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

Prepared for:

US Army Corps
of Engineers®

Los Angeles District

With Technical Assistance Provided by:

AECOM
Orange, California

January 2015

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1.0 INTRODUCTION

This draft 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 Draft 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 Project 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 draft 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.

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 This Draft SEA/EIR Addendum

This draft SEA/EIR Addendum has been prepared by AECOM for and in coordination with the Corps and OCFCD and has been independently reviewed by the 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 this draft SEA/EIR Addendum are identified in Chapter 9, List of Preparers and Contributors.

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, 4,140 feet (0.78 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.

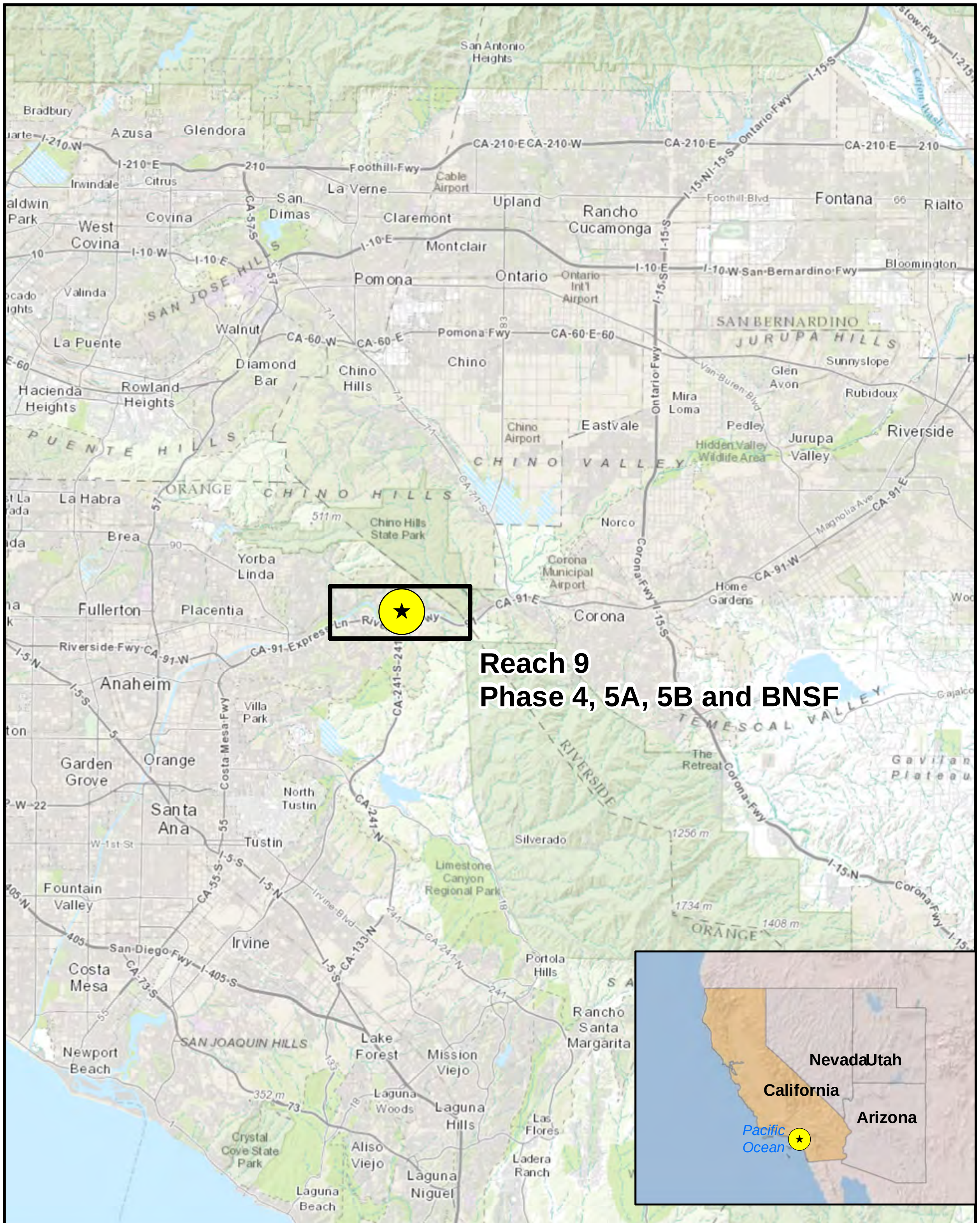
2.3 Phase 4

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

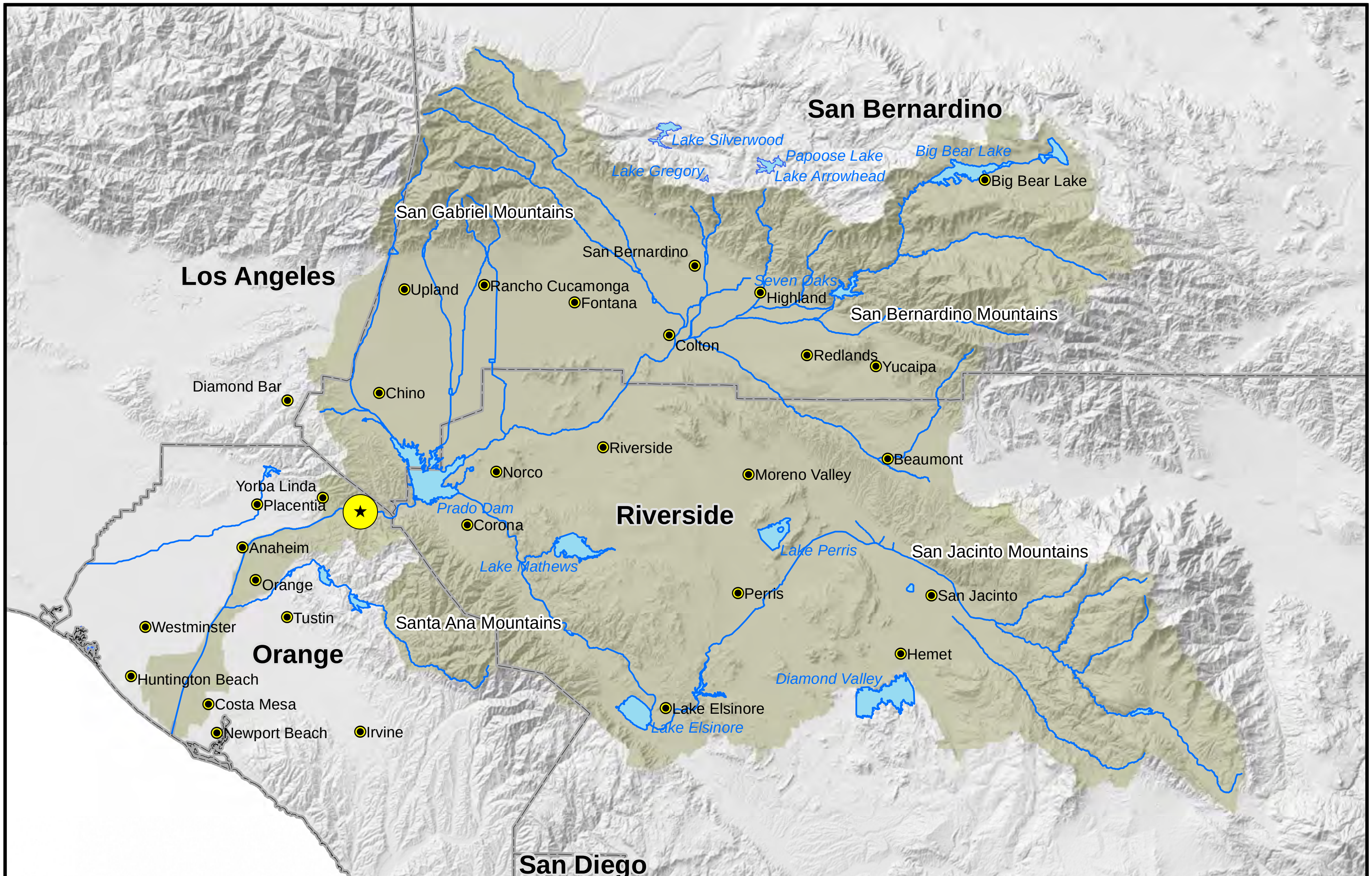
Scale: 1:360,000 1 inch = 30,000 feet

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



Source: Cal-Atlas 2008; SAWPA 2004

0 25,000 50,000 100,000 Feet

Scale: 1:720,000 1 inch = 60,000 feet

Legend

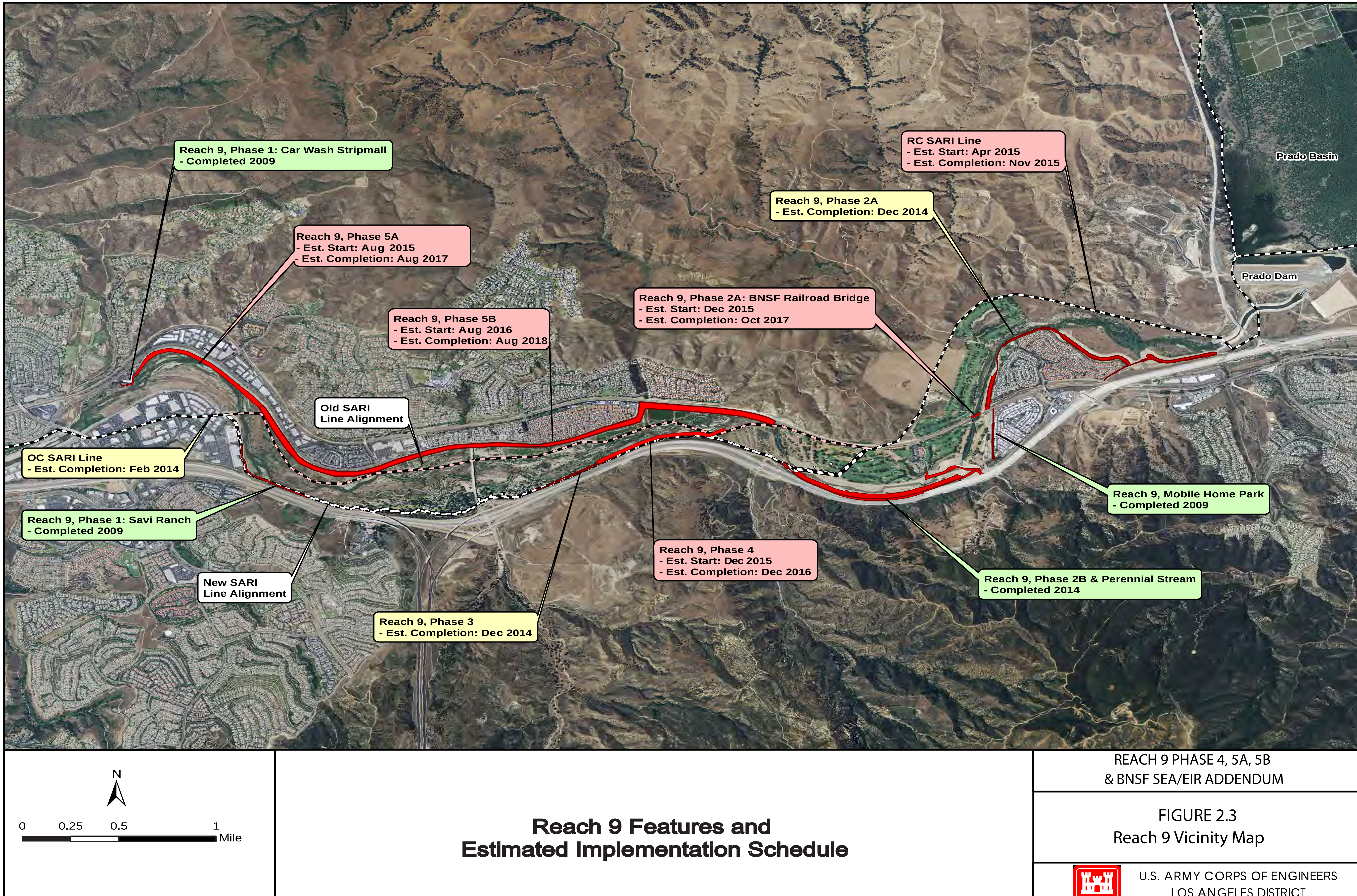
- Reach 9
- City
- County Boundary
- Rivers
- Lakes
- Watershed

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



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

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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, Phases 5A and 5B 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. Grouted stone or soil cement structures, and in Phase 5A, a section of sheet pile protection, are recommended for installation to 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 would provide new bridge pier protection features (i.e., pier nose extensions, sheet pile enclosure walls) and bank protection features (i.e., grouted stone, sheet pile walls, concrete walls) 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.

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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, 4,140 feet (0.78 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 4,140-foot section of the LDY-S Levee consisting of ungrouted stone bank protection would be replaced by 1,100 feet of a grouted stone structure and 3,040 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 1,100-foot reach. Figure 4.1-3 depicts a typical grouted stone section and Figure 4.1-4 a typical sheet pile section proposed under this alternative.

Construction Phasing

It is anticipated that bank protection in Phase 5A would be constructed in two phases; one to construct the grouted stone structure and one for installation of sheet pile protection. 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 1,100 feet long. Approximately 30,400 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, 3,600 tons, and 69,900 cubic yards, respectively. In addition to alluvial excavation, an estimated 3,600 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 3,600 tons of riprap stone and 7,900 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.

Interior Drainage

There are six existing interior side drains belonging to OCFCD 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.

Source: ACOE 2014; Bing Maps

0 75 150 300 Feet

Scale: 1:2,400; 1 inch = 200 feet

Legend

- Permanent Maintenance Road
- Temporary Construction Easement Grouted Stone
- Temporary Construction Easement Sheet Pile
- Permanent Grouted Stone
- Permanent Sheet Pile
- Staging Area

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

FIGURE 4.1-1
PHASE 5A - Project Features

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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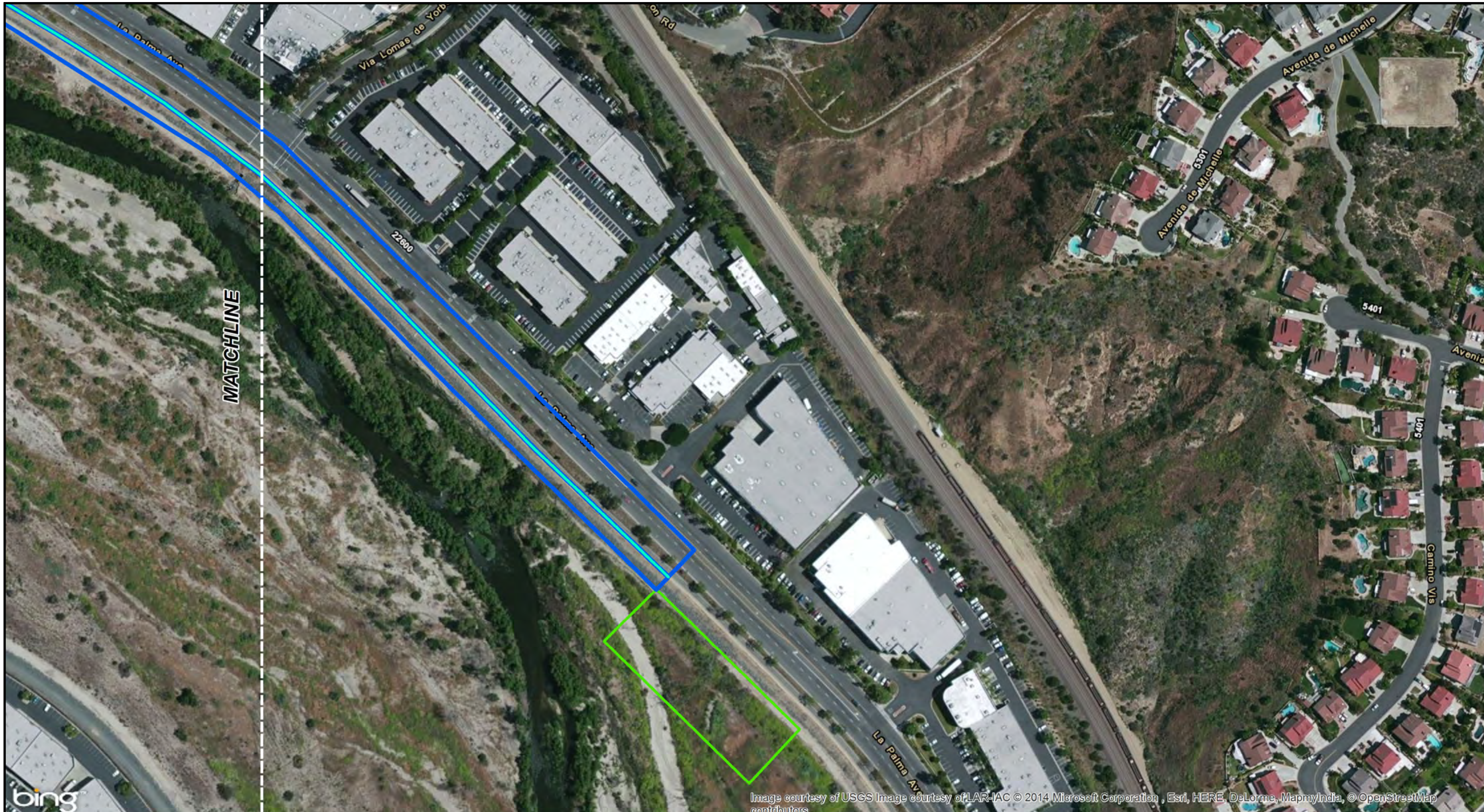

Source: ACOE 2014; Bing Maps

N

0 75 150 300 Feet

Scale: 1:2,400; 1 inch = 200 feet

Legend

- Temporary Construction Easement Grouted Stone
- Temporary Construction Easement Sheet Pile
- Permanent Grouted Stone
- Permanent Sheet Pile
- Staging Area

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

FIGURE 4.1-2
PHASE 5A - Project Features

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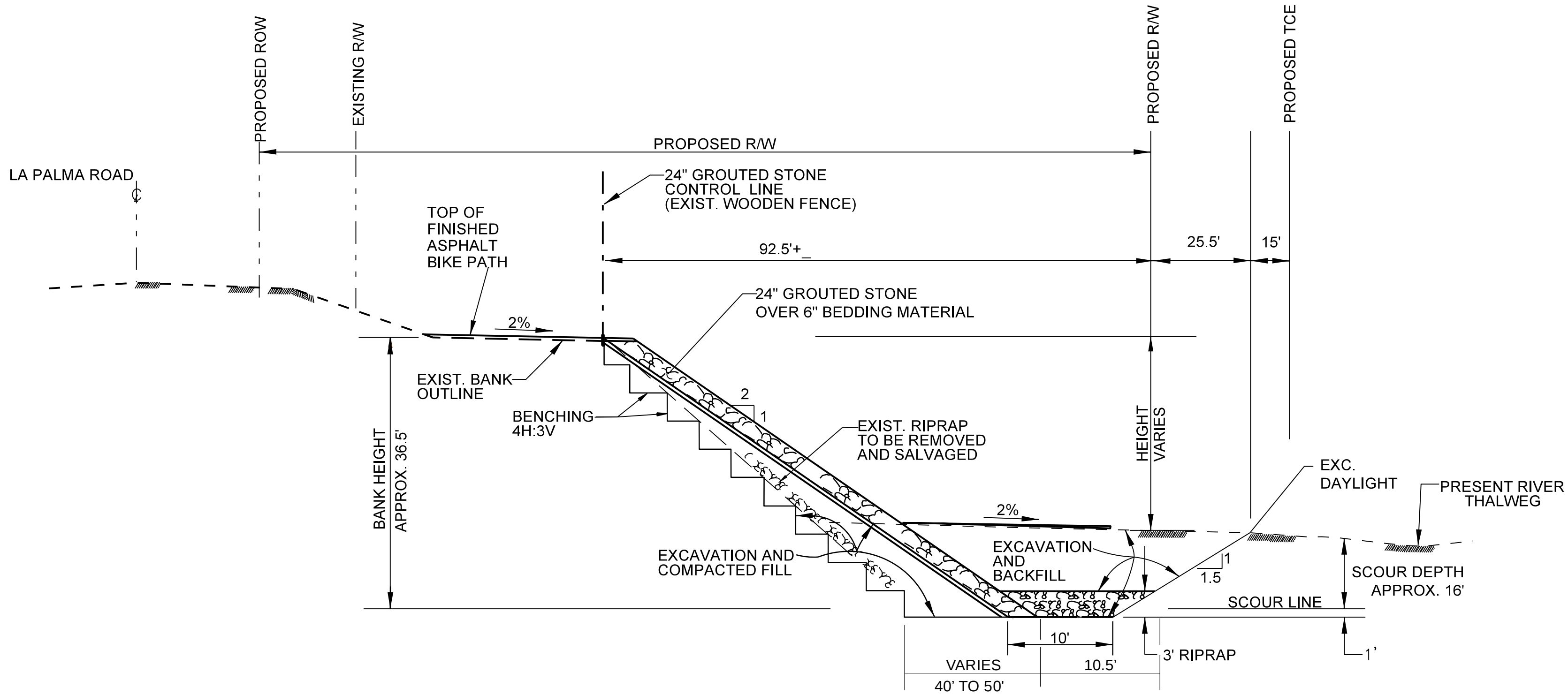

TYPICAL GROUTED STONE SECTION
LOOKING UPSTREAM
N.T.S.

Source: ACOE 2014

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

FIGURE 4.1-3
Phase 5A - Typical Grouted Stone Section

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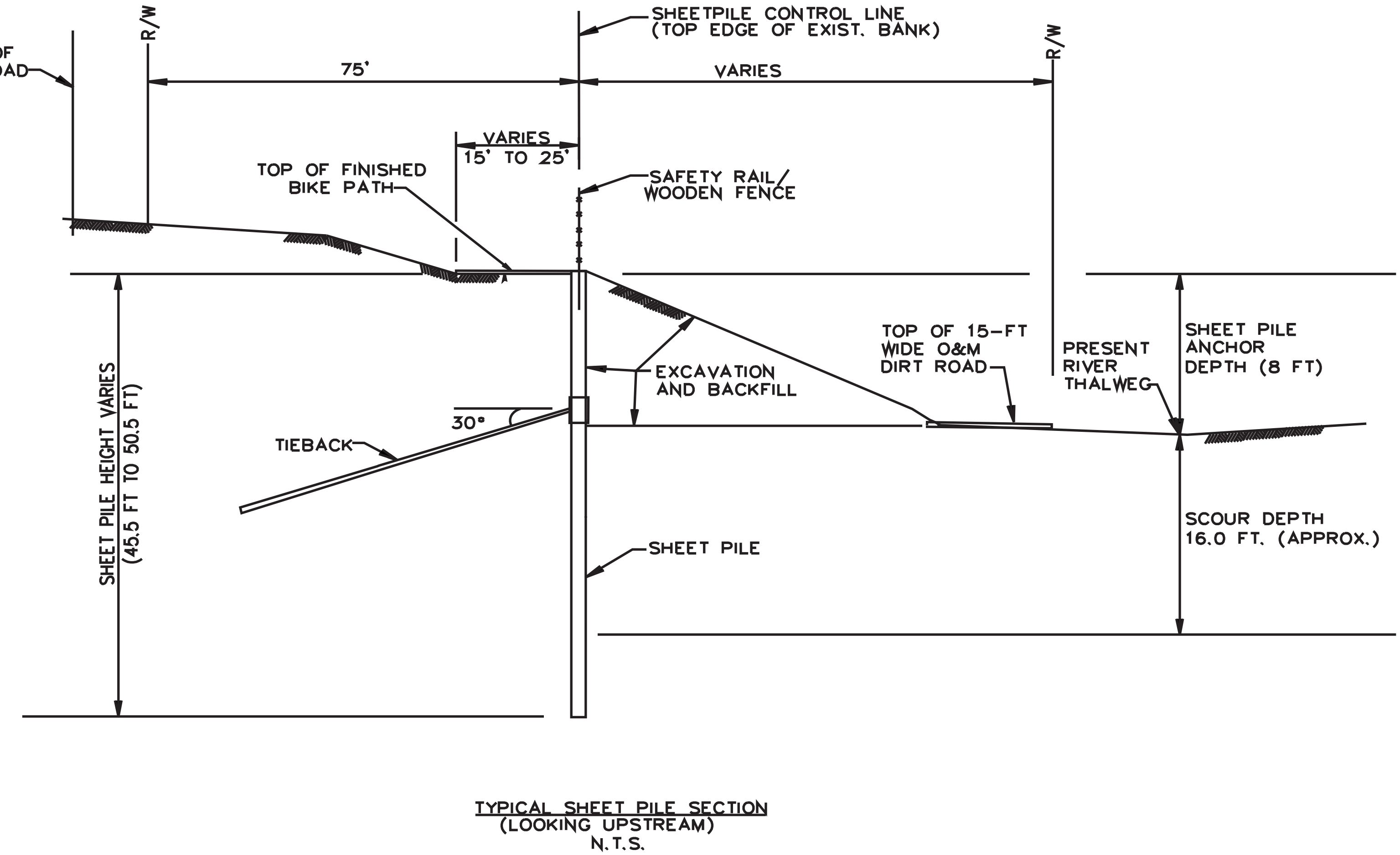

Source: ACOE 2014

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

FIGURE 4.1-4
Phase 5A - Typical Sheet Pile Section

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Water Diversion and Dewatering

No diversion or control of water in the active channel of the SAR would be required during construction. Dewatering 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 1.34 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.

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 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 18–24 months to complete. Clearing and grubbing is proposed to begin in August 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 August 2017. Funding constraints, weather delays, and other issues could potentially move the construction timeline into 2018. Daily construction would occur between 7:00 a.m. and 4:00 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 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 20 to 26 months to complete. Clearing and grubbing would commence in August 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 October 2017. Funding constraints, weather delays, and other issues could potentially move the construction timeline into 2018. Daily construction would occur between 7:00 a.m. and 4:00 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 3,040-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 Grouted Stone Alternative (Preferred Alternative, Alternative 1)

Under this alternative, grouted stone 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. 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 cubic yards 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 4.2-4 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 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

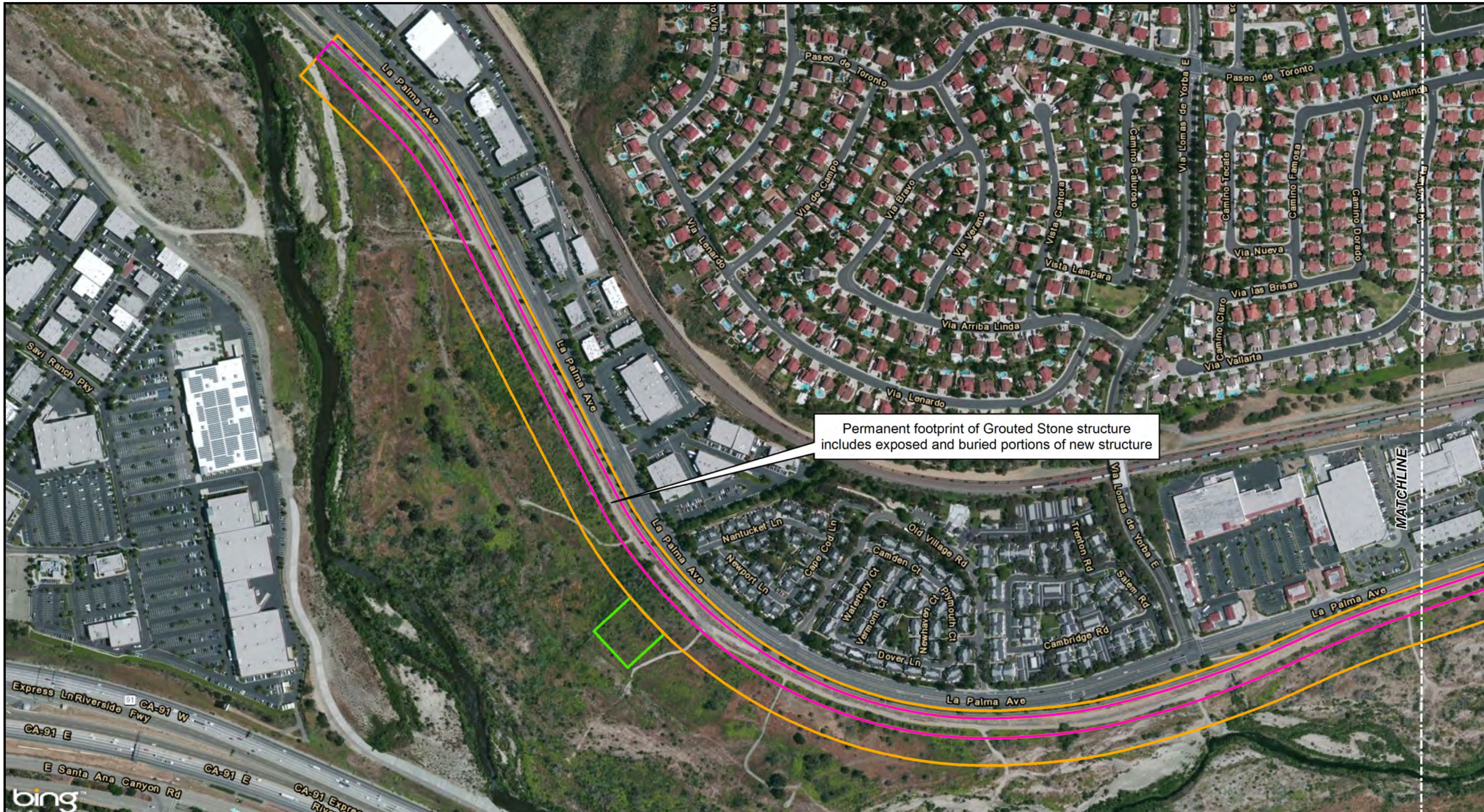
Three staging areas are required; two along the main Phase 5B construction area (as shown in Figures 4.2-1 and 4.2-2), and a third in a location to be determined for the extension area near the BNSF rail line. Precise locations of the staging areas have not yet been determined, although each would be 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.



Source: ACOE 2014; Bing 2014

0 100 200 400 Feet

Scale: 1:4,800; 1 inch = 400 feet

Legend

- Permanent Grouted Stone
- Proposed Staging Area
- Temporary Construction Easement

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

FIGURE 4.2-1
PHASE 5B - Project Features

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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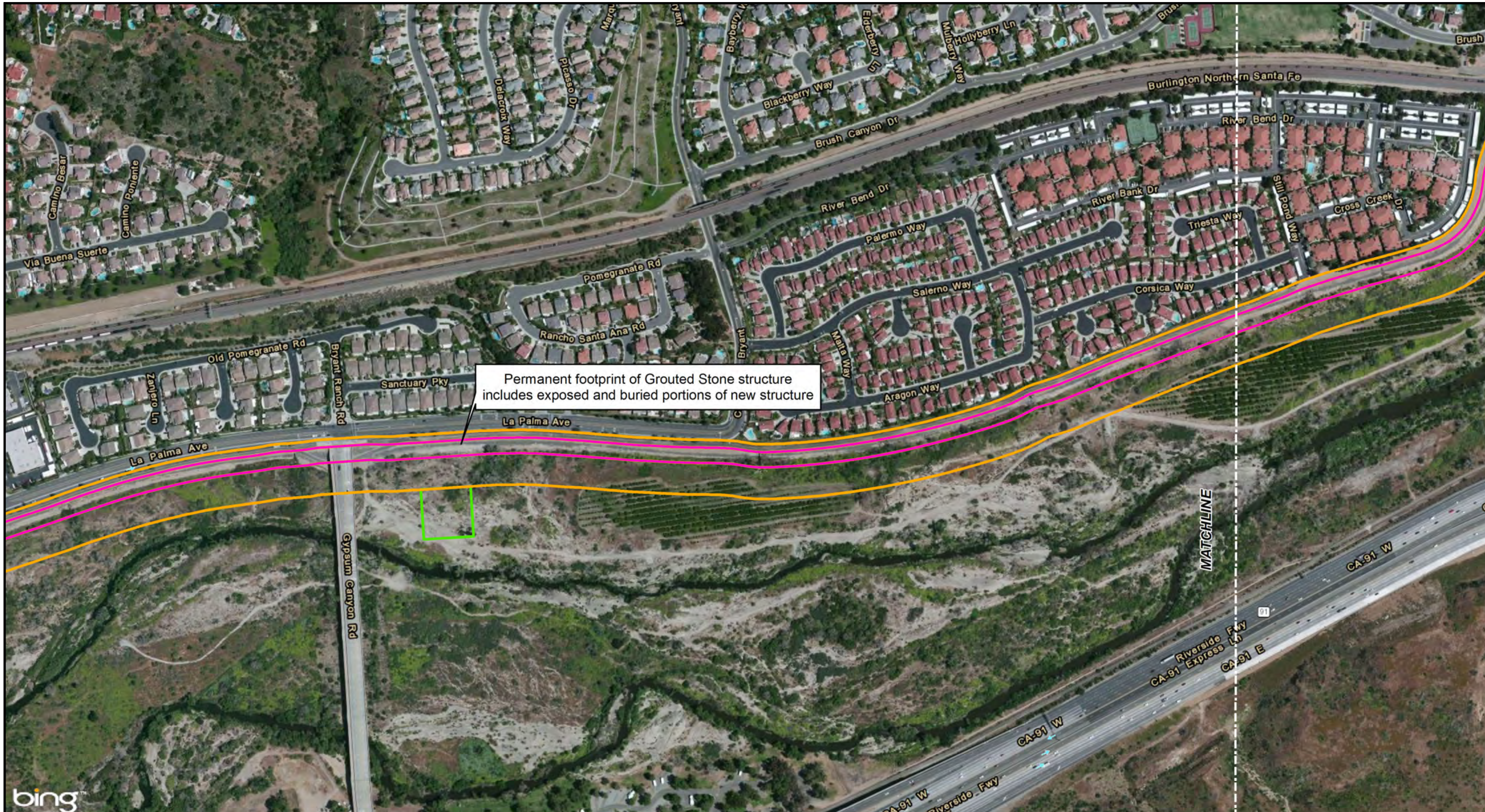

Source: ACOE 2014; Bing 2014

N

0 100 200 400 Feet

Scale: 1:4,800; 1 inch = 400 feet

Legend

Permanent Grouted Stone

Proposed Staging Area

Temporary Construction Easement

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

FIGURE 4.2-2
PHASE 5B - Project Features

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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Source: ACOE 2014; Bing 2014

0 100 200 400 Feet

Scale: 1:4,800; 1 inch = 400 feet

Legend

- Permanent Grouted Stone
- Proposed Staging Area
- Temporary Construction Easement

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

FIGURE 4.2-3
PHASE 5B - Project Features

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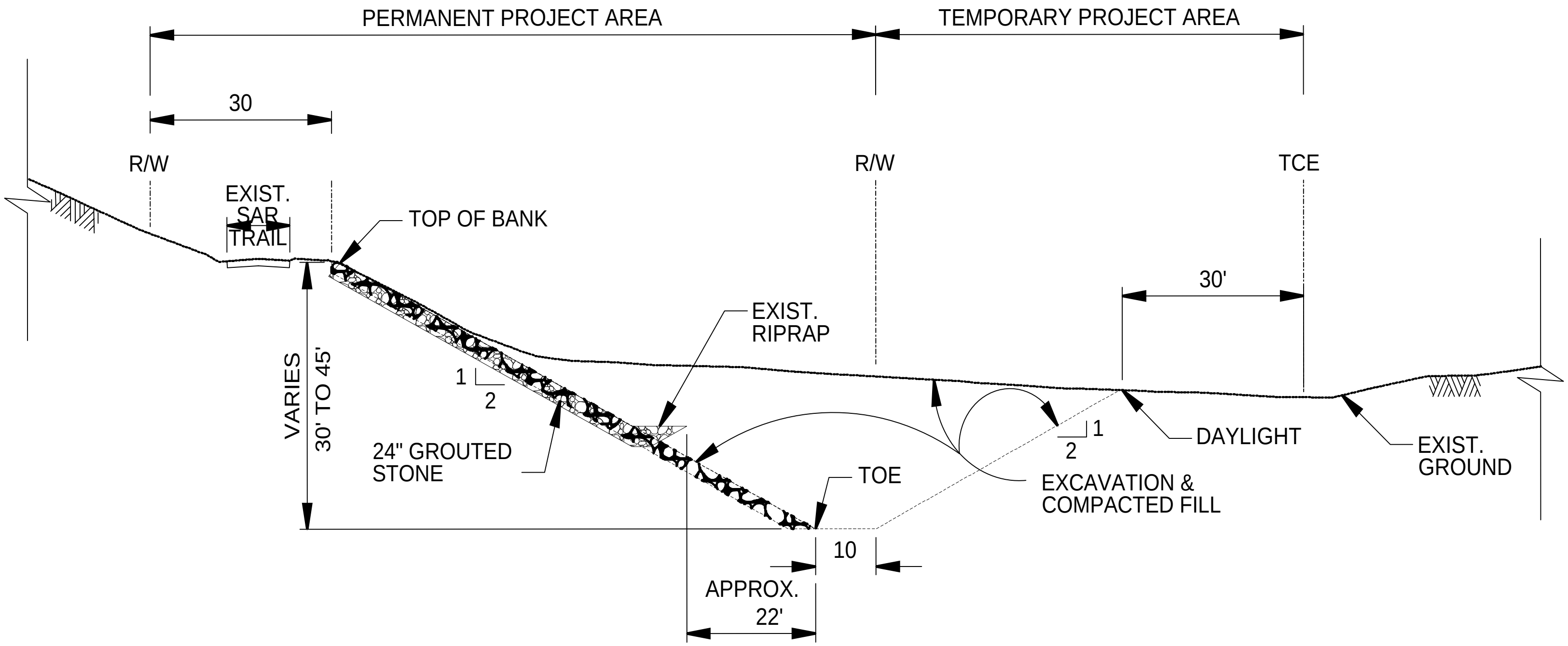

TYPICAL SECTION GROUTED STONE

N.T.S.

Source: ACOE 2014

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

FIGURE 4.2-4
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

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 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 7:00 a.m. and 4:00 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 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 7:00 a.m. and 4:00 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 Soil Cement Alternative (Alternative 1, Preferred Alternative)

Under this alternative, an approximate 3,790-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. Areas of the exposed and buried portions of the soil cement structure are approximately 1.7 acres and 2.7 acres, respectively.

A trapezoidal cut is required to place the soil cement structure. The excavation footprint would be approximately 100 feet wide along the 3,790-foot span. Approximately 160,000 cubic yards of alluvial substrate would be excavated. The volume of the soil cement structure would be approximately 45,000 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.

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 begin in fall or winter 2016 in order to complete it outside of the bird breeding season (which in this area is February 15 through August 15). Sound walls, where needed, would be installed prior to March 1. The installation of the dewatering system and excavation would begin mid-April 2016, or earlier. 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 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,

Source: ACOE 2014; Bing 2014; Esri 2014

0 75 150 300 Feet

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

Legend

- Staging Area
- Permanent Soil Cement
- Temporary Construction Easement
- Side Drains
- Maintenance Road

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

FIGURE 4.3-1
PHASE 4 Soil Cement - Project Features

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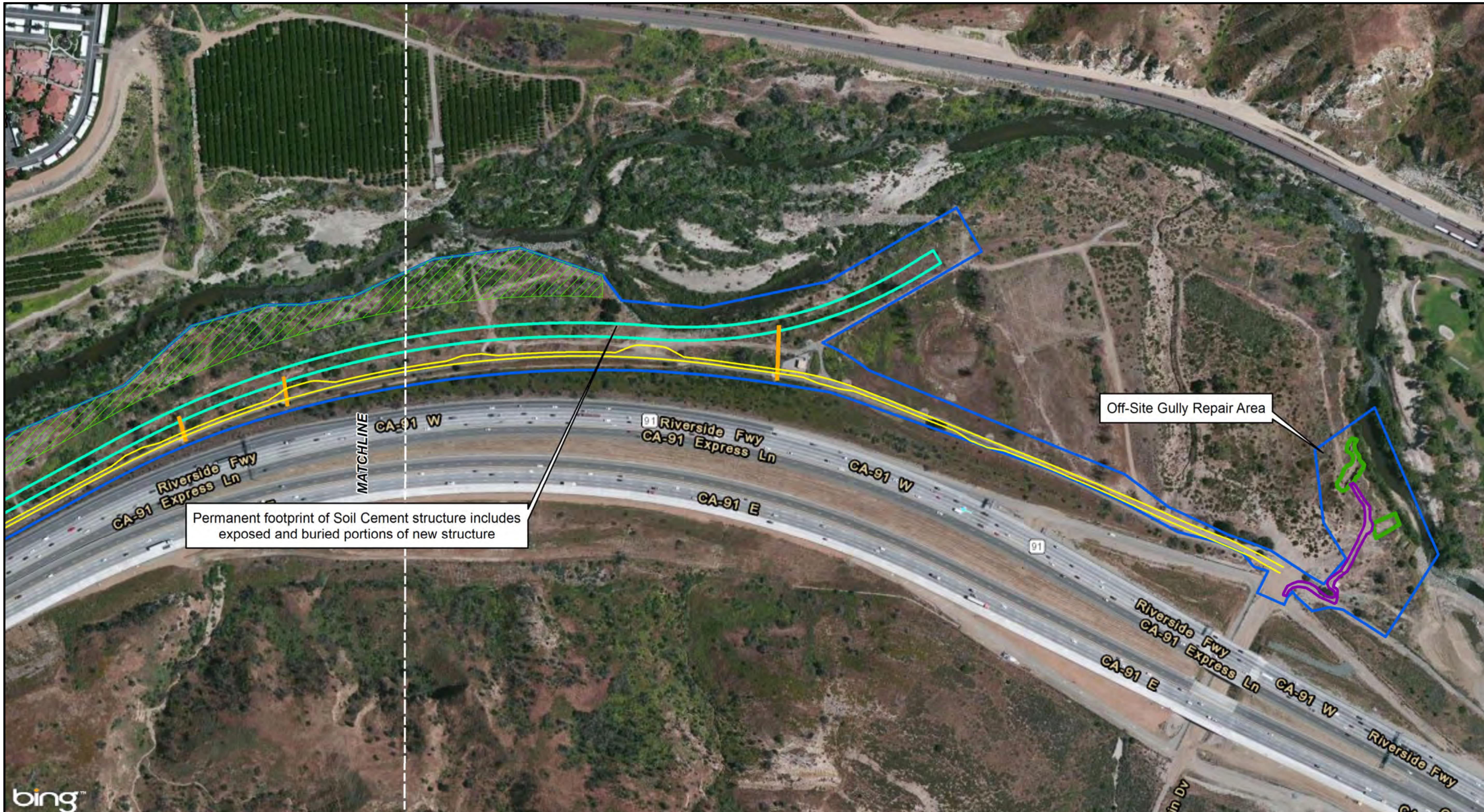

Source: ACOE 2014; Bing 2014; Esri 2014

N

0 75 150 300 Feet

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

Legend

- Staging Area
- Permanent Soil Cement
- Temporary Construction Easement
- Side Drains
- Maintenance Road
- Access Road
- Erosion Repair Sites

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

FIGURE 4.3-2
PHASE 4 Soil Cement - Project Features

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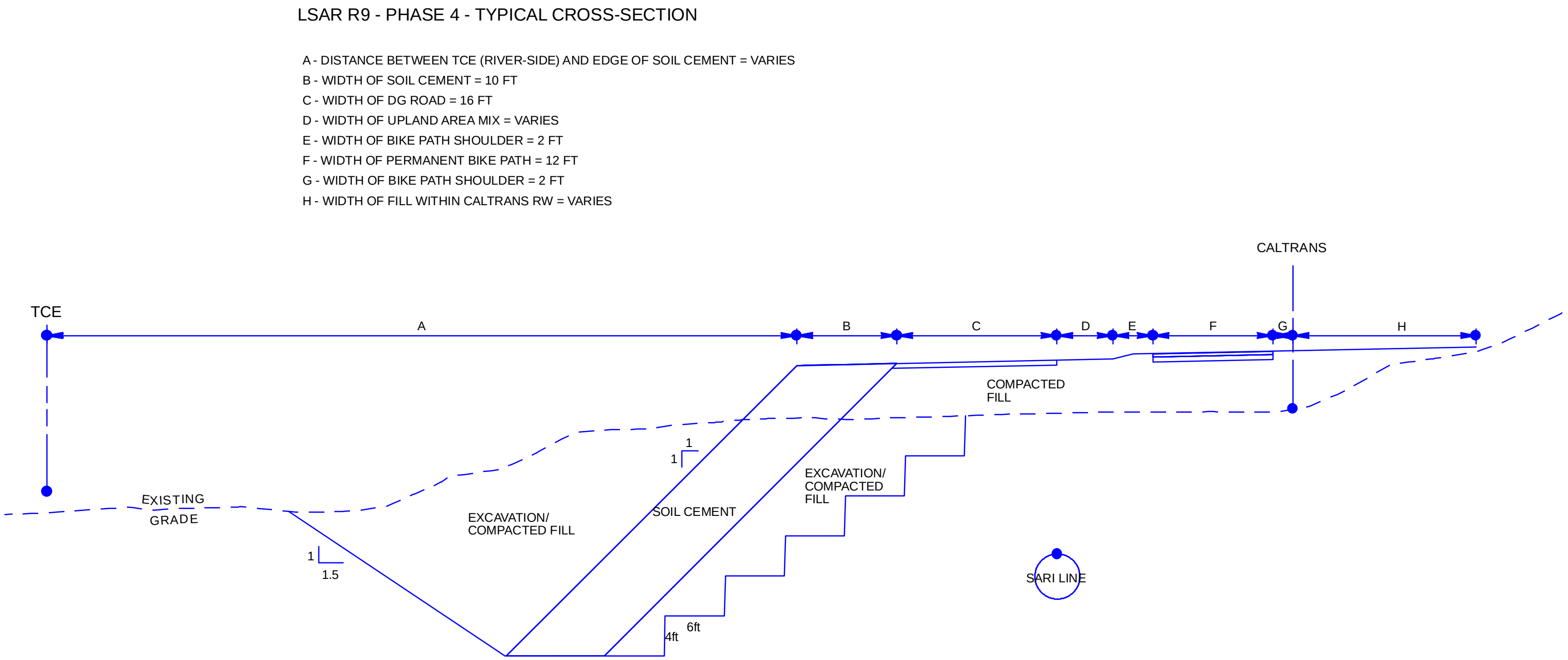

Source: ACOE 2014

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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 as depicted in Figures 4.3-1 and 4.3-2. 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.

Roads

A 16-foot wide road of decomposed granite would be installed immediately along the north side of the soil cement structure, as shown on the Phase 4cross 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 north 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. The drains include one 24-inch RCP, two 5-foot by 5-foot reinforced concrete boxes (RCBs), and one 3-foot by 3-foot RCB. The four side drains would be extended through the soil cement structure. The modification includes demolition of the existing outlet structures, extension of the RCP and the RCBs, then reconstruction of the outlet structures.

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. Additionally, delivery trucks would be associated with imported materials.

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 take approximately 12 months to complete. 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 2016. Funding constraints, weather delays, and other issues could potentially move the construction timeline into 2017. 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, 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.

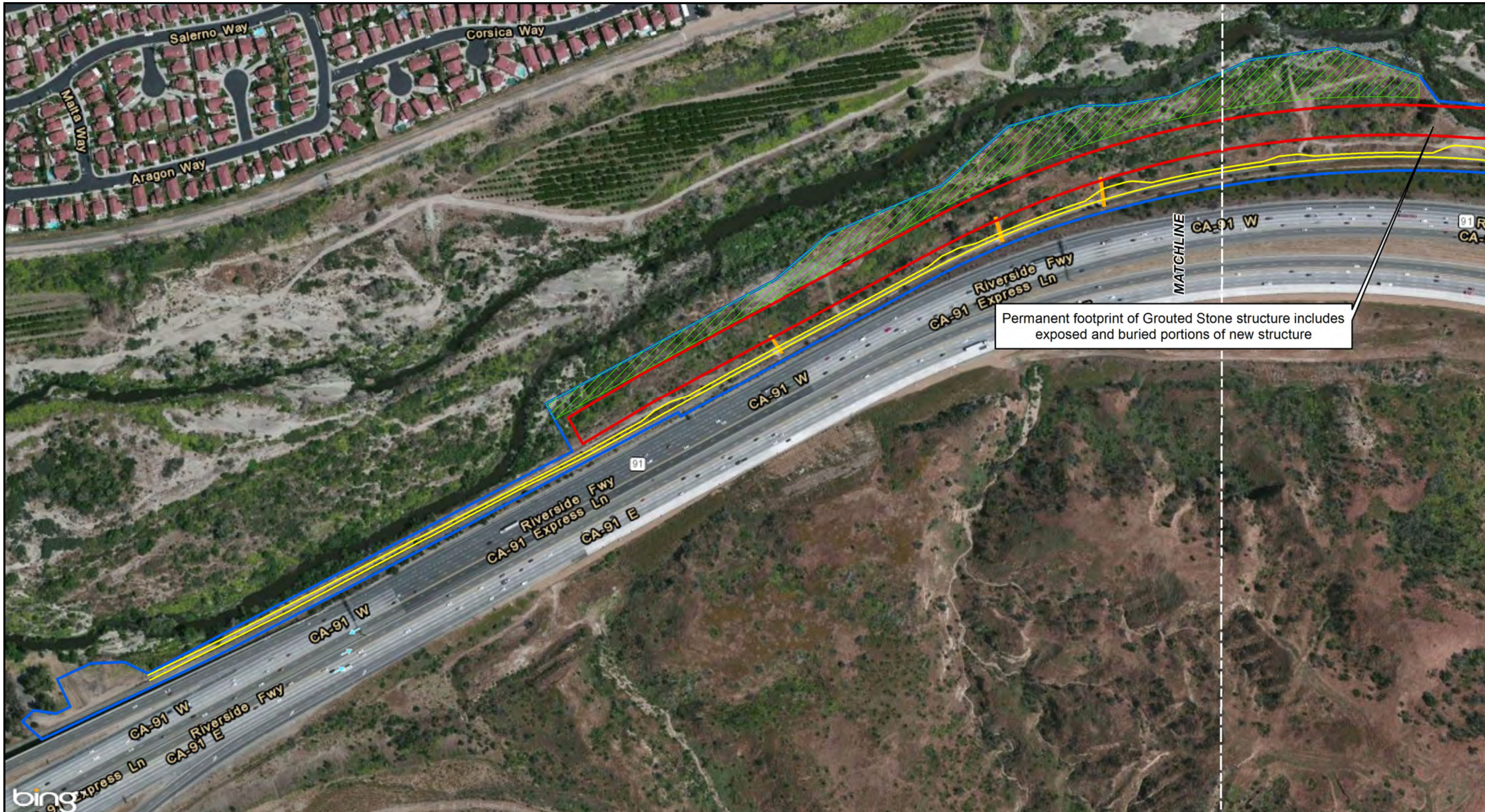
Additional Work to Be Conducted under Phase 4: State Parks, Phase 2B Gully Erosion Repair

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 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.



Source: ACOE 2014; Bing 2014; Esri 2014

N

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

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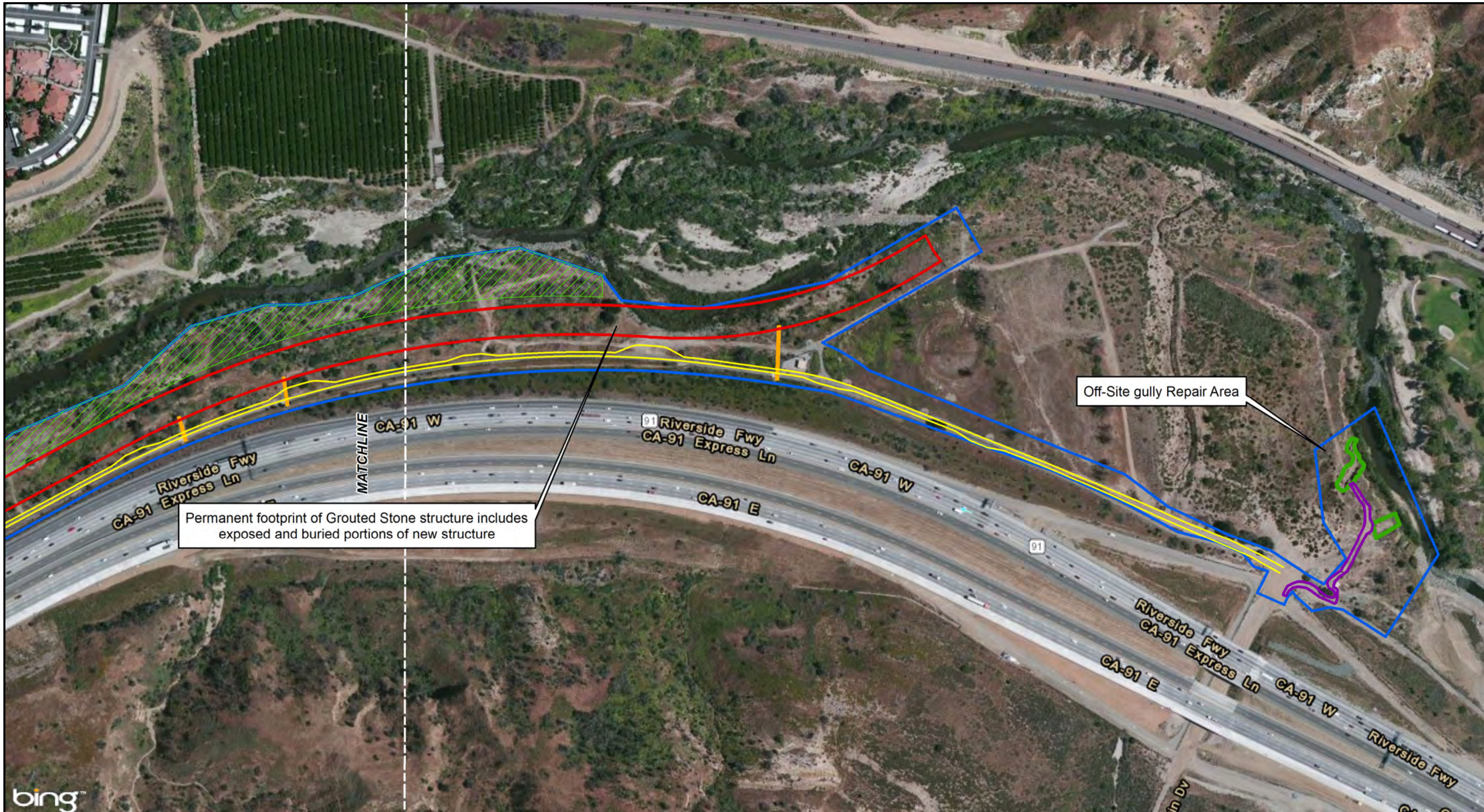

Source: ACOE 2014; Bing 2014; Esri 2014

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

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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 would begin in fall or winter 2016 in order to complete it outside of the bird breeding season (which in this area is February 15 through August 15). Sound walls, where needed, would be installed prior to March 1. The installation of the dewatering system and excavation would begin mid-April 2016, or earlier. 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 north (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 take approximately 12 months to complete. 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 2016. Funding constraints, weather delays, and other issues could potentially move the construction timeline into 2017. Daily construction would occur between 7:00 a.m. and 4:00 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 18 months.

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. Figure 4.4-1 depicts the locations of permanent bridge and bank protection features and the temporary construction easement associated with this alternative.

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.

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 22 to 24 months 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 into 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

Source: ACOE 2014; Bing Maps

0 75 150 300 Feet

Scale: 1:2,320; 1 inch = 193 feet

Legend

- Concrete Paving
- Storm Drain
- Existing Sheet Pile
- Grouted Stone
- Concrete Wall
- Dirt Road
- Sheet Pile Wall
- Temporary Construction Easement
- Pier Nose Extension
- Sheet Pile Pier Enclosure

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

FIGURE 4.4-1
BNSF Bridge - Project Features

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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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.

  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

SARI Line relocation is nearing completion and the contractor is scheduled to proceed with pipe abandonment of the existing SARI Line. The project consists of typical 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 would likely employ steel piles driven into the pipeline to fracture the concrete and sections would be filled with sand and slurry plugs. In addition, the top section of existing manholes would be removed, the shaft filled with sand or slurry, and the base of the manhole shaft perforated.

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.

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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:

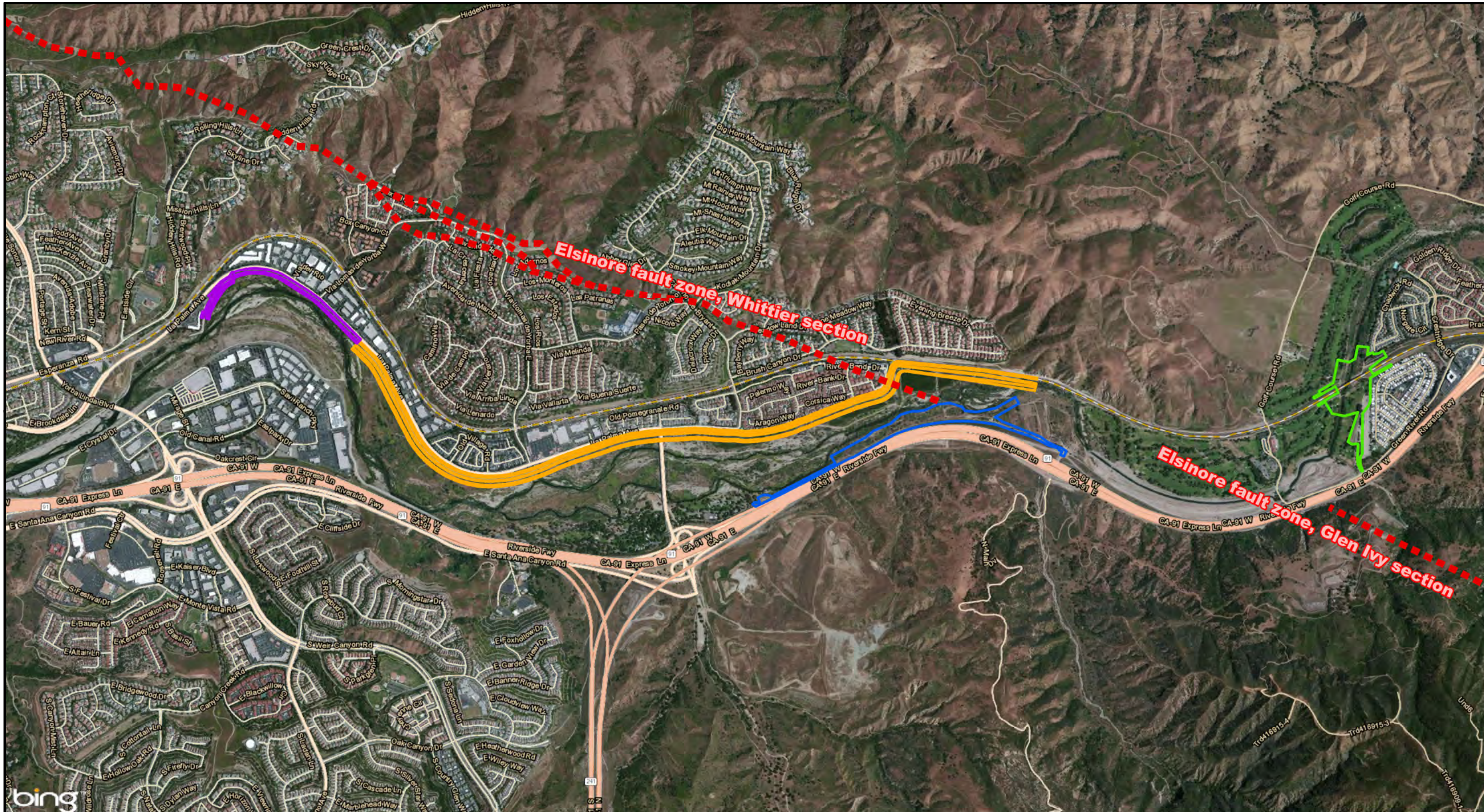
- Maximum probable earthquake (MPE) is 6.9 M (earthquake magnitude);
- Could cause up to 19 feet of horizontal offset;
- Maximum site acceleration from an earthquake estimated is 0.55 *g*; (*g* is the force of gravity. An acceleration of 1 *g* is equal to a force of 32 feet/second/second.)
- Maximum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

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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

<u>Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)</u>

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 1,100-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.

<u>No Federal Action Alternative (Alternative 3)</u>

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

<u>Grouted Stone Alternative (Preferred Alternative, Alternative 1)</u>

The Grouted Stone 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. 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 cubic yards 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 5.5-2c). 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.

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

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.

<u>No Federal Action Alternative (Alternative 3)</u>

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

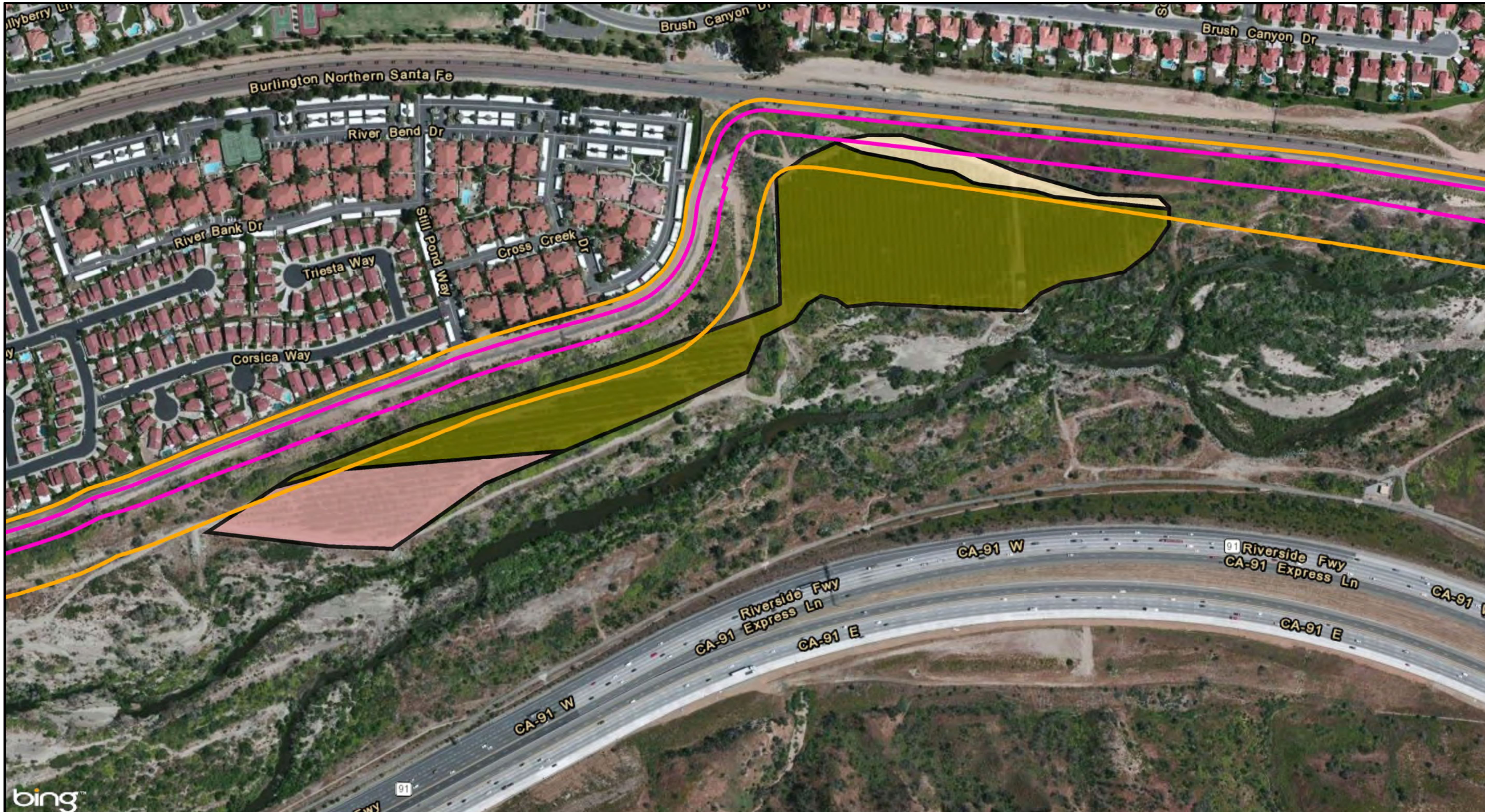
Soil Cement Alternative (Preferred Alternative, Alternative 1)

Under the Soil Cement Alternative, an approximate 3,790-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 3,790-foot span. Approximately 160,000 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.

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.



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

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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.

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.

<u>No Federal Action Alternative (Alternative 2)</u>

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

<u>Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)</u>

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 1,100-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 4.1-3 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.

<u>Soil Cement and Sheet Pile Alternative (Alternative 2)</u>

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.

<u>No Federal Action Alternative(Alternative 3)</u>

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 Alternative (Preferred Alternative, Alternative 1)

Under the Preferred Alternative, grouted stone 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. 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 4.2-4 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 3,790-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 3,790-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.

<u>No Federal Action Alternative(Alternative 3)</u>

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

<u>Pier and Abutment Protection Alternative (Preferred Alternative, Alternative 1)</u>

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.

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 ground-water 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 1,100-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.

<u>No Federal Action Alternative (Alternative 3)</u>

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

<u>Grouted Stone Alternative (Preferred Alternative, Alternative 1)</u>

The Preferred Alternative would entail removal of existing protection and reconstruction of the embankment with grouted stone. 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.

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

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.

<u>No Federal Action Alternative (Alternative 3)</u>

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

<u>Soil Cement Alternative (Preferred Alternative, Alternative 1)</u>

Under the Preferred Alternative, an approximate 3,790-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 3,790-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 12-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 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.

<u>Grouted Stone Alternative (Alternative 2)</u>

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 3,790-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 12-month 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.

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 22 to 24-month 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.

<u>No Federal Action Alternative (Alternative 2)</u>

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

<u>Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)</u>

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 1,100-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 Alternative (Preferred Alternative, Alternative 1)

The Grouted Stone Alternative would entail removal of existing protection and reconstruction of the embankment with grouted stone. 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 3,790-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 3,790-foot 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 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.

<u>No Federal Action Alternative (Alternative 2)</u>

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 are broken down into the vegetation communities/land cover types depicted for each Reach 9 measure in Figures 5.5-1 through 5.5-4. The detailed community classifications shown on the figures correspond with the Orange County HCS. 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.

<u>Riparian</u>

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.

Source: ACOE 2014; Bing Maps

0 75 150 300 Feet

Scale: 1:2,400; 1 inch = 200 feet

Legend

- Permanent Maintenance Road
- Temporary Construction Easement Grouted Stone
- Temporary Construction Easement Sheet Pile
- Staging Area
- Permanent Grouted Stone
- Permanent Sheet Pile

Vegetation Communities

- (15.1) Urban and Commercial
- (15.5) Ornamental Landscaping
- (16.1) Disturbed or Barren
- (4.6) Ruderal Grassland
- (7.12) Barren Riparian
- (7.3) Mulefat Scrub
- (7.6) Arroyo Willow Riparian Forest
- (7.8) Cottonwood-Willow Riparian Forest

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

FIGURE 5.5-1a
PHASE 5A Preferred Alternative (Grouted Stone) - Vegetation Communities

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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Source: ACOE 2014; Bing Maps

0 75 150 300 Feet

Scale: 1:2,400; 1 inch = 200 feet

Legend

- Temporary Construction Easement Grouted Stone
- Temporary Construction Easement Sheet Pile
- Staging Area
- Permanent Grouted Stone
- Permanent Sheet Pile

Vegetation Communities

- (15.1) Urban and Commercial
- (15.5) Ornamental Landscaping
- (16.1) Disturbed or Barren
- (4.6) Ruderal Grassland
- (7.12) Barren Riparian
- (7.3) Mulefat Scrub
- (7.6) Arroyo Willow Riparian Forest
- (7.8) Cottonwood-Willow Riparian Forest

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

FIGURE 5.5-1b
PHASE 5A Preferred Alternative (Grouted Stone) - Vegetation Communities

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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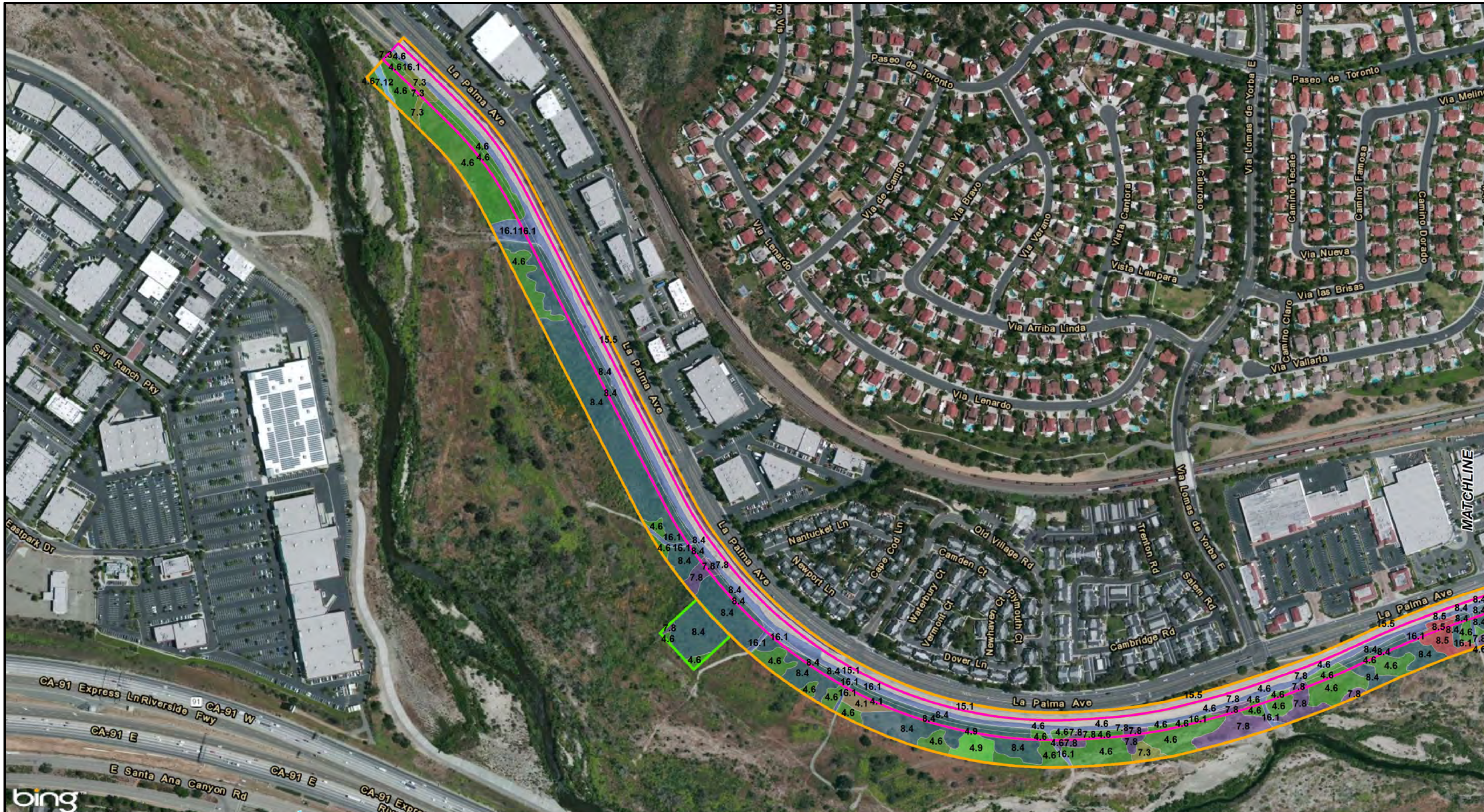

Source: ACOE 2014; Bing 2014

0 100 200 400 Feet

Scale: 1:4,800; 1 inch = 400 feet

Legend

- Permanent Grouted Stone
- Proposed Staging Area
- Temporary Construction Easement

Vegetation Communities

- (13.1) Perennial Rivers and Streams
- (14.3) Orchard and Vineyard
- (15.1) Urban and Commercial
- (15.5) Ornamental Landscaping
- (16.1) Disturbed or Barren
- (16.2.2) Disturbed Riparian
- (2.10) Yerba Santa Scrub
- (2.3.6) Sagebrush Scrub
- (2.6) Scale-Broom Scrub
- (2.9) Scrub-Eucalyptus Planting
- (4.1) Annual Grassland
- (4.10) Salt Grass Grassland
- (4.11) Giant Reed Grassland
- (4.6) Ruderal Grassland
- (4.9) Elderberry Savanna
- (7.1) Herbaceous Riparian
- (7.12) Barren Riparian
- (7.2) Willow Riparian Scrub
- (7.3) Mulefat Scrub
- (7.6) Arroyo Willow Riparian Forest
- (7.7) Black Willow Riparian Forest
- (7.8) Cottonwood-Willow Riparian Forest
- (8.1) Coast Live Oak Woodland
- (8.2) California Walnut Woodland
- (8.4) Mexican Elderberry Woodland
- (8.5) Nonnative Woodland

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

FIGURE 5.5-2a
PHASE 5B Preferred Alternative (Grouted Stone) - Vegetation Communities

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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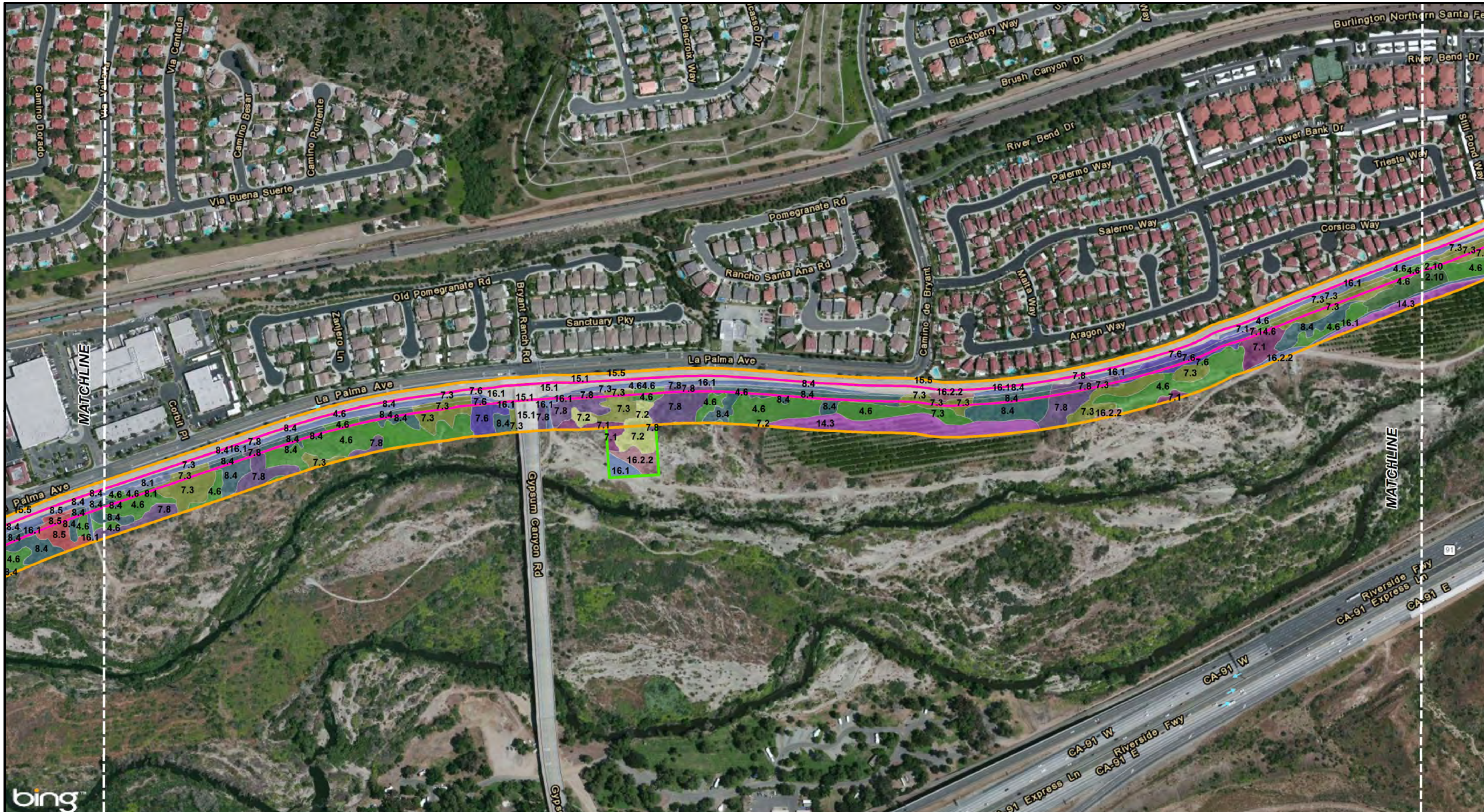

Source: ACOE 2014; Bing 2014

0 100 200 400 Feet

Scale: 1:4,800; 1 inch = 400 feet

Legend

- Permanent Grouted Stone
- Proposed Staging Area
- Temporary Construction Easement

Vegetation Communities

- (13.1) Perennial Rivers and Streams
- (14.3) Orchard and Vineyard
- (15.1) Urban and Commercial
- (15.5) Ornamental Landscaping
- (16.1) Disturbed or Barren
- (16.2.2) Disturbed Riparian
- (2.10) Yerba Santa Scrub
- (2.3.6) Sagebrush Scrub
- (2.6) Scale-Broom Scrub
- (2.9) Scrub-Eucalyptus Planting
- (4.1) Annual Grassland
- (4.10) Salt Grass Grassland
- (4.11) Giant Reed Grassland
- (4.6) Ruderal Grassland
- (4.9) Elderberry Savanna
- (7.1) Herbaceous Riparian
- (7.12) Barren Riparian
- (7.2) Willow Riparian Scrub
- (7.3) Mulefat Scrub
- (7.6) Arroyo Willow Riparian Forest
- (7.7) Black Willow Riparian Forest
- (7.8) Cottonwood-Willow Riparian Forest
- (8.1) Coast Live Oak Woodland
- (8.2) California Walnut Woodland
- (8.4) Mexican Elderberry Woodland
- (8.5) Nonnative Woodland

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

FIGURE 5.5-2b
PHASE 5B Preferred Alternative (Grouted Stone) - Vegetation Communities

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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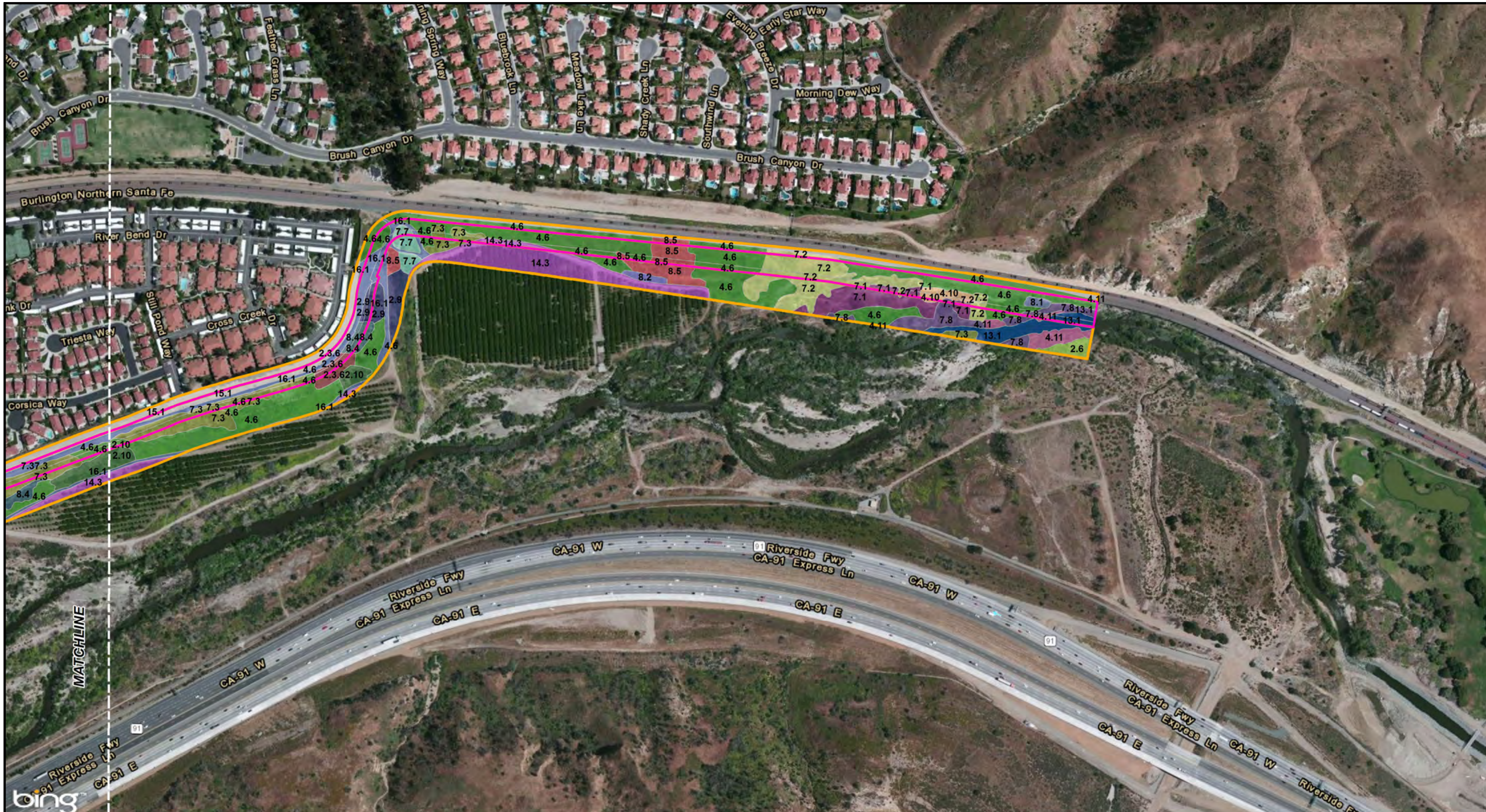

Source: ACOE 2014; Bing 2014

0 100 200 400 Feet

Scale: 1:4,800; 1 inch = 400 feet

Legend

- Permanent Grouted Stone
- Proposed Staging Area
- Temporary Construction Easement

Vegetation Communities

- (13.1) Perennial Rivers and Streams
- (14.3) Orchard and Vineyard
- (15.1) Urban and Commercial
- (15.5) Ornamental Landscaping
- (16.1) Disturbed or Barren
- (16.2.2) Disturbed Riparian
- (2.10) Yerba Santa Scrub
- (2.3.6) Sagebrush Scrub
- (2.6) Scale-Broom Scrub
- (2.9) Scrub-Eucalyptus Planting
- (4.1) Annual Grassland
- (4.10) Salt Grass Grassland
- (4.11) Giant Reed Grassland
- (4.6) Ruderal Grassland
- (4.9) Elderberry Savanna
- (7.1) Herbaceous Riparian
- (7.12) Barren Riparian
- (7.2) Willow Riparian Scrub
- (7.3) Mulefat Scrub
- (7.6) Arroyo Willow Riparian Forest
- (7.7) Black Willow Riparian Forest
- (7.8) Cottonwood-Willow Riparian Forest
- (8.1) Coast Live Oak Woodland
- (8.2) California Walnut Woodland
- (8.4) Mexican Elderberry Woodland
- (8.5) Nonnative Woodland

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

FIGURE 5.5-2c
PHASE 5B Preferred Alternative (Grouted Stone) - Vegetation Communities

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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Source: ACOE 2014; Bing 2014; Esri 2014

N

0 75 150 300 Feet

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

Legend

- Maintenance Road
- Staging Area
- Permanent Soil Cement
- 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 5.5-3a
PHASE 4 Preferred Alternative (Soil Cement) -
Vegetation Communities

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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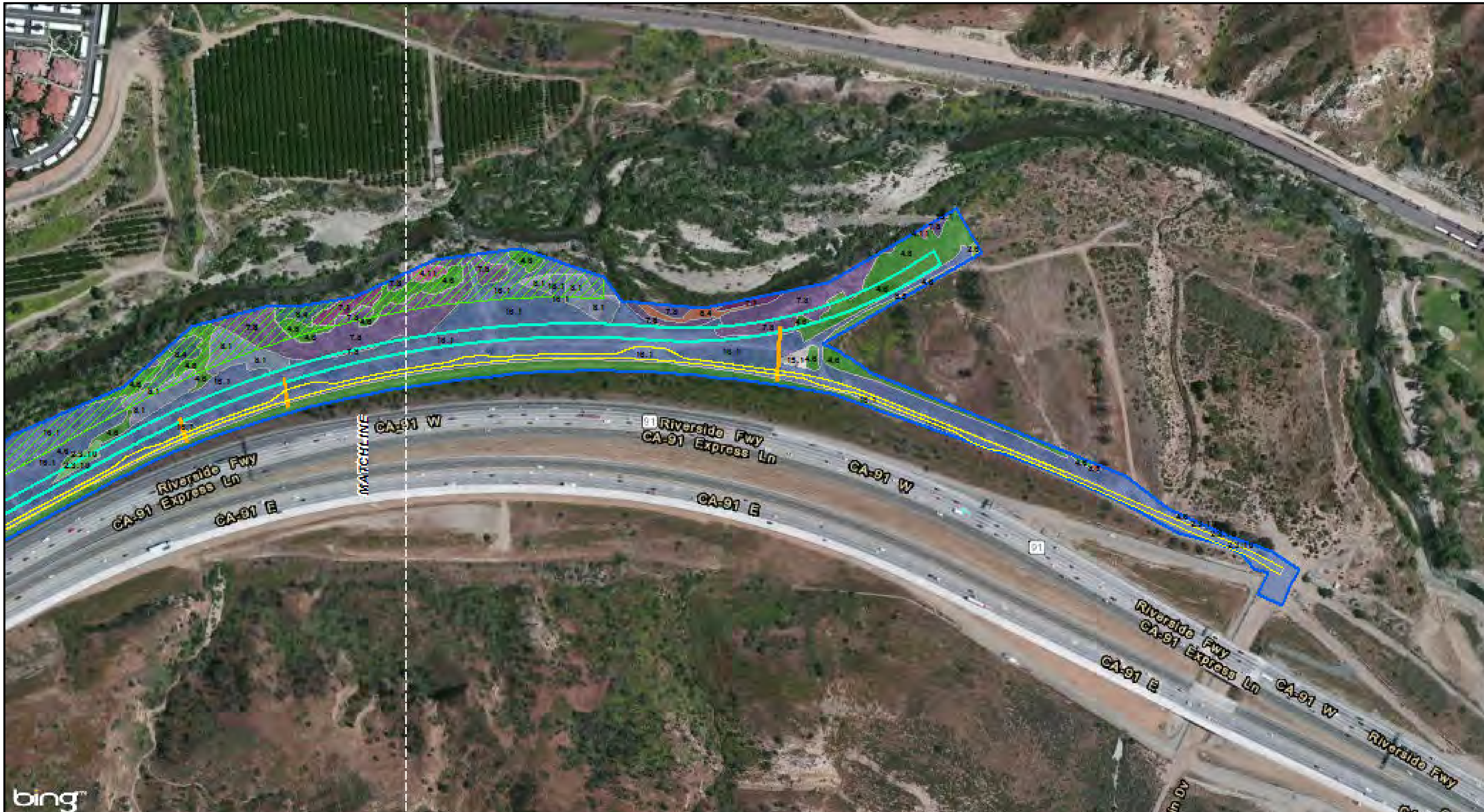

Source: ACOE 2014; Bing 2014; Esri 2014

N

0 75 150 300 Feet

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

Legend

- Maintenance Road
- Staging Area
- Permanent Soil Cement
- 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 5.5-3b
PHASE 4 Preferred Alternative (Soil Cement) - Vegetation Communities

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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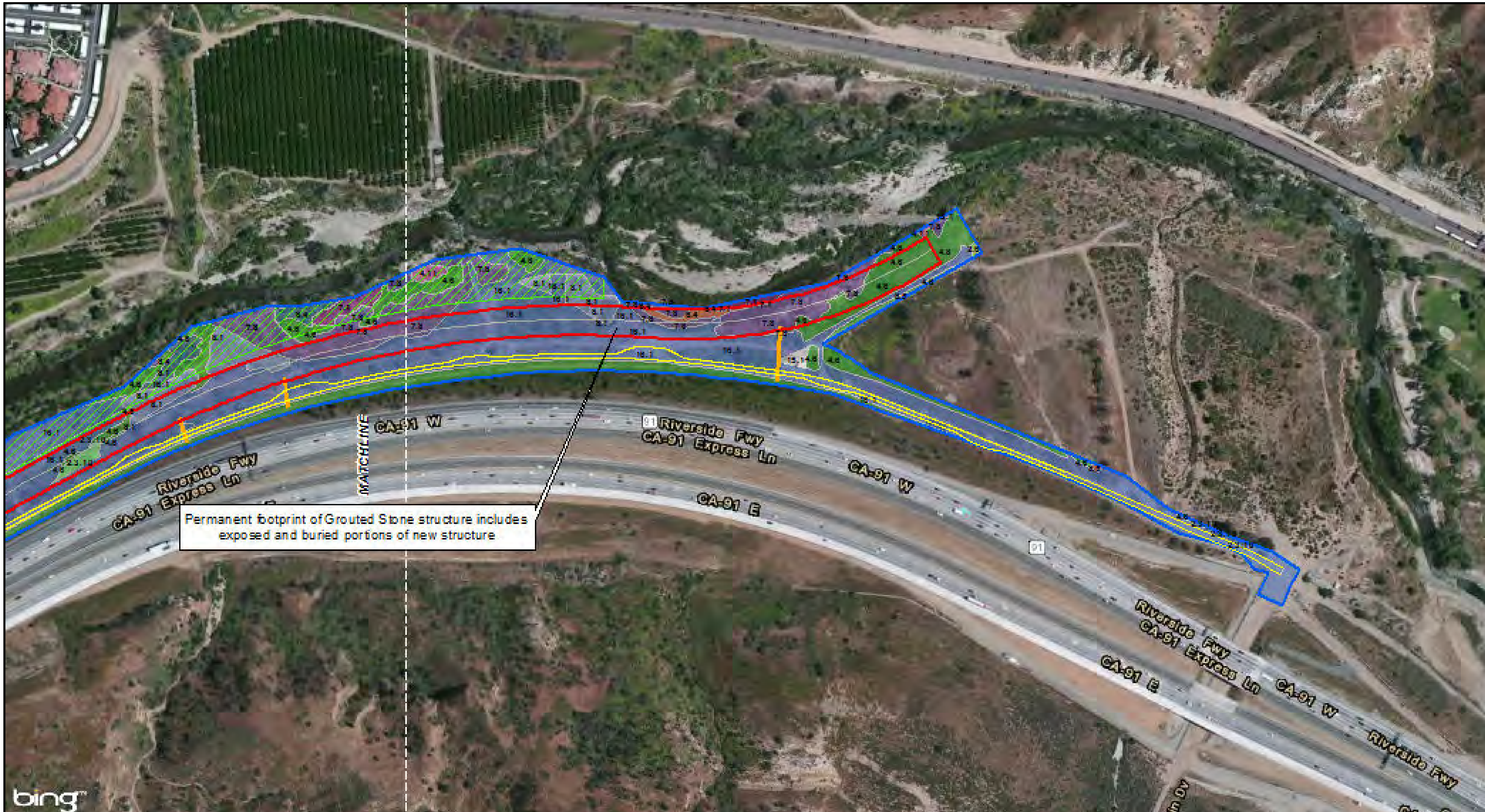

Source: ACOE 2014; Bing 2014; Esri 2014

N

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

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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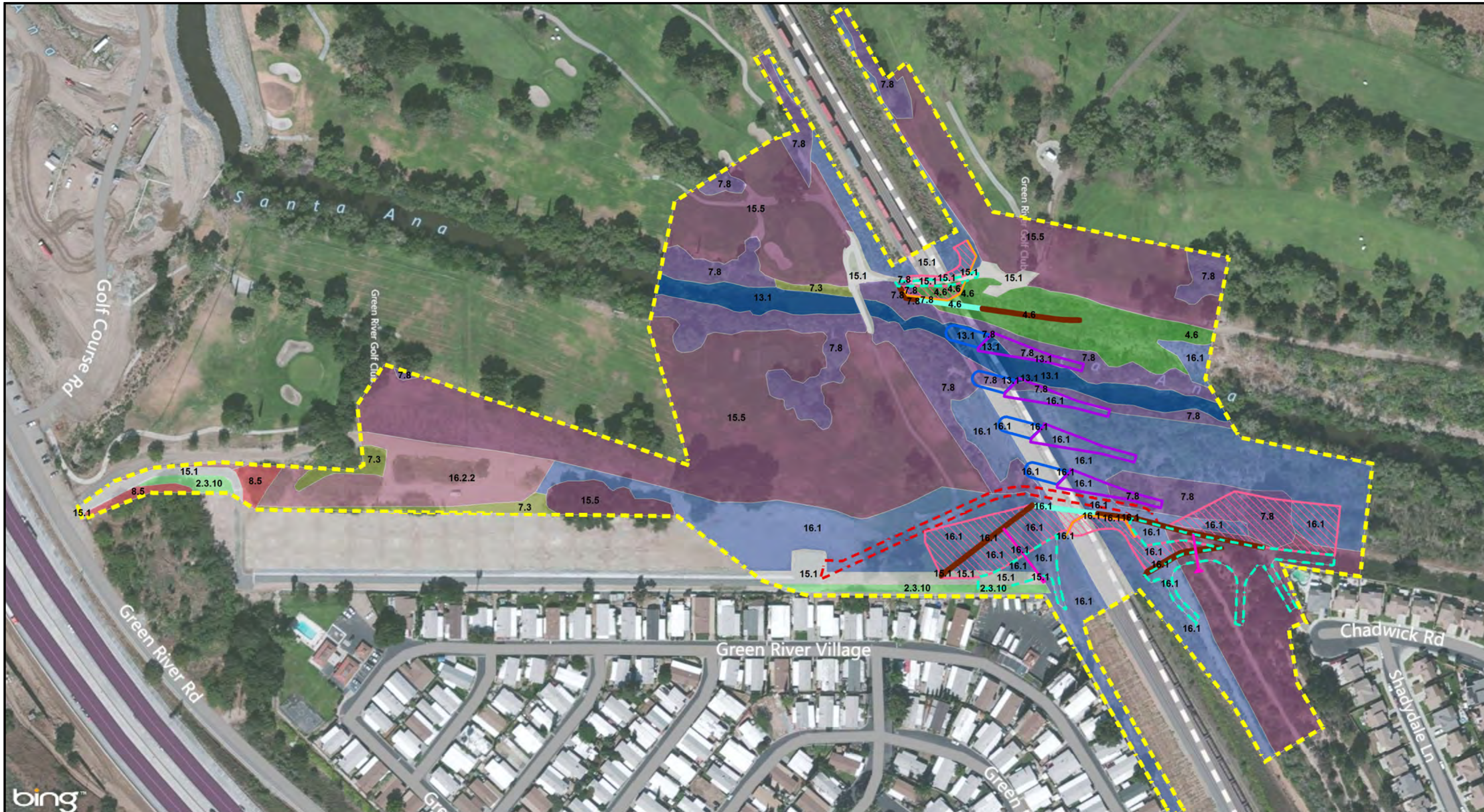

Source: ACOE 2014; Bing Maps

0 50 100 200 Feet

Scale: 1:2,320; 1 inch = 193 feet

Legend

- Concrete Paving
- Storm Drain
- Existing Sheet Pile
- Grouted Stone
- Concrete Wall
- Dirt Road
- Sheet Pile Wall
- Temporary Construction Easement
- Pier Nose Extension
- Sheet Pile Pier Enclosure

Vegetation Communities

- (13.1) Perennial Rivers and Streams
- (15.1) Urban and Commercial
- (15.5) Ornamental Landscaping
- (16.1) Disturbed or Barren
- (16.2.2) Disturbed Riparian
- (2.3.10) Mixed Scrub
- (4.6) Ruderal Grassland
- (7.3) Mulefat Scrub
- (7.8) Cottonwood-Willow Riparian Forest
- (8.5) Nonnative Woodland

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

FIGURE 5.5-4a
BNSF Bridge (Preferred Alternative) -
Vegetation Communities

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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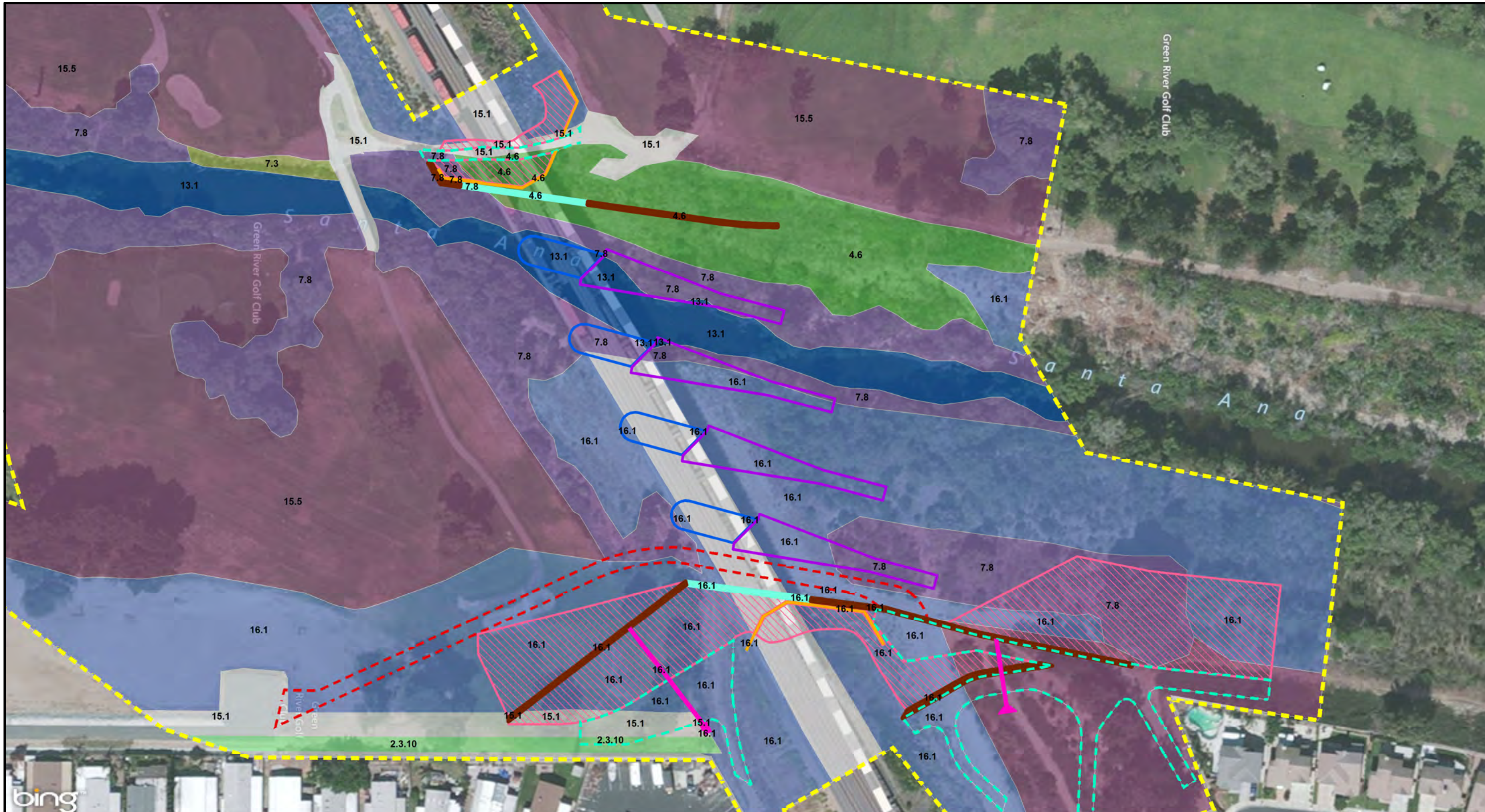

Source: ACOE 2014; Bing Maps

0 50 100 200 Feet

Scale: 1:1,200;1 inch = 100 feet

Legend

- Concrete Paving
- Storm Drain
- Existing Sheet Pile
- Grouted Stone
- Concrete Wall
- Dirt Road
- Sheet Pile Wall
- Temporary Construction Easement
- Pier Nose Extension
- Sheet Pile Pier Enclosure

Vegetation Communities

- (13.1) Perennial Rivers and Streams
- (15.1) Urban and Commercial
- (15.5) Ornamental Landscaping
- (16.1) Disturbed or Barren
- (16.2.2) Disturbed Riparian
- (2.3.10) Mixed Scrub
- (4.6) Ruderal Grassland
- (7.3) Mulefat Scrub
- (7.8) Cottonwood-Willow Riparian Forest
- (8.5) Nonnative Woodland

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

FIGURE 5.5-4b
BNSF Bridge (Preferred Alternative) -
Vegetation Communities

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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<u>Disturbed</u>

- *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.

<u>Coastal sage scrub</u> (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.

<u>Grassland</u>: 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.

<u>Woodland</u>: 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

<u>Watercourses</u>: 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

<u>Federal</u> U.S. Fish and Wildlife Service (USFWS)

<u>State</u> California Department of Fish and Wildlife (CDFW)

<u>Other</u>
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). 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).

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).

Source: ACOE 2014; Bing 2014; Esri 2014

N

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

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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.

<u>CNDDB</u>

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*).

<u>2001 SEIS/EIR</u>

The 2001 SEIS/EIR identified a number of special-status species that occur or potentially could occur in Reach 9, including four birds, two amphibian, 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 Figure 5.5-6.

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 CDFW: SSC MSHCP: G3	Found in cismontane stream systems in Southern California and including the SAR. Habitat generalists, but prefer sand-cobble bottoms, cool, clear water, and algae.	Present at BNSF only (footprints of other measures do not extend into the SAR's active channel)	**Moderate.** Habitat preferred by this species is absent at Phase 5A, 5B 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

Common Name *Scientific Name*[2]	Status[3]	General Habitat Description[4]	Potentially Suitable Habitat Present/ Absent	Potential for Occurrence
				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 migrate over 1 km to breed in ponds, reservoirs and slow moving streams.	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
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 shallow sandy soils.	Present	**High.** This species has been detected in the vicinity of BNSF Bridge (SAWA 2008). The Reach 9 measure areas support suitable habitat and are within the known distribution for this species.

Common Name *Scientific Name*[2]	Status[3]	General Habitat Description[4]	Potentially Suitable Habitat Present/ Absent	Potential for Occurrence
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 grasslands with a mix of grasses, forbs and scattered shrubs.	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**
		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.
coastal cactus wren *campylorhynch us*	USFWS: none CDFW: SSC MSHCP: G3	Found in coastal sage scrub and chaparral. Requires dense stands of cactus or for	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**
brunneicapillus sandiegensis		breeding and nesting.		
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 MSHCP: G3	Riparian woodlands in southern California.	Present	**Low**. Marginally suitable habitat is present within and surrounding the Reach 9 measure areas.
bald eagle *Haliaeetus leucocephalus*	USFWS: Delisted, CDFW:	Found in forested areas near lakes, reservoirs, rivers,	Present	**Low**. Marginally suitable habitat is present within and

Common Name *Scientific Name*[2]	Status[3]	General Habitat Description[4]	Potentially Suitable Habitat Present/ Absent	Potential for Occurrence
	Endangered, FP MSHCP: G1	marshes, and coasts. Have been known to congregate at fisheries and below dams.		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 has been 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. As a result this species has moderate potential to occur within and surrounding the Reach 9 measure areas, in particular Phase 5A.
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.

Common Name *Scientific Name*[2]	**Status**[3]	**General Habitat Description**[4]	**Potentially Suitable Habitat Present/ Absent**	**Potential for Occurrence**
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 californicus*	USFWS: None CDFW: SSC WBWG: H	Open semiarid to arid habitats, including 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.	Absent	**Not Expected**. The Reach 9 measure areas do not 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

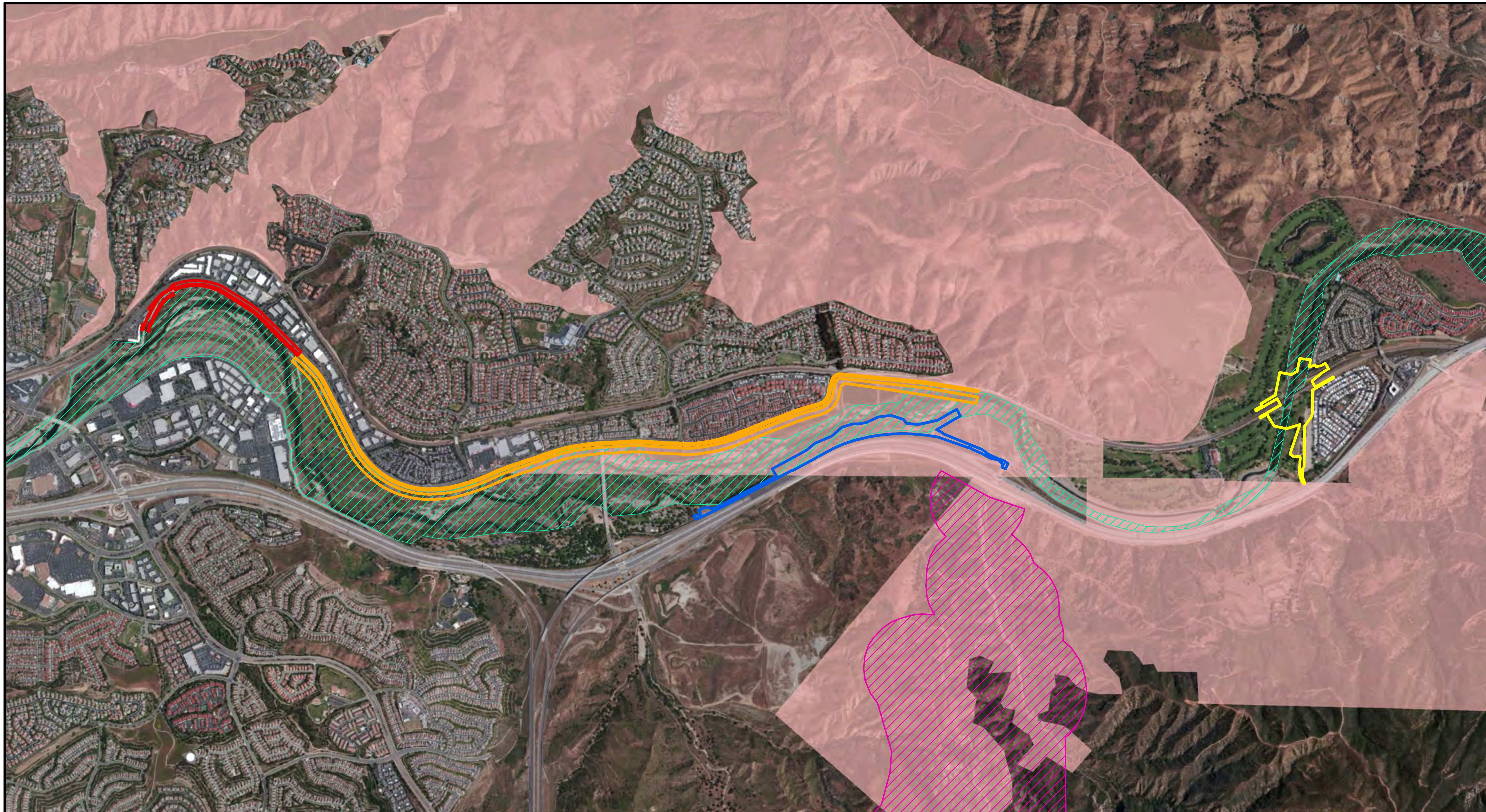
Federal and State Listed Species

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) (Figure 5.5-6). 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. One sucker was detected in two river diversions in Reach 9 Phase 2B in 2012, however, none were detected during Reach 9, Phase 3 diversions in 2013 and 2014.



Source: ACOE 2014; Bing 2014; Esri 2014; USFWS 2014

N

0 1,000 2,000 4,000 Feet

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

Legend

- BNSF Bridge Temporary Construction Easement
- Phase 5A Temporary Construction Easement
- Phase 5B Temporary Construction Easement
- Phase 4 Temporary Construction Easement
- Braunton's Milk-Vetch
- Santa Ana Sucker
- Coastal California Gnatcatcher

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

FIGURE 5.5-6
USFWS Critical Habitat

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_CriticalHabitat.mxd, 12/22/2014, wallacerj

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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. Gnatcatchers were recently 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). Coastal sage scrub elements are present within the project area of sufficient quality to facilitate use by the gnatcatcher. 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 (Figure 5.5-6).

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 5.5-7c). 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

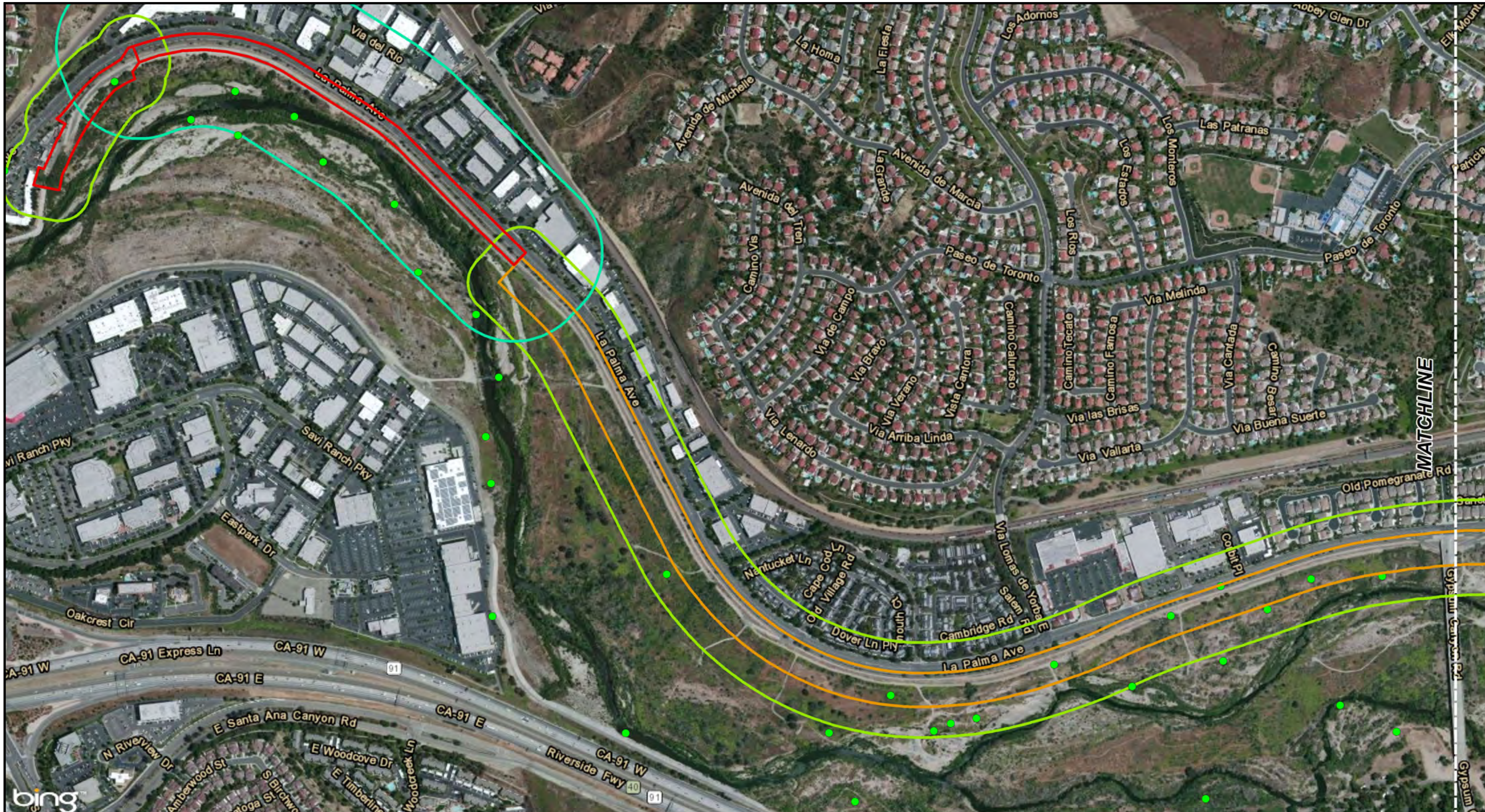
The peregrine falcon was recently removed from the federal list of threatened and endangered species. It is still State endangered and a MSHCP-covered species. This bird prefers coastal estuaries and other wetlands that concentrate waterfowl and shorebirds, but forages widely over many habitats, especially 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.

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.



Source: ACOE 2014; Bing 2014; Esri 2014

N

0 325 650 1,300 Feet

Scale:1:7,800 ; 1 inch = 650 feet

Legend

- Phase 5A Temporary Construction Easement
- Phase 5B Temporary Construction Easement
- Phase 4 Temporary Construction Easement
- BNSF Bridge Temporary Construction Easement
- Least Bell's Vireo Occurrences
- Buffer 200 foot
- Buffer 500 foot

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

FIGURE 5.5-7a
2014 Least Bell's Vireo Occurrences

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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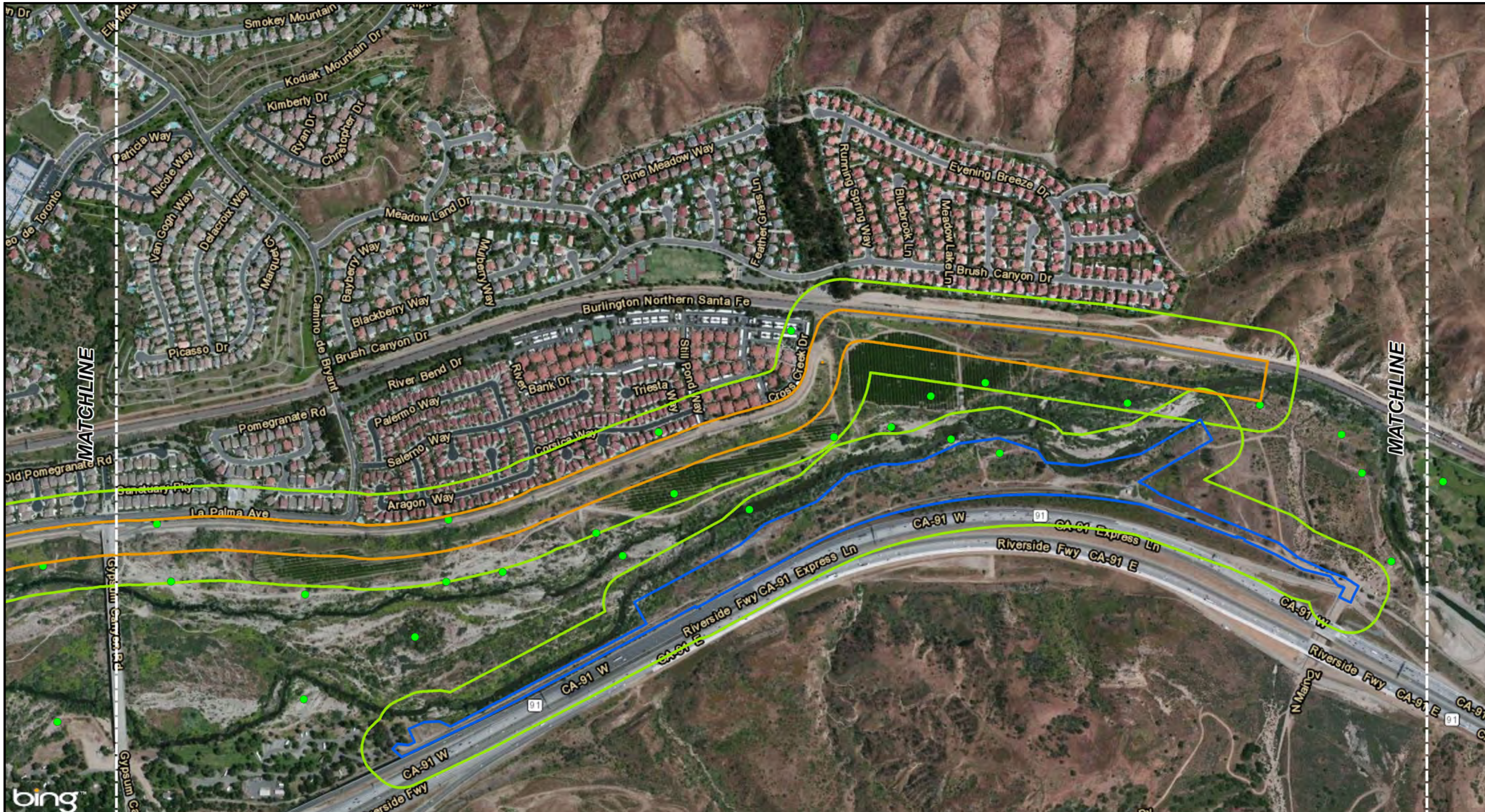

Source: ACOE 2014; Bing 2014; Esri 2014

N

0 325 650 1,300 Feet

Scale:1:7,800 ; 1 inch = 650 feet

Legend

- Phase 5A Temporary Construction Easement
- Phase 5B Temporary Construction Easement
- Phase 4 Temporary Construction Easement
- BNSF Bridge Temporary Construction Easement
- Least Bell's Vireo Occurrences
- Buffer 200 foot
- Buffer 500 foot

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

FIGURE 5.5-7b
2014 Least Bell's Vireo Occurrences

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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Source: ACOE 2014; Bing 2014; Esri 2014

N

0 325 650 1,300 Feet

Scale:1:7,800 ; 1 inch = 650 feet

Legend

- Phase 5A Temporary Construction Easement
- Phase 5B Temporary Construction Easement
- Phase 4 Temporary Construction Easement
- BNSF Bridge Temporary Construction Easement
- Least Bell's Vireo Occurrences
- Buffer 200 foot
- Buffer 500 foot

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

FIGURE 5.5-7c
2014 Least Bell's Vireo Occurrences

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_LBVI_Occurrences.mxd, 1/6/2015, wallacerj

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- 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

<u>Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)</u>

Vegetation Communities

Implementation of the Phase 5A Grouted Stone 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 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. As a result, 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. 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 4.1-3); 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 Figures 5.5-1a and b).

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 1.16 acres of permanent impacts associated with the proposed grouted stone structure and 12.57 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		
Arroyo-Willow Forest	0.06	0.07
Barren Riparian		0.09
Black Willow Forest		
Cottonwood-Willow		0.43
Disturbed Riparian		
Herbaceous Riparian		
Mexican Elderberry		
Mulefat Scrub	0.91	2.07
Willow Riparian Scrub		
TOTAL RIPARIAN	**0.97**	**2.66**
Upland		
Annual Grassland		
Coast Live Oak		
California Walnut Wood		
Elderberry Savanna		
Giant Reed Grass		
Mixed Scrub		
Non-native Woodland		
Ruderal Grassland	0.08	0.96
Scale-Broom Scrub		
Scrub Eucalyptus Plant		
Salt Grass Grassland		
Sagebrush Scrub		
Yerba Santa Scrub		
TOTAL UPLAND	**0.08**	**0.96**
Developed		
Disturbed or Barren	0.08	0.81
Ornamental/Landscape		1.47
Orchard Vineyard		
Urban/Commercial	0.03	6.67
TOTAL DEVELOPED	**0.11**	**8.95**
TOTAL	**1.16**	**12.57**

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-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. 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

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 7.75 acres of non-native invasives if it is determined that requirements of a 1:1 ratio can be met, or 13.07 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]	0.97	4.85	2.66	2.66/7.98
Upland[2]	0.08	0.24	0.96	NA
Developed	0.11	NA	8.95	NA
Total Mitigation		5.09		2.66/7.98
Total Mitigation Required Using 1:1 Ratio for Temp Impacts = 7.75 acres				
Total Mitigation Required Using 3:1 Ratio for Temp Impacts = 13.07 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. Designated critical habitat for the species occurs within the project area, as is shown in Figure 5.5-6. Suckers have been documented within Reach 9 in recent histories and are assumed to be present in low numbers; however breeding in Reach 9 has not been confirmed in recent years. Construction of the alternatives of Reach 9 measures would result in permanent and temporary impacts to sucker habitat (i.e., Perennial Streams), within the BNSF Bridge area. Since aquatic habitats suitable for Santa Ana sucker do not existing within Phase 5A, 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 the implementation or funding towards a cowbird trapping program. The requirements of the cowbird trapping program have been met for previously analyzed Reach 9 features; however, 5 additional years (2016-2020) of trapping is proposed to minimize construction impacts and support restoration efforts related to Phases 5A, 5B, 4 and BNSF Bridge. 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. Impacts are anticipated under Phase 5B and will be further discussed in Chapter 5.5.2.2. 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, the proposed Reach 9 measures may adversely affect, but would not jeopardize 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 5.5-6) and as a result adverse modification to critical habitat would not occur under this alternative. Impacts to scrub habitat preferred by gnatcatcher would occur under Phase 4 and BNSF Bridge. As a result, implementation of those measures would adversely affect critical habitat; 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.

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	10	18
Phase 4	1	4
BNSF Bridge	2	2
TOTALS	14	32

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 0.97 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 2.66 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 46 vireo territories (14 territories within the TCE and an additional 32 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 the implementation or funding towards a cowbird trapping program. The requirements of the cowbird trapping program have been met for previously analyzed Reach 9 features, however, 5 additional years of cowbird trapping will be implemented to minimize construction impacts and support restoration efforts related to Phases 5A, 5B, 4 and BNSF Bridge features. According to the 2001 SEIS/EIR and 2001 BO, 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. 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 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 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.

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.

<u>Soil Cement and Sheet Pile Alternative (Alternative 2)</u>

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.

<u>No Federal Action Alternative (Alternative 3)</u>

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 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 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. As a result, 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. For the grouted stone structure along the Phase 5B Grouted Stone Alternative, the distance between the existing toe and the toe of grouted stone proposed under the

Grouted Stone Alternative is determined to be 22 feet (see Figure 4.2-4). Permanent impacts associated with the Phase 5B Grouted Stone Alternative are primarily to Riparian classifications (i.e., Mexican Elderberry, mulefat scrub) (see Figures 5.5-2a,b, and c). Due to the preliminary nature of this alternative's design, the grouted stone structure coincides with Perennial Stream habitat at the eastern terminus (Figure 5.5-2c); 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 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 5.5-2c); 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 Alternative are presented in Table 5.5-7. Within the Phase 5B work area, the Grouted Stone Alternative would entail 7.76 acres of permanent impacts associated with the proposed grouted stone structure and 73.07 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 Alternative: Permanent and Temporary Impacts

Vegetation Communities and Classifications	Permanent Impacts (acres)	Temporary Impacts (acres)
Riparian		
Arroyo-Willow Forest	0.31	0.71
Barren Riparian		<0.01
Black Willow Forest	0.04	0.27
Cottonwood-Willow	0.62	4.60
Disturbed Riparian	0.01	0.46
Herbaceous Riparian	0.15	1.69
Mexican Elderberry	2.54	10.58
Mulefat Scrub	1.10	3.79
Willow Riparian Scrub	0.26	2.24
TOTAL RIPARIAN	**5.03**	**24.34**
Upland		
Annual Grassland	0.02	0.21
Coast Live Oak	0.04	0.17
California Walnut Wood		0.11
Elderberry Savanna	< 0.01	0.35
Giant Reed Grass	0.02	0.40
Mixed Scrub		
Non-native Woodland	0.18	1.16
Ruderal Grassland	1.49	17.90
Scale-Broom Scrub		0.22
Scrub Eucalyptus Plant	0.08	0.56
Salt Grass Grassland	0.07	0.15
Sagebrush Scrub	0.09	0.19
Yerba Santa Scrub	0.01	0.69
TOTAL UPLAND	**2.00**	**22.11**
Developed		
Disturbed or Barren	0.39	6.88
Ornamental/Landscape		1.34
Orchard Vineyard	0.14	3.72
Urban/Commercial	0.10	14.05
TOTAL DEVELOPED	**0.63**	**25.99**
TOTAL	**7.76**	**73.07**

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. 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 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 Alternative would include the removal of 55.50 acres of non-native invasives if it is determined that requirements of a 1:1 ratio can be met, or 104.17 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 (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]	5.03	25.15	24.34	24.34/73.02
Upland[2]	2.00	6.00	22.11	NA
Developed	0.63	NA	25.99	NA
Total Mitigation		31.15		24.35/73.02
Total Mitigation Required Using 1:1 Ratio for Temp Impacts = 55.50 acres				
Total Mitigation Required Using 3:1 Ratio for Temp Impacts = 104.17 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 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 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 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 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 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 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 Alternative below.

Santa Ana Sucker

Designated critical habitat for the species occurs within the Phase 5B Grouted Stone Alternative, as is shown in Figure 5.5-6; however implementation of this alternative would not impact aquatic habitats suitable for sucker. As a result, 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 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 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 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 Alternative and other Reach 9 measure areas. Designated critical habitat for the species does, however, coincide with approximately two-thirds of Phase 5B (Figure 5.5-6). Under the Phase 5B Grouted Stone Alternative, minor permanent impacts (0.09 acre) and temporary impacts (0.19 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 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 Alternative may adversely affect, but would not jeopardize the coastal California gnatcatcher. Designated critical habitat for the species occurs within the Phase 5B Grouted Stone Alternative (see Figure 5.5-6) and as a result adverse modification to critical habitat would occur under this alternative. 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 Alternative would result in temporary displacement of 28 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, 10 vireo territories coincide with the Phase 5B Grouted Stone 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 5.03 acres of Riparian habitat would be permanently impacted and 24.34 acres of Riparian habitat temporarily impacted by implementation of the Phase 5B Grouted Stone 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 Alternative could potentially result in take of the 18 vireo territories that occur within the 200-foot buffer (see Figures 5.5-7a and b), for a total project take of 28 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 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.

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.

Soil Cement Alternative (Alternative 2)

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 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 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 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 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 and b).

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 and b). 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 5.52 acres of permanent impacts associated with the proposed soil cement structure (3.38 acres) and maintenance road (2.15 acres); and 23.09 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		
Arroyo-Willow Forest		
Barren Riparian		
Black Willow Forest		
Cottonwood-Willow	0.27	2.78
Disturbed Riparian		
Herbaceous Riparian		0.30
Mexican Elderberry		0.39
Mulefat Scrub		
Willow Riparian Scrub		
TOTAL RIPARIAN	**0.27**	**3.47**
Upland		
Annual Grassland		
Coast Live Oak		1.18
California Walnut Wood		
Elderberry Savanna		
Giant Reed Grass		0.11
Mixed Scrub	0.07	0.06
Non-native Woodland		0.03
Ruderal Grassland	0.39	4.42
Scale-Broom Scrub		0.02
Scrub Eucalyptus Plant		
Salt Grass Grassland		
Sagebrush Scrub		
Yerba Santa Scrub		
TOTAL UPLAND	**0.46**	**5.82**
Developed		
Disturbed or Barren	4.79	13.66
Ornamental/Landscape		0.05
Orchard Vineyard		
Urban/Commercial		0.09
TOTAL DEVELOPED	**4.79**	**13.80**
TOTAL	**5.52**	**23.09**

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 6.20 acres of non-native invasives if it is determined that requirements of a 1:1 ratio can be met, or 13.14 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]	0.27	1.35	3.47	3.47/10.41
Upland[2]	0.46	1.38	5.82	NA
Developed	4.79	NA	13.80	NA
Total Mitigation		2.73		3.47/10.41
Total Mitigation Required Using 1:1 Ratio for Temp Impacts = 6.20 acres				
Total Mitigation Required Using 3:1 Ratio for Temp Impacts = 13.14 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 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 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 5.5-6; however implementation of this alternative would not impact aquatic habitats suitable for sucker. As a result, 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 5.5-6). 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 adversely affect, but would not jeopardize the coastal California gnatcatcher. Designated critical habitat for the species occurs within the Phase 4 Soil Cement Alternative (see Figure 5.5-6) and as a result adverse modification to critical habitat would occur under this alternative. 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 5.5-6 and depicted in Figure 5.5-7b.

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 5.5-7b, 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 5.03 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 24.34 acres of Riparian habitat would be temporarily impacted by implementation of the Phase 5B Grouted Stone 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 four vireo territories that occur within the 200-foot buffer (see Figures 5.5-7b), for a total project take of five 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 2013amendments. 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 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.

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.

<u>Grouted Stone Alternative (Alternative 2)</u>

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 5.5-3c 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 5.5-3c 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		
Arroyo-Willow Forest		
Barren Riparian		
Black Willow Forest		
Cottonwood-Willow	0.55	2.50
Disturbed Riparian		
Herbaceous Riparian		0.30
Mexican Elderberry		0.39
Mulefat Scrub		
Willow Riparian Scrub		
TOTAL RIPARIAN	**0.55**	**3.19**
Upland		
Annual Grassland		
Coast Live Oak	0.03	1.15
California Walnut Wood		
Elderberry Savanna		
Giant Reed Grass		0.11
Mixed Scrub	0.11	0.01
Non-native Woodland		0.03
Ruderal Grassland	0.45	4.36
Scale-Broom Scrub		0.02
Scrub Eucalyptus Plant		
Salt Grass Grassland		
Sagebrush Scrub		
Yerba Santa Scrub		
TOTAL UPLAND	**0.59**	**5.68**
Developed		
Disturbed or Barren	5.36	13.09
Ornamental/Landscape		0.05
Orchard Vineyard		
Urban/Commercial		0.09
TOTAL DEVELOPED	**5.36**	**13.23**
TOTAL	**6.50**	**22.10**

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 Figure 5.5-7b. 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.

No Federal Action Alternative (Alternative 3)

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

<u>Pier Noses and Abutment Protection Alternative (Alternative 1, Preferred Alternative)</u>

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 Figures 5.5-4b).

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 5.5-4a and b).

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 2.82 acres of permanent impacts and 22.98 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	**0.08**	**0.92**
Riparian		
Arroyo-Willow Forest		
Barren Riparian		
Black Willow Forest		
Cottonwood-Willow	0.48	3.09
Disturbed Riparian		1.17
Herbaceous Riparian		
Mexican Elderberry		
Mulefat Scrub		0.33
Willow Riparian Scrub		
TOTAL RIPARIAN	**0.48**	**4.59**
Upland		
Annual Grassland		
Coast Live Oak		
California Walnut Wood		
Elderberry Savanna		
Giant Reed Grass		
Mixed Scrub	0.01	0.27
Non-native Woodland		0.19
Ruderal Grassland	0.08	0.98
Scale-Broom Scrub		
Scrub Eucalyptus Plant		
Salt Grass Grassland		
Sagebrush Scrub		
Yerba Santa Scrub		
TOTAL UPLAND	**0.09**	**1.44**
Developed		
Disturbed or Barren	1.41	5.25
Ornamental/Landscape	0.46	9.54
Orchard Vineyard		
Urban/Commercial	0.30	1.24
TOTAL DEVELOPED	**2.17**	**16.03**
TOTAL	**2.82**	**22.98**

[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 1.0 acre of stream creation or restoration to compensate for permanent (0.08 acre) and temporary (0.92 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 7.26 acres of non-native invasives if it is determined that requirements of a 1:1 ratio can be met, or 16.44 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]	0.08	0.08	0.92	0.92
Total Mitigation Required for Waters = 1.0 acre				
Riparian[2]	0.48	2.40	4.59	4.59/13.77
Upland[3]	0.09	0.27	1.44	NA
Developed	2.17	NA	16.03	NA
Total Vegetation Mitigation		2.67		4.59/13.77
Total Mitigation Required for Vegetation Using 1:1 Ratio for Temp Impacts = 7.26 acres **Total Mitigation Required for Vegetation Using 3:1 Ratio for Temp Impacts = 16.44 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 0.08 acres of Perennial Stream habitat would be permanently impacted by construction of pier protection, and 0.92 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 5.5-6.

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 (the most recent in 2013), 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. 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 that anticipated and addressed in the 2001 SEIS/EIR and Biological Opinion.

Any areas disturbed by construction of the Reach 9 measures would be restored upon completion and measures will be taken to avoid and minimize impacts to suckers during surface flow dewatering and diversion efforts. Therefore, the proposed project may adversely affect, but would not jeopardize the Santa Ana sucker and is not expected to adversely modify designated critical habitat for the species.

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 designated critical habitat for the species does not coincide with the measure (Figure 5.5-6). 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 adversely affect, but would not jeopardize the coastal California gnatcatcher. Designated critical habitat for the species does not occur within BNSF Bridge (see Figure 5.5-6) and as a result adverse modification to critical habitat would not occur under this alternative.

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 four vireo territories occurring within the APE of this alternative, as presented in Table 5.5-6 and depicted in Figure 5.5-7c.

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, 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 0.48 acres of Riparian habitat would be permanently impacted. Table 5.5.12 indicates that 4.59 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 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.

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), an analysis of the BNSF Bridge measure in relation to the MSHCP is provided in Table 5.5-15 below.

Table 5.5-15. BNSF Bridge-Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP) Analysis

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 owned by the Riverside County Flood Control.
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 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.

<u>No Federal Action Alternative (Alternative 2)</u>

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.

<u>Future Operations and Maintenance</u>

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	Phase 4 Preferred Soil Cement	Phase 4 Alt 2 Grouted Stone	BNSF Bridge Protection Features[1]
Waters					
Perennial Stream					0.08
TOTAL WATERS					
Riparian					
Arroyo-Willow Forest	0.06	0.31			
Barren Riparian					
Black Willow Forest		0.04			
Cottonwood-Willow		0.62	0.27	0.55	0.48
Disturbed Riparian		0.01			
Herbaceous Riparian		0.15			
Mexican Elderberry		2.54			
Mulefat Scrub	0.91	1.10			
Willow Riparian Scrub		0.26			
TOTAL RIPARIAN	**0.97**	**5.03**	**0.27**	**0.55**	**0.48**
Upland					
Annual Grassland		0.02			
Coast Live Oak		0.04		0.03	
California Walnut Wood					
Elderberry Savanna		< 0.01			
Giant Reed Grass		0.02			
Mixed Scrub			0.07	0.11	0.01
Non-native Woodland		0.18			
Ruderal Grassland	0.08	1.49	0.39	0.45	0.08
Scale-Broom Scrub					
Scrub Eucalyptus Plant		0.08			
Salt Grass Grassland		0.07			

Vegetation Communities and Other Cover Types	Phase 5A Preferred Grouted Stone + Sheet Pile	Phase 5B Preferred Grouted Stone	Phase 4 Preferred Soil Cement	Phase 4 Alt 2 Grouted Stone	BNSF Bridge Protection Features[1]
Sagebrush Scrub		0.09			
Yerba Santa Scrub		0.01			
TOTAL UPLAND	**0.08**	**2.00**	**0.46**	**0.59**	**0.09**
Developed					
Disturbed or Barren	0.08	0.39	4.79	5.36	**1.41**
Ornamental/Landscape					**0.46**
Orchard Vineyard		0.14			
Urban/Commercial	0.03	0.10			**0.30**
TOTAL DEVELOPED	**0.11**	**0.63**	**4.79**	**5.36**	**2.17**
TOTAL	**1.16**	**7.76**	**5.52**	**6.50**	**2.82**

[1] BNSF Bridge protection features include: pier nose extension walls, pier enclosure walls, concrete walls, grouted stone, and concrete pavement.

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	Phase 4 Preferred Soil Cement	Phase 4 Alt 2 Grouted Stone	BNSF Bridge Protection Features
Waters					
Perennial Stream					0.92
TOTAL WATERS					
Riparian					
Arroyo-Willow Forest	0.07	0.71			
Barren Riparian	0.09	<0.01			
Black Willow Forest		0.27			
Cottonwood-Willow	0.43	4.60	2.78	2.50	3.09
Disturbed Riparian		0.46			1.17
Herbaceous Riparian		1.69	0.30	0.30	
Mexican Elderberry		10.58	0.39	0.39	
Mulefat Scrub	2.07	3.79			0.33
Willow Riparian Scrub		2.24			
TOTAL RIPARIAN	**2.66**	**24.34**	**3.47**	**3.19**	**4.59**
Upland					
Annual Grassland		0.21			
Coast Live Oak		0.17	1.18	1.15	
California Walnut Wood		0.11			
Elderberry Savanna		0.35			
Mixed Scrub		0.40	0.11	0.11	0.27
Giant Reed Grass			0.06	0.01	0.19
Non-native Woodland		1.16	0.03	0.03	0.98
Ruderal Grassland	0.96	17.90	4.42	4.36	

Vegetation Communities and Other Cover Types	**Phase 5A Preferred Grouted Stone + Sheet Pile**	**Phase 5B Preferred Grouted Stone**	**Phase 4 Preferred Soil Cement**	**Phase 4 Alt 2 Grouted Stone**	**BNSF Bridge Protection Features**
Scale-Broom Scrub		0.22	0.02	0.02	
Scrub Eucalyptus Plant		0.56			
Salt Grass Grassland		0.15			
Sagebrush Scrub		0.19			
Yerba Santa Scrub		0.69			
TOTAL UPLAND	**0.96**	**22.11**	**5.82**	**5.68**	**1.44**
Developed					
Disturbed or Barren	0.81	6.88	13.66	13.09	**5.25**
Ornamental/Landscape	1.47	1.34	0.05	0.05	**9.54**
Orchard Vineyard		3.72			
Urban/Commercial	6.67	14.05	0.09	0.09	**1.24**
TOTAL DEVELOPED	**8.95**	**25.99**	**13.80**	**13.23**	**16.03**
TOTAL	**12.57**	**73.07**	**23.09**	**22.10**	**22.98**

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	5.09	2.66/7.98
Phase 5B Grouted Stone	31.15	24.34/73.02
Phase 4 Soil Cement	2.73	3.47/10.41
Phase 4 Grouted Stone	4.52	3.19/9.57
BNSF Bridge – Waters[3]	0.08	0.92
BNSF Bridge - Vegetation	2.67	4.59/13.77

[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.]

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.]

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 will 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 will 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.)"

BR-19 Conduct a cowbird trapping program for a period of 2 years during construction of Reach 9 measures, and 5 years following completion of construction. Trapping shall consist of fifteen monitored traps during least Bell's vireo and southwestern willow flycatcher egg-laying season (15 March to 30 July). This effort is viewed as supplementing ongoing cowbird trapping activities in the Prado Basin. The Corps funded four years of trapping efforts in Reach 9 and vicinity from 2002 through 2006, and awarded a contract in 2009 for an additional three years of trapping. As such, the requirements of BR-19 have been fulfilled for the projects that were analyzed in the 2001 SEIS/EIR and project BO's. Five additional years of cowbird trapping will be implemented to minimize construction impacts and support restoration efforts related to Phases 5A, 5B, 4 and BNSF Bridge features.

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. 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.

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 hydro-seed all disturbed upland areas with local native shrubs and groundcover. The mix of native species in the hydro-seed shall be approved in advance by the Environmental Resources Branch of the Corps' Los Angeles District. Container plants shall also be implemented in the effort to restore upland habitats.

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.

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.

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.

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.

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.

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

Pollutant	Averaging Time	California Standards[a]		National Standards[b]		
		Concentration[c]	**Method**	**Primary[c,d]**	**Secondary[c,e]**	**Method**
Ozone	1 hour	0.09 ppm (180 $\mu g/m^3$)	Ultraviolet photometry	–	Same as primary standard	Ultraviolet photometry
	8 hours	0.070 ppm (137 $\mu g/m^3$)		0.075 ppm (147 $\mu g/m^3$)		
Respirable particulate matter (PM_{10})	24 hours	50 $\mu g/m^3$	Gravimetric or beta attenuation	150 $\mu g/m^3$	Same as primary standard	Inertial separation and gravimetric analysis
	Annual arithmetic mean	20 $\mu g/m^3$		–		
Fine particulate matter ($PM_{2.5}$)	24 hours	–	–	35 $\mu g/m^3$	Same as primary standard	Inertial separation and gravimetric analysis
	Annual arithmetic mean	12 $\mu g/m^3$	Gravimetric or beta attenuation	12 $\mu g/m^3$	15 $\mu g/m^3$	
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)		–	–	

		California Standards [a]		National Standards [b]		
Pollutant	**Averaging Time**	**Concentration [c]**	**Method**	**Primary [c,d]**	**Secondary [c,e]**	**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.

Source: CARB 2013

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.

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 (µg/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 (µg/m^3)	24.9	22.4	25.4
$PM_{2.5}$			
24-hour (µg/m^3)	39.2	50.1	37.8
Days above the Federal Standard	2	4	1
Annual Arithmetic Mean (µg/m^3)	10.9	10.8	10.0

Source: CARB 2014a.
Acronyms: ppm = parts per million; µg/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 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);
- 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

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	N/A	100	100	100
Exceed *de minimis* Thresholds?	No	N/A	No	No	No

[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 93.153(a)(5)(v).

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 in conformance under 40 CFR 93.153(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 93.153(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. Implementation of the Grouted Stone and Sheet Pile Alternative would not change the findings in the 2001 SEIS/EIR, in that construction emissions would violate an ambient air quality standard or contribute substantially to an existing violation. Therefore, SARMP construction impacts related to violation of an ambient air quality standard would still be considered significant.

Future OMRR&R activities would include structural and non-structural repairs and inspections. Implementation of the Phase 5A Grouted Stone and Sheet Pile Alternative is not anticipated to generate substantial new vehicle trips or use of off-road equipment during maintenance and operations compared to existing conditions. No new permanent, stationary source of emissions would be constructed or operated as part of the construction of the Phase 5A Grouted Stone and Sheet Pile Alternative. Therefore, operational emissions were not estimated for the proposed project. These long-term OMRR&R 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.

The 2001 SEIS/EIR concluded that the NOx emissions associated with construction of other SARMP features were considered a significant and unavoidable impact. The construction and operational emissions associated with the Phase 5A Grouted Stone and Sheet Pile Alternative are anticipated to be similar to those addressed in the 2001 SEIS/EIR, . As with other features, construction impacts for the Phase 5A Grouted Stone and Sheet Pile Alternative related to violation of an ambient air quality standard would be significant, and 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. Because the construction-related emissions would exceed the SCAQMD project-level air quality significance thresholds, the Phase 5A Grouted Stone and Sheet Pile

Alternative would have a cumulatively considerable contribution to the region's air quality. The cumulative impact would be significant.

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	N/A	100	100	100
Exceed *de minimis* Thresholds?	No	N/A	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 93.153(a)(5)(v).

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. Consistent with the approach in the 2001 SEIS/EIR, the annual NOx emissions associated with Alternative 2 were determined to be in conformance under 40 CFR 93.153(a)(5)(v). Therefore, construction-related emissions associated with the Soil Cement and Sheet Pile Alternative would conform to the SIP, and a formal conformity analysis would not be required.

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. Implementation of the Soil Cement and Sheet Pile Alternative would not change the findings in the 2001 SEIS/EIR, and construction emissions would violate an ambient air quality standard or contribute substantially to an existing violation. Therefore, construction impacts related to violation of an ambient air quality standard would be significant.

Because the Soil Cement and Sheet Pile 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 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.

<u>No Federal Action Alternative (Alternative 3)</u>

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 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 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 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 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	N/A	100	100	100
Exceed *de minimis* Thresholds?	No	N/A	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 93.153(a)(5)(v).

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. Consistent with the approach in the 2001 SEIS/EIR, the annual NOx emissions associated with the Phase 5B Grouted Stone Alternative were determined to be in conformance under 40 CFR 93.153(a)(5)(v). Therefore, construction-related emissions associated with the Grouted Stone Alternative would conform to the SIP, and a formal conformity analysis would not be required.

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 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. Implementation of the Phase 5B Grouted Stone Alternative would not change the findings in the 2001 SEIS/EIR , and construction emissions would violate an ambient air quality standard or contribute substantially to an existing violation. Therefore, construction impacts related to violation of an ambient air quality standard would be significant. 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.

The 2001 SEIS/EIR concluded that the NOx emissions associated with other SARMP features were considered a significant and unavoidable impact. The construction and operational emissions associated with the proposed Phase 5B Grouted Stone Alternative are anticipated to be similar to those addressed in the 2001 SEIS/EIR. **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)**

Because the construction-related emissions would exceed the SCAQMD project-level air quality significance thresholds, the project alternative would have a cumulatively considerable contribution to the region’s air quality. The cumulative impact would be significant.

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 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 Alternative would not be expected to add any new odor sources. As a result, the Phase 5B Grouted Stone 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.

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

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 Alternative. However, the Soil Cement Alternative would have overall impacts (e.g., significant and unavoidable NOx emissions) similar to the Grouted Stone 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
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	N/A	100	100	100
Exceed *de minimis* Thresholds?	No	N/A	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 93.153(a)(5)(v).

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. Consistent with the approach in the 2001 SEIS/EIR, the annual NOx emissions associated with the Soil Cement Alternative were determined to be in conformance under 40 CFR 93.153(a)(5)(v). Therefore, construction-related emissions associated with the Soil Cement Alternative would conform to the SIP, and a formal conformity analysis would not be required.

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. Implementation of the Soil Cement Alternative would not change the findings in the 2001 SEIS/EIR. Because the Soil Cement 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 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.

<u>No Federal Action Alternative (Alternative 3)</u>

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

<u>Soil Cement Alternative (Preferred Alternative, Alternative 1)</u>

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 3,790-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. Construction is expected to take 12 months to complete.

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}	$PM_{2.5}$
2015	0.04	0.31	0.25	6.60	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

[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 93.153(a)(5)(v).

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. Consistent with the approach in the 2001 SEIS/EIR, the annual NOx emissions associated with the Phase 4 Soil Cement Alternative were determined to be in conformance under 40 CFR 93.153(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 5.6-14, construction emissions for the project alternative would result in maximum daily emissions of approximately 33 pounds of VOC, 272 pounds of NOx, 131 pounds of CO, 111 pounds of PM_{10}, and 32 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	32.88	271.58	131.02	111.15	31.91
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 5.6-14, 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. Implementation of the Phase 4 Soil Cement Alternative would not change the findings in the 2001 SEIS/EIR. 3Long-term OMRR&R activities would not generate substantial criteria pollutant emissions. Therefore, operational emissions were not estimated for the project alternative. These 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.

The 2001 SEIS/EIR concluded that the NOx emissions associated with other SARMP features were considered a significant and unavoidable impact. The construction and operational emissions associated with the Phase 4 Soil Cement Alternative are anticipated to be similar to those addressed in the 2001

SEIS/EIR, **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)**

Because the construction-related emissions would exceed the SCAQMD project-level air quality significance thresholds, the Phase 4 Soil Cement Alternative would have a cumulatively considerable contribution to the region's air quality. The cumulative impact would be significant.

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 3,260 MT CO_2e. Construction emissions amortized over the assumed lifetime of the project would be 65 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 93.153(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}	$PM_{2.5}$
2015	0.04	0.31	0.25	4.59	1.24
2016	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	N/A	100	100	100
Exceed *de minimis* Thresholds?	No	N/A	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 93.153(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. Implementation of Phase 4 Alternative 2 would not change the findings in the 2001 SEIS/EIR

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.

<u>No Federal Action Alternative (Alternative 3)</u>

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

<u>Pier and Abutment Protection Alternative (Preferred Alternative, Alternative 1)</u>

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	N/A	100	100	100
Exceed *de minimis* Thresholds?	No	N/A	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 93.153(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 93.153(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. Implementation of the BNSF Bridge Preferred Alternative would not change the findings in the 2001 SEIS/EIR

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.

The 2001 SEIS/EIR concluded that the NOx emissions associated with other SARMP features were considered a significant and unavoidable impact. The construction and operational emissions associated with the BNSF Bridge Preferred Alternative are anticipated to be similar to those addressed in the 2001 SEIS/EIR

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)

Because the construction-related emissions would exceed the SCAQMD project-level air quality significance thresholds, the project alternative would have a cumulatively considerable contribution to the region's air quality. The cumulative impact would be significant.

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.

<u>No Federal Action Alternative (Alternative 3)</u>

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

<u>Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)</u>

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 (between 18 to 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 of Phase 5A,

Figure 5.7-1 Noise Monitoring Locations

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 7:00 a.m. and 4:00 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.

<u>Soil Cement and Sheet Pile Alternative (Alternative 2)</u>

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 (between 18 to 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.

<u>No Federal Action Alternative (Alternative 3)</u>

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

<u>Grouted Stone Alternative (Preferred Alternative, Alternative 1)</u>

Construction of the Grouted Stone Alternative under Phase 5B would require truck trips to and from the site in the City of Yorba Linda. It is anticipated that no more than 20 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 7:00 a.m. and 4:00 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.

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

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.

<u>No Federal Action Alternative (Alternative 3)</u>

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

<u>Soil Cement Alternative (Preferred Alternative, Alternative 1)</u>

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 scheduled to occur for up to 12 months, 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 7:00 a.m. and 4:00 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.

<u>Grouted Stone Alternative (Alternative 2)</u>

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 (12 months). Therefore, it would have impacts similar to the Soil Cement Alternative.

<u>No Federal Action Alternative (Alternative 3)</u>

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

<u>Pier and Abutment Protection Alternative (Preferred Alternative, Alternative 1)</u>

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. This survey indicated that for this feature, 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

<u>Grouted Stone and Sheet Pile Alternative(Preferred Alternative, Alternative 1)</u>

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.

<u>Soil Cement and Sheet Pile Alternative (Alternative 2)</u>

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.

<u>No Federal Action Alternative (Alternative 3)</u>

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

<u>Grouted Stone Alternative (Preferred Alternative, Alternative 1)</u>

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.

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

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.

<u>No Federal Action Alternative (Alternative 3)</u>

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

<u>Soil Cement Alternative (Preferred Alternative, Alternative 1)</u>

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.

<u>Grouted Stone Alternative (Alternative 2)</u>

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

<u>Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)</u>

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 1.34 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.

<u>Soil Cement and Sheet Pile Alternative (Alternative 2)</u>

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.

<u>No Federal Action Alternative (Alternative 3)</u>

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

<u>Grouted Stone Alternative (Preferred Alternative, Alternative 1)</u>

The Grouted Stone 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 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.

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

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 period of 18 to 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.

<u>No Federal Action Alternative (Alternative 3)</u>

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

<u>Grouted Stone Alternative (Preferred Alternative, Alternative 1)</u>

Construction proposed under the Phase 5B Grouted Stone 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, and a short project construction period of 12 months, 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

<u>Pier and Abutment Protection Alternative (Preferred Alternative, Alternative 1)</u>

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 22 to 24 months, 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.

<u>No Federal Action Alternative (Alternative 2)</u>

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

<u>Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)</u>

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.

<u>Soil Cement and Sheet Pile Alternative (Alternative 2)</u>

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.

<u>No Federal Action Alternative (Alternative 3)</u>

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

<u>Grouted Stone Alternative (Preferred Alternative, Alternative 1)</u>

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.

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

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.

<u>No Federal Action Alternative (Alternative 3)</u>

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.

<u>No Federal Action Alternative (Alternative 2)</u>

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 1,100 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 Alternative (Preferred Alternative, Alternative 1)

Construction under the Grouted Stone 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 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 3,790-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 3,790-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.

<u>Grouted Stone Alternative (Alternative 2)</u>

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.

<u>No Federal Action Alternative (Alternative 3)</u>

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

<u>Pier and Abutment Protection Alternative (Preferred Alternative, Alternative 1)</u>

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.

<u>No Federal Action Alternative (Alternative 2)</u>

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

<u>Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)</u>

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 OCFD 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.

<u>Soil Cement and Sheet Pile Alternative (Alternative 2)</u>

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.

<u>No Federal Action Alternative (Alternative 3)</u>

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 Alternative (Preferred Alternative, Alternative 1)

The Grouted Stone 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 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.

<u>No Federal Action Alternative (Alternative 3)</u>

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.

<u>Soil Cement and Sheet Pile Alternative (Alternative 2)</u>

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.

<u>No Federal Action Alternative (Alternative 3)</u>

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

<u>Grouted Stone Alternative (Preferred Alternative, Alternative 1)</u>

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.

<u>No Federal Action Alternative (Alternative 3)</u>

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

<u>Soil Cement Alternative (Preferred Alternative, Alternative 1)</u>

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.

<u>No Federal Action Alternative (Alternative 3)</u>

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

<u>Grouted Stone and Sheet Pile Alternative (Preferred Alternative, Alternative 1)</u>

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 18 to 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.

<u>Soil Cement and Sheet Pile Alternative (Alternative 2)</u>

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.

<u>No Federal Action Alternative (Alternative 3)</u>

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 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 would be short-term (approximately 16 months) and 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.

<u>No Federal Action Alternative (Alternative 3)</u>

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 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 Perennial Stream	Riverside and Orange Counties. South (left) bank of the SAR, between the GRMH embankment and Reach 9, Phase 4.	This project constructed approximately 6,000 feet of bank protection along the GRGC. Provides flood damage reduction to SR-91.	Construction completed 2014.

Project Name/Case Number	General Location	Description	Status
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 3,790 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 August 2015 and completion November 2016.
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 4,140 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 July 2015 and completion April 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) 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 July 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. As discussed in

Chapter 5.6, construction-related NOx and PM_{10} emissions for the individual project alternatives would exceed the SCAQMD thresholds and would cause a significant impact. In addition, the project alternatives for each phase would potentially be constructed concurrently with, and in proximity to, other Reach 9 measures in the cumulative study area. To the extent to which all reasonably foreseeable cumulative projects would result in significant cumulative impacts depends on their proximity and construction time schedules.

Due to the potential overlapping construction schedules (e.g., Phases 5A and 5B in 2016) of the Reach 9 measures, it is anticipated that construction-related emissions would result in a violation of ambient air quality standards (NOx) and would result in a cumulatively considerable net increase of criteria pollution (NOx) for which the SARMP region is non-attainment under an applicable federal or state ambient air quality standard. Because construction-related emissions would exceed the SCAQMD project-level air quality significance thresholds, current and proposed Reach 9 measures would have a cumulatively considerable contribution to the region's air quality. The cumulative impact would be significant. This finding is consistent with the 2001 SEIS/EIR, and therefore not a new significant impact.

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 and southwestern willow flycatcher in the spring and early summer in the year prior to construction, as well as during the year of construction.

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 will 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]

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.)"

BR-19 The Corps [or its non-federal sponsor] shall implement a cowbird trapping program in Reach 9 or shall make a cash contribution to the Santa Ana River Conservation Trust Fund for that purpose. In lieu of a cash contribution, the Corps or its non-federal sponsor shall conduct a cowbird trapping program for a period of 2 years during construction of Reach 9 measures, and 5 years following completion of construction. Trapping shall consist of 15 monitored traps during least Bell's vireo and southwestern willow flycatcher egg-laying season (March 15 to July 30). This effort is viewed as supplementing ongoing cowbird trapping activities in the Prado Basin. The Corps funded 4 years of trapping efforts in Reach 9 and vicinity from 2002 through 2006, and awarded a contract in 2009 for an additional 3 years of trapping. As such, the requirements of BR-19 have been fulfilled for the projects that were analyzed in the 2001 SEIS/EIR and project Biological Opinions. Five additional years (2016-2020) of cowbird trapping will be implemented to minimize construction impacts and support restoration efforts related to Phases 4, 5A, 5B, and BNSF Bridge features.

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 is present, the construction contractor shall install noise barriers between construction areas and riparian habitat prior to March 1. These noise barriers shall be kept in place until all construction in the area is completed. The Corps will 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. Sound monitoring and vireo surveys will be conducted throughout the nesting season to determine if noise barriers or other modifications are warranted.]

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 hydroseed all disturbed upland areas with local native shrubs and groundcover. The mix of native species in the hydroseed shall be approved in advance by the Environmental Resources Branch of the Corps' Los Angeles District. Container plants shall also be implemented in the effort to restore upland habitats.

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.

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.

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.

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.

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.

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

<u>The National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA)</u>

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.

<u>National Historic Preservation Act (NHPA) of 1966, as amended</u>

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.

<u>Bald and Golden Eagle Protection Act, as Amended</u>

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.

<u>Fish and Wildlife Coordination Act (FWCA), as Amended</u>

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 or will also been coordinated with the resource agencies. Furthermore, this SEA/EIR Addendum will be 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

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 are being addressed in a consultation with USFWS. It is anticipated that a new or amended Biological Opinion will be provided for the proposed Reach 9 measures prior to finalizing this SEA/EIR Addendum.

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. 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 will be prepared and the Corps will coordinate with the Santa Ana River RWQCB to receive 401 Certification for these measures. Measures to protect water quality during dewatering (i.e., river diversion and control of sedimentation) would be similar to those to be implemented during construction of previous Reach 9 measures.

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)

A Construction SWPPP would be developed for the Reach 9 measures and filed with the Santa Ana RWQCB prior to construction. 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 will be amended after receipt of a Biological Opinion by USFWS to address the proposed measures.

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 will coordinate 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.

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 Draft SEA/EIR Addendum will be distributed to several public agencies and numerous interested parties for review.

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 Draft SEA will serve as the Biological Assessment that will be used to facilitate formal consultation with USFWS for the Reach 9 measures.

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9.0 LIST OF PREPARERS AND REVIEWERS

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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.

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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

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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

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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. <u>Santa Ana Valley Irrigation Ranch Levee</u>. 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. <u>BNSF Railroad</u>. 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. **<u>Completed Improvements Constructed by USACE</u>**. 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. <u>SARI Line</u>. 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. <u>Gypsum Canyon Road Bridge</u>. 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. **<u>Summary of Recommendations</u>**. To summarize, the following recommendations made within this MFR for both local and federal improvements include:

a. <u>Lomas de Yorba-Sur Levee</u>. 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.

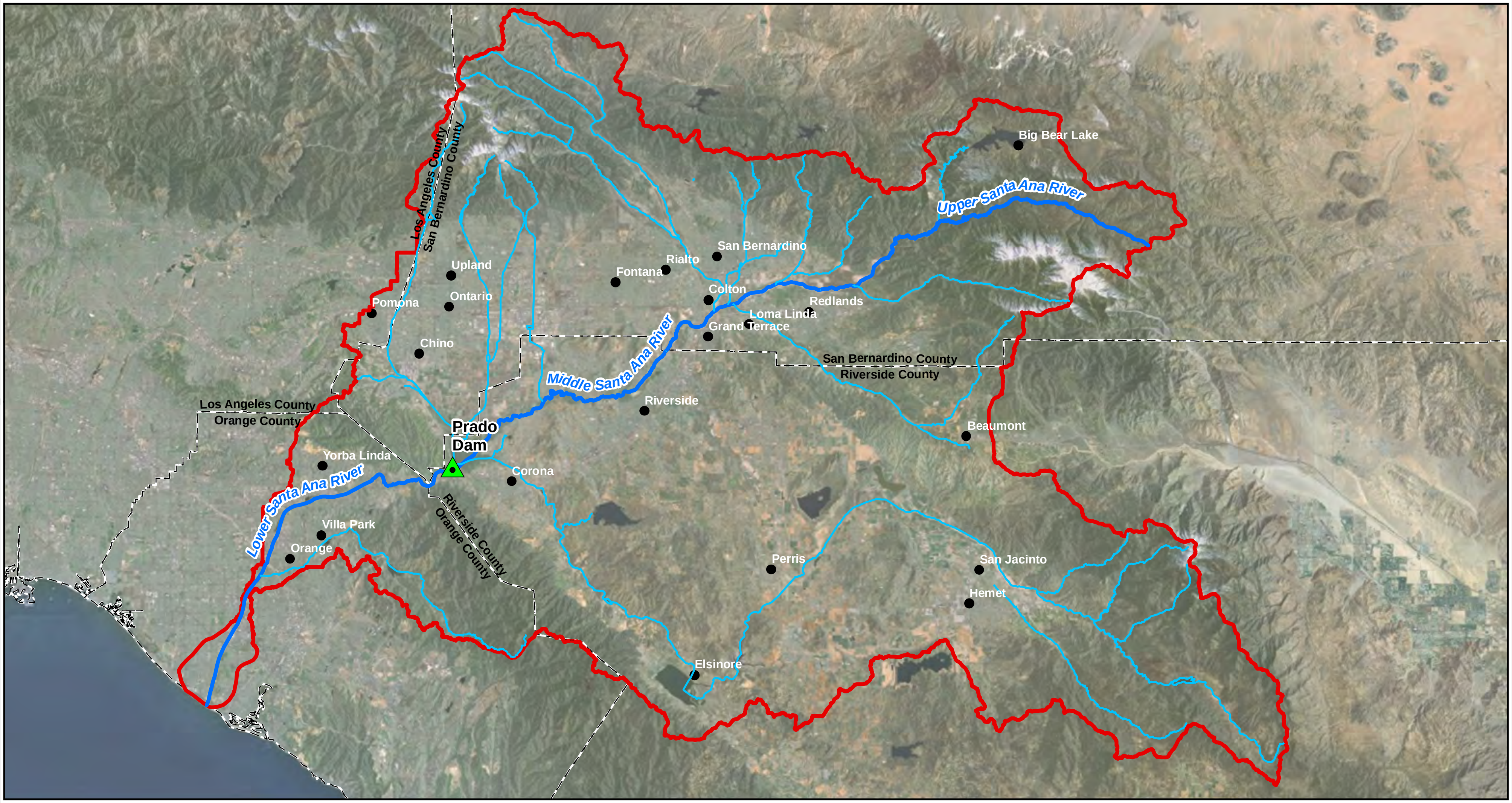
14. **Conclusion**. This MFR presents all the project features in Reach 9 of the Lower Santa Ana River in support of the SARM project to provide flood damage reduction. The features will allow Prado Dam storm water releases of up to 30,000 cfs without damaging infrastructure and will account for river 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.

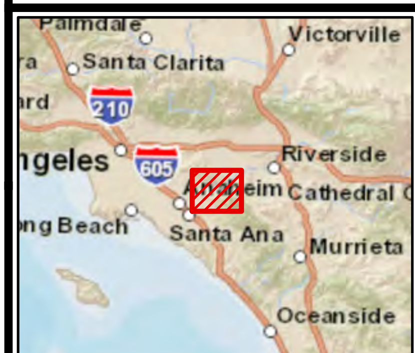
In addition, the information herein will provide the project description in support of the environmental studies and documentation for projects proposed in this reach. The sediment transport study (USACE 2012) will also provide information on how the riverbed will respond to Prado Dam flow releases.

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

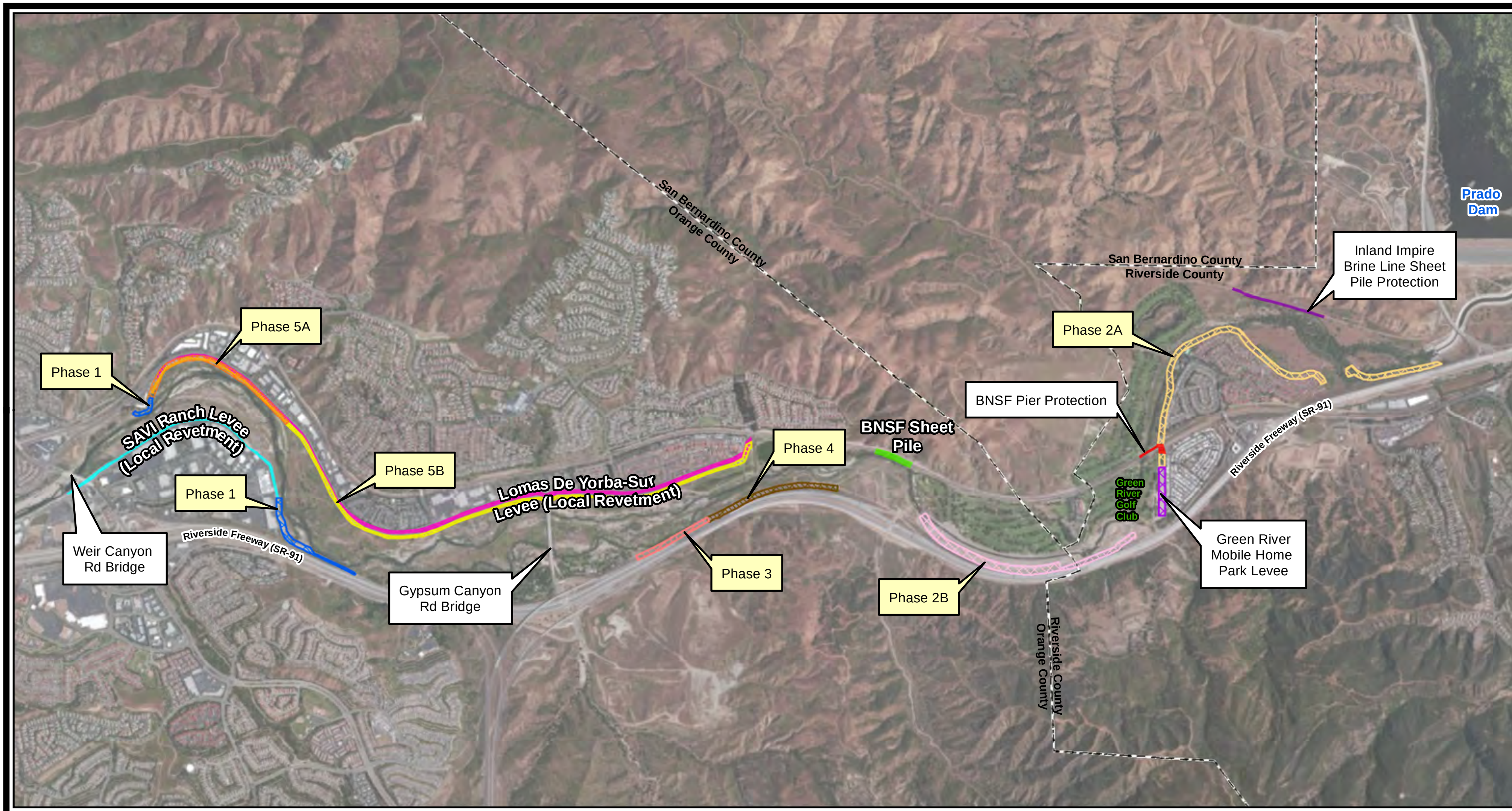
0 10 20 Miles

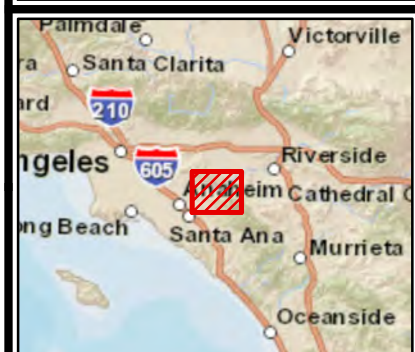
SANTA ANA RIVER MAINSTEM PROJECT

SANTA ANA RIVER WATERSHED OVERVIEW

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Figure 1





Legend

- BNSF Pier Protection
- Riverside County Proposed Sheetpile (SARI)
- Upgrade Existing Local Revetment (5B)
- BNSF Sheet Pile
- Green River Mobile Home Park (Completed)
- Phase 1 (Completed)
- Phase 2A (Construction in Progress)
- Phase 2B (Construction in Progress)
- Phase 3 (Awarded 2013)
- Phase 4 (Proposed)
- Phase 5A (Proposed)
- Phase 5B (Proposed)
- Lomas De Yorba-Sur Levee (Local Revetment)
- SAVI Ranch Levee (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

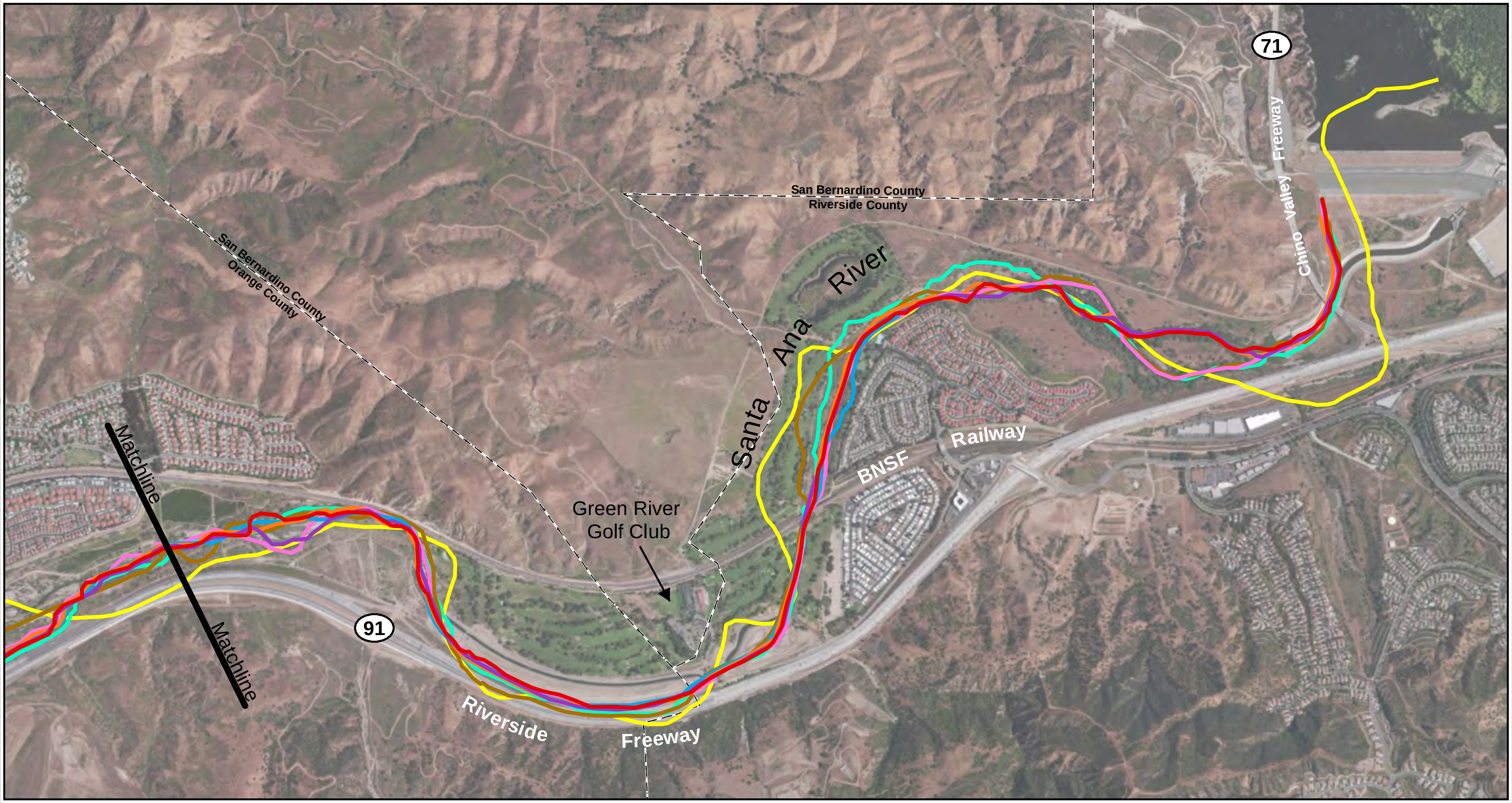
0 0.5 1 Miles

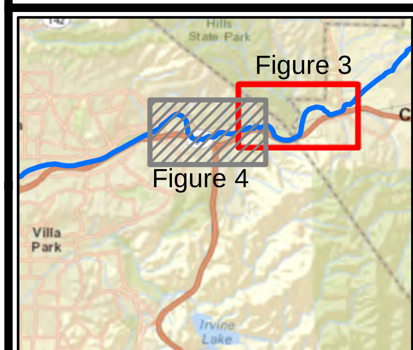
SANTA ANA RIVER MAINSTEM PROJECT

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

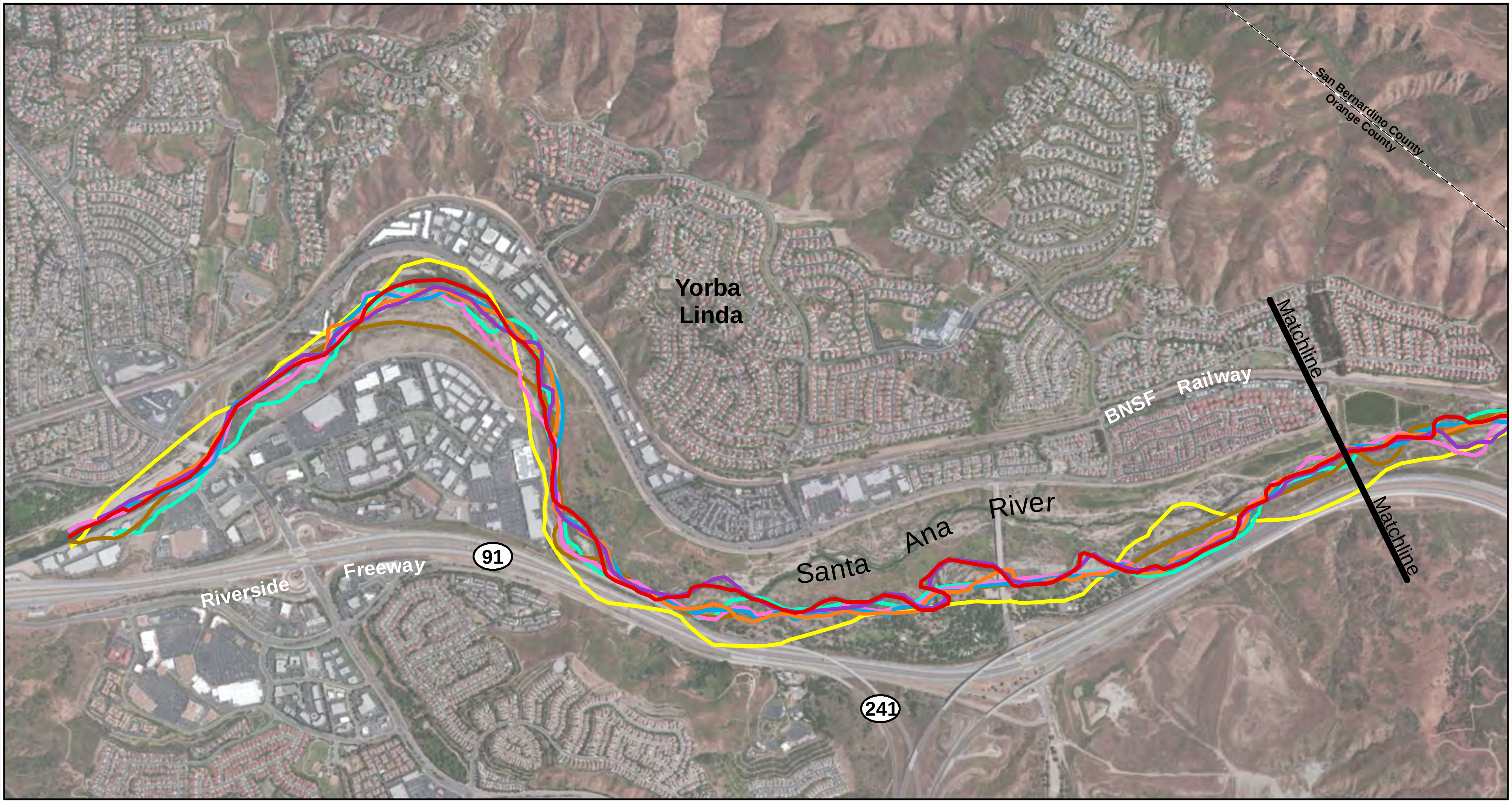
0 0.3 0.6 Miles

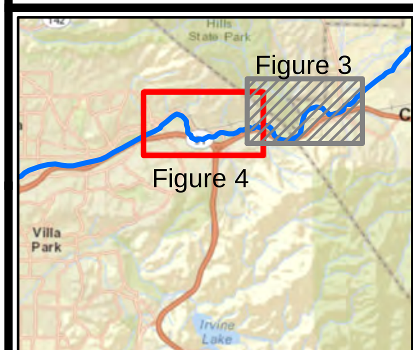
SANTA ANA RIVER
MAINSTEM PROJECT

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
- 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

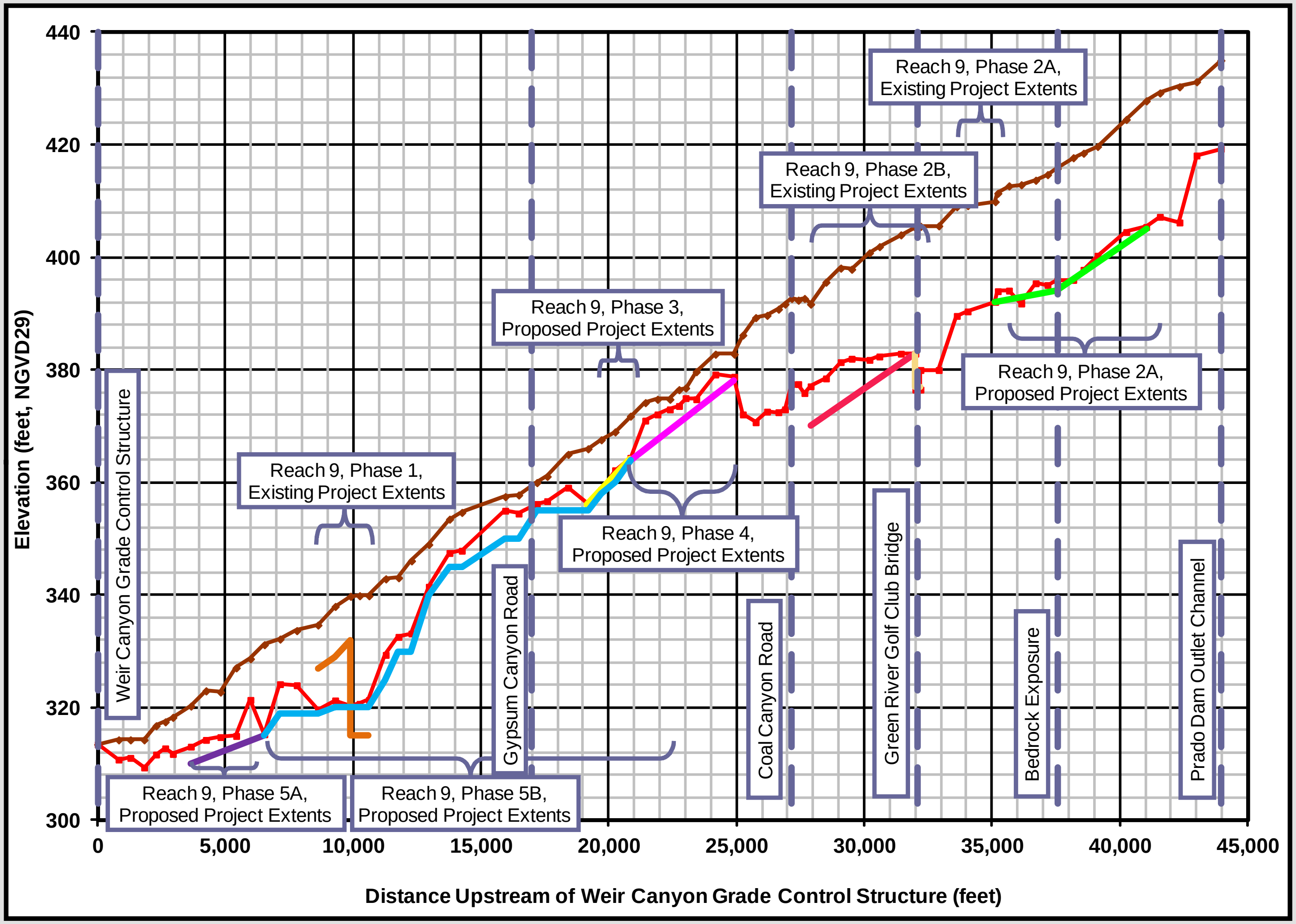
0 0.3 0.6 Miles

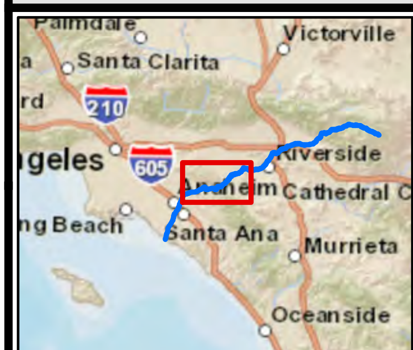
SANTA ANA RIVER
MAINSTEM PROJECT

REACH 9
HISTORIC THALWEG (2/2)
SAR CENTERLINE COMPARISON
(MAP 2 OF 2)

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Figure 4





Legend

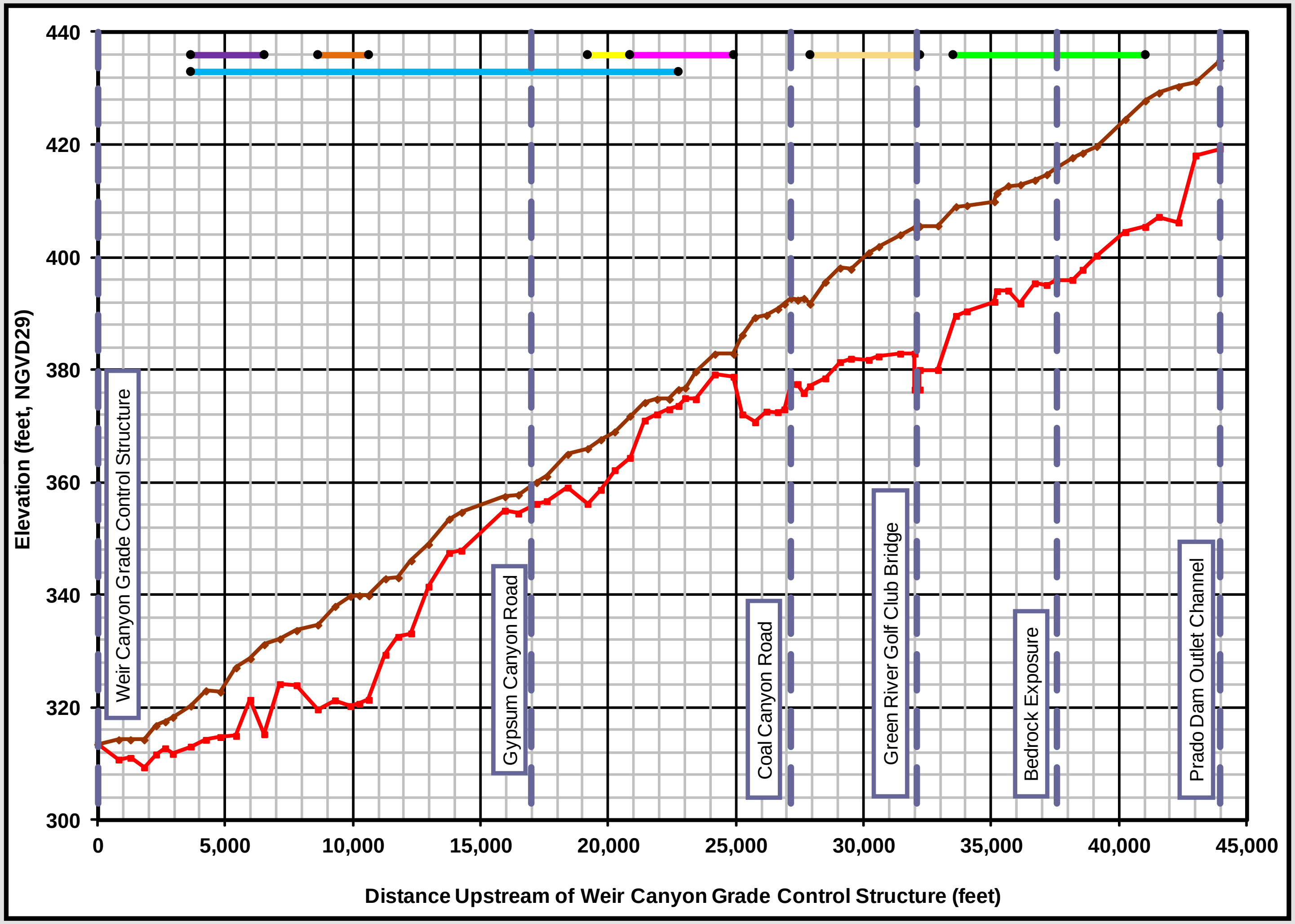
- 2007 Conditions Invert Profile
- Potential Maximum Invert Scour Profile
- Reach 9, Phase 1, Complete
- Reach 9, Phase 2A, Proposed
- Reach 9, Phase 2B, Complete
- Reach 9, Phase 3, Proposed
- Reach 9, Phase 4, Proposed
- Reach 9, Phase 5A, Proposed
- Reach 9, Phase 5B, Proposed

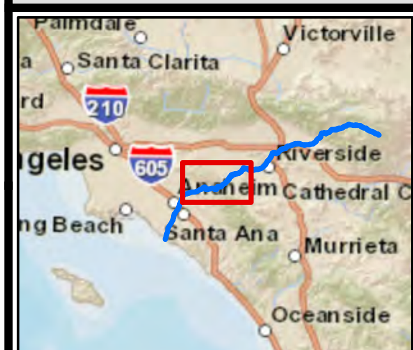
SANTA ANA RIVER
MAINSTEM PROJECT

POTENTIAL MAXIMUM SCOUR PROFILE AND REQUIRED SCOUR DESIGN PROFILES

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Figure 5





Legend

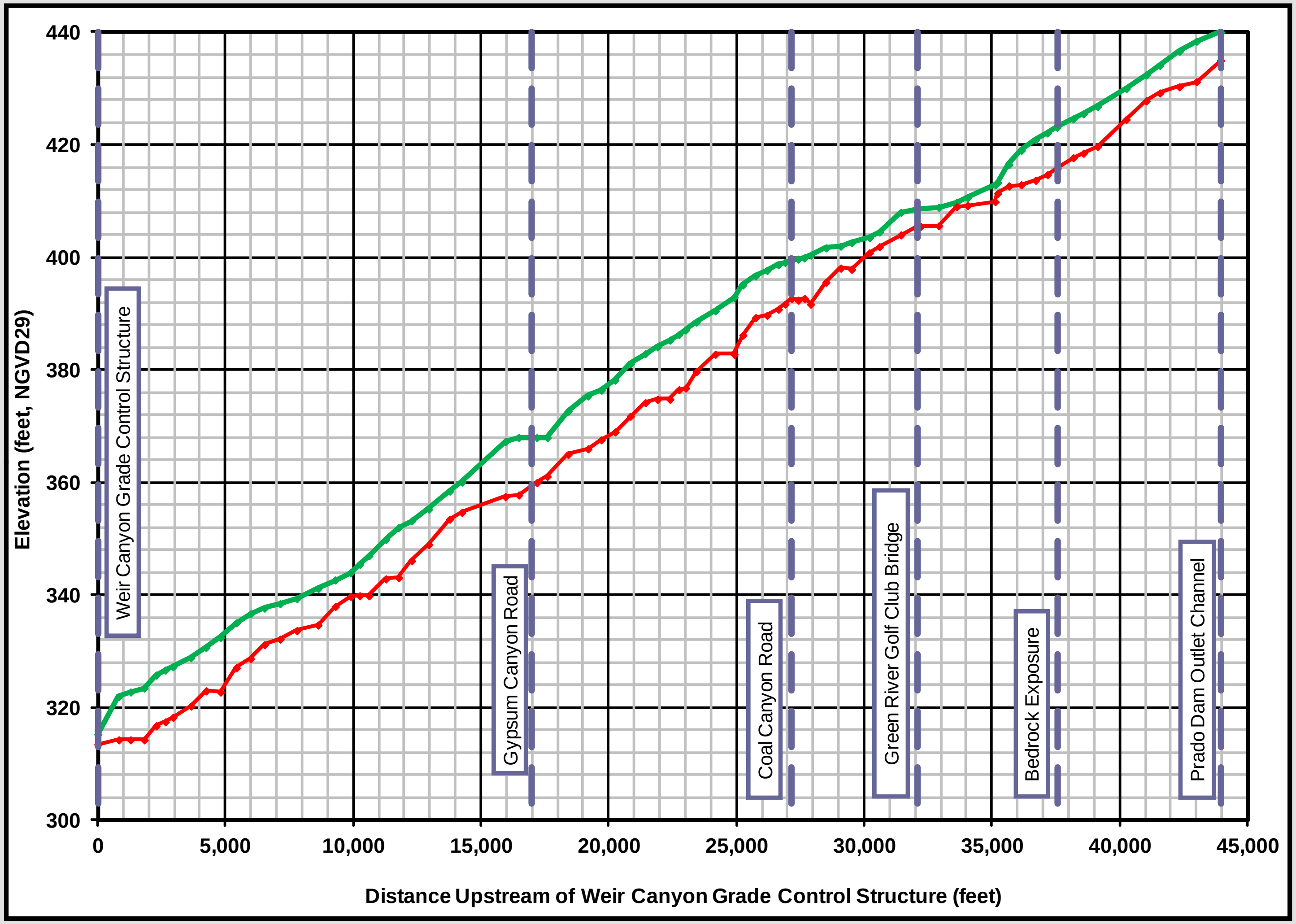
- 2007 Conditions Invert Profile
- Potential Maximum Invert Scour Profile
- Reach 9, Phase 1, Complete
- Reach 9, Phase 2A, Proposed
- Reach 9, Phase 2B, Complete
- Reach 9, Phase 3, Proposed
- Reach 9, Phase 4, Proposed
- Reach 9, Phase 5A, Proposed
- Reach 9, Phase 5B, Proposed

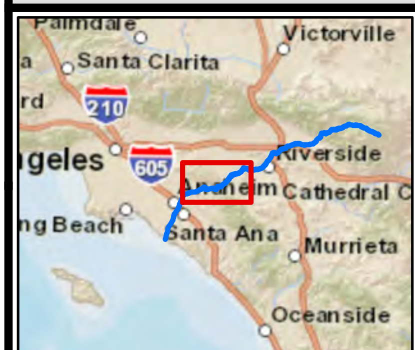
SANTA ANA RIVER
MAINSTEM PROJECT

POTENTIAL MAXIMUM SCOUR
PROFILE AND USACE
IMPROVEMENT PHASES

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Figure 6





Legend

1978 Conditions Invert Profile

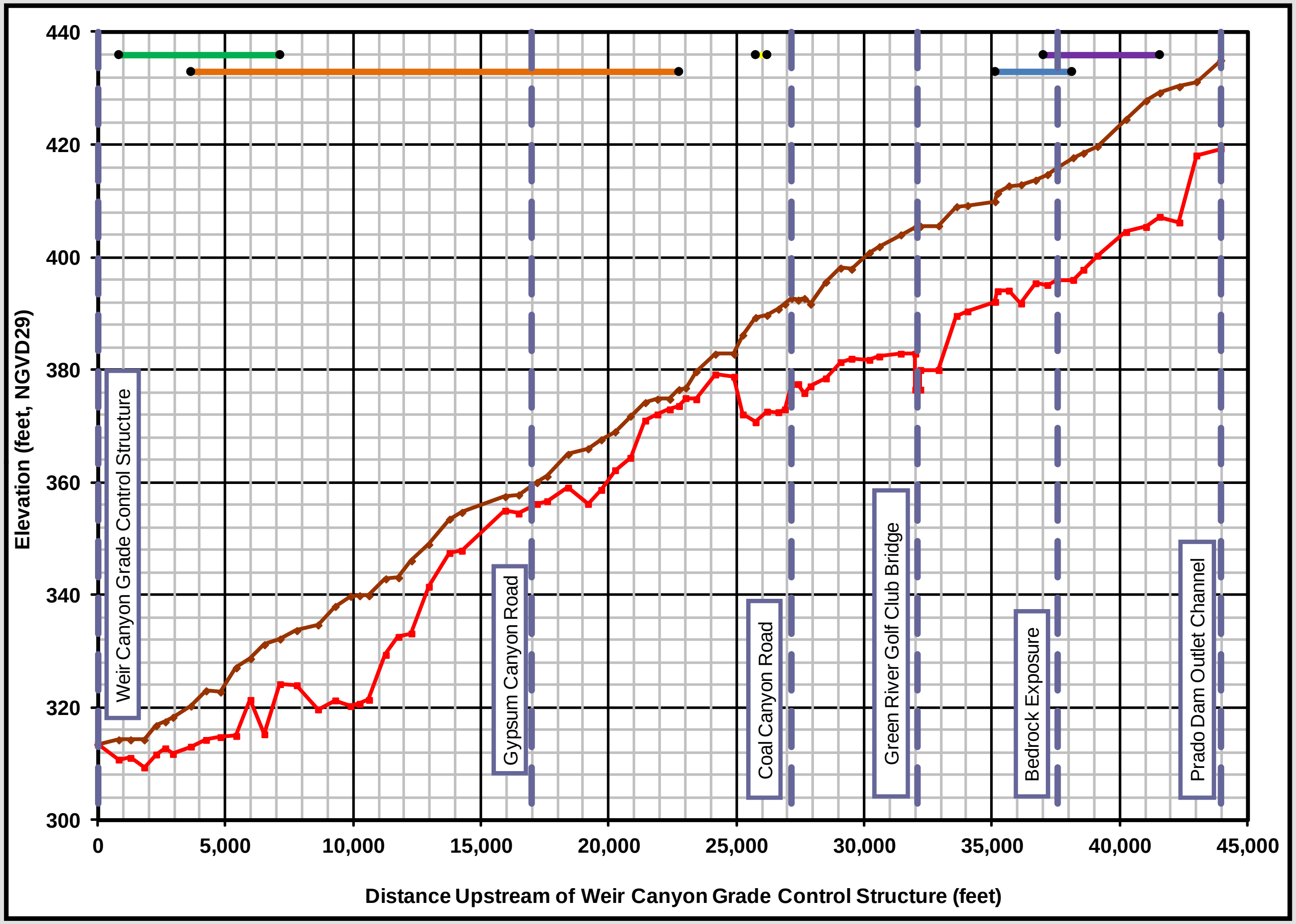
2007 Conditions Invert Profile

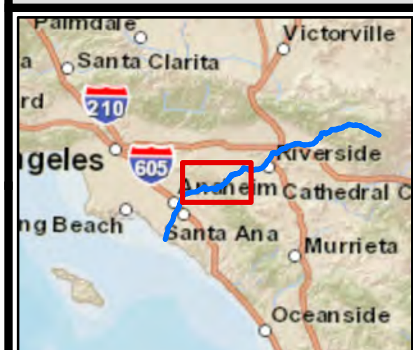
SANTA ANA RIVER
MAINSTEM PROJECT

REACH 9
HISTORIC PROFILES

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Figure 7





Legend

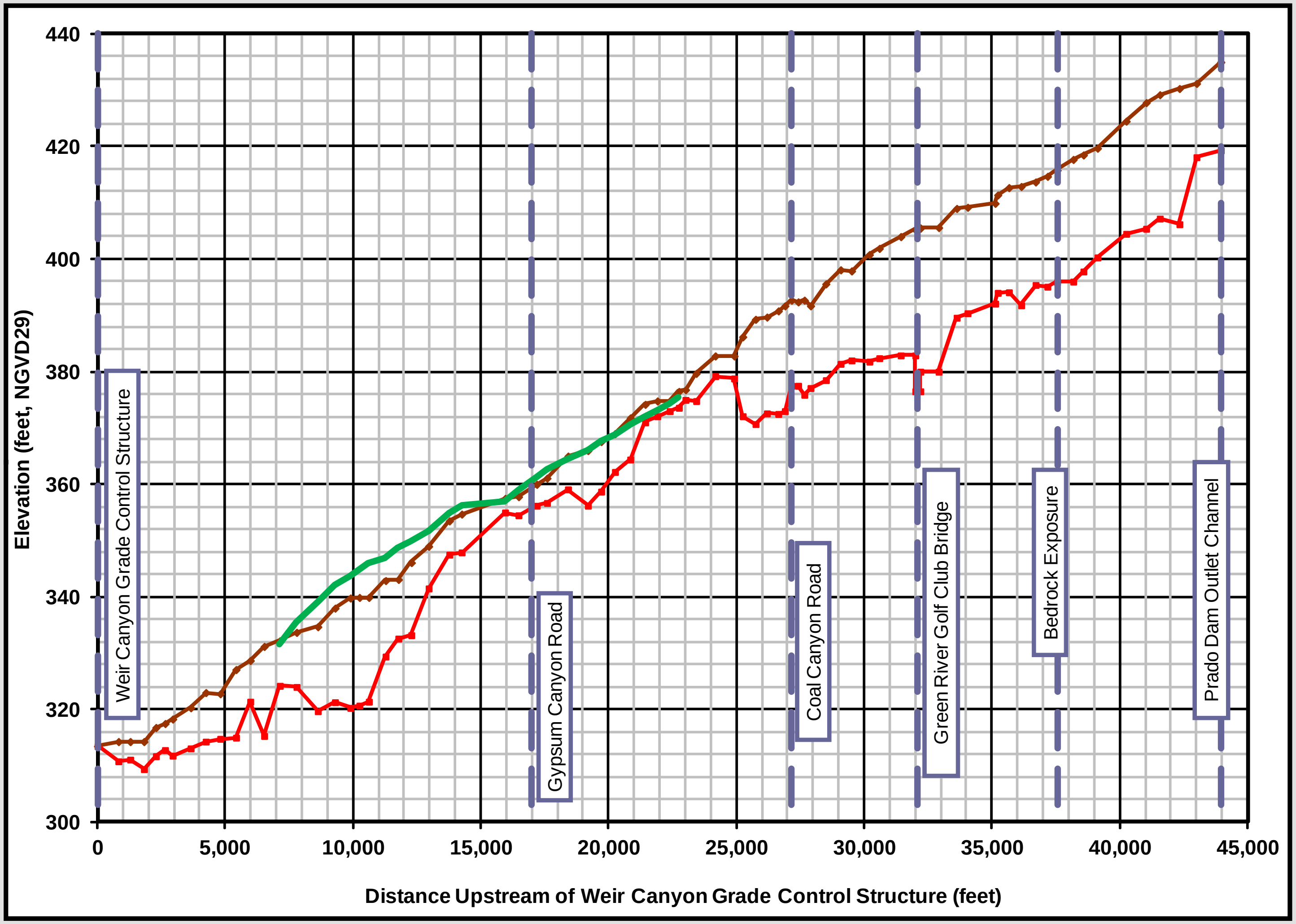
- 2007 Conditions Invert Profile
- Potential Maximum Invert Scour Profile
- Lomas De Yorba-Sur Levee, Existing
- SAVI Ranch Levee, Existing
- BNSF Sheetpiles, Existing
- SARI Sheetpiles, Proposed
- Green River Village Levee, Existing

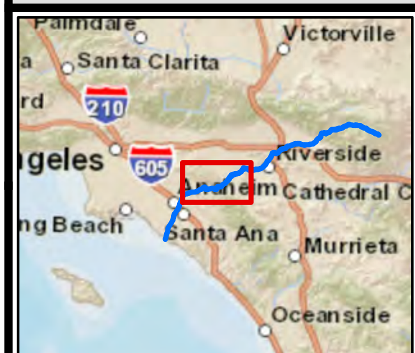
SANTA ANA RIVER MAINSTEM PROJECT

POTENTIAL MAXIMUM SCOUR PROFILE AND LOCAL IMPROVEMENT FEATURES

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Figure 8





Legend

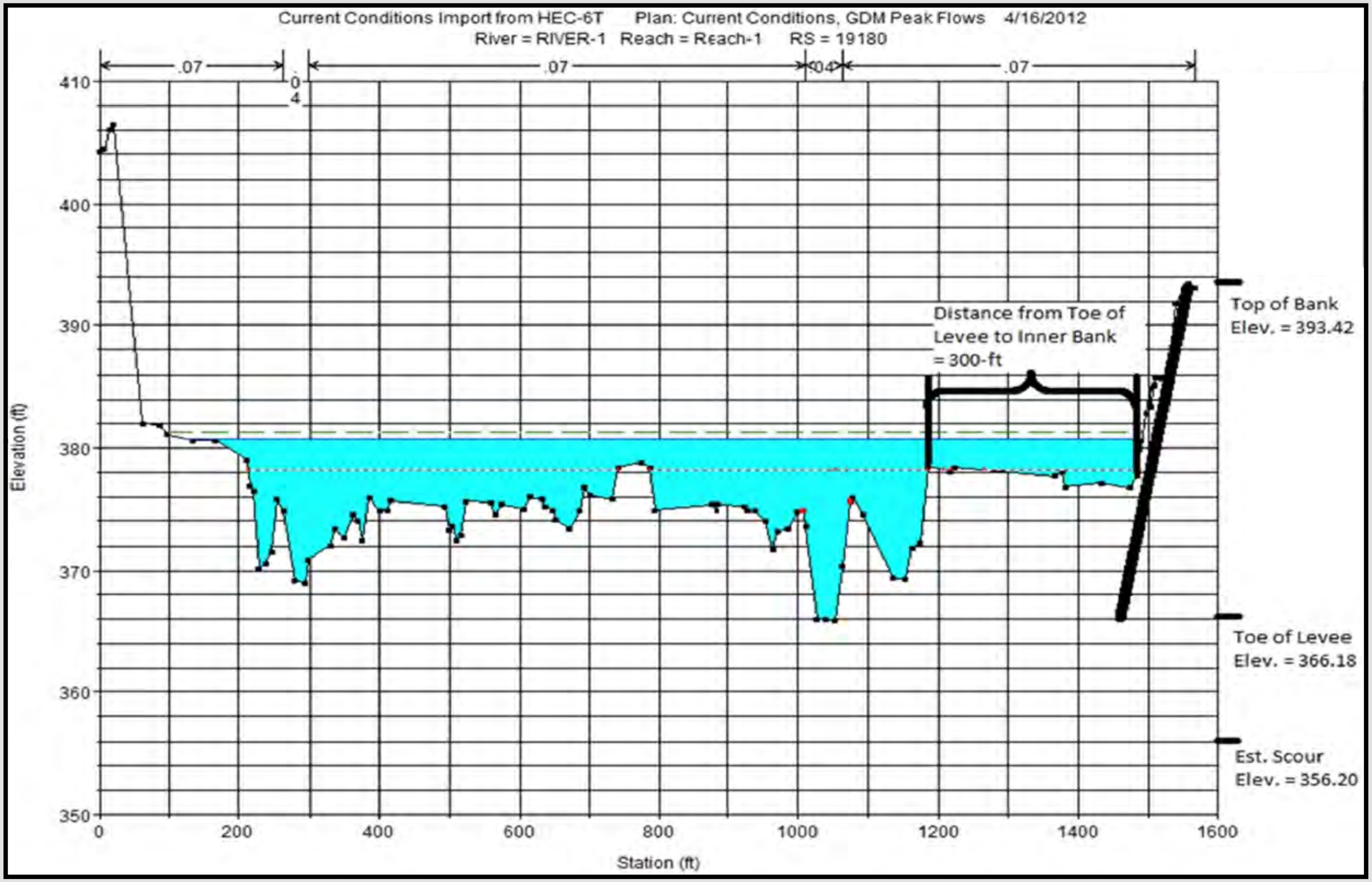
- 2007 Conditions Invert Profile
- Potential Maximum Invert Scour Profile
- Lomas De Yorba-Sur Levee, Existing

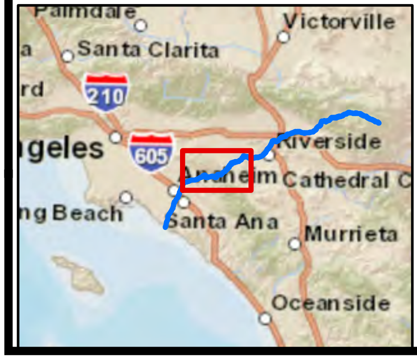
SANTA ANA RIVER
MAINSTEM PROJECT

POTENTIAL MAXIMUM SCOUR PROFILE AND LOMAS DE YORBA-SUR LEVEE PROTECTION

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Figure 9





Legend

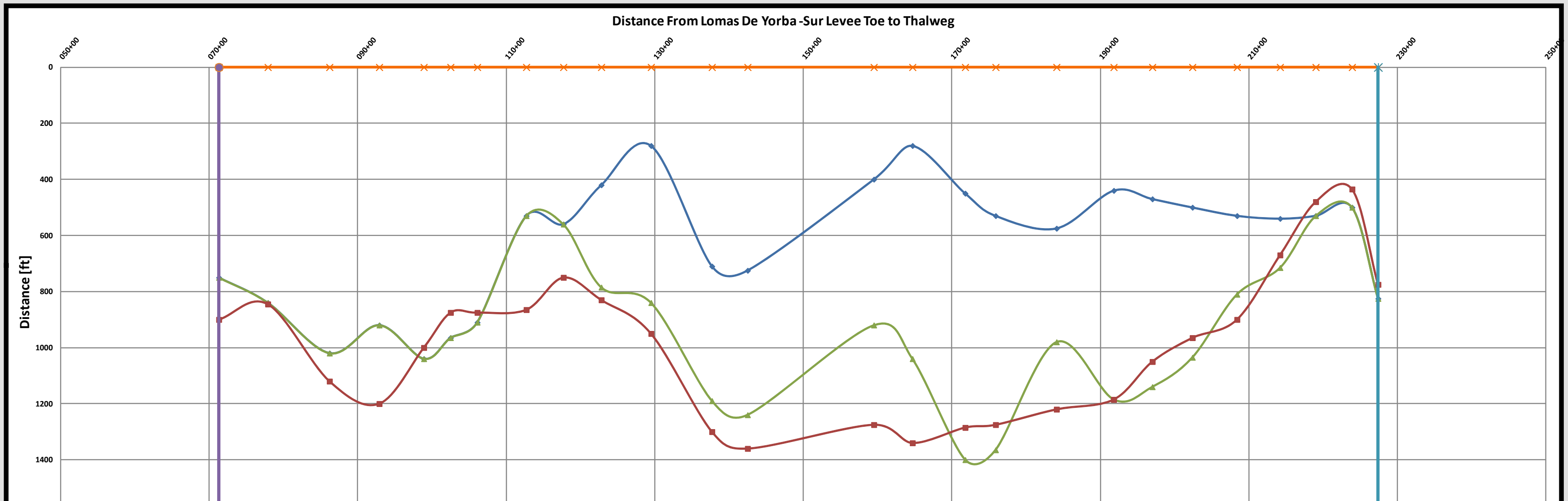
EG 50-190-YR
WS 50-190-YR
Ground
Bank Station

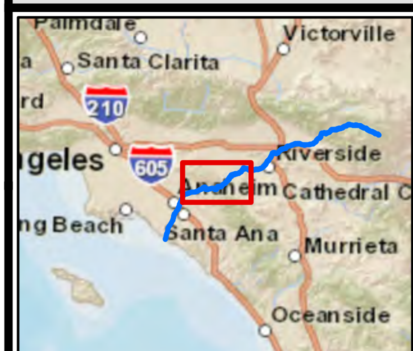
SANTA ANA RIVER
MAINSTEM PROJECT

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 Biological Opinion

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.

<u>Santa Ana River Mainstem Project Consultation History and Current Status</u>

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 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 ~~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 species~~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.

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[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)

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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.

<u>General Habitat Creation/Restoration Measures, Mitigation Option for Permanent Impacts</u>

- 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.

<u>Maintenance and Management of Riparian Habitat Downstream of Prado Dam</u>

- 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).

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[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.

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	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
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

						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	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

						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	**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

						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	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

						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	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.

	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								**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

						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
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

						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	**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

						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	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

						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	**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

						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	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

						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	**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

						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
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

						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	**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

						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
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

						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	**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

						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	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	0.01	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

						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	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.

	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	**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

						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**
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

						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	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.

	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	**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

						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
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

						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	**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

						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**
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

						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	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.

	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	**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

						Emissions Summary (lbs/day)							Emissions Summary (tons)							
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																				
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

						Emissions Summary (lbs/day)							Emissions Summary (tons)							
	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	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.

	Emissions Summary (lbs/day)							Emissions Summary (tons)							
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								**0.51**	**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	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								**0.67**	**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	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**
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	0.00	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	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								**0.53**	**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

		lb/day	tpy
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

		lb/day	tpy
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

		lb/day	tpy
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
Total Concrete Material Required	2,159	48,578

[167 = 20 gal/yd X 8.34 lb/gal]

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.

Appendix D

U.S. Army Corps of Engineers, Regulatory 401(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	Alternative 1 – Grouted Stone Alternative	Alternative 1 – Soil Cement Alternative	Alternative 1 – Pier and Abutment Protection 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 1,100-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 3,790-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			
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 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. <u>Location</u>. 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. <u>General Description of Dredged or Fill Material</u>. Approximately 30,400 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, 3,600 tons, and 69,900 cubic yards, respectively. In addition to alluvial excavation, an estimated 3,600 tons of existing riprap stone would be removed and salvaged for reuse to the greatest extent possible.

c. <u>Description of the Proposed Discharge Site</u>. The grouted stone structure would be constructed at a 2H:1V slope, is approximately 1,100 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 3,040 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.

d. Description of Dredging and Disposal Methods: Heavy duty vehicles and equipment such as excavators, front-end loaders, bulldozers, dump 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 18–24 months to complete. Clearing and grubbing is proposed to begin in August 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 August 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, 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 20 to 26 months to complete. Clearing and grubbing would commence in August 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 October 2017. Funding constraints, weather delays, and other issues could potentially move the construction timeline into 2018.

Phase 5B
Preferred Alternative – Grouted Stone

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 cubic yards 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, 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, 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 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 18 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, and graders.

e. Timing and duration of Discharge: Construction of the Preferred Alternative is expected to take approximately 12 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 2016. Funding constraints, weather delays, and other issues could potentially move the construction timeline into 2017.

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.

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 22 to 24 months 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 into 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. <u>Disposal Site Physical Substrate Determinations</u>:

1. <u>Substrate Elevation and Slope.</u>
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. <u>Sediment type.</u>
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. <u>Dredged/Fill Material Movement.</u>
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. <u>Physical Effects on Benthos (burial, changes in sediment type, composition, etc.).</u>
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. <u>Other Effects.</u>
Impact: __X__ N/A ___ INSIGNIFICANT ____ SIGNIFICNT

6. <u>Actions Taken to Minimize Impacts.</u>
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) 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 ____ SIGNIFICNT

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 ____ SIGNIFICNT

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 ____ SIGNIFICNT

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 ____ SIGNIFICNT

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 ____ 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 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. The Corps will request a 401 Certification from the Regional Water Quality Control Board (a single certification will be requested for Phase 5A, Phase 5B, Phase 4 and BNSF) and will comply with its terms and conditions. The Construction contractor will prepare a SWPPP and provide required notifications/reports to the State Water Resources Control Board.

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) of this act will be completed prior to implementation of this project.

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 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

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) 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. The Corps will request a 401 Certification from the Regional Water Quality Control Board (a single certification will be requested for Phase 5A, Phase 5B, Phase 4 and BNSF) and will comply with its terms and conditions. The Construction contractor will prepare a SWPPP and provide required notifications/reports to the State Water Resources Control Board.

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) of this act will be completed prior to implementation of this project.

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 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

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. The Corps will request a 401 Certification from the Regional Water Quality Control Board (a single certification will be requested for Phase 5A, Phase 5B, Phase 4 and BNSF) and will comply with its terms and conditions. The Construction contractor will prepare a SWPPP and provide required notifications/reports to the State Water Resources Control Board.

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) of this act will be completed prior to implementation of this project.

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 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

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. The Corps will request a 401 Certification from the Regional Water Quality Control Board (a single certification will be requested for Phase 5A, Phase 5B, Phase 4 and BNSF) and will comply with its terms and conditions. The Construction contractor will prepare a SWPPP and provide required notifications/reports to the State Water Resources Control Board.

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) of this act will be completed prior to implementation of this project.

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

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

Paul Frost
CA. Dept. of Conservation, District 1
Division of Oil, Gas and Geothermal
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
OC Parks
13042 Old Myford Rd.
Irvine, CA 92602

Mr. Kirk Holland
Manager, OC 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
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City of Anaheim
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Organizations/Groups

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Santa Ana Watershed Association
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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
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Friends of Harbors, Beaches and Parks
P.O. Box 9256
Newport Beach, CA 92658

Riverside Audubon Society
5370 Riverview Drive
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Audubon Society
San Bernardino Valley Chapter
P.O. Box 10973
San Bernardino, CA 92423-0973

Brad Richards
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Sierra Club San Gorgonio Chapter
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3200 E. Guasti Rd., Suite 200
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Robert S. Coldren
Hart, King and Coldren
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James Cathcart, P.E.
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3230 El Camino Real, Suite 200
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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

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