0.9616	0.5532	2.1900e-003	4.0898	0.0162	4.1060	0.4168	0.0149	0.4317	0.0000	202.7390	202.7390	1.5600e-003	0.0000	202.7718
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0525**	**0.9616**	**0.5532**	**2.1900e-003**	**4.0898**	**0.0162**	**4.1060**	**0.4168**	**0.0149**	**0.4317**	**0.0000**	**202.7390**	**202.7390**	**1.5600e-003**	**0.0000**	**202.7718**

3.2 Demolition - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	4.5083	48.3629	36.0738	0.0399		2.4508	2.4508		2.2858	2.2858		4,127.1934	4,127.1934	1.1188		4,150.6886
Total	**4.5083**	**48.3629**	**36.0738**	**0.0399**		**2.4508**	**2.4508**		**2.2858**	**2.2858**		**4,127.1934**	**4,127.1934**	**1.1188**		**4,150.6886**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.1306	20.2470	11.2193	0.0488	99.2361	0.3597	99.5958	10.0974	0.3309	10.4282		4,969.5822	4,969.5822	0.0380		4,970.3811
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**1.1306**	**20.2470**	**11.2193**	**0.0488**	**99.2361**	**0.3597**	**99.5958**	**10.0974**	**0.3309**	**10.4282**		**4,969.5822**	**4,969.5822**	**0.0380**		**4,970.3811**

Appendix C
Addendum
Emissions Estimates for Hauling for Phase 4 Soil Cement Alternative

Emissions estimates for Phase 4 Soil Cement Alternative were revised to include emissions associated with hauling 60,000 cy of fill material to the project site from Prado Basin. The work would require approximately 4,000 truck trips over a distance of 15 miles (30 mile round trip). Duration of hauling operations is approximately 3 months. Approximately 95% of the haul roads are assumed to be paved. Thus, approximately 28.5 miles of the 30 mile round trip are assumed to be paved.

Emissions were estimated using CalEEMod.2013.2.2 using the parameters above. Emissions estimates were added to respondent figures from Table 5.6-13. and Table 5.6-14. Annual emissions estimates were divided by 2 and added to each construction year in 2015 and 2016 since hauling operations would occur at the outset and the conclusion of construction. Emissions for PM10 and PM2.5 were reported at 55% of values generated from CalEEMod since the modeling software does not apply mitigation to hauling operations when modeled exclusively for on road emissions.

With the revised figures, the daily emissions of PM10 exceed the daily construction threshold. In contrast, daily emission estimates for PM10 in the original estimates were below the daily construction threshold.

Data Tables from Draft EA (w/o emissions for trucking)

	Criteria Pollutant Emissions (tons/year)				
Emission Source	**VOC**	**NO_X**	**CO**	**PM_{10}**	**$PM_{2.5}$**
2015	0.04	0.31	0.25	6.6	1.54
2016	2.33	19.38	9.28	8.34	2.36
Maximum Annual Emissions	2.33	19.38	9.28	8.34	2.36
De minimis Thresholds[1]	10	N/A	100	100	100
Exceed *de minimis* Thresholds?	No	N/A	No	No	No

Data Tables from Draft EA (w/emissions for trucking)

	Criteria Pollutant Emissions (tons/year)				
Emission Source	**VOC**	**NO_X**	**CO**	**PM_{10}**	**$PM_{2.5}$**
2015	0.07	0.79	0.53	7.73	1.66
2016	2.36	19.86	9.56	9.47	2.48
Maximum Annual Emissions	2.81	19.66	10.41	8.46	103.75
De minimis Thresholds[1]	10	N/A	100	100	100
Exceed *de minimis* Thresholds?	No	N/A	No	No	No

Data Tables from Draft EA (w/o emissions for trucking)

Emission Source	Criteria Pollutant Emissions (pounds/day)				
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
Maximum Daily Emissions	32.88	271.58	131.02	111.15	31.91
Daily Thresholds	**75**	**100**	**550**	**150**	**55**
Exceed Thresholds?	**No**	**Yes**	**No**	**No**	**No**

Data Tables from Draft EA (w/ emissions for trucking)

Emission Source	Criteria Pollutant Emissions (pounds/day)				
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$
Maximum Daily Emissions	34.01	291.78	142.23	165.85	40.91
Daily Thresholds	**75**	**100**	**550**	**150**	**55**
Exceed Thresholds?	**No**	**Yes**	**No**	**Yes**	**No**

Appendix D

U.S. Army Corps of Engineers, Regulatory 404(b)(1) Evaluation

SECTION 404(b) (1) EVALUATION
SANTA ANA RIVER REACH 9, PHASES 4, 5A, 5B & BNSF Bridge
EMBANKMENT AND BRIDGE PROTECTION
ORANGE AND RIVERSIDE COUNTIES, CALIFORNIA

EFFECTS OF THE DISCHARGE OF DREDGED OR FILL MATERIAL INTO THE WATERS OF THE UNITED STATES

I. INTRODUCTION

The following evaluation is provided in accordance with Section 404(b) (1) of the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500) as amended by the Clean Water Act of 1977 (Public Law 95-217). Its intent is to succinctly state and evaluate information regarding the effects of discharge of dredged or fill material into Waters of the United States. As such, this analysis is not meant to stand alone, and depends on information provided in the Supplemental Environmental Assessment (SEA) to which this evaluation is appended.

II. PROJECT DESCRIPTION

Basic Project Purpose. The basic project purpose comprises the fundamental, essential, or irreducible purpose of the proposed project, and is used by the Corps to determine whether the project is water dependent. The basic project purpose for the proposed project is flood protection. Phases 5A, 5B, and 4 will consist of provided new protection with a buried toe that extends deeper and further out from the river bank than the existing protection. BNSF Bridge includes constructing new protection around piers of the BNSF railroad bridge, and new bank protection beneath the bridge along both banks. As a result, the project is water dependent.

Overall Project Purpose. The overall project purpose serves as the basis for the Corps 404(b) (1) alternatives analysis and is determined by further defining the basic project purpose in a manner that more specifically describes the goals for the project, and which allows a reasonable range of alternatives to be analyzed. The project purpose includes protection of an approximate 4.5-mile (23,840 foot) long segment of the north bank of the Santa Ana River, and infrastructure along East La Palma Avenue, Yorba Linda, Orange County, California (Phases 5A and 5B); protection of a 3,790-foot long segment of the south bank of the SAR, and embankment of the Riverside Freeway (State Route 91) in Yorba Linda (Phase 4); and bridge pier and bank protection at the Burlington Northern Santa Fe railroad bridge, Corona, Riverside County, California (BNSF Bridge), against future scour associated with high discharges from Prado Dam.

A requirement of the 404(b) (1) Evaluation is the identification of the Least Environmental Damaging Practicable Alternative (LEDPA). The alternatives evaluated in this document, and in the accompanying SEA, include the following for each of the Reach 9 measures:

Phase 5A	**Phase 5B**	**Phase 4**	**BNSF Bridge**
Alternative 1 – Grouted Stone and Sheet Pile	Alternative 1 – Grouted Stone and Sheet Pile	Alternative 1 – Soil Cement Alternative	Alternative 1 – Pier and Abutment Protection

Phase 5A	Phase 5B	Phase 4	BNSF Bridge
Alternative	Alternative		Alternative
Alternative 2 – Soil Cement and Sheet Pile Alternative	Alternative 2 – Soil Cement Alternative	Alternative 2 – Grouted Stone Alternative	Alternative 2 – No Federal Action
Alternative 3 – No Federal Action	Alternative 3 – No Federal Action	Alternative 3 – No Federal Action	

Phase 5A

Alternative 1 – Grouted Stone and Sheet Pile Protection. Under this alternative, a 980-foot long grouted stone structure, with a 2:1 slope would be constructed in the downstream portion of this project. A two-foot wide steel sheet pile structure would occupy the 3,040-foot long upstream portion of the project.

Alternative 2 – Soil Cement and Sheet Pile Protection. In place of a grouted stone structure, this alternative would employ an 80-foot wide by 1,100-foot long soil cement structure at a 2:1 slope. The sheet pile structure would be unchanged from Alternative 1. The soil cement structure under this alternative would have a similar footprint to the grouted stone structure proposed under Alternative 1. As a result, both Alternative 1 and 2 would equally be the LEDPA for Phase 5A.

Alternative 3 - No Federal Action would require occasional emergency protection of existing bank protection, potentially resulting in repeated disturbances to aquatic and riparian habitat. This alternative, therefore, is not the least environmentally damaging practicable alternative, and would not meet the Overall Project Purpose.

Phase 5B

Alternative 1 – Grouted Stone Protection. Under this alternative, a 80-foot wide by 19,700-foot long grouted stone structure with a 2:1 slope would be constructed.

Alternative 2 – Soil Cement and Sheet Pile Protection. In place of a grouted stone structure, this alternative would employ an 80-foot wide by 19,700-foot long soil cement structure at a 2:1 slope. The soil cement structure under this alternative would have a similar footprint to the grouted stone structure proposed under Alternative 1. As a result, both Alternative 1 and 2 would be the LEDPA for Phase 5B.

Alternative 3 - No Federal Action would require occasional emergency protection of existing bank protection, potentially resulting in repeated disturbances to aquatic and riparian habitat. This alternative, therefore, is not the least environmentally damaging practicable alternative, and would not meet the Overall Project Purpose.

Phase 4

Alternative 1 – Soil Cement Protection. Under this alternative, a 3,150-foot-long soil cement structure would be constructed along an established alignment and extend further and deeper than the existing soil cement structure. The new structure would be approximately 30 feet in

height and 10 feet in width, and placed at a 1H:1V slope. As a result, Alternative 1 would be the LEDPA for Phase 4.

Alternative 2 – Grouted Stone Protection. In place of a soil cement structure, this alternative would employ a 3,790-foot long grouted stone structure at a 2:1 slope. This alternative would have a larger permanent and temporary footprint than the preferred alternative (Alternative 1), and therefore would not be the LEDPA.

Alternative 3 - No Federal Action would require occasional emergency protection of existing bank protection, potentially resulting in repeated disturbances to aquatic and riparian habitat. This alternative, therefore, is not the least environmentally damaging practicable alternative, and would not meet the Overall Project Purpose.

BNSF Bridge

Alternative 1 – Pier and Abutment Protection. Under this alternative, reinforced concrete walls, sheet pile and reinforced concrete diaphragm walls, and grouted stone protection would be constructed to provide additional scour protection to piers and abutments of the BNSF Bridge, and tie previously constructed bank protection along the east bank of the channel into the existing eastern bridge abutment. Reinforced concrete enclosure walls would be installed around Pier Nos. 2 through 5 and reinforced concrete pier nose extension walls would be constructed immediately upstream of these piers. This alternative provides for construction of the sheet pile and reinforced concrete diaphragm walls with tieback anchors parallel to existing Pier Nos. 1 and 6 to guide the design flow safely under the bridge. Additionally, 24-inch grouted stone bank protection would be installed to tie the existing bridge abutment along the east bank of the river channel (Pier No. 1) into bank protection previously installed upstream and downstream of the BNSF bridge. Other alternatives considered in the early design phase (including grade stabilizers) were not carried forward because they would result in unacceptable environmental impacts. No other option appears to be available that meets the project purpose and conforms with environmental and design constraints. As a result, Alternative 1 is the LEDPA.

Alternative 2 - No Federal Action would require occasional emergency protection of existing banks and bridge piers, potentially resulting in repeated disturbances to aquatic and riparian habitat. This alternative, therefore, is not the least environmentally damaging practicable alternative, and would not meet the Overall Project Purpose.

The Alternatives discussed above for LEDPA are summarized in the Table below.

Alternatives	Practicable?	Least Environmentally Damaging?	Meets overall Project Purpose?
Phase 5A			
Alternative 1	Yes	Yes	Yes
Alternative 2	Yes	Yes	Yes
Alternative 3	Yes	No	No
Phase 5B			

Alternatives	Practicable?	Least Environmentally Damaging?	Meets overall Project Purpose?
Alternative 1	Yes	Yes	Yes
Alternative 2	Yes	Yes	Yes
Alternative 3	Yes	No	No
Phase 4			
Alternative 1	Yes	Yes	Yes
Alternative 2	Yes	No	Yes
Alternative 3	Yes	No	No
BNSF Bridge			
Alternative 1	Yes	Yes	Yes
Alternative 2	Yes	No	No

Based on the 404(b) (1) evaluation analysis and additional information in the SEA, it has been determined that Alternative 1 (Grouted Stone and Sheet Pile) and Alternative 2 (Soil Cement and Sheet Pile for Phase 5A would equally be the LEDPA. For Phase 5B, Alternative 1 (Grouted Stone and Sheet Pile) and Alternative 2 (Soil Cement) would equally be the LEDPA. For Phase 4, Alternative 1 (Soil Cement) would be the LEDPA. For BNSF Bridge, Alternative 1 (Pier and Abutment Protection) would be the LEDPA.

Unlike the No Action Alternatives, these alternatives meet the project purpose, and result in less impact to Waters of the U.S. The LEDPAs, therefore, are carried forward for additional analysis, below.

Phase 5A
Preferred Alternative, Alternative 1 – Grouted Stone and Sheet Pile

a. Location. The Santa Ana River Reach 9 Phase 5A project area is located along the north bank of the Lower Santa Ana River, in the County of Orange, California, approximately 7 miles downstream of Prado Dam.

b. General Description of Dredged or Fill Material. Approximately 34,000 cubic yards of alluvial substrate would be excavated. The estimated amounts of 24-inch grouted stone, salvaged riprap, and compacted backfill to be used during construction are 10,600 tons, 3,500 tons, and 32,000 cubic yards, respectively. In addition to alluvial excavation, an estimated 3,500 tons of existing riprap stone would be removed and salvaged for reuse to the greatest extent possible.

c. Description of the Proposed Discharge Site. The grouted stone structure would be constructed at a 2H:1V slope, is approximately 980 linear feet and approximately 80 feet wide (including the 10-foot wide structure). The grouted stone structure would be approximately 37.5 feet tall, measured vertically from 1 foot below the scour line to top of the structure, and would be buried approximately 18 to 20 feet below the channel invert. The sheet pile would be a 3,273 linear feet long by 2-feet-wide “Z”-shaped steel wall with tiebacks, and would be driven vertically down into the existing bank to a design elevation; height of the sheet pile varies from 45 to 50.5 feet.

Retaining Wall, Riding/Hiking Trail and Bikeway

To accommodate a 24-ft wide section consisting of a 10-ft wide DG (Decomposed Granite) riding/hiking trail and a 14-ft wide AC (Asphalt Concrete) bikeway, a retaining wall is needed on top of the terrace slope of the proposed bank, along the grouted stone and sheet pile reaches. The retaining wall height ranges from 2.5 to 4.5-ft.

d. Description of Dredging and Disposal Methods: Heavy duty vehicles and equipment such as excavators, front-end loaders, bulldozers, dump trucks, concrete pump trucks, water trucks, and graders. Hydraulic hammers and cranes would be necessary for installation of the sheet pile structure.

e. Timing and duration of Discharge: Construction is expected to take 24 months to complete. Clearing and grubbing is proposed to begin in fall 2015 and would be initiated and completed outside of the bird breeding season (February 15 through August 15) to avoid impacts to nesting birds. Sound barriers, if needed, would be constructed prior to March 1 of each year. Construction is expected to continue to approximately fall 2017. Funding constraints, weather delays, and other issues could potentially move the construction timeline into 2018.

Phase 5A
Alternative 2 – Soil Cement and Sheet Pile

a. Location. Alternative 2 would occur at the same location as the Preferred Alternative.

b. General Description of Dredged or Fill Material. Approximately 20,000 cubic yards of alluvial substrate would be excavated for soil cement placement. In addition to alluvial excavation, an estimated amount of 850 cubic yards of riprap would be removed and hauled to appropriate disposal sites.

c. Description of the Proposed Discharge Site. The soil cement structure would also be constructed at a 2:1 slope, approximately 35 feet tall measured vertically from the scour line to top of the structure, and would be buried approximately 20 to 25 feet below the channel invert. The sheet pile structure would be unchanged from the Preferred Alternative, and would be a 3,040 linear feet long by 2-feet-wide “Z”-shaped steel wall with tiebacks, driven vertically down into the existing bank to a design elevation; height of the sheet pile varies from 45 to 50.5 feet.

d. Description of Dredging and Disposal Methods: Heavy duty vehicles and equipment such as excavators, front-end loaders, bulldozers, dump trucks, concrete pump trucks, water trucks, rollers, and graders. Hydraulic hammers and cranes would be necessary for installation of the sheet pile structure.

e. Timing and duration of Discharge: Construction of Alternative 2 would require at least an additional 2 months over the Preferred Alternative, and would be expected to take 26 months to complete. Clearing and grubbing would commence in fall 2015 and would be initiated and completed outside of the bird breeding season (February 15 through August 15) to avoid impacts to nesting birds. Sound barriers, if needed, would also be constructed prior to March 1 of each

year. Construction is expected to continue to approximately late fall 2017. Funding constraints, weather delays, and other issues could potentially move the construction timeline into 2018.

Phase 5B
Preferred Alternative – Grouted Stone and Sheet Pile

a. Location. The Santa Ana River Reach 9 Phase 5B project area is located along the north bank of the Lower Santa Ana River, in the County of Orange, California. Phase 5B begins approximately 4 miles downstream of Prado Dam and extends 3.7 miles downstream. Phase 5B is contiguous to, and lies immediately upstream of Phase 5A.

b. General Description of Dredged or Fill Material. A total of approximately 1,116,000 cubic yards of alluvial substrate would be excavated. The estimated amounts of grouted stone and compacted backfill to be used during construction are 80,000 to 93,700 cy (or 166,000 tons) of stone and 1,116,000 cubic yards, respectively. In addition to alluvial excavation, an estimated amount of 65,000 cubic yards of existing stone would be removed and salvaged for reuse to the greatest extent possible.

c. Description of the Proposed Discharge Site. The grouted stone structure would be constructed at a 2:1 slope, 24-inches thick, and would range in height from 30 to 45 feet, with the buried portion of the grouted stone slope approximately 25 feet deep.

d. Description of Dredging and Disposal Methods: Heavy duty vehicles and equipment such as excavators, front-end loaders, bulldozers, concrete pump trucks, water trucks, dump trucks, and graders.

e. Timing and duration of Discharge: Construction is expected to take approximately 24 months to complete. Clearing and grubbing is proposed to begin in August 2016 and would be completed outside of the bird breeding season (which in this area is February 15 through August 15) to avoid impacts to nesting birds. Sound barriers, if needed, would be constructed prior to March 1 of each year. Construction is expected to continue to approximately August 2018. Funding constraints, weather delays, and other issues could potentially delay the construction completion.

Phase 5B
Alternative 2 – Soil Cement

a. Location. Alternative 2 would occur at the same location as the Preferred Alternative.

b. General Description of Dredged or Fill Material. Approximately 959,000 cubic yards of alluvial substrate would be excavated for soil cement placement. Suitable excavated material would be used for soil cement construction and to backfill the trench. Unsuitable and excessive material would be hauled to appropriate disposal sites. In addition to alluvial excavation, an estimated 65,000 cubic yards of riprap would be removed and hauled to appropriate disposal sites or blended in with backfill.

c. Description of the Proposed Discharge Site. The soil cement structure would be also constructed at a 2:1 slope, 10-feet-thick, and would be placed against the existing bank. The structure would range from 30 to 45 feet in height and be buried approximately 25 feet deep

d. Description of Dredging and Disposal Methods: Heavy duty vehicles and equipment such as excavators, front-end loaders, concrete pump trucks, water trucks, bulldozers, dump trucks, rollers, and graders.

e. Timing and duration of Discharge: Construction of Alternative 2 would require at least an additional 2 months over the Preferred Alternative, and would be expected to take 26 to 28 months to complete. Clearing and grubbing would commence in August 2016 and would be initiated and completed outside of the bird breeding season (February 15 through August 15) to avoid impacts to nesting birds. Sound barriers, if needed, would also be constructed prior to March 1 of each year. Construction is expected to continue to approximately October 2018. Funding constraints, weather delays, and other issues could potentially move the construction timeline into 2019.

Phase 4
Preferred Alternative – Soil Cement

a. Location. The Santa Ana River Reach 9 Phase 4 project area is located along the south bank of the Lower Santa Ana River, in the County of Orange, California, approximately 4 miles downstream of Prado Dam.

b. General Description of Dredged or Fill Material. A combined total of approximately 135,000 cubic yards of alluvial substrate would be excavated.

c. Description of the Proposed Discharge Site. The soil cement structure would be approximately 30 feet high and 10 feet wide, placed at a 1H:1V slope.Approximately 10 feet would be exposed above-ground, with the remaining structure buried. The areas of the exposed and buried portions of the soil cement structure are approximately equal at 1.5 acres each.
d. Description of Dredging and Disposal Methods: Heavy duty vehicles and equipment such as excavators, front-end loaders, bulldozers, dump trucks, soil cement compactors, concrete pump trucks, water trucks, graders, and a soil cement batch plant.

e. Timing and duration of Discharge: Construction of the Preferred Alternative is expected to take approximately 24 months to complete. Clearing and grubbing would need to be completed outside of the bird breeding season (February 15 through August 15). Sound barriers, if needed, would be constructed prior to March 1 of each year. Construction is expected to continue to approximately December 2017. Funding constraints, weather delays, and other issues could potentially move the construction timeline into 2017.

Phase 4
Alternative 2 – Grouted Stone

a. Location. The project location would be the same as the Preferred Alternative.

b. General Description of Dredged or Fill Material. A combined total of approximately 100 cubic yards of alluvial substrate would be excavated.

c. Description of the Proposed Discharge Site. The grouted stone structure would be approximately 28 feet high, with approximately 28 feet of the structure buried beneath the channel invert in a typical cross section, while the upper 10 feet would remain exposed above the channel invert.

d. Description of Dredging and Disposal Methods: Heavy duty vehicles and equipment such as excavators, front-end loaders, bulldozers, dump trucks, concrete pump trucks, water trucks, and graders.

e. Timing and duration of Discharge: Construction of the Preferred Alternative is expected to be of similar duration of the Preferred Alternative. Clearing and grubbing would need to be completed outside of the bird breeding season (February 15 through August 15). Sound barriers, if needed, would be constructed prior to March 1 of each year. Construction is expected to continue to approximately December 2017. Funding constraints, weather delays, and other issues could potentially move the construction timeline into 2018.

BNSF Bridge
Preferred Alternative – Pier and Abutment Protection

a. Location. The Santa Ana River Reach 9 BNSF Bridge project area is located in the Lower Santa Ana River, in the County of Orange, California, approximately 2.25 miles downstream of Prado Dam.

b. General Description of Dredged or Fill Material. Under this alternative, reinforced concrete walls, reinforced concrete diaphragm walls, sheet piling and grouted stone would be utilized to provide additional scour protection to bridge piers and abutments, and tie previously constructed bank protection along the east bank of the channel into the existing eastern bridge abutment. Pier and abutment protection features include, nose extensions (0.10 acre each) and sheet pile enclosure walls (0.05 acre each) at four bridge piers; and sheet pile and concrete walls (0.09 acres) and grouted stone protection (1.44 acres) at abutments.

c. Description of the Proposed Discharge Site. The construction of in-river bridge protection features would occur first. Activities would begin with the construction of below-grade diaphragm walls to protect the bridge abutments. These walls would require tieback tendons. Pier wall extensions would then be constructed on H-piles, and excavation and installation of four flat web sheet pile walls to protect the existing bridge piers would follow.

Following the completion of in-stream features, a 24-inch layer of grouted stone would be placed on 6-inch bedding material along the slope on the east side of the river. Derrick stone would be placed at the toe of the grouted stone protection. The amount and types of “fill material” associated with this alternative includes 6,175 cy of grouted stone, 637 cy of bedding material

under the grouted stone, 4,000 cy of concrete for the pier nose extension walls (1,000 cy each), 1,360 linear feet of H-Piles under each of the pier nose extensions (total of 5,440 linear feet), and 15,200 cy of concrete for the reinforced concrete diaphragm walls.

Project activities would be completed by extending side drain through the grouted stone, installing 3.5-foot-high concrete masonry unit wall, replacing a portion of the concrete golf cart path along the west bank, grading and paving of ramps on the east side of the SAR to tie into existing roads and trails, and incidental work.

d. Description of Dredging and Disposal Methods: Equipment to be used for construction of bridge and bank protection features would include cranes, bulldozers, excavators, compactors, dump trucks, rollers, pickup trucks, earth augers, vacuum trucks, pile drivers, low overhead drill rigs, and low headroom hydromill.

e. Timing and duration of Discharge: Construction is expected to take approximately 3 years to complete. Clearing and grubbing is proposed to begin in 2016 and would need to be completed outside of the bird breeding season (February 15 through August 15). Construction is expected to continue to approximately 2018. Funding constraints, weather delays, and other issues could potentially move the construction timeline beyond 2019.

III. FACTUAL DETERMINATIONS.

Phase 5A

Since the Phase 5A Preferred Alternative (Grouted Stone and Sheet Pile) and Alternative 2 (Soil Cement and Sheet Pile) have similar footprints, the determination below applies to both Phase 5A alternatives.

A. Disposal Site Physical Substrate Determinations:

1. Substrate Elevation and Slope.
Impact: ____ N/A __X_ INSIGNIFICANT ____ SIGNIFICNT

The proposed Phase 5A alternatives are not expected to result in significant substrate impacts, because the existing embankment would be reconstructed at approximately the same elevation and slope.

2. Sediment type.
Impact: ____ N/A __X_ INSIGNIFICANT ____ SIGNIFICNT

Sediment consists primarily of Riverwash material and fine sandy loam. Excavated material will be reused for backfill within the same area. If additional fill material is needed, it would be compatible with existing materials.

3. Dredged/Fill Material Movement.
Impact: ____ N/A __X_ INSIGNIFICANT ____ SIGNIFICNT

Fill material would be placed (or replaced) within the footprint of the project and is expected to be held in place by the grouted stone under the Preferred Alternative, and soil cement under Alternative 2.

4. Physical Effects on Benthos (burial, changes in sediment type, composition, etc.).
Impact: ____ N/A __X_ INSIGNIFICANT ____ SIGNIFICNT

Temporary, short-term impacts from excavation and placement of fill material as backfill may occur. Material that is currently behind the existing riprap embankment is not expected to support any benthic organisms and the proposed grouted stone/soil cement and sheet pile structures would not occur in the active river channel. As a result, no long-term, adverse significant impacts are expected.

5. Other Effects.
Impact: __X__ N/A ___ INSIGNIFICANT ____ SIGNIFICNT

6. Actions Taken to Minimize Impacts.
Needed: __X__ YES ___ NO
If needed, Taken: __X__ YES ____ NO

Fill material and backfill for embankment protection would be monitored for effects on water quality. Water Resources Environmental Commitments and Best Management Practices (BMP) would be implemented to avoid significant impacts to water quality, or if turbidity exceeds water quality criteria.

7. Effect on Water Circulation, Fluctuation, and Salinity Determinations:

(1) Water. The following potential impacts were considered:

Salinity	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Water Chemistry	____N/A	__X_ INSIGNIFICANT	____SIGNIFICANT
Clarity	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Odor	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Taste	__X_N/A	____ INSIGNIFICANT	____ SIGNIFICANT
Dissolved gas levels	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Nutrients	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Eutrophication	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Others	__X_N/A	____ INSIGNIFICANT	____ SIGNIFICANT

The proposed Phase 5A alternatives are not expected to significantly affect water circulation, fluctuation, salinity, or other chemical/physical constituents as the alternatives do not coincide with the active river channel. Most of the material to be discharged would have been excavated from within the footprint of the project alternatives, so no new sources of nutrients, salinity or chemical contamination will be introduced. The grouted stone under the Preferred Alternative and soil cement under Alternative 2, would be inert substances and would not affect water quality once they have dried.

(2) Current Patterns and Circulation. The potential of discharge on the following conditions were evaluated:

Current Pattern and Flow	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Velocity	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Stratification	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Hydrology Regime	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT

The proposed Phase 5A alternatives are not expected to significantly affect current patterns or circulation, as they do not coincide with the active river channel.

(3) Normal Water Level Fluctuations. The potential of discharge on the following were evaluated:

Tide	__X__N/A	___ INSIGNIFICANT	____ SIGNIFICANT
River Stage	___N/A	_X__ INSIGNIFICANT	____ SIGNIFICANT

For reasons listed above, the proposed Phase 5A alternatives do not expect to have a significant impact on water level fluctuations.

8. Suspended Particulate/Turbidity Determinations.

(1) Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Site.

Impact: _X___N/A ____ INSIGNIFICANT ____ SIGNIFICANT

The Phase 5A alternatives do not coincide with the active river channel. Additionally, BMP that would be implemented as part of the Contractor's Storm Water Pollution Prevention Plan (SWPPP), would protect water quality throughout construction.

(2) Effects on Chemical and Physical Properties of the Water Column.

Light Penetration	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Dissolved Oxygen	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Toxic Metals & Organic	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Pathogen	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Aesthetics	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Others	__X N/A ____ INSIGNIFICANT ____ SIGNIFICANT

For reasons listed above, impacts would not be significant or adverse.

(3) Effects of Turbidity on Biota.

Primary Productivity	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Suspension/Filter Feeders	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Sight feeders	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT

For reasons listed above, impacts would not be significant or adverse. The Phase 5A alternatives do not coincide with the active river channel.

(4) Actions Taken to Minimize Impacts.

Needed:	__X__ YES ___ NO
If needed, Taken:	__X__ YES ____ NO

Water Resources Environmental Commitments and BMP would be implemented to avoid significant impacts to water quality.

9. Contaminant Determination. The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material.
(Check only those appropriate).

(1) Physical characteristics _X_

(2) Hydrography in relation to known or anticipated sources of contaminants _X_

(3) Results from previous testing of the material or similar material in the vicinity of the proposed project _X_

(4) Known, significant sources of contaminants (e.g. pesticides) from land runoff or percolation _X__

(5) Spill records for petroleum products or designated (Section 311 of the CWA) hazardous substances _X__

(6) Other public records of significant introduction of contaminants from industries, municipalities, or other sources _X__

(7) Known existence of substantial material deposits of substances which could be released in harmful quantities to the aquatic environment by man-induced discharge activities _X__

(8) Other sources (specify) _X__

From an evaluation performed on Federal, state of California, and County of Orange HRTW databases, there are no known past or existing HTRW sites within Phase 5A.

10. Effect on aquatic Ecosystem and Organism Determinations.

Plankton	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Benthos	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Nekton	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Food Web	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT

Sensitive Habitats

Sanctuaries, refuges	__X_N/A	___ INSIGNIFICANT	____ SIGNIFICANT
Wetlands	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Mudflats	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Eelgrass beds	__X_N/A	___ INSIGNIFICANT	____ SIGNIFICANT
Riffle & pool Complexes	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Threatened & endangered species	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Other wildlife	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT

11. Actions Taken to Minimize Impacts.
Clearing and grubbing of vegetation will occur prior to the nesting period for sensitive/migratory birds, and sound barriers would be installed prior to March 1, where needed, to reduce potential noise impacts to adjacent riparian habitats that may be occupied by sensitive/migratory birds. The Corps will also actively re-vegetate temporary work areas. Temporary and permanent impacts will also be mitigated off-site through habitat restoration (invasive plant removal), to further improve conditions for native species throughout the watershed.

12. Proposed Disposal Site Determinations. Is the mixing zone for each disposal site confined to the smallest practicable zone? __X_ YES ____ NO

13. Determination of Cumulative Effects of Disposal or Fill on the Aquatic Ecosystem. Impacts: ____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT

14. Determination of Indirect Effects of Disposal or Fill on the Aquatic Ecosystem. Impacts: ____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT

Phase 5B

Since the Phase 5B Preferred Alternative (Grouted Stone&Sheet Pile) and Alternative 2 (Soil Cement) have similar footprints, the determination below applies to both Phase 5B alternatives.

A. Disposal Site Physical Substrate Determinations:

1. Substrate Elevation and Slope.
Impact: ____ N/A __X_ INSIGNIFICANT ____ SIGNIFICNT

The proposed Phase 5B alternatives are not expected to result in significant substrate impacts, because the existing embankment would be reconstructed at approximately the same elevation and slope.

2. Sediment type.
Impact: ____ N/A __X_ INSIGNIFICANT ____ SIGNIFICNT

Sediment consists primarily of sandy loam and Riverwash material. Excavated material will be reused for backfill within the same area. If additional fill material is needed, it would be compatible with existing materials.

3. Dredged/Fill Material Movement.
Impact: ____ N/A __X_ INSIGNIFICANT ____ SIGNIFICNT

Fill material would be placed (or replaced) within the footprint of the project and is expected to be held in place by the grouted stone under the Preferred Alternative, and soil cement under Alternative 2.

4. Physical Effects on Benthos (burial, changes in sediment type, composition, etc.).
Impact: ____ N/A __X_ INSIGNIFICANT ____ SIGNIFICNT

Temporary, short-term impacts from excavation and placement of fill material as backfill may occur. Material that is currently behind the existing riprap embankment is not expected to support any benthic organisms and the proposed grouted stone/soil cement structures would not occur in the active river channel. As a result, no long-term, adverse significant impacts are expected.

5. Other Effects.
Impact: __X__ N/A ___ INSIGNIFICANT ____ SIGNIFICNT

6. Actions Taken to Minimize Impacts.
Needed: __X__ YES ___ NO
If needed, Taken: __X__ YES ____ NO

Fill material and backfill for embankment protection would be monitored for effects on water quality. Water Resources Environmental Commitments and BMP would be implemented to avoid significant impacts to water quality, or if turbidity exceeds water quality criteria.

7. Effect on Water Circulation, Fluctuation, and Salinity Determinations:

(1) Water. The following potential impacts were considered:

Salinity	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Water Chemistry	____N/A	__X_ INSIGNIFICANT	____SIGNIFICANT
Clarity	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Odor	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Taste	__X_N/A	____ INSIGNIFICANT	____ SIGNIFICANT
Dissolved gas levels	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Nutrients	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Eutrophication	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Others	__X_N/A	____ INSIGNIFICANT	____ SIGNIFICANT

The proposed Phase 5B alternatives are not expected to significantly affect water circulation, fluctuation, salinity, or other chemical/physical constituents as the alternatives do not coincide with the active river channel. Most of the material to be discharged would have been excavated from within the footprint of the project alternatives, so no new sources of nutrients, salinity or chemical contamination will be introduced. The grouted stone under the Preferred Alternative and soil cement under Alternative 2, would be inert substances and would not affect water quality once they have dried.

(2) Current Patterns and Circulation. The potential of discharge on the following conditions were evaluated:

Current Pattern and Flow	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Velocity	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Stratification	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Hydrology Regime	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT

The proposed Phase 5B alternatives are not expected to significantly affect current patterns or circulation, as they do not coincide with the active river channel.

(3) Normal Water Level Fluctuations. The potential of discharge on the following were evaluated:

Tide __X__N/A ___ INSIGNIFICANT ____ SIGNIFICANT
River Stage ___N/A _X__ INSIGNIFICANT ____ SIGNIFICANT

For reasons listed above, the proposed Phase 5B alternatives do not expect to have a significant impact on water level fluctuations.

8. Suspended Particulate/Turbidity Determinations.

(1) Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Site.

Impact: _X___N/A ____ INSIGNIFICANT ____ SIGNIFICANT

The Phase 5B alternatives do not coincide with the active river channel. Additionally, BMP that would be implemented as part of the Contractor's SWPPP, would protect water quality throughout construction.

(2) Effects on Chemical and Physical Properties of the Water Column.

Light Penetration	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Dissolved Oxygen	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Toxic Metals & Organic	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Pathogen	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Aesthetics	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Others	__X N/A ____ INSIGNIFICANT ____ SIGNIFICANT

For reasons listed above, impacts would not be significant or adverse.

(3) Effects of Turbidity on Biota.

Primary Productivity	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Suspension/Filter Feeders	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Sight feeders	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT

For reasons listed above, impacts would not be significant or adverse. The Phase 5B alternatives do not coincide with the active river channel.

(4) Actions Taken to Minimize Impacts.

Needed:	__X__ YES ___ NO
If needed, Taken:	__X__ YES ____ NO

Water Resources Environmental Commitments and BMP would be implemented to avoid significant impacts to water quality.

9. Contaminant Determination. The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material.
(Check only those appropriate).

(1) Physical characteristics _X_

(2) Hydrography in relation to known or anticipated sources of contaminants _X_

(3) Results from previous testing of the material or similar material in the vicinity of the proposed project _X_

(4) Known, significant sources of contaminants (e.g. pesticides) from land runoff or percolation _X__

(5) Spill records for petroleum products or designated (Section 311 of the CWA) hazardous substances _X__

(6) Other public records of significant introduction of contaminants from industries, municipalities, or other sources _X__

(7) Known existence of substantial material deposits of substances which could be released in harmful quantities to the aquatic environment by man-induced discharge activities _X__

(8) Other sources (specify) _X__

From an evaluation performed on Federal, state of California, and County of Orange HRTW databases, there are no known past or existing HTRW sites within Phase 5B.

10. Effect on aquatic Ecosystem and Organism Determinations.

Plankton	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Benthos	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Nekton	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Food Web	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT

Sensitive Habitats

Sanctuaries, refuges	__X_N/A	___ INSIGNIFICANT	____ SIGNIFICANT
Wetlands	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Mudflats	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Eelgrass beds	__X_N/A	___ INSIGNIFICANT	____ SIGNIFICANT
Riffle & pool Complexes	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Threatened & endangered species	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT

Other wildlife ____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT

11. Actions Taken to Minimize Impacts.

Clearing and grubbing of vegetation will occur prior to the nesting period for sensitive/migratory birds, and sound barriers would be installed prior to March 1, where needed, to reduce potential noise impacts to adjacent riparian habitats that may be occupied by sensitive/migratory birds. The Corps will also actively re-vegetate temporary work areas. Temporary and permanent impacts will also be mitigated off-site through habitat restoration (invasive plant removal), to further improve conditions for native species throughout the watershed.

12. Proposed Disposal Site Determinations. Is the mixing zone for each disposal site confined to the smallest practicable zone? __X_ YES ____ NO

13. Determination of Cumulative Effects of Disposal or Fill on the Aquatic Ecosystem.
Impacts: ____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT

14. Determination of Indirect Effects of Disposal or Fill on the Aquatic Ecosystem.
Impacts: ____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT

Phase 4

The determination below applies to the Phase 4 Preferred Alternative (Soil Cement).

A. Disposal Site Physical Substrate Determinations:

1. Substrate Elevation and Slope.
Impact: ____ N/A __X_ INSIGNIFICANT ____ SIGNIFICANT

The proposed Phase 4 Preferred Alternative is not expected to result in significant substrate impacts, because the existing embankment would be reconstructed at approximately the same elevation and slope.

2. Sediment type.
Impact: ____ N/A __X_ INSIGNIFICANT ____ SIGNIFICANT

Sediment consists primarily of Riverwash material. Excavated material will be reused for backfill within the same area. If additional fill material is needed, it would be compatible with existing materials.

3. Dredged/Fill Material Movement.
Impact: ____ N/A __X_ INSIGNIFICANT ____ SIGNIFICANT

Fill material would be placed (or replaced) within the footprint of the project and is expected to be held in place by the cement emulsion.

4. Physical Effects on Benthos (burial, changes in sediment type, composition, etc.).
Impact: ____ N/A __X_ INSIGNIFICANT ____ SIGNIFICANT

Temporary, short-term impacts from excavation and placement of fill material as backfill may occur. Material that is currently behind the existing soil cement embankment is not expected to support any benthic organisms and the proposed soil cement structure would not occur in the active river channel. As a result, no long-term, adverse significant impacts are expected.

5. Other Effects.
Impact: __X__ N/A ___ INSIGNIFICANT ____ SIGNIFICANT

6. Actions Taken to Minimize Impacts.
Needed: __X__ YES ___ NO
If needed, Taken: __X__ YES ____ NO

Fill material and backfill for embankment protection would be monitored for effects on water quality. Water Resources Environmental Commitments and BMP would be implemented to avoid significant impacts to water quality, or if turbidity exceeds water quality criteria.

7. Effect on Water Circulation, Fluctuation, and Salinity Determinations:

(1) Water. The following potential impacts were considered:

Salinity	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Water Chemistry	____N/A __X_ INSIGNIFICANT ____SIGNIFICANT
Clarity	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Odor	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Taste	__X_N/A ____ INSIGNIFICANT ____ SIGNIFICANT
Dissolved gas levels	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Nutrients	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Eutrophication	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Others	__X_N/A ____ INSIGNIFICANT ____ SIGNIFICANT

The proposed Phase 4 Preferred Alternative is not expected to significantly affect water circulation, fluctuation, salinity, or other chemical/physical constituents as the Preferred Alternative does not coincide with the active river channel. Most of the material to be discharged would have been excavated from within the footprint of the project, so no new sources of nutrients, salinity or chemical contamination will be introduced. The soil cement under the Preferred Alternative would be an inert substance and would not affect water quality once it has dried.

(2) Current Patterns and Circulation. The potential of discharge on the following conditions were evaluated:

Current Pattern and Flow	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Velocity	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT

Stratification ____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Hydrology Regime ____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT

The proposed Phase 4 Preferred Alternative is not expected to significantly affect current patterns or circulation, as it does not coincide with the active river channel.

(3) Normal Water Level Fluctuations. The potential of discharge on the following were evaluated:

Tide __X__N/A ___ INSIGNIFICANT ____ SIGNIFICANT
River Stage ___N/A _X__ INSIGNIFICANT ____ SIGNIFICANT

For reasons listed above, the proposed Phase 4 Preferred Alternative does not expect to have a significant impact on water level fluctuations.

8. Suspended Particulate/Turbidity Determinations.

(1) Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Site.

Impact: _X___N/A ____ INSIGNIFICANT ____ SIGNIFICANT

The Phase 4 Preferred Alternative does not coincide with the active river channel. Additionally, BMP that would be implemented as part of the Contractor's SWPPP, would protect water quality throughout construction.

(2) Effects on Chemical and Physical Properties of the Water Column.

Light Penetration ____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Dissolved Oxygen ____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Toxic Metals & Organic ____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Pathogen ____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Aesthetics ____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Others __X N/A ____ INSIGNIFICANT ____ SIGNIFICANT

For reasons listed above, impacts would not be significant or adverse.

(3) Effects of Turbidity on Biota.

Primary Productivity ____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Suspension/Filter Feeders ____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Sight feeders ____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT

For reasons listed above, impacts would not be significant or adverse. The Phase 4 Preferred Alternative does not coincide with the active river channel.

(4) Actions Taken to Minimize Impacts.

Needed: __X__ YES ___ NO
If needed, Taken: __X__ YES ____ NO

Water Resources Environmental Commitments and BMP would be implemented to avoid significant impacts to water quality.

9. Contaminant Determination. The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material. (Check only those appropriate).

(1) Physical characteristics _X_

(2) Hydrography in relation to known or anticipated sources of contaminants _X_

(3) Results from previous testing of the material or similar material in the vicinity of the proposed project _X_

(4) Known, significant sources of contaminants (e.g. pesticides) from land runoff or percolation _X__

(5) Spill records for petroleum products or designated (Section 311 of the CWA) hazardous substances _X__

(6) Other public records of significant introduction of contaminants from industries, municipalities, or other sources _X__

(7) Known existence of substantial material deposits of substances which could be released in harmful quantities to the aquatic environment by man-induced discharge activities _X__

(8) Other sources (specify) _X__

From an evaluation performed on Federal, state of California, and County of Orange HRTW databases, there are no known past or existing HTRW sites within Phase 4.

10. Effect on aquatic Ecosystem and Organism Determinations.

Plankton	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Benthos	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Nekton	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Food Web	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT

Sensitive Habitats

Sanctuaries, refuges	__X_N/A	___ INSIGNIFICANT	____ SIGNIFICANT
Wetlands	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT

Mudflats	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Eelgrass beds	__X_N/A ___ INSIGNIFICANT ____ SIGNIFICANT
Riffle & pool Complexes	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Threatened & endangered species	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT
Other wildlife	____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT

11. Actions Taken to Minimize Impacts.

Clearing and grubbing of vegetation will occur prior to the nesting period for sensitive/migratory birds, and sound barriers would be installed prior to March 1, where needed, to reduce potential noise impacts to adjacent riparian habitats that may be occupied by sensitive/migratory birds. The Corps will also actively re-vegetate temporary work areas. Temporary and permanent impacts will also be mitigated off-site through habitat restoration (invasive plant removal), to further improve conditions for native species throughout the watershed.

12. Proposed Disposal Site Determinations. Is the mixing zone for each disposal site confined to the smallest practicable zone? __X_ YES ____ NO

13. Determination of Cumulative Effects of Disposal or Fill on the Aquatic Ecosystem.
Impacts: ____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT

14. Determination of Indirect Effects of Disposal or Fill on the Aquatic Ecosystem.
Impacts: ____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT

BNSF Bridge

The determination below applies to the BNSF Bridge Preferred Alternative (Pier and Abutment Protection).

A. Disposal Site Physical Substrate Determinations:

1. Substrate Elevation and Slope.
Impact: ____ N/A __X_ INSIGNIFICANT ____ SIGNIFICNT

The proposed BNSF Bridge Preferred Alternative is not expected to result in significant substrate impacts.

2. Sediment type.
Impact: ____ N/A __X_ INSIGNIFICANT ____ SIGNIFICNT

Sediment consists primarily of loamy sand, Riverwash material, fine loamy sand, and gravelly loam. Excavated material will be reused for backfill within the same area. If additional fill material is needed, it would be compatible with existing materials.

3. Dredged/Fill Material Movement.
Impact: ____ N/A __X_ INSIGNIFICANT ____ SIGNIFICNT

Fill material would be placed (or replaced) within the footprint of the project and is expected to be held in place by bridge pier and abutment features within the active channel and along the east bank, and also by grouted stone and paved areas along the east bank.

4. Physical Effects on Benthos (burial, changes in sediment type, composition, etc.).
Impact: ____ N/A __X_ INSIGNIFICANT ____ SIGNIFICNT

Temporary, short-term impacts from excavation and placement of fill material as backfill may occur. Excavation and fill within the active river channel (after water is diverted) would likely disturb/destroy organisms within that area. However, this community is expected to quickly re-establish, and no long-term, adverse significant impacts are expected.

5. Other Effects.
Impact: __X__ N/A ___ INSIGNIFICANT ____ SIGNIFICNT

6. Actions Taken to Minimize Impacts.
Needed: __X__ YES ___ NO
If needed, Taken: __X__ YES ____ NO

Fill material and backfill for embankment protection would be monitored for effects on water quality. Water Resources Environmental Commitments and BMP would be implemented to avoid significant impacts to water quality, or if turbidity exceeds water quality criteria.

7. Effect on Water Circulation, Fluctuation, and Salinity Determinations:

(1) Water. The following potential impacts were considered:

Salinity	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Water Chemistry	____N/A	__X_ INSIGNIFICANT	____SIGNIFICANT
Clarity	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Odor	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Taste	__X_N/A	____ INSIGNIFICANT	____ SIGNIFICANT
Dissolved gas levels	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Nutrients	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Eutrophication	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Others	___X_N/A	____ INSIGNIFICANT	____ SIGNIFICANT

The proposed BNSF Bridge Preferred Alternative is not expected to significantly affect water circulation, fluctuation, salinity, or other chemical/physical constituents. River flows will be temporarily diverted around work areas for in-stream pier protection features, thereby avoiding the potential for accidental spills or other construction-related effects. Existing hydrology will be re-established once construction is completed. Clarity will be affected during the diversion and re-diversion process, but turbidity would quickly subside (within a few hours). Most of the material to be discharged would have been excavated from within the project footprint, so no

new sources of nutrients, salinity or chemical contamination would be introduced. The concrete walls and grouted stone, once dry, will be a inert substances and would not affect water quality.

(2) Current Patterns and Circulation. The potential of discharge on the following conditions were evaluated:

Current Pattern and Flow	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Velocity	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Stratification	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Hydrology Regime	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT

The proposed BNSF Bridge Preferred Alternative is not expected to significantly affect current patterns or circulation. River flows will be temporarily diverted around in-stream work areas. It is anticipated that the diversion would be of sufficient width and depth to accommodate anticipated flow volumes without substantially increasing velocity. Existing hydrology will be re-established once construction is completed.

(3) Normal Water Level Fluctuations. The potential of discharge on the following were evaluated:

Tide __X__N/A ___ INSIGNIFICANT ____ SIGNIFICANT
River Stage ___N/A _X__ INSIGNIFICANT ____ SIGNIFICANT

For reasons listed above, the proposed BNSF Bridge Preferred Alternative does not expect to have a significant impact on water level fluctuations.

8. Suspended Particulate/Turbidity Determinations.

(1) Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Site.

Impact: _X___N/A ____ INSIGNIFICANT ____ SIGNIFICANT

Impacts would be temporary and short term, but not adverse or significant. Diversion and re-diversion of river flows will require construction of coffer dams within the flowing water, resulting in short-term, substantial increases in suspended particulates. Turbidity plumes would likely extend several hundred feet (or more) downstream of the action area during the initial diversion event(s), but these would quickly subside (within a few hours). This diversion, and other BMP implemented as part of the Contractor's SWPPP, would then allow water quality to be protected throughout the remainder of the construction.

(2) Effects on Chemical and Physical Properties of the Water Column.

Light Penetration	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Dissolved Oxygen	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Toxic Metals & Organic	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT

Pathogen	____N/A __X_ INSIGNIFICANT ____	SIGNIFICANT
Aesthetics	____N/A __X_ INSIGNIFICANT ____	SIGNIFICANT
Others	__X N/A ____ INSIGNIFICANT ____	SIGNIFICANT

For reasons listed above, impacts would not be significant or adverse.

(3) Effects of Turbidity on Biota.

Primary Productivity	____N/A __X_ INSIGNIFICANT ____	SIGNIFICANT
Suspension/Filter Feeders	____N/A __X_ INSIGNIFICANT ____	SIGNIFICANT
Sight feeders	____N/A __X_ INSIGNIFICANT ____	SIGNIFICANT

For reasons listed above, impacts would be temporary and short term, but not significant or adverse. Fish and other mobile organisms within the active river channel will be able to avoid the areas of high turbidity during the diversion/re-diversion process, and will be able to re-occupy as soon as suspended sediments settle, and once in-stream construction is complete.

(4) Actions Taken to Minimize Impacts.

Needed:	__X__ YES ___ NO
If needed, Taken:	__X__ YES ____ NO

Water Resources Environmental Commitments and BMP would be implemented to avoid significant impacts to water quality.

9. Contaminant Determination. The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material. (Check only those appropriate).

(1) Physical characteristics _X_

(2) Hydrography in relation to known or anticipated sources of contaminants _X_

(3) Results from previous testing of the material or similar material in the vicinity of the proposed project _X_

(4) Known, significant sources of contaminants (e.g. pesticides) from land runoff or percolation _X__

(5) Spill records for petroleum products or designated (Section 311 of the CWA) hazardous substances _X__

(6) Other public records of significant introduction of contaminants from industries, municipalities, or other sources _X__

(7) Known existence of substantial material deposits of substances which could be released in harmful quantities to the aquatic environment by man-induced discharge activities _X__

(8) Other sources (specify) _X__

From an evaluation performed on Federal, state of California, and County of Riverside HRTW databases, there are no known past or existing HTRW sites within BNSF Bridge.

10. Effect on aquatic Ecosystem and Organism Determinations.

Plankton	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Benthos	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Nekton	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Food Web	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT

Sensitive Habitats

Sanctuaries, refuges	__X_N/A	___ INSIGNIFICANT	____ SIGNIFICANT
Wetlands	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Mudflats	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Eelgrass beds	__X_N/A	___ INSIGNIFICANT	____ SIGNIFICANT
Riffle & pool Complexes	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Threatened & endangered species	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT
Other wildlife	____N/A	__X_ INSIGNIFICANT	____ SIGNIFICANT

11. Actions Taken to Minimize Impacts.

Clearing and grubbing of vegetation will occur prior to the nesting period for sensitive/migratory birds and sound barriers would be installed prior to March 1 where needed, to reduce potential noise impacts to adjacent riparian habitats that may be occupied by sensitive/migratory birds. Flows will be diverted around the in-stream work areas to avoid use of construction equipment within wetted areas (other than the equipment needed to build and remove coffer dams). This activity is expected to occur prior to the main spawning season for native fish. After the coffer dam is in place and the work area is cut off from the main channel, most mobile species would likely sense and follow the remaining flow path as water drains from the work area. Thorough surveys will be conducted as the water drains to rescue and relocate any native aquatic species. Non-native species that are stranded within the work area will be disposed of, thereby removing potential predators/competitors and improving conditions for native species in the long-term. Once construction is completed and river flows are restored within the project area, it is expected that the benthic and vegetative community will re-establish within several months to a few years. In the meantime, food sources and shelter will continue to exist upstream and downstream of the work area. The Corps will actively revegetate temporary work areas, and will restore or improve physical dimensions/substrate within the perennial stream, to expedite the recovery process. Temporary and permanent impacts will also be mitigated off-site through habitat restoration (invasive plant removal), to further improve conditions for native species throughout the watershed.

12. Proposed Disposal Site Determinations. Is the mixing zone for each disposal site confined to the smallest practicable zone? __X_ YES ____ NO

13. Determination of Cumulative Effects of Disposal or Fill on the Aquatic Ecosystem.
Impacts: ____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT

14. Determination of Indirect Effects of Disposal or Fill on the Aquatic Ecosystem.
Impacts: ____N/A __X_ INSIGNIFICANT ____ SIGNIFICANT

IV. FINDING OF COMPLIANCE

Phase 5A

a. Adaptation of the Section 404 (b)(1) Guidelines to this Evaluation. No significant adaptations of the guidelines were made relative to this evaluation.

b. Evaluation of Availability of Practicable Alternatives to the Proposed Discharge Site Which Would Have Less Adverse Impact on the Aquatic Ecosystem. All practicable alternatives for fill material and backfill were evaluated. The Phase 5A Preferred Alternative (Grouted Stone and Sheet Pile) is both the most cost effective and least environmentally damaging.

c. Compliance with Applicable State Water Quality Standards: The proposed Phase 5A Preferred Alternative would comply with State of California water quality standards. On January 23, 2015, the Corps requested a 401 Certification from the Santa Ana Regional Water Quality Control Board "RWQCB" (a single certification will be requested for Phase 5A, Phase 5B, Phase 4 and BNSF). As no response was received from the RWQCB, the Corps has assumed a waiver of 401 Certification for the proposed action. The Corps will continue to coordinate informally with the RWQCB, and the construction contractors will comply with separate requirements to request discharge permits where applicable, prepare SWPPPs, and provide notifications to the State Water Resources Control Board. These plans would ensure that impacts to water quality as a result of Reach 9 project activities would not take place.

d. Compliance with Applicable Toxic Effluent Standard or Prohibition Under Section 307 of the Clean Water Act: No toxic materials/wastes are expected to be produced or introduced into the environment by Phase 5A. Discharge will consist of native substrate mixed with concrete. The concrete, once dried, will be inert and stable.

e. Compliance with the Endangered Species Act of 1973: As discussed in the attached SEA/EIR Addendum, the Corps has determined Phase 5A may adversely affect, but would not jeopardize the continued existence of Federally-listed threatened or endangered species including coastal California gnatcatcher and least Bell's vireo. Formal consultation pursuant to Section 7(c) was initiated on January 23, 2015 with the USFWS. The USFWS and CDFW provided comments on the Draft SEA/EIR Addendum subsequent to the public review period. The Corps and OCFCD coordinated with the USFWS and CDFW extensively on the review comments and on the proposed responses. Modifications to the project description, including conservation measures, were made based on this coordination. A Biological Opinion was received on July 23, 2015 which concluded formal consultation under Section 7 of the ESA for the proposed Reach 9 measures. The Reach 9 Phases 4, 5A, 5B & BNSF Bridge project is in compliance with ESA.

f. Compliance with Specified Protection Measures for Marine Sanctuaries Designated by the Marine Protection, Research, and Sanctuaries Act of 1972: No sanctuaries as designated by the Marine Protection, Research and Sanctuaries Act of 1972 will be affected by Phase 5A. No sediments would be disposed of within the ocean.

g. Evaluation of Extent of Degradation of the Waters of the United States: No significant degradation of municipal or private water supplies, special aquatic sites, or plankton resources will occur.

h. Appropriate and Practicable Steps Taken to Minimize Potential Adverse Impacts of the Discharge on the Aquatic Ecosystem: Specific environmental commitments are outlined in Section 6 of the attached SEA/EIR Addendum.

i. On the Basis of the Guidelines, the Proposed Disposal Site(s) for the Discharge of Dredged or Fill Material is:

_X_ (1) Specified as complying with the requirements of these guidelines; or,
____ (2) Specified as complying with the requirements of these guidelines, with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects on the aquatic ecosystem; or,

____ (3) Specified as failing to comply with the requirements of these guidelines.
Prepared by: Arthur Popp: Date: January 21, 2015. Update: July 2015.

Phase 5B

a. Adaptation of the Section 404 (b)(1) Guidelines to this Evaluation. No significant adaptations of the guidelines were made relative to this evaluation.

b. Evaluation of Availability of Practicable Alternatives to the Proposed Discharge Site Which Would Have Less Adverse Impact on the Aquatic Ecosystem. All practicable alternatives for fill material and backfill were evaluated. The Phase 5B Preferred Alternative (Grouted Stone and Sheet Pile) is both the most cost effective and least environmentally damaging.

c. Compliance with Applicable State Water Quality Standards: The proposed Phase 5B Preferred Alternative would comply with State of California water quality standards. On January 23, 2015, the Corps requested a 401 Certification from the Santa Ana Regional Water Quality Control Board "RWQCB" (a single certification will be requested for Phase 5A, Phase 5B, Phase 4 and BNSF). As no response was received from the RWQCB, the Corps has assumed a waiver of 401 Certification for the proposed action. The Corps will continue to coordinate informally with the RWQCB, and the construction contractors will comply with separate requirements to request discharge permits where applicable, prepare SWPPPs, and provide notifications to the State Water Resources Control Board. These plans would ensure that impacts to water quality as a result of Reach 9 project activities would not take place.

d. Compliance with Applicable Toxic Effluent Standard or Prohibition Under Section 307 of the Clean Water Act: No toxic materials/wastes are expected to be produced or introduced into the environment by Phase 5B. Discharge will consist of native substrate mixed with concrete. The concrete, once dried, will be inert and stable.

e. Compliance with the Endangered Species Act of 1973: As discussed in the attached SEA/EIR Addendum, the Corps has determined Phase 5B may adversely affect, but would not jeopardize the continued existence of Federally-listed threatened or endangered species including coastal California gnatcatcher and least Bell's vireo. Formal consultation pursuant to Section 7(c) was initiated on January 23, 2015 with the USFWS. The USFWS and CDFW provided comments on the Draft SEA/EIR Addendum subsequent to the public review period. The Corps and OCFCD coordinated with the USFWS and CDFW extensively on the review comments and on the proposed responses. Modifications to the project description, including conservation measures, were made based on this coordination. A Biological Opinion was received on July 23, 2015 which concluded formal consultation under Section 7 of the ESA for the proposed Reach 9 measures. The Reach 9 Phases 4, 5A, 5B & BNSF Bridge project is in compliance with ESA.

f. Compliance with Specified Protection Measures for Marine Sanctuaries Designated by the Marine Protection, Research, and Sanctuaries Act of 1972: No sanctuaries as designated by the Marine Protection, Research and Sanctuaries Act of 1972 will be affected by Phase 5B. No sediments would be disposed of within the ocean.

g. Evaluation of Extent of Degradation of the Waters of the United States: No significant degradation of municipal or private water supplies, special aquatic sites, or plankton resources will occur.

h. Appropriate and Practicable Steps Taken to Minimize Potential Adverse Impacts of the Discharge on the Aquatic Ecosystem: Specific environmental commitments are outlined in Chapter 6 of the attached SEA/EIR Addendum.

i. On the Basis of the Guidelines, the Proposed Disposal Site(s) for the Discharge of Dredged or Fill Material is:

_X_ (1) Specified as complying with the requirements of these guidelines; or,
____ (2) Specified as complying with the requirements of these guidelines, with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects on the aquatic ecosystem; or,

____ (3) Specified as failing to comply with the requirements of these guidelines.
Prepared by: Arthur Popp: Date: January 21, 2015. Update: July 2015.

Phase 4

a. Adaptation of the Section 404 (b)(1) Guidelines to this Evaluation. No significant adaptations of the guidelines were made relative to this evaluation.

b. Evaluation of Availability of Practicable Alternatives to the Proposed Discharge Site Which Would Have Less Adverse Impact on the Aquatic Ecosystem. All practicable alternatives for fill material and backfill were evaluated. The Phase 4 Preferred Alternative (Soil Cement) is the least environmentally damaging alternative.

c. Compliance with Applicable State Water Quality Standards: The proposed Phase 4 Preferred Alternative would comply with State of California water quality standards. On January 23, 2015, the Corps requested a 401 Certification from the Santa Ana Regional Water Quality Control Board "RWQCB" (a single certification will be requested for Phase 5A, Phase 5B, Phase 4 and BNSF). As no response was received from the RWQCB, the Corps has assumed a waiver of 401 Certification for the proposed action. The Corps will continue to coordinate informally with the RWQCB, and the construction contractors will comply with separate requirements to request discharge permits where applicable, prepare SWPPPs, and provide notifications to the State Water Resources Control Board. These plans would ensure that impacts to water quality as a result of Reach 9 project activities would not take place.

d. Compliance with Applicable Toxic Effluent Standard or Prohibition Under Section 307 of the Clean Water Act: No toxic materials/wastes are expected to be produced or introduced into the environment by Phase 4. Discharge will consist of native substrate mixed with concrete. The concrete, once dried, will be inert and stable.

e. Compliance with the Endangered Species Act of 1973: As discussed in the attached SEA/EIR Addendum, the Corps has determined Phase 4 may adversely affect, but would not jeopardize the continued existence of Federally-listed threatened or endangered species including coastal California gnatcatcher and least Bell's vireo. Formal consultation pursuant to Section 7(c) was initiated on January 23, 2015 with the USFWS. The USFWS and CDFW provided comments on the Draft SEA/EIR Addendum subsequent to the public review period. The Corps and OCFCD coordinated with the USFWS and CDFW extensively on the review comments and on the proposed responses. Modifications to the project description, including conservation measures, were made based on this coordination. A Biological Opinion was received on July 23, 2015 which concluded formal consultation under Section 7 of the ESA for the proposed Reach 9 measures. The Reach 9 Phases 4, 5A, 5B & BNSF Bridge project is in compliance with ESA.

f. Compliance with Specified Protection Measures for Marine Sanctuaries Designated by the Marine Protection, Research, and Sanctuaries Act of 1972: No sanctuaries as designated by the Marine Protection, Research and Sanctuaries Act of 1972 will be affected by Phase 4. No sediments would be disposed of within the ocean.

g. Evaluation of Extent of Degradation of the Waters of the United States: No significant degradation of municipal or private water supplies, special aquatic sites, or plankton resources will occur.

h. Appropriate and Practicable Steps Taken to Minimize Potential Adverse Impacts of the Discharge on the Aquatic Ecosystem: Specific environmental commitments are outlined in Section 6 of the attached SEA/EIR Addendum.

i. On the Basis of the Guidelines, the Proposed Disposal Site(s) for the Discharge of Dredged or Fill Material is:

_X_ (1) Specified as complying with the requirements of these guidelines; or,
____ (2) Specified as complying with the requirements of these guidelines, with the inclusion

of appropriate and practical conditions to minimize pollution or adverse effects on the aquatic ecosystem; or,

____ (3) Specified as failing to comply with the requirements of these guidelines.
Prepared by: Arthur Popp: Date: January 21, 2015. Update: July 2015.

BNSF Bridge

a. Adaptation of the Section 404 (b)(1) Guidelines to this Evaluation. No significant adaptations of the guidelines were made relative to this evaluation.

b. Evaluation of Availability of Practicable Alternatives to the Proposed Discharge Site Which Would Have Less Adverse Impact on the Aquatic Ecosystem. All practicable alternatives for fill material and backfill were evaluated. The BNSF Bridge Preferred Alternative (Pier and Abutment Protection) is the least environmentally damaging alternative.

c. Compliance with Applicable State Water Quality Standards: The proposed BNSF Bridge Preferred Alternative would comply with State of California water quality standards. On January 23, 2015, the Corps requested a 401 Certification from the Santa Ana Regional Water Quality Control Board "RWQCB" (a single certification will be requested for Phase 5A, Phase 5B, Phase 4 and BNSF). As no response was received from the RWQCB, the Corps has assumed a waiver of 401 Certification for the proposed action. The Corps will continue to coordinate informally with the RWQCB, and the construction contractors will comply with separate requirements to request discharge permits where applicable, prepare SWPPPs, and provide notifications to the State Water Resources Control Board. These plans would ensure that impacts to water quality as a result of Reach 9 project activities would not take place.

d. Compliance with Applicable Toxic Effluent Standard or Prohibition Under Section 307 of the Clean Water Act: No toxic materials/wastes are expected to be produced or introduced into the environment by BNSF Bridge. Discharge will consist of native substrate mixed with concrete. The concrete, once dried, will be inert and stable.

e. Compliance with the Endangered Species Act of 1973: As discussed in the attached SEA/EIR Addendum, the Corps has determined Phase 4 may adversely affect, but would not jeopardize the continued existence of Federally-listed threatened or endangered species including coastal California gnatcatcher, least Bell's vireo, and Santa Ana sucker. Formal consultation pursuant to Section 7(c) was initiated on January 23, 2015 with the USFWS. The USFWS and CDFW provided comments on the Draft SEA/EIR Addendum subsequent to the public review period. The Corps and OCFCD coordinated with the USFWS and CDFW extensively on the review comments and on the proposed responses. Modifications to the project description, including conservation measures, were made based on this coordination. A Biological Opinion was received on July 23, 2015 which concluded formal consultation under Section 7 of the ESA for the proposed Reach 9 measures. The Reach 9 Phases 4, 5A, 5B & BNSF Bridge project is in compliance with ESA.

f. Compliance with Specified Protection Measures for Marine Sanctuaries Designated by the Marine Protection, Research, and Sanctuaries Act of 1972: No sanctuaries as designated by the Marine Protection, Research and Sanctuaries Act of 1972 will be affected by BNSF Bridge. No sediments would be disposed of within the ocean.

g. Evaluation of Extent of Degradation of the Waters of the United States: No significant degradation of municipal or private water supplies, special aquatic sites, or plankton resources will occur.

h. Appropriate and Practicable Steps Taken to Minimize Potential Adverse Impacts of the Discharge on the Aquatic Ecosystem: Specific environmental commitments are outlined in the attached SEA/EIR Addendum.

i. On the Basis of the Guidelines, the Proposed Disposal Site(s) for the Discharge of Dredged or Fill Material is:

_X_ (1) Specified as complying with the requirements of these guidelines; or,
____ (2) Specified as complying with the requirements of these guidelines, with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects on the aquatic ecosystem; or,

____ (3) Specified as failing to comply with the requirements of these guidelines.
Prepared by: Arthur Popp: Date: January 21, 2015. Update: July 2015.

Appendix E

Distribution Mailing List

Federal Agencies

U.S. Environmental Protection Agency Deanna W. Wieman, Deputy Director Cross Media Division
Mail Code CMD-2 75
Hawthorne Street
San Francisco, CA 94105

Mr. Mendel Stewart, Field Supervisor
U.S. Fish & Wildlife Service
2177 Salk Avenue, Suite 250
Carlsbad, CA 92008

Ms. Christine Medak
U.S. Fish and Wildlife Service
2177 Salk Avenue, Suite 250
Carlsbad, CA 92008

Lisa Lyren Supervisory
Ecologist
U.S. Geological Survey-BRD Western Ecological Research Center
2177 Salk Avenue, Suite 250
Carlsbad, CA 92008

State Agencies

State Clearinghouse
Office of Planning and Research
P.O. Box 3044
Sacramento, CA 95812-3044

Kathleen Andrews
CA. Dept. of Conservation
District 1, Division of Oil, Gas and Geothermal Resources
5816 Corporate Avenue, Suite 200
Cypress, CA 90630-4731

Jeff Brandt
California Department of Fish and Wildlife
3602 Inland Empire Blvd., Ste C-220
Ontario, CA 91764

Kim Freeburn-Marquez
California Department of Fish and Wildlife
3602 Inland Empire Blvd., Ste. C-220
Ontario, CA 91764

California Department of Fish and Wildlife
Attn: Streambed Team
4665 Lampson Ave., Suite J
Los Alamitos, CA 90720

Milford Wayne Donaldson
State Historic Preservation Officer Office of Historic Preservation 1725 23rd Street,
Suite 100
Sacramento, CA 95816

Christopher Herre
Chief, Local Development/IGR Caltrans, District 12
3337 Michelson Drive, Suite 380
Irvine, CA 92612

Caltrans, District 8
Attn: IGR/CEQA Division
464 W. 4th St.
San Bernardino, CA 92402

Mr. Kurt V. Berchtold
Regional Water Quality Control Board
Region 8
Attn: Marc Brown
3737 Main Street, Suite 500
Riverside, CA 92501-3339

Dave Singleton
Native American Heritage Commission
915 Capital Mall, Room 364
Sacramento, CA 95814

James Hockenberry
State Water Resources Control Board
Environmental Services Unit
1001 I Street
Sacramento, CA 95814

Enrique Arroyo, District Planner
Department of Parks and Recreation
Inland Empire District
17801 Lake Perris Dr.
Perris, CA 92571

CA Dept. of Toxic Substances Control
5796 Corporate Avenue
Attn: Greg Holmes, Unit Chief
Cypress, CA 90630

CA Dept. of Public Health
P.O. Box 997377
Sacramento, CA 95899

Local Agencies

Dan Bott
Orange County Water District 18700
Ward Street
Fountain Valley, California 92708

Dick Zembal
Orange County Water District 18700
Ward Street
Fountain Valley, CA 92708

General Manager
Orange County Water District
10500 Ellis Avenue
Fountain Valley, CA 92708

General Manager
Inland Empire Utilities Agency
P.O. Box 9020
Chino Hills, CA 91709

Rich Adler
Orange County Parks
13042 Old Myford Rd.
Irvine, CA 92602

Mr. Kirk Holland, Manager
Orange County Parks
13042 Old Myford Rd.
Irvine, CA 92602

General Manager
Western Municipal Water District
14205 Meridian Parkway
Riverside, CA 92518

Mr. Albert Martinez
Riverside Co. Flood Control
1995 Market St.
Riverside, CA 92501
Corona Department of Water and Power
400 S. Vincentia Ave.
Corona, CA 92882

Ms. Laura Manchester
Deputy City Manager City of Corona
P.O. Box 940
Corona, CA 91718-0090

Steve Powers
City of Corona
Public Works Department
815 West Sixth Street
Corona, CA 91720-3238

Mr. David Lovell
Assistant Chief, Federal Projects Division
San Bernardino County Flood Control District
Public Works Group
825 East Third Street, Room 118
San Bernardino, CA 92415-0835

Mr. Lance Natsuhara
Orange County Public Works
Flood Control Div./Santa Ana River Section 300
N. Flower Street
Santa Ana, CA 92703

Mr. Ariel Corpuz
Orange County Public Works
Flood Control Div./Santa Ana River Section 300
N. Flower Street
Santa Ana, CA 92703

Mr. Greg Yi
Orange County Public Works
Flood Control Div./Santa Ana River Section
300 N. Flower Street
Santa Ana, CA 92703

Mr. Giatho Tran
Orange County Public Works
Flood Control Div./Santa Ana River Section
300 N. Flower Street
Santa Ana, CA 92703

Jeff Dickman
Orange County Public Works
Flood Control Div./Santa Ana River Section
300 N. Flower Street
Santa Ana, CA 92703

Mr. Hardat Khublall
Orange County Sanitation District 10844
Ellis Avenue
Fountain Valley, CA 92708-7018

South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, CA 91765

General Manager
Metropolitan Water District
P.O. Box 54153
Los Angeles, CA 90054-0153

Orange County Transportation Authority
Attn: Dan Phu
550 S. Main Street
Orange, CA 92863

Riverside County, County Recorder
P.O. Box 751
2724 Gateway Drive
Riverside, CA 92502

Riverside County Planning Department
Director of Planning
4080 Lemon Street
Riverside, CA 92501

Parks Director
Riverside County Regional Parks and Open Space
4600 Crestmore Road
Riverside, CA 92509

Don Williams, Asst. General Manager
Strategic Planning and Engineering
Department of Water and Power
815 W. Sixth Street
Corona, CA 92882

Orange County Clerk -
Recorder
12 Civic Center Plaza, Room 101 Santa
Ana, CA 92701

Charles Landry
Executive Director
Western Riverside County Regional
Conservation Authority
3403 10th Street
Riverside, CA 92501

Mark Stowell, Director of Public Works City
of Yorba Linda
4845 Casa Loma
P.O. Box 87014
Yorba Linda, CA 92886-8714

City of Yorba Linda Planning Department
4845 Casa Loma
P.O. Box 87014
Yorba Linda, CA 92886-8714

Jonathan E. Borrego
City of Anaheim Planning Department
P.O. Box 3222
Anaheim, CA 92803

City of Anaheim Attn:
Don Calkins City Hall
West
201 S. Anaheim Blvd., Ste 1101
Anaheim, CA 92803

Organizations/Groups

Hugh Wood Executive
Director
Santa Ana Watershed Association
P.O. Box 5407 Riverside,
CA 92517

Riverside-Corona Resource Conservation District
Attn: Kerwin Russell
4500 Glenwood Dr., Bldg A
Riverside, CA 92501

David Ruhl
Santa Ana Watershed Project Authority
11615 Sterling Avenue
Riverside, CA 92503

General Manager
Santa Ana Watershed Project Authority
11615 Sterling Avenue
Riverside, CA 92503

Friends of Harbors, Beaches and Parks
P.O. Box 9256
Newport Beach, CA 92658

Riverside Audubon Society 5370
Riverview Drive
Rubidoux, CA 92509

Audubon Society
San Bernardino Valley Chapter
P.O. Box 10973
San Bernardino, CA 92423-0973

Brad Richards
Chair: Prado Basin Group
Sierra Club San Gorgonio Chapter
4079 Mission Inn Ave.
Riverside, CA 92501

Glenn Parker
Wildlife Corridor Conservation Authority
570 West Avenue 26, Suite 100
Los Angeles, CA 90065

Private Entity

Stephanie Blanco Parsons
3200 E. Guasti Rd., Suite 200
Ontario, CA 91761

Dana Busch Canyon RV Park
24001 Santa Ana Canyon Road
Anaheim, CA 92808

Ann and Gordon Luce
6020 Toulan Way Yorba
Linda, CA 92887

Terry J. Hartman
Irvine Community Development Company
550 Newport Center Drive
Newport Beach, CA 92660

Robert S. Coldren Hart,
King and Coldren
200 Sandpointe Avenue, Fourth Floor
Santa Ana, CA 92707

James Cathcart, P.E. HDR
Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, CA 92607

Libraries

Orange County Public Library Villa
Park Library
17865 Santiago Blvd.
Villa Park, CA 92861

Yorba Linda Library
18262 Lemon Drive
Yorba Linda, CA 92686

Main Library
City of Anaheim
500 West Broadway
Anaheim, CA 92805

CSU Fullerton Library
800 N. State College
Fullerton, CA 92833

Corona Public Library - Nora Jacob
650 South Main Street
Corona, CA 91720

Norco Public Library
3954 Old Hamner Avenue
Norco, CA 91760

Riverside Public Library
Attn: Government Documents
3581 Mission Inn Avenue
Riverside, CA 92501

San Bernardino County Library
104 West 4th Street
San Bernardino, CA 92401

Chino Branch Library
13180 Central Avenue
Chino, CA 91710

Native American Contacts

Juaneno Band of Mission Indians Acjachemen Nation
David Belardes, Chairperson
32161 Avenida Los Amigos
San Juan Capistrano, CA 92675

Tongva Ancestral Territorial Tribal Nation
John Tommy Rosas, Tribal Admin.
Private Address

Gabrieleno/Tongva San Gabriel Band Mission
Anthony Morales, Chairperson
PO Box 693
San Gabriel, CA 91778

Gabrielino Tongva Nation Sam Dunlap,
Chairperson
P.O. Box 86908
Los Angeles, CA 90086

Juaneno Band of Mission Indians
Acjachemen Nation
Anthony Rivera, Chairman
31411-A La Matanza Street
San Juan Capistrano, CA 92675-2674

Gabrielino Tongva Indians of California
Tribal Council
Robert F. Dorame,
Tribal Chair/Cultural Resources
P.O. Box 490
Bellflower, CA 90707

Juaneno Band of Mission Indians
Alfred Cruz, Cultural Resources Coordinator
P.O. Box 25628
San Ana, CA 92799

Juaneno Band of Mission Indians Sonia
Johnston, Tribal Chairperson
P.O. Box 25628
Santa Ana, CA 92799

Juaneno Band of Mission Indians
Anita Espinoza
1740 Concerto Drive
Anaheim, CA 92807
United Coalition to Protect Panhe (UCPP)

Rebecca Robles
119 Avenida San Fernando
San Clemente, CA 92672

Gabrielino-Tongva Tribe
Bernie Acuna
1875 Century Pk East #1500
Los Angeles, CA 90067

Juaneno Band of Mission Indians
Acjachemen Nation
Joyce Perry, Representing Tribal Chairperson
4955 Paseo Segovia
Irvine, CA 92612

Gabrielino-Tongva Tribe Linda
Candelaria, Chairwoman
1875 Century Pk East #1500
Los Angeles, CA 90067

Gabrieleno Band of Mission Indians
Andrew Salas, Chairperson
P.O. Box 393
Covina, CA 91723

Appendix F

Correspondence, Public Comments and Responses

Reach 9, Phases 4, 5A, 5B, and BNSF Project

Comments on the January 2015 Public Draft SEA/EIR Addendum

Copies of all correspondence are included in full in this appendix. The following table provides a summary of the comment and the response.

Agency	Letter Dated	Nature of Comments	Responses to Comments/Changes to SEA/Status
Chairman Of Gabrieleño Band Of Mission Indians/Kizh (Kit'c) Nation (Andy Salas) BOMI/KN-1	2/6/15	Request that one of their experienced and certified Native American (NA) monitors be on site during any and all ground disturbance activities.	The Corps will ensure that the project is monitored by a professional archaeologist who meets the Standards of the Secretary of the Interior as stated in Section 5.8.3 Environmental Commitment CR-1. Tribal monitors are also welcome to be on site as long as they comply with safety requirements and check in first with the Contractor superintendent or Corps inspector. The Corps will not be able to reimburse the tribal monitors for any costs incurred. No change to the SEA/EIR Addendum is required in response to this comment, as the requirement for monitoring was already included as Measure EC-CR-1 in Chapter 6 (Environmental Commitments).
United Coalition to Protect Panhe UCP-1	2/10/15 via e-mail	Concur with mitigation measure CR-1 that requires archaeological monitoring of construction. This mitigation measure should be applied whenever ground disturbing activities may affect areas that have not been subject to erosion and the ground disturbance will go deeper than recent and historic flood episodes. Request to be kept informed in the event that cultural resources are discovered during construction.	Comment noted. No change necessary to FSEA/EIR Addendum. Concur.
Orange County Sanitation District (OCSD) OCSD-1	2/19/15	Request Corps to consider removing the emergency rock that had been placed not only in the Phase 4 area but also throughout the project location to minimize impacts to sensitive wildlife area and conserve resources; Corps can re-use on-site rock as a resource to mitigate the importation of additional materials.	As discussed at previous meetings between the Corps and OCSD, the Corps is not authorized to conduct rock removal outside of active project footprints. Furthermore, as rock removal is a condition of a Corps Regulatory permit, the Corps cannot implement such conditions on behalf of the applicant. Rock within the Phase 4 temporary construction easement would not be

			removed for the purpose of fulfilling a permit condition, but solely to enable construction to proceed. As the project description was not changed in response to this comment, no change to the SEA/EIR Addendum is required.
CA Dept of Conservation, Division of Oil, Gas and Geothermal Resources DOC-1	3/3/15	Address future CEQA-related letters to Kathleen Andrews. The address is: Kathleen Andrews California Department of Conservation District 1, Division of Oil, Gas and Geothermal Resources 5816 Corporate Avenue, Suite 200 Cypress, California 90630-4731	POC has been updated in FSEA/EIR Addendum Distribution List (Appendix E).
Dept of Parks and Recreation (DPR) DPR-1	3/3/15	**Phase 5B** Presence of the Coastal California Gnatcatcher at Coal Canyon should be added to the description in Table 5.5-3. (The table presently only mentions Weir and Gypsum Canyons.) Additionally, Coastal California Gnatcatchers have been detected recently on the north side of SR-91 near the east end of Reach 9, Phase 5B temporary construction easement. Information in number 1 above should be added to the Special Species description on the Coastal California Gnatcatcher in the same section.	This information has been added to the Final SEA/EIR Addendum (various locations in Section 5.5, including Table 5.5-3).
DPR-2		The dirt road along the northern boundary of the state park should remain accessible throughout the project.	The dirt road will be accessible during construction, assuming the dirt road in question is the one skirting the northern boundary of State Parks property near Coal Canyon. (This response provides clarification that the project will not affect access to the state park; no change to the project description, alternatives or SEA/EIR Addendum is required.)
DPR-3		**Phase 4** Exposure of the soil cement structure at the east end of Phase 4 near the cell tower will result in a major impediment to wildlife movement and a significant	The upstream-most segment of Phase 4 as depicted in the Draft SEA/EIR Addendum is no longer included in the currently proposed project

		impact. The design should incorporate measures to reduce it with backfilling and native plantings. We request a simulation of the finished product as viewed from the state park, especially structures that would be adjacent to the state park.	description. As a result, the additional analysis requested for the now deleted segment is no longer applicable. The Corps is continuing to assess the need and evaluate alternatives for this segment. If construction of this or a different alternative is proposed again in the future, the Corps will prepare another SEA. The requested simulations could also be provided at that time.
DPR-4		It appears a component of this project will include restoration of the county's bike path. We request to be involved in the design and approval of the finished product since it also involves restoring the state park land where the bike path currently detours.	The Corps will coordinate the final bike path design and restoration plans with State Parks.
DPR-5		6.0 **Environmental Commitments** The mitigation measures described in this section, if fully implemented as described, will generally result in minimizing permanent and temporary impacts to biological resources from this project. However, the following additional measure needs to be added to minimize impacts to the Coastal California Gnatcatcher. Biological Resources item BR-16. We request surveys and monitoring for Coastal California Gnatcatcher for the east end of Phase 5B and east portions of Phase 4 between the cell tower and the Off-site Gully Repair Area.	Surveys of all potentially suitable habitat throughout the project area are ongoing and will be completed prior to construction. Survey results to date have been incorporated in the Final SEA/EIR Addendum, and the commitment for continued surveys has been added to BR-16 in Section 5.5 and Chapter 6.
DOT (submitted thru State Clearinghouse) DOT-1	3/6/15	**<u>Water Quality</u>** Any work within the Caltrans (ROW) must comply with the Caltrans Statewide NPDES permit (Order No. 2012-0011-DWQ, NPDES No. CAS000003) and any subsequent permit issued at the time of encroachment. Any work within State ROW will require an Encroachment Permit including reviewing and approving a SWPPP and reviewing project plans for NPDES/water quality compliance. *(Note: format of the following comments are different from the rest of the table because they are copied directly from the pdf letter.).*	A SWPPP including BMPs would be developed and implemented during construction of each feature as identified in the FSEA/EIR Addendum. Caltrans will be given an opportunity to review the SWPPP and project plans for any work conducted within their property. Requirements for the construction contractor(s) to prepare SWPPPs and comply with NPDES requirements were already included in the SEA/EIR Addendum; no modification is needed in response to this comment.

DOT-2		As stated in page 4-36 of the Supplemental Environmental Assessment, the existing drainage outlets into the Santa Ana River for Phase 4 will be extended through the proposed soil cement structure. These modifications include demolishing and reconstructing the outlets. With the source of the runoff from these drainage structures coming from State Route (SR) 91, there is concern that Caltrans maintenance forces will be limited in obtaining access to these storm drains from the outlet side. Caltrans maintenance has encountered similar problems with the access to the outlets upstream from this location due to the grouted rip rap. It is understood that this location will construct soil cement to protect the stream bank, and Caltrans would like to coordinate with the reconstruction of the outlets in the Santa Ana River. Caltrans would like to coordinate an adequate access to the outlets and/or provide a manhole access at the State ROW so that Caltrans maintenance crews can access the drainage system without entering the Santa Ana River.	Coordination with Caltrans will continue throughout final design and construction to ensure that access for maintenance of drainage outlets is not impeded. This coordination is standard practice for proposed work within Caltrans rights of way; no modification to the SEA/EIR Addendum is required.
DOT-3		Mitigation Planting and Landscape Improvements Project maps reveal that work proposed for Reach 9, Phases 4 and 5B will occur in close proximity to a Caltrans mitigation planting site located just northwest of the decommissioned interchange at Coal Canyon and SR 91. Additionally, the Temporary Construction Easement for Reach 9, Phase 4 extends all the way to the Coal Canyon interchange. Caltrans recently performed a number of landscape improvements at this interchange location, including enhancement plantings. Caltrans requests that the Corps coordinate closely with the Caltrans Landscape Architecture and Environmental Analysis units to avoid impacts to these various planting sites.	Restoration and bikeway relocation plans will be coordinated with Caltrans to avoid, minimize or mitigate for any impacts to existing landscaped or restored areas. This coordination is standard practice for proposed work within Caltrans rights of way; no modification to the SEA/EIR Addendum is required.
DOT-4		Transportation Permit TMPs for construction vehicles should be submitted to Caltrans in order to minimize the impacts to State highway facilities. Coordination of this project with other construction activities on State Routes may be needed. Any hauling of materials should not occur during A.M. and P.M. peak period of travel on State facilities during demolition and construction of the proposed project. All vehicles loads should be covered so that materials do not blow over or onto the Department's ROW.	A Traffic Management/Traffic Control Plan, if needed, will be prepared by the construction contractor in coordination with DOT and submitted to the DOT prior to construction. This coordination is standard practice for proposed work within Caltrans rights of way; no modification to the SEA/EIR Addendum is required.

<table>
<tr>
<td>DOT-5</td>
<td></td>
<td>Encroachment Permit

If any project work (e.g. storage of materials, street widening, emergency access improvements, sewer connections, sound walls, storm drain construction, street connections, curb, gutter or sidewalk, etc.) will occur in the vicinity of the Department's Right-of-Way (ROW), and Encroachment Permit is required prior to commencement of work. When applying for an Encroachment Permit, please incorporate Environmental Documentation, SWPPP/WPCP, Hydraulic Calculations, Traffic Control Plans, Geotechnical Analysis, ROW certification and all relevant design details including design exception approvals. Additional signage may be warranted for pedestrians and bicycles detours during construction. Surface restoration and post construction activities should meet current ADA requirements. For specific details on the Department's Encroachment Permit procedures, please refer to the Departments' Encroachment Permits Manual.

To apply, a completed encroachment permit application, certified environmental document for the project, and five (5) sets of plans clearly indicating State ROW must be submitted to the Encroachment Permits office in the appropriate Caltrans District. Any necessary mitigation measures should be incorporated into the construction plans during the encroachment permit process. Please allow 2 to 4 weeks for a complete submittal packet to be reviewed and for a permit to be issued. Additional permit information can be found online at the following website: http://www.dot.ca.gov/hq/traffops/developserv/permits/.</td>
<td>Any necessary encroachment permits will be obtained prior to construction.</td>
</tr>
<tr>
<td>DOT-6</td>
<td></td>
<td>Regional Transportation Planning Agency and Local Jurisdiction General Plans

Your proposed access routes and structure locations should be incorporated into these area wide plans. Please verify your coordination with these entities when seeking site specific approvals.
District Specific Planning Contacts

When seeking site specific approvals, please consult with the Caltrans districts via points of contact identified on Attachment 1.

ATTACHMENT 1: Caltrans District Planning Contacts

<table>
<tr><th>District</th><th>Counties</th><th>Contact</th><th>Phone</th></tr>
<tr><td>8</td><td>Riverside and San Bernardino</td><td>Mark Roberts</td><td>(909) 383-4557</td></tr>
<tr><td>12</td><td>Orange</td><td>Maureen El Harake</td><td>(949) 724-2086</td></tr>
</table></td>
<td>Thank you for the information and points of contact.</td>
</tr>
<tr>
<td>Valley Municipal Water District

VMWD-1</td>
<td>3/9/15</td>
<td>SAS Recovery efforts by the Upper HCP; will project eliminate the possibility of SAS re-establishing below Prado Dam?</td>
<td>No. The project (embankment and bridge pier protection) will not result in a substantial change in hydrology or habitat suitability for Santa Ana sucker. In fact, one of the potential mitigation measures that have been identified in coordination with the USFWS is gravel augmentation within Reach 9, which would improve habitat conditions.</td>
</tr>
</table>

			(This response provides clarification that the project will not adversely affect SAS recovery efforts; no change to the project description, alternatives or SEA/EIR Addendum is required in response to this comment.)
FWS	3/31/15	Letter responded to request for initiation of Section 7 Consultation, requested additional information, and provided a list of recommended conservation measures.	A response to the letter, including the requested information was provided by letter dated April 15, 2015. Both the USFWS letter and the Corps response are included in full in Appendix F. Following is a summary of the specific information requests, conservation recommendations and initial Corps response, followed in some instances by an updated response based on continued coordination and analysis.
FWS-1	3/31/15	1. <u>Proposed Changes in Conservation Measures:</u> The Draft SEA/EIR includes mitigation measures (referred to in this document as environmental commitments) from a multitude of environmental documents. To facilitate our understanding of the proposed commitments related to this consultation relative to Conservation Measures included in prior consultations, please clarify any proposed changes/additions to the Conservation Measures included in the 2012 biological opinion (Service 2012).	FWS-1 - All Conservation Measures from the biological opinion that apply to Reach 9 have been incorporated into the Draft SEA (for instance, BR-18 which addresses non-native removal requirements to compensate for temporary and permanent impacts to riparian and other floodplain habitat). The Corps is not proposing to change or modify the Conservation Measures or mitigation strategy included in the 2012 biological opinion. Many of the environmental commitments (which include avoidance, minimization and mitigation measures) identified in the Draft SEA are related to protecting or mitigating general biological or other environmental resources, and are not strictly or directly related to listed species, and therefore were not listed in the 2012 BO. For instance, EC-BR-6 addresses compensation for oak tree impacts, and EC-BR-13 addresses wildlife movement at Phase 4.
FWS-2(a-f)		2. <u>Calculation of Permanent and Temporary Impacts:</u> a. It appears the calculation of permanent and temporary impacts takes into account "permanent impacts" from past projects rather than calculating impacts based only on existing conditions. This may be appropriate, but it	FWS-2a. Any floodplain vegetation occurring within backfilled areas on top of existing or proposed structural improvements will be considered to be permanently affected by these

		requires additional explanation. For example, on page 5-106: "permanent impacts associated with the new grouted stone structure were calculated only for that portion of the buried toe that extends beyond the toe of the existing structure." Please provide information to support the conclusion that vegetation communities growing above the toe of the existing levees were considered permanently impacted and mitigated as part of the original levee construction projects. b. Clarify the extent and location of the existing levees in the figures for each project component. It is not clear from information presented that existing levees extend along the entire length of the proposed projects (e.g., east end of Reach 9 Phase 5B, all of Reach 9 Phase 4). c. Clarify if the numbers presented in the impact tables (e.g., Table 5.5-4) are based on the footprint of impacts presented in the impact figures (e.g., Figures 5.5-1a-1b). d. Areas mapped as disturbed in Figures 5.5-1a-4b include areas that were temporarily disturbed during construction of other projects (including the SARP) and were anticipated to be restored following completion of construction. Clarify the extent of areas that were previously anticipated to be restored but are now anticipated to be permanently impacted. e. For areas previously disturbed by construction, clarify if additional measures will be necessary to restore temporary impacts due to repeated compaction of the soil by heavy equipment. In addition, address the potential for the extended period of disturbance (several years) to increase the spread of non-native invasive plant species into adjacent undisturbed vegetation. f. The permanent impacts are limited to the footprint of the proposed embankment (excluding the footprint of the existing levees); however, all areas permanently isolated from flood flows behind the embankment (including areas disturbed by prior construction projects but anticipated to be restored) should also be considered permanently impacted if they will no longer support the existing vegetation community (e.g., Reach 9 Phase 4).	actions and will be mitigated according to the mitigation strategy described in the 2012 BO. It is unclear at this time whether non-Federal entities mitigated for permanent impacts to vegetated areas for the construction of the Caltrans or Yorba Sur embankments. The Corps is not responsible for previous vegetation losses or floodway encroachments. However, to the extent that those areas have been impacted, those permanent impacts are considered part of the baseline condition. Many of the existing embankment footings, especially on the north side of the river, are buried under dirt roads or other areas mapped as "disturbed/barren." Even so, some of this area will be replanted or will recover naturally within backfilled areas, at least unless or until bed degradation occurs. Vegetation impacts beyond the edge of the new toe are considered temporary and will be mitigated according to the terms of the 2012 BO. The Corps considers this to be a very conservative approach that will likely result in addressing impacts that are attributable to other entities' actions and not this Federal Action, although as already stated, the amount of vegetation within existing backfilled areas is not substantial. ***Update to response:*** The Corps has completed additional GIS mapping that fully accounts for all existing vegetation within the project area, whether or not that vegetation occurs within the footprint of an existing structure. Updated maps and exhibits are included in the Final SEA/EIR Addendum. As previously stated, all temporary or permanent impacts to existing vegetation within the project footprint will be mitigated according to requirements outlined in the 2012

			BO Amendment. FWS-2b - None of the existing or proposed features within the action area are considered levees although the description may suggest otherwise. Levees are structures which would rise above the existing channel banks and have a back slope. The existing non-Federal structures functionally serve as bank protection, resisting erosion of the banks at the existing grade. The Federal Action areas (Phases 4, 5A and 5B) follow existing engineered banks for the vast majority of their length. The upstream-most end of Phase 5B is not adjacent to an armored bank, but follows the existing railroad embankment. Figures 1-6 includes the current and proposed protection alignments in the vicinity of each feature. ***Update to response:*** The Corps has completed additional GIS mapping that more accurately depicts existing and proposed protection. Updated maps and exhibits are included in the Final SEA/EIR Addendum. In addition, several of the proposed project areas have been redesigned to further minimize impacts. This information was provided to the FWS and is included in the Final SEA/EIR Addendum. FWS-2c - The numbers presented in the impact tables (e.g., Table 5.5-4) are based on the footprint of impacts presented in the impact figures (e.g., Figures 5.5-1a-1b). Note: some of the vegetation polygons that were mapped (prior to overlaying the design information) extend outside of the permanent and, or temporary impact areas. The Draft SEA impact tables are based on the footprint of temporary and permanent impacts as calculated from the

			overlay of existing and proposed project features and temporary construction easements (from the detailed design drawings) onto existing habitat maps. This overlay was displayed in the referenced figures. ***Update to response:*** The Corps has completed additional GIS mapping that more accurately assesses anticipated vegetation impacts. This information was provided to the FWS and is included in the Final SEA/EIR Addendum. FWS-2d - There are three areas totaling 0.76 acres in size (0.63 acres of coastal sage scrub and 0.13 acres riparian) that had been previously (temporarily) impacted by SARI Line construction and will be impacted by this Federal Action. The largest of the three sites that included restoration commitments for 0.41 acres upland and 0.13 acres riparian is shown partially overlapped by Phase 5B on Figure 3. Although not shown on the map, the other two sites fall entirely within the Phase 5B footprint and would now be permanently affected. Figures 7-9 show the overlap of other aspects of the Federal Action on previous SARP construction limits that either had been restored, or in the case of portions of Phase 3 and 2A, have not been restored pending upcoming construction. As shown in Figure 7, a portion of the Phase 5A grouted stone segment (totaling 0.6 acres of permanent impact) will be constructed in an area that was previously disturbed for Phase 1. Figure 8 shows that a small portion (0.37 acres) of the BNSF bridge abutment in-between the Mobile Home Park and Phase 2A embankments will be located in an area that had been temporarily disturbed for those project features. Figure 9 shows that almost the entire length of

			the Phase 4 feature (2.14 acres) will be constructed in an area that had been previously disturbed by the SARI line and Phase 3 temporary construction easement and/or staging areas. All areas of temporary and permanent impact were identified in the Reach 9 SEA and will be mitigated, although that document did not distinguish areas that had previously been affected by other project features. ***Update to response:*** The Corps has completed additional GIS mapping that more accurately depicts and measures areas of overlap between proposed and previous construction. Updated maps and exhibits are included in the Final SEA/EIR Addendum. Areas that had been temporarily affected by previous construction but will be permanently affected by the proposed project have been defined and re-categorized as floodplain habitat rather than "disturbed," and mitigation estimates have been revised accordingly. This information was provided to the FWS and summary maps and tables are included in the Final SEA/EIR Addendum. FWS-2e - The Corps intends to take whatever measures are required within the TCE to ensure a successful re-establishment of native vegetation, whether or not the site had been previously impacted. We anticipate that for disturbed or repeatedly disturbed and restored areas, measures would include de-compaction of soil, the use of soil amendments or replacement of stockpiled topsoil to restore appropriate physical and chemical parameters consistent with surrounding native soil types. Consistent

			with other restoration areas and the 2012 BO, the TCE will then be hydroseeded and, or planted with a native palette, and weeded for a minimum of five years after construction to ensure that non-native invasive species do not establish or spread to (or from) adjacent areas. As an example, an approximately 12 acre area that was initially disturbed by Phase 3 construction will be restored by the Phase 4 contractor because of overlapping boundaries. (The Corps purposefully designed the Phase 4 feature to re-use previously impacted areas for staging and access to the extent possible, in order to minimize cumulative effects to the floodplain.) When Phase 3 construction was completed, the bare area was coated with an organic based soil binder for dust control purposes until Phase 4 construction begins. Restoration of the area will include the steps outlined above (decompaction, soil testing. adding soil admendments, hydroseeding/ planting and weeding). FWS-2f - Based on a review of existing and "pre-Reach 9 Phase 3" vegetation maps, as well as the hydrology maps provided in response to item 4b, there does not appear to be any vegetation within temporary impact areas behind the proposed Phase 4 embankment that is currently supported by flood flows. The Corps does not anticipate that the character of any "isolated" vegetation would change as a result of this action. Therefore, there would be no permanent impacts to areas between the Phase 4 embankment and the freeway. ***Update to response:*** The Corps re-examined the

			Phase 4 plans and recognized that a small strip of native "habitat" was to be included between the soil cement embankment and the freeway. The purpose was primarily for landscaping. As this will not be functional habitat, the Corps has ensured that this entire zone (or the portions that had not been previously developed) has been accounted for as a permanent impact area.
FWS-3		3. Permanent Impacts to the Santa Ana River Canyon Habitat Management Area: The Santa Ana River Canyon Habitat Management Area (HMA) was to be "operated and maintained for open space and wildlife habitat values" by the County of Orange as mitigation for the SARP (Corps 1988). In addition, the Corps has committed to maintaining a baseline level of riparian vegetation, habitat for the least Bell's vireo, within the HMA (Service 2001, 2012). Clarify how permanent impacts within the HMA from the additional proposed projects will affect the baseline of riparian vegetation and the total open space available for wildlife.	FWS-3 - With restoration of temporary impact areas and after the constructed features are backfilled and replanted, the proposed action will not reduce the baseline amount of riparian vegetation within the Habitat Management Area, and will not reduce the total open space available for wildlife. Most areas that are considered for mitigation purposes to be "permanently affected" (see response to 2a) will in fact be backfilled and continue to support vegetation unless or until future high flows result in bed degradation and shifting of the active river channel. This eventuality, should it occur, is already accounted for in the Habitat Management Plan. Habitat values will be fully mitigated in accordance with the terms of the 2012 BO. If necessary to ensure that there is not an immediate loss of baseline habitat due to construction of these features, a portion of the required mitigation could be implemented within Reach 9. Moreover, habitat within temporarily affected areas may be improved over time compared to existing conditions as non-native vegetation is removed and replaced with a more diverse native palette.
FWS-4(a-b)		4. Encroachment into the Floodplain: According to the Draft SEA/EIR (Section 5.2), encroachment of the proposed project into the river floodplain is not expected to affect channel capacity, water surface elevation, or velocity. Additional information is needed to substantiate this conclusion: a. Provide a comparison of water velocities immediately downstream from the BNSF Railroad Bridge with and without the proposed project. A project-	FWS-4a - Channel capacity will not be reduced, and water surface elevation and velocity will not be increased due to construction of BNSF bridge protection. The BNSF bridge protection feature is designed to shift the erosive forces from the piers to the proposed pier nose extensions. The pier nose extensions will not cause any

		related increase in water velocity below the BNSF Railroad Bridge has the potential to impact habitat restored for the Santa Ana sucker by the Corps as part of the Reach 9 Phase 2B component of the SARP. b. The analysis of impacts to hydrology for the Reach 9 Phase 4 Project assume a floodplain width of approximately 700 to 900 feet; however, it appears the floodplain will be confined to a width of about 300 feet between the east ends of the Reach 9 Phase 4 and Reach 9 Phase 5B Projects. Clarify how the reduction in floodplain width will affect the extent of riparian vegetation over time.	appreciable flow velocity changes immediate downstream from the BNSF Bridge. Moreover, the new grading plan for the low flow channel will extend across two of the bay openings, whereas currently the low flow channel goes through only one bay. A HEC-RAS model was used to verify that the flow velocities would be the same under both the "with-project" and "without project" condition at the downstream end of the railroad bridge. For instance, for a 30,000 cfs release, the flow depth under both scenarios would be 19.35 feet and the velocity would be 11.86 feet per second. Similarly, there would be no change to flow velocity associated with smaller and more frequent releases. Therefore, construction of the BNSF bridge protection feature would have no influence on the restored perennial stream within the Phase 2B area. As the bridge is still the same width (although the low flow will be expanded), channel capacity will not be lost and water surface elevation will not be increased. FWS-4b - This Federal Action will not reduce the floodplain width and therefore will not have impacts to riparian vegetation beyond the direct effects specified in the SEA. The bank protection alignment protects the existing bank of the channel and ties into high ground at the upstream extent. See Figures 10-12 attached to this enclosure. Figures 10 and 11 display the design discharge inundation extents throughout Reach 9. Figure 12 provides a closer view of the Phase 4 area and compares the Phase 4 alignment with the design discharge inundation extents. Figure 12 confirms that while the Phase 4 alignment turns toward the center of the channel (following existing high ground), it does not encroach upon the expected inundation area. As a result, Phase 4 would not affect the

			inundation footprint or hydraulic properties (water surface elevation or velocities), and therefore would have no influence on the extent of riparian vegetation supported by these dynamics. The alignment extends further upstream than the original CalTrans embankment to tie into high ground and to protect against observed flow impingement that may increase due to the planned removal of the temporary SARI rock groin protection. With the removal of the rock groin, a shorter Phase 4 alignment (if proposed) may allow for flows to impinge upon the bank upstream of the protection, thus compromising the project and protected banks. ***Update to response:*** In further coordination with USFWS and CDFW, the Corps has agreed to delete the upstream-most segment of the Phase 4 project that turned away from the freeway to follow high ground adjacent to State Parks land. The Corps will continue to analyze the need for this segment and evaluate alternatives. If it is determined that additional protection is necessary, the Corps will prepare supplemental environmental documentation and seek necessary permits/approvals at that time.
FWS-5		5. Grade Control Structures Considered in the Scour Profile Modeling: Modeling was conducted to determine the maximum scour profile (depth of the streambed) and required scour design profiles (i.e., depth of the toe of the embankment) for each project component (Draft SEA/EIR, Appendix A, Figure 5). Several grade control structures are evident in the scour profile and appear to coincide with riprap placed to temporarily protect the Santa Ana River Interceptor Line (SARI Line) until it could be relocated out of the river floodplain (e.g., locations approximately 6,000, 8,000, 18,500, 25,000, 27,000 feet upstream from Weir Canyon Grade Control Structure). We anticipated the riprap would be removed or notched following completion of the SARI Line Protection/Relocation Project, as indicated in the Draft SEA/EIR (page 4-54). Clarify if the proposed project design depends on maintaining existing grade control structures in place and if these	FWS-5 - The Federal Action does not depend upon maintaining the temporary riprap grade control structures, which were put in place to protect the SARI Line. As required by Corps Regulatory permits, the structures are to be removed by the Orange County Sanitation District upon completion of the SARI Line relocation.

		structures will be maintained in a manner that will alter habitat for the Santa Ana sucker and/or impede upstream migration.	
FWS-6(a-b)		6. Impacts to Wildlife Movement: The Draft SEA/EIR (page 5-39) acknowledges that the Corps is required to maintain wildlife movement and habitat connectivity within the HMA commensurate with baseline conditions. The 2001 biological opinion for the SARP discusses the importance of maintaining wildlife corridors within Reach 9 for preserving the ecological integrity and function that sustains the local population of least Bell's vireos (Service 2001). In particular, large predators (e.g., coyotes, bobcats, mountain lions) help to control populations of smaller predators (e.g., raccoons and feral cats) that can exert strong predation pressure on songbird populations in fragmented habitat. Insufficient information is provided to support a conclusion that the proposed Reach 9 Phase 4 and BNSF Railroad Bridge components of the SARP will maintain wildlife movement commensurate with baseline conditions. Clarify and support the Corps' expectations regarding wildlife movement for large predators: a. The Reach 9 Phase 4 component includes switchback ramps that will be incorporated into the embankment below each side drain to facilitate wildlife movement (Draft SEA/EIR, mitigation measure EC-BR-13); however, the embankment will be constructed of soil cement with a 1:1 slope ratio. Identify specific changes in the dimensions of the side drains, the extent of vegetation surrounding the drain openings, and the height of the drain openings above the ground following anticipated bed degradation. Clarify the Corps' expectations for wildlife use of the soil cement switch back ramps and the potential for the ramp to exit into the active channel relative to future drainage patterns with anticipated bed scour. b. Protection of the BNSF Railroad Bridge includes sheet pile and concrete walls on both sides of the river. Clarify anticipated wildlife movement paths if the river flows adjacent to the proposed vertical walls.	FWS-6a - The wildlife ramps are intended to provide ease of entry/exit in the future, if the channel bed were to scour below the bottom of the culvert opening. This is expected to preserve the ability of wildlife movement into the future. The potential maximum scour depths are detailed in **Table 1** (see April 15 response letter). We expect some animals, including coyotes and bobcats might be physically able to navigate the soil cement slope without a ramp, but the ramp is expected to make the openings easier to use and find. The ramp could be covered with soil to make it more suitable for a variety of wildlife species. This type of feature does not exist with the existing bank protection, so it is anticipated to be an improvement over the existing condition. Please see **Figure 6(a)-3** in the April 15 response letter, for some photographic examples of the switch back ramps that were implemented within the Reach 9 Phase 3 feature, which is a very similar soil cement bank protection feature when compared with the Reach 9 Phase 4 feature. ***Update to response:*** The upstream-most culvert extension depicted and discussed in the April 15 response letter is no longer proposed to be extended through the Phase 4 embankment. There will be a gap between the existing culvert opening and the Phase 4 embankment, where wildlife can exit as they do now. The area between where the culvert daylights north of SR-91 and the 'land side' of the embankment will be graded to direct water from the culvert through a drain that will run through the embankment toward the river. The drain will have a flap gate on the river side of the embankment to prevent water from backing up through the drain. The

			Corps will continue coordinating with USFWS to discuss methods for ensuring that wildlife will be able to maneuver over or around the embankment to access the culvert (to cross under the freeway), or to access the riverbed from the culvert. FWS-6b – Wildlife is expected to be able to move through the BNSF Railroad Project Area in a manner similar to what they would in the existing condition. Steps have also been taken to improve the long term viability of this area for wildlife movement, even though this particular location currently represents a pinch point. Wildlife can continue to make at grade crossings over the railroad. Wildlife can also move beneath the railroad between east and west abutments and Piers 1 and 6, respectively. The April 15 response letter and its enclosures describe the specific movement paths for this location.
FWS-7		**Conservation Measures recommended to address existing threats to recovery of the Santa Ana sucker from operations of the Prado Dam** 7. Impacts due to Changes in Water Quality below Prado Dam: The Draft SEA/EIR (page 5-29) indicates that Reach 9 is "water quality limited" and requires the development of a Total Maximum Daily Load for indicator bacteria by the U.S. Environmental Protection Agency. Increases in water holding periods above Prado Dam were anticipated due to the SARP; however, changes in total dissolved solids and bacteria levels as a result of longer holding periods were determined to be unpredictable (Corps 1988, page SEIS-V-27-28). We are concerned that changes in water quality resulting from the operations of the SARP may be limiting the potential for Reach 9 to support a viable population of Santa Ana sucker. Long term streamflow and water quality data are available for a gage station 2 miles downstream from Prado Dam (Draft SEA/EIR, page 5-29). Provide a comparison of water quality before and after the new Prado Dam outlet became operational in 2008. Compare water quality below Prado Dam with areas occupied by the Santa Ana sucker upstream from the influence of the dam operations. Determine the cause of the reduction in water quality and alternative operations and/or measures to reduce any degradation to water quality associated with operating	FWS-7 - The Corps appreciates the recommendations for analyzing changes in water quality downstream of Prado Dam. These are good suggestions that would be a worthwhile analysis as part of the issuance of the Prado Dam OMRR&R manual and associated impact assessment and consultation. The Corps has already initiated development of a plan of action for assessing impacts to sediment movement and associated geomorphological changes that may be occurring upstream and downstream of Prado Dam, due to flood control operations. While additional work on the plan of action is required to include a more in-depth assessment of previous modeling efforts, the Corps will provide the current version to your agency for review. We expect to complete the plan of action this fiscal year, begin implementation in early FY16, and complete the analysis within

		Prado Dam, relative to what was anticipated in prior consultations with our agency.	another one or two years, unless it is determined that longer-term study is required to fully answer all of the questions. The recommended water quality assessment will be incorporated into this study. It should be noted, however, that differences in water quality between Reach 9 and the occupied Santa Ana sucker habitat upstream of the dam are likely due to more than dam operations, as there are also substantial differences in topography and other factors that could influence water quality. However, the Corps is willing to consider operational changes that would improve water quality as long as they do not affect approved or proposed flood control and water conservation objectives. As these recommendations do not relate specifically to the proposed action, they are not addressed further in this SEA/EIR Addendum.
FWS-8(a-e)		8. Based on the most recent information available, clarify how SARP-related increases in sediment deposition upstream from Prado Dam and bed degradation below Prado Dam will affect the least Bell's vireo and Santa Ana sucker. This information is needed for evaluating the baseline condition for the species and should be used by the Corps to identify appropriate measures to minimize and offset anticipated SARP-related changes in habitat for least Bell's vireo and Santa Ana sucker, relative to what was anticipated in prior consultations on the SARP with our agency. Some potential measures to consider in the near term include: a. Bypassing sediment around Prado Dam – Sediment management will reduce the extent of scour below Prado Dam and decrease the amount of sediment backing up above Prado Dam. A reduction in sediment accumulation behind Prado Dam will increase the extent of spawning and foraging habitat available for Santa Ana sucker and reduce the number of days habitat for the vireo is inundated by water held upstream of the dam. A reduction in bed degradation downstream from Prado Dam will maintain the appropriate substrate composition and gradient for Santa Ana sucker and prevent a reduction in the extent of riparian vegetation available for the vireo (i.e., due to channel incision). b. Reducing degradation in Reach 9 by installing grade stabilization structures resembling natural riffles that will not impede fish passage. The Corps could	FWS-8 – See response to #7 on plans for and timing of the sediment/geomorphology study. FWS-8a – The Corps is involved in two separate but connected efforts to evaluate the potential for bypassing sediment around Prado Dam, and to assess potential benefits to upstream and downstream habitat. As your agency is aware, the Corps is processing an outgrant proposal by Orange County Water District (OCWD) to implement a demonstration project along these lines, while at the same time developing the Prado Basin Feasibility Study that has both ecosystem restoration and water conservation objectives. Sediment bypass is one of the key measures that is being investigated in the feasibility study that would potentially benefit both objectives. It is anticipated that feasibility study would be completed in FY17. FWS-8b – In-stream habitat improvements are

		coordinate with Orange County Sanitation District to relocate riprap placed to temporarily protect the SARI Line and supplement the riprap with river rock of various sizes to create the riffles. This may reduce the extent of bed degradation and channel incision over time. c. Modifying drop structures between Weir Canyon and Imperial Highway to allow fish passage and an increase in the extent of habitat for the Santa Ana sucker below Prado Dam. The drop structures impede fish passage and create favorable habitat conditions for non-native fish species such as largemouth bass that are predators on Santa Ana sucker. d. Increasing the contribution of gravel and cobble sediment at the top end of the range of the Santa Ana sucker (i.e., near La Cadena Avenue) to offset the reduction in habitat near Prado Dam. Large releases from Seven Oaks Dam could be used to periodically flush sediment downstream or habitat could be artificially enhanced through regular management activities (i.e., placement of appropriate substrate, boulders, woody debris). e. Creating additional habitat in tributaries to the Santa Ana River. Potential opportunities include removing the cement lining from Sunnyslope Creek above the occupied habitat and providing access into Evans Creek through modification of the drop structure through the Riverside Levee. Additional measures that should be considered in the long term include: a. Modifying the outlet channel to increase energy dissipation. b. Modifying the outlet to allow sluicing of sediment through Prado Dam. c. Development and implementation of a plan to reintroduce Santa Ana suckers to the Santa Ana River above Seven Oaks Dam consistent with the recommendations in our draft recovery plan for the sucker (Service 2014, Action 4.2.1: Priority 1).	being investigated as part of the Prado Basin Feasibility Study. This conservation measure will be considered as one method of achieving the objectives of that Study. ***Update to response:*** In coordination with USFWS, this recommendation has been further developed as one of the optional measures for mitigating impacts to Santa Ana sucker habitat associated with BNSF Bridge protection. This information has been included in the Final SEA/EIR Addendum. FWS-8c – The Corps is willing to consider this possibility as either a measure to address impacts of the issuance of the final Prado Dam OMRR&R manual, or as part of the Prado Basin Feasibility Study, as long as the scope of this conservation measure is within the Corps' existing authority. Specifically, if it requires only a minor modification (i.e., notching) of any structures, and is determined to have no effect on authorized or proposed flood control and water conservation operations. This possibility has already been discussed in very general terms by USFWS and certain Corps staff, but would need to be evaluated more fully in terms of costs, technical feasibility, authority, operational impacts, and other environmental impacts (as the character of habitat in the vicinity could change, which may also result in changes to the "baseline" of riparian habitat identified in the Habitat Management Plan). The Corps will continue to coordinate with the USFWS to more fully understand the issue and objectives, and determine if there are less costly or more practicable measures that could be implemented to achieve those objectives. FWS-8d – The Corps is willing to investigate

			opportunities to improve habitat conditions within or upstream of active spawning grounds, which may include these suggested measures or others. Such improvements could be considered as mitigation for Reach 9 features such as Phase 3 (in lieu of ongoing efforts to address red algae issues) and, or BNSF bridge protection, or alternatively could be considered to offset impacts from Prado Dam operations. The Corps anticipates that placement of appropriate substrate and, or construction of small groins or other structures to capture cobbles and gravels would have a greater and longer-lasting benefit than periodic releases from Seven Oaks Dam, which would require substantial rainfall in order to build a sufficient pool elevation (under which circumstance there would already be moderate or high flows in the river channel from ungated tributaries). It is important to note that Seven Oaks Dam is the OMRR&R responsibility of the non-federal sponsors. Changes to the OMRR&R manual and water control plan would require further coordination with the non-federal sponsors. ***Update to response:*** In coordination with USFWS, a portion of this recommendation has been further developed as mitigation for impacts to Santa Ana sucker habitat associated with previous Reach 9 Phase 3 bank protection. This information has been included in the Biological Opinion for the current project. FWS-8e - The Corps is willing to investigate opportunities to improve habitat conditions within or upstream of active spawning grounds, which may include these suggested measures or others. Such improvements could be considered as mitigation for Reach 9 features such as Phase 3 (in lieu of ongoing efforts to address red algae

			issues) and, or BNSF bridge protection, or alternatively could be considered to offset impacts from Prado Dam operations. The Corps anticipates that placement of appropriate substrate and, or construction of small groins or other structures to capture cobbles and gravels would have a greater and longer-lasting benefit than periodic releases from Seven Oaks Dam, which would require substantial rainfall in order to build a sufficient pool elevation (under which circumstance there would already be moderate or high flows in the river channel from ungated tributaries). It is important to note that Seven Oaks Dam is the OMRR&R responsibility of the non-federal sponsors. Changes to the OMRR&R manual and water control plan would require further coordination with the non-federal sponsors. Instead of or in addition to Items 8d and 8e, the Corps recommends continuing recent discussions that we have had with USFWS and others on opportunities for increasing populations of Santa Ana sucker. One option would be to assist the Riverside-Corona Resource Conservation District with proposed modifications to an artificial stream to enhance their captive breeding program for Santa Ana suckers. Another option that has been discussed frequently with USFWS staff is to relocate suckers and establish additional populations in areas that already support the required habitat characteristics, but from which suckers have been extirpated. The Corps would also facilitate discussions with other affected stakeholders to ensure that they receive any necessary “take” or safe harbor agreement to cover their existing or planned activities in the area. The Corps would also require assurances of the amount and type of mitigation “credit” that would be applied to

			current or future Federal Actions prior to implementing habitat improvements or repopulation efforts. ***Update to response:*** In coordination with USFWS, the concept of relocating captive-bred Santa Ana suckers has been further developed as one of the optional measures for mitigating impacts associated with BNSF Bridge protection. This information has been included in the Final SEA/EIR Addendum. FWS-additional 8 a-c – a and b: The Corps is willing to discuss these concepts with USFWS to determine how or whether it would potentially be feasible to modify the outlet structure as suggested, and to consider the potential benefits of doing so compared to other restoration measures (such as sediment bypass) that are already being investigated through the Prado Basin Feasibility Study. Current authorities do not provide for modifications to the existing outlet structure. Other avenues to approve and, or authorize such a change would need to be further evaluated.
FWS/DFW-0	4/29/15	<u>General Comments</u> Draft SEA/EIR does not include information comparing the changes in impacts to biological resources anticipated in the 1988 SEIS and 2001 SEIS/EIR with the substantially different actual impacts that have resulted from the operations of Prado Dam. Without this information, the existing condition of the biological resources in the project area cannot be evaluated against future project impacts to these same resources. In addition, the Draft SEA/EIR does not adequately describe the extent of impacts from the proposed projects to the wildlife habitats committed to be conserved	Any impacts related to operation of Prado Dam will be evaluated separately, concurrent with an anticipated update to the Water Control Manual that would modify dam operations. The current proposed action is to improve protection of the river banks and BNSF Bridge piers. Sufficient information is provided in the SEA/EIR Addendum to evaluate impacts associated with this action. See response to FWS-3, above.

		within the existing 1,100-acre Habitat Management Area or the potential impediments to wildlife movement from the proposed projects. Because the information in the Draft SEA/EIR identifies significant impacts to biological resources from existing operations of Prado Dam that were not anticipated in the 1988 SEIS or 2001 SEIS/EIR, a new EIS addressing these impacts appears warranted, and the Corps' lack of such analysis is not clear in the Draft SEA/EIR.	The SEA/EIR Addendum evaluates impacts associated with construction of embankment and bridge protection features. No significant and unmitigable impacts to biological resources associated with the proposed action were identified. The SEA/EIR Addendum did not draw any conclusions regarding impacts from a potential change in dam operations, which would be addressed in a separate analysis/documentation. Existing operations and associated impacts were part of the baseline condition prior to preparation of either the 1988 SEIS or the 2001 SEIS/EIR.
FWS/DFW-1	4/29/15	<u>Specific Comments</u> **1. SARP-Related Changes in Hydrology/Fluvial Geomorphology** The Wildlife Agencies recommend that the Corps commit to immediate, well-defined actions as part of the proposed action that will reduce sedimentation upstream of Prado Dam and reduce bed degradation downstream of Prado Dam. These actions could include periodic release of scouring flows from Seven Oaks Dam combined with dredging/pumping (or bypassing) of sandy material from upstream of Prado Dam to downstream. Such actions would have the combined benefits of improving habitat for the Santa Ana sucker upstream of Prado Dam and reducing the threats to infrastructure and loss of habitats downstream of Prado Dam from bed degradation. If these or similar measures are not currently practicable, artificial periodic augmentation of coarse sediment (sand, gravel, and cobble) material into the riverbed downstream of Prado Dam should be implemented in the near future to arrest bed degradation in Reach 9 in the short- and mid-term. This type of augmentation is already being performed below a number of dams in the western U.S. (for example, see Bunte 2004, Corps 2013). We expect that the costs of these measures would likely be partially offset through the savings associated with the resultant reduced need to armor areas downstream from continued bed degradation. The Wildlife Agencies propose to work with the Corps to develop these immediate management actions while additional studies are completed on the hydrology/ geomorphology of the Santa Ana River.	These recommendations are related to dam operations rather than bank or bridge protection (the proposed action). However, the Corps has agreed to consider gravel augmentation in Reach 9 as a potential measure for mitigating effects of the proposed BNSF project. This information has been included in the Final SEA/EIR Addendum.
FWS/DFW-2	4/29/15	**2. Impacts due to Changes in Water Quality below Prado Dam** The Draft SEA/EIR (page 5- 29) indicates that Reach 9 is "water quality limited" and	See response to FWS-7, above.

		requires the development of a Total Maximum Daily Load for indicator bacteria by the U.S. Environmental Protection Agency. Increases in water holding periods above Prado Dam were anticipated due to the SARP; however, changes in total dissolved solids and bacteria levels as a result of longer holding periods were determined to be unpredictable (Corps 1988, page SEIS-V-27-28). We are concerned that changes in water quality resulting from the operations of the SARP may limit the potential for Reach 9 to support aquatic species, including the Santa Ana sucker. Long term streamflow and water quality data are available for a gauge station 2 miles downstream from Prado Dam (Draft SEA/EIR, page 5-29). Please clarify any changes in water quality that have occurred since the new Prado Dam outlet became operational in 2008 and identify measures to mitigate changes in water quality as appropriate to allow for continued support of native aquatic species in Reach 9.	
FWS/DFW-3	4/29/15	**3. Environmental Commitments** The Draft SEA/EIR includes mitigation measures (referred to in this document as Environmental Commitments) from a multitude of environmental documents. To ensure a clear understanding of the proposed commitments, we recommend a comprehensive list of mitigation measures be included in the final environmental documentation for this proposed project. It appears that in the process of updating commitments, measure BR-18A from the 2001 SEIS/EIR may have been unintentionally omitted.	Comment noted and revision made to Section 5.5.3 Env Commitment Section and Section 6 of the FSEA/EIR Addendum. BR-18A has been included. See also response to FWS-1, above.
FWS/DFW-4(a-f)	4/29/15	**4. Calculation of Permanent and Temporary Impacts** a. It appears the calculation of permanent and temporary impacts for the project takes into account "permanent impacts" from past projects rather than calculating impacts based only on existing conditions. This may be appropriate, but it requires additional explanation. For example, on page 5-106: "permanent impacts associated with the new grouted stone structure were calculated only for that portion of the buried toe that extends beyond the toe of the existing structure." Please provide information to support the conclusion that vegetation communities growing above the toe of the existing levees were considered permanently impacted and mitigated as part of the original levee construction projects. b. Please clarify the extent and location of the existing levees in the figures for each project component. It is not clear from information presented that existing levees extend along the entire length of the proposed projects (e.g., east end of Reach 9 Phase 5B, all of Reach 9 Phase 4). c. Please clarify if the numbers presented in the impact tables (e.g., Table 5.5-4) are based on the footprint of impacts presented in the impact figures (e.g., Figures 5.5-1a-1b).	See response to FWS-2(a-f), above.

		d. Areas mapped as disturbed in Figures 5.5-1a-4b include areas that were temporarily disturbed during construction of other projects (including the SARP) and were anticipated to be restored following completion of construction. Please clarify the extent of areas that were previously anticipated to be restored but are now anticipated to be permanently impacted. e. For areas previously disturbed by construction, please clarify if additional measures will be necessary to restore temporary impacts due to repeated compaction of the soil by heavy equipment. In addition, please address the potential for the extended period of disturbance (several years) to increase the spread of non-native invasive plant species into adjacent undisturbed vegetation. f. The permanent impacts are limited to the footprint of the proposed embankment (excluding the footprint of the existing levees); however, all areas permanently isolated from flood flows behind the embankment (including areas disturbed by prior construction projects but anticipated to be restored) should also be considered permanently adversely affected if they will no longer support the existing vegetation community (e.g., Reach 9 Phase 4). Please clarify the extent of permanent impacts on appropriate figures.	
FWS/DFW-5	4/29/15	**5. Permanent Impacts to the SAR Canyon Habitat Management Area** The 1,100- acre Santa Ana River Canyon Habitat Management Area (HMA) was to be "operated and maintained for open space and wildlife habitat values" by the County of Orange as mitigation for the SARP (Corps 1988). In addition, the Corps has committed to maintaining a baseline level of habitat for the vireo and riparian vegetation within the HMA (e.g., Service 2001, 2012). Please clarify how permanent impacts from the project within the HMA will affect the baseline of riparian vegetation and associated function, and the total open space available for native wildlife.	See response to FWS-3, above.
FWS/DFW-6(a-b)	4/29/15 FWS/DFW-	**6. Encroachment into the Floodplain** According to the Draft SEA/EIR (Section 5.2), encroachment of the proposed project into the river floodplain is not expected to affect channel capacity, water surface elevation, or velocity. Additional information is needed to substantiate this conclusion: a. Please provide a comparison of water velocities immediately downstream from the BNSF Railroad Bridge with and without the proposed project. A project-related increase in storm water velocity below the BNSF Railroad Bridge (as we expect may occur with the project) has the potential to impact habitat restored for the Santa Ana sucker by the Corps as part of the Reach 9 Phase 2B component of	See response to FWS-4(a-b), above.

		the SARP. b. The analysis of impacts to hydrology for the Reach 9 Phase 4 Project assumes a floodplain width of approximately 700 to 900 feet; however, it appears the floodplain will be confined to a width of about 300 feet between the east ends of the Reach 9 Phase 4 and Reach 9 Phase 5B Projects. Please clarify how the reduction in floodplain width will affect the extent of riparian vegetation over time.	
FWS/DFW-7	4/29/15	**7. Grade Control Structures Considered in the Scour Profile Modeling** Modeling was conducted to determine the maximum scour profile (depth of the streambed) and required scour design profiles (i.e., depth of the toe of the embankment) for each project component (Draft SEA/EIR, Appendix A, Figure 5). Several grade control structures are evident in the scour profile and appear to coincide with riprap placed to temporarily protect the Santa Ana River Interceptor Line (SARI Line) until it could be relocated out of the river floodplain (e.g., locations approximately 6,000, 8,000, 18,500, 25,000, 27,000 feet upstream from Weir Canyon Grade Control Structure). Discussions regarding the removal of temporarily placed riprap following completion of the SARI Line Protection/Relocation Project are ongoing, as indicated in the Draft SEA/EIR (page 4-54). Please clarify if the proposed project design depends on maintaining existing grade control structures in place and if these structures will be maintained in a manner that will alter habitat for the Santa Ana sucker and/or impede upstream migration.	See response to FWS-5, above.
FWS/DFW-8	4/29/15	**8. Impacts to Wildlife Movement** The Draft SEA/EIR (page 5-39) acknowledges that the Corps is required to maintain wildlife movement and habitat connectivity within the HMA commensurate with baseline conditions. Insufficient information is provided to support a conclusion that the proposed Reach 9 Phase 4 and BNSF Railroad Bridge components of the SARP will maintain wildlife movement commensurate with baseline conditions. Please clarify and support the Corps' expectations regarding wildlife movement (particularly for mountain lions, bobcats, gray fox, mule deer, and coyotes as umbrella planning species) in regards to the following: a. The Reach 9 Phase 4 component includes switchback ramps that will be incorporated into the embankment below each side drain to facilitate wildlife movement (Draft SEA/EIR, mitigation measure EC-BR-13); however, the embankment will be constructed of soil cement with a 1:1 slope ratio. Identify specific changes in the dimensions of the side drains, the extent of vegetation surrounding the drain openings, and the height of the drain openings above the ground following anticipated scour. Please clarify anticipated wildlife movement	See response to FWS-6(a-b), above.

		paths if the river flows adjacent to the soil cement embankment. b. Protection of the BNSF Railroad Bridge includes sheet pile and concrete walls on both sides of the river. Please clarify anticipated functional wildlife movement paths through this area if the river flows adjacent to the proposed vertical walls (see also comments in 7 below).	
FWS/DFW-9	4/29/15	**9a. MSHCP Compliance** Section 15125(d) of the CEQA Guidelines requires environmental documents to discuss any inconsistencies between a proposed Project and applicable general plans and regional plans, including habitat conservation plans and natural community conservation plans. The Draft SEA/EIR includes an assessment of the consistency with the MSHCP and concludes that the BNSF Bridge Project will not conflict with the MSHCP. Some actions identified as future discretionary actions that will be implemented by Riverside County as part of the BNSF Project (e.g., property acquisition, encroachment permits, utility relocation, and future maintenance) were not addressed in the consistency analysis. The MSHCP anticipated wildlife movement between the Santa Ana Mountains and Chino Hills State Park through an area referred to as proposed Constrained Linkage 1; however, a cooperative multi-agency effort is currently underway to improve limitations of the MSHCP and support a more effective linkage through "B Canyon." The proposed BNSF Bridge Project is located within and adjacent to B Canyon. Please clarify how the proposed BNSF Bridge Project, including future maintenance and utility relocation, will affect wildlife movement through B Canyon. In particular, we are concerned about potential future uses of the proposed temporary access road located east of the Canyon and extending under the BNSF Bridge. Vehicle and pedestrian traffic can reduce wildlife interest in using corridors and can contribute to long term degradation of natural habitats. We recommend the temporary access road be decommissioned and restored to native vegetation to support wildlife movement after project construction is complete.	See response to FWS-6 to address questions regarding potential impacts to wildlife movement. The Corps has agreed to redesign the access road leading from Green River Rd. to move it farther from B Canyon, to reduce potential conflicts with wildlife movement. This commitment has been included in the Final SEA/EIR Addendum.
		9b. The project will also permanently impact habitats defined by the MSHCP Riparian and Riverine Protection Policy (Section 6.1.2). Areas that contain habitats dominated by trees, shrubs, persistent emergent, or emergent mosses and lichens, which occur close to or depend upon soil moisture from a nearby fresh water source, or areas with fresh water flow during all or portions of the year are resources that must be considered under Section 6.1.2. We recommend the Draft SEA/EIR clarify how the proposed mitigation measures are consistent with the Riparian and Riverine Protection Policy	Section 5.5.2.4 of the SEA provides a summary of how impacts to riparian/riverine areas and vernal pools would be avoided, minimized or mitigated. Chapter 6 of the Final SEA/EIR Addendum also includes a list of environmental commitments to avoid and minimize impacts to habitats and affected species. Based on this information, the BNSF project will not conflict with the MSHCP Riparian and Riverine Protection

			Policy.
FWS/DFW-10	4/29/15	**10. Bat Roosts** Project work on or near bridge structures may result in take as defined in Fish and Game Code Section 4150 and/or disturbances to bats. Bats are considered non-game mammals and are afforded protection by State law from take and/or harassment (Fish and Game Code Section 4150, California Code of Regulations, Section 251.1). Several bat species are also considered California Species of Special Concern (SSC) and meet the CEQA definition of rare, threatened or endangered species (CEQA Guidelines § 15065). Take of SSC could require a mandatory finding of significance by the Lead Agency (CEQA Guidelines§ 15065). The following avoidance and minimization measures should be incorporated in Section 6.1: Environmental Commitments of the Final SEA/EIR: "In order to avoid the breeding season for bats, construction in and adjacent to bridge structures shall be avoided between January 1st and September 30th to the greatest extent feasible. If this is not possible, construction will occur after preconstruction surveys are conducted by a qualified biologist and no bat roosts or nurseries are found within the immediate Project area. Preconstruction bat surveys will include: I) the exact location of all roosting sites (location shall be adequately described and drawn on a map), 2) the number of bats present at the time of visit (count or estimate), 3) each species of bat present will be named (include how the species was identified), 4) the location, amount, distribution and age of all bat droppings will be described and pinpointed on a map, and 5) the type of roost-- night roost (rest at night while out feeding) versus a day roost (maternity colony)-- will be clearly stated. Locations of all roosts will be kept confidential to protect them from disturbance."	The Corps and/or the non-federal sponsors shall continue to conduct bat surveys prior to construction of the BNSF Bridge and will coordinate with CDFW to determine appropriate avoidance and minimization measures. This commitment has been included in the Final SEA/EIR Addendum.
FWS/DFW-11	4/29/15	**11. State Regulations** The Draft SEA/EIR states that, "CESA permit (2081-200 1-023-06) previously issued for the SARMP will be amended after receipt of a Biological Opinion by USFWS to address the proposed measures" (SEA/EIR, page 382). The Draft SEA/EIR also states that the Orange County Flood Control District (OCFCD) will be responsible for renewing or amending the existing Streambed Alteration Agreement (SAA; 1600-2009-0031-R6). The Department has concluded that current project activities are not included in the existing CESA permit and SAA; therefore, a new CESA permit and new SAA will be required. The final SEA/EIR should reflect this and include a discussion of how the OCFCD will coordinate with the Department to acquire a new CESA permit and SAA.	The Corps and OCFCD (CEQA lead) have been coordinating with CDFW staff. CDFW is considering whether a CESA permit is required, since impacts to State-listed species would occur during construction (which is overseen by the Federal government) and are not anticipated during routine maintenance. OCFCD is preparing an application for a new SAA, and if necessary will also apply for a CESA permit.

Email Correspondence (Informal Information Exchange)

Agency	Email Dated	Nature of Email	Responses/Status
Corps to WQCB (401 Cert)	1/28/15	Requested WQCB (Marc Brown and Glenn Robertson) to review the draft 401 application for Phase 4, 5A, 5B, and BNSF bridge protection for sufficiency in format and level of detail.	No response. Letter and application were completed and sent to WQCB on January 23, 2015.
SAWA	2/6/15	Noted possible errors in GIS projections of vireo territories.	Comment noted, errors were corrected and updated maps are included in the Final SEA/EIR Addendum.
California State Parks (Enrique Arroyo)	2/19/15	Request confirmation on comment review period, Feb 20 or Mar 18 (per Clearinghouse)	Corps granted extension of review period until end of February; however the State Clearinghouse subsequently sent out a new notice to allow comments through March 6.
USFWS (Chris Medak)	2/24/15	Request report on SAS observed in Reach 9 Phase 2B area in 2012 as stated in the SEA.	Corps has confirmed that no SAS were observed in 2012. The Final SEA/EIR Addendum has been revised accordingly.
USFWS (Chris Medak)	3/2/15	USFWS confirmed receipt of Corps letter to request Section 7 consultation on the SARP on 1/30/15. Working to clarify information request. Anticipate Corps will receive USFWS response to the request for consultation by the end of the week.	Corps, USFWS and CDFW continued exchanging information and providing updates to the project description via e-mail and written correspondence through July 2015, when the Biological Opinion was received and the SEA/EIR Addendum was finalized.
Corps to WQCB (401 Cert)	4/1/18	Follow up email to WQCB for 401 application status	4/3/15 WQCB (Glenn Robertson) responded that the application was placed on Marc Brown's desk in March.
Corps to WQCB (401 Cert)	6/15/15	No response from WQCB since 4/1/15 email as stated above; Corps will assume a waiver for the Reach 9 construction (which includes Phases 4, 5A, 5B and BNSF embankment and bridge protection). Corps will implement measures to minimize water quality and biological impacts. Construction contractor(s) will prepare a SWPPP and comply notification and reporting requirements, and will obtain dewatering permits where necessary. Anticipate continued coordination with WQCB on these matters throughout construction.	No response has been received.

Letters from Corps to Agencies

Agency	Letter Dated	Nature of Letter
USFWS	1/23/15	Letter to FWS to request initiation of formal consultation
WQCB (SAR)	1/23/15	Letter to WQCB requesting a Section 401 WQC for the project within 60 days of submittal of request.
State Clearinghouse	1/26/15	Notice of Completion and Environmental Document Transmittal
WQCB	1/29/2015	401 Application to WQCB
USFWS	3/31/15	Letter to FWS responding to request for additional information

EXTERNAL Corps 5A 5B BNSF protection features of the Santa Ana River Mainstem project ..txt

From: Gabrieleno Band of Mission Indians [gabrielenoindians@yahoo.com]
Sent: Friday, February 06, 2015 10:12 PM
To: Jones, Christopher T SPL; Christina Swindall; Matt Teutimez.Kizh Gabrieleno;

Tim Miguel
Subject: [EXTERNAL] The U.S. Army Corps of Engineers (Corps) 5A, 5B Burlington
Northern and Santa Fe (BNSF) Railroad Bridge protection features of the Santa Ana River Mainstem project .

Dear Christopher Jones
Chief, Planning Division

“The project locale lies in an area where the traditional territories of the Kizh(Kitc) Gabrieleño villages adjoined and overlapped with each other, at least during the Late Prehistoric and Protohistoric Periods. The homeland of the Kizh (Kitc) Gabrieleños , probably the most influential Native American group in aboriginal southern California (Bean and Smith 1978a:538), was centered in the Los Angeles Basin, and reached as far east as the San Bernardino-Riverside area. The homeland of the Serranos was primarily the San Bernardino Mountains, including the slopes and lowlands on the north and south flanks.Whatever the linguistic affiliation, Native Americans in and around the project area echibited similar orgainization and resource procurement strategies. Villages were based on clan or lineage groups. Their home/ base sites are marked by midden deposits, often with bedrock mortars. During their seasonal rounds to exploit plant resources, small groups would migrate within their traditional territory in search of specific plants and animals. Their gathering strategies often left behind signs of special use sites, usually grinding slicks on bedrock boulders, at the locations of the resources. Therefore in order to protect our Cultural resources we're requesting one of our experienced & certified Native American monitors to be on site during any & all ground disturbances.

BOMI/KN-1

In all cases, when the NAHC states there are “No" records of sacred sites” in the subject area; they always refer the contractors back to the Native American Tribes whose tribal territory the project area is in. This is due to the fact, that the NAHC is only aware of general information on each California NA Tribe they are "NOT " the “experts” on our Tribe. Our Elder Committee & Tribal Historians are the experts and is the reason why the NAHC will always refer contractors to the local tribes.

Please contact our office regarding this project to coordinate a Native American Monitor to be present.

Sincerely,

Andy Salas Chairman Of Gabrieleño Band Of Mission Indians/Kizh (Kit'c) Nation

Of the Los Angeles Basin, Orange county and the Channel islands.

NOTICE: PLEASE FILE OUR CONTACT INFORMATION FOR CONSULTATION ON ALL FUTURE PROJECTS WITHIN OUR TRIBAL TERRITORY.....

Gabrieleño Band of Mission Indians disclaimer

DISCLAIMER: Notice: This message contains information which is confidential and protected by copyright or which may contain any other intellectual

property rights. The use of the "Gabrieleño Band of Mission Indians Kizh(Kit'c)Nation" trademarks without the prior written consent of the Gabrieleño Band of Mission Indians Kizh(Kit'c) Nation is forbidden. If you are not the intended recipient of this message please delete it and destroy all copies. If you are the intended recipient of this message you should not disclose or distribute this message to third parties without the consent of the Gabrieleño Band of Mission Indians Kizh(Kit'c) Nation. Our Tribe does not represent, warrant and/or guarantee that the integrity of this message has been maintained nor that the communication is free of virus, interception or interferene.

Response to Comments: BOMI-KN Email (Feb 6, 2015)

BOMI/KN-1**:** The Corps will ensure that the project is monitored by a professional archaeologist who meets the Standards of the Secretary of the Interior as stated in Section 5.8.3 Environmental Commitment CR-1. Tribal monitors are also welcome to be on site as long as they comply with safety requirements and check in first with the Contractor superintendent or Corps inspector. The Corps will not be able to reimburse the tribal monitors for any costs incurred.

No change to the SEA/EIR Addendum is required in response to this comment, as the requirement for monitoring was already included as Measure EC-CR-1 in Chapter 6 (Environmental Commitments).

From:	Rececca Robles
To:	Jones, Christopher T SPL
Subject:	[EXTERNAL] Corps of Engineers Draft EA/EIR for Santa Ana River project
Date:	Wednesday, February 11, 2015 7:21:10 PM
Attachments:	PastedGraphic-3.pdf

February 10, 2015

Christopher Jones, Project Biologist

Los Angeles District Corps of Engineers

Re: Draft Supplemental Environmental Assessment/Environmental Impact Report Addendum (SEA/EIR Addendum) for the Reach 9 Phases 4, 5A, 5B and Burlington Northern and Santa Fe Railroad Bridge protection features of the Santa Ana River Mainstem Project.

Thank you for the opportunity to comment on the above mentioned project. We do not know of any cultural resources within the proposed project area, and we understand that an archaeological survey was conducted in 1985 and that it was determined that cultural resources are not present. While periodic flooding episodes from the Santa Ana River may have destroyed any cultural resources that were present, it is also possible that flooding episodes could deposit sediments and bury them. Therefore we concur with mitigation measure CR-1 that requires archaeological monitoring of construction. This mitigation measure should be applied whenever ground disturbing activities may affect areas that have not been subject to erosion and the ground disturbance will go deeper than recent and historic flood episodes.

UCP-1

We request that you continue to keep us informed in the event that cultural resources are discovered during construction. In that event, we reserve our right to comment further in the future.

Sincerely,

Rebecca Robles

United Coalition to Protect Panhe

Response to Comments: UCP Email (February 10, 2015)

UCP-1: Comment noted. No change necessary to FSEA/EIR Addendum.

Concur.

Serving:
Anaheim
Brea
Buena Park
Cypress
Fountain Valley
Fullerton
Garden Grove
Huntington Beach
Irvine
La Habra
La Palma
Los Alamitos
Newport Beach
Orange
Placentia
Santa Ana
Seal Beach
Stanton
Tustin
Villa Park
Yorba Linda
County of Orange
Costa Mesa Sanitary District
Midway City Sanitary District
Irvine Ranch Water District

Orange County Sanitation District
10844 Ellis Avenue, Fountain Valley, CA 92708
(714) 962-2411 www.ocsewers.com

RECEIVED
2015 MAR -3 AM 9:00
OCSD
Mail Room

February 19, 2015

Josephine R. Axt, Ph.D.
Chief, Planning Division
U.S. Army Corps of Engineers
Los Angeles District
915 Wilshire Blvd. Ste. 930
Attn: Christopher Jones (CESPL-PD-RN)
Los Angeles, CA 90017

SUBJECT: Draft Supplemental Environmental Assessment/Environmental Impact Report Addendum for the Reach 9, Phase 4, 5A, 5B of the Santa Ana River Mainstem Project

---

Thank you for the opportunity to review and comment on Draft Supplemental Environmental Assessment / Environmental Impact Report Addendum for the Reach 9, Phase 4, 5A, 5B of the Santa Ana River Mainstem Project (the "Addendum"). The Corps' proposed embankment protection project calls for the replacement of existing soil cement and riprap along 4.48 miles of embankment on the north side of the Santa Ana River (Phase 5A and 5B) and 3,150 feet of embankment on the south side of the Santa Ana River (Phase 4) of Reach 9.

The Orange County Sanitation District (OCSD), in a joint effort with the County of Orange and the Santa Ana Watershed Project Authority (SAWPA), recently relocated the 54-inch Santa Ana River Interceptor ("SARI") line out of the riverbed to the south side of the floodplain parallel to the freeway. The SARI line carries 35 million gallons per day of commercial and industrial wastewater from Orange, Riverside, and San Bernardino counties to OCSD's Treatment Plant No. 2. The pipeline was relocated due to changes in the River and increased discharges from Prado Dam, which compromised the integrity of the pipeline.

To protect the old SARI Line from on-going river erosion caused by large volume releases, OCSD placed rock at 16 sites under emergency permits issued by the Corps. Rock installation was implemented between 2005 and 2011 in accordance with USACE Permit Nos. 2005-00089-JPL, 2005-00680-JPL, 2005-00995-JPL, 2006-00006-SAD, and SPL-2008-00996-JPL.

The emergency permits issued by the Corps authorizing placement of the rock imposed a condition requiring OCSD to remove the rock when the SARI Relocation project was completed. OCSD is currently soliciting proposals to comply with CEQA prior to removing the rock as required by the Corps.

1070474.1

As indicated in the Addendum, section 4.5 *Description of Additional Work*, it is anticipated that the Corps will remove the emergency rocks placed in the Phase 4 area. (Addendum, p. 4-54.) Emergency rocks, however, were also placed throughout the project location identified in the Addendum, Reach 9. (please see enclosed map to see overlay of project areas).

As noted in the Addendum, at least 29 special-status wildlife species occur or have potential to occur in the project area. (Addendum p. 5-84.) A number of special-status plant species also have the potential to occur. (Addendum p. 5-65.) Additionally, the project area includes important aesthetic, hydrological, and recreational resources. (See, e.g., Addendum, pp. 5-241, 5-29, 5-225.) As an environmental steward, OCSD supports the Corps' objective to minimize impacts to these and other key resources in the project area.

OCSD-1 On this basis, OCSD requests that the Corps consider including the removal of all emergency rock placed under the above reference permits as a part of its project for embankment protection. Implementing these two projects as one project will mitigate environmental impact to this sensitive area and conserve resources, including public funds, while simultaneously meeting both project objectives. The emergency rocks currently serve to partially protect the embankment until the Corp completes the proposed project. The Corp would also be free to reuse the on-site rock as a resource to mitigate the importation of additional materials.

OCSD would like the opportunity to discuss this proposition further. OCSD is confident that a solution can be reached that will be beneficial to all parties.

Thank you for the opportunity to comment on the Draft SEA/EIR addendum. If you have any questions, please contact Jim Colston at 714-593-7450.

Daisy Covarrubias

Daisy Covarrubias, MPA
Senior Staff Analyst

DC:sa
I:\Transferred folders\Daisy C\OCSD - Comment on SEA _ Addendum for the Santa Ana River Mainstem Proejct (3).doc

Response to Comments: OCSD Letter (February 19, 2015)

OCSD-1: As discussed at previous meetings between the Corps and OCSD, the Corps is not authorized to conduct rock removal outside of active project footprints. Furthermore, as rock removal is a condition of a Corps Regulatory permit, the Corps cannot implement such conditions on behalf of the applicant. Rock within the Phase 4 temporary construction easement would not be removed for the purpose of fulfilling a permit condition, but solely to enable construction to proceed.

As the project description was not changed in response to this comment, no change to the SEA/EIR Addendum is required.

Wong, Megan T SPL

From: Andrews, Kathleen@DOC [Kathleen.Andrews@conservation.ca.gov]
Sent: Tuesday, March 03, 2015 2:51 PM
To: Jones, Christopher T SPL
Subject: [EXTERNAL] Army Corps of Engineers CEQA distribution list

DOC-1

Hello, Christopher,

The Division of Oil, Gas and Geothermal Resources received information regarding the Draft Supplemental Environmental Assessment/Environmental Impact Report Addendum for the Reach 9 Phases 4, 5A, 5B and Burlington Northern and Santa Fe (BNSF) Railroad Bridge protection features for the Santa Ana Mainstream Project. The letter was addressed to Paul Frost. Mr. Frost retired more than five years ago. Please address future CEQA-related letters to me. The address is:

Kathleen Andrews

California Department of Conservation

District 1, Division of Oil, Gas and Geothermal Resources

5816 Corporate Avenue, Suite 200

Cypress, California 90630-4731

Thank you.

Kathleen Andrews

Associate Oil and Gas Engineer

California Division of Oil, Gas and Geothermal Resources

Cypress, CA 90630

714-816-6847

Response to Comments: CA DOC Email (March 3, 2015)

DOC-1: POC has been updated in the FSEA/EIR Addendum Distribution List (Appendix E).

State of California • Natural Resources Agency
Edmund G. Brown Jr., *Governor*

DEPARTMENT OF PARKS AND RECREATION
Lisa Ann L. Mangat, *Acting Director*
Inland Empire District
17801 Lake Perris Drive
Perris, CA 92571

March 3, 2015

Josephine R. Axt, Ph.D.
Chief, Planning Division
U.S. Army Corps of Engineers
Los Angeles District
915 Wilshire Boulevard, Suite 930
Attn: Christopher Jones (CESPL-PD-RN)
Los Angeles, CA 90017

Subject: Comments on the Reach 9 Phases 4, 5A, 5B and BNSF Bridge Protection Project, SCH #2015021003

Dear Dr. Axt:

The Inland Empire District of the Department of Parks and Recreation (State Parks) appreciates the opportunity to comment on the aforementioned project. As described, the project would require use of state park land for access from the freeway to construction site(s) and to repair the gullies along the east end of the Coal Canyon North portion of Chino Hills State Park.

State Parks is a trustee agency as defined by the California Environmental Quality Act (CEQA). State Parks' mission in part is to provide for the health, inspiration, and education of the people of California by preserving the state's extraordinary biodiversity and creating opportunities for high quality outdoor recreation. As the office responsible for the stewardship of Chino Hills State Park (Chino Hills SP), we have an interest and concern about contemplated alterations of land use within and adjacent to the park. The long-term health of Chino Hills SP is dependent on the health of the regional ecosystems because the biotic boundaries of the park extend beyond its jurisdictional boundaries.

Phase 5B

DPR-1 Presence of the Coastal California Gnatcatcher at Coal Canyon should be added to the description in Table 5.5-3. (The table presently only mentions Weir and Gypsum Canyons.) Additionally, Coastal California Gnatcatchers have been detected recently on the north side of SR-91 near the east end of Reach 9, Phase 5B temporary construction easement.

Information in number 1 above should be added to the Special Species description on the Coastal California Gnatcatcher in the same section.

DPR-2 The dirt road along the northern boundary of the state park should remain accessible throughout the project.

Phase 4

DPR-3 Exposure of the soil cement structure at the east end of Phase 4 near the cell tower will result in a major impediment to wildlife movement and a significant impact. The design should incorporate measures to reduce it with backfilling and native plantings.

We request a simulation of the finished product as viewed from the state park, especially structures that would be adjacent to the state park.

DPR-4 It appears a component of this project will include restoration of the county's bike path. We request to be involved in the design and approval of the finished product since it also involves restoring the state park land where the bike path currently detours.

6.0 Environmental Commitments

The mitigation measures described in this section, if fully implemented as described, will generally result in minimizing permanent and temporary impacts to biological resources from this project. However, the following additional measure needs to be added to minimize impacts to the Coastal California Gnatcatcher.

DPR-5 **Biological Resources item BR-16**

We request surveys and monitoring for Coastal California Gnatcatcher for the east end of Phase 5B and east portions of Phase 4 between the cell tower and the Off-site Gully Repair Area.

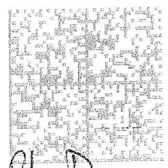
Thank you again for the opportunity to comment and for your serious consideration. For further discussion, please contact me or Enrique Arroyo at (951) 453-6848.

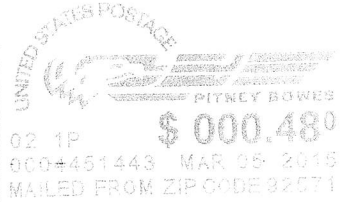
Sincerely,

Kelly Elliott
District Superintendent
Inland Empire District

STATE OF CALIFORNIA
DEPT. OF PARKS & RECREATION
17801 LAKE PERRIS DRIVE
PERRIS, CALIFORNIA 92571

SAN BERNARDINO
CA 924
05 MAR '15
PM 7 L





Josephine Axt, Ph.D
Chief, Planning Division
US Army Corps of Engineers
LA District
915 Wilshire Bl., Ste 930
Attn: Christopher Jones (CESPL-PD-RN)
Los Angeles, CA 90017

9001783474

Response to Comments: DPR Letter (March 3, 2015)

DPR-1: This information has been added to the Final SEA/EIR Addendum (various locations in Section 5.5, including Table 5.5-3).

DPR-2: The dirt road will be accessible during construction, assuming the dirt road in question is the one skirting the northern boundary of State Parks property near Coal Canyon.

(This response provides clarification that the project will not affect access to the state park; no change to the project description, alternatives or SEA/EIR Addendum is required.)

DPR-3: The upstream-most segment of Phase 4 as depicted in the Draft SEA/EIR Addendum is no longer included in the currently proposed project description. As a result, the additional analysis requested for the now deleted segment is no longer applicable. The Corps is continuing to assess the need and evaluate alternatives for this segment. If construction of this or a different alternative is proposed again in the future, the Corps will prepare another SEA. The requested simulations could also be provided at that time.

DPR-4: The Corps will coordinate the final bike path design and restoration plans with State Parks.

DPR-5: Surveys of all potentially suitable habitat throughout the project area are ongoing and will be completed prior to construction. Survey results to date have been incorporated in the Final SEA/EIR Addendum, and the commitment for continued surveys has been added to BR-16 in Section 5.5 and Chapter 6.

STATE OF CALIFORNIA

GOVERNOR'S OFFICE *of* PLANNING AND RESEARCH

STATE CLEARINGHOUSE AND PLANNING UNIT

EDMUND G. BROWN JR.
GOVERNOR

KEN ALEX
DIRECTOR

March 9, 2015

Hayley Lovan
U.S. Army Corps of Engineers
915 Wilshire Boulevard
Los Angeles, CA 90017

Subject: Santa Ana River: Reach 9 Phases 4, 5A, 5B, & BNSF Bridge
SCH#: 2015021003

Dear Hayley Lovan:

The State Clearinghouse submitted the above named Draft EIR to selected state agencies for review. On the enclosed Document Details Report please note that the Clearinghouse has listed the state agencies that reviewed your document. The review period closed on March 6, 2015, and the comments from the responding agency (ies) is (are) enclosed. If this comment package is not in order, please notify the State Clearinghouse immediately. Please refer to the project's ten-digit State Clearinghouse number in future correspondence so that we may respond promptly.

Please note that Section 21104(c) of the California Public Resources Code states that:

> "A responsible or other public agency shall only make substantive comments regarding those activities involved in a project which are within an area of expertise of the agency or which are required to be carried out or approved by the agency. Those comments shall be supported by specific documentation."

These comments are forwarded for use in preparing your final environmental document. Should you need more information or clarification of the enclosed comments, we recommend that you contact the commenting agency directly.

This letter acknowledges that you have complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act. Please contact the State Clearinghouse at (916) 445-0613 if you have any questions regarding the environmental review process.

Sincerely,

Scott Morgan
Director, State Clearinghouse

Enclosures
cc: Resources Agency

Document Details Report
State Clearinghouse Data Base

SCH# 2015021003
Project Title Santa Ana River: Reach 9 Phases 4, 5A, 5B, & BNSF Bridge
Lead Agency U.S. Army Corps of Engineers

Type EIR Draft EIR

Description Note: Review per lead.

The U.S. Army Corps of Engineers proposes to extend bank protection structures within Reach 9 of the Santa Ana River by constructing three bank and infrastructure protection measures, Phases 4, 5A, and 5B, in the City of Yorba Linda, Orange County. The purpose of these projects is to prevent undercutting and erosion of Santa Ana River embankments, caused by high-velocity flows and associated scour. The fourth project involves structural improvements to the BNSF bridge, which crosses over the Santa Ana River, and is located in the City of Corona, Riverside County. This project would address potential deficiencies in protection and susceptibility to scour at the bridge piers and abutments.

Lead Agency Contact

Name Hayley Lovan
Agency U.S. Army Corps of Engineers
Phone 213 452 3863 **Fax**
email
Address 915 Wilshire Boulevard
City Los Angeles **State** CA **Zip** 90017

Project Location

County Orange, Riverside
City Yorba Linda, Orange, Corona
Region
Lat / Long 33° 52' 19.4" N / 117° 42' 1.8" W
Cross Streets Gypsum Canyon Road and East La Palma Avenue, Yorba Linda, OC
Parcel No.
Township **Range** **Section** **Base**

Proximity to:

Highways SR-91, 71, 241
Airports
Railways BNSF
Waterways Santa Ana River
Schools
Land Use Open Space-general

Project Issues Aesthetic/Visual; Agricultural Land; Air Quality; Archaeologic-Historic; Biological Resources; Economics/Jobs; Flood Plain/Flooding; Geologic/Seismic; Noise; Population/Housing Balance; Public Services; Recreation/Parks; Soil Erosion/Compaction/Grading; Toxic/Hazardous; Traffic/Circulation; Vegetation; Water Quality; Water Supply; Wetland/Riparian; Landuse; Cumulative Effects

Reviewing Agencies Resources Agency; Department of Boating and Waterways; Department of Fish and Wildlife, Region 5; Department of Fish and Wildlife, Region 6; Department of Parks and Recreation; Department of Water Resources; Office of Emergency Services, California; California Highway Patrol; Caltrans, District 12; Caltrans, District 8; Air Resources Board, Transportation Projects; Regional Water Quality Control Board, Region 8; Native American Heritage Commission; Public Utilities Commission; State Lands Commission

Date Received 02/02/2015 **Start of Review** 02/02/2015 **End of Review** 03/06/2015

Note: Blanks in data fields result from insufficient information provided by lead agency.

CLEAR
3-6-15

DEPARTMENT OF TRANSPORTATION
DIVISION OF TRANSPORTATION PLANNING
P.O. BOX 942874, MS-32
SACRAMENTO, CA 94274-0001
PHONE (916) 653-1067
FAX (916) 653-4570
TTY 711
www.dot.ca.gov/hq/tpp/

RECEIVED
MAR 0 6 2015
STATE CLEARING HOUSE

Serious Drought. Help save water!

March 6, 2015

Ms. Hayley Lovan
Chief - Ecosystems Planning Section
US Army Corps of Engineers
Los Angeles District
915 Wilshire Blvd., Ste 930
Los Angeles, CA 90017

SCH # 2015021003
SEA/AEIR

Subject: Santa Ana River: Reach 9 Phases 4, 5A, 5B & BNSF Bridge - Supplemental Environmental Assessment and Addendum to Environmental Impact Report

Dear Ms. Lovan:

Thank you for the opportunity to review and provide comments on the Supplemental Environmental Assessment and Addendum to the Environmental Impact Report (EIR) for the Santa Ana River: Reach 9 Phases 4, 5A, 5B & BNSF Bridge project, SCH# 2015021003. The Supplemental Assessment and Addendum is a supplement to the Final Supplemental Environmental Impact Statement (SEIS) and EIR for the Prado Basin and Vicinity, Including Reach 9 and Stabilization of the Bluff Toe at Norco Bluffs, dated November 2001. The US Army Corps of Engineers (Corps) proposes to extend bank protection measures within Reach 9 by construction three additional bank and infrastructure measures, Phases 4, 5A, and 5B, and fortifying the BNSF Bridge.

As the owner and operator of the State Highway System (SHS), the main objective of the Local Development – Intergovernmental Review (LD-IGR) Program is to protect the mobility and operational safety of the SHS. To ensure a safe and efficient transportation system, we encourage early consultation and coordination with local jurisdictions and project proponents on all development projects that may have an impact on state facilities and the multi-modal transportation network.

Caltrans new mission, vision, and goals signal a modernization of our approach to California's transportation system. While safety continues to be a number one goal, we want to promote health through an emphasis on active transportation and reduced pollution in communities. Consistent with the State's direction we want to make smart mobility decisions that improve the environment, support a vibrant economy, and build livable communities.

Water Quality

DOT-1 Any work within Caltrans Right-of-Way (ROW) must comply with the Caltrans Statewide NPDES permit (Order No. 2012-0011-DWQ, NPDES No. CAS000003) and any subsequent

permit issued at the time of encroachment. Any work within State ROW will require an Encroachment Permit including reviewing and approving a Storm Water Pollution Prevention Plan (SWPPP) and reviewing project plans for NPDES/ water quality compliance.

DOT-2 As stated in page 4-36 of the Supplemental Environmental Assessment, the existing drainage outlets into the Santa Ana River for Phase 4 will be extended through the proposed soil cement structure. These modifications include demolishing and reconstructing the outlets. With the source of the runoff from these drainage structures coming from State Route (SR) 91, there is concern that Caltrans maintenance forces will be limited in obtaining access to these storm drains from the outlet side. Caltrans maintenance has encountered similar problems with the access to the outlets upstream from this location due to the grouted rip rap. It is understood that this location will construct soil cement to protect the stream bank, and Caltrans would like to coordinate with the reconstruction of the outlets in the Santa Ana River. Caltrans would like to coordinate an adequate access to the outlets and/or provide a manhole access at the State ROW so that Caltrans maintenance crews can access the drainage system without entering the Santa Ana River.

Mitigation Planting and Landscape Improvements

DOT_3 Project maps reveal that work proposed for Reach 9, Phases 4 and 5B will occur in close proximity to a Caltrans mitigation planting site located just northwest of the decommissioned interchange at Coal Canyon and SR 91. Additionally, the Temporary Construction Easement for Reach 9, Phase 4 extends all the way to the Coal Canyon interchange. Caltrans recently performed a number of landscape improvements at this interchange location, including enhancement plantings. Caltrans requests that the Corps coordinate closely with the Caltrans Landscape Architecture and Environmental Analysis units to avoid impacts to these various planting sites.

Transportation Permit

DOT-4 TMPs for construction vehicles should be submitted to Caltrans in order to minimize the impacts to State highway facilities. Coordination of this project with other construction activities on State Routes may be needed. Any hauling of materials should not occur during A.M. and P.M. peak period of travel on State facilities during demolition and construction of the proposed project. All vehicles loads should be covered so that materials do not blow over or onto the Department's ROW.

Encroachment Permit

DOT_5 If any project work (e.g. storage of materials, street widening, emergency access improvements, sewer connections, sound walls, storm drain construction, street connections, curb, gutter or sidewalk, etc.) will occur in the vicinity of the Department's Right-of-Way (ROW), and Encroachment Permit is required prior to commencement of work. When applying for an

Encroachment Permit, please incorporate Environmental Documentation, SWPPP/WPCP, Hydraulic Calculations, Traffic Control Plans, Geotechnical Analysis, ROW certification and all relevant design details including design exception approvals. Additional signage may be warranted for pedestrians and bicycles detours during construction. Surface restoration and post construction activities should meet current ADA requirements. For specific details on the Department's Encroachment Permit procedures, please refer to the Departments' Encroachment Permits Manual.

To apply, a completed encroachment permit application, certified environmental document for the project, and five (5) sets of plans clearly indicating State ROW must be submitted to the Encroachment Permits office in the appropriate Caltrans District. Any necessary mitigation measures should be incorporated into the construction plans during the encroachment permit process. Please allow 2 to 4 weeks for a complete submittal packet to be reviewed and for a permit to be issued. Additional permit information can be found online at the following website: http://www.dot.ca.gov/hq/traffops/developserv/permits/.

Regional Transportation Planning Agency and Local Jurisdiction General Plans

DOT-6 Your proposed access routes and structure locations should be incorporated into these area wide plans. Please verify your coordination with these entities when seeking site specific approvals.

District Specific Planning Contacts

When seeking site specific approvals, please consult with the Caltrans districts via points of contact identified on Attachment 1.

For questions regarding this comment letter please contact Joshua Pulverman, Local Development-Intergovernmental Review (LD-IGR) Statewide Coordinator, Office of Sustainable Community Planning at (916) 653-0808, or at josh.pulverman@dot.ca.gov.

Sincerely,

For TERRI PENCOVIC
LD-IGR Statewide Program Manager
Office of Sustainable Community Planning

c: Scott Morgan, State Clearinghouse
Mark Roberts, Chief, IGR/Community Planning, Caltrans District 8
Maureen El Harake, Chief, Regional-Community-Transit Planning, Caltrans District 12
Maryam Molavi, IGR-Community Planning, Caltrans District 12

ATTACHMENT 1: Caltrans District Planning Contacts

District	Counties	Contact	Phone
8	Riverside and San Bernardino	Mark Roberts	(909) 383-4557
12	Orange	Maureen El Harake	(949) 724-2086

Response to Comments: DOT Letter (March 6, 2015)

DOT-1: A SWPPP including BMPs would be developed and implemented during construction of each feature as identified in the FSEA/EIR Addendum. Caltrans will be given an opportunity to review the SWPPP and project plans for any work conducted within their property.

Requirements for the construction contractor(s) to prepare SWPPPs and comply with NPDES requirements were already included in the SEA/EIR Addendum; no modification is needed in response to this comment.

DOT-2: Coordination with Caltrans will continue throughout final design and construction to ensure that access for maintenance of drainage outlets is not impeded.

This coordination is standard practice for proposed work within Caltrans rights of way; no modification to the SEA/EIR Addendum is required.

DOT-3: Restoration and bikeway relocation plans will be coordinated with Caltrans to avoid, minimize or mitigate for any impacts to existing landscaped or restored areas.

This coordination is standard practice for proposed work within Caltrans rights of way; no modification to the SEA/EIR Addendum is required.

DOT-4: A Traffic Management/Traffic Control Plan, if needed, will be prepared by the construction contractor in coordination with DOT and submitted to the DOT prior to construction.

This coordination is standard practice for proposed work within Caltrans rights of way; no modification to the SEA/EIR Addendum is required.

DOT-5: Any necessary encroachment permits will be obtained prior to construction.

DOT-6: Thank you for the information and points of contact.

SAN BERNARDINO Valley MUNICIPAL WATER DISTRICT

380 East Vanderbilt Way
San Bernardino, CA 92408
phone: 909.387.9200
fax: 909.387.9247
www.sbvmwd.com

March 9, 2015

Dr. Josephine Axt
Chief, Planning Division
U.S. Army Corps of Engineers
915 Wilshire Blvd, Ste 930
Los Angeles, CA 90017
Attention: Christopher Jones (CESPL-PD-RN)

SUBJECT: Santa Ana River: Reach 9, Phases 4,5A,5B & BNSF Bridge Comment

Dear Dr. Axt,

The ten project partners of the Upper Santa Ana River Habitat Conservation Plan are investing significant resources in improving the status of native fishes in the Santa Ana River. In an effort to provide on-the-ground benefit to Santa Ana sucker (sucker) and Arroyo chub we are investing hundreds of thousands of dollars on mainstem and tributary restoration activities. We hope that our planned improvements and management of spawning, forage, and refugia habitat will contribute to the Santa Ana sucker eventually meeting the delisting criteria for segments of the River upstream of Prado Dam as detailed in the U.S. Fish and Wildlife Service's (Service) 2014 Draft Recovery Plan. However, in order to reach recovery, the Service also identified criteria for the segment of the River below Prado Dam, the Prado/Imperial Reach, as potentially necessary to delist the species. We are concerned that continued armoring and channelization of the River below Prado Dam will eliminate the potential for future habitat improvements and re-establishment of native fishes, especially Santa Ana sucker, in this reach. Although observations of sucker below Prado have been sparse in recent years it is possible that some individuals may be occupying the habitat and the reach may be suitable for future population augmentation if habitat restoration were undertaken. We request that you consider direct and indirect effects of the proposed project, including the effect of a hardening channel and changes river hydrology, in the context of the potential for Santa Ana sucker to ever meet delisting criteria in this reach of the River. In other words, will the project eliminate the possibility of Santa Ana sucker re-establishing below Prado Dam? The consequences of such an occurrence may have repercussions for stakeholders who are working towards recovery of the species, an action which may be dependent upon a sustainable population of sucker below Prado Dam per the Recovery Plan.

VMWD-1

Sincerely,

Heather Dyer
Water Resources Project Manager

Board of Directors and Officers

ED KILLGORE	GIL NAVARRO	SUSAN LONGVILLE	MARK BULOT	STEVE COPELAN	DOUGLAS D. HEADRICK
Division 1	Division 2	Division 3	Division 4	Division 5	General Manager

Response to Comments: VMWD Letter (March 9, 2015)

VMWD-1: No. The project (embankment and bridge pier protection) will not result in a substantial change in hydrology or habitat suitability for Santa Ana sucker. In fact, one of the potential mitigation measures that have been identified in coordination with the USFWS is gravel augmentation within Reach 9, which would improve habitat conditions.

(This response provides clarification that the project will not adversely affect SAS recovery efforts; no change to the project description, alternatives or SEA/EIR Addendum is required in response to this comment.)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Carlsbad Fish and Wildlife Office
2177 Salk Avenue, Suite 250
Carlsbad, California 92008

In Reply Refer To:
FWS-OR-08B0408-15TA0216

MAR 31 2015

Josephine R. Axt, Ph.D.
Chief, Planning Division
U.S. Army Corps of Engineers, Los Angeles District
915 Wilshire Boulevard, Suite 930
Los Angeles, California 90017-3409

Attention: Christopher Jones (CESPL-PD-RN)

Subject: Request for Initiation of Formal Consultation on Bank and Bridge Protection Projects along the Santa Ana River, Riverside and Orange Counties, California

Dear Dr. Axt:

This letter acknowledges the U.S. Fish and Wildlife Service's (Service) receipt of your January 23, 2015, letter requesting initiation of formal consultation, pursuant to section 7 of the Endangered Species Act of 1973 (Act), as amended (16 U.S.C. 1531 *et seq.*), on a series of bank and bridge protection measures associated with the U.S. Army Corps of Engineers (Corps) Santa Ana River Mainstem Flood Control Project (SARP). Your letter was received in our office on January 30, 2015, along with a copy of the January 2015 Draft Supplemental Environmental Assessment and Addendum to Environmental Impact Report (Draft SEA/EIR) prepared for the subject projects and provided to our agency to serve as the Biological Assessment for this consultation.

It is our understanding that formal consultation is requested for the preferred alternative identified in the Draft SEA/EIR (Jones 2015, pers. comm.) and that the existing embankments and bridge pilings require additional protective measures to withstand large flood releases from Prado Dam along with the anticipated riverbed scour. As indicated in your letter, the project area begins 2.25 miles downstream of Prado Dam at the Burlington Northern and Santa Fe (BNSF) Railroad Bridge crossing in Riverside County and continues another 5 miles downstream into Orange County.

By your request, this consultation concerns the possible effects of the proposed Santa Ana River Reach 9 Phases 4, 5A, and 5B projects and the BNSF Railroad Bridge Protection Project on the federally endangered least Bell's vireo (*Vireo bellii pusillus*) and the threatened coastal California gnatcatcher (*Polioptila californica californica*, gnatcatcher) and Santa Ana sucker (*Catostomus santaanae*). Designated critical habitat for the gnatcatcher and Santa Ana sucker will also be addressed by this consultation.

The Service has issued a series of biological opinions [i.e., Service 1980, 1989, 1993, 2000a, 2000b, 2001a, 2001b, 2002a, 2002b, 2003, 2004, 2012, 2013a, 2013b, 2013c] addressing the effects of constructing, operating, and maintaining the SARP on federally listed species and their critical habitat. In 2012, the Service expressed significant concerns to your agency regarding potential effects of ongoing operations at Prado Dam and proposed changes to the operations of Seven Oaks Dam on the Santa Ana sucker and its designated critical habitat.

As a result of these discussions, the Corps committed to work with the Service to assess how operations of these dams is potentially affecting geomorphology, hydrology, sediment transport, and other factors important to maintaining suitable habitat conditions for the Santa Ana sucker. The Corps also committed to coordinate with our agency to implement management measures to avoid and minimize adverse effects to sucker and its designated critical habitat (Corps 2012). While the Corps initiated the Prado Ecosystem and Water Conservation Feasibility Study to determine if bypassing sediment around Prado Dam could improve habitat conditions within the Santa Ana River for the Santa Ana sucker and resolve issues related to the alteration of the natural sediment transport regime, no management measures have been implemented and habitat conditions within the river have continued to degrade to the point where the species is increasingly vulnerable to extirpation within this portion of its range (Service 2011, 2014a, 2014b).

Moreover, the limited availability of spawning habitat for the species and the most recent survey information for the Santa Ana sucker within the river (Service 2014b) indicate that additional impacts to individuals and designated critical habitat in the project area, without inclusion of specific conservation measures to alleviate existing threats, cannot be endured without serious consideration of the overall impact on species recovery rangewide. While habitat conditions for the least Bell's vireo have not been as drastically affected by operations of Prado Dam, we are also concerned about the Corps' prior commitments to maintaining habitat downstream of Prado Dam for this species and how its habitat will be affected by the increase in sediment deposition upstream from Prado Dam over the long term.

The Service recognizes the need for construction of the additional flood protection measures to address maintenance and safety of existing infrastructure and river-adjacent development. Thus, to move forward with this consultation in a manner that provides for these concerns, and consistent with the section 7 regulations [50 CFR §402.14(c)], we require the additional project information identified (Enclosure 1-6) to conduct an appropriate evaluation of impacts to listed species and recommend additional conservation measures (Enclosure 7-8) be implemented to address the existing threats to recovery of the species from operations of the Prado Dam. Implementation of such conservation measures concurrent with the impacts anticipated by the necessary flood protection measures will ensure that impacts to Santa Ana sucker and its designated critical habitat from projects below the dam can be evaluated in this consultation against actions being taken to address baseline conditions and existing threats to the species that are impeding recovery of the species.

In accordance with 50 CFR §402.14(d), Federal agencies are responsible for providing the Service with the best scientific and commercial data available or which can be obtained during the consultation for an adequate review of the effects that action may have upon listed species or critical habitat. A significant amount of time was required by our staff to review the Draft SEA/EIR, which is lacking in sufficient project detail to adequately assess impacts to listed species and critical habitat. While not required by regulation, for a project of this scope, a biological assessment would have improved the efficiency and timeline of the consultation, especially since your letter requested expedited completion of the consultation and submission of a draft biological opinion by April 2015, which cannot now be met.

In order to meet the 90-day formal consultation period and complete the biological opinion within an additional 45 days (June 14, 2015), the additional information requested must be received within 2 weeks of receipt of this letter. An extension of time to complete the final biological opinion will be requested if your agency cannot more clearly define the project details (Enclosure 1-6) within this timeframe. In addition, we recommend a meeting to discuss your commitment to implementing appropriate conservation measures to address our overarching concerns for continued impacts to the Santa Ana sucker and its designated critical habitat from the operations of Prado Dam.

If you have any questions regarding this letter, please contact Jon Avery of this office at 760-431-9440, extension 309.

Sincerely,

G. Mendel Stewart

G. Mendel Stewart
Field Supervisor

Enclosure

Literature Cited

[Corps] U.S. Army Corps of Engineers. 2012. Letter from Josephine Axt, Chief, Planning Division of Corps, Los Angeles District to James Bartel, Field Supervisor, Carlsbad Fish and Wildlife Office, requesting informal consultation on potential effects to Santa Ana sucker, and its critical habitat, from ongoing operations at Prado and proposed Seven Oaks Dam water quality and seasonal water conservation initiatives. August 3, 2012.

[Service] U.S. Fish and Wildlife Service. 1980. Biological opinion on the effects of the Santa Ana River Flood Control Project in the Counties of Orange, Riverside, and San Bernardino, California, on endangered species and their habitat (1-1-80-F-75).

[Service] U.S. Fish and Wildlife Service. 1989. Biological opinion and conference on the Corps of Engineers Santa Ana River Project in San Bernardino, Riverside, and Orange Counties, California (1-6-88-F-6). June 22, 1989.

[Service] U.S. Fish and Wildlife Service. 1993. Biological opinion on the Prado Basin Water Conservation Project, Orange County Water District, Riverside and San Bernardino Counties, California (1-6-93-F-7).

[Service] U.S. Fish and Wildlife Service. 2000a. Formal section 7 consultation on the Prado Basin Water Conservation and Water Control Operations Project, Prado Basin, Riverside and San Bernardino Counties, California (1-6-99-F-75).

[Service] U.S. Fish and Wildlife Service. 2000b. Amendment to formal section 7 consultation, Santa Ana Mainstem Project, Orange County, California (1-88-F-6-R1).

[Service] U.S. Fish and Wildlife Service. 2001a. Biological opinion on the Prado Mainstem and Santa Ana River Reach 9 Flood Control Projects and Norco Bluffs Stabilization Project, Orange, Riverside, and San Bernardino Counties, California (FWS-SB-909.6).

[Service] U.S. Fish and Wildlife Service. 2001b. Formal section 7 consultation/conference for the San Timoteo Creek Reach 3B Flood Control Project, San Bernardino County, California (FWS-SB-740.4).

[Service] U.S. Fish and Wildlife Service. 2002a. Biological opinion for the Prado Dam Water Conservation and Supply Study, Orange, Riverside, and San Bernardino Counties, California (FWS-WRIV-2102.3).

[Service] U.S. Fish and Wildlife Service. 2002b. Section 7 consultation for operations of Seven Oaks Dam, San Bernardino County, California (1-6-02-F-1000.10).

[Service] U.S. Fish and Wildlife Service. 2003. Biological opinion on the Car Wash Strip Mall

Project feature, Santa Ana River Mainstem Flood Control and Norco Bluffs Toe Stabilization Projects, Orange, Riverside, and San Bernardino Counties, California (FWS-OR-909.9).

[Service] U.S. Fish and Wildlife Service. 2004. Reinitiation of formal section 7 consultation for the Prado Mainstem and Santa Ana River Reach 9 Flood Control Projects and Norco Bluffs Stabilization Project, Orange, Riverside, and San Bernardino Counties, California (FWS-SB-909.13).

[Service] U.S. Fish and Wildlife Service. 2011. 5-year review for Santa Ana sucker (*Catostomus santaanae*). Carlsbad Fish and Wildlife Office, Carlsbad, California.

[Service] U.S. Fish and Wildlife Service. 2012. Reinitiation of formal section 7 consultation for the Prado Mainstem and Santa Ana River Reach 9 Flood Control Projects and Norco Bluffs Stabilization Project, Orange, Riverside, and San Bernardino Counties, California (FWS-SB/WRIV/OR-08B0408-11F0551).

[Service] U.S. Fish and Wildlife Service. 2013a. Reinitiation of Formal Section 7 Consultation on the Santa Ana River Project, Reach 9 Phase 3, San Bernardino, Riverside and Orange Counties, California (FWS-OR-08B0408-13F0036).

[Service] U.S. Fish and Wildlife Service. 2013b. Reinitiation of Formal Section 7 Consultation on the Santa Ana River Project, California Institute for Women Dike Component, San Bernardino, Riverside and Orange Counties, California (FWS-SB-08B0408-13F0233).

[Service] U.S. Fish and Wildlife Service. 2013c. Reinitiation of Formal Section 7 Consultation on the Santa Ana River Project, Reach 9 Phase 3, San Bernardino, Riverside and Orange Counties, California (FWS-OR-14B0408-14F0059).

[Service] U.S. Fish and Wildlife Service. 2014a. Draft Recovery Plan for Santa Ana sucker (*Catostomus santaanae*). Region 8, U.S. Fish and Wildlife Service, Sacramento, California.

[Service] U.S. Fish and Wildlife Service. 2014b. Data compiled from 2014 Riverwalk Survey data sheets. On file in the Carlsbad Fish and Wildlife Office, Carlsbad, California.

Personal Communications and Observations

Jones, C. 2015. Biologist, Ecosystem Planning Section, U.S. Army Corps of Engineers, Los Angeles District. Telephone conversation with Christine Medak, Carlsbad Fish and Wildlife Office, Carlsbad, California. March 4, 2015.

ENCLOSURE

Additional project information needed to evaluate the impacts of the proposed Bank and Bridge Protection Projects along the Santa Ana River, Riverside and Orange Counties, California, on federally listed species and designated critical habitat.

1. Proposed Changes in Conservation Measures: The Draft SEA/EIR includes mitigation measures (referred to in this document as environmental commitments) from a multitude of environmental documents. To facilitate our understanding of the proposed commitments related to this consultation relative to Conservation Measures included in prior consultations, please clarify any proposed changes/additions to the Conservation Measures included in the 2012 biological opinion (Service 2012). FWS-1

2. Calculation of Permanent and Temporary Impacts:

   a. It appears the calculation of permanent and temporary impacts takes into account "permanent impacts" from past projects rather than calculating impacts based only on existing conditions. This may be appropriate, but it requires additional explanation. For example, on page 5-106: "permanent impacts associated with the new grouted stone structure were calculated only for that portion of the buried toe that extends beyond the toe of the existing structure." Please provide information to support the conclusion that vegetation communities growing above the toe of the existing levees were considered permanently impacted and mitigated as part of the original levee construction projects. FWS-2a

   b. Clarify the extent and location of the existing levees in the figures for each project component. It is not clear from information presented that existing levees extend along the entire length of the proposed projects (e.g., east end of Reach 9 Phase 5B, all of Reach 9 Phase 4). FWS-2b

   c. Clarify if the numbers presented in the impact tables (e.g., Table 5.5-4) are based on the footprint of impacts presented in the impact figures (e.g., Figures 5.5-1a-1b). FWS-2c

   d. Areas mapped as disturbed in Figures 5.5-1a-4b include areas that were temporarily disturbed during construction of other projects (including the SARP) and were anticipated to be restored following completion of construction. Clarify the extent of areas that were previously anticipated to be restored but are now anticipated to be permanently impacted. FWS-2d

   e. For areas previously disturbed by construction, clarify if additional measures will be necessary to restore temporary impacts due to repeated compaction of the soil by heavy equipment. In addition, address the potential for the extended period of disturbance (several years) to increase the spread of non-native invasive plant species into adjacent undisturbed vegetation. FWS-2e

   f. The permanent impacts are limited to the footprint of the proposed embankment (excluding the footprint of the existing levees); however, all areas permanently isolated FWS-2f

from flood flows behind the embankment (including areas disturbed by prior construction projects but anticipated to be restored) should also be considered permanently impacted if they will no longer support the existing vegetation community (e.g., Reach 9 Phase 4).

3. Permanent Impacts to the Santa Ana River Canyon Habitat Management Area: The Santa Ana River Canyon Habitat Management Area (HMA) was to be "operated and maintained for open space and wildlife habitat values" by the County of Orange as mitigation for the SARP (Corps 1988). In addition, the Corps has committed to maintaining a baseline level of riparian vegetation, habitat for the least Bell's vireo, within the HMA (Service 2001, 2012). Clarify how permanent impacts within the HMA from the additional proposed projects will affect the baseline of riparian vegetation and the total open space available for wildlife.

FWS-3

4. Encroachment into the Floodplain: According to the Draft SEA/EIR (Section 5.2), encroachment of the proposed project into the river floodplain is not expected to affect channel capacity, water surface elevation, or velocity. Additional information is needed to substantiate this conclusion:

a. Provide a comparison of water velocities immediately downstream from the BNSF Railroad Bridge with and without the proposed project. A project-related increase in water velocity below the BNSF Railroad Bridge has the potential to impact habitat restored for the Santa Ana sucker by the Corps as part of the Reach 9 Phase 2B component of the SARP.

FWS-4a

b. The analysis of impacts to hydrology for the Reach 9 Phase 4 Project assume a floodplain width of approximately 700 to 900 feet; however, it appears the floodplain will be confined to a width of about 300 feet between the east ends of the Reach 9 Phase 4 and Reach 9 Phase 5B Projects. Clarify how the reduction in floodplain width will affect the extent of riparian vegetation over time.

FWS-4b

5. Grade Control Structures Considered in the Scour Profile Modeling: Modeling was conducted to determine the maximum scour profile (depth of the streambed) and required scour design profiles (i.e., depth of the toe of the embankment) for each project component (Draft SEA/EIR, Appendix A, Figure 5). Several grade control structures are evident in the scour profile and appear to coincide with riprap placed to temporarily protect the Santa Ana River Interceptor Line (SARI Line) until it could be relocated out of the river floodplain (e.g., locations approximately 6,000, 8,000, 18,500, 25,000, 27,000 feet upstream from Weir Canyon Grade Control Structure). We anticipated the riprap would be removed or notched following completion of the SARI Line Protection/Relocation Project, as indicated in the Draft SEA/EIR (page 4-54). Clarify if the proposed project design depends on maintaining existing grade control structures in place and if these structures will be maintained in a manner that will alter habitat for the Santa Ana sucker and/or impede upstream migration.

FWS-5

6. Impacts to Wildlife Movement: The Draft SEA/EIR (page 5-39) acknowledges that the Corps is required to maintain wildlife movement and habitat connectivity within the HMA commensurate with baseline conditions. The 2001 biological opinion for the SARP discusses

the importance of maintaining wildlife corridors within Reach 9 for preserving the ecological integrity and function that sustains the local population of least Bell's vireos (Service 2001). In particular, large predators (e.g., coyotes, bobcats, mountain lions) help to control populations of smaller predators (e.g., raccoons and feral cats) that can exert strong predation pressure on songbird populations in fragmented habitat. Insufficient information is provided to support a conclusion that the proposed Reach 9 Phase 4 and BNSF Railroad Bridge components of the SARP will maintain wildlife movement commensurate with baseline conditions. Clarify and support the Corps' expectations regarding wildlife movement for large predators:

a. The Reach 9 Phase 4 component includes switchback ramps that will be incorporated into the embankment below each side drain to facilitate wildlife movement (Draft SEA/EIR, mitigation measure EC-BR-13); however, the embankment will be constructed of soil cement with a 1:1 slope ratio. Identify specific changes in the dimensions of the side drains, the extent of vegetation surrounding the drain openings, and the height of the drain openings above the ground following anticipated bed degradation. Clarify the Corps' expectations for wildlife use of the soil cement switch back ramps and the potential for the ramp to exit into the active channel relative to future drainage patterns with anticipated bed scour.

FWS-6a

b. Protection of the BNSF Railroad Bridge includes sheet pile and concrete walls on both sides of the river. Clarify anticipated wildlife movement paths if the river flows adjacent to the proposed vertical walls.

FWS-6b

Conservation Measures recommended to address existing threats to recovery of the Santa Ana sucker from operations of the Prado Dam

7. Impacts due to Changes in Water Quality below Prado Dam: The Draft SEA/EIR (page 5-29) indicates that Reach 9 is "water quality limited" and requires the development of a Total Maximum Daily Load for indicator bacteria by the U.S. Environmental Protection Agency. Increases in water holding periods above Prado Dam were anticipated due to the SARP; however, changes in total dissolved solids and bacteria levels as a result of longer holding periods were determined to be unpredictable (Corps 1988, page SEIS-V-27-28). We are concerned that changes in water quality resulting from the operations of the SARP may be limiting the potential for Reach 9 to support a viable population of Santa Ana sucker. Long-term streamflow and water quality data are available for a gage station 2 miles downstream from Prado Dam (Draft SEA/EIR, page 5-29). Provide a comparison of water quality before and after the new Prado Dam outlet became operational in 2008. Compare water quality below Prado Dam with areas occupied by the Santa Ana sucker upstream from the influence of the dam operations. Determine the cause of the reduction in water quality and alternative operations and/or measures to reduce any degradation to water quality associated with operating Prado Dam, relative to what was anticipated in prior consultations with our agency.

FWS-7

8. Based on the most recent information available, clarify how SARP-related increases in sediment deposition upstream from Prado Dam and bed degradation below Prado Dam will

affect the least Bell's vireo and Santa Ana sucker. This information is needed for evaluating the baseline condition for the species and should be used by the Corps to identify appropriate measures to minimize and offset anticipated SARP-related changes in habitat for least Bell's vireo and Santa Ana sucker, relative to what was anticipated in prior consultations on the SARP with our agency. Some potential measures to consider in the near term include:

a. Bypassing sediment around Prado Dam – Sediment management will reduce the extent of scour below Prado Dam and decrease the amount of sediment backing up above Prado Dam. A reduction in sediment accumulation behind Prado Dam will increase the extent of spawning and foraging habitat available for Santa Ana sucker and reduce the number of days habitat for the vireo is inundated by water held upstream of the dam. A reduction in bed degradation downstream from Prado Dam will maintain the appropriate substrate composition and gradient for Santa Ana sucker and prevent a reduction in the extent of riparian vegetation available for the vireo (i.e., due to channel incision).

FWS-8a

b. Reducing degradation in Reach 9 by installing grade stabilization structures resembling natural riffles that will not impede fish passage. The Corps could coordinate with Orange County Sanitation District to relocate riprap placed to temporarily protect the SARI Line and supplement the riprap with river rock of various sizes to create the riffles. This may reduce the extent of bed degradation and channel incision over time.

FWS-8b

c. Modifying drop structures between Weir Canyon and Imperial Highway to allow fish passage and an increase in the extent of habitat for the Santa Ana sucker below Prado Dam. The drop structures impede fish passage and create favorable habitat conditions for non-native fish species such as largemouth bass that are predators on Santa Ana sucker.

FWS-8c

d. Increasing the contribution of gravel and cobble sediment at the top end of the range of the Santa Ana sucker (i.e., near La Cadena Avenue) to offset the reduction in habitat near Prado Dam. Large releases from Seven Oaks Dam could be used to periodically flush sediment downstream or habitat could be artificially enhanced through regular management activities (i.e., placement of appropriate substrate, boulders, woody debris).

FWS-8d

e. Creating additional habitat in tributaries to the Santa Ana River. Potential opportunities include removing the cement lining from Sunnyslope Creek above the occupied habitat and providing access into Evans Creek through modification of the drop structure through the Riverside Levee.

FWS-8d

Additional measures that should be considered in the long term include:

a. Modifying the outlet channel to increase energy dissipation.

FWS-8(a-c)

b. Modifying the outlet to allow sluicing of sediment through Prado Dam

c. Development and implementation of a plan to reintroduce Santa Ana suckers to the Santa Ana River above Seven Oaks Dam consistent with the recommendations in our draft recovery plan for the sucker (Service 2014, Action 4.2.1: Priority 1).

Literature Cited

[Corps] U.S. Army Corps of Engineers. 1988. Santa Ana River Design Memorandum No. 1 Phase II GDM on the Santa Ana River Mainstem including Santiago Creek. Main Report & Supplemental Environmental Impact Statement. August 1988.

[Service] U.S. Fish and Wildlife Service. 2001. Biological opinion on the Prado Mainstem and Santa Ana River Reach 9 Flood Control Projects and Norco Bluffs Stabilization Project, Orange, Riverside, and San Bernardino Counties, California (FWS-SB-909.6).

[Service] U.S. Fish and Wildlife Service. 2012. Reinitiation of formal section 7 consultation for the Prado Mainstem and Santa Ana River Reach 9 Flood Control Projects and Norco Bluffs Stabilization Project, Orange, Riverside, and San Bernardino Counties, California (FWS-SB/WRIV/OR-08B0408-11F0551).

[Service] U.S. Fish and Wildlife Service. 2014. Draft Recovery Plan for Santa Ana sucker (*Catostomus santaanae*). Region 8, U.S. Fish and Wildlife Service, Sacramento, California.

Response to Comments: USFWS Letter (Mar 31, 2015)

A response to the letter, including the requested information was provided by letter dated April 15, 2015. Both the USFWS letter and the Corps response are included in full in this appendix. Following is a summary of the specific information requests, conservation recommendations and initial Corps response, followed in some instances by an updated response based on continued coordination and analysis.

FWS-1: All Conservation Measures from the biological opinion that apply to Reach 9 have been incorporated into the Draft SEA (for instance, BR-18 which addresses non-native removal requirements to compensate for temporary and permanent impacts to riparian and other floodplain habitat). The Corps is not proposing to change or modify the Conservation Measures or mitigation strategy included in the 2012 biological opinion. Many of the environmental commitments (which include avoidance, minimization and mitigation measures) identified in the Draft SEA are related to protecting or mitigating general biological or other environmental resources, and are not strictly or directly related to listed species, and therefore were not listed in the 2012 BO. For instance, EC-BR-6 addresses compensation for oak tree impacts, and EC-BR-13 addresses wildlife movement at Phase 4.

FWS-2a: Any floodplain vegetation occurring within backfilled areas on top of existing or proposed structural improvements will be considered to be permanently affected by these actions and will be mitigated according to the mitigation strategy described in the 2012 BO. It is unclear at this time whether non-Federal entities mitigated for permanent impacts to vegetated areas for the construction of the Caltrans or Yorba Sur embankments. The Corps is not responsible for previous vegetation losses or floodway encroachments. However, to the extent that those areas have been impacted, those permanent impacts are considered part of the baseline condition. Many of the existing embankment footings, especially on the north side of the river, are buried under dirt roads or other areas mapped as "disturbed/barren." Even so, some of this area will be replanted or will recover naturally within backfilled areas, at least unless or until bed degradation occurs. Vegetation impacts beyond the edge of the new toe are considered temporary and will be mitigated according to the terms of the 2012 BO.

The Corps considers this to be a very conservative approach that will likely result in addressing impacts that are attributable to other entities' actions and not this Federal Action, although as already stated, the amount of vegetation within existing backfilled areas is not substantial.

Update to response: The Corps has completed additional GIS mapping that fully accounts for all existing vegetation within the project area, whether or not that vegetation occurs within the footprint of an existing structure. Updated maps and exhibits are included in the Final SEA/EIR Addendum. As previously stated, all temporary or permanent impacts to existing vegetation within the project footprint will be mitigated according to requirements outlined in the 2012 BO Amendment.

FWS-2b: None of the existing or proposed features within the action area are considered levees although the description may suggest otherwise. Levees are structures which would rise above the existing channel banks and have a back slope. The existing non-Federal structures functionally serve as bank protection, resisting erosion of the banks at the existing grade. The Federal Action areas (Phases 4, 5A and 5B) follow existing engineered banks for the vast majority of their length. The upstream-most end of Phase 5B is not adjacent to an armored bank, but follows the existing railroad embankment. Figures 1-6 includes the current and proposed protection alignments in the vicinity of each feature.

Update to response: The Corps has completed additional GIS mapping that more accurately depicts existing and proposed protection. Updated maps and exhibits are included in the Final SEA/EIR Addendum. In addition, several

Update to response: The Corps has completed additional GIS mapping that more accurately assesses anticipated vegetation impacts. This information was provided to the FWS and is included in the Final SEA/EIR Addendum.

FWS-2d: There are three areas totaling 0.76 acres in size (0.63 acres of coastal sage scrub and 0.13 acres riparian) that had been previously (temporarily) impacted by SARI Line construction and will be impacted by this Federal Action. The largest of the three sites that included restoration commitments for 0.41 acres upland and 0.13 acres riparian is shown partially overlapped by Phase 5B on Figure 3. Although not shown on the map, the other two sites fall entirely within the Phase 5B footprint and would now be permanently affected. Figures 7-9 show the overlap of other aspects of the Federal Action on previous SARP construction limits that either had been restored, or in the case of portions of Phase 3 and 2A, have not been restored pending upcoming construction. As shown in Figure 7, a portion of the Phase 5A grouted stone segment (totaling 0.6 acres of permanent impact) will be constructed in an area that was previously disturbed for Phase 1. Figure 8 shows that a small portion (0.37 acres) of the BNSF bridge abutment in-between the Mobile Home Park and Phase 2A embankments will be located in an area that had been temporarily disturbed for those project features. Figure 9 shows that almost the entire length of the Phase 4 feature (2.14 acres) will be constructed in an area that had been previously disturbed by the Phase 3 temporary construction easement and/or staging areas. All areas of temporary and permanent impact were identified in the Reach 9 SEA and will be mitigated, although that document did not distinguish areas that had previously been affected by other project features.

Update to response: The Corps has completed additional GIS mapping that more accurately depicts and measures areas of overlap between proposed and previous construction. Areas that had been temporarily affected by previous construction but will be permanently affected by the proposed project have been defined and re-categorized as floodplain habitat rather than "disturbed," and mitigation estimates have been revised accordingly. This information was provided to the FWS and summary maps and tables are included in the Final SEA/EIR Addendum.

FWS-2e: The Corps intends to take whatever measures are required within the TCE to ensure a successful re-establishment of native vegetation, whether or not the site had been previously impacted. We anticipate that for disturbed or repeatedly disturbed and restored areas, measures would include de-compaction of soil, the use of soil amendments or replacement of stockpiled topsoil to restore appropriate physical and chemical parameters consistent with surrounding native soil types. Consistent with other restoration areas and the 2012 BO, the TCE will then be hydroseeded and, or planted with a native palette, and weeded for a minimum of five years after construction to ensure that non-native invasive species do not establish or spread to (or from) adjacent areas.

As an example, an approximately 12 acre area that was initially disturbed by Phase 3 construction will be restored by the Phase 4 contractor because of overlapping boundaries. (The Corps purposefully designed the Phase 4 feature to re-use previously impacted areas for staging and access to the extent possible, in order to minimize cumulative effects to the floodplain.) When Phase 3 construction was completed, the bare area was coated with an organic based soil binder for dust control purposes until Phase 4 construction begins. Restoration of the area will include the steps outlined above (decompaction, soil testing. adding soil admendments, hydroseeding/ planting and weeding).

FWS-2f: Based on a review of existing and "pre-Reach 9 Phase 3" vegetation maps, as well as the hydrology maps provided in response to item 4b, there does not appear to be any vegetation within temporary impact areas behind the proposed Phase 4 embankment that is currently supported by flood flows. The Corps does not anticipate that the character of any "isolated" vegetation would change as a result of this action. Therefore, there would be no permanent impacts to areas between the Phase 4 embankment and the freeway.

Update to response: The Corps re-examined the Phase 4 plans and recognized that a small strip of native "habitat" was to be included between the soil cement embankment and the freeway. The purpose was primarily for landscaping. As this will not be functional habitat, the Corps has ensured that this entire zone (or the portions that had not been previously developed) has been accounted for as a permanent impact area.

FWS-3: With restoration of temporary impact areas and after the constructed features are backfilled and replanted, the proposed action will not reduce the baseline amount of riparian vegetation within the Habitat Management Area, and will not reduce the total open space available for wildlife. Most areas that are considered for mitigation purposes to be "permanently affected" (see response to 2a) will in fact be backfilled and continue to support vegetation unless or until future high flows result in bed degradation and shifting of the active river channel. This eventuality, should it occur, is already accounted for in the Habitat Management Plan. Habitat values will be fully mitigated in accordance with the terms of the 2012 BO. If necessary to ensure that there is not an immediate loss of baseline habitat due to construction of these features, a portion of the required mitigation could be implemented within Reach 9. Moreover, habitat within temporarily affected areas may be improved over time compared to existing conditions as non-native vegetation is removed and replaced with a more diverse native palette.

FWS-4a: Channel capacity will not be reduced, and water surface elevation and velocity will not be increased due to construction of BNSF bridge protection. The BNSF bridge protection feature is designed to shift the erosive forces from the piers to the proposed pier nose extensions. The pier nose extensions will not cause any appreciable flow velocity changes immediate downstream from the BNSF Bridge. Moreover, the new grading plan for the low flow channel will extend across two of the bay openings, whereas currently the low flow channel goes through only one bay. A HEC-RAS model was used to verify that the flow velocities would be the same under both the "with-project" and "without project" condition at the downstream end of the railroad bridge. For instance, for a 30,000 cfs release, the flow depth under both scenarios would be 19.35 feet and the velocity would be 11.86 feet per second. Similarly, there would be no change to flow velocity associated with smaller and more frequent releases. Therefore, construction of the BNSF bridge protection feature would have no influence on the restored perennial stream within the Phase 2B area. As the bridge is still the same width (although the low flow will be expanded), channel capacity will not be lost and water surface elevation will not be increased.

FWS-4b: This Federal Action will not reduce the floodplain width and therefore will not have impacts to riparian vegetation beyond the direct effects specified in the SEA. The bank protection alignment protects the existing bank of the channel and ties into high ground at the upstream extent. See Figures 10-12 attached to this enclosure. Figures 10 and 11display the design discharge inundation extents throughout Reach 9. Figure 12 provides a closer view of the Phase 4 area and compares the Phase 4 alignment with the design discharge inundation extents. Figure 12 confirms that while the Phase 4 alignment turns toward the center of the channel (following existing high ground), it does not encroach upon the expected inundation area. As a result, Phase 4 would not affect the inundation footprint or hydraulic properties (water surface elevation or velocities), and therefore would have no influence on the extent of riparian vegetation supported by these dynamics.

The alignment extends further upstream than the original CalTrans embankment to tie into high ground and to protect against observed flow impingement that may increase due to the planned removal of the temporary SARI rock groin protection. With the removal of the rock groin, a shorter Phase 4 alignment (if proposed) may allow for flows to impinge upon the bank upstream of the protection, thus compromising the project and protected banks.

Update to response: In further coordination with USFWS and CDFW, the Corps has agreed to delete the upstream-most segment of the Phase 4 project that turned away from the freeway to follow high ground adjacent to State Parks land. The Corps will continue to analyze the need for this segment and evaluate alternatives. If it is determined that additional protection is necessary, the Corps will prepare supplemental environmental documentation and seek necessary permits/approvals at that time.

FWS-5: The Federal Action does not depend upon maintaining the temporary riprap grade control structures, which were put in place to protect the SARI Line. As required by Corps Regulatory permits, the structures are to be removed by the Orange County Sanitation District upon completion of the SARI Line relocation.

FWS-6a: The wildlife ramps are intended to provide ease of entry/exit in the future, if the channel bed were to scour below the bottom of the culvert opening. This is expected to preserve the ability of wildlife movement into the future. The potential maximum scour depths are detailed in **Table 1** (see April 15 response letter). We expect some animals, including coyotes and bobcats might be physically able to navigate the soil cement slope without a ramp, but the ramp is expected to make the openings easier to use and find. The ramp could be covered with soil to make it more suitable for a variety of wildlife species. This type of feature does not exist with the existing bank protection, so it is anticipated to be an improvement over the existing condition. Please see **Figure 6(a)-3** in the response letter, for some photographic examples of the switch back ramps that were implemented within the Reach 9 Phase 3 feature, which is a very similar soil cement bank protection feature when compared with the Reach 9 Phase 4 feature.

Update to response: The upstream-most culvert extension depicted and discussed in the April 15 response letter is no longer part of the current proposed project. No modifications to that culvert are proposed at this time[l1].

FWS-6b: Wildlife is expected to be able to move through the BNSF Railroad Project Area in a manner similar to what they would in the existing condition. Steps have also been taken to improve the long term viability of this area for wildlife movement, even though this particular location currently represents a pinch point. Wildlife can continue to make at grade crossings over the railroad. Wildlife can also move beneath the railroad between east and west abutments and Piers 1 and 6, respectively. The April 15 response letter and its enclosures describe the specific movement paths for this location.

FWS-7: The Corps appreciates the recommendations for analyzing changes in water quality downstream of Prado Dam. These are good suggestions that would be a worthwhile analysis as part of the issuance of the Prado Dam OMRR&R manual and associated impact assessment and consultation. The Corps has already initiated development of a plan of action for assessing impacts to sediment movement and associated geomorphological changes that may be occurring upstream and downstream of Prado Dam, due to flood control operations. While additional work on the plan of action is required to include a more in-depth assessment of previous modeling efforts, the Corps will provide the current version to your agency for review. We expect to complete the plan of action this fiscal year, begin implementation in early FY16, and complete the analysis within another one or two years, unless it is determined that longer-term study is required to fully answer all of the questions. The recommended water quality assessment will be incorporated into this study. It should be noted, however, that differences in water quality between Reach 9 and the occupied Santa Ana sucker habitat upstream of the dam are likely due to more than dam operations, as there are also substantial differences in topography and other factors that could influence water quality. However, the Corps is willing to consider operational changes that would improve water quality as long as they do not affect approved or proposed flood control and water conservation objectives.

FWS-8: See response to #7 on plans for and timing of the sediment/geomorphology study.

FWS-8a: The Corps is involved in two separate but connected efforts to evaluate the potential for bypassing sediment around Prado Dam, and to assess potential benefits to upstream and downstream habitat. As your agency is aware, the Corps is processing an outgrant proposal by Orange County Water District (OCWD) to implement a demonstration project along these lines, while at the same time developing the Prado Basin Feasibility Study that has both ecosystem restoration and water conservation objectives. Sediment bypass is one of the key measures that is being investigated in the feasibility study that would potentially benefit both objectives. It is anticipated that feasibility study would be completed in FY17.

FWS-8b: In-stream habitat improvements are being investigated as part of the Prado Basin Feasibility Study. This conservation measure will be considered as one method of achieving the objectives of that Study.

Update to response: In coordination with USFWS, this recommendation has been further developed as one of the optional measures for mitigating impacts to Santa Ana sucker habitat associated with BNSF Bridge protection. This information has been included in the Final SEA/EIR Addendum.

FWS-8c: The Corps is willing to consider this possibility as either a measure to address impacts of the issuance of the final Prado Dam OMRR&R manual, or as part of the Prado Basin Feasiblity Study, as long as the scope of this conservation measure is within the Corps' existing authority. Specifically, if it requires only a minor modification (i.e., notching) of any structures, and is determined to have no effect on authorized or proposed flood control and water conservation operations. This possibility has already been discussed in very general terms by USFWS and certain Corps staff, but would need to be evaluated more fully in terms of costs, technical feasibility, authority, operational impacts, and other environmental impacts (as the character of habitat in the vicinity could change, which may also result in changes to the "baseline" of riparian habitat identified in the Habitat Management Plan). The Corps will continue to coordinate with the USFWS to more fully understand the issue and objectives, and determine if there are less costly or more practicable measures that could be implemented to achieve those objectives.

FWS-8d: The Corps is willing to investigate opportunities to improve habitat conditions within or upstream of active spawning grounds, which may include these suggested measures or others. Such improvements could be considered as mitigation for Reach 9 features such as Phase 3 (in lieu of ongoing efforts to address red algae issues) and, or BNSF bridge protection, or alternatively could be considered to offset impacts from Prado Dam operations. The Corps anticipates that placement of appropriate substrate and, or construction of small groins or other structures to capture cobbles and gravels would have a greater and longer-lasting benefit than periodic releases from Seven Oaks Dam, which would require substantial rainfall in order to build a sufficient pool elevation (under which circumstance there would already be moderate or high flows in the river channel from ungated tributaries). It is important to note that Seven Oaks Dam is the OMRR&R responsibility of the non-federal sponsors. Changes to the OMRR&R manual and water control plan would require further coordination with the non-federal sponsors.

Update to response: In coordination with USFWS, a portion of this recommendation has been further developed as mitigation for impacts to Santa Ana sucker habitat associated with previous Reach 9 Phase 3 bank protection. This information has been included in the Biological Opinion for the current project.

FWS-8e: The Corps is willing to investigate opportunities to improve habitat conditions within or upstream of active spawning grounds, which may include these suggested measures or others. Such improvements could be considered as mitigation for Reach 9 features such as Phase 3 (in lieu of ongoing efforts to address red algae issues) and, or BNSF bridge protection, or alternatively could be considered to offset impacts from Prado Dam operations. The Corps anticipates that placement of appropriate substrate and, or construction of small groins or other structures to capture cobbles and gravels would have a greater and longer-lasting benefit than periodic releases from Seven Oaks Dam, which would require substantial rainfall in order to build a sufficient pool elevation (under which circumstance there would already be moderate or high flows in the river channel from ungated tributaries). It is important to note that Seven Oaks Dam is the OMRR&R responsibility of the non-federal sponsors. Changes to the OMRR&R manual and water control plan would require further coordination with the non-federal sponsors.

Instead of or in addition to Items 8d and 8e, the Corps recommends continuing recent discussions that we have had with USFWS and others on opportunities for increasing populations of Santa Ana sucker. One option would be to assist the Riverside-Corona Resource Conservation District with proposed modifications to an artificial stream to enhance their captive breeding program for Santa Ana suckers. Another option that has been discussed frequently with USFWS staff is to relocate suckers and establish additional populations in areas that already support the

required habitat characteristics, but from which suckers have been extirpated. The Corps would also facilitate discussions with other affected stakeholders to ensure that they receive any necessary "take" or safe harbor agreement to cover their existing or planned activities in the area. The Corps would also require assurances of the amount and type of mitigation "credit" that would be applied to current or future Federal Actions prior to implementing habitat improvements or repopulation efforts.

Update to response: In coordination with USFWS, the concept of relocating captive-bred Santa Ana suckers has been further developed as one of the optional measures for mitigating impacts associated with BNSF Bridge protection. This information has been included in the Final SEA/EIR Addendum.

FWS-additional 8 a-c:

a and b: The Corps is willing to discuss these concepts with USFWS to determine how or whether it would potentially be feasible to modify the outlet structure as suggested, and to consider the potential benefits of doing so compared to other restoration measures (such as sediment bypass) that are already being investigated through the Prado Basin Feasibility Study.

Current authorities do not provide for modifications to the existing outlet structure. Other avenues to approve and, or authorize such a change would need to be further evaluated.

U.S. Fish and Wildlife Service
Carlsbad Fish and Wildlife Office
2177 Salk Avenue, Suite 250
Carlsbad, California 92008
760-431-9440
FAX 760-431-9624

California Department of Fish and Wildlife
South Coast Region
3883 Ruffin Road
San Diego, California 92123
858-467-4201
FAX 858-467-4239

In Reply Refer To:
FWS/CDFW-08B0408-15CPA0170

APR 29 2015

Josephine R. Axt, Ph.D.
Chief, Planning Division
U.S. Army Corps of Engineers, Los Angeles District
915 Wilshire Boulevard, Suite 930
Los Angeles, California 90017

Attention: Christopher Jones (CESPL-PD-RN)

Subject: Draft Supplemental Environmental Assessment and Addendum to Environmental Impact Report for Santa Ana River: Reach 9 Phases 4, 5A, 5B and BNSF Bridge, Counties of Orange and Riverside, California

Dear Dr. Axt:

The U.S. Fish and Wildlife Service (Service) and the California Department of Fish and Wildlife (Department), hereafter collectively referred to as the Wildlife Agencies, have reviewed the Draft Supplemental Environmental Assessment and Addendum to Environmental Impact Report (Draft SEA/EIR), dated January 2015, for the above referenced project. The proposed project and environmental documentation supplements a previous Federal Project, the Santa Ana River Mainstem Project (SARP), which is designed to provide protection to areas susceptible to floods ranging from 100-year to 190-year frequencies in San Bernardino, Riverside, and Orange Counties, as described in the *Final Supplemental Environmental Impact Statement/Environmental Impact Report for Prado Basin and Vicinity, Including Reach 9 and Stabilization of the Bluff Toe at Norco Bluffs* [2001 SEIS/EIR; U.S. Army Corps of Engineers (Corps) 2001].

The primary concern and mandate of the Service is the protection of public fish and wildlife resources and their habitats. The Service has legal responsibility for the welfare of migratory birds, anadromous fish, and endangered animals and plants occurring in the United States. Specifically, the Service is responsible for administering the Federal Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*), and provides support to other Federal agencies in accordance with the provisions of the Fish and Wildlife Coordination Act (16 U.S.C. 661 *et seq.*). The Department is a Trustee Agency and a Responsible Agency pursuant to the California Environmental Quality Act (CEQA; §§ 15386 and 15381, respectively) and is responsible for ensuring appropriate conservation of the state's biological resources, including rare, threatened, and endangered plant and animal species, pursuant to the California Endangered Species Act (CESA; Fish and Game Code § 2050 *et seq.*) and Fish and Game Code section 1600 *et seq.* The Department also administers the Natural Community Conservation Planning (NCCP) program, a California regional habitat conservation planning program.

A portion of the proposed project, the Burlington Northern and Santa Fe Railroad Bridge Protection Project (BNSF Bridge Project), is located within the plan area for the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP). On June 22, 2004, the Service issued a section 10 (a)(1)(B) permit and the Department issued a NCCP permit for the MSHCP. The MSHCP established a multiple species conservation program to minimize and mitigate habitat loss and the incidental take of covered species in association with activities covered under the permit. The Riverside County Flood Control and Water Conservation District (Riverside County), a Permittee of the MSHCP, is the local sponsor for this portion of the proposed project.

The proposed project is located within Reach 9 of the Santa Ana River, which extends approximately 7.4 miles between Prado Dam, Riverside County and Weir Canyon Road Bridge, Orange County. This area contains all remaining mature riparian vegetation in the lower river, between Prado Dam and the ocean outlet. It is also the only section of the Santa Ana River below Prado Dam that has not been channelized in conjunction with the SARP. The *Santa Ana River Design Memorandum No. 1 Phase II GDM on the Santa Ana River Mainstem, including Santiago Creek: Main Report & Supplemental Environmental Impact Statement* (1988 SEIS) for the SARP required Orange County to acquire and manage approximately 1,100 acres of floodplain within Reach 9 ("Habitat Management Area") as mitigation, including a portion of the project area, to be "operated and maintained for open space and wildlife habitat values" (Corps 1988).

The Wildlife Agencies offer the following general and specific comments and recommendations based on our review of the Draft SEA/EIR and our knowledge of biological resources in Reach 9 of the Santa Ana River. Due to the extent of clarifications requested and the scope of our concerns for impacts to biological resources, we recommend that a response to our comments be coordinated with us prior to issuance of any final environmental documentation for this project.

General Comments

FWS/DFW-0

The Draft SEA/EIR does not include information comparing the changes in impacts to biological resources anticipated in the 1988 SEIS and 2001 SEIS/EIR with the substantially different actual impacts that have resulted from the operations of Prado Dam. Without this information, the existing condition of the biological resources in the project area cannot be evaluated against future project impacts to these same resources. In addition, the Draft SEA/EIR does not adequately describe the extent of impacts from the proposed projects to the wildlife habitats committed to be conserved within the existing 1,100-acre Habitat Management Area or the potential impediments to wildlife movement from the proposed projects. Because the information in the Draft SEA/EIR identifies significant impacts to biological resources from existing operations of Prado Dam that were not anticipated in the 1988 SEIS or 2001 SEIS/EIR, a new EIS addressing these impacts appears warranted, and the Corps' lack of such analysis is not clear in the Draft SEA/EIR.

Specific Comments

FWS/DFW-1

1. <u>SARP-Related Changes in Hydrology/Fluvial Geomorphology:</u> The Corps previously determined that operation of Prado Dam would result in increased deposition of sediment within the dam basin and upstream up to 563 feet in elevation; this was predicted to modify sediment deposition in the river about 5.5 miles upstream from Prado Dam (Corps 1988). Despite the anticipated increase in sediment deposition, changes to habitats for species such

as the federally threatened Santa Ana sucker (*Catostomus santaanae*) and the federally and State-endangered least Bell's vireo (*Vireo bellii pusillus*, vireo) as a result of this sediment deposition were not evaluated in the environmental documentation for the project (Corps 1988, 2001). This modified sediment deposition may reduce the extent and function of habitat available for Santa Ana sucker due to changes in surface substrate composition and decrease the function of habitat for vireo due to increases in the length of time habitat is inundated by water held behind the dam. Current operations of Prado Dam allow water to be held to certain elevations for flood control or water conservation purposes. The reduction in capacity within the basin due to sediment deposition may also increase the effective water holding/inundation periods and consequently could impact the understory vegetation that otherwise supports nesting vireos.

The Corps concluded operational procedures at the dam and associated inundation of habitat within the reservoir pool would have no impact on Santa Ana suckers above the dam (Corps 2001). Based on observations since Prado Dam was constructed, substantially more deposited sediment exists behind the dam than originally anticipated, likely because modeling did not account for the extensive riparian woodland that has developed as a result of water pooling in the Prado Basin. In some areas of Prado Basin (e.g., near the terminus of the Santa Ana River within the basin) between 30 and 35 feet of sediment has already been deposited (Golder Associates 2011). Surveys conducted annually since 2006 indicate the river channel is predominantly sand substrate upstream for a minimum of 18.5 miles above Prado Dam (e.g., Service 2011), which is 76 percent of the remaining perennial stream habitat for Santa Ana sucker above the dam. In 2014, the vast majority of the riverbed was greater than 90 percent sand up to 23 miles above Prado Dam (Service 2014). Santa Ana sucker require a range of substrates for their life history, including gravel, cobble and mixtures of gravel or cobble with sand, to support breeding and foraging activities (e.g., Haglund *et al*. 2002, Service 2011). The continuing loss or degradation of habitat for the sucker due to modified sediment deposition caused by the dam features and related operations represents a serious threat to the persistence of the Santa Ana sucker in the Santa Ana River.

Downstream of Prado Dam, the Corps has reassessed the need for embankment protection in Reach 9 based on recent modeling efforts that indicate the potential for bed degradation (channel incision) is "more severe than originally anticipated" (Draft SEA/EIR, page 1-1). We are concerned that bed degradation below Prado Dam may reduce the functions and/or extent of habitats for sensitive species, including Santa Ana sucker and vireo. Habitat for the Santa Ana sucker could be adversely affected by changes in gradient and substrate composition. Changes in the extent of habitat for the vireo could result from project-related incision and/or widening of the channel and reduced function of riparian vegetation for breeding use.

In addition, the Draft SEA/EIR (Appendix A, page 3) indicates that Seven Oaks Dam (a component of the SARP) has an influence on Prado Dam operations. In particular, controlled releases from Seven Oaks Dam will contribute to the predicted 30,000 cubic feet per second (cfs) controlled release(s) from Prado Dam (Corps 1988) that necessitates the additional proposed channel embankment protection in Reach 9 under future watershed conditions.

The Corps acknowledged the effects of operating Prado Dam and Seven Oaks Dam on the hydrology/fluvial geomorphology of the Santa Ana River: "Implementation of the project would result in a basically irreversible alteration of the natural erosion patterns of the Santa Ana River" (Corps 2001, page 6-1) and has recently initiated studies to inform a potential restoration project along this stretch of the river. However, these studies could take several years to complete, and funding and nature of the restoration activities is not assured. The Wildlife Agencies recommend that the Corps commit to immediate, well-defined actions as part of the proposed action that will reduce sedimentation upstream of Prado Dam and reduce bed degradation downstream of Prado Dam. These actions could include periodic release of scouring flows from Seven Oaks Dam combined with dredging/pumping (or bypassing) of sandy material from upstream of Prado Dam to downstream. Such actions would have the combined benefits of improving habitat for the Santa Ana sucker upstream of Prado Dam and reducing the threats to infrastructure and loss of habitats downstream of Prado Dam from bed degradation. If these or similar measures are not currently practicable, artificial periodic augmentation of coarse sediment (sand, gravel, and cobble) material into the riverbed downstream of Prado Dam should be implemented in the near future to arrest bed degradation in Reach 9 in the short- and mid-term. This type of augmentation is already being performed below a number of dams in the western U.S. (for example, see Bunte 2004, Corps 2013). We expect that the costs of these measures would likely be partially offset through the savings associated with the resultant reduced need to armor areas downstream from continued bed degradation. The Wildlife Agencies propose to work with the Corps to develop these immediate management actions while additional studies are completed on the hydrology/geomorphology of the Santa Ana River.

2. Impacts due to Changes in Water Quality below Prado Dam: The Draft SEA/EIR (page 5-29) indicates that Reach 9 is "water quality limited" and requires the development of a Total Maximum Daily Load[1] for indicator bacteria by the U.S. Environmental Protection Agency. Increases in water holding periods above Prado Dam were anticipated due to the SARP; however, changes in total dissolved solids and bacteria levels as a result of longer holding periods were determined to be unpredictable (Corps 1988, page SEIS-V-27-28). We are concerned that changes in water quality resulting from the operations of the SARP may limit the potential for Reach 9 to support aquatic species, including the Santa Ana sucker. Long-term streamflow and water quality data are available for a gauge station 2 miles downstream from Prado Dam (Draft SEA/EIR, page 5-29). Please clarify any changes in water quality that have occurred since the new Prado Dam outlet became operational in 2008 and identify measures to mitigate changes in water quality as appropriate to allow for continued support of native aquatic species in Reach 9.

FWS/DFW-2

3. Environmental Commitments: The Draft SEA/EIR includes mitigation measures (referred to in this document as Environmental Commitments) from a multitude of environmental documents. To ensure a clear understanding of the proposed commitments, we recommend a comprehensive list of mitigation measures be included in the final environmental documentation for this proposed project. It appears that in the process of updating

FWS/DFW-3

[1] Total Maximum Daily Load is the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards.

commitments, measure BR-18A from the 2001 SEIS/EIR may have been unintentionally omitted.

4. Calculation of Permanent and Temporary Impacts:

a. It appears the calculation of permanent and temporary impacts for the project takes into account "permanent impacts" from past projects rather than calculating impacts based only on existing conditions. This may be appropriate, but it requires additional explanation. For example, on page 5-106: "permanent impacts associated with the new grouted stone structure were calculated only for that portion of the buried toe that extends beyond the toe of the existing structure." Please provide information to support the conclusion that vegetation communities growing above the toe of the existing levees were considered permanently impacted and mitigated as part of the original levee construction projects.

FWS/DFW-4a

b. Please clarify the extent and location of the existing levees in the figures for each project component. It is not clear from information presented that existing levees extend along the entire length of the proposed projects (e.g., east end of Reach 9 Phase 5B, all of Reach 9 Phase 4).

FWS/DFW-4b

c. Please clarify if the numbers presented in the impact tables (e.g., Table 5.5-4) are based on the footprint of impacts presented in the impact figures (e.g., Figures 5.5-1a-1b).

FWS/DFW-4c

d. Areas mapped as disturbed in Figures 5.5-1a-4b include areas that were temporarily disturbed during construction of other projects (including the SARP) and were anticipated to be restored following completion of construction. Please clarify the extent of areas that were previously anticipated to be restored but are now anticipated to be permanently impacted.

FWS/DFW-4d

e. For areas previously disturbed by construction, please clarify if additional measures will be necessary to restore temporary impacts due to repeated compaction of the soil by heavy equipment. In addition, please address the potential for the extended period of disturbance (several years) to increase the spread of non-native invasive plant species into adjacent undisturbed vegetation.

FWS/DFW-4e

f. The permanent impacts are limited to the footprint of the proposed embankment (excluding the footprint of the existing levees); however, all areas permanently isolated from flood flows behind the embankment (including areas disturbed by prior construction projects but anticipated to be restored) should also be considered permanently adversely affected if they will no longer support the existing vegetation community (e.g., Reach 9 Phase 4). Please clarify the extent of permanent impacts on appropriate figures.

FWS/DFW-4f

5. Permanent Impacts to the Santa Ana River Canyon Habitat Management Area: The 1,100-acre Santa Ana River Canyon Habitat Management Area (HMA) was to be "operated and maintained for open space and wildlife habitat values" by the County of Orange as mitigation

FWS/DFW-5

for the SARP (Corps 1988). In addition, the Corps has committed to maintaining a baseline level of habitat for the vireo and riparian vegetation within the HMA (e.g., Service 2001, 2012). Please clarify how permanent impacts from the project within the HMA will affect the baseline of riparian vegetation and associated function, and the total open space available for native wildlife.

6. Encroachment into the Floodplain: According to the Draft SEA/EIR (Section 5.2), encroachment of the proposed project into the river floodplain is not expected to affect channel capacity, water surface elevation, or velocity. Additional information is needed to substantiate this conclusion:

   a. Please provide a comparison of water velocities immediately downstream from the BNSF Railroad Bridge with and without the proposed project. A project-related increase in storm water velocity below the BNSF Railroad Bridge (as we expect may occur with the project) has the potential to impact habitat restored for the Santa Ana sucker by the Corps as part of the Reach 9 Phase 2B component of the SARP.

FWS/DFW-6a

   b. The analysis of impacts to hydrology for the Reach 9 Phase 4 Project assumes a floodplain width of approximately 700 to 900 feet; however, it appears the floodplain will be confined to a width of about 300 feet between the east ends of the Reach 9 Phase 4 and Reach 9 Phase 5B Projects. Please clarify how the reduction in floodplain width will affect the extent of riparian vegetation over time.

FWS/DFW-6b

7. Grade Control Structures Considered in the Scour Profile Modeling: Modeling was conducted to determine the maximum scour profile (depth of the streambed) and required scour design profiles (i.e., depth of the toe of the embankment) for each project component (Draft SEA/EIR, Appendix A, Figure 5). Several grade control structures are evident in the scour profile and appear to coincide with riprap placed to temporarily protect the Santa Ana River Interceptor Line (SARI Line) until it could be relocated out of the river floodplain (e.g., locations approximately 6,000, 8,000, 18,500, 25,000, 27,000 feet upstream from Weir Canyon Grade Control Structure). Discussions regarding the removal of temporarily placed riprap following completion of the SARI Line Protection/Relocation Project are ongoing, as indicated in the Draft SEA/EIR (page 4-54). Please clarify if the proposed project design depends on maintaining existing grade control structures in place and if these structures will be maintained in a manner that will alter habitat for the Santa Ana sucker and/or impede upstream migration.

FWS/DFW-7

8. Impacts to Wildlife Movement: The Draft SEA/EIR (page 5-39) acknowledges that the Corps is required to maintain wildlife movement and habitat connectivity within the HMA commensurate with baseline conditions. Insufficient information is provided to support a conclusion that the proposed Reach 9 Phase 4 and BNSF Railroad Bridge components of the SARP will maintain wildlife movement commensurate with baseline conditions. Please clarify and support the Corps' expectations regarding wildlife movement (particularly for mountain lions, bobcats, gray fox, mule deer, and coyotes as umbrella planning species) in regards to the following:

a. The Reach 9 Phase 4 component includes switchback ramps that will be incorporated into the embankment below each side drain to facilitate wildlife movement (Draft SEA/EIR, mitigation measure EC-BR-13); however, the embankment will be constructed of soil cement with a 1:1 slope ratio. Identify specific changes in the dimensions of the side drains, the extent of vegetation surrounding the drain openings, and the height of the drain openings above the ground following anticipated scour. Please clarify anticipated wildlife movement paths if the river flows adjacent to the soil cement embankment.

FWS/DFW-8a

b. Protection of the BNSF Railroad Bridge includes sheet pile and concrete walls on both sides of the river. Please clarify anticipated functional wildlife movement paths through this area if the river flows adjacent to the proposed vertical walls (see also comments in 7 below).

FWS/DFW-8b

9. MSHCP Compliance: Section 15125(d) of the CEQA Guidelines requires environmental documents to discuss any inconsistencies between a proposed Project and applicable general plans and regional plans, including habitat conservation plans and natural community conservation plans. The Draft SEA/EIR includes an assessment of the consistency with the MSHCP and concludes that the BNSF Bridge Project will not conflict with the MSHCP. Some actions identified as future discretionary actions that will be implemented by Riverside County as part of the BNSF Project (e.g., property acquisition, encroachment permits, utility relocation, and future maintenance) were not addressed in the consistency analysis.

FWS/DFW-9

The MSHCP anticipated wildlife movement between the Santa Ana Mountains and Chino Hills State Park through an area referred to as proposed Constrained Linkage 1; however, a cooperative multi-agency effort is currently underway to improve limitations of the MSHCP and support a more effective linkage through "B Canyon." The proposed BNSF Bridge Project is located within and adjacent to B Canyon. Please clarify how the proposed BNSF Bridge Project, including future maintenance and utility relocation, will affect wildlife movement through B Canyon. In particular, we are concerned about potential future uses of the proposed temporary access road located east of B Canyon and extending under the BNSF Bridge. Vehicle and pedestrian traffic can reduce wildlife interest in using corridors and can contribute to long term degradation of natural habitats. We recommend the temporary access road be decommissioned and restored to native vegetation to support wildlife movement after project construction is complete.

The project will also permanently impact habitats defined by the MSHCP Riparian and Riverine Protection Policy (Section 6.1.2). Areas that contain habitats dominated by trees, shrubs, persistent emergent, or emergent mosses and lichens, which occur close to or depend upon soil moisture from a nearby fresh water source, or areas with fresh water flow during all or portions of the year are resources that must be considered under Section 6.1.2. We recommend the Draft SEA/EIR clarify how the proposed mitigation measures are consistent with the Riparian and Riverine Protection Policy.

10. Bat Roosts: Project work on or near bridge structures may result in take as defined in Fish and Game Code Section 4150 and/or disturbances to bats. Bats are considered non-game mammals and are afforded protection by State law from take and/or harassment (Fish and Game Code Section 4150, California Code of Regulations, Section 251.1). Several bat

FWS/DFW-10

species are also considered California Species of Special Concern (SSC) and meet the CEQA definition of rare, threatened or endangered species (CEQA Guidelines § 15065). Take of SSC could require a mandatory finding of significance by the Lead Agency (CEQA Guidelines § 15065). The following avoidance and minimization measures should be incorporated in Section 6.1: Environmental Commitments of the Final SEA/EIR: "In order to avoid the breeding season for bats, construction in and adjacent to bridge structures shall be avoided between January 1st and September 30th to the greatest extent feasible. If this is not possible, construction will occur after preconstruction surveys are conducted by a qualified biologist and no bat roosts or nurseries are found within the immediate Project area. Preconstruction bat surveys will include: 1) the exact location of all roosting sites (location shall be adequately described and drawn on a map), 2) the number of bats present at the time of visit (count or estimate), 3) each species of bat present will be named (include how the species was identified), 4) the location, amount, distribution and age of all bat droppings will be described and pinpointed on a map, and 5) the type of roost -- night roost (rest at night while out feeding) versus a day roost (maternity colony) -- will be clearly stated. Locations of all roosts will be kept confidential to protect them from disturbance."

11. State Regulations: The Draft SEA/EIR states that, "CESA permit (2081-2001-023-06) previously issued for the SARMP will be amended after receipt of a Biological Opinion by USFWS to address the proposed measures" (SEA/EIR, page 382). The Draft SEA/EIR also states that the Orange County Flood Control District (OCFCD) will be responsible for renewing or amending the existing Streambed Alteration Agreement (SAA; 1600-2009-0031-R6). The Department has concluded that current project activities are not included in the existing CESA permit and SAA; therefore, a new CESA permit and new SAA will be required. The final SEA/DEIR should reflect this and include a discussion of how the OCFCD will coordinate with the Department to acquire a new CESA permit and SAA.

FWS/DFW-11

We appreciate the opportunity to comment on the subject Draft SEA/EIR and are available to work with you to address our concerns. Should you have any questions regarding this letter, please contact Jon Avery of the Service at (760) 431-9440 extension 309, or Jennifer Edwards of the Department at (858) 467-2717.

Sincerely,

Karen A. Goebel
Assistant Field Supervisor
U.S. Fish and Wildlife Service

Gail K. Sevrens
Environmental Program Manager
California Department of Fish and Wildlife

cc: Jeff Brandt CDFW Region 6

Literature Cited

Bunte, K. 2004. State of the Science Review Gravel Mitigation and Augmentation Below Hydroelectric Dams: A Geomorphological Perspective. Stream Systems Technology Center, USDA Forest Service Rocky Mountain Research Station, Fort Collins, CO.

[Corps] U.S. Army Corps of Engineers. 1988. Santa Ana River Design Memorandum No. 1 Phase II GDM on the Santa Ana River Mainstem including Santiago Creek. Main Report & Supplemental Environmental Impact Statement. August 1988.

[Corps] U.S. Army Corps of Engineers. 2001. Prado Basin and Vicinity, Including Reach 9 and Stabilization of the Bluff Toe at Norco Bluffs Supplemental Final Environmental Impact Statement/Environmental Impact Report (State Clearinghouse No. 97071087) Riverside, San Bernardino and Orange Counties, California. Planning Division, Army Corps of Engineers, Los Angeles District, Los Angeles, California. November 2011.

[Corps] U.S. Army Corps of Engineers. 2013. Lower Yuba River Gravel Augmentation Project Yuba and Nevada Counties, California; Final Supplemental Environmental Assessment. Army Corps of Engineers, Sacramento District. July 2013.

Golder Associates. 2011. Assessment of water and sediment patterns within Prado Basin. Prepared for Orange County Water District, Fountain Valley, California.

Haglund, T. R., Baskin, J. N., and C. C. Swift. 2002. Results of the year 2 implementation of the Santa Ana Sucker Conservation Program for the Santa Ana River. Prepared for the Santa Ana Watershed Project Authority.

[Service] U.S. Fish and Wildlife Service. 2001. Biological opinion on the Prado Mainstem and Santa Ana River Reach 9 Flood Control Projects and Norco Bluffs Stabilization Project, Orange, Riverside, and San Bernardino Counties, California (FWS-SB-909.6).

[Service] U.S. Fish and Wildlife Service. 2011. Santa Ana sucker 5-year review: Summary and evaluation. Prepared by the Carlsbad Fish and Wildlife Office.

[Service] U.S. Fish and Wildlife Service. 2012. Reinitiation of formal section 7 consultation for the Prado Mainstem and Santa Ana River Reach 9 Flood Control Projects and Norco Bluffs Stabilization Project, Orange, Riverside, and San Bernardino Counties, California (FWS-SB/WRIV/OR-08B0408-11F0551).

[Service] U.S. Fish and Wildlife Service. 2014. Data compiled from 2014 Riverwalk Survey data sheets. On file in the Carlsbad Fish and Wildlife Office, Carlsbad, California.

Response to Comments: USFWS & CDFW Letter (April 29, 2015)

FWS/DFW-0: Any impacts related to operation of Prado Dam will be evaluated separately, concurrent with an anticipated update to the Water Control Manual that would modify dam operations. The current proposed action is to improve protection of the river banks and BNSF Bridge piers. Sufficient information is provided in the SEA/EIR Addendum to evaluate impacts associated with this action.

See Response to Comments USFWS Letter (Mar 31, 2015), response FWS-3.

The SEA/EIR Addendum evaluates impacts associated with construction of embankment and bridge protection features. No significant and unmitigable impacts to biological resources associated with the proposed action were identified. The SEA/EIR Addendum did not draw any conclusions regarding impacts from a potential change in dam operations, which would be addressed in a separate analysis/documentation. Existing operations and associated impacts were part of the baseline condition prior to preparation of either the 1988 SEIS or the 2001 SEIS/EIR.

FWS/DFW-1: These recommendations are related to dam operations rather than bank or bridge protection (the proposed action). However, the Corps has agreed to consider gravel augmentation in Reach 9 as a potential measure for mitigating effects of the proposed BNSF project. This information has been included in the Final SEA/EIR Addendum.

FWS/DFW-2: See Response to Comments USFWS Letter (Mar 31, 2015), response FWS-7.

FWS/DFW-3: Comment noted and revision made to Section 5.5.3 Environmental Commitment Section and Section 6 of the FSEA/EIR Addendum. BR-18A has been included. See also Response to Comments USFWS Letter (Mar 31, 2015), response FWS-1.

FWS/DFW-4: See Response to Comments USFWS Letter (Mar 31, 2015), response FWS-2(a-f).

FWS/DFW-5: See Response to Comments USFWS Letter (Mar 31, 2015), response FWS-3.

FWS/DFW-6: See Response to Comments USFWS Letter (Mar 31, 2015), response FWS-4(a-b).

FWS/DFW-7: See Response to Comments USFWS Letter (Mar 31, 2015), response FWS-5.

FWS/DFW-8: See Response to Comments USFWS Letter (Mar 31, 2015), response FWS-6(a-b).

FWS/DFW-9a: See Response to Comments USFWS Letter (Mar 31, 2015), response FWS-6 to address questions regarding potential impacts to wildlife movement.

The Corps has agreed to redesign the access road leading from Green River Road to move it farther from B Canyon, to reduce potential conflicts with wildlife movement.

FWS/DFW-9b: Section 5.5.2.4 of the SEA provides a summary of how impacts to riparian/riverine areas and vernal pools would be avoided, minimized or mitigated. Chapter 6 of the Final SEA/EIR Addendum also includes a

list of environmental commitments to avoid and minimize impacts to habitats and affected species. Based on this information, the BNSF project will not conflict with the MSHCP Riparian and Riverine Protection Policy.

FWS/DFW-10: The Corps and/or the non-federal sponsors shall continue to conduct bat surveys prior to construction of the BNSF Bridge and will coordinate with CDFW to determine appropriate avoidance and minimization measures. This commitment has been included in the Final SEA/EIR Addendum.

FWS/DFW-11: The Corps and OCFCD (CEQA lead) have been coordinating with CDFW staff. CDFW is considering whether a CESA permit is required, since impacts to State-listed species would occur during construction (which is overseen by the Federal government) and are not anticipated during routine maintenance. OCFCD is preparing an application for a new SAA, and if necessary will also apply for a CESA permit.

DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, U.S. ARMY CORPS OF ENGINEERS
915 WILSHIRE BOULEVARD, SUITE 930
LOS ANGELES, CALIFORNIA 90017

January 23, 2015

Office of the Chief
Planning Division

Mr. Mendel Stewart
Field Supervisor
U.S. Fish & Wildlife Service
2177 Salk Avenue, Suite 250
Carlsbad, CA 92008

Dear Mr. Mendel Stewart:

The U.S. Army Corps of Engineers, Los Angeles District (Corps) requests initiation of formal consultation with the U.S. Fish and Wildlife Service, pursuant to Section 7 of the Endangered Species Act of 1973, as amended. The subject of this consultation is a series of bank and bridge protection measures within Reach 9 of the Santa Ana River (Phases 4, 5A, 5B, and Burlington Northern and Santa Fe (BNSF) Railroad Bridge), associated with the Santa Ana River Mainstem Project. Enclosed is a copy of the Draft Supplemental Environmental Assessment/ Environmental Impact Report Addendum (SEA/EIR Addendum), which also serves as the Biological Assessment (BA) for the proposed project. Please see Chapters 1 to 4 for the Project Background, Project Location, Purpose and Need, and Alternatives descriptions, respectively. Chapter 5.5 contains a description and analysis of the existing conditions within the project area and potential effects to biological resources, including threatened and endangered species such as the least Bell's vireo (*Vireo bellii pusillus*), coastal California gnatcatcher (*Polioptila californica californica*), and Santa Ana sucker (*Catostomus santaanae*) and corresponding designated critical habitat. Chapter 6 contains a list of Environmental Commitments that are expected to avoid, minimize or mitigate potential effects of the proposed project.

The Corps has determined that the proposed project may adversely affect, but is not likely to jeopardize the continued existence of the least Bell's vireo, coastal California gnatcatcher, and Santa Ana sucker. The proposed project is not expected to adversely modify designated critical habitat for the coastal California gnatcatcher or Santa Ana sucker.

The proposed embankment protection features involve replacing existing soil cement and riprap protection along 4.48 miles of embankment on the north side of the river (Phases 5A and 5B), and 3,150 feet of embankment on the south side of the river (Phase 4), with a combination of grouted stone, soil cement and sheet pile. The BNSF Railroad Bridge feature would include protective features around the bridge pilings, as well as reinforced abutments. The existing embankment and pier protection is neither thick enough nor deep enough to withstand large flood releases from Prado Dam along with the anticipated riverbed scour. The project area begins at the BNSF Railroad Bridge crossing approximately 2.25 miles downstream of Prado Dam, in Riverside County, with embankment protection continuing downstream (where needed) another 5 miles, terminating in the City of Yorba Linda, Orange County, California.

This SEA/EIR Addendum amends the Final Supplemental Environmental Impact Statement and EIR for Prado Basin and Vicinity, dated November 2001, in compliance with the National Environmental Policy Act (NEPA), and serves as an addendum to the EIR for CEQA (California Environmental Quality

Act) purposes. The Prado Basin and Vicinity Project is part of the Corps' Santa Ana River Mainstem Flood Control Project, which provides flood protection to areas within San Bernardino, Riverside, and Orange Counties.

The 2001 SEIS/EIR had identified six distinct locations on the south and north banks of Reach 9 that required protection. The additional features described in the enclosed SEA/EIR Addendum were not specifically included in the 2001 SEIS/EIR, but were identified after additional technical (scour) studies were conducted and analyzed. These studies indicated that the existing embankment protection and bridge piers would not provide adequate, long-term protection for the 91 Freeway, river-adjacent development, the BNSF Railroad Bridge and other infrastructure.

Construction of Reach 9 Phases 4 and 5A is scheduled to begin in summer or fall of 2015, with remaining phases scheduled to begin over the next few years. Each phase, or feature, would take at least one or two years to complete, and would be followed by several years of habitat restoration. Initial vegetation removal within each of the work sites would occur prior to or after the nesting season.

In order to meet this schedule, the Corps would appreciate your review and completion of a Draft BO, or another amendment to the existing BO for the SARP, preferably by the end of April 2015. Please forward any comments on the Draft SEA/EIR Addendum by February 20, 2015.

Please submit any correspondence or comments to:

Josephine R. Axt, Ph.D.
Chief, Planning Division
U.S. Army Corps of Engineers
Los Angeles District
915 Wilshire Boulevard, Suite 930
Attention: Christopher Jones (CESPL-PD-RN)
Los Angeles, California 90017

If you have any questions regarding this project, please contact Christopher Jones, Project Biologist at (213) 304-6271 or via e-mail at christopher.t.jones@usace.army.mil.

Thank you for your attention to this document.

Sincerely,

Josephine R. Axt, Ph.D.
Chief, Planning Division

Enclosure

DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, U.S. ARMY CORPS OF ENGINEERS
915 WILSHIRE BOULEVARD, SUITE 930
LOS ANGELES, CALIFORNIA 90017

January 23, 2015

Office of the Chief
Planning Division

Mr. Marc Brown
Santa Ana Regional Water Quality Control Board
California Tower
3737 Main Street, Suite 500
Riverside, California 92501

Dear Mr. Brown:

The U.S. Army Corps of Engineers (Corps) requests a Section 401 Water Quality Certification (WQC) for the proposed construction of embankment and bridge protection features downstream of Prado Dam, in Riverside and Orange Counties, California. These features (Reach 9 Phases 4, 5A, 5B, and Burlington Northern and Santa Fe (BNSF) Railroad Bridge) are proposed as part of the Santa Ana River Mainstem flood control project (SARMP). This construction is required to protect State Route (SR)-91, the Santa Ana River Interceptor (SARI) line, the BNSF Bridge, and other river-adjacent development and infrastructure from damage that may occur as a result of anticipated scour that is projected from large releases from Prado Dam. The primary non-federal sponsor and lead agency under the California Environmental Quality Act (CEQA) for the project is the Orange County Flood Control District. Enclosed is a Supplemental Environmental Assessment/Environmental Impact Report Addendum (SEA/EIR Addendum), 404(b)(1) Evaluation, and application for WQC.

The Corps also requests your review of SEA/EIR Addendum, which contains additional information on the specific features of the project. This SEA/EIR Addendum amends the Final Supplemental Environmental Impact Statement and EIR for Prado Basin and Vicinity, dated November 2001, in compliance with the National Environmental Policy Act (NEPA), and serves as an addendum to the EIR for CEQA (California Environmental Quality Act) purposes.

The 2001 SEIS/EIR had identified six distinct locations on the south and north banks of Reach 9 that required protection. The additional features described in the enclosed SEA/EIR Addendum were not specifically included in the 2001 SEIS/EIR, but were identified after additional technical (scour) studies were conducted and analyzed.

As discussed in the enclosed SEA/EIR Addendum and in the 2001 SEIS/EIR, the Corps had requested 401 Certification for the Prado Dam and Vicinity Project on August 4, 2000. The Regional Board did not reply to the request and the Corps eventually assumed a waiver of Certification.

The proposed action that is the subject of this new WQC request is to replace existing soil cement and riprap protection along 4.48 miles of embankment on the north side of the river (Phases 5A and 5B), and 3,150 feet of embankment on the south side of the river (Phase 4), with a combination of grouted stone, soil cement and sheet pile. The BNSF Railroad Bridge feature would include protective features around the bridge pilings, as well as reinforced abutments. The existing embankment and pier protection is neither thick enough nor deep enough to withstand large flood releases from Prado Dam along with the anticipated riverbed scour. The project area begins at the BNSF Railroad Bridge crossing approximately

2.25 miles downstream of Prado Dam, in Riverside County, with embankment protection continuing downstream (where needed) another 5 miles, terminating in the City of Yorba Linda, Orange County, California.

The Corps does not issue itself a permit for civil works projects under Section 404 of the Clean Water Act (CWA). However, to comply with the CWA, a Section 404(b)(1) evaluation has been prepared for construction of the project and is included as an appendix to the Draft SEA/EIR Addendum. Environmental commitments and mitigation measures have been incorporated in the Draft SEA/EIR Addendum to minimize impacts to water quality and other resources. The proposed project is not expected to result in significant, adverse impacts to environmental resources, with the exception of temporary, construction related air quality impacts which were addressed in previous documents related to SARMP.

Section 404(t) of the CWA requires the Corps to comply with the State or Regional Boards' substantive and procedural requirements pertaining to the discharge of dredged or fill material including structural discharges. However, this Section does not authorize the payment of fees as a condition of compliance with these requirements. Fundamentally, as an agency of the Federal government, legal determination preclude the Corps from paying fees, except where Congress has clearly and unambiguously waived Federal sovereignty.

This letter, and the enclosed application, satisfies the requirements of the CWA to request Section 401 WQC pursuant to 33 CFR 336.1(a)(1). The Corps requests issuance of Section 401 WQC within sixty (60) days of submittal of this request. We would also appreciate any comments on the enclosed SEA by **February 20, 2015**. If your office does not respond to our request for 401 Certification within ninety (90) days of receipt of this letter, we will consider this project to be in full compliance with the Clean Water Act.

If you have any questions regarding the proposed project, please contact Mr. Christopher Jones, the Corps' Project Biologist, at (213) 304-6234.

Thank you for your attention to this document.

Sincerely,

for Josephine R. Axt, Ph.D.
Chief, Planning Division

Enclosure(s)

Print Form

Appendix C

Notice of Completion & Environmental Document Transmittal

Mail to: State Clearinghouse, P.O. Box 3044, Sacramento, CA 95812-3044 (916) 445-0613
For Hand Delivery/Street Address: 1400 Tenth Street, Sacramento, CA 95814

SCH #

Project Title: Santa Ana River: Reach 9 Phases 4, 5A, 5B, & BNSF Bridge

Lead Agency: US Army Corps of Engineers, Los Angeles District | Contact Person: Hayley Lovan

Mailing Address: 915 Wilshire Blvd., Ste 930 | Phone: 213-452-3863

City: Los Angeles | Zip: 90017 | County:

Project Location: County: Orange and Riverside | City/Nearest Community: Yorba Linda, OC and Corona, RC

Cross Streets: Gypsum Canyon Road and East La Palma Avenue, Yorba Linda, OC | Zip Code: 92886

Longitude/Latitude (degrees, minutes and seconds): 33 ° 52 ′ 19.4 ″ N / 117 ° 42 ′ 1.8 ″ W | Total Acres: 150 (total of 4 areas)

Assessor's Parcel No.: | Section: | Twp.: | Range: | Base:

Within 2 Miles: State Hwy #: SR-91, 71, and 241 | Waterways: Santa Ana River

Airports: | Railways: BNSF | Schools:

Document Type:

CEQA: ☐ NOP ☐ Early Cons ☐ Neg Dec ☐ Mit Neg Dec ☐ Draft EIR ☐ Supplement/Subsequent EIR (Prior SCH No.) ☐ Other: Addendum to EIR

NEPA: ☐ NOI ☐ EA ☐ Draft EIS ☐ FONSI

Other: ☐ Joint Document ☐ Final Document ☒ Other: Supplemental EA

Local Action Type:

☐ General Plan Update ☐ General Plan Amendment ☐ General Plan Element ☐ Community Plan
☐ Specific Plan ☐ Master Plan ☐ Planned Unit Development ☐ Site Plan
☐ Rezone ☐ Prezone ☐ Use Permit ☐ Land Division (Subdivision, etc.)
☐ Annexation ☐ Redevelopment ☐ Coastal Permit ☐ Other:

Development Type:

☐ Residential: Units Acres
☐ Office: Sq.ft. Acres Employees
☐ Commercial: Sq.ft. Acres Employees
☐ Industrial: Sq.ft. Acres Employees
☐ Educational:
☐ Recreational:
☐ Water Facilities: Type MGD
☐ Transportation: Type
☐ Mining: Mineral
☐ Power: Type MW
☐ Waste Treatment: Type MGD
☐ Hazardous Waste: Type
☒ Other: Flood Protection

Project Issues Discussed in Document:

☒ Aesthetic/Visual
☒ Agricultural Land
☒ Air Quality
☒ Archeological/Historical
☒ Biological Resources
☐ Coastal Zone
☐ Drainage/Absorption
☒ Economic/Jobs
☐ Fiscal
☒ Flood Plain/Flooding
☐ Forest Land/Fire Hazard
☒ Geologic/Seismic
☐ Minerals
☒ Noise
☒ Population/Housing Balance
☒ Public Services/Facilities
☒ Recreation/Parks
☐ Schools/Universities
☐ Septic Systems
☐ Sewer Capacity
☒ Soil Erosion/Compaction/Grading
☐ Solid Waste
☒ Toxic/Hazardous
☒ Traffic/Circulation
☒ Vegetation
☒ Water Quality
☒ Water Supply/Groundwater
☒ Wetland/Riparian
☐ Growth Inducement
☒ Land Use
☒ Cumulative Effects
☐ Other:

Present Land Use/Zoning/General Plan Designation:

Open Space-General

Project Description: *(please use a separate page if necessary)*

The U.S. Army Corps of Engineers proposes to extend bank protection structures within Reach 9 of the Santa Ana River by constructing three bank and infrastructure protection measures, Phases 4, 5A, and 5B, in the City of Yorba Linda, Orange County. The purpose of these projects is to prevent undercutting and erosion of Santa Ana River embankments, caused by high-velocity flows and associated scour. The fourth project involves structural improvements to the BNSF Bridge, which crosses over the Santa Ana River, and is located in the City of Corona, Riverside County. This project would address potential deficiencies in protection and susceptibility to scour at the bridge piers and abutments.

Note: The State Clearinghouse will assign identification numbers for all new projects. If a SCH number already exists for a project (e.g. Notice of Preparation or previous draft document) please fill in.

Reviewing Agencies Checklist

Lead Agencies may recommend State Clearinghouse distribution by marking agencies below with and "**X**".
If you have already sent your document to the agency please denote that with an "**S**".

_____ Air Resources Board
_____ Boating & Waterways, Department of
_____ California Emergency Management Agency
_____ California Highway Patrol
S _____ Caltrans District # 8&12
_____ Caltrans Division of Aeronautics
_____ Caltrans Planning
_____ Central Valley Flood Protection Board
_____ Coachella Valley Mtns. Conservancy
_____ Coastal Commission
_____ Colorado River Board
S _____ Conservation, Department of
_____ Corrections, Department of
_____ Delta Protection Commission
_____ Education, Department of
_____ Energy Commission
S _____ Fish & Game Region # 6
_____ Food & Agriculture, Department of
_____ Forestry and Fire Protection, Department of
_____ General Services, Department of
_____ Health Services, Department of
_____ Housing & Community Development
S _____ Native American Heritage Commission
S _____ Office of Historic Preservation
_____ Office of Public School Construction
S _____ Parks & Recreation, Department of
_____ Pesticide Regulation, Department of
_____ Public Utilities Commission
S _____ Regional WQCB # 8
_____ Resources Agency
_____ Resources Recycling and Recovery, Department of
_____ S.F. Bay Conservation & Development Comm.
_____ San Gabriel & Lower L.A. Rivers & Mtns. Conservancy
_____ San Joaquin River Conservancy
_____ Santa Monica Mtns. Conservancy
_____ State Lands Commission
_____ SWRCB: Clean Water Grants
S _____ SWRCB: Water Quality
_____ SWRCB: Water Rights
_____ Tahoe Regional Planning Agency
_____ Toxic Substances Control, Department of
_____ Water Resources, Department of

_____ Other: _____
_____ Other: _____

Local Public Review Period (to be filled in by lead agency)

Starting Date 1/26/15 Ending Date 2/20/15

Lead Agency (Complete if applicable):

Consulting Firm: _____
Address: _____
City/State/Zip: _____
Contact: _____
Phone: _____

Applicant: _____
Address: _____
City/State/Zip: _____
Phone: _____

Signature of Lead Agency Representative: _____ **Date:** _____

Authority cited: Section 21083, Public Resources Code. Reference: Section 21161, Public Resources Code.

401 WATER QUALITY STANDARDS CERTIFICATION

California Regional Water Quality Control Board
Santa Ana Region

Office Address:
3737 Main Street, Suite 500
Riverside, CA 92501-3348
401 Coordinator: Marc Brown (951) 320-6363

Phone: (951) 782-4130
Fax: (951) 781-6288
www.waterboards.ca.gov/santaana

Instructions: Provide all information on the form that applies to your project. *Filling out this form is not required*; a cover letter that includes this information is acceptable (including all the information described in this form will expedite the processing of your request). An electronic copy of this form is available at the following website:
www.waterboards.ca.gov/santaana/water_issues/programs/401_certification/index.shtml
Attach additional sheets as necessary. **An incomplete application will delay the processing or receipt of the 401 certification.**

APPLICANT

Name	U.S. Army Corps of Engineers
Title	Los Angeles District
Company	Attn: Hayley Lovan (CESPL-PD-RN)
Address	915 Wilshire Blvd.
City/State/Zip Code	Los Angeles, CA 90017
Telephone Number	213-452-3863
Fax Number	213-452-4204
E-mail Address	hayley.j.lovan@usace.army.mil

AGENT (consultant)*

Name	
Title	
Company	
Address	
City/State/Zip Code	
Telephone Number	
Fax Number	
E-mail Address	

*Complete only if applicable

FILING FEE*

Amount N/A (federal project)

Is it attached? _____yes _____no

PROJECT DESCRIPTION (See "Instructions for Filling Out the Water Quality Standards Certification Application" for types of information needed). Also, please refer to "Contents of a Complete Section 401 Certification Application" for any clarification on items required.

*Please refer to "Section 401 Water Quality Standards Certification Fee Schedule" to determine fee.

Project Title: Santa Ana River Reach 9 Phases 4, 5A, 5B and BNSF Bridge

Purpose/Goal: Flood damage reduction, embankment and bridge pier protection

Project Activities: Bridge pier noses/abutments, bank protection (grouted stone, soil cement and sheet pile)

Is the fill/excavation or dredge activity for which 401 certification is sought part of a larger plan of development?

X yes _____ no

Proposed Schedule for fill/excavation or dredging activity (ies) (start-up, duration, and completion dates):

Construction will occur under 4 separate contracts, with initial construction in late summer 2015, all complete in ~ 5 years.

If fill/excavation or dredge activity is plan of development, proposed schedule for that larger development (start-up, duration, and completion dates):

Santa Ana River Mainstem Project (construction ongoing since the mid-1990s).

Project location (If fill/excavation or dredge activity is part of a plan of development, a map of suitable quality and detail of the entire project site should be included):

City or Area Corona/Yorba Linda County Riverside/Orange Counties

Longitude/Latitude multiple locations (see SEA for more information)

Township/Range/Section/Quadrangle _____

Total size of area to be impacted by fill/excavation or dredge activity

~150 acres 5+ miles linear feet (if appropriate)

Total size of **entire** project area (including larger plan of development, where applicable):

_____ acres 75+ miles linear feet (if appropriate)

Please attach a hydrology report detailing the pre- and post-construction (Q_{10} and Q_{100}) if your project is a development.

RECEIVING WATER*

Name of Affected Water body(ies) and type(s) of receiving water body(ies)

Santa Ana River

Is receiving water(s) within the San Jacinto Watershed? _____ yes X _____ no

Major Tributary(ies) Downstream of Prado Dam, to Weir Canyon Road

*As listed in the *Water Quality Control Plan, Santa Ana Region* (Basin Plan). For unlisted waters, the major named tributary(ies) must be identified.

FILL/EXCAVATED* AREA

Indicate in ACRES and LINEAR FEET (where appropriate) the proposed **waters of the United States** to be impacted, and identify the impact(s) as permanent and/or temporary for each water body type listed below:

Wetland	_____ acres of permanent	_____ acres of temporary impact
	_____ linear feet of permanent	_____ linear feet of temporary impact
Riparian	6.75 acres of permanent	35.06 acres of temporary impact
	_____ linear feet of permanent	_____ linear feet of temporary impact
Streambed	0.08 acres of permanent	0.92 acres of temporary impact
	_____ linear feet of permanent	_____ linear feet of temporary impact
Lake	_____ acres of permanent	_____ acres of temporary impact
	_____ linear feet of permanent	_____ linear feet of temporary impact
Ocean	_____ acres of permanent,	_____ acres of temporary impact
	_____ linear feet of permanent	_____ linear feet of temporary impact

Indicate type(s) of material proposed to be discharged in waters of the United States:

Excavated backfill, grouted stone, soil cement, concrete, sheet pile with tiebacks

DREDGE VOLUME

Indicate in **CUBIC YARDS** the proposed **waters of the United States** to be impacted.

~1,537,400 cubic yards

Indicate type(s) of material proposed to be discharged in waters of the United States:

Estimated 183,600 cy of grouted stone, concrete and soil cement, and 1,353,800 cy of excavated backfill.

Note: Dredging generally includes removing sediment in deeper water to increase the depth. Impacts to beneficial uses are best described by the volume of sediment discharged. Dredging typically occurs to facilitate navigation and for aggregate extraction in marine waters.

FEDERAL PERMIT

File No.(s) (if known) _____

Individual - list Corps control number _____

Nationwide – list permit number _____

Does the project require any other Federal Application(s), Notification(s) or Correspondence?

X yes (attach copy(ies)) _____ no (attach detailed explanation)

CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

Indicate CEQA document (submit final or draft copy if available*****) and Lead Agency:

Draft SEA/EIR Addendum, January 2015, USACE (provided to WQCB)

Has the document been certified/approved, or has a Notice of Exemption been filed?

If yes, date of approval/filing: _____ If no, expected approval/filing date: May 2015

If exempt, list section that applies (cite code) and explain exemption:

***** Note: ample time must be provided to the Regional Board to properly review a final copy of valid CEQA documentation before certification can occur.

THREATENED OR ENDANGERED SPECIES

Please list the expected impacts and species

Primarily temporary impacts to riparian and floodplain habitat will affect least Bell's vireo and CA gnatcatcher.

Impacts to perennial stream at BNSF site will affect Santa Ana sucker critical habitat. All impacts will be mitigated.

Is the project within the Stephens' Kangaroo Rat fee area? _____ yes X no

Is a Section 7 or 10 Consultation with the U.S. Fish and Wildlife Service necessary? X yes _____ no

Has the U.S. Fish and Wildlife Service issued a Biological Opinion? _____ yes X no

If yes, list date Opinion was issued _____

MITIGATION FOR IMPACTS TO WATER QUALITY STANDARDS

Please identify the pollutants that may be associated with the proposed development. Describe the short- and long-term water quality impacts on the receiving waters and downstream waters that may result from discharge of these pollutants.

See 404(b)(1) Evaluation attached to the SEA/EIR Addendum.

Primary impacts would be caused by short-term increased in turbidity associated with construction.

SWPPP will be developed and implemented to provide erosion control and protect water quality.

Please list any beneficial uses (as defined in the Basin Plan) of the receiving water(s) and downstream water(s) that may be lost or impacted through project implementation.

Short-term impacts to water quality (minimized through use of SWPPP and BMPs), biological resources (mostly temp impacts, mitigated through on and off-site habitat restoration) may affect MUN, AGR (orange groves by 5B), GWR, REC 1&2, WARM, WILD and RARE.

What are the proposed mitigation measures to limit impacts on water quality standards in receiving water(s) and also downstream water(s)? List the avoidance or alternative measures considered (if described in CEQA document, please reference page number). Please indicate if no such measures were considered.

Standard BMPs through implementation of SWPPP, as well as on and off-site habitat restoration.

See Chapter 6.0 (Environmental Commitments) of Reach 9 SEA/EIR Addendum.

FILL/EXCAVATION AND DREDGE MITIGATION (Indicate in **ACRES and LINEAR FEET** (where appropriate) the total quantity of **waters of the United States** proposed to be created, restored, enhanced and/or preserved for purposes of providing compensatory mitigation and indicate the water body type).

Water Body Type	Created	Restored	Enhanced	Preserved
Perennial Stream			1.0 acres	
Riparian/Upland Habitat		min. 84.32 acres		

Other proposed compensatory mitigation related to fill/excavation and dredge activities (e.g., mitigation banks) (omit if not applicable):

How many acres of proposed mitigation area are considered waters of the United States? Not delineated.

Location of compensatory mitigation site(s) (attach map of suitable quality and detail):

City or Area Corona and Norco, CA County_____

Longitude/Latitude_____ Township/Range_____

Will a mitigation plan be prepared in accordance with the Army Corps of Engineers' guidelines and submitted to the Regional Board office?

X yes _____ no

CALIFORNIA DEPARTMENT OF FISH AND GAME (CDFG) STREAMBED ALTERATION AGREEMENT

Agreement issued _____ yes (attach copy) X_____ no

Applying for Agreement X_____ yes (attach copy) _____ no

Exempt _____ yes _____ no

If exempt from a Streambed Alteration Agreement, state why

_____

_____

DEWATERING PERMIT

Will groundwater dewatering be necessary? X_____ yes _____ no

If so, what is the proposed method of disposal of the dewatered wastewater?

Pumped into settling basins or direct discharge into river downstream, using methods that would avoid erosion/turbidity.

Has an NPDES permit for dewatering discharges to surface waters already been obtained?

_____ yes x_____ no

Dewatering permit number _____

COASTAL DEVELOPMENT PERMIT

Permit issued _____ yes (attach copy) X_____ no

Applying for permit _____ yes (attach copy) X_____ no

Exempt X_____ yes _____ no

If exempt from a Coastal Development Permit, state why

Project will not affect the coastal zone.

_____

PAST/FUTURE PROPOSALS BY THE APPLICANT

Briefly describe any projects carried out in the last 5 years or planned for implementation in the next 5 years that relate in any way to the proposed activity or **may impact the receiving body of water**. Include estimated adverse impacts.

See Cumulative Impacts Section (5.17) of SEA/EIR Addendum. Other Corps and non-Corps projects in vicinity

(ongoing, recently completed or proposed) include Reach 9 Phases 2A, 2B, and 3; SARI Line relocation, SARI Line

pipe severing; and OCSD emergency rock removal.

STORM WATER PERMIT STATUS*

Obtained storm water permit _____ yes X no

Filed Notice of Intent with the SWRCB _____ yes X no _____ date

Prepared Storm Water Pollution Prevention Plan (SWPPP) _____ yes X no

If you believe that a Storm Water permit is not necessary, state why

Please list (Best Management Practices) BMPs that will be used to minimize impacts to water quality standards (i.e., water quality and beneficial uses) during and after construction.

See Environmental Commitments, Chapter 6 of SEA/EIR Addendum, which include development and implementation of SWPPP, and on-site and off-site habitat restoration.

Please discuss BMP maintenance and monitoring activities and duration, including the party(ies) responsible for long-term maintenance of any BMP installed. If maintenance and monitoring will be provided through another agency/party, submit a letter from that agency/party demonstrating that an agreement for such long-term maintenance/monitoring has been or will be reached.

Construction contractor will be responsible for BMPs, and Corps inspectors and biological monitors will ensure compliance.

Applicant's Signature (or Agent) Date

DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, U.S. ARMY CORPS OF ENGINEERS
915 WILSHIRE BOULEVARD, SUITE 930
LOS ANGELES, CALIFORNIA 90017

April 15, 2015

Office of the Chief
Planning Division

Mr. Mendel Stewart
Field Supervisor
U.S. Fish & Wildlife Service
2177 Salk Avenue, Suite 250
Carlsbad, California 92008

Dear Mr. Stewart:

We have received your March 31, 2015 letter in which you request additional information from the U.S. Army Corps of Engineers (Corps) about implementation of the Santa Ana River Reach 9 Bank and Bridge Protection measures (Federal Action) as described in the Corps' draft Supplemental Environmental Assessment and Addendum to Environmental Impact Report, dated January 2015. It requests additional information in order to determine how or to what extent our Federal Action may affect listed species or critical habitat. Responses to your information requests (items 1-6 listed in the enclosure to your letter) are provided in Enclosure 1.

The Corps remains committed to work collaboratively with the U.S. Fish and Wildlife Service (Service) to identify opportunities to develop information and to support the recovery of species and, or critical habitat. As noted in your letter, the Corps is continuing to evaluate ecosystem restoration measures, including bypassing sediment around Prado Dam, to improve conditions within the vicinity of Prado Dam and will continue to work with the Service to develop measures and alternatives. The Corps is also actively working with the Service and in 2014 provided substantial support to design and develop alternatives for combating invasive red algae. The Corps also constructed a 24 acre perennial stream/riparian habitat restoration feature in 2012 within the Green River Golf Club adjacent to the Reach 9 Phase 2B area. This included 10 acres of streambed habitat that was designed specifically to support Santa Ana sucker spawning and foraging. We wish to continue to support the Service in the future and to develop information necessary to better understand how Prado Dam operations affect the surrounding ecosystem.

While we recognize the Service's concerns with respect to Prado Dam operations, implementation of this Federal Action is intended to armor bridge piers and banks along the Santa Ana River. Recommendations for reducing or eliminating impacts to the Santa Ana sucker associated with construction and maintenance of the BNSF bridge protection feature are being considered and may be implemented in the near future. Please see Enclosure 2 for the Corps' detailed responses to proposed conservation measures. The issuance of a final, comprehensive Operations, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) manual in the future, when the entire Santa Ana River Mainstem Project project is complete or substantially complete, could result in a change to current baseline Prado Dam operations. Assuming such

changes in operation are proposed, any impacts upon endangered species or authorized habitat would be addressed in a separate consultation at that time. No changes are proposed under this Federal Action to the current operations of Prado Dam, which are part of the baseline.

Should you require additional clarification with respect to the referenced enclosures, we are available to discuss. We appreciate your commitment to issue the Final Biological Opinion (BO) by June 14, 2015 consistent with the Corps' implementation schedule for our Federal Action. To provide sufficient time for review and discussion of proposed Terms and Conditions, we respectfully request that you provide us with a copy of a Draft BO by May 14, 2015.

We look forward to our continued coordination and receipt of a Draft BO. As already expressed by phone and e-mail, it is essential for the continued success of SARMP to initiate construction of the Phase 4 and Phase 5A features this fiscal year. This is necessary not only to provide the required bank and bridge protection, but also to ensure that beneficial activities and measures that enhance, restore or establish critical habitat and support recovery of species are not jeopardized by our failure to meet existing obligations.

If you have any additional questions, please contact Ms. Hayley Lovan, Chief of Ecosystem Planning Section at (213) 452-3863 or at hayley.j.lovan@usace.army.mil.

Thank you for your attention to this document.

Sincerely,

for Josephine R. Axt, Ph.D.
Chief, Planning Division

Enclosure(s)

ENCLOSURE 1

Responses to Information Requests 1-6

1. All Conservation Measures from the biological opinion that apply to Reach 9 have been incorporated into the Draft SEA (for instance, BR-18 which addresses non-native removal requirements to compensate for temporary and permanent impacts to riparian and other floodplain habitat). The Corps is not proposing to change or modify the Conservation Measures or mitigation strategy included in the 2012 biological opinion. Many of the environmental commitments (which include avoidance, minimization and mitigation measures) identified in the Draft SEA are related to protecting or mitigating general biological or other environmental resources, and are not strictly or directly related to listed species, and therefore were not listed in the 2012 BO. For instance, EC-BR-6 addresses compensation for oak tree impacts, and EC-BR-13 addresses wildlife movement at Phase 4.

2a. Any floodplain vegetation occurring within backfilled areas on top of existing or proposed structural improvements will be considered to be permanently affected by these actions and will be mitigated according to the mitigation strategy described in the 2012 BO. It is unclear at this time whether non-Federal entities mitigated for permanent impacts to vegetated areas for the construction of the Caltrans or Yorba Sur embankments. The Corps is not responsible for previous vegetation losses or floodway encroachments. However, to the extent that those areas have been impacted, those permanent impacts are considered part of the baseline condition. Many of the existing embankment footings, especially on the north side of the river, are buried under dirt roads or other areas mapped as "disturbed/barren." Even so, some of this area will be replanted or will recover naturally within backfilled areas, at least unless or until bed degradation occurs. Vegetation impacts beyond the edge of the new toe are considered temporary and will be mitigated according to the terms of the 2012 BO.

   The Corps considers this to be a very conservative approach that will likely result in addressing impacts that are attributable to other entities' actions and not this Federal Action, although as already stated, the amount of vegetation within existing backfilled areas is not substantial.

2b. None of the existing or proposed features within the action area are considered levees although the description may suggest otherwise. Levees are structures which would rise above the existing channel banks and have a back slope. The existing non-Federal structures functionally serve as bank protection, resisting erosion of the banks at the existing grade. The Federal Action areas (Phases 4, 5A and 5B) follow existing engineered banks for the vast majority of their length with the exception of the upstream-most end of Phase 4, which curves away from the freeway to tie into high ground. The upstream-most end of Phase 5B is not adjacent to an armored bank, follows the existing railroad embankment. Figures 1-6 includes the current and proposed protection alignments in the vicinity of each feature.

2c. The numbers presented in the impact tables (e.g., Table 5.5-4) are based on the footprint of impacts presented in the impact figures (e.g., Figures 5.5-1a-1b). Note: some of the vegetation polygons that were mapped (prior to overlaying the design information) extend outside of the permanent and, or temporary impact areas. The Draft SEA impact tables are based on the footprint of temporary and permanent impacts as calculated from the overlay of existing and proposed project features and temporary construction easements (from the detailed design drawings) onto existing habitat maps. This overlay was displayed in the referenced figures.

2d. There are three areas totaling 0.76 acres in size (0.63 acres of coastal sage scrub and 0.13 acres riparian) that had been previously (temporarily) impacted by SARI Line construction and will be impacted by this Federal Action. The largest of the three sites that included restoration commitments for 0.41 acres upland and 0.13 acres riparian is shown partially overlapped by Phase 5B on Figure 3. Although not shown on the map, the other two sites fall entirely within the Phase 5B footprint and would now be permanently affected. Figures 7-9 show the overlap of other aspects of the Federal Action on previous SARP construction limits that either had been restored, or in the case of portions of Phase 3 and 2A, have not been restored pending upcoming construction. As shown in Figure 7, a portion of the Phase 5A grouted stone segment (totaling 0.6 acres of permanent impact) will be constructed in an area that was previously disturbed for Phase 1. Figure 8 shows that a small portion (0.37 acres) of the BNSF bridge abutment in-between the Mobile Home Park and Phase 2A embankments will be located in an area that had been temporarily disturbed for those project features. Figure 9 shows that almost the entire length of the Phase 4 feature (2.14 acres) will be constructed in an area that had been previously disturbed by the Phase 3 temporary construction easement and/or staging areas. All areas of temporary and permanent impact were identified in the Reach 9 SEA and will be mitigated, although that document did not distinguish areas that had previously been affected by other project features.

2e. The Corps intends to take whatever measures are required within the TCE to ensure a successful re-establishment of native vegetation, whether or not the site had been previously impacted. We anticipate that for disturbed or repeatedly disturbed and restored areas, measures would include de-compaction of soil, the use of soil amendments or replacement of stockpiled topsoil to restore appropriate physical and chemical parameters consistent with surrounding native soil types. Consistent with other restoration areas and the 2012 BO, the TCE will then be hydroseeded and, or planted with a native palette, and weeded for a minimum of five years after construction to ensure that non-native invasive species do not establish or spread to (or from) adjacent areas.

As an example, an approximately 12 acre area that was initially disturbed by Phase 3 construction will be restored by the Phase 4 contractor because of overlapping boundaries. (The Corps purposefully designed the Phase 4 feature to re-use previously impacted areas for staging and access to the extent possible, in order to minimize cumulative effects to the floodplain.) When Phase 3 construction was completed, the bare area was coated with an organic based soil binder for dust control purposes until

Phase 4 construction begins. Restoration of the area will include the steps outlined above (decompaction, soil testing. adding soil admendments, hydroseeding/planting and weeding).

2f. Based on a review of existing and "pre-Reach 9 Phase 3" vegetation maps, as well as the hydrology maps provided in response to item 4b, there does not appear to be any vegetation within temporary impact areas behind the proposed Phase 4 embankment that is currently supported by flood flows. The Corps does not anticipate that the character of any "isolated" vegetation would change as a result of this action. Therefore, there would be no permanent impacts to areas between the Phase 4 embankment and the freeway.

3. With restoration of temporary impact areas and after the constructed features are backfilled and replanted, the proposed action will not reduce the baseline amount of riparian vegetation within the Habitat Management Area, and will not reduce the total open space available for wildlife. Most areas that are considered for mitigation purposes to be "permanently affected" (see response to 2a) will in fact be backfilled and continue to support vegetation unless or until future high flows result in bed degradation and shifting of the active river channel. This eventuality, should it occur, is already accounted for in the Habitat Management Plan. Habitat values will be fully mitigated in accordance with the terms of the 2012 BO. If necessary to ensure that there is not an immediate loss of baseline habitat due to construction of these features, a portion of the required mitigation could be implemented within Reach 9. Moreover, habitat within temporarily affected areas may be improved over time compared to existing conditions as non-native vegetation is removed and replaced with a more diverse native palette.

4a. Channel capacity will not be reduced, and water surface elevation and velocity will not be increased due to construction of BNSF bridge protection. The BNSF bridge protection feature is designed to shift the erosive forces from the piers to the proposed pier nose extensions. The pier nose extensions will not cause any appreciable flow velocity changes immediate downstream from the BNSF Bridge. Moreover, the new grading plan for the low flow channel will extend across two of the bay openings, whereas currently the low flow channel goes through only one bay. A HEC-RAS model was used to verify that the flow velocities would be the same under both the "with-project" and "without project" condition at the downstream end of the railroad bridge. For instance, for a 30,000 cfs release, the flow depth under both scenarios would be 19.35 feet and the velocity would be 11.86 feet per second. Similarly, there would be no change to flow velocity associated with smaller and more frequent releases. Therefore, construction of the BNSF bridge protection feature would have no influence on the restored perennial stream within the Phase 2B area. As the bridge is still the same width (although the low flow will be expanded), channel capacity will not be lost and water surface elevation will not be increased.

4b. This Federal Action will not reduce the floodplain width and therefore will not have impacts to riparian vegetation beyond the direct effects specified in the SEA. The bank protection alignment protects the existing bank of the channel and ties into high ground at the upstream extent. See Figures 10-12 attached to this enclosure. Figures 10 and 11

display the design discharge inundation extents throughout Reach 9. Figure 12 provides a closer view of the Phase 4 area and compares the Phase 4 alignment with the design discharge inundation extents. Figure 12 confirms that while the Phase 4 alignment turns toward the center of the channel (following existing high ground), it does not encroach upon the expected inundation area. As a result, Phase 4 would not affect the inundation footprint or hydraulic properties (water surface elevation or velocities), and therefore would have no influence on the extent of riparian vegetation supported by these dynamics.

The alignment extends further upstream than the original CalTrans embankment to tie into high ground and to protect against observed flow impingement that may increase due to the planned removal of the temporary SARI rock groin protection. With the removal of the rock groin, a shorter Phase 4 alignment (if proposed) may allow for flows to impinge upon the bank upstream of the protection, thus compromising the project and protected banks.

5. The Federal Action does not depend upon maintaining the temporary riprap grade control structures, which were put in place to protect the SARI Line. As required by Corps Regulatory permits, the structures are to be removed by the Orange County Sanitation District upon completion of the SARI Line relocation.

6a. Expectation for wildlife use of the soil cement switch back ramps. The wildlife ramps are intended to provide ease of entry/exit in the future, if the channel bed were to scour below the bottom of the culvert opening. This is expected to preserve the ability of wildlife movement into the future. The potential maximum scour depths are detailed in **Table 1**, below. We expect some animals, including coyotes and bobcats might be physically able to navigate the soil cement slope without a ramp, but the ramp is expected to make the openings easier to use and find. The ramp could be covered with soil to make it more suitable for a variety of wildlife species. This type of feature does not exist with the existing bank protection, so it is anticipated to be an improvement over the existing condition. Please see **Figure 6(a)-3**, attached, for some photographic examples of the switch back ramps that were implemented within the Reach 9 Phase 3 feature, which is a very similar soil cement bank protection feature when compared with the Reach 9 Phase 4 feature.

Specific changes for each culvert are shown in the following table.

Table 1 Specific changes for each culvert/drain within the Reach 9 Phase 4 Project Area. For a plan view of culvert locations relative to the Reach 9 Phase 4 feature, see Figure 6(a)-1, attached.

Type	Station #	Alt ID	Alteration	Width	Height	Change in Angle	Change in Length	Max Scour Height to Invert	Switchback Ramps
Existing Condition									
24 in RCP	1388+68	P4-1	-	24 in	24 in	N/A	N/A	N/A	N/A
5ft by 5ft RCB	1396+05	91-05	-	5 ft	5 ft	N/A	N/A	N/A	N/A
5ft by 5ft RCB	1399+38	91-06	-	5 ft	5 ft	N/A	N/A	N/A	N/A
3ft by 3ft RCB	1413+60	91-07	-	3 ft	3 ft	N/A	N/A	N/A	N/A
With Federal Action Condition									
24 in RCP	1388+68	P4-1	extended linearly	24 in	24 in	0 degrees	70 ft	16.5 ft	No
5ft by 5ft RCB	1396+05	91-05	extended curved	5 ft	5 ft	7 degrees	75 ft	20.2 ft	Yes
5ft by 5ft RCB	1399+38	91-06	extended curved	5 ft	5 ft	5.5 degrees	85 ft	22.1 ft	Yes
3ft by 3ft RCB	1413+60	91-07	not altered	3 ft	3 ft	Not altered	-	-	No
4ft by 5ft RCB			new structure	5 ft	4 ft	N/A	65 ft	15.3 ft	No

Height of the drain opening above the ground following anticipated bed degradation: See **Table 1**, above.

Specific changes to the extent of vegetation surrounding the drain openings: Upon completion of construction, areas on the river side of the culvert openings would be restored with the same plant communities that existed prior to disturbance, if that plant community type was native. If it is was not native, as is the case for Culvert 91-06, the area near the opening would be restored with an adjacent plant community that is native and is appropriate for the setting. The Corps utilized a dataset that was created by LSA for the Habitat Management Plan (HMP) for Reach 9 Habitat Management Area (HMA) to determine where and which plant communities occurred on site prior to disturbance by

construction for the SARI Line or Reach 9 Phase 3. This dataset shows the types and location of plant communities during 2004. **Table 2**, shown below, displays the plant communities associated with each culvert opening.

Table 2 Shows culverts and plant communities that occurred near their openings prior to disturbance from the SARI Line Project or Reach 9 Phase 3.

Culvert Number	Map Number	Plant Community @ Opening	Adjacent Plant Communities	Expected Restored Community
P4-1	Figure 6(a)-2.1	Mexican elderberry woodland	Willow riparian scrub, cottonwood-willow riparian forest, disturbed or barren, ruderal	Mexican elderberry woodland
91-05	Figure 6(a)-2.2	Coast live oak woodland	Ruderal grassland, disturbed or barren, Mexican elderberry woodland	Coast live oak woodland
91-06	Figure 6(a)-2.2	Ruderal grassland	Coast live oak woodland, cottonwood-willow riparian forest, disturbed or barren	Coast live oak woodland
91-07 (not altered-see below for further explanation)	Figure 6(a)-2.3	Ruderal grassland	Ruderal grassland, urban and commercial, disturbed or barren, non-native woodland	Coastal sage scrub

Culvert 91-07 requires more a more detailed explanation. It will not be extended through the Reach 9 Phase 4 bank protection feature and its existing opening will not be altered by this Federal Action. 91-07 will daylight as it currently does. The 4-foot x 5-foot culvert described in the 'With Federal Action Condition' portion of **Table 1**, above, is expected to work in tandem with 91-07 to carry flow through the Phase 4 feature. The area between SR-91 and the 'Soil Cement – Permanent foot print,' shown on **Figure 6(a)-2.3** will be graded to promote flow towards the 4-foot x 5-foot drain within the feature. The 4-foot x 5-foot drain will have guards (i.e. flap gates or grates) on the openings to prevent wildlife from using them. The ground near the opening has been disturbed by the SARI Line relocation and was kept in a disturbed state during the Reach 9 Phase 3 work, which is currently ongoing. Upon completion of the Reach 9 Phase 4 work, this area will be restored with a coastal sage scrub seed mix and plantings. Prior to disturbance by the SARI Line relocation, there was an area of approximately 0.15 acres

of what was mapped as cottonwood-willow riparian forest in 2004 that would be cut off from the floodplain by the Phase 4 feature in the immediate vicinity of 91-07, as shown on **Figure 6(a)-2.3**, attached. With the exception of this small area mapped as riparian forest, the majority of the area in the vicinity of this culvert was characterized by a high level of disturbance (e.g. urban and commercial, disturbed or barren, and ruderal grassland). The coastal sage scrub restoration effort is expected to provide better overall habitat value for the immediate area since it will be replacing the vastly disturbed and sparse cover that previously existed. The coastal sage scrub is expected to complement the surrounding alluvial sage scrub habitat. Wildlife would be expected to be able to walk over or around the Corps' Phase 4 bank protection feature en route to or from 91-07.

Potential for the ramp to exit into the active channel relative to future drainage patterns. **Figure 6(a)-4**, attached, shows historic thalwegs of the Santa Ana River within the immediate vicinity of the Reach 9 Phase 4 feature between 1929 and 2007. It appears that the river's thalweg tends toward its current alignment, which is located over 200 feet away from the permanent foot print of the proposed soil cement alignment. However, there is potential for the channel to migrate towards the Phase 4 bank protection feature and result in the ramps exiting into the active channel. There is a potential for flows to run against the Phase 4 feature, as history has shown, but it is not expected to happen frequently and the thalweg appears to return to near its current alignment. As a precaution, the switch back ramps include a pathway to the top of the soil cement feature to allow wildlife to access the top of the embankment so they can access other areas up- or downstream resulting in an insignificant impact to wildlife movement.

6b. Wildlife is expected to be able to move through the BNSF Railroad Project Area in a manner similar to what they would in the existing condition. Steps have also been taken to improve the long term viability of this area for wildlife movement, even though this particular location currently represents a pinch point. Wildlife can continue to make at grade crossings over the railroad. Wildlife can also move beneath the railroad between east and west abutments and Piers 1 and 6, respectively (see **Figure 6(b)-1**, BNSF Railroad Bridge Protection, attached). The following paragraphs and **Figure 6(b)-2**, attached, describe the specific movement paths for this location.

- East side of the river: Wildlife is expected to be able pass beneath the bridge between Pier 1 and the East Abutment (see Movement Path #1 on **Figure 6(b)-2**) in a situation where the flow from the river was running against the east diaphragm wall/sheet pile bank protection. The concrete diaphragm wall and proposed sheet pile wall will protect this passageway. The protection of this path does not currently exist. The maximum height of the diaphragm wall/sheet pile is expected to be approximately 4-feet higher than the backfill, or ground level, at its highest point. The elevation of the wall/pile alignment will tie into the Reach 9 Phase 2A and Green River Mobile Home Park embankments.

Access roads will be constructed over the wall/pile alignment to preserve maintenance access along the railroad right of way. These unpaved roads will also allow wildlife to

pass. Ramps will be incorporated on both sides of the rise that have a gradual slope (i.e. approximately 2.5:1 slope) to allow wildlife to walk over the sheet pile and diaphragm wall (see Movement Paths #2 and #3 on **Figure 6(b)-2**, BNSF Movement Paths, attached). Animals could also walk along the maintenance roads from the Reach 9 Phase 2A or Green River Mobile Home Park bank protection features to gain access between the east abutment and Pier 1, shown as Movement Path #4 and #5 on **Figure 6(b)-2**, attached. An earthen path will also be maintained on top of the grouted stone leading over the sheet pile/diaphragm wall, on the south side of the railroad to provide passage between Pier 1 and the east abutment (see Movement Path #6 and #7 on **Figure 6(b)-2**, attached).

- West side of the river: Similar to the east side of the river, the proposed construction will allow wildlife to pass linearly, adjacent to the river even if the river is flowing against the proposed diaphragm wall or guide wall. Wildlife would likely move along the existing golf cart path alignment. This pathway will be preserved in the future when the project is implemented and is expected to at least maintain the existing amount of wildlife movement capability. Movement paths are shown on **Figure 6(b)-2** (see Movement Paths #8-11).

ENCLOSURE 2

Responses to Recommended Conservation Measures for Recovery of Santa Ana Sucker

The Corps has reviewed the recommended conservation measures and most of these recommendations (especially 7 through 8c) are unrelated to the current Federal Action which is embankment and bridge protection in Reach 9. Not all of these measures would necessarily be implemented by the Corps or required to offset construction or operational impacts for future Corps actions, but they may be discussed, evaluated and prioritized by the Corps (in coordination with the Service) as an environmental steward in the Santa Ana watershed as part of the Corps' Santa Ana River OMRR&R program. Recommendations that would have the greatest near-term and direct benefits to existing sucker populations (such as 8d, 8e, or other suggested measures discussed below) could be considered as potential mitigation strategies for Reach 9 impacts.

7. The Corps appreciates the recommendations for analyzing changes in water quality downstream of Prado Dam. These are good suggestions that would be a worthwhile analysis as part of the issuance of the Prado Dam OMRR&R manual and associated impact assessment and consultation. The Corps has already initiated development of a plan of action for assessing impacts to sediment movement and associated geomorphological changes that may be occurring upstream and downstream of Prado Dam, due to flood control operations. While additional work on the plan of action is required to include a more in-depth assessment of previous modeling efforts, the Corps will provide the current version to your agency for review. We expect to complete the plan of action this fiscal year, begin implementation in early FY16, and complete the analysis within another one or two years, unless it is determined that longer-term study is required to fully answer all of the questions. The recommended water quality assessment will be incorporated into this study. It should be noted, however, that differences in water quality between Reach 9 and the occupied Santa Ana sucker habitat upstream of the dam are likely due to more than dam operations, as there are also substantial differences in topography and other factors that could influence water quality. However, the Corps is willing to consider operational changes that would improve water quality as long as they do not affect approved or proposed flood control and water conservation objectives.

8. See response to #7 on plans for and timing of the sediment/geomorphology study.

8a. The Corps is involved in two separate but connected efforts to evaluate the potential for bypassing sediment around Prado Dam, and to assess potential benefits to upstream and downstream habitat. As your agency is aware, the Corps is processing an outgrant proposal by Orange County Water District (OCWD) to implement a demonstration project along these lines, while at the same time developing the Prado Basin Feasibility Study that has both ecosystem restoration and water conservation objectives. Sediment bypass is one of the key measures that is being investigated in the feasibility study that would potentially benefit both objectives. It is anticipated that feasibility study would be completed in FY17.

8b. In-stream habitat improvements are being investigated as part of the Prado Basin Feasibility Study. This conservation measure will be considered as one method of achieving the objectives of that Study.

8c. The Corps is willing to consider this possibility as either a measure to address impacts of the issuance of the final Prado Dam OMRR&R manual, or as part of the Prado Basin Feasiblity Study, as long as the scope of this conservation measure is within the Corps' existing authority. Specifically, if it requires only a minor modification (i.e., notching) of any structures, and is determined to have no effect on authorized or proposed flood control and water conservation operations. This possibility has already been discussed in very general terms by USFWS and certain Corps staff, but would need to be evaluated more fully in terms of costs, technical feasibility, authority, operational impacts, and other environmental impacts (as the character of habitat in the vicinity could change, which may also result in changes to the "baseline" of riparian habitat identified in the Habitat Management Plan). The Corps will continue to coordinate with the USFWS to more fully understand the issue and objectives, and determine if there are less costly or more practicable measures that could be implemented to achieve those objectives.

8d. The Corps is willing to investigate opportunities to improve habitat conditions within or upstream of active spawning grounds, which may include these suggested measures or others. Such improvements could be considered as mitigation for Reach 9 features such as Phase 3 (in lieu of ongoing efforts to address red algae issues) and, or BNSF bridge protection, or alternatively could be considered to offset impacts from Prado Dam operations. The Corps anticipates that placement of appropriate substrate and, or construction of small groins or other structures to capture cobbles and gravels would have a greater and longer-lasting benefit than periodic releases from Seven Oaks Dam, which would require substantial rainfall in order to build a sufficient pool elevation (under which circumstance there would already be moderate or high flows in the river channel from ungated tributaries). It is important to note that Seven Oaks Dam is the OMRR&R responsibility of the non-federal sponsors. Changes to the OMRR&R manual and water control plan would require further coordination with the non-federal sponsors.

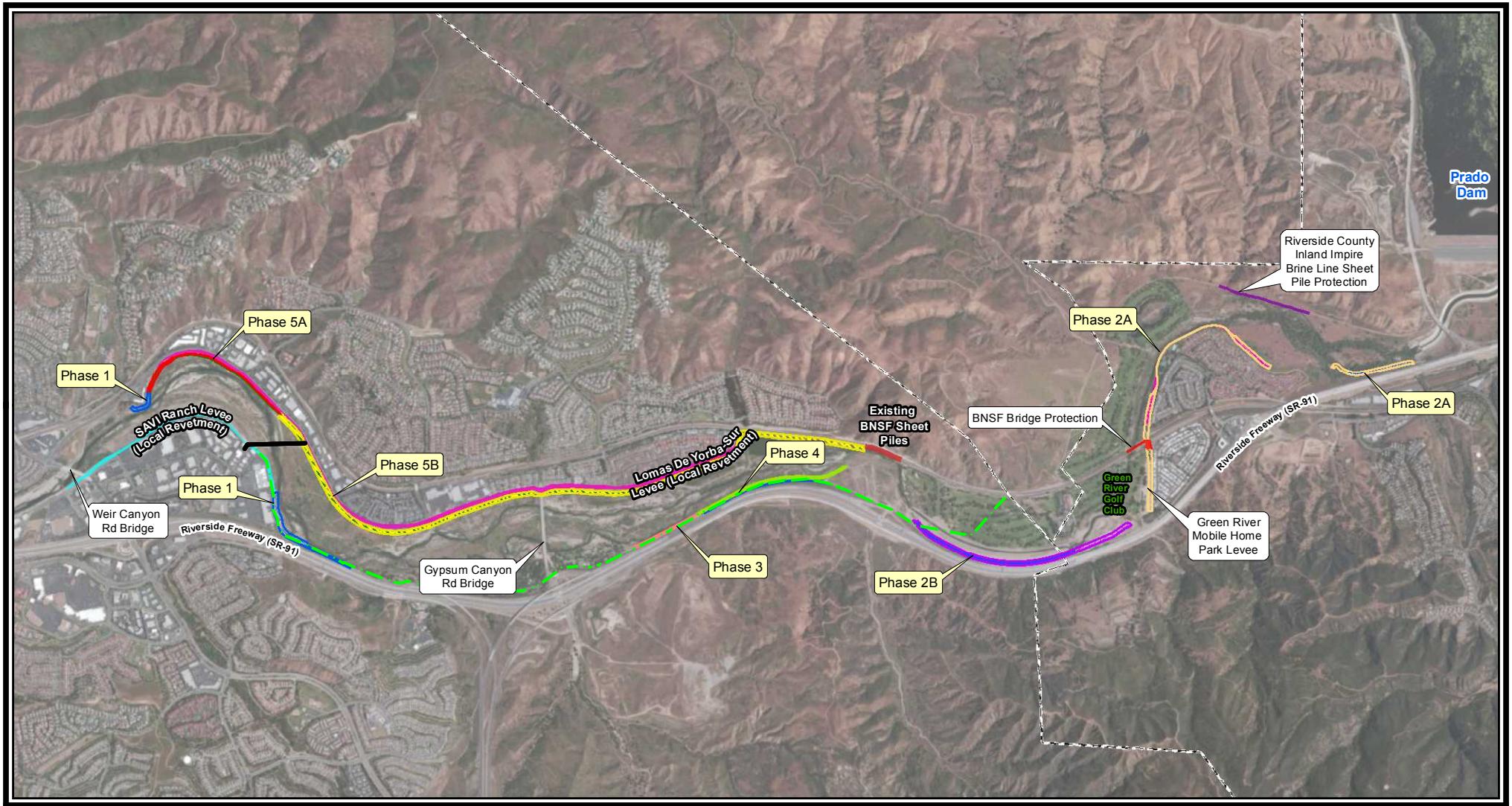
8e. Habitat restoration within one or more tributaries is another possible measure that could be investigated either as mitigation for Reach 9 construction, or to offset effects from the issuance of a final OMRR&R manual for Prado Dam. Removal of the cement lining from Sunnyslope Creek is extremely problematic as it was put in place to provide flood damage reduction, and is still needed for that purpose. Many years ago, the Corps investigated opportunities to create a low-flow bypass to extend the amount of potential spawning habitat in that area, but we encountered several roadblocks and then the suitability of this area was compromised when connectivity to the Santa Ana River mainstem was lost during a flood event. The Evans Creek drain or other tributary restoration may be more feasible, and these options will be further coordinated with the USFWS as potential mitigation for impacts from the current Federal Action.

Instead of or in addition to Items 8d and 8e, the Corps recommends continuing recent discussions that we have had with USFWS and others on opportunities for increasing populations of Santa Ana sucker. One option would be to assist the Riverside-Corona Resource Conservation District with proposed modifications to an artificial stream to enhance their captive breeding program for Santa Ana suckers. Another option that has been discussed frequently with USFWS staff is to relocate suckers and establish additional populations in areas that already support the required habitat characteristics, but from which suckers have been extirpated. The Corps would also facilitate discussions with other affected stakeholders to ensure that they receive any necessary "take" or safe harbor agreement to cover their existing or planned activities in the area. The Corps would also require assurances of the amount and type of mitigation "credit" that would be applied to current or future Federal Actions prior to implementing habitat improvements or repopulation efforts.

Responses to Additional Measures for Consideration

a and b: The Corps is willing to discuss these concepts with USFWS to determine how or whether it would potentially be feasible to modify the outlet structure as suggested, and to consider the potential benefits of doing so compared to other restoration measures (such as sediment bypass) that are already being investigated through the Prado Basin Feasibility Study. Current authorities do not provide for modifications to the existing outlet structure. Other avenues to approve and, or authorize such a change would need to be further evaluated.

FIGURE 1





Legend

- Yorba Spur
- SARI New Alignment
- BNSF Bridge Protection (Proposed)
- Riverside County Sheet piles (SARI)
- Existing BNSF Sheet Piles
- Phase 1
- Phase 2A Footprint
- Phase 2B Footprint
- Phase 3 Footprint
- Phase 4 Footprint
- Phase 5A Footprint
- Phase 5B Footprint
- Lomas De Yorba - Sur Levee Existing Bank Protection
- CalTrans Existing Bank Protection
- HOA Existing Bank Protection
- Lomas De Yorba-Sur Levee (Existing Local Revetment)
- SAVI Ranch Levee (Existing Local Revetment)

Sources:

Background is from the ESRI ArcGIS Online Basemap Sources

Coordinate System:
State Plane California VI (FIPS 0406, Feet)
Datum: NAD 1983

Map Created: January 2014

N

0 0.25 0.5 1 Miles

SANTA ANA RIVER MAINSTEM PROJECT

REACH 9 PHASES AND IMPROVEMENT FEATURES

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

~~Plate 2b~~

FIGURE 2





Legend

- Phase 1 Footprint
- Phase 5A Footprint
- Phase 5B Footprint
- Lomas De Yorba - Sur Levee Existing Bank Protection

0 200 400 800 Feet

1 inch = 400 feet

Sources:

Background is from the ESRI ArcGIS Online Basemap Sources

Coordinate System:
State Plane California VI (FIPS 0406, Feet)
Datum: NAD 1983

N

SANTA ANA RIVER
MAINSTEM PROJECT

REACH 9 PHASE 5A
PROJECT EXTENT

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Plate XX





Legend

- SARI - Upland Revegetation (0.41 acres)
- SARI - Riparian Revegetation (0.13 acres)
- Phase 5A Footprint
- Phase 5B Footprint
- Lomas De Yorba - Sur Levee Existing Bank Protection

0 450 900 1,800 Feet

1 inch = 909 feet

Sources:

Background is from the ESRI ArcGIS Online Basemap Sources

Coordinate System:
State Plane California VI (FIPS 0406, Feet)
Datum: NAD 1983

N

SANTA ANA RIVER
MAINSTEM PROJECT

REACH 9 PHASE 5B DOWNSTREAM PROJECT EXTENTS

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Plate XX

FIGURE 4





Legend

Phase 5B Footprint

Lomas De Yorba - Sur Levee Existing Bank Protection

Sources:

Background is from the ESRI ArcGIS Online Basemap Sources

Coordinate System:
State Plane California VI (FIPS 0406, Feet)
Datum: NAD 1983

N

0 450 900 1,800 Feet

1 inch = 900 feet

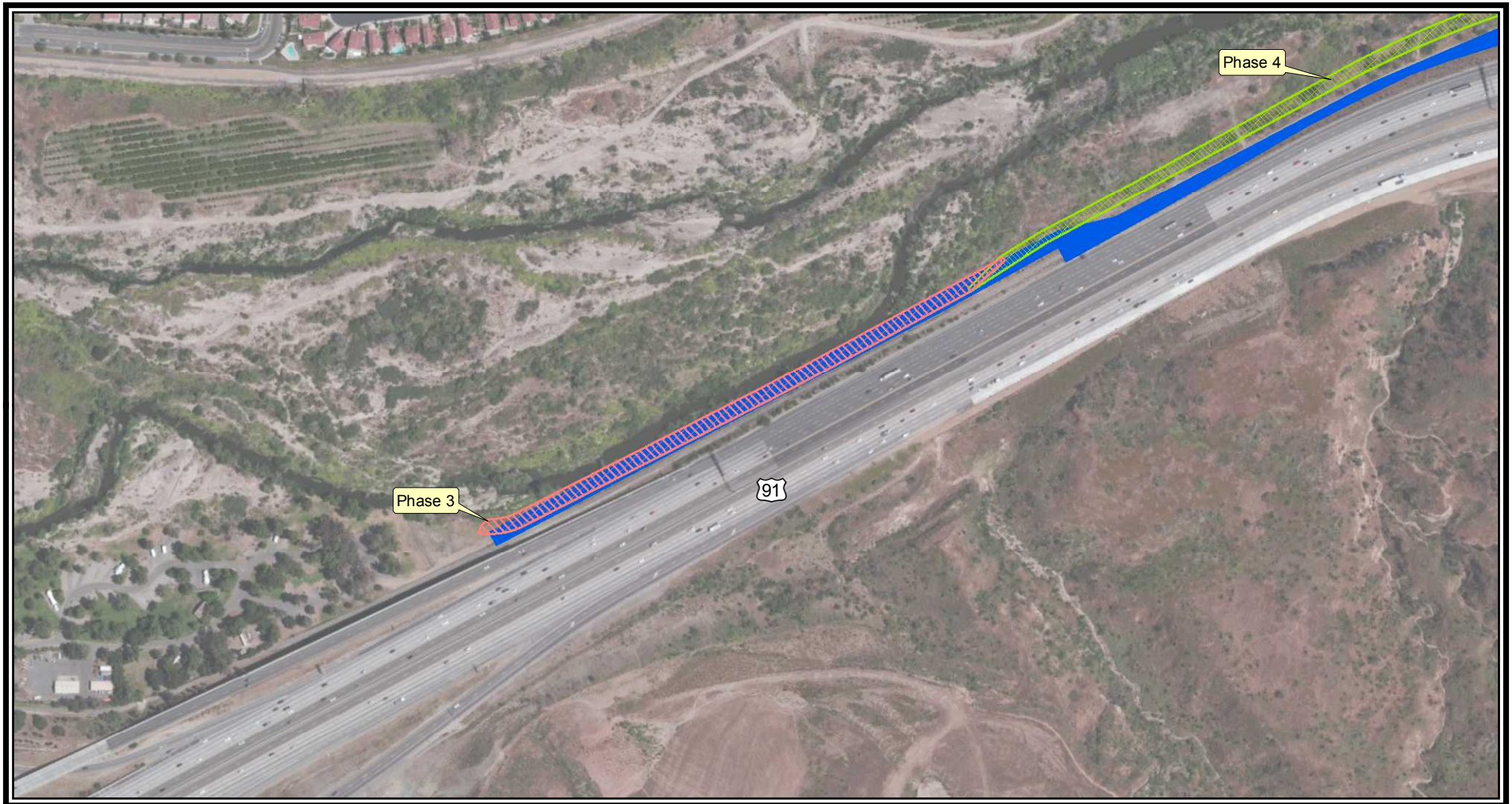
SANTA ANA RIVER
MAINSTEM PROJECT

REACH 9 PHASE 5B
UPSTREAM
PROJECT EXTENTS

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

~~Plate XX~~

FIGURE 5





Legend

- Phase 3 Footprint
- Phase 4 Footprint
- CalTrans Existing Bank Protection

Sources:

Background is from the ESRI ArcGIS Online Basemap Sources

Coordinate System:
State Plane California VI (FIPS 0406, Feet)
Datum: NAD 1983

N

0 200 400 800 Feet

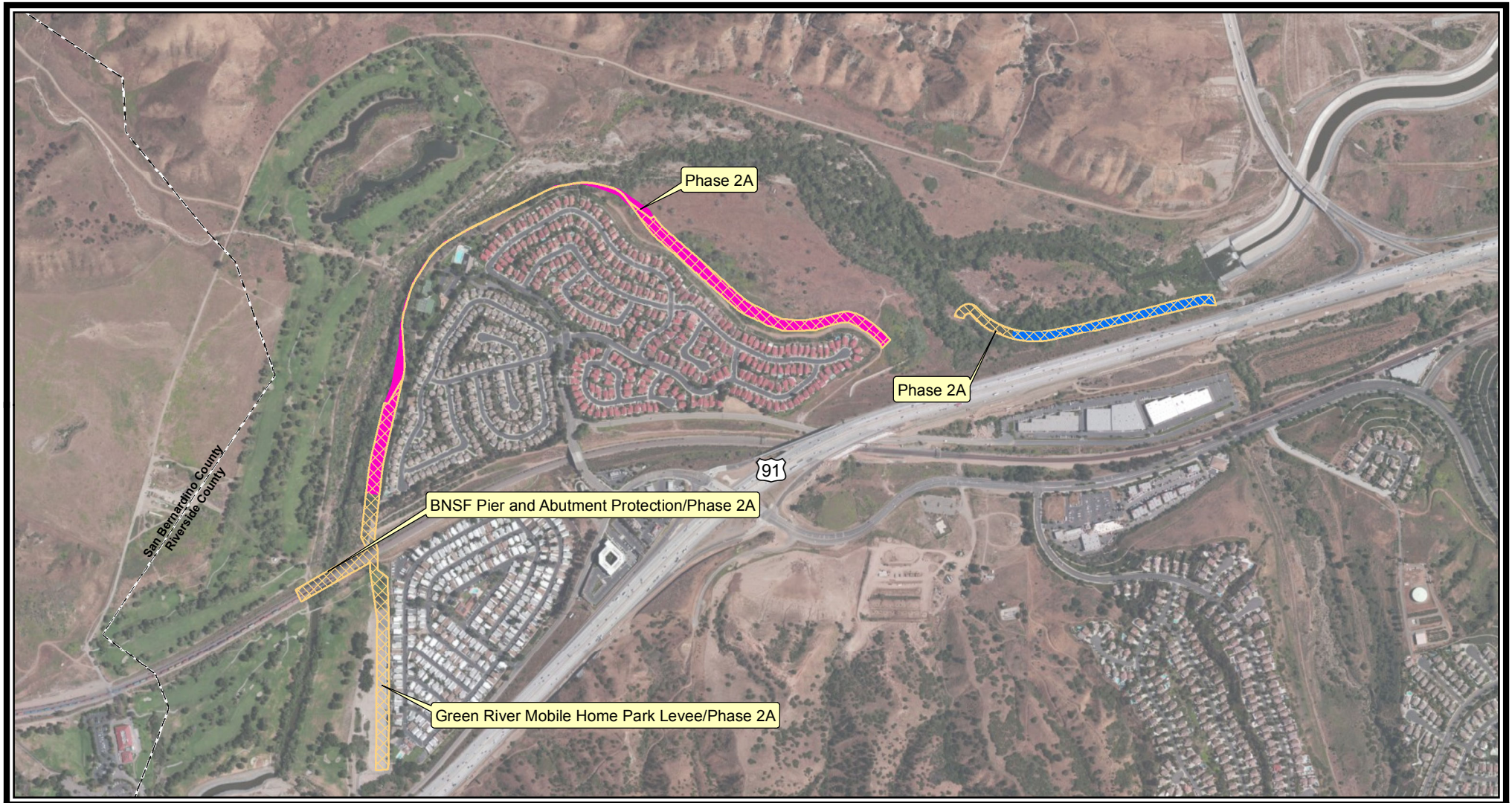
1 inch = 400 feet

SANTA ANA RIVER MAINSTEM PROJECT

REACH 9 PHASE 3 PROJECT EXTENT

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

~~Plate XX~~





Legend

- Phase 2A Footprint
- HOA Existing Bank Protection
- CalTrans Existing Bank Protection

Sources:

Background is from the ESRI ArcGIS Online Basemap Sources

Coordinate System:
State Plane California VI (FIPS 0406, Feet)
Datum: NAD 1983

N

0 450 900 1,800 Feet

1 inch = 1,054 feet

SANTA ANA RIVER
MAINSTEM PROJECT

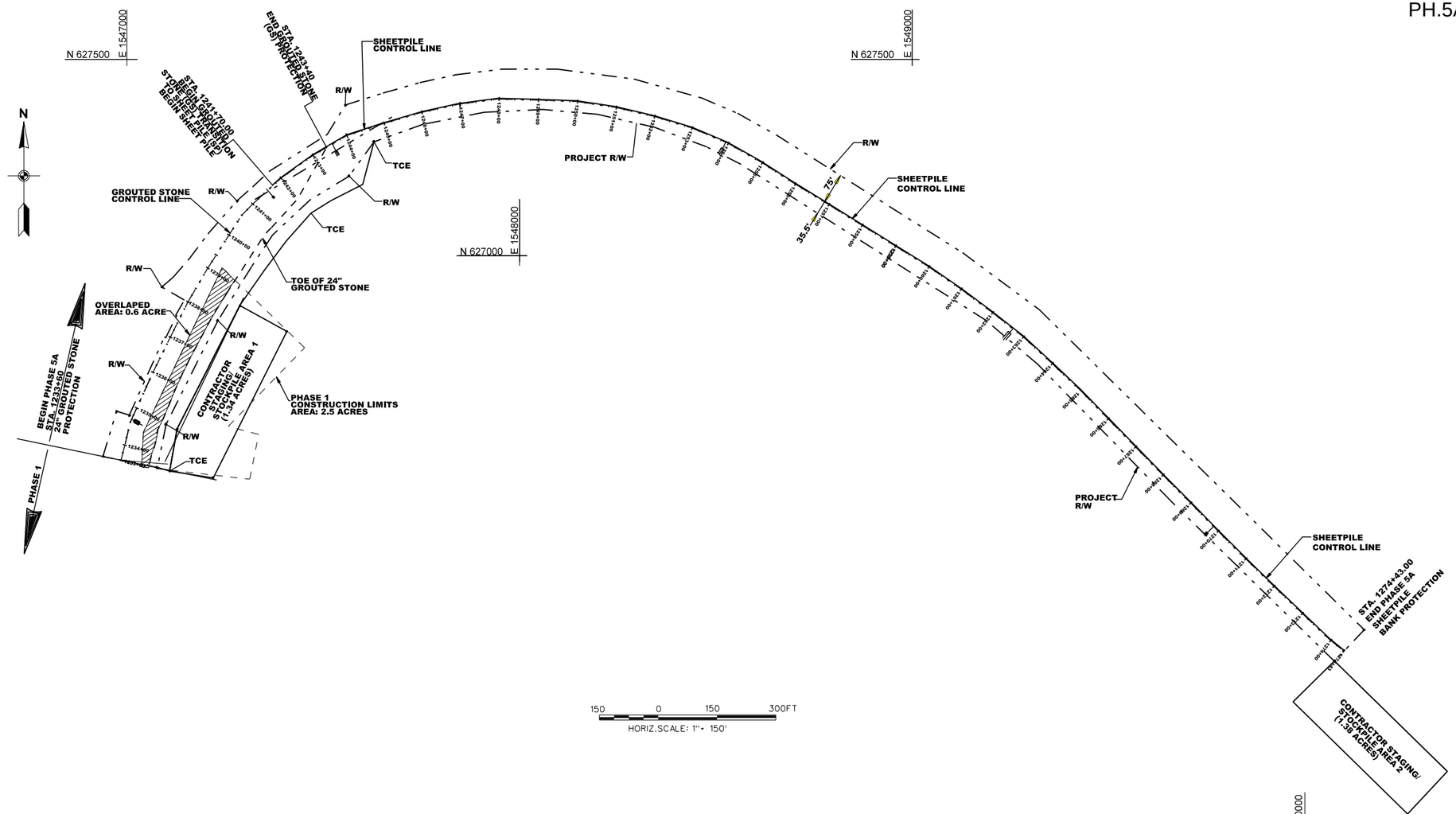
REACH 9 PHASE 2A PROJECT EXTENT

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Plate XX

FIGURE 7

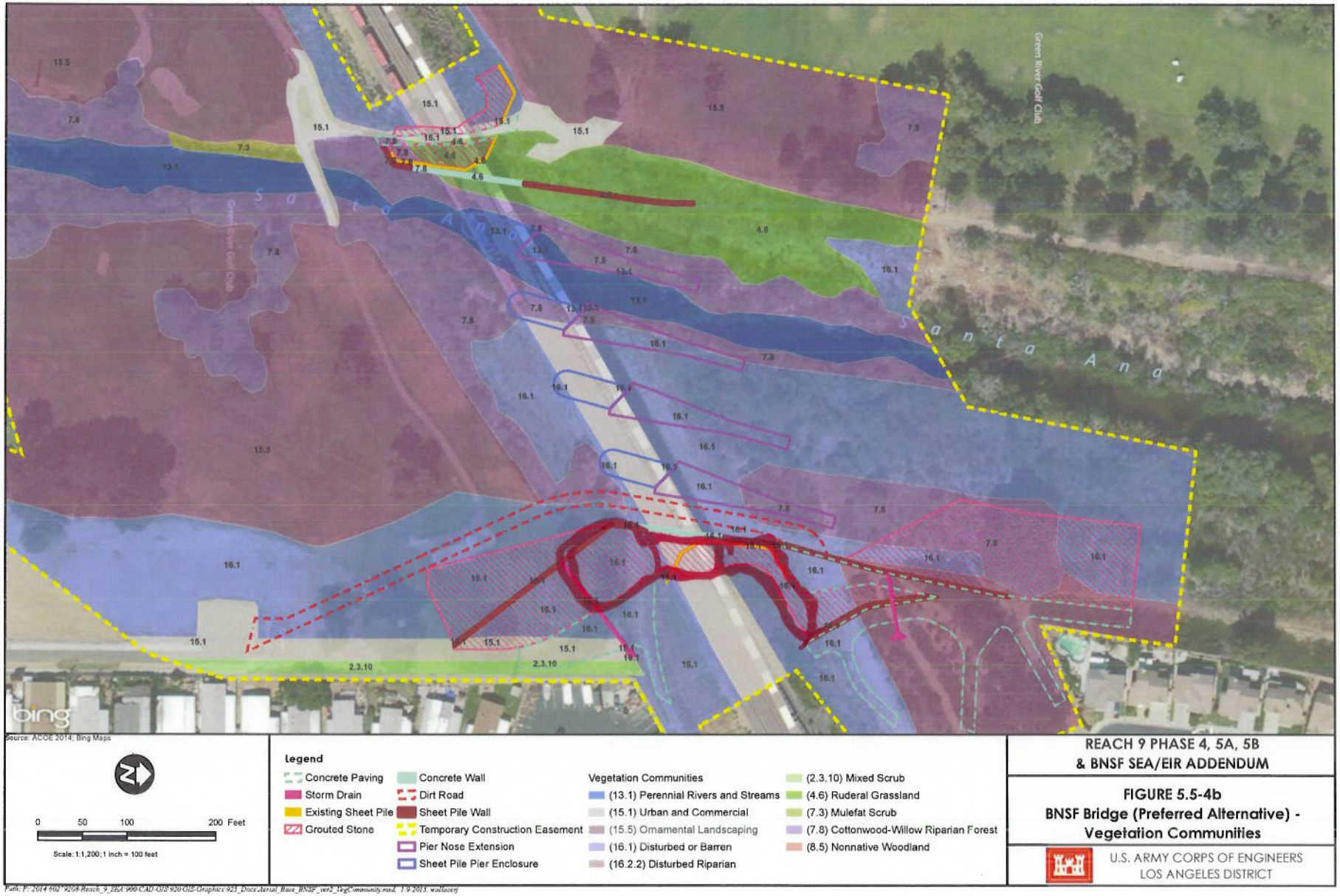
PH.5A OVERLAP WITH PH. 1 TCE



239/3335

FIGURE 8

BNSF OVERLAP WITH PH. 2A TCE





LEGEND:

DISTURBED AREA DURING THE CONSTRUCTION OF LSAR R9 PHASE 3 PROJECT.

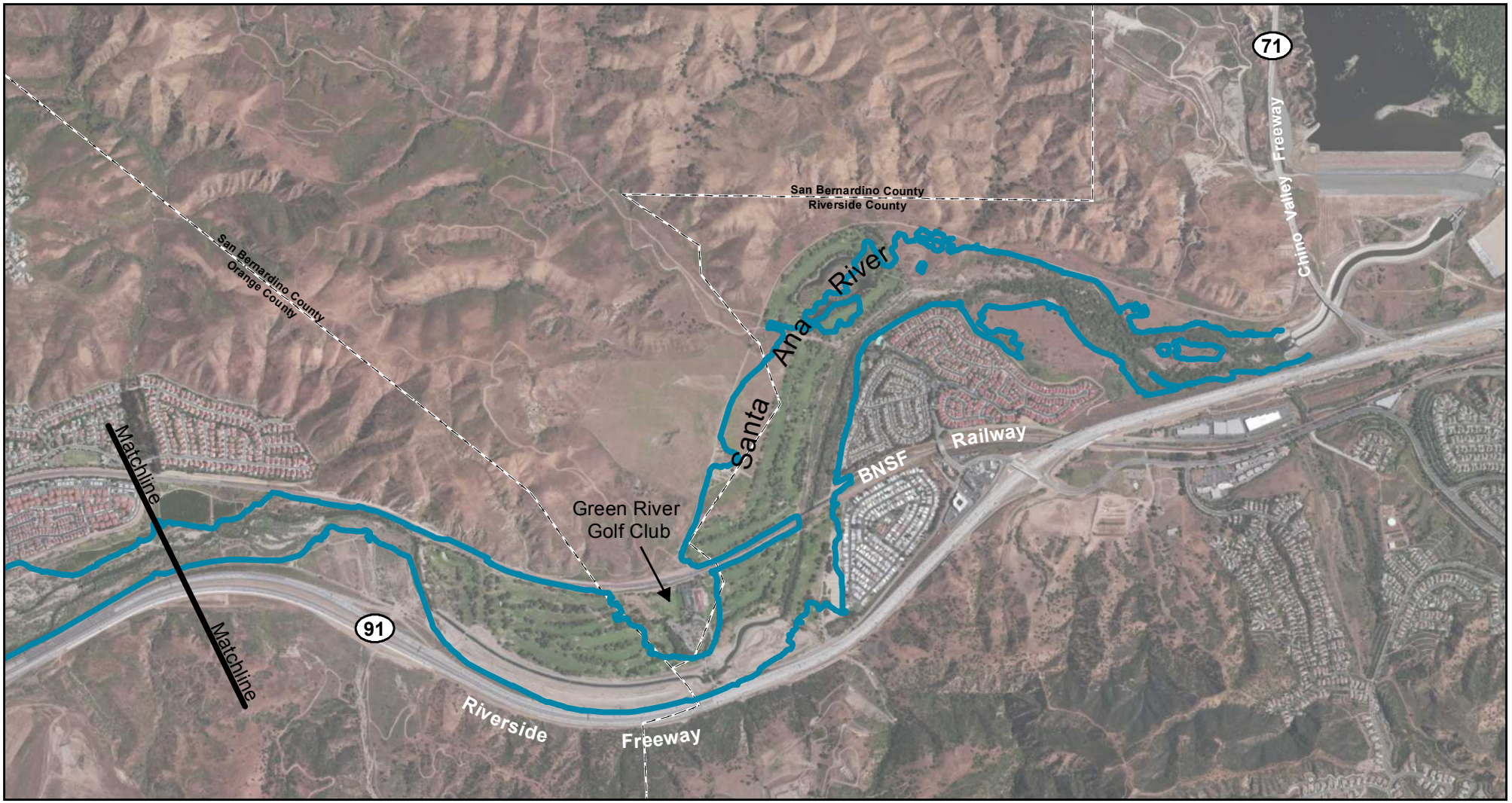
PERMANENTLY IMPACTED AREA FOR THE DESIGN OF LSAR R9 PHASE 4 PROJECT.

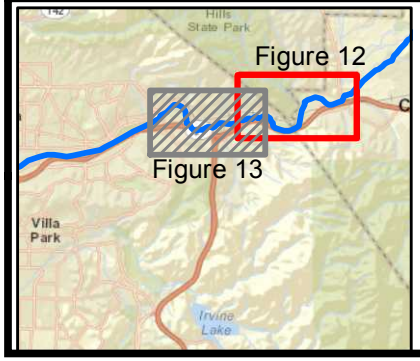
AREA THAT WAS DISTURBED DURING THE CONSTRUCTION OF LSAR R9 PHASE 3 PROJECT AND HAS BEEN IDENTIFIED AS AREA THAT WILL BE PERMANENTLY IMPACTED AFTER LSAR R9 PHASE 4 IS CONSTRUCTED (AREA = 2.14 ACRES).

FIGURE 9

200 100 0 200 400FT

SCALE: 1"= 200'





Legend

30000 cfs released

County Boundary

Sources:

Background is from the ESRI ArcGIS Online Basemap Sources

Coordinate System:
State Plane California VI (FIPS 0406, Feet)
Datum: NAD 1983

Map Created: January 2014

N

0 1,000 2,000 4,000 Feet

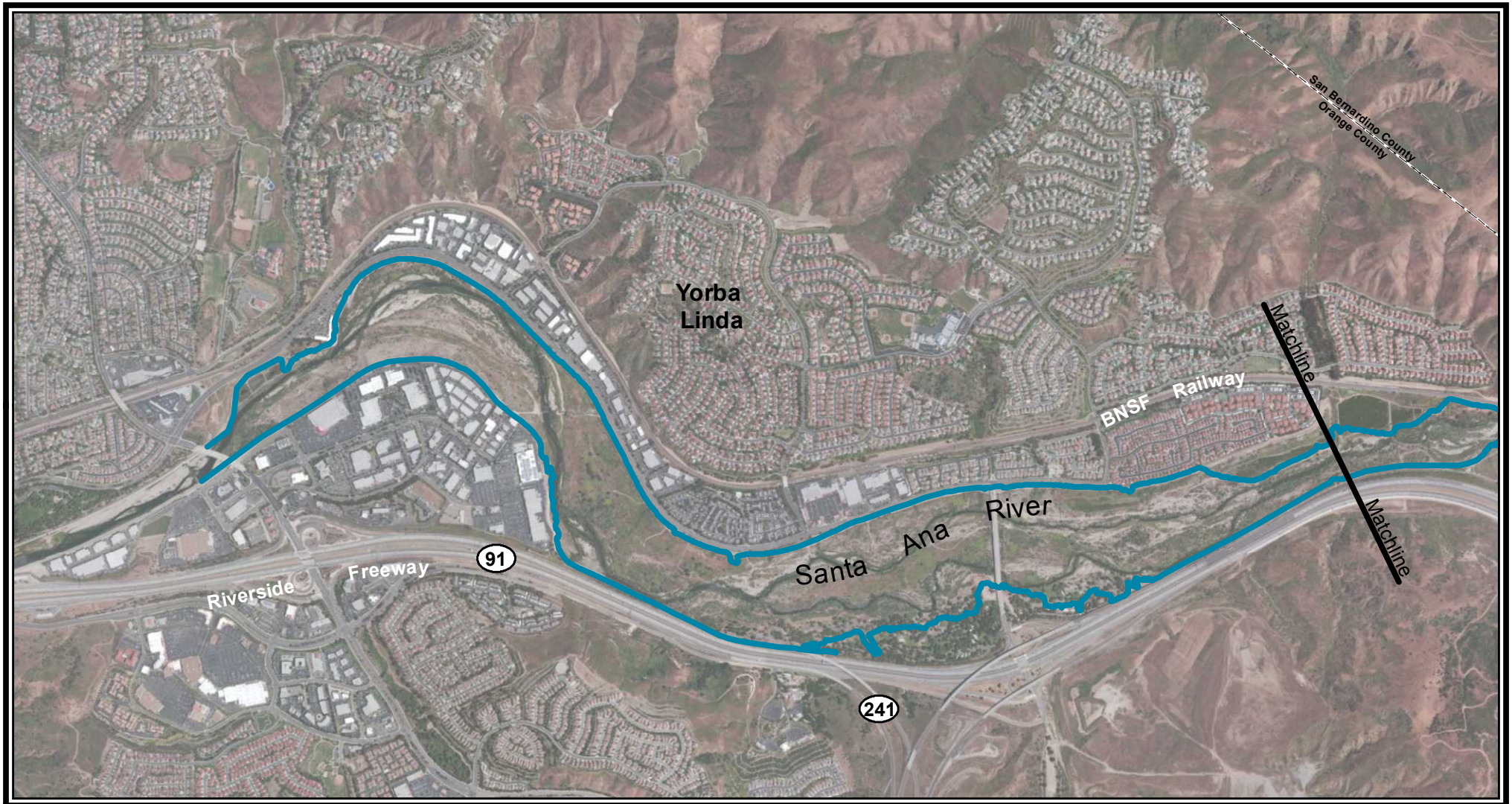
1 inch = 2,000 feet

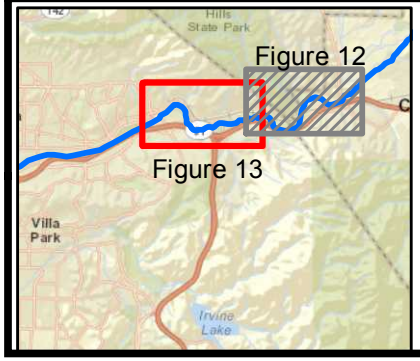
SANTA ANA RIVER
MAINSTEM PROJECT

REACH 9
PROJECT DESIGN
FLOOD INUNDATION MAP
(MAP 1 OF 2)

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

FIGURE 11





Legend

30000 cfs released

County Boundary

Sources:

Background is from the ESRI ArcGIS Online Basemap Sources

Coordinate System:
State Plane California VI (FIPS 0406, Feet)
Datum: NAD 1983

Map Created: January 2014

N

0 1,000 2,000 4,000 Feet

1 inch = 2,000 feet

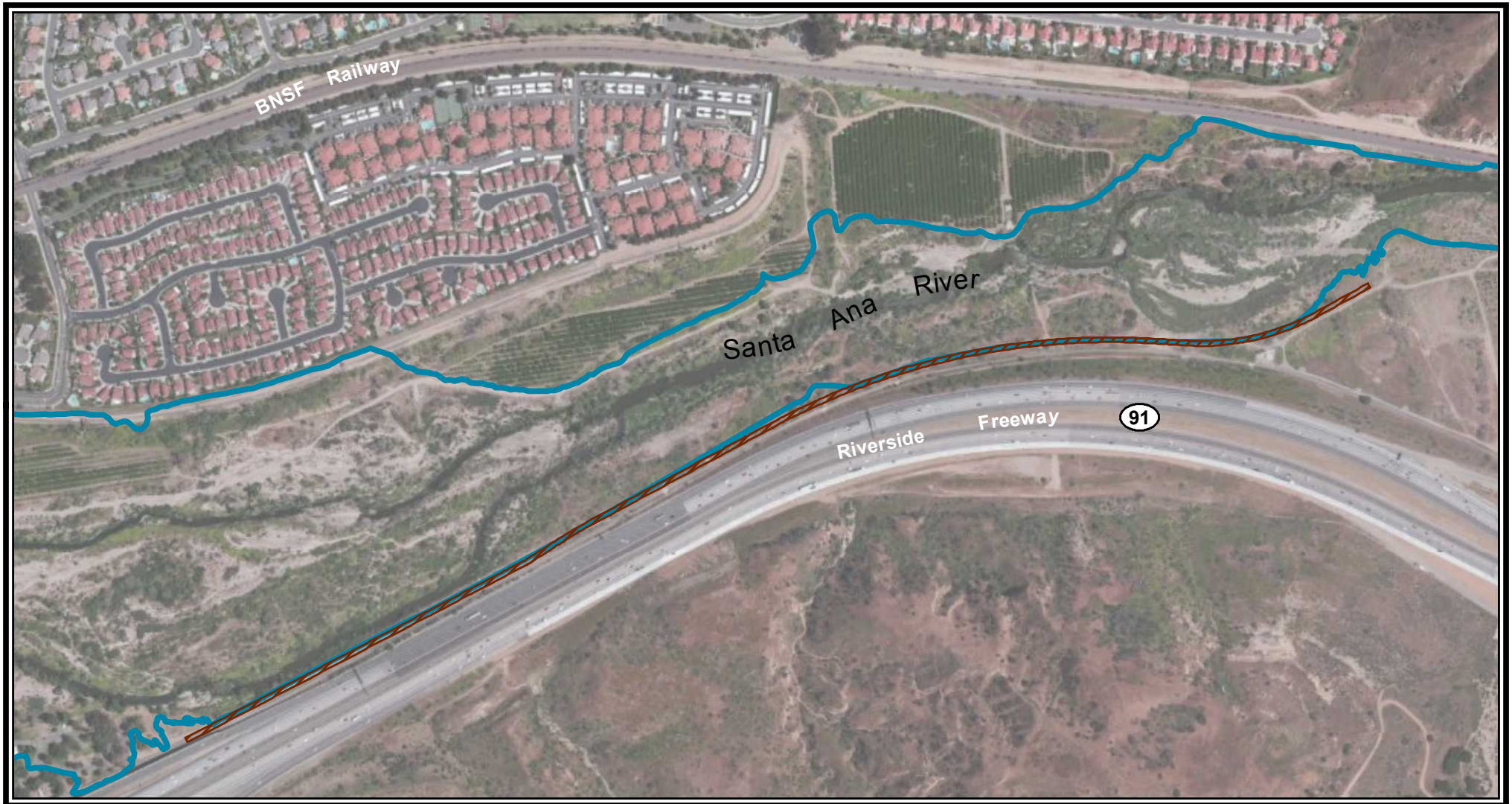
SANTA ANA RIVER
MAINSTEM PROJECT

REACH 9
PROJECT DESIGN
FLOOD INUNDATION MAP
(MAP 2 OF 2)

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Plate 13

FIGURE 12





Legend

Phase 4 (Proposed)

30000 cfs released

Sources:

Background is from the ESRI ArcGIS Online Basemap Sources

Coordinate System:
State Plane California VI (FIPS 0406, Feet)
Datum: NAD 1983

Map Created: January 2014

N

0 300 600 1,200 Feet

1 inch = 600 feet

SANTA ANA RIVER
MAINSTEM PROJECT

REACH 9
PROJECT DESIGN
FLOOD INUNDATION MAP
PHASE 4

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Plate XX

Figure 6(a)-1 Culvert Locations at Reach 9 Phase 4 Project Feature

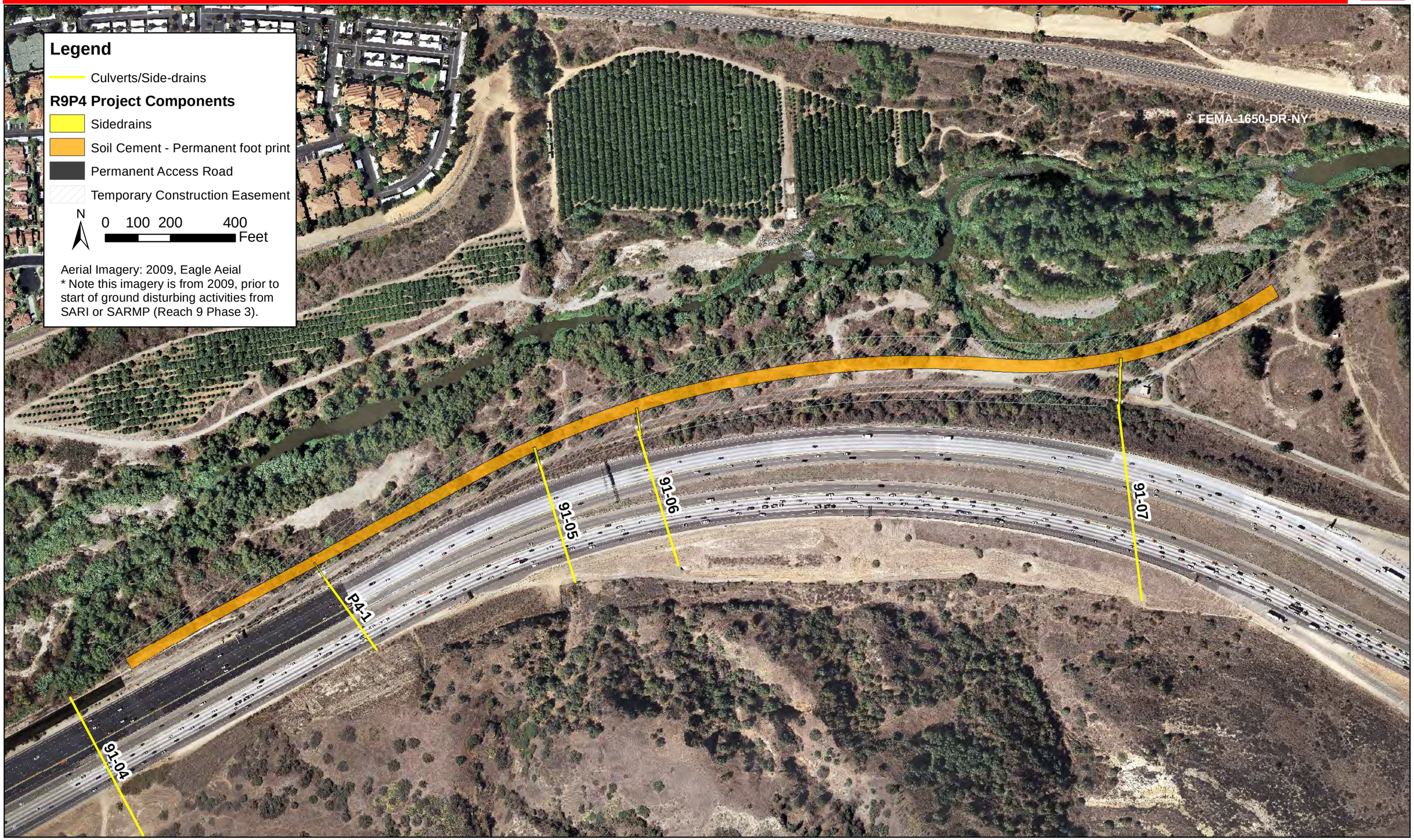


Figure 6(a)-2.1 Plant Communities near Culvert (P4-1) Opening

(14.3) Orchard and Vineyard
(16.2.1) Disturbed Scrub
(13.1) Perennial Rivers and Streams
(7.8) Cottonwood-Willow Riparian Forest
(8.1) Coast Live Oak Woodland
(4.6) Ruderal Grassland
(4.1) Annual Grassland
(4.11) Giant Reed Grassland
(16.1) Disturbed or Barren
(2.3.10) Mixed Scrub
(7.2) Willow Riparian Scrub
(2.6) Scale-Broom Scrub
(2.10) Yerba Santa Scrub
(8.4) Mexican Elderberry Woodland
P4-1

Legend

Culverts/Side-drains

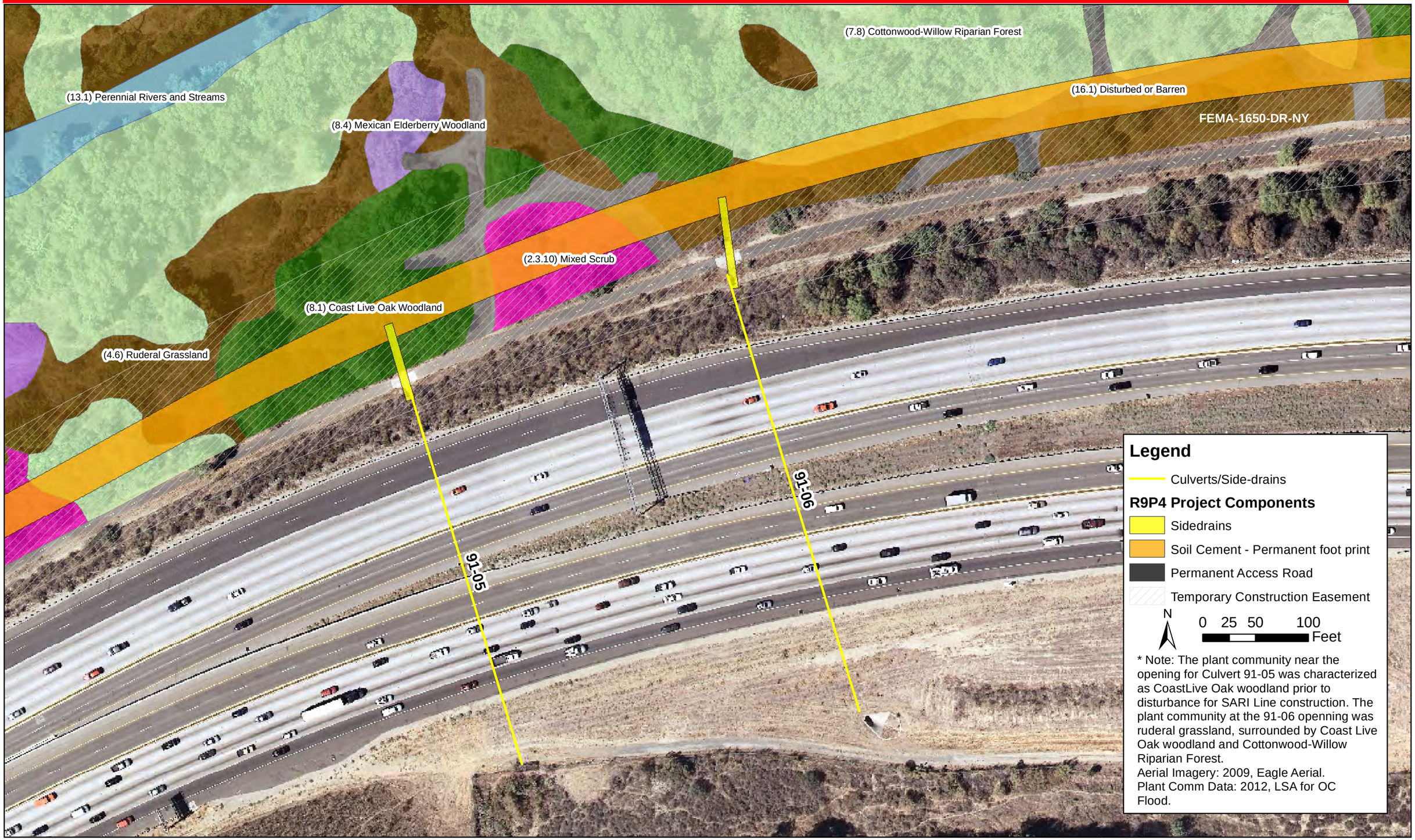
R9P4 Project Components

Sidedrains
Soil Cement - Permanent foot print
Permanent Access Road
Temporary Construction Easement

N
0 25 50 100 Feet

* Note: The opening for Culvert P4-1 was characterized as Mexican elderberry woodland prior to disturbance for SARI Line construction.
Aerial Imagery: 2009, Eagle Aerial.
Plant Comm Data: 2012, LSA for OC Flood.

Figure 6(a)-2.2 Plant Communities near Culvert (91-05 & 91-06) Openings



* Note: The plant community near the opening for Culvert 91-05 was characterized as CoastLive Oak woodland prior to disturbance for SARI Line construction. The plant community at the 91-06 openning was ruderal grassland, surrounded by Coast Live Oak woodland and Cottonwood-Willow Riparian Forest.
Aerial Imagery: 2009, Eagle Aerial.
Plant Comm Data: 2012, LSA for OC Flood.

Figure 6(a)-2.3 Plant Communities near Culvert (91-07) Opening

(7.1) Herbaceous Riparian
(14.3) Orchard and Vineyard
(4.11) Giant Reed Grassland
FEMA-1650-DR-NY
(2.6) Scale-Broom Scrub
(7.12) Barren Riparian
(13.1) Perennial Rivers and Streams
(7.3) Mulefat Scrub
(7.8) Cottonwood-Willow Riparian Forest
(4.6) Ruderal Grassland
(8.1) Coast Live Oak Woodland
(16.1) Disturbed or Barren
(2.3.10) Mixed Scrub
(15.1) Urban and Commercial
91-06
91-07

Legend

- Culverts/Side-drains
- 4-Foot x 5-Foot Drain

R9P4 Project Components

- Sidedrains
- Soil Cement - Permanent foot print
- Permanent Access Road
- Temporary Construction Easement

N

0 50 100 200 Feet

* Note: The plant community near the opening for Culvert 91-07 was characterized as Cottonwood-Willow Riparian Forest prior to disturbance for SARI Line construction.
Aerial Imagery: 2009, Eagle Aerial.
Plant Comm Data: 2012, LSA for OC Flood.

Figure 6(a)-3 Wildlife Switch-back Ramp Photographs at Reach 9 Phase 3

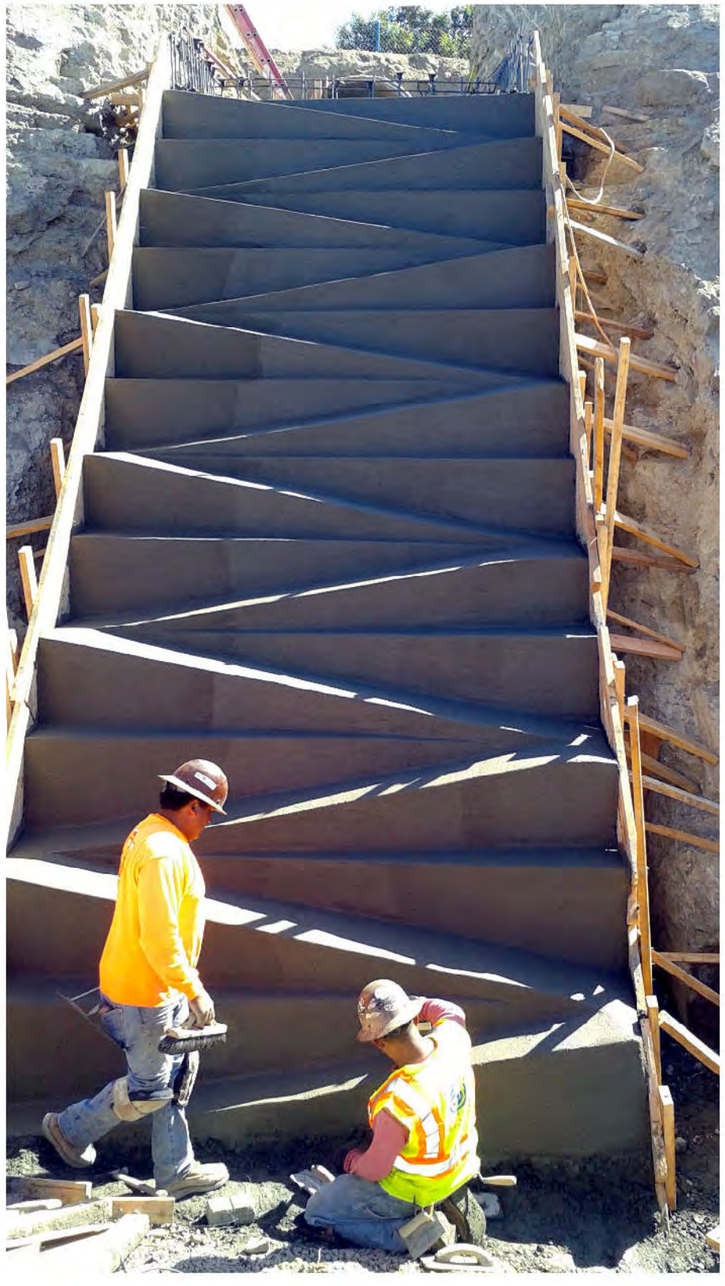




Figure 6(a)-4 Historic Thalweg Locations within the Vicinity of the Reach 9 Phase 4 SARMP Feature

FEMA-1650-DR-NY

91-04
P4-1
91-05
91-06
91-07
80-75

Legend

Historic Thalwegs By Year

- 1929
- 1968
- 1970
- 1979
- 1981
- 1990/1991
- 2004
- 2007

- Culverts/Side-drains
- 4-Foot x 5-Foot Drain

R9P4 Project Components

- Sidedrains
- Soil Cement - Permanent foot print
- Permanent Access Road
- Temporary Construction Easement

N

0 100 200 400 Feet

* Looking at mapped thalwegs at points in time between 1929 and 2007, it appears that the channel tends toward its current alignment.

Figure 6(b)-1 BNSF Railroad Bridge Protection

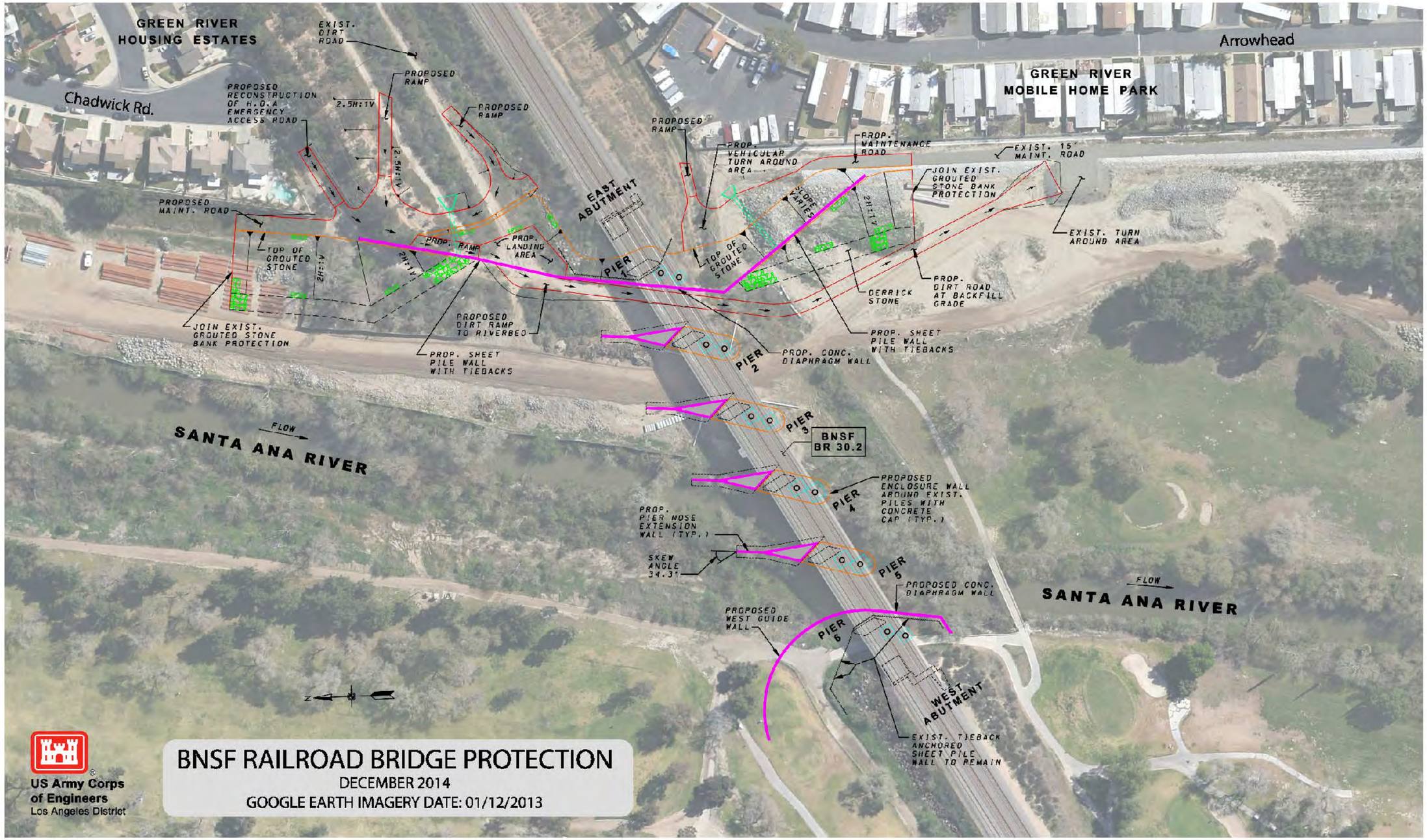
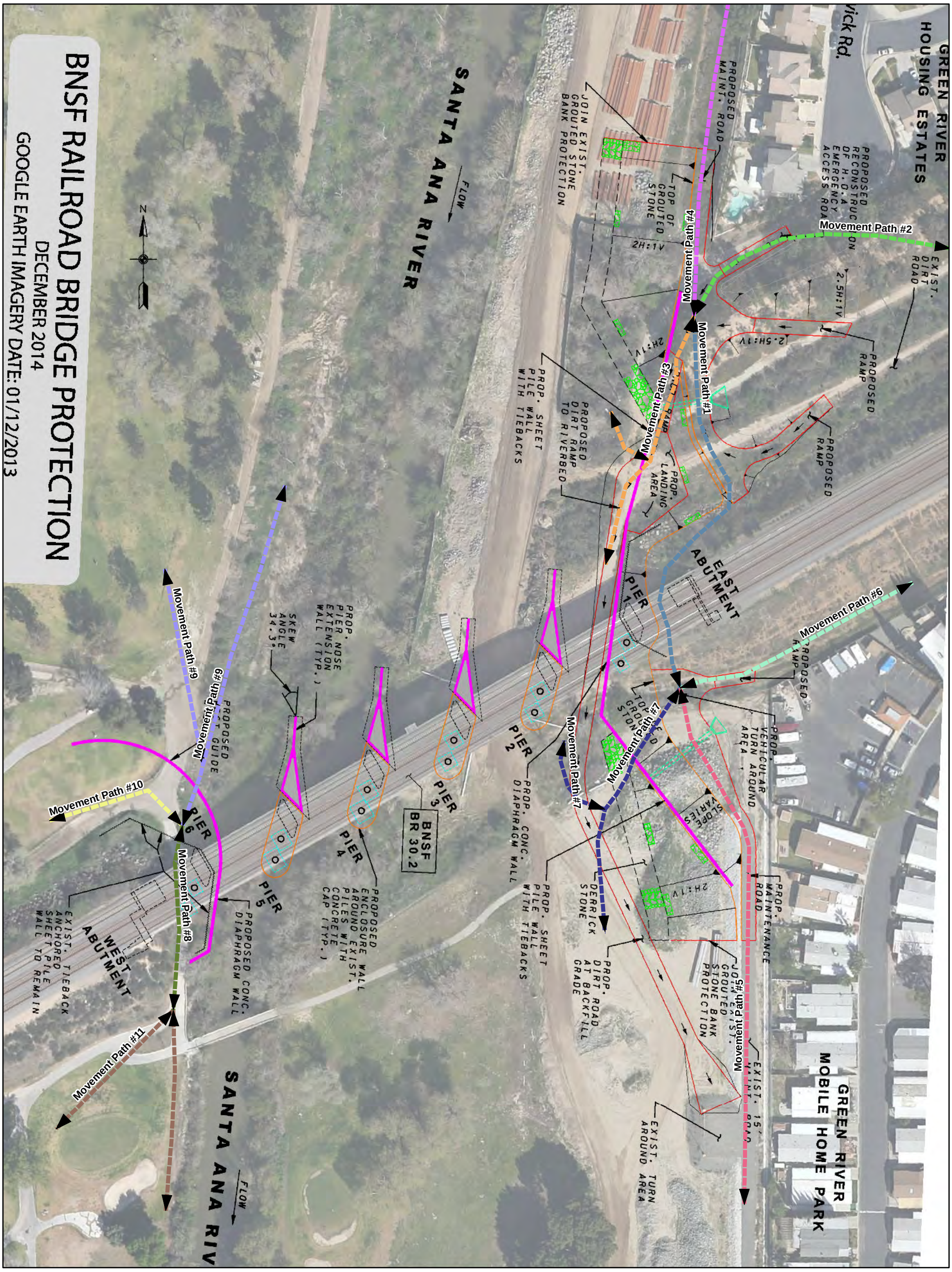
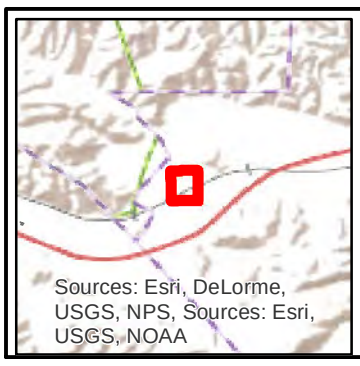


Figure 6(b)-2 BNSF Movement Paths





Legend

Wildlife Movement Routes

- Movement Path #1
- Movement Path #2
- Movement Path #3
- Movement Path #4
- Movement Path #5
- Movement Path #6
- Movement Path #7
- Movement Path #8
- Movement Path #9
- Movement Path #10
- Movement Path #11

0 0.004 0.008 0.016
Miles

DISCLAIMER - While the United States Army Corps of Engineers, (hereinafter referred to USACE) has made a reasonable effort to insure the accuracy of the maps and associated data, its should be explicitly noted that USACE makes no warranty, representation or guaranty, either express or implied, as to the content, sequence, accuracy, timeliness or completeness of any of the data provided herein. The USACE, its officers, agents, employees, or servants shall assume no liability of any nature for any errors, omissions, or inaccuracies in the information provided regardless of how caused. The USACE, its officers, agents, employees or servants shall assume no liability for any decisions made or actions taken or not taken by the user of the maps and associated data in reliance upon any information or data furnished here. By using these maps and associated data the user does so entirely at their own risk and explicitly acknowledges that he/she is aware of and agrees to be bound by this disclaimer and agrees not to present any claim or demand of any nature against the USACE, its officers, agents, employees or servants in any forum whatsoever for any damages of any nature whatsoever that may result from or may be caused in any way by the use of the maps and associated data.

PATH/FILE_NAME/DATE/TIME