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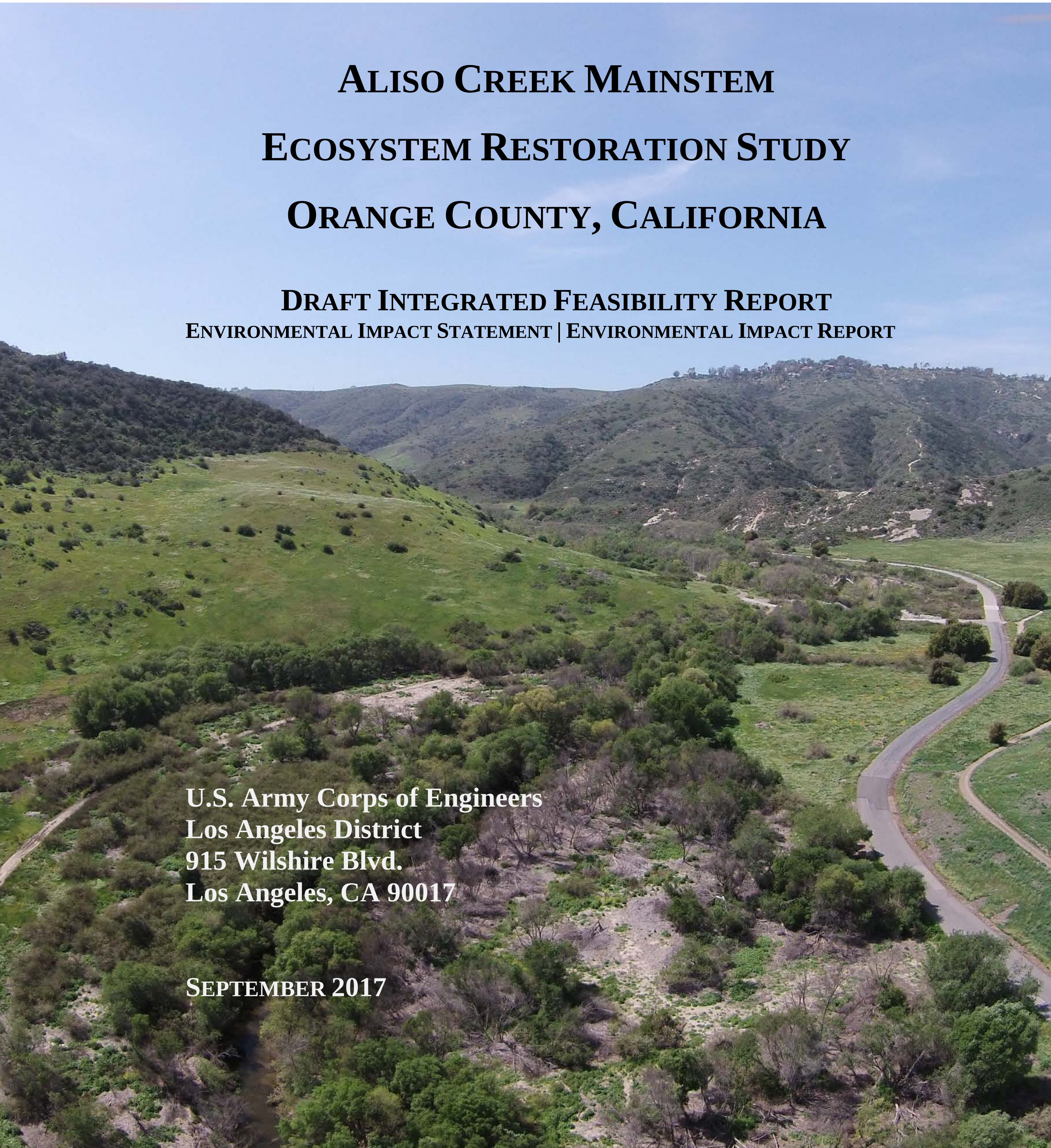

ALISO CREEK MAINSTEM

ECOSYSTEM RESTORATION STUDY

ORANGE COUNTY, CALIFORNIA

DRAFT INTEGRATED FEASIBILITY REPORT

ENVIRONMENTAL IMPACT STATEMENT | ENVIRONMENTAL IMPACT REPORT

U.S. Army Corps of Engineers
Los Angeles District
915 Wilshire Blvd.
Los Angeles, CA 90017

SEPTEMBER 2017

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COVER SHEET*

Aliso Creek Watershed Ecosystem Restoration
Draft Integrated Feasibility Report
(Feasibility Study/Environmental Impact Statement/Environmental Impact Report)
Orange County, California

The Federal lead agency responsible for implementing the National Environmental Policy Act (NEPA) is the U.S. Army Corps of Engineers (Corps). The local lead agency responsible for implementing the California Environmental Quality Act (CEQA) is the County of Orange. This report is an Integrated Feasibility Report (IFR), combining a feasibility report and draft environmental impact statement/environmental impact report (DEIS/EIR) complying with requirements of the Council of Environmental Quality, and is intended to reduce duplication and paperwork. An asterisk in the table of contents notes sections that are required for NEPA compliance.

Abstract
The study area is located within the Aliso and Wood Canyons Wilderness Park, owned and managed by Orange County. Identified Aliso Creek problems include channel instability, degraded water quality, loss of fish and wildlife habitat, and flood damage. This Draft IFR evaluates opportunities for restoring degraded ecosystem function and stream channel stability along the lower five miles of Aliso Creek Mainstem for long term sustainability in Orange County, California.

This Draft IFR identifies the Federal interest in riverine ecosystem restoration within a significant largely undeveloped coastal canyon resource in southern California. Four Action Alternatives were carried forward for analysis. The Tentatively Selected Plan (TSP) is Alternative 3.6, which includes raising the creek bed to approach the pre-incised elevations that would reestablish the historic flood plain. The focus of the project is to restore the creek's dynamic function including restoring connectivity to the floodplain and tributaries, restoring riverine (aquatic and associated terrestrial) habitat, improving water quality, and enhancing passive recreational opportunities. The study also identifies streambank protection ancillary benefits ("incidental benefits") to wastewater and water supply infrastructure that are associated with the Proposed Project.

This Draft IFR is available for public review from September 29, 2017. The official closing date for the receipt of comments is November 13, 2017, 45 days from the date on which the notice of availability of this Draft IFR appears in the Federal Register. During this review period, comments should be sent to:

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EXECUTIVE SUMMARY

ES.1 INTRODUCTION

This document serves as a draft feasibility report, Environmental Impact Statement and Environmental Impact Report – known as a Draft Integrated Feasibility Report (Draft IFR) – for the Aliso Creek Mainstem Ecosystem Restoration Project. The Proposed Project analyzed in this Draft IFR is the implementation of an ecosystem restoration project within lower Aliso Creek in Orange County, California. The U.S. Army Corps of Engineers (Corps) is the lead agency under the National Environmental Policy Act (NEPA), and the non-Federal sponsor, Orange County Public Works (OCPW), Environmental Resources is the lead agency under the California Environmental Quality Act (CEQA).

This Draft IFR identifies the Federal interest in riverine ecosystem restoration and complementary recreation features within a significant largely undeveloped coastal canyon ecosystem resource in southern California. The study also identifies ancillary benefits to wastewater infrastructure located within the Proposed Project area that result from streambank protection features. Such measures are necessary to avoid negative impacts to the restored ecosystem that would result from the release of effluent or sludge, and construction activity required for repairs. Ancillary benefits are also identified for water supply infrastructure, as well as for passive recreation.

This Draft IFR was prepared as an interim and partial response to the resolution of the Committee on Public Works, House of Representatives, adopted May 8, 1964, for the Santa Ana River Basin and Area Streams, Orange County, California; and also to the Water Resources Development Act (WRDA) 2007, Section 4015, authorizing the Secretary of the Army "…to conduct a study to determine the feasibility of carrying out a project for streambank protection and environmental restoration along Aliso Creek, California."

This Draft IFR includes documentation of the planning process conducted for this feasibility study and the detailed evaluation and comparison of a final array of five alternatives, including the No Action alternative. The Draft IFR is prepared to comply with NEPA, CEQA, and applicable Federal, state, and local environmental laws and regulations. An outcome of the planning process is the identification of the National Ecosystem Restoration (NER) plan, and designation of the Tentatively Selected Plan (TSP).

ES.2 PROPOSED PROJECT SETTING AND SIGNIFICANCE

The Aliso Creek watershed is located in southern Orange County, California, approximately 50 miles south of Los Angeles, and encompasses an area of about 35 square miles. Aliso Creek flows nearly 19.5 miles from its headwaters at approximately 2,400 feet above sea level in the rugged Santa Ana Mountains within the Cleveland

National Forest to its outlet at the Pacific Ocean at Aliso Beach in south Laguna Beach, California. For discussion purposes, Aliso Creek is divided into 17 reaches (shown in Figure ES-2 and Figure ES-3).

Within the lower portion of the Aliso Creek watershed is the 4,200-acre Aliso and Wood Canyons Wilderness Park (Wilderness Park), a significant largely undeveloped natural resource in southern California. The Wilderness Park is a coastal canyon ecosystem with significant biodiverse value, supporting limited and scarce landscape habitat types unique to California, including coastal sage scrub, chaparral, native grassland, oak woodland, riparian woodland/forest, and freshwater marsh, and provides several important wildlife corridors that link wildlife habitat within and between protected open spaces in the region. The natural landscape supports many plant and wildlife species, including those listed as Federal and state threatened or endangered such as the least Bell's vireo and the coastal California gnatcatcher. There are relatively few protected coastal canyon ecosystems existing in southern California (Figure ES-1).

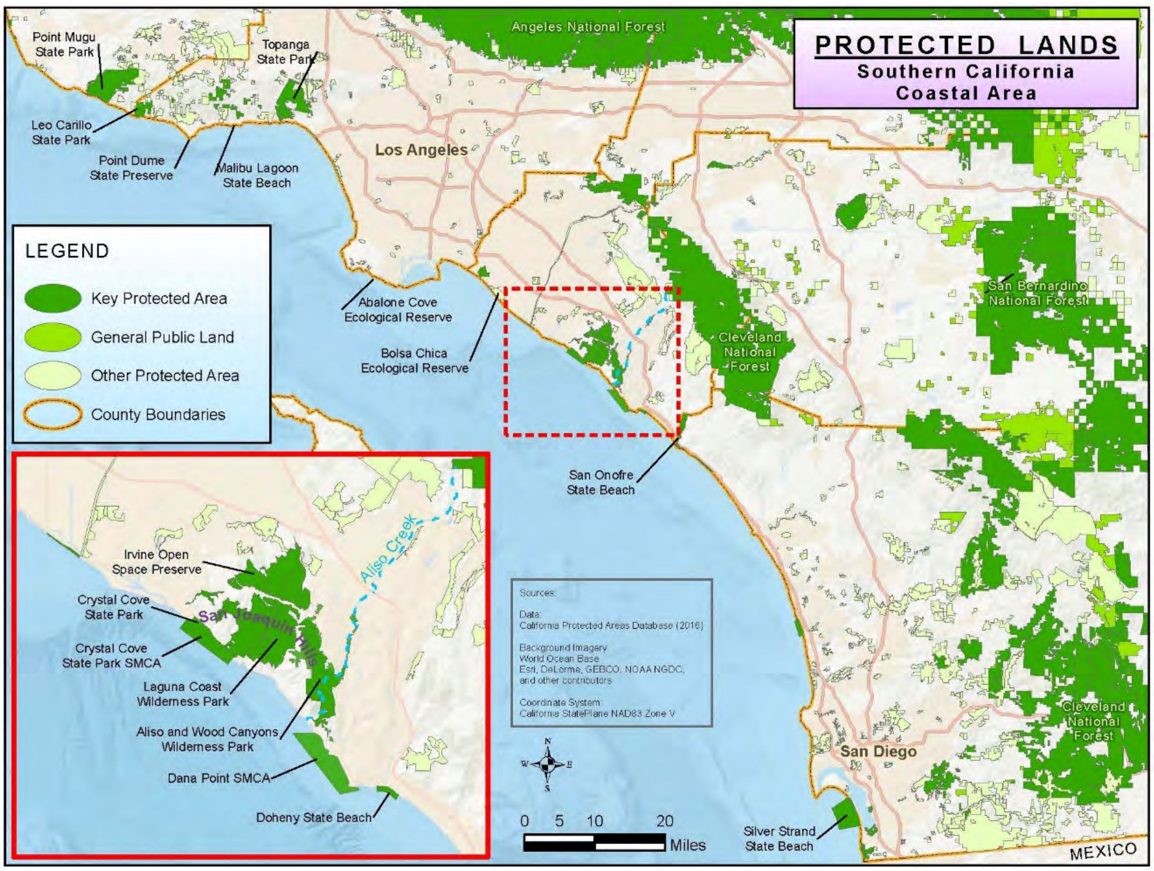

Figure ES-1 Protected Lands of the Southern California Coastal Area

The Wilderness Park is part of the broader 20,000-acre South Coast Wilderness area within the coastal San Joaquin Hills. Lower Aliso Creek watershed links two regionally significant ecosystems: the terrestrial greenbelt formed by the natural habitat of the South Coast Wilderness area, and the bluebelt of the coastal and offshore Laguna Beach State

Marine Reserve/Conservation Area, recently established by the Marine Life Protection Act.

Laguna Beach and the South Coast Wilderness area were designated a national landmark in 2017 by gaining recognition as a Historic American Landscape by the National Park Service. Other national recognition of the region includes designation of the Aliso Creek Regional Riding and Hiking Trail as a National Recreation Trail in 2012.

Natural habitat areas in Orange County are highly fragmented by development. Upstream urbanization within the Aliso Creek watershed has caused downstream degradation of riverine (aquatic and riparian) habitat quality within the Wilderness Park as a result of hydrologic alterations, floodplain function loss, channel modifications, loss in contributing sediment sources, channel instability (streambed incision and streambank erosion), and introduction and spreading of non-native plant species. Severe channel incision and severing of most of the stream's hydrologic connection to the floodplain results in the lowering of groundwater levels in the floodplain, with a consequent decline of riparian and floodplain habitat biodiversity, and shrinking of its areal extent, culminating in habitat type conversion. Within the incised channel, restricted and narrowed riparian and aquatic habitat is subject to confined high flows during large storm events, resulting in the increased likelihood of vegetation community and aquatic wildlife destabilization and loss.

A failed former non-Federal mitigation site within the Wilderness Park, referred to as the Aliso Creek Wildlife Habitat Enhancement Project (ACWHEP), has aggravated the stability of the Aliso Creek mainstem. Severe streambank and streambed erosion has occurred downstream of the structure, which now acts as a large drop structure. Incision downstream of the structure is about 25 feet.

An assessment from three decades ago indicated that California had lost 90 to 95 percent of its native riparian community (Faber et al. 1989). In neighboring San Diego County, a loss of 40 percent of riparian wetlands was recorded within a decade since the late 1980s (CDPR 1988).

Riparian ecosystems are dependent on perennial, ephemeral, or intermittent surface or near-surface water. Many species of wildlife rely on riverine ecosystems during some, or all, of their life cycles. Riverine corridors function as linkages for wildlife movement between habitat areas. Vegetation and habitat type connectivity maintain populations of migratory animals, provide corridors for gene flow, allow wildlife and plant dispersal to new areas, and provide movement corridors at both the local and regional level. Dispersal into connecting habitats increases the diversity of plants and animals that can be supported.

For the Aliso Creek watershed, habitat, species numbers, and diversity have declined due to the loss of connectivity between habitats. Aquatic linkages especially have been impaired by manmade channel modifications and the introduction of flow control structures and road crossings, creating barriers to aquatic wildlife and inhibiting dispersal. Species diversity is highly dependent on habitat diversity. Linkages are critical for supporting multiple populations of species to assure continual exchange of genes within populations, which in turn help sustain genetic diversity. Within the Wilderness Park, linkages for aquatic species along a five-mile stretch of Aliso Creek, including its connection to its major tributary (Wood Canyon Creek), are severely fragmented by manmade changes.

Despite the watershed fragmentation, terrestrial wildlife corridors are still intact between the Wilderness Park and the other portions of the South Coast Wilderness Area to the west. Additionally, for some mammal species (including coyote, bobcat, and occasional mountain lion), the 19.5 miles of Aliso Creek still serves as a northerly wildlife corridor to the Cleveland National Forest, despite some short stretches where some channelized sections and narrow channel easements exist.

Species that depend on multiple habitat types for different activities or different life stages have also declined. Migratory birds that may rely on riparian habitat, face population declines due to losses of this type of habitat. Biological diversity in Aliso Creek has also been impacted by the introduction of non-native species. Invasive exotic plants, such as giant reed, castor bean, and tamarisk, alter the hydrology, community structure and function, nutrient cycling, and soil chemistry of riparian ecosystems, and they compete with, hybridize, or exclude native species and have reduced the quality of riverine habitat. Exotic predators, such as bullfrogs, have decimated populations of native fish and aquatic wildlife. Southwestern pond turtle, a California Species of Special Concern, and currently under review for Federal listing, are known to inhabit only a few locations in Orange County, including Aliso and Oso Creeks.

Regional wastewater infrastructure, serving a population of more than 40,000, is susceptible to erosion-driven damage from Aliso Creek. Channel degradation from larger flow events has caused infrastructure damage in recent years exceeding $5 million in the lower watershed. Threatened wastewater pipeline infrastructure vulnerable to bank erosion poses a significant threat to human health and a measurable impact to the environment, valued beach recreation, and the local economy from potential major sewer line failure. Due to the instabilities in the creek, the South Orange County Wastewater Authority (SOCWA), a public utility, which operates the Coastal Treatment Plant (CTP) located within an isolated parcel at the lower end of the Wilderness Park, must routinely perform temporary emergency protective actions to their facilities.

Additional water supply infrastructure is susceptible to damage from Aliso Creek just downstream of Pacific Park Drive. The Joint Regional Water Supply System (JRWSS) is a water supply transmission line, owned by the public utility South Coast Water District, which provides a primary source of drinking water for more than 200,000 residents in southern Orange County communities. Two locations of the Joint Transmission Main, one in parallel, and one crossing under the creek, are threatened.

ES.3 PROPOSED PROJECT AREA

The Proposed Project area encompasses about a five-mile stretch of the Aliso Creek mainstem riverine system from the Pacific Park Drive area downstream to the SOCWA CTP Bridge, located about 1.2 miles upstream of the ocean outlet. The Proposed Project area includes approximately 700 feet of Wood Canyon Creek, and also 600 feet of Sulphur Creek to Alicia Parkway, from their respective confluence with Aliso Creek. The majority of the Proposed Project area lies within the Aliso and Wood Canyons Wilderness Park, which is owned, operated, and managed by the County of Orange.

ES.4 PURPOSE AND NEED

The purpose of the Proposed Project is to increase habitat function and value associated with aquatic and riparian ecosystem resources along approximately five miles of lower Aliso Creek. Intensive urbanization within the Aliso Creek watershed during the past 50 years has resulted in significant degradation to aquatic and riparian habitat quality and function, riverine and floodplain connectivity, and stream channel stability. Ecosystem restoration would also be supported by protecting critical wastewater infrastructure from creek erosion and instability. Ecosystem restoration project alternatives would not be sustainable without a solution to the infrastructure threat within the Proposed Project area. Failure of wastewater infrastructure would cause undesired impacts to any restoration effort. Long-term increases in habitat function and value would also provide incidental passive recreational enhancement. A secondary objective of the Proposed Project is to provide recreational opportunities compatible with the purpose of ecosystem restoration.

The need exists to diminish the adverse effects of manmade alterations affecting the lower Aliso Creek riverine system to support a healthy aquatic and riparian community, and to improve connectivity for wildlife species between the Aliso and Wood Canyons Wilderness Park and the broader South Coast Wilderness area, as well as with the Cleveland National Forest. The need also exists to protect critical wastewater infrastructure from streambank erosion and stream instability that poses a significant threat should pipeline rupture occur, with impacts to the environment and to the local economy which relies heavily on the recreational use and high esthetic value of the coastal zone.

ES.5 PLANNING OBJECTIVES

The investigation of the problems and opportunities in the study area led to the establishment of the following planning objectives:

- Improve the degraded aquatic and riparian habitat ecosystem function and structure, including the mosaic and heterogeneity of vegetation types, to increase plant and animal biodiversity for the Aliso Creek mainstem and tributary confluences within the Aliso and Wood Canyons Wilderness Park throughout the period of analysis. In

particular, promote instream connectivity (longitudinal, lateral, and vertical) to facilitate the reproductive viability of aquatic species.
- Improve the hydrologic and hydraulic regime to increase floodplain function and channel stability for the Aliso Creek system within the Aliso and Woods Canyon Wilderness Park throughout the period of analysis.
- Enhance the passive recreational experience that is compatible with the Proposed Project within the Aliso and Wood Canyons Wilderness Park throughout the period of analysis.

ES.6 KEY PLANNING CONSTRAINTS AND CONSIDERATIONS

Planning constraints restrict plan formulation and are specific elements that alternative plans should avoid.

- Avoid adverse impacts to designated critical habitat for the threatened tidewater goby.
- Avoid destabilization of existing historical landslide masses or other potential unstable slopes in the proposed project area.

Planning considerations are the overarching guidelines used to inform the development of, assess, and screen alternatives. There are several considerations specific to the study area.

- Avoid or minimize increases in flood and erosion damages to facilities and infrastructure as a result of a Federal project. This includes the ocean outfall section within the golf course property.
- Avoid or minimize impacts where possible to archeological resources in the project area.
- Avoid increase in manmade structures with visible construction elements (such as concrete) that would not be esthetically consistent with the natural setting of the Wilderness Park.
- Based on public input, assess options to improve the current operating use of the access roads within the Wilderness Park.

ES.7 PLAN FORMULATION

ES.7.1 Management Measures

A full array of structural and non-structural measures was formulated during the planning process and combined into various alternatives to address the planning objectives. Management measures address riparian and aquatic habitat structure and function, floodplain function, channel stability, and passive recreation.

ES.7.2 Focused Array of Alternatives

The process in developing the focused array of alternatives included the establishment of the No Action Plan (Alternative 1) and of three base alternatives (Alternatives 2, 3, and

4). The base alternatives address the reestablishment of floodplain function, as this is a foundational need associated with habitat restoration efforts within incised channel systems. The basis for Base Alternative 2 is to maintain a similar streambed elevation to existing conditions within the incised channel margins. The basis for Base Alternative 3 is to raise the streambed elevation to improve connection with the historic floodplain; and that for Base Alternative 4 is to raise the streambed elevation to establish an intermediate floodplain connection. Each base alternative possesses the minimum number of measures to achieve the basis (i.e. respective streambed elevation; geomorphically stable channel; vegetation; and streambank protection in key areas to preclude infrastructure threat) for that alternative and to create a sustainable aquatic and riparian habitat structure and function.

The formulation of the focused array consisted of assessing additional measures, which could be combined with each base alternative to create variations of the alternatives. The Institute for Water Resources Planning Suite software was utilized to perform cost effectiveness and incremental cost analysis (CE/ICA) on the various combinations of base plans and additional measures. Results of the CE/ICA yielded 27 cost-effective alternatives, of which five were identified as Best Buy Plans (including the No Action Plan). Cost-effective alternatives included Base Alternatives 2 and 3, and associated variations. Base Alternative 4 and its variations were not identified as cost-effective. Based on further screening conducted on the cost-effective plans, and the inclusion of an additional plan provided by the U.S. Fish and Wildlife Service (USFWS) in its Planning Aid Letter, dated August 28, 2015, a total of 12 alternatives were identified to comprise the focused array. The USFWS plan (Alternative C) is formulated based upon a similar restoration strategy as Base Alternative 2, but limits changes to the channel dimensions and streambed gradients to reduce impacts to existing riparian vegetation, and incorporates sediment augmentation efforts.

Criteria used in the evaluation of the focused array of alternatives included: aquatic species connectivity and viability; floodplain connectivity; quality and expanse of riparian habitat, including successional stage diversity; protection of critical infrastructure, and the relative need for onsite disposal areas. Metrics established to compare the focused array include how the alternatives compare in meeting the planning objectives, risk and uncertainty associated with bank erosion and threat to infrastructure, project sustainability (key factors for operability), flooding impacts to the east and west access roads, and potential impacts related to geotechnical issues (landslides) and cultural resources. Comparison of the focused array is presented in Table ES-1 and Table ES-2.

Table ES-1 Focused Array Comparison: Ecosystem Restoration Metrics

			Objective 1 Restoration of Riverine Habitat Structure and Function							Objective 2 Floodplain Connect; Channel Stability		
Alt	**Description** *(*Best Buy Plan)*	**Project Footprint**	**ACWHEP Removed**	**Aliso Aquatic Wildlife Connect (mi)**	**Wood Canyon Connect Aquatic Wildlife (mi)**	**Aquatic Wildlife Genetic Diversity Benefit**	**Riparian Veg Benefit: Channel**	**Riparian Veg Benefit: Overbank**	**Groundwater Rise**	**Floodplain Function Increase** (net over No Action)	**Sinuosity Gain** (net over No Action)	**Channel Stability** (and no. of Riffles)
1	**No Action**	-	No	2.2	0	At risk; barrier at ACWHEP	Unstable. Limited to early succes'l; frequent loss	Narrow; less dense; mostly late succes'l	No	-	-	-
2	**Maintain Similar Streambed Elevation**											
2.1	Base 2	SOCWA to ACWHEP (Rch. 4A-6)	No	2.2	0	At risk; barrier at ACWHEP	Limited to early succes'l; frequent loss	Narrow; less dense; mostly late succes'l	No	Slight	None	Yes; regime
2.2	2.1 + Sinuosity (Wood Canyon [WC])										Slight	
2.3	2.2 + Newbury Weirs										Slight	Yes; regime; (11)
3	**Restore Historic Streambed Elevation**											
3.1	Base 3	SOCWA to AWMA Br (Rch. 4A-9)	Yes	3.6	0	At risk; barrier at first 10-ft drop structure	Early and mid-succes'l	Wider, denser, mid-to late succes'l	Yes	Moderate	None	Yes; regime (34)
3.2	Base 3 + WC connect + WC Trailhead				3.5							
3.3*	3.2 +Widen/Recontour Channel +PPDBC	SOCWA to Pacific Park Dr. (Rch. 4A-12)	Yes	5 (Plus 3.5 mi Steward-ship)	3.5	Promotes genetic diversity; Barriers removed	Early and mid-succes'l	Wider, denser, mid-to late succes'l	Yes	Substantial	None	Yes; regime (47)
3.4	3.3 + Sinuosity (PPD)										Slight	
3.5	3.3 + Sinuosity (PPD+WC)											

Table ES-1 Focused Array Comparison: Ecosystem Restoration Metrics

			Objective 1 Restoration of Riverine Habitat Structure and Function							Objective 2 Floodplain Connect; Channel Stability		
Alt	**Description** *(*Best Buy Plan)*	**Project Footprint**	**ACWHEP Removed**	**Aliso Aquatic Wildlife Connect (mi)**	**Wood Canyon Connect Aquatic Wildlife (mi)**	**Aquatic Wildlife Genetic Diversity Benefit**	**Riparian Veg Benefit: Channel**	**Riparian Veg Benefit: Overbank**	**Groundwater Rise**	**Floodplain Function Increase** (net over No Action)	**Sinuosity Gain** (net over No Action)	**Channel Stability** (and no. of Riffles)
3.6*	3.3 + Oxbow			reaches to I-5)							High	Yes; regime (46)
3.7*	3.3 + Oxbow + Sinuosity (PPD)											
3.8*	3.3 + Oxbow + Sinuosity (PPD, WC)											
	USFWS Alternative											
C	Similar to Alt 2; limited grading	SOCWA to ACWHEP (Rch. 4A-6)	No	2.2	No	At risk; Barrier at ACWHEP	Limited to early succes'l; frequent loss	Narrow; less dense; mostly late succes'l	No	Slight	Slight; entrenched	No short term stability

Table ES-2 Focused Array Comparison: Erosion Damage Reduction and Other Metrics

			Reduce Erosion Risk Damage		Other Metrics			
Alt	**Description** ***(*Best Buy Plan)***	**Project Footprint**	**Infrastructure Protection**	**Risk and Uncertainty** ***(Bank Erosion)***	**Project Sustainability**	**West & East Access Roads Flooding Impacts**	**Geotechnical** ***(Potential Risk)***	**Cultural Resources** ***(Potential Risk)***
1	**No Action**	NA	Piecemeal; emergency actions by SOCWA	High	NA	0.3 mi west side; 0.6 mi east side for 1% ACE (100-yr) storm event	Some risk; though generally low	Some potential losses
2	**Maintain Similar Streambed Elevation**							
2.1	Base 2	SOCWA to ACWHEP	Yes for AWMA Road and wastewater utilities	Low	Requires ensuring ACWHEP structure integrity	Similar to No Action	Some risk; though generally low with some potential moderate.	Relatively less potential impacts as smaller footprint than Alternative 3 variations
2.2	2.1 + Sinuosity (WC)							
2.3	2.2 + Newbury Weirs							
3	**Restore Historic Streambed Elevation**							
3.1	Base 3	SOCWA to AWMA Br	Yes for AWMA Road and wastewater utilities	Low		Some increase (15%) over No Action, mostly due to 1% ACE	Some risk; though generally low with some potential moderate. Raising streambed may assist buttressing effect.	Potential impacts
3.2	Base 3 + WC connect + WC Trailhead							
3.3*	3.2 +Widen/Recontour Chl +PPD Bypass	SOCWA to Pac Park Dr	Yes for AWMA Road and wastewater utilities; and water supply crossing (JRWSS)	Low	Requires PPD Bypass for connection to upstream Stewardship reaches (see section ES.8).			
3.4	3.3 + Sinuosity (PPD)							
3.5	3.3 + Sinuosity (PPD+WC)							
3.6*	3.3 + Oxbow						Some risk; though generally low with some	
3.7*	3.3 + Oxbow + Sinuosity (PPD)							

Table ES-2 Focused Array Comparison: Erosion Damage Reduction and Other Metrics

			Reduce Erosion Risk Damage		Other Metrics			
Alt	**Description** ***(*Best Buy Plan)***	**Project Footprint**	**Infrastructure Protection**	**Risk and Uncertainty** ***(Bank Erosion)***	**Project Sustainability**	**West & East Access Roads Flooding Impacts**	**Geotechnical** ***(Potential Risk)***	**Cultural Resources** ***(Potential Risk)***
3.8*	3.3 + Oxbow + Sinuosity (PPD, WC)						potential moderate to high. Raising streambed may assist buttressing effect.	
	USFWS Alternative							
C	Similar to Alt 2; limited grading	SOCWA to Pac Park Dr	Yes; for AWMA Road and wastewater utilities, but requires more protection than Alt 2 due to inherent uncertainty	Moderate	Requires ensuring ACWHEP structure integrity. Utilizes long term gravel augmentation. Higher costs for streambank protection and gravel augmentation renders this alternative less efficient than Alternative 2 variants, and possibly not cost effective.	Generally similar to No Action, but more uncertainty	Some risk; though generally low with some potential moderate.	Likely more potential impacts than Alternative 2 variations

ES.7.3 Final Array of Alternatives

Further screening of the focused array was conducted using the criteria of effectiveness, completeness, efficiency, and acceptability. The final array of action alternatives that best satisfy the criteria were Alternatives 3.3, 3.6, 3.7, and 3.8. These four alternatives best meet the key planning objectives and the significance of plan outputs associated with restoration of aquatic and riparian habitat structure and function, aquatic species connectivity and viability, floodplain connectivity, and the improvement of geomorphic channel stability. The four alternatives provide wastewater infrastructure protection to the one percent annual chance of exceedance (ACE) (100-year event), and greatly limit the potential compromise of ecosystem restoration outputs due to erosion damage to pipelines. These alternatives also provide erosion protection to the JTM regional water supply pipeline crossing in Reach 11 as an ancillary benefit resulting from the restoration project features. All four of the alternatives raise the existing streambed elevation to pre-incised elevations (circa 1967) within the Wilderness Park. Alternatives 3.6, 3.7, and 3.8 additionally reconnect the abandoned oxbow. Alternatives 3.7 adds sinuosity to the stream alignment just downstream of Pacific Park Drive, while Alternative 3.8 adds the same feature in addition to sinuosity downstream of Wood Canyon Creek.

Table ES-3 presents a summary comparison of the NER-related outputs of the final array of action alternatives for ecosystem restoration.

Table ES-3 NER Outputs of Final Array Action Alternatives
(FY16 Price Levels; FY17 Discount Rate 2.875%)

	Alternative 3.3	Alternative 3.6	Alternative 3.7	Alternative 3.8
Average Annual Habitat Units				
Net Increase AAHU (Over No Action)	5,597	5,775	5,834	5,842
Incremental AAHU	5,597	177	60	8
Gross Project Costs				
First Costs	$91,611,965	$96,809,585	$98,724,986	$99,156,555
Interest During Construction	$3,238,387	$3,248,643	$3,251,585	$3,251,963
Total Gross Investment	$94,850,352	$100,058,228	$101,976,571	$102,408,518
Annual Costs				
Total Annual Costs of Gross Investment	$3,599,389	$3,797,018	$3,869,816	$3,886,207
Annual Cost of Maintenance (OMRR&R)	$187,446	$196,560	$197,890	$198,550
Total Average Annual Costs (AAC)	$3,786,835	$3,993,578	$4,067,706	$4,084.757
Incremental AAC	$3,786,835	$206,743	$74,127	$17,052
Incremental AAC/AAHU	$673	$1,167	$1,239	$2,145

Table ES-4 presents a brief summary of the beneficial and adverse effects associated with the final array of alternatives, with an emphasis on the resources that have the most significant influence pertaining to Plan Formulation.

Table ES-4 Final Array Comparison: Beneficial and Adverse Effects

Resource	Description	Alternative 1 (No Action)	Alternative 3.3	Alternative 3.6	Alternatives 3.7 and 3.8
Earth Resources	**Construction Impacts**	None	Short term, temporary and less than significant. Impacts further reduced with Environmental Commitments.		
			Disposal to onsite areas: 130,000 cubic yards. Beneficially adds to buttressing effect against potential landslides.	Disposal to onsite areas: 300,000 cubic yards. Beneficially adds to buttressing effect against potential landslides.	Disposal to onsite areas: 340,000 and 350,000 cubic yards, respectively. Beneficially adds to buttressing effect against potential landslides.
	Channel Geomorphology	Some further incision (varies from five feet maximum to 1 foot minimum, and widening as channel seeks dynamic equilibrium (est. 50 year min)	Streambed raised to approach historic pre-incised elevation. Geomorphically stable channel.		
	Sediment Yield to Ocean	As dynamic equilibrium approaches, average sediment delivery range approaches 20,000 to 60,000 tons/year	Similar yield to No Action but occurs sooner.		
	"S" Bend (Reach 4B)	Expected cutoff after 25 years of this distinctive feature, which offers channel complexity and associated habitat biodiversity (including freshwater marsh)	"S" bend remains intact.		
	Landslides	Loss of channel banks immediately adjacent to ascending canyon slopes could potentially compromise slope stability where ancient landslides have occurred. Cuts made into canyon slopes that expose adversely oriented bedding could potentially develop landslides along those bedding planes. The degree to which landslides toes are stabilized by relatively thick canyon alluvium fill and extent to which fluvial erosion has disturbed the buttressing effect has not yet been quantified.	Based on qualitative evaluation, some risk, though generally low. Some potential moderate risk to one ancient slide area, to be further addressed during Pre-Construction Engineering and Design (PED) phase.	Based on qualitative evaluation, some risk, though generally low. Some potential moderate risk to one ancient slide area, and higher risk to second one to be further addressed during Pre-Construction Engineering and Design PE) phase.	
			Raising streambed may bolster buttressing effect, increasing overall resistance to potential sliding.		

Table ES-4 Final Array Comparison: Beneficial and Adverse Effects

Resource	Description	Alternative 1 (No Action)	Alternative 3.3	Alternative 3.6	Alternatives 3.7 and 3.8
Earth Resources (continued)	**Coastal Effects**	Upper estuary subject to slight aggradational trends; less likely in lower estuary, though fluctuation dependent on tidal and littoral effects. As Aliso Creek is the largest sediment contributor in the littoral cell, some potential narrowing of downcoast beaches to Dana Point over time due to reduction of sediment yield. Sea level rise could compound these effects.	Impacts to estuary and supply of sand to downcoast beaches expected to be similar to No Action.		
Water Resources	**Construction Impacts**	None	Short term, temporary and less than significant. Impacts further reduced with Environmental Commitments.		
	Floodplain Hydrologic Connectivity	Severely incised channel provides limited floodplain breakout for 10-year and 100-year flows. Current acres of floodplain: 2-year (56 ac); 10-year (78 ac); and 100-year (106 ac).	Raised streambed elevation increases floodplain widths by 112% for 2-year; 94% for 10-year, and 61% for 100-year.		
	Flood Inundation to Infrastructure	Limited flooding to east (unpaved) and west (AWMA Road) access roads within Reaches 4A to 9.	Total increase of 15% inundation (i.e. to total lengths of roads) over No Action. Corresponding impacts to access expected to be minor. No flood mitigation measures warranted except for paving of east road. Coastal Treatment Plant is not affected.		
	Groundwater Levels	Disconnected floodplain function will continue to provide very limited aquifer recharge opportunities.	Groundwater levels expected to incrementally rise along the raised streambed course, and for some distance laterally, due to channel seepage direct influence. Additionally, use of embedded sheet pile to accompany transverse rock riffle structure locations will raise local groundwater levels directly upstream of the structures for a limited distance as groundwater flows in the vicinity of the structures would tend to mound.		

<table>
<tr><th colspan="6">Table ES-4 Final Array Comparison: Beneficial and Adverse Effects</th></tr>
<tr><th>Resource</th><th>Description</th><th>Alternative 1 (No Action)</th><th>Alternative 3.3</th><th>Alternative 3.6</th><th>Alternatives 3.7 and 3.8</th></tr>
<tr><td rowspan="5">Biological Resources</td><td>Construction Impacts</td><td>None.</td><td colspan="3">With the establishment of temporary suitable habitat areas adjacent to the Proposed Project area, impacts to biological resources would be minimal, and short term. Environmental Commitments will further reduce impacts.</td></tr>
<tr><td rowspan="3">Riverine and Floodplain Ecosystem</td><td rowspan="3">Continued decline and narrowing of riverine habitat corridor and biodiversity, primarily due to channel incision and severed floodplain connectivity, creek instability, and vegetation die back from perching effects of lowered groundwater levels. As riparian zone narrows, habitat type conversion would be likely to coastal scrub and annual grasslands. The prevalence of steep streambank slopes will degrade the value of the riparian structure that can establish within the channel margins.</td><td colspan="3">With a hydrologically restored connection and a more stable geomorphic system, the quality of the aquatic, riparian, and floodplain ecosystem would be significantly increased within the restored area. Greater and more complex vegetation structure would develop, supporting a greater species richness, including federal and state listed special species.

Disposal sites would be planted with coastal sage scrub and grasslands.</td></tr>
<tr><td rowspan="2">No added sinuosity.</td><td colspan="2">Reconnection of abandoned oxbow would add an important gain in stream sinuosity and a corresponding benefit to increased morphologic variability and ecological function.</td></tr>
<tr><td></td><td>Some additional limited net gains in sinuosity (30 feet for Alternative 3.7; and 90 feet total for Alternative 3.8).</td></tr>
<tr><td>Aquatic Species Connectivity</td><td>Aquatic wildlife connectivity remains impeded along lower Aliso Creek, including the connection to Wood Canyon tributary, due to severe channel incision and the presence of large barriers such as the ACWHEP structure. The quality of aquatic habitat in Aliso Creek will continue to deteriorate within a deeply incised channel and fragmented habitat to few non-native aquatic species.</td><td colspan="3">Increased aquatic species connectivity for resulting from removal of manmade impediments would facilitate the reproductive viability of aquatic species. Within the Proposed Project area, connectivity would increase to 5 miles for the Aliso Creek mainstem (compared to 2.2 miles for No Action); and 3.5 miles for Wood Canyon (compared to limited/no connectivity under No Action). The inclusion of the Pacific Park Bypass increases the overall aquatic species connectivity of the mainstem by an additional 3.5 miles upstream, for a total of 8.5 miles.</td></tr>
</table>

<table>
<tr><th colspan="6">Table ES-4 Final Array Comparison: Beneficial and Adverse Effects</th></tr>
<tr><th>Resource</th><th>Description</th><th>Alternative 1 (No Action)</th><th>Alternative 3.3</th><th>Alternative 3.6</th><th>Alternatives 3.7 and 3.8</th></tr>
<tr><td rowspan="2">Cultural Resources</td><td rowspan="2">Construction Impacts</td><td rowspan="2">None.

Areas of identified cultural resources are largely protected from new development and would not be expected to change from existing conditions. It is probable, however, that sites may be disturbed or lost both by other human actions and through natural processes such as erosion.</td><td colspan="3">For all action alternatives, with implementation of Environmental Commitments, direct and indirect impacts would be minimized, but with the partial to complete destruction of up to 12 archaeological sites and the potential for impacting human burials, impacts would be significant and adverse.</td></tr>
<tr><td>Impacts to cultural resources from disposal sites footprints would likely be avoided.</td><td>Impacts to cultural resources from disposal sites footprints would likely be avoided.

Potentially slightly greater impact on cultural resources compared to Alternative 3.3 due to inclusion of reconnected oxbow</td><td>Impacts to cultural resources from disposal sites footprints would likely result from at least one of the disposal sites.

Incremental greater impacts to cultural resources due to inclusion of reconnected oxbow and added sinuosity downstream of Wood Canyon confluence for both Alternative 3.7 and 3.8.</td></tr>
<tr><td>Utilities</td><td>Construction Impacts</td><td>None.

Public agency wastewater infrastructure would remain at risk from continuing bank erosion posing a significant threat to public safety and a measurable impact to the environment and local economy. SOCWA efforts to protect pipelines at risk from storm flow-induced streambank erosion and undermining will be piecemeal and short-term “band-aid” solutions. Channel incision will continue to threaten the JTM water supply transmission pipeline, requiring periodic intervention to protect from undermining, with an impact to the environment.</td><td colspan="3">Buried streambank protection at key locations would provide erosion protection up to the 1% annual chance of exceedance (100-year event) to SOCWA wastewater utilities lines and west (AWMA Road) access road (Reaches 4A to 9).

JTM regional water supply line would be protected from channel undermining effects (Reach 11).</td></tr>
</table>

ES.7.4 Identification of National Ecosystem Restoration (NER) Plan

Based on the assessment of the final array of alternatives (1, 3.3, 3.6, 3.7 and 3.8), the plan that reasonably maximizes NER outputs relative to costs, meets planning objectives, reasonably avoids constraints, and provides significant ecosystem outputs is Alternative 3.6. This alternative is designated as the NER Plan and is also identified as the TSP.

In terms of costs and output metrics (Table ES-3), Alternative 3.6 provides 5,775 average annual habitat units (AAHU), an increase of 177 AAHU, or 3 percent gain over Alternative 3.3, at an incremental average annual cost (AAC) of $206,743. In comparing plans, it is useful to show the change in cost from one plan to another in a “per unit” basis. This would be in terms of AAC per AAHU. Alternative 3.6 has an incremental AAC/AAHU of $1,167 relative to Alternative 3.3, which is 73 percent higher than that of Alternative 3.3 ($673) relative to Alternative 1. The incremental investment in cost of Alternative 3.6 over Alternative 3.3 is considered worthwhile to pursue for riverine habitat improvement for the following reasons.

Compared to Alternative 3.3, Alternative 3.6 adds the stream reconnection through the abandoned river meander/oxbow associated, which would provide an important gain in sinuosity (about 850 feet of lengthened channel) and a corresponding benefit to increased morphologic variability and ecological function within the Aliso Creek system. The reconnected oxbow reach would provide an opportunity to create a wider areal expanse as a result of its high radius of curvature and pattern complexity that in turn would promote a mosaic of habitat types, including riparian forest or woodland, open ponded water and freshwater marsh within one distinct area. This areal expanse of riparian and aquatic ecosystem (net gain of over 500 feet wide and 10 additional acres, compared to Alternative 3.3) would be unique within the watershed, and also lies within the heart of the Wilderness Park where the coastal canyon floodplain is the widest. Amphibians, such as the southwestern pond turtle, a California Species of Special Concern under consideration for Federal listing, and salamander would benefit from the greater prevalence of moist soils. Slow moving waters promoted by the high radius sinuosity and resulting gentler stream grade would provide important refugia habitat. The reconnected meander oxbow area would allow for the development of a wider expanse of a heterogenetic, multi-layered habitat structure of functional riparian habitat for breeding, foraging and cover/resting opportunities that will benefit bird species including the Federally endangered least Bell’s vireo and southwestern willow flycatcher, and the Federally threatened California gnatcatcher, as well as a variety of neotropical migrants species and California Species of Special Concern, including yellow-breasted chat, Swanson’s thrush, yellow warbler, and yellow-headed blackbird.

The rationale why Alternative 3.7 or Alternative 3.8 was not selected as the NER plan is as follows:

In addition to the oxbow reconnection, Alternative 3.7, compared to Alternative 3.6, adds the "sinuosity downstream of Pacific Park Drive" feature within Reach 11. Due to the relative narrowness of the floodplain within this reach (which lies in the more northern portion of the Wilderness Park where urbanization has constrained the floodplain laterally), this feature only provides a very small gain in sinuosity, or about 30 feet in length. Alternative 3.7 provides 5,834 AAHU, or a 1 percent gain over Alternative 3.6. Although the incremental AAC/AAHU are relatively close for the two alternatives, the relatively limited aquatic habitat ecological benefit that Alternative 3.7 provides and the incremental 40,000 cubic yards of excess materials requiring disposal makes the selection of this alternative less desirable compared to Alternative 3.6.

Alternative 3.8 is similar to Alternative 3.7, but also adds the feature "sinuosity downstream of Wood Canyon Creek" in Reach 5C. This feature adds about 60 feet of additional stream lengthening. With the limited incremental gain in AAHU (less than 1 percent), and the significant increase in incremental AAC/AAHU (about 73 percent higher than Alternative 3.7 at $2,145 versus $1,239), the additional investment is not warranted.

ES.8 TENTATIVELY SELECTED PLAN

ES.8.1 TSP Outputs

The TSP restores 191 acres of riverine (aquatic and riparian) habitat throughout the five miles of the Proposed Project area between the SOCWA CTP Bridge and Pacific Park Drive (Reaches 4A-12). Together with the upstream reaches (13 to 17B, referred to as the Stewardship Reaches) that are outside of, but contiguous to, the Federal proposed project area, the TSP reconnects 371 acres of riverine habitat type for 8.5 miles to the I-5 Freeway. Removal or modification to manmade structures that act as aquatic wildlife impediments within the Federal project footprint would increase connectivity for aquatic species to 8.5 miles throughout the reconnected area between the SOCWA CTP and the I-5 Freeway, and would reestablish lateral connectivity to the 3.5-mile-long high-quality habitat of the Wood Canyon Creek tributary. The ecosystem outputs are summarized in Table ES-5. The TSP features are displayed in Figure ES-2. The Stewardship reaches are shown in Figure ES-3.

Within the TSP Proposed Project area, recontouring of the streambanks to gentler side slopes and the creation of a widened channel margin that incorporates inset floodplain terracing would provide greater stability to the creek system, especially for larger flow events. With raising of the streambed elevation, localized groundwater levels associated with Aliso Creek would rise incrementally, improving the interface with riparian vegetation root systems to support a more extensive riparian habitat. Additionally, the lateral hydrologic connectivity to the 10-year floodplain would almost double to 151 acres; while the 100-year floodplain would increase by about 60 percent to 171 acres.

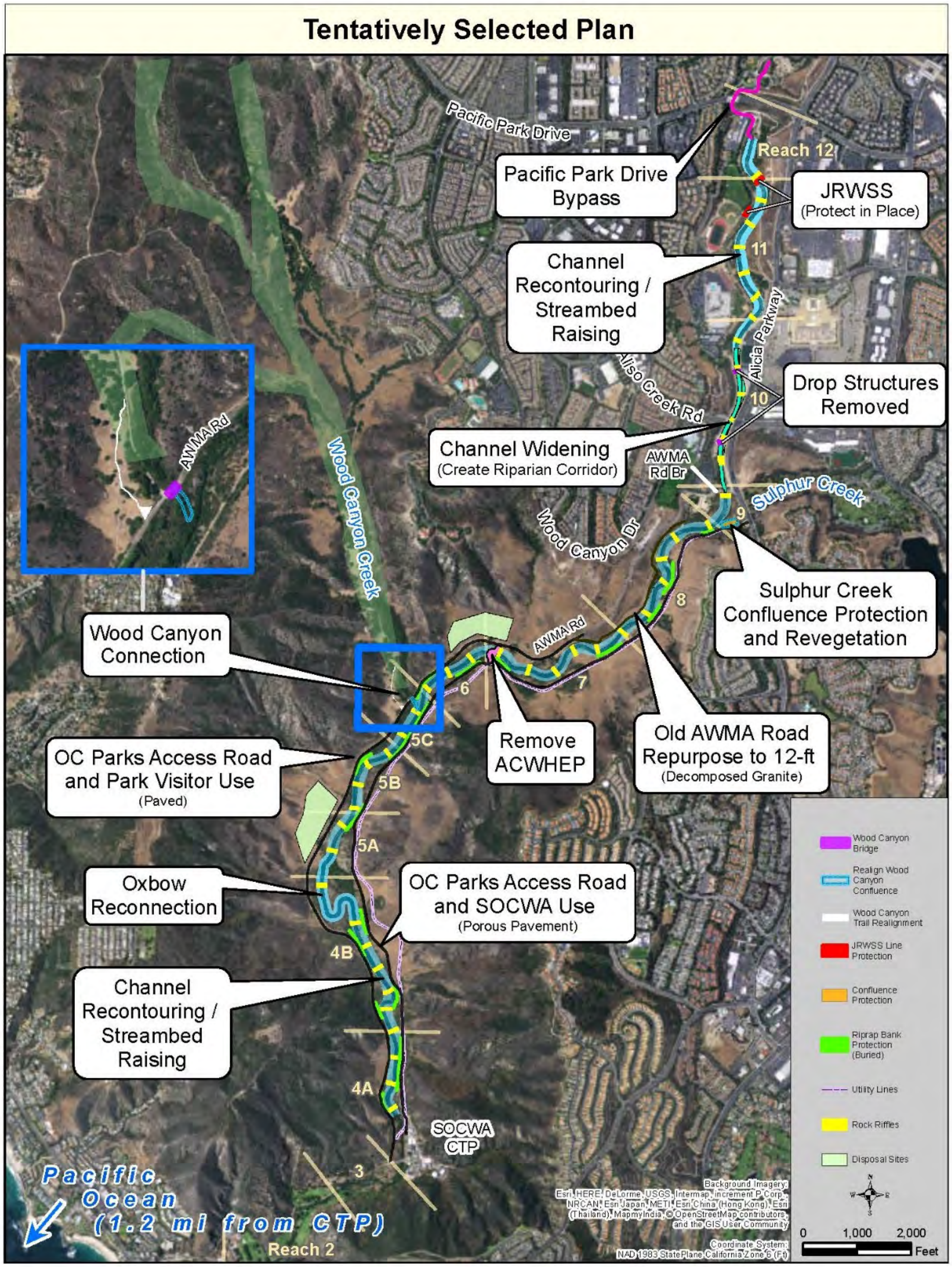

Figure ES-2 Tentatively Selected Plan

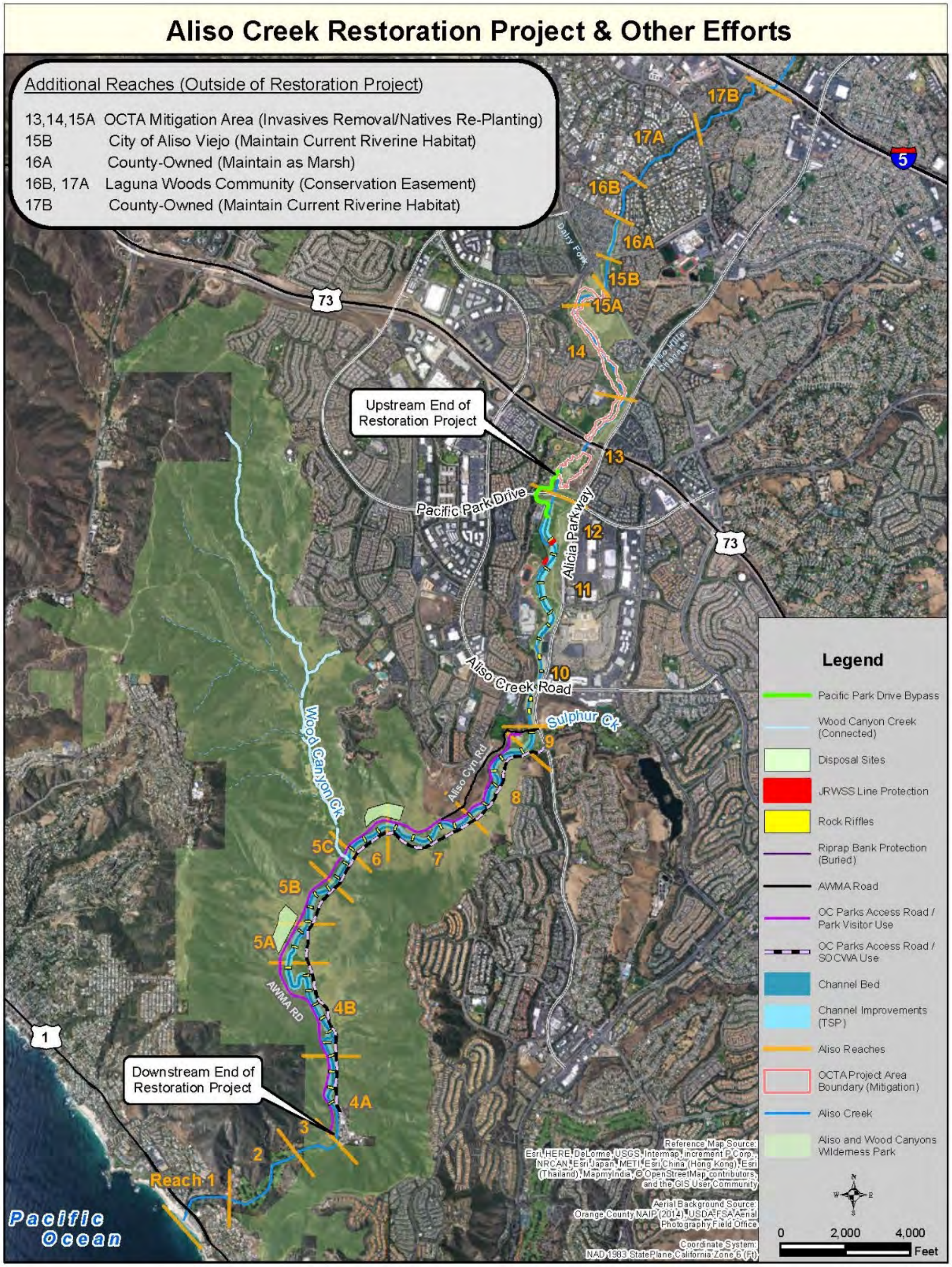

Figure ES-3 Tentatively Selected Plan and Stewardship Reaches

Table ES-5 Ecosystem Outputs Associated with the TSP

Description		Habitat Value (HU)		HU Incr. Gain at Year 50	Riverine (Aquatic and Riparian) (acres)		Riverine Incr. Gain at Year 50	Aquatic Species Connectivity
		Year 0	Year 50		Year 0	Year 50		
No Action[1]		2,994	2,350	-	154	99	-	2.2 miles
TSP	Restored Habitat Area (Direct Restoration)	5,626	6,541	178% over No Action	191	191	93% over No Action	5 miles (Aliso Creek)
	Reconnected Habitat Area							
	Wood Canyon Creek	1,030	1,030	-	84	84	-	3.5 miles
Stewardship Reaches[2]	Pacific Park Drive to I-5	1,198	1,198	-	96	96	-	3.5 miles
Restored Habitat Area plus Reconnected Habitat Area		7,853	8,768	273% over No Action	371	371	275% over No Action	8.5 miles (Aliso Creek); 3.5 miles (Wood Canyon Creek trib)
HU Net Gain (over No Action)		4,859	6,418					
AAHU[3] Net Gain (over No Action)		5,775						
AAHU No Action		2,762						

[1] Area of No Action Alternative encompasses same area to be pursued under with-project actions for restored habitat areas.
[2] Stewardship reaches comprise additional reaches upstream of the Proposed Project upstream limit, from Pacific Park Drive to the I-5 Freeway. These reaches are under the jurisdiction of either Orange County, the City of Aliso Viejo, or the City of Laguna Woods.
[3] AAHU is average annual habitat unit value over a 50-year period of analysis (Years 0, 5, 25, and 50).

The inclusion of inset floodplain terraces would more than double the two-year floodplain to 118 acres. Table ES-6 provides a summary of hydrologic connectivity. Flooding impacts associated with the increased floodplain is limited to some inundation of the east and west access roads within the Wilderness Park, at a level slightly greater (about 15 percent) than without-project conditions. Accordingly, no flood mitigation measures were included to address induced flooding in these areas other than paving the existing east dirt access road in Reaches 4A-9.

Table ES-6 Floodplain Connectivity Increases Associated with the TSP

Footprint	2-Year		10-Year		100-Year	
	Floodplain (acres)	Incremental Gain	Floodplain (acres)	Incremental Gain	Floodplain (acres)	Incremental Gain
Without-Project (Existing)	56	-	78	-	106	-
TSP (Restored Habitat Area[1])	118	112% over Without-Project	151	94% over Without-Project	171	61% over Without-Project

[1] Does not include reconnected habitat area of Wood Canyon Creek tributary.

With a hydrologically restored connection and a more stable geomorphic system, the quality of the aquatic, riparian, and floodplain ecosystem would be significantly increased within the restored area. The TSP would enable greater and more complex vegetation structure to develop, comprising of stands of trees (willow, sycamore, and cottonwood) with varying heights and canopies, dense shrub understories (arroyo willow, sandbar willow, mulefat), and herbaceous plants that interface with open water and freshwater marsh habitat. This vegetation structure, or stratification, would support a greater species richness, including federal and state listed species. The increased connectivity for aquatic species resulting from removal of manmade impediments would facilitate the reproductive viability of aquatic species.

The TSP would also provide water quality improvement as an output of ecosystem restoration. These benefits were not quantified and are considered ancillary to the Proposed Project. The increased hydrologic connection to the floodplain would allow more opportunity to settle out fine suspended sediments and their associated nutrient loads, thereby promoting improved instream and coastal receiving water quality.

In addition to ecosystem restoration benefit outputs, the TSP provides incidental erosion damage reduction benefits. These benefits are associated with the protection of regional wastewater conveyance and water supply infrastructure from streambank and streambed erosion threat. For SOCWA wastewater conveyance infrastructure, there is a net reduction of average annual damages of $646,000 within the Proposed Project area for bank erosion protection features related to the TSP. These features are necessary to safeguard the restoration benefit outputs. For the JTM water supply transmission infrastructure, a quantitative erosion damage reduction analysis was not performed. However, the current erosion threat to the pipeline crossing would be significantly diminished as an outcome of the ecosystem restoration features that are related to the strategic placement of required grade control (rock riffles) structures. Benefits related to erosion damage reduction are considered incidental to the construction of the ecosystem restoration project.

ES.8.2 Stewardship Reaches 13-17B

Though not critical to aquatic species sustainability, the reconnection to 3.5 miles of additional aquatic and riparian habitat between Pacific Park Drive and the I-5 Freeway would provide a beneficial increment to the TSP, providing a larger reconnected area of this habitat type.

For the additional 3.5 miles of the Aliso Creek riverine corridor (Reaches 13 to 17B) upstream of the Proposed Project limit, the various landowners of the subreaches (Orange County, Aliso Viejo Community Association, and the City of Laguna Woods), would continue to pursue stewardship practices in protecting and maintaining natural resources in accordance with their adopted resource management plans. These additional reaches of Aliso Creek mainstem would not involve any implementation actions by the Federal government. Figure ES-3 shows the TSP in context with the other local efforts.

ES.8.3 Recreation Plan

The objective of the recreation plan is to enhance the passive recreational experience associated with the Proposed Project. The recreation plan formulated for the NER Plan was developed through coordination with the non-Federal sponsor to take advantage of existing recreation facilities, as well as proposed ecosystem restoration improvements, while complying with Corps policies and regulations pertinent to recreation improvements at ecosystem restoration projects.

The recreation plan includes the construction of five interpretive kiosks within the Proposed Project at key locations. The kiosks would be located along points of recreational access for the public, which includes the Aliso Creek Bikeway and AWMA Road, both paralleling the west side of Aliso Creek within the Wilderness Park. The kiosks provide educational value and are intended to increase public understanding and appreciation of the restored habitat and diverse ecosystem functions within the Wilderness Park. Proposed locations of the kiosks are as follows:

- Vicinity of Pacific Park Drive, west side along Aliso Creek Bikeway.
- Vicinity of Ranger Station/Visitor Area.
- Three locations along AWMA Road between the Ranger Station and SOCWA CTP Bridge.

Based on the economic recreation benefits analysis performed using a unit day value method, there are two benefits considered: the incidental recreation benefits associated with the NER project, which will enhance the recreation experience due to improved visual quality and environmental setting for recreation users, and the benefit associated with the recreation plan due to the addition of the kiosks. For benefits related to the ecosystem restoration project, the TSP provides $308,000 in incidental equivalent annual recreation benefits, or a 32 percent gain over without-project conditions. For benefits related to the kiosks, there is an incremental gain of $11,000 in equivalent annual recreation benefits, or a 0.8 percent increase over benefits related to the ecosystem restoration project. The recreation plan has a benefit to cost ratio of 11:1.

ES.8.4 Plan Implementation

ES.8.4.1 Lands, Easements, Right-of Way, and Disposal Sites (LERRDs)

The majority of the land associated with the project footprint is owned by the County of Orange, and is within the boundaries of the Wilderness Park. The TSP would require approximately 174.16 acres in fee ownership; 21.37 acres of permanent easements; and 30.16 acres of temporary easements. No borrow sites would be necessary for implementation of the TSP. No facility or utility relocations would be necessary for implementation of the TSP; the TSP proposed utility actions would be to protect in place, remove as abandoned, and protect in-place and modify.

ES.8.4.2 Geotechnical Investigations

Geotechnical investigations would be conducted during the Preconstruction, Engineering and Design (PED) phase to supplement those conducted during the feasibility phase. These investigations would be necessary to better address the existing level of stability and reduce any potential risk of reactivation of identified ancient slope failures (landslide masses), or destabilization of some other areas currently unaffected by sliding, as a result of the planned excavations and grading of alluvial soils associated with the channel alignment. Additionally, any segments of the proposed alignment that are adjacent to an identified unstable ascending slope, whose stability could be undermined should localized channel widening result during larger storm events, would need to be evaluated for risk level in coordination with the engineering team. The outcome of the geotechnical investigations would allow reconciliation of any potential destabilization concerns and recommend adjustments, as warranted, to project design and construction, including any protective mitigation measures.

ES.8.4.3 Cultural Resources Investigations

A comprehensive cultural resource inventory of the Area of Potential Effects (APE) would occur during the PED phase to supplement site investigations conducted during the feasibility phase. The Corps, in consultation with the California State Historic Preservation Office (SHPO) and the Affected Tribes, would execute a programmatic agreement (PA) prior to PED. The PA will layout the procedures for the cultural resource inventory, the evaluation of any resources located during the inventory, and a process for avoiding, minimizing, and mitigating any adverse effects. If adverse effects to resources determined to be eligible for the National Register of Historic Places cannot be avoided, the Corps, California SHPO, the Affected Tribes, and the County of Orange would execute a Memorandum of Agreement during PED specifying a treatment plan, which would be undertaken by the Corps prior to or during the project construction period to address adverse effects.

ES.8.5 Costs of the TSP

Table ES-7 summarizes the benefits and costs for the Tentatively Selected Plan. Project first cost includes costs for all real estate interests, construction of the ecosystem restoration features, monitoring and adaptive management measures, cultural resources data recovery, and costs to construct the recreation features. The first cost of the project also includes the cost for the next phase of study, the PED phase.

Table ES-7 Summary of Benefits and Costs for TSP
(FY16 Price Level; FY17 Discount Rate 2.875%)

Item	Amount
NER First Cost	
Real Estate	$17,115,000
Construction	$61,454,200
PED (including EDC)	$9,525,400
Construction Management (S&A)	$3,994,500
Monitoring and Adaptive Management	$3,517,000
Cultural Resources (Data Recovery)	$703,400
Geotechnical Investigations	$500,000
Total NER First Cost	**$96,809,500**
NER Average Annual Cost	
Annual Cost of Total Gross Investment	$3,797,000
OMRR&R	$196,600
Total Average Annual Cost (AAC)	**$3,993,600**
Total AAC per Average Annual Habitat Unit (AAHU)	**$692**
Restored plus Reconnected Habitat	**371 Acres**
NER Average Annual Benefits	
Net AAHU	5,775
Incidental Streambank Erosion Protection (Wastewater Conveyance)	$646,000
Incidental Streambank Erosion Protection (Water Supply Conveyance)	Not quantified. Protects water supply for more than 200,000 residents
Recreation	
First Cost	$25,000
AAC	$1,000
Average Annual Benefits	$11,000
Benefit-to-Cost Ratio	11
Incidental Annual Recreation Benefits (NER)	$308,000
TSP Total Project First Cost	**$96,834,500**

ES.8.6 Project Cost Sharing

The apportionment of total project costs between the Federal government and the non-Federal sponsor, as established by Section 103 of the WRDA of 1986 (Public Law 99-662), as amended, is displayed in Table ES- 8. Standard cost-sharing policy for ecosystem restoration projects is described in current guidance (Engineer Regulation 1105-2-100) as follows:

ES.8.6.1 Ecosystem Restoration

- The non-Federal share will be 35 percent of the project or separable element implementation costs (preconstruction, engineering and design and construction) allocated to ecosystem restoration.
- The non-Federal sponsor is responsible for providing 100 percent of the LERRDs and OMRR&R.

The value of LERRDs shall be included in the non-Federal 35 percent share. Table ES- 8 also includes a line item for Federal administrative costs. These costs represent Federal administration and review activities relating to the non-Federal sponsor's provision of LERRDs for the project, and are therefore a cost-shared component of the project and are not part of LERRDs.

ES.8.6.2 Recreation

- Recreation costs will be shared equally.

Table ES- 8 Federal and Non-Federal Apportionment of Total Project First Cost

Item	Federal	Non-Federal	Total (Rounded)
Real Estate			
Non-Federal Sponsor LERRD	0	15,500,000	15,500,000
Non-Federal Sponsor Administrative Costs	0	1,550,000	1,550,000
Federal Administrative Costs	65,000	0	65,000
Subtotal – Real Estate	65,000	17,050,000	17,115,000
Construction			
Construction	61,454,200	0	61,454,200
PED (including EDC)	9,525,400	0	9,525,400
Geotechnical Investigations	500,000	0	500,000
Construction Management (S&A)	3,994,500	0	3,994,500
Subtotal – Construction	75,474,100	0	75,474,100
Monitoring/Adaptive Management			
Monitoring	1,406,800	0	1,406,800
Adaptive Management	2,110,200	0	2,110,200
Subtotal Monitoring/Adaptive Management	3,517,000	0	3,517,000
Pre-Adjusted Total Cost-Share Amount (65/35)	79,056,100	17,050,000	96,106,100
Adjustment for Cost-Share	-16,587,135	16,587,135	0
Total (65/35)	**62,468,965**	**33,637,135**	**96,106,100**
Percent of Total	*65%*	*35%*	
Other Costs			
Recreation (50/50)	12,500	12,500	25,000
Cultural Resources (Data Recovery; Initial Federal)	703,400	0	703,400
Total Cash Contribution	**63,184,865**	**16,599,635**	**78,784,500**
Total Project Cost	**63,184,865**	**33,649,635**	**96,834,500**

ES.9 NEXT STEPS IN THE PLANNING PROCESS

Comments provided on these alternative plans during the public draft review period, and other comments on the Draft IFR and technical appendices, will be considered by the Corps and OCPW. After the close of the public review (and other concurrent reviews), the Corps will prepare for the Agency Decision Milestone meeting, when feedback on any significant comments and impacts to the NER Plan/TSP will be presented to a panel of Corps senior leaders. A decision will be made at that meeting regarding the selection of a plan to carry forward for feasibility-level design in order to complete the feasibility study and recommend to Congress for authorization.

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CHAPTER 1 INTRODUCTION*

1.1 GENERAL

This document serves as a draft feasibility report, Environmental Impact Statement and Environmental Impact Report – known as a Draft Integrated Feasibility Report (Draft IFR) – for the Aliso Creek Mainstem Ecosystem Restoration Project. The Proposed Project analyzed in this Draft IFR is the implementation of an ecosystem restoration project within lower Aliso Creek in Orange County, California. This Draft IFR analyzes the environmental impacts of implementing ecosystem restoration alternatives, reviews the process for identifying the tentatively selected plan, and concludes with recommendations for project implementation.

The U.S. Army Corps of Engineers (Corps) is the lead agency under the National Environmental Policy Act (NEPA), and the non-Federal sponsor, Orange County Public Works (OCPW), Environmental Resources, is the lead agency under the California Environmental Quality Act (CEQA). This Draft IFR identifies the Federal interest in riverine ecosystem restoration within a significant largely undeveloped coastal canyon resource in southern California. The study also identifies ancillary benefits to wastewater infrastructure located within the Proposed Project area that result from streambank protection features. Such measures are necessary to avoid negative impacts to the restored ecosystem that would result from the release of effluent or sludge, and construction activity required for repairs. Ancillary benefits are also identified for water supply infrastructure, as well as for passive recreation.

1.2 GUIDING REGULATIONS

This Draft IFR was prepared to comply with NEPA (42 United States Code [U.S.C] Section 4321, et seq.) in conformance with the Council for Environmental Quality ((CEQ) Regulations for Implementing NEPA (40 Code of Federal Regulations [C.F.R] Part 1500, et seq.) and the Corps' Engineer Regulation (ER) 200-2-2, *Implementing NEPA* (33 C.F.R. Part 230), as well as Corps policies including, the *Economic and Environmental Principles for Water and Related Resources* (May 1983), and ER 1105-2-100, *Planning Guidance Notebook* (22 April 2000), as amended. This Draft IFR was also prepared to comply with the CEQA (California Public Resources Code [P.R.C.] Section 21000, et seq.) and the Guidelines for Implementation of the CEQA of 1970 (CEQA Guidelines) (14 California Code of Regulations [C.C.R.] Section 15000, et seq.).

1.3 STUDY AUTHORITY

This Draft IFR has been prepared as an interim and partial response to authorities from 1964 and from 2007. Corps engagement originally arises by a resolution of the Committee on Public Works, House of Representatives, adopted May 8, 1964, for the Santa Ana River Basin and Area Streams, Orange County, California:

"Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the reports on (a) San Gabriel River and Tributaries, published as House Document No. 838, 76th Congress, 3d Session; (b) Santa Ana River and Tributaries, published as House Document No. 135, 81st Congress, 1st Session; and (c) the project authorized by the Flood Control Act of 1936 for the protection of the metropolitan area in Orange County, with a view to determining the advisability of modification of the authorized projects in the interest of flood control and related purposes."

Additionally, the Water Resources Development Act (WRDA) of 2007 includes the following authority under Section 4015, Aliso Creek, California:

"The Secretary shall conduct a study to determine the feasibility of carrying out a project for streambank protection and environmental restoration along Aliso Creek, California."

1.4 STUDY AREA, PROJECT SETTING, AND BACKGROUND

The study area is generally the Aliso Creek watershed. The Aliso Creek watershed is located in southern Orange County, California and encompasses an area of approximately 35 square miles (Figure 1.4-1). Aliso Creek flows nearly 19.5 miles from its headwaters at approximately 2,400 feet above sea level in the rugged Santa Ana Mountains within the Cleveland National Forest, through a somewhat level valley in the middle reaches, and finally through a narrow and more steep coastal canyon along the downstream-most reaches to its outlet at the Pacific Ocean at Aliso Beach in south Laguna Beach, California. The Aliso Creek outlet is approximately 50 miles south of Los Angeles and approximately 65 miles north of San Diego. The creek is joined by six major tributaries; four in the middle watershed (Munger Creek, English Canyon, Dairy Fork, and Aliso Hills Channel), and two in the lower watershed (Sulphur Creek and Wood Canyon Creek).

Within the lower portion of the Aliso Creek watershed is the 4,200-acre Aliso and Wood Canyons Wilderness Park, a significant largely undeveloped natural resource in southern California. The Aliso and Wood Canyons Wilderness Park is a coastal canyon ecosystem with significant biodiverse value, supporting limited and scarce landscape habitat types unique to California, including coastal sage scrub, chaparral, native grassland, oak woodland, riparian woodland/forest, and freshwater marsh, and provides several important wildlife corridors that link wildlife habitat within and between protected open space in the region.

The Aliso and Wood Canyons Wilderness Park is part of the broader 20,000-acre South Coast Wilderness area within the coastal San Joaquin Hills, which includes, contiguously to the Aliso Creek watershed, the Laguna Coast Wilderness Park, Irvine Open Space Preserve, and Crystal Cove State Park. Lower Aliso Creek watershed links two regionally significant ecosystems: the terrestrial greenbelt formed by the natural habitat of the South

Coast Wilderness area, and the bluebelt of the coastal and offshore Laguna Beach State Marine Reserve/Conservation Area, recently established by the Marine Life Protection Act.

Figure 1.4-2 displays these ecosystem resources, the watershed, and the Proposed Project area. The Proposed Project area, to be described later in this chapter, lies within the Aliso and Wood Canyons Wilderness Park. There are relatively few protected coastal canyon ecosystems remaining in southern California (Figure 1.4-3).

Laguna Beach and the South Coast Wilderness area were designated a national landmark in 2017 by gaining recognition as a Historic American Landscape by the National Park Service. Other national recognition of the region includes designation of the Aliso Creek Regional Riding and Hiking Trail as a National Recreation Trail by the Secretary of the Interior in 2012. The 15-mile trail, popular for hiking, cycling, walking, running, equestrian, and birdwatching, links the Santa Ana Mountains to the Aliso and Wood Canyons Wilderness Park.

1.4.1 Urbanization Effects to Riverine Ecosystem

Presently, about 75 percent of the Aliso Creek watershed has been developed and is at near build-out. The most intensive development has occurred in the broad middle section comprised of the cities of Lake Forest, Aliso Viejo, Mission Viejo, Laguna Niguel, Laguna Hills, and Laguna Woods. Development has consisted of medium- to high-density residential areas interspersed with commercial and industrial developments. Of the undeveloped 25 percent of the watershed, the Cleveland National Forest in the extreme upper portion and the Aliso and Wood Canyons Wilderness Park (Wilderness Park) in the lower portion are protected public lands.

The urbanization boom between the 1960s and the 1980s has had a significant impact on the natural drainage system of the watershed. Particularly in the highly developed middle areas of the watershed, the tributaries and mainstem of Aliso Creek have been subject to confinement by urban development and by physical alterations. Alterations include various channel straightening efforts and inclusion of flood flow management features, such as drop structures, retention basins, and channel bank and streambed armoring. Figure 1.4-4 displays modified segments of the mainstem. Of the six tributaries, only Wood Canyon Creek has avoided major alterations. Existing alterations are due to creek trail crossings associated with the Wilderness Park trail system; erosion protection modifications at the headwaters and subtributaries in response to urban drainage from residential housing development along the northern and eastern ridge rims of the subwatershed; and a culvert road crossing that provides access to the Wilderness Park and to a nearby wastewater treatment plant facility.

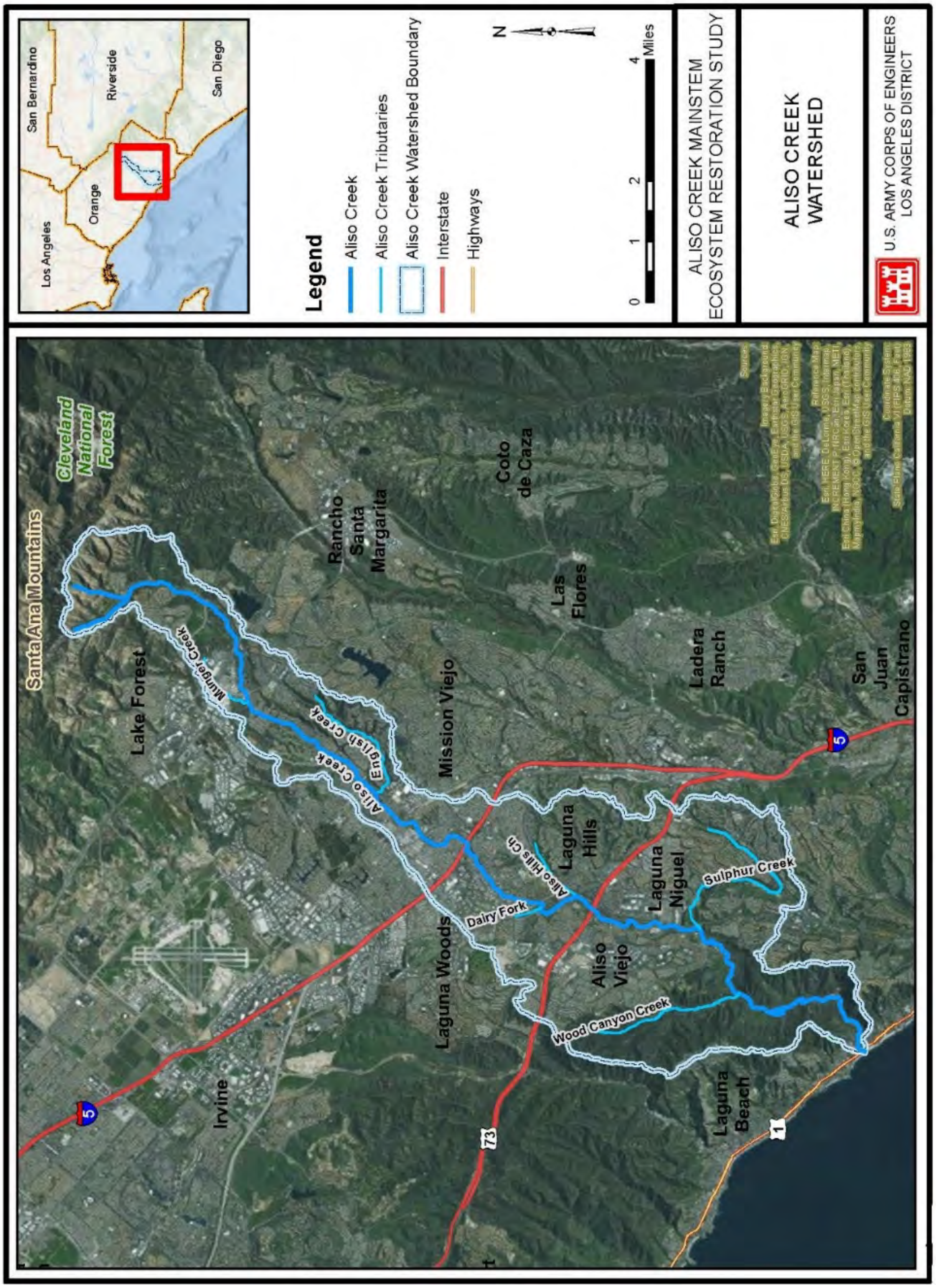

Figure 1.4-1 Aliso Creek Study Area

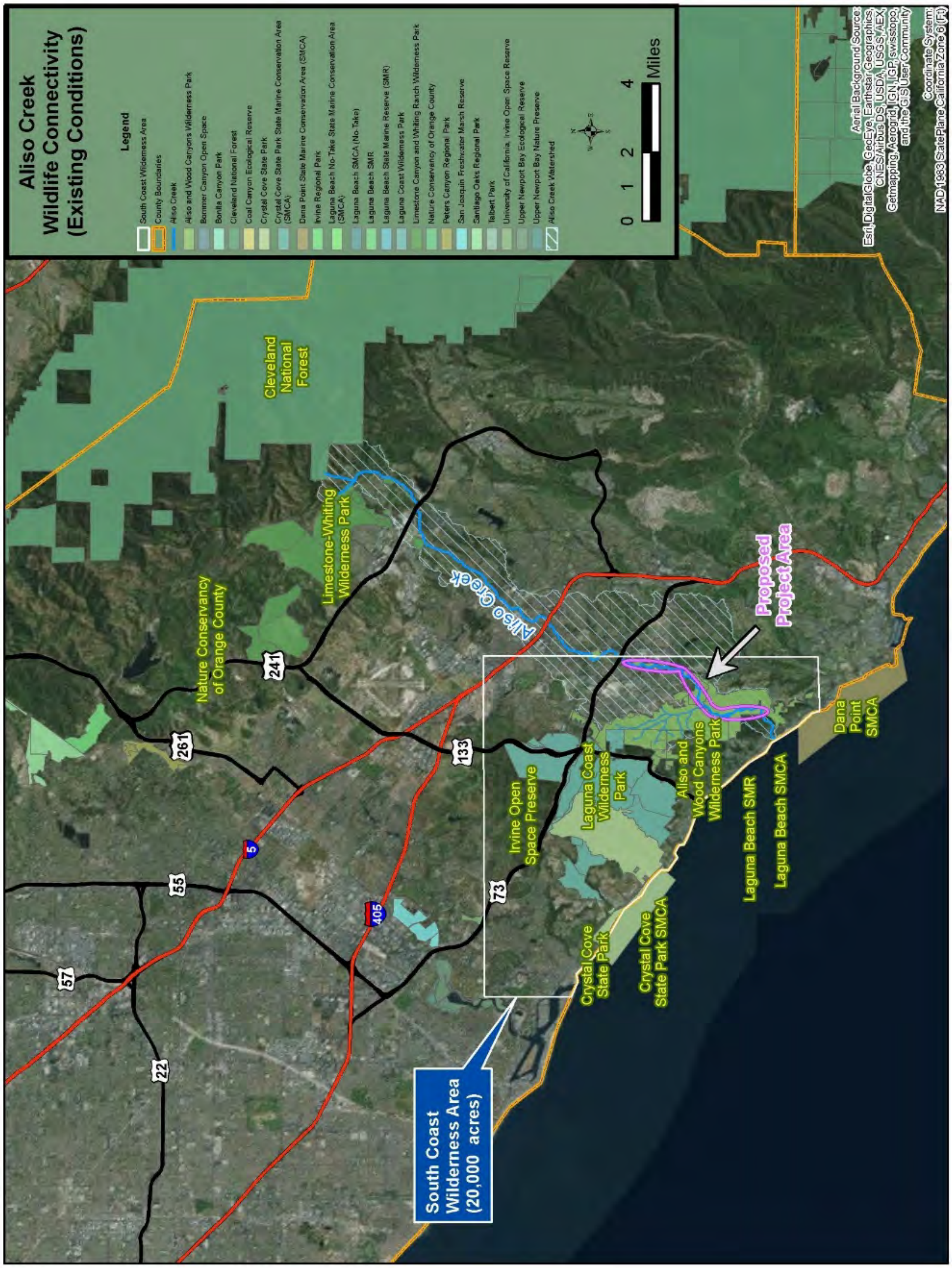

Figure 1.4-2 Aliso Creek Watershed and Vicinity

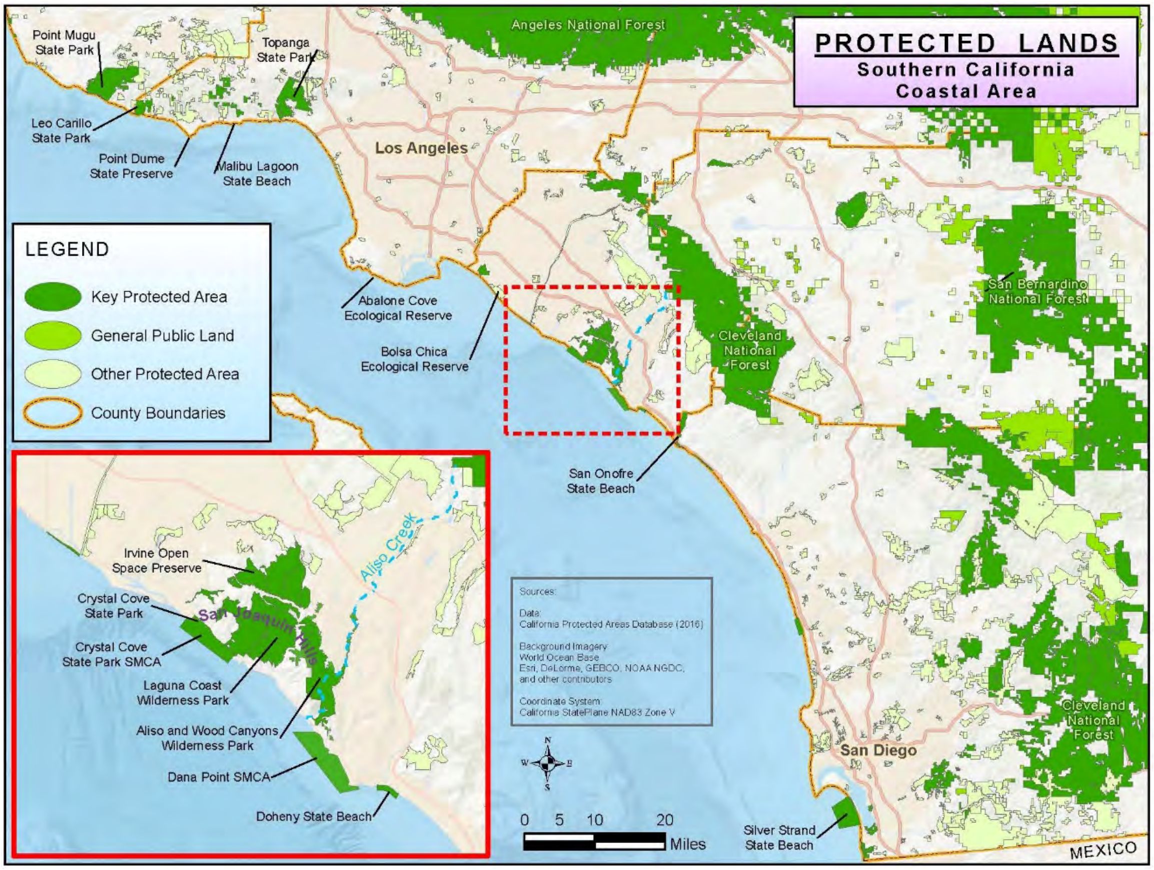

Figure 1.4-3 Protected Lands of the Southern California Coastal Area

Natural habitat areas in Orange County, including those in the Aliso Creek watershed, are highly fragmented by development. Human activities have caused degradation of riverine (aquatic and riparian) habitat quality as a result of changes to hydrology, floodplain function loss, channel modifications, loss in contributing sediment sources, channel instability, and introduction and spreading of non-native plant species. An assessment from three decades ago indicated that California had lost 90 to 95 percent of its native riparian community (Faber et al. 1989). In neighboring San Diego County, a loss of 40 percent of riparian wetlands was recorded within a decade since the late 1980s (CDPR 1988).

Riparian ecosystems are dependent on perennial, ephemeral, or intermittent surface or near-surface water. Many species of wildlife rely on riverine ecosystems during some, or all, of their life cycles. Within the Wilderness Park, the quality of aquatic, riparian, and floodplain habitat biodiversity has been adversely affected by channel incision and instability, loss of hydrologic floodplain connection, competition with invasive vegetation species, and habitat type conversion.

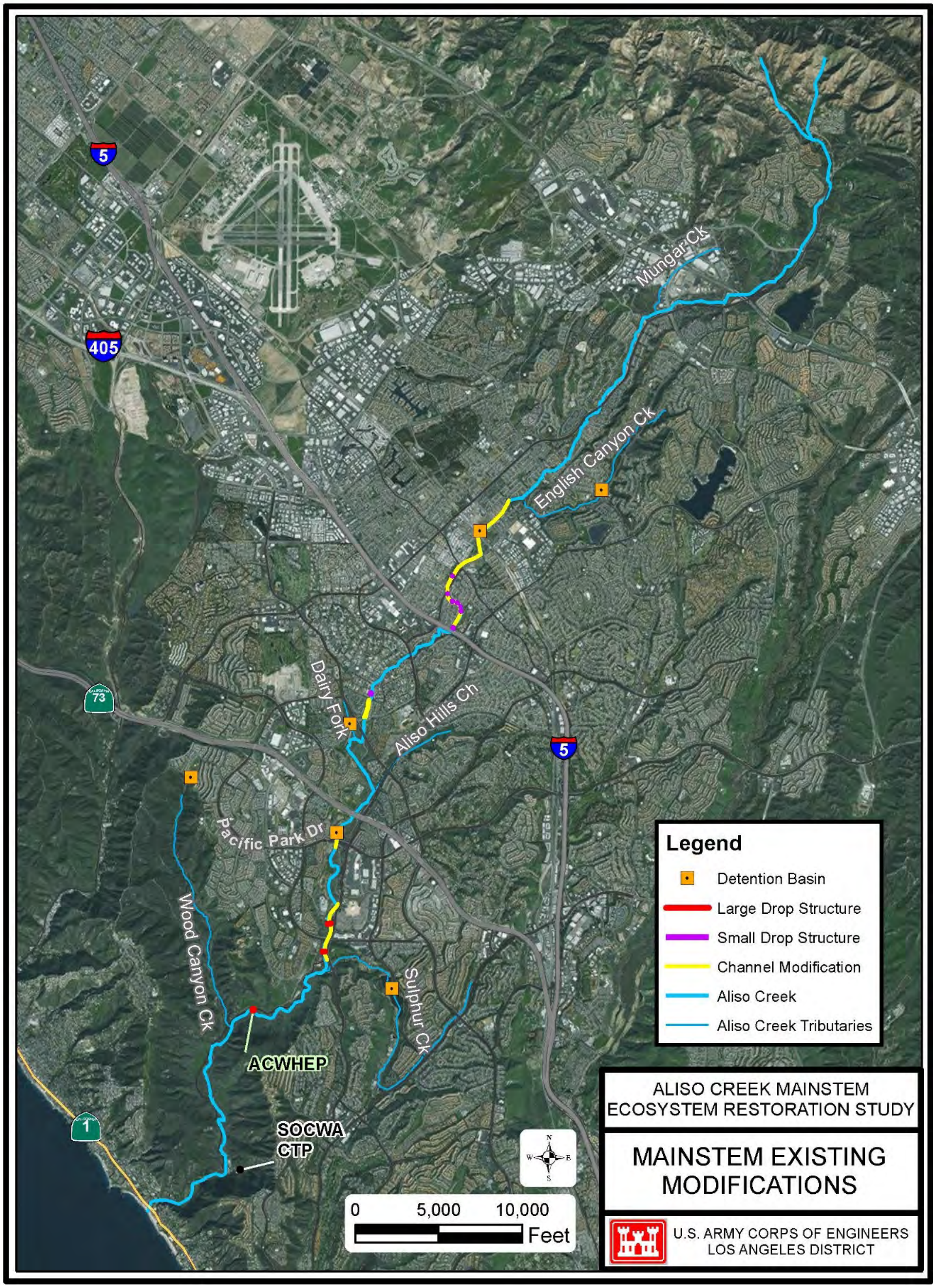

Figure 1.4-4 Existing Modifications – Aliso Creek Watershed

Riverine corridors function as linkages for wildlife movement between habitat areas. Vegetation and habitat type connectivity maintain populations of migratory animals, provide corridors for gene flow, allow wildlife and plant dispersal to new areas, and provide movement corridors at both the local and regional level. Dispersal into connecting habitats increases the diversity of plants and animals that can be supported.

For the Aliso Creek watershed, habitat and species numbers and diversity have declined due to the loss of connectivity between habitats. Aquatic linkages especially have been impaired by manmade channel modifications and the introduction of flow control structures and road crossings, creating barriers to aquatic wildlife and inhibiting dispersal. Species diversity is highly dependent on habitat diversity. Linkages are critical for supporting multiple populations of species to assure continual exchange of genes within populations, which in turn help sustain genetic diversity. Within the Wilderness Park, linkages for aquatic species along a five-mile stretch of Aliso Creek, including its connection to its major tributary (Wood Canyon Creek), are severely fragmented by manmade changes.

Despite the watershed fragmentation, terrestrial wildlife corridors are still intact between the Wilderness Park and other portions of the South Coast Wilderness Area to the west. Additionally, for some mammal species (including coyote, bobcat, and occasional mountain lion), the 19.5 miles of Aliso Creek still serves as a northerly wildlife corridor to the Cleveland National Forest, despite some short stretches where some modified channel sections and narrow channel easements exist.

Species that depend on multiple habitat types for different activities or different life stages have also declined. Migratory birds that may rely on riparian habitat, face population declines due to losses of this type of habitat. Biological diversity in Aliso Creek has also been impacted by the introduction of non-native species. Invasive exotic plants, such as giant reed, castor bean, and tamarisk, alter the hydrology, community structure and function, nutrient cycling, and soil chemistry of riparian ecosystems; they compete with, hybridize, or exclude native species and have reduced the quality of riverine habitat. Exotic predators, such as bullfrogs, have decimated populations of native fish and aquatic wildlife. Southwestern pond turtle, a California Species of Special Concern, as defined in the California Department of Fish and Wildlife Natural Diversity Database (2016), are known to inhabit only a few locations in Orange County including Aliso and Oso Creeks. A small extant group (about eight individuals) occur in Aliso Creek, likely from a failed mitigation effort (A. Backlin, USGS WERC, personal communication, November 10, 2015). The species is currently under review for Federal listing.

Regional wastewater infrastructure is susceptible to erosion-driven damage from Aliso Creek. Channel degradation from larger flow events has caused infrastructure damage in recent years in excess of $5 million in the lower watershed. Threatened wastewater infrastructure vulnerable to bank erosion poses a significant threat to human health and a measurable impact to the environment, valued beach recreation, and the local economy from potential major sewer line failure. Due to the instabilities in the creek, the South

Orange County Wastewater Authority (SOCWA), a public utility, must routinely perform temporary emergency protective actions to their facilities. Ecosystem restoration project alternatives would not be sustainable without a solution to the infrastructure threat within the Proposed Project area. Failure of wastewater infrastructure would cause undesired impacts to any restoration effort.

1.5 PURPOSE AND NEED

1.5.1 Purpose

The purpose of the Proposed Project considered in this Draft IFR is to increase habitat function and value associated with aquatic and riparian ecosystem resources along approximately five miles of lower Aliso Creek that has been adversely affected by urbanization-induced changes. Ecosystem restoration project alternatives would not be sustainable without a solution to the infrastructure threat within the Proposed Project area. Failure of wastewater infrastructure would cause undesired impacts to any restoration effort. Long-term increases in habitat function and value would also provide incidental passive recreational enhancement. A secondary objective of the Proposed Project is to provide recreational opportunities compatible with the purpose of ecosystem restoration.

1.5.2 Need

Intensive urbanization within the Aliso Creek watershed during the past 50 years has resulted in significant degradation to aquatic and riparian habitat quality and function, riverine and floodplain connectivity, and stream channel stability. The need exists to diminish the adverse effects of manmade alterations affecting the lower Aliso Creek riverine system to support a healthy aquatic and riparian community, and to improve connectivity for wildlife species between the Aliso and Wood Canyons Wilderness Park and the broader South Coast Wilderness area, as well as with the Cleveland National Forest.

The need also exists to protect critical wastewater infrastructure from streambank erosion and stream instability that would otherwise compromise ecosystem restoration benefits.

1.6 STUDY SCOPE AND PROPOSED PROJECT AREA

1.6.1 Study Scope

The basis for this Draft IFR utilizes the findings and recommendations of the *Aliso Creek Watershed Management Study* (USACE 2002). The lower half of the watershed was identified in the 2002 study as having the most significant issues associated with riverine ecosystem degradation, infrastructure threat from streambank erosion, and surface water quality impairment. The watershed study did not identify flood risk management as warranted for Federal participation due to limited expected economic damages to property from potential flood events. While the watershed is heavily urbanized, most development is safely out of reach of the Aliso Creek floodplain.

Based on the results of the 2002 study, the current study focuses on:

- Analysis of environmental impacts of implementing riverine (aquatic and riparian) ecosystem restoration alternatives in the lower watershed, and recommendations for project implementation with Federal participation
- Reduction of streambank erosion threat to critical public wastewater infrastructure that would otherwise impair benefits resulting from an ecosystem restoration effort

Surface water quality improvement benefits as a consequence of the effects of an ecosystem restoration project will be addressed in this Draft IFR in a qualitative ancillary manner. Any potential adverse impacts to water quality resulting from implementation of the Proposed Project will be assessed. The Draft IFR will include a brief overview of water quality improvement activities either implemented or planned by local municipalities and water agencies.

At the non-Federal sponsor's request, estuarine restoration is not within the scope of this current study effort. A separate future study could be pursued if another sponsor is interested. The California Coastal Conservancy is currently funding a study led by the Laguna Ocean Foundation to evaluate the Aliso Creek estuary restoration. The estuary is identified as critical habitat for the tidewater goby, a Federally endangered species. The tidewater goby occurred historically at the mouth of Aliso Creek, but has not been observed in the area for over three decades. Aliso Creek is the only location between Newport Bay in Orange County and San Mateo Creek in San Diego County where the possibility exists to link protected freshwater (Aliso Creek estuary) and coastal marine ecosystems (see Figure 1.4-2 above).

Study consideration associated with the two main tributaries within the Wilderness Park, Wood Canyon Creek and Sulphur Creek, will be limited to that within the confluence areas only. Any potential restoration opportunities for small projects within Wood Canyon Creek, including the Mallard Marsh area, will be for future consideration by OCPW and other agencies. For Sulphur Creek, the Wilderness Park boundary is at Alicia Parkway to the east. Separate restoration efforts for Sulphur Creek were pursued jointly by the City of Laguna Niguel with the Corps completed utilizing the Corps' Continuing Authorities Program (CAP). Therefore, restoration efforts along this tributary, in association with this Draft IFR, would be limited to the short reach between Aliso Creek and the Alicia Parkway Bridge.

The current study does not include any aquatic habitat restoration measures on the Ranch at Laguna Beach property, as further described below. The Ranch has performed an invasive vegetation removal project along the creek in 2013 and continues maintenance. Ongoing entitlement negotiations for a proposed renovation of the site and City of Laguna Beach are expected to mandate perpetual control of invasive vegetation along the creek corridor (Laguna Canyon Foundation 2015).

1.6.2 Proposed Project Area

The establishment of the Proposed Project area was based upon input from OCPW, stakeholders, and the Corps, and is focused on the Wilderness Park area. The Aliso Creek riverine system within the Wilderness Park offers the greatest opportunities to increase habitat quality and connectivity. The upstream and downstream limits of the Aliso Creek mainstem are defined by a detention basin embankment crossing and a bridge crossing, respectively.

The Proposed Project area (Figure 1.6-1) encompasses about a five-mile stretch of Aliso Creek mainstem riverine system from the Pacific Park Drive area downstream to the SOCWA Coastal Treatment Plant (CTP) bridge, located about 1.2 miles upstream of the ocean outlet. The lower 3.6 miles of the Proposed Project area (downstream of AWMA Road Bridge) lies within a narrow coastal canyon that varies in width between approximately 400 and 1,400 feet; the upper 1.4 miles lies within the existing channel width where the channel has been modified for flood control purposes, but extends out to about a width of 200 feet where prior improvements have not occurred. The Proposed Project area includes approximately 700 feet of Wood Canyon Creek, and 600 feet of Sulphur Creek to Alicia Parkway, from their respective confluence with Aliso Creek. The trailhead area of the Wood Canyon Creek trail is also within the Proposed Project area. The Proposed Project area also includes adjacent areas to the riverine corridor for temporary staging areas, access routes and entry points to the site during construction, and permanent road access for operations and maintenance.

Within most of the Proposed Project area, Aliso Creek is a natural channel, except for a 3,000-foot engineered reach (natural bottom with riprap stone side slopes) approximately one mile downstream of Pacific Park Drive. Within this reach are two large concrete drop structures.

In addition to the Proposed Project area, there are opportunities for aquatic wildlife connectivity to an additional 3.5 miles upstream of Pacific Park Drive to the Interstate 5 (I-5). These reaches are within the jurisdiction of Orange County, the City of Laguna Woods, or the City of Aliso Viejo, local entities who are committed to stewardship roles to protect riverine resources.

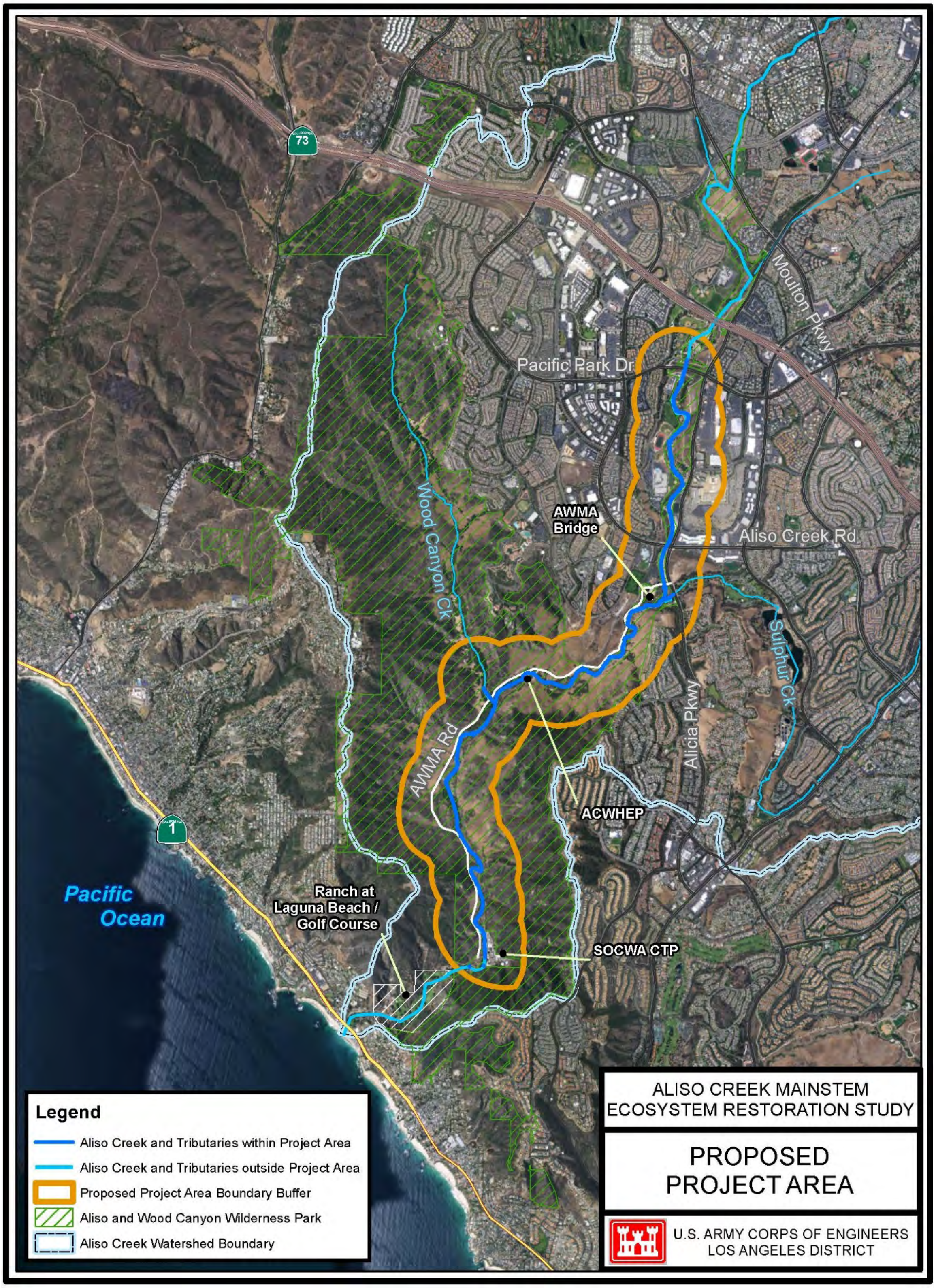

Figure 1.6-1 Proposed Project Area

The majority of the Proposed Project area lies within the Aliso and Wood Canyons Wilderness Park, which is owned, operated, and managed by the County of Orange. The Wilderness Park was dedicated to Orange County in 1979, created by the purchase of 40 land parcels. The Wilderness Park comprises a scarce, unique and biodiverse natural landscape, supporting many plant and wildlife species, including those listed as Federally threatened or endangered. Scarce biological resources, which are represented within the Wilderness Park, include riparian woodland/forest and freshwater marsh. Within the Wilderness Park, the 3.5-mile long Wood Canyon Creek tributary is a significant natural habitat. It includes a mixed array of vegetation type alliances, including dense live oak forest, live oak grassland, stands of willow, cottonwood, and sycamore riparian. Compared to Aliso Creek, Wood Canyon supports mostly upland vegetation communities and has a very narrow riparian zone.

The Wilderness Park has scenic, wildlife, ecologic, archeological, and paleontological resources, in addition to passive recreational opportunities. Conservation efforts by Orange County and others have helped to ensure that the open space remains undeveloped.

Within the Wilderness Park is a remnant structure from a former mitigation site of the Mission Viejo Company and Orange County, referred to as the Aliso Creek Wildlife Habitat Enhancement Project (ACWHEP). The ACWHEP, initiated in 1990, utilized a constructed headworks structure to divert Aliso Creek low flows through irrigation lines to downstream planted riparian terraces. The intent of the design was to abate incision directly downstream (approximately 10 feet at that time) and to improve riparian habitat along 4,000 feet of the historical Aliso Creek floodplain.

The ACWHEP structure is approximately 450 feet in width and is an armored earth fill embankment that straddles Aliso Creek approximately 3.3 miles upstream of the ocean outlet. As a result of severe storm damage in the winter of 1997-1998, major channel slope failures had ruptured the irrigation system. The ACWHEP no longer functions as intended and has accelerated erosion downstream, a trend that would have occurred regardless of the effects of upstream urbanization (i.e. from changes in sediment yield, runoff rates and volumes, and floodplain encroachment). Severe streambank and streambed erosion (current incision totaling about 25 feet) continues downstream of the structure, which now acts as a large drop structure.

The structure and its downstream flanks historically have had to be periodically protected by Orange County with the addition of grouted stone to prevent a loss in structural integrity and failure. Failure of the structure and the resulting headcut moving upstream would jeopardize existing upstream infrastructure along Aliso Creek. This includes abutments at numerous bridge locations, underground utilities, and the Alicia Parkway embankment.

A public utility, the SOCWA is situated in Aliso Canyon within an isolated parcel surrounded by the Wilderness Park. The facility, in operation since 1950 and upgraded beginning in 1967, is located on the east side of Aliso Creek and is approximately 1.2

miles upstream from the Pacific Ocean. The wastewater treatment plant has a design capacity of 6.7 million gallons per day and serves a regional population of more than 40,000 (Brian Peck, personal communication, 2016). The facility is accessible by way of the SOCWA CTP Bridge via AWMA Road which parallels Aliso Creek to the west through the Wilderness Park. Orange County Parks Department (OC Parks) staff and park visitors (pedestrian and cyclists) share AWMA Road, which also provides access to the Wood Canyon trailhead near the confluence with Wood Canyon Creek. SOCWA also uses an unimproved (dirt) service road on the east side of Aliso Creek between the CTP and Alicia Parkway to the northeast (SOCWA 2013) for access to pipeline manholes. This service road is also open to hikers and other recreationists, and is referred to by the OC Parks as Aliso Creek Trail East.

The SOCWA CTP facility is a conventional sludge plant that receives raw wastewater from the City of Laguna Beach, Emerald Bay Service District, South Coast District, and Moulton Niguel Water District. The wastewater is processed at the facility through secondary treatment. The clear, treated effluent is either recycled or discharged into an ocean outfall transmission main that parallels Aliso Creek. Wastewater conveyance pipelines run parallel to the east side of Aliso Creek, including a 36- to 39-inch effluent transmission main operated by SOCWA for conveyance of treated wastewater to its ocean outfall, an 18-inch interceptor sewer transmission line operated by Mouton Niguel Water District for conveyance of untreated wastewater to the downstream coastal plant, and two 4-inch force mains operated by SOCWA for conveying sludge upstream from the CTP to the inland regional treatment plant to the east above Sulphur Creek Reservoir. Various manholes, pipeline appurtenances, and maintenance access are associated with these pipelines. Pipeline setback distances from the creek vary from a few feet to 300 feet.

1.6.3 Reaches Downstream of Proposed Project Area

Downstream of the SOCWA CTP Bridge and the Wilderness Park boundary is the privately-owned Ranch at Laguna Beach/Ben Brown's Golf Course (formally the Aliso Creek Inn and Golf Course), located at the Aliso Canyon mouth. The land was once owned by an early homesteader in Aliso Canyon, George Thurston. The riverine corridor in this segment is generally open water with freshwater marsh and some black willow riparian habitat. Some segments of Aliso Creek are protected with riprap stone. Further downstream, the channel side slopes are concrete lined.

The lowermost reach of Aliso Creek near its point of discharge into the Pacific Ocean is an engineered earthen channel and supports an estuary system that transitions from a freshwater to a brackish to a marine environment. There are no real salt marsh characteristics associated with the estuary. On the inland side of Pacific Coast Highway (PCH), former habitat associated with the estuary and creek system has been constrained and encroached upon by development. A beach overflow parking lot and recreational area is owned and operated by OC Parks.

The estuary is protected from tidal action by a sand bar, which forms during seasons of low creek flow. The sand bar is breached with high flows and wave action, or by Orange County maintenance intervention, but is eventually reestablished by sediment washing down the creek and by littoral transport action. Permitted breaching actions of the sand bar are performed on occasion by Orange County when stagnant water of poor quality at the estuary poses a health and safety risk to the beach public or to nearby private residents.

1.7 PUBLIC COORDINATION

Throughout the reconnaissance and feasibility phases of this study, as well as the early Watershed Management Study effort, public and agency input have been identified through a series of meetings and oral and written correspondence. The development of the study problems and opportunities are a direct result of the public and agency concerns.

Agencies and groups that have provided input in the study process are listed in Table 1.7-1. Private individuals have also offered input.

Full public comments received from the initial scoping meeting in 2009 for this Draft IFR effort are contained in Appendix B-1. The concerns of the general public, resource agencies, and local agencies used to develop the problems and opportunities are summarized below. The summarized comments below are described, as presented to the Corps, and would not necessarily be within the study scope or authority.

- <u>Cultural Resources</u> – Prehistoric archeological sites are located within a quarter mile of Aliso Creek, some of which are in very close proximity to or along the creek. The preference would be for the resources to be preserved in place and left undisturbed. Some of the sites meet the criteria for listing on the National Register of Historic Places. The Aliso Creek Bridge spanning PCH is considered a historical feature and is located in the study area.
- <u>Habitat and Endangered Species</u> – Much of the Proposed Project area is located within the Aliso and Wood Canyons Wilderness Park. These precious habitat and wildlife resources, including endangered species must be protected from impacts from urbanization. Species associated with the Aliso Beach environment should also be considered.
- <u>Degradation from Urban Runoff</u> – Over-urbanization has been greatly responsible for ecosystem degradation of the Aliso Creek watershed, especially in the highly impacted lower portion, from the effects of increased stormwater and dry weather runoff and associated urban pollutants.
- <u>Flooding and Infrastructure Damage</u> – Flooding damages have resulted to structures on lands prone to flooding from Aliso Creek. The extent of development in the watershed has contributed to larger flood flows. Erosion and undermining from large flows have damaged infrastructure.

Table 1.7-1 Public Involvement

Federal Agencies	State Agencies
▪ USACE Engineer Research and Development Center ▪ U.S. Fish and Wildlife Service ▪ U.S Geological Survey- Western Ecological Research Center	▪ California Coastal Conservancy ▪ California Department of Fish and Wildlife ▪ California State Water Resources Control Board ▪ Department of Toxic Substances Control
County of Orange Agencies	**City Governments**
▪ County Board of Supervisors ▪ County Executive Office ▪ OC Public Works ▪ OC Parks	▪ Aliso Viejo ▪ Laguna Beach ▪ Laguna Niguel ▪ Laguna Woods ▪ Laguna City Council ▪ Laguna Hills ▪ Lake Forest ▪ Mission Viejo
Local Committees/Groups	**Water Districts**
▪ California Cultural Resources Preservation Alliance ▪ Clean Water Now! Coalition ▪ Friends of Harbors, Beaches, and Parks ▪ Sierra Club ▪ Friends of the Aliso Creek Steelhead ▪ Laguna Greenbelt ▪ Laguna Ocean Foundation ▪ National Audubon Society, Laguna Hills Chapter ▪ Nature Reserve of Orange County ▪ Orange County Coastkeeper ▪ Permaculture Institute of Southern California ▪ Philip Williams & Associates ▪ Santa Ana College, History Department ▪ South Laguna Civic Association ▪ Surfrider Foundation ▪ Village Laguna Board	▪ Moulton Niguel Water District ▪ South Coast Water District ▪ South Orange County Wastewater Authority

- Invasive Species – Invasive non-native species are decreasing the habitat value in the watershed. A long-term invasive control plan and funding source should be identified as part of a potential project.
- Poor Surface Water Quality – Aliso Creek is on the Clean Water Act (CWA), Section 303(d) list of impaired water bodies for coliform bacteria, phosphorus, and toxicity. Threat to public health is a concern. Aliso Beach has been impacted (including closures) due to contamination from broken sewage pipes, urban runoff, and stagnation of creek water. Adverse impacts to ocean ecosystems should be addressed.
- Fish Passage – Existing fish passage should be analyzed, and fish passage standards from the California Salmonid Stream Habitat Restoration Manual should be integrated in alternatives formulation.
- Compensatory Habitat Mitigation Sites – Past sites within the study area should be identified and any direct impacts from a proposed project and regulatory implications need to be disclosed and addressed.
- Estuarine Restoration – Assess potential restoration of estuarine area, including natural functioning of sand bar, to historic ecological conditions. Due to the complex

nature of the estuarine regime and multiple land owners, some stakeholders stated that any potential estuarine planning process and project should be separate from any restoration efforts on the mainstem creek.

- ACWHEP Structure – Address opportunities to remove the ACWHEP structure or to replace it with a structure that is more stable and esthetically consistent with the Wilderness Park.
- Utilities and Access Roads – As the existing wastewater utilities are on the east side of the creek, limiting SOCWA access to only the east side of the creek should be evaluated. Also evaluate alternatives to relocate utilities and service road away from the creek. Comments were also received to consider eliminating SOCWA utility pipelines from Aliso Canyon.
- SUPER Project – The SUPER (Stabilization, Utility Protection, and Environmental Restoration) project is a conceptual plan developed by the County of Orange and water/wastewater agencies. The plan conceives of integrating components of stream stabilization with grade control structures, water quality treatment upstream of PCH of dry weather flows and beneficial reuse, utility protection, and ecosystem restoration. Public comments received specifically mentioning the SUPER Project were, in general, opposition. Prevalent arguments against the SUPER project are lack of instream water quality benefits upstream, end-of-pipe treatment plant near the mouth of Aliso Creek, and need for large quantity of drop structures for stream stabilization within the Proposed Project area without addressing potential reduction of runoff flow frequency, duration, and volume from upstream development.
- Control of Urban Stormwater and Dry Weather Discharges – Altered hydrology from upstream cities in the watershed, combined with pollutant sources that accompany urbanization, lead to water quality, stream channel, and habitat degradation. The ecosystem restoration project should work in conjunction with the implementation of a proposed Municipal Separate Storm Sewer System (MS4) Permit program that addresses pollution prevention, upstream source control, and treatment-control Best Management Practices (BMPs).
- Detention/Retention Basins – Investigate on and offline detention/retention basin opportunities to address reduction of stormwater and dry weather discharges. Include consideration to the Dairy Fork confluence area in the vicinity of Moulton Parkway.
- Treatment Wetlands/Biofiltration – Investigate water quality improvements for dry weather flows at storm drain outlets to creek through creation of wetlands/biofiltration projects. Evaluate effectiveness of recent water quality enhancement projects conducted by the County.
- Diversion of Runoff Flows Underground or for Treatment/Reuse –Consider aquifer replenishment to augment local supply, and treatment for reuse. Local treatment plants would require upgrading, however. Opinions regarding resale of reclaimed water were often not favorable. Also consider large scale cistern strategies. Offline creek flow diversion to the Chet Holifield Federal Building parking lot was mentioned for cistern catchment and percolation; geotechnical considerations would need to be addressed.
- Oxbow Reconnection – Investigate opportunities to reconnect abandoned oxbow features to the active channel and/or floodplain to increase habitat function.
- Mallard Marsh – This is a small, well-established marsh in Wood Canyon Creek, one

of very limited marsh habitat sites in Orange County. Address opportunities to expand size, reconnect flow regime, and utilize urban flows as a water source. The proposed project area should be extended upstream of the confluence area to include this marsh in the restoration effort.

- Ocean Ecosystem Degradation – Assess impacts of poor water quality associated with Aliso Creek stormwater plume to ocean natural resources, and recommend alternatives for rehabilitation of lost coastal habitat, such as kelp reforestation, and reintroduction of lost species.
- Sand Source Depletion for Coastal Sand Replenishment – Sand delivery capacity from Aliso Creek must not be compromised, and any creek restoration alternatives must allow for an equilibrium for coastal replenishment to persist.
- Levels of Intervention for Creek Restoration Alternatives – A wide range of approaches were recommended for analysis ranging from minimal or no intervention and non-structural approaches to restoration to meet the historic floodplain. Points that were also made included: minimization or no manmade structures, a self-sustaining and natural system; low maintenance requirements; consideration to changes in future hydrology; stability of manmade structure issues; and use of biotechnical approaches to streambank stabilization.
- Creek Reach through Golf Course –The feasibility study should not exclude the reach of Aliso Creek through the Ranch at Laguna Beach property from restoration recommendations, especially its interrelationship with the estuary and coastal area.
- Climate Change and Sea Level Rise – Effects of sea level rise and impacts to the study area need to be evaluated, especially in terms of sediment supply needs to the coastal regime.
- Loss of Recreational Experience – The esthetic natural beauty of the Wilderness Park has been impaired by degradation issues and storm damage caused by the creek. Poor water quality impacts the recreational experience at Aliso Beach.

1.8 PROBLEMS AND OPPORTUNITIES

Problem statements were developed for this Draft IFR in response to public, non-Federal sponsor, resource agency, and other stakeholder concerns, as noted above. Several public concerns, including the need for the Federal project to include estuarine restoration, address adverse impacts to ocean ecosystems from Aliso Creek impaired water quality, development of treatment wetlands at storm drain outlets, restoration of Mallard Marsh associated with Wood Canyon Creek subwatershed, and restoration of the creek reach within the Ranch at Laguna Beach property, were considered in the baseline inventory and forecast, but were deemed beyond the scope of this study. The following problem and opportunity statements were developed.

1.8.1 Problems

Upstream urbanization has caused changes in sediment yield, runoff rates and volumes, channel straightening, floodplain encroachment, and has introduced non-native plant species, which in turn is causing downstream channel incision, streambank instability, and spreading of non-native plant species. The changes have led to:

- Severing of most of the stream's hydrologic connection (i.e. lateral connectivity) to the floodplain, loss of floodplain function, including aquifer recharge through floodwater infiltration, and abatement of floodwater energies. Diminished access of streamflow overbanking across the floodplain, and the lowering of groundwater levels in the floodplain result in a decline of riparian and floodplain habitat biodiversity, and shrinking of its areal extent, culminating in habitat type conversion. Within the incised channel, restricted and narrowed riparian and aquatic habitat is subject to confined high flows during large storm events, resulting in the increased likelihood of plant community, habitat and aquatic wildlife destabilization and loss.
- Faster growing invasive riparian plant species (especially giant reed or *Arundo donax*) have outcompeted native riparian species under the current unstable channel regime, thereby limiting native plant species diversity and reducing wildlife habitat conditions for foraging, breeding, and cover/resting.
- Loss in stream sinuosity as higher flows overcome stream meanders resulting in simplification of channel pattern complexity, and associated loss of slow water habitats, refugia, and biodiversity.
- Manmade alterations (two large concrete drop structures upstream of AWMA Road Bridge and the ACWHEP structure) have eliminated longitudinal connectivity, creating barriers (up to 25 feet) for aquatic wildlife movement and dispersal along the lower Aliso Creek mainstem and the Wood Canyon Creek tributary. This is promoting habitat fragmentation, reducing vegetation structure complexity and function, isolating and impairing the genetic variability to aquatic resources, such as amphibians, and diminishing aquatic habitat value.
- A significant threat to public wastewater infrastructure and to public health and safety should pipeline rupture occur, with impacts to the environment and to the local economy, which relies heavily on the recreational use and high esthetic value of the coastal region. Channel instability also threatens a major regional water supply transmission line immediately downstream of Pacific Park Drive. The Joint Regional Water Supply System (JRWSS), owned by the public utility South Coast Water District, provides a primary source of drinking water for more than 200,000 residents in southern Orange County communities. Two locations of the Joint Transmission Main (JTM), one in parallel, and one crossing under the creek, are threatened.
- The ongoing channel, habitat, and water quality degradation of the creek system within the Wilderness Park has devalued the passive recreational experience in the lower Aliso Creek watershed. Furthermore, passive recreational experience is currently compromised by the current sharing of AWMA Road (west access road) by SOCWA operations, OC Parks, and as a recreation trail (cyclists and pedestrian).

1.8.2 Opportunities

- The ability to improve habitat quality and connectivity in the Aliso Creek watershed provides a rare opportunity to preserve a functional wildland habitat despite stressors from urban development.
- Restore floodplain connection in lower Aliso Creek to allow overbanking of flows to the historic floodplain, promote flood flow infiltration (aquifer recharge), abatement of floodwater energy, and restore stable channel and geomorphic regime.

- Reestablish appropriate native vegetation types within the riverine and floodplain system of the lower watershed.
- Improve altered flow regime (i.e. frequency, duration, and volume), channel stability and sinuosity in the lower Aliso Creek watershed.
- Reestablish aquatic habitat connectivity within the lower Aliso Creek mainstem system, including Wood Canyon tributary.
- Support ecosystem benefits and public health and safety by reducing threat to regional wastewater and water supply utilities.
- Provide ancillary improvement, as an output of ecosystem restoration, to stream water quality impaired by non-point sources.
- Increase the passive recreational experience by improving the esthetic quality of the riverine habitat consistent with the surrounding natural setting providing for environmental education.

1.9 OBJECTIVES AND CONSTRAINTS

1.9.1 National Objectives

The Corps is authorized to carry out civil works water resources projects for flood risk management, ecosystem restoration, and water supply, as well as navigation, storm damage prevention, and hydroelectric power. Planning for Federal water resources projects constructed by the Corps is based on the *Economic and Environmental Principles and Guidelines for Water and Land Related Resources Implementation Studies* adopted by the Water Resources Council (U.S. Water Resources Council 1983). These principles and guidelines represent the “rules” that govern how Federal agencies evaluate proposed water resource development projects. They state that the primary Federal objective of water and related land resources project planning is to contribute to National Economic Development (NED) consistent with protecting the nation’s environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. Ecosystem restoration is one of the primary missions of the Corps’ Civil Works program. The Corps’ objective in ecosystem restoration planning is to contribute to National Ecosystem Restoration (NER). Contributions to NER outputs are increases in the net quantity and/or quality of desired ecosystem resources.

Assessing potential contributions to NER is based upon a system developed by the Corps for measuring changes in ecological resource quality as a function of improvement in habitat quality or quantity which are expressed quantitatively in physical units or indices (non-monetary units). Contributions to NED, on the other hand, typically apply to projects such as flood risk management or streambank erosion protection that result in increases in the net value of the national output of goods and services, expressed in monetary units.

This Draft IFR is charged with determining the Federal interest in ecosystem restoration opportunities within lower Aliso Creek and how these opportunities can help meet the Corps’ mission and the Federal objective. The Corps will develop a NER plan composed of ecosystem restoration measures that reasonably maximize ecosystem benefits compared to costs. Accrued NED benefits associated with streambank erosion reduction as a result of the proposed project will be considered to be incidental. Regional Economic Development (RED) benefits and Other Social Effects (OSE) will also be assessed as part of plan selection.

1.9.2 Specific Planning Objectives

The national objectives are general statements and not specific enough for direct use in plan formulation. The water and related land resource problems and opportunities identified in this study lead to specific planning objectives that provide focus for the formulation of alternatives. These planning objectives address the problems and opportunities and represent desired positive changes.

The objectives were refined throughout the formulation process, resulting in the following study objectives for the five-mile reach of the Aliso Creek extending from Pacific Park Drive to the SOCWA CTP Bridge, including the confluence areas of Wood Canyon Creek and Sulphur Creek:

- Improve the degraded aquatic and riparian habitat ecosystem function and structure, including the mosaic and heterogeneity of vegetation types, to increase plant and animal biodiversity for the Aliso Creek mainstem and tributary confluences within the Aliso and Wood Canyons Wilderness Park throughout the period of analysis[1]. In particular, promote instream connectivity (i.e. longitudinal, lateral, and vertical) to facilitate the reproductive viability of aquatic species.
- Improve the hydrologic and hydraulic regime to increase floodplain function and channel stability for the Aliso Creek system within the Aliso and Woods Canyon Wilderness Park throughout the period of analysis.
- Enhance the passive recreational experience that is compatible with the Proposed Project within the Aliso and Wood Canyons Wilderness Park throughout the period of analysis.

1.9.3 Planning Constraints

Planning constraints restrict plan formulation and are specific elements that alternative plans should avoid.

- Avoid adverse impacts to designated critical habitat for the threatened tidewater goby.
- Avoid destabilization of existing historical landslide masses or other potential unstable slopes in the proposed project area.

[1] The period of analysis is the period of time adopted in the economic evaluation to assess beneficial and adverse effects for each project alternative. The period of analysis is 50 years. (ER 1105-2-100)

1.9.4 Planning Considerations

Planning considerations are the overarching guidelines used to inform the development of, assess, and screen alternatives. There are several considerations specific to the study area.

- No increases in flood and erosion risk damages to facilities and infrastructure as a result of a Federal project. This includes the ocean outfall section within the golf course property.
- Avoid or minimize impacts where possible to archeological resources in the project area.
- Avoid increase in manmade structures with visible construction elements (such as concrete) that would not be esthetically consistent with the natural setting of the Wilderness Park.
- Based on public input, assess options to improve the current operating use of the access roads within the Wilderness Park.

1.10 PRIOR REPORTS AND EXISTING WATER PROJECTS

Following is a list of prior studies and existing water projects associated with the Corps and local agencies affecting the study area, and were used to inform this Draft IFR and identify any associated commitments.

1.10.1 Corps

Floodplain Information, Aliso Creek, Orange County, California (1973). History of past flooding in the area; identifies areas subject to possible future floods. Furnishes basis for land use controls to guide floodplain development.

San Juan and Aliso Creeks Watershed Management Study, Reconnaissance Report (1997). Identified Federal interest in conducting feasibility-level watershed management studies for the Aliso Creek watershed and San Juan Creek Watershed

Aliso Creek Watershed Management Study and Plan (2002). Completed in conjunction with the County of Orange, and coordination with various municipalities, water districts, and numerous other stakeholders, this comprehensive study performed a general review of existing conditions, and identified problems and opportunities within the watershed as a whole. The watershed management plan identified feasibility studies to pursue under specific Corps project authorization programs tailored for the size and complexity of a potential project. It also provided technical analysis including hydrologic, hydraulic, and sediment transport studies and preliminary design recommendations for potential ecosystem restoration pursuits. The largest and most complex element recommended by the study would be the ecosystem restoration objectives for the lower Aliso Creek Mainstem, suitable for a General Investigations consideration. Additionally, four studies under the CAP were identified. The SOCWA Coastal Treatment Plant Bridge Emergency Streambank Protection Section 14 and Sulphur Creek Section 206 have been constructed as of 2009. The non-Federal sponsors for these projects were SOCWA and the City of Laguna Niguel, respectively. Wood Canyon Creek and English Canyon Creek Section 206 Aquatic Ecosystem Restoration studies produced draft integrated Detailed Project Reports, but were later suspended by request of their non-Federal sponsors, OCPW and the City of Mission Viejo, respectively.

Coast of California, Storm and Tidal Waves Study (2002). State of the Coast Report for the South Coast Region, Orange County. This report evaluates prevailing coastal processes that initiate or propagate coastal changes with the objective of providing a database to improve planning, design, and management in the coastal zone.

SOCWA Coastal Treatment Plant Bridge Emergency Streambank Protection (2006). This study was completed under the Corps' CAP Section 14 and constructed in 2009 in partnership with SOCWA. The project protects the bridge foundation from scour and includes a grade control structure with a low flow channel to facilitate aquatic species passage.

Sulphur Creek Aquatic Ecosystem Restoration (2007). This study was completed under the Corps' CAP Section 206. The project reestablishes a natural and diverse riparian floodplain. The Sulphur Creek Section 206 project was constructed in 2009 in partnership with the City of Laguna Niguel.

1.10.2 Local Agencies

Agreement Regarding the Aliso Creek Wildlife Habitat Enhancement Project (including Statement of Clarification) (1989). Signatory document covering implementation and responsibilities of participating entities for the ACWHEP mitigation site.

South Orange County Integrated Regional Water Management (IRWM) Plan (2006). The IRWM Plan focused primarily on the projects and plans of the member agencies, with an emphasis on water supply and water quality. It identified potential projects to improve water quality and water supply; provided recommendations to review feasibility of the potential projects; and engaged in long range water planning, including establishing priorities among various proposals and identifying potential funding sources to implement the projects. Potential projects identified for Aliso Creek include protecting the existing utilities along the creek, invasive species removal, and a storm drain bacterial mitigation program to reduce bacterial loading and improve water quality.

Aliso Creek Concept Plan Report (2007). This is a conceptual plan developed by the County of Orange and water/wastewater agencies to provide a potential solution addressing stream stability and water quality improvements, protection of infrastructure, and restoration of degraded habitat. A significant part of the plan would focus on the segment of Aliso Creek passing through the Wilderness Park. This effort has been identified as the Aliso SUPER project. The stream stabilization and ecosystem restoration components were based on a solution assessed in the 2002 Watershed Management

Study. The concept plan also considers a surface water treatment facility near the mouth of Aliso Creek to improve the quality of dry weather flow draining to the ocean.

Final Resource Management Plan (RMP) – Aliso and Wood Canyons Wilderness Park (2009). The RMP, prepared by OC Parks, provides a comprehensive, long-term management plan for the Aliso and Wood Canyons Wilderness Park. The fundamental objective for the RMP is to identify the best way to manage, protect, and enhance the natural resource values of the Wilderness Park while balancing the needs of the local community for safe recreational and education opportunities. Major plan objectives include enhancement of wildlife habitats, development of vegetation management practices, and availability of recreational opportunities and public access that have minimal impacts on resources.

OC Parks, Mitigation Matrix, Sites within the Orange County Central/Coastal NCCP Reserve (2009). Describes project name, mitigation locations, restoration effort, performance standards, and status.

Orange County Transportation Authority (OCTA) Measure M – Aliso Creek, Draft Habitat Mitigation and Monitoring Plan (2015). Describes proposed implementation for compensatory mitigation by OCTA for Aliso Creek in Aliso Viejo area for countywide transportation improvements as part of Measure M2 Program.

1.11 REPORT ORGANIZATION

The content for this Draft IFR was established based on Corps guidelines, professional judgment, CEQA Guidelines, and Corps standard NEPA practices. Chapters noted below by an asterisk (*) are compliant with and required by the Council on Environmental Quality's Regulations for Implementing the NEPA. Detailed technical and background information are provided in the appendices.

An overview of the contents and purpose of each section is provided below:

<u>Chapter 1* – Introduction</u>: Describes lead agencies, guiding regulations, study authority, statement of purpose and need, proposed project area and scope, study participants and coordination. Identifies problems and opportunities, project objectives and planning constraints, prior reports, and report organization.

<u>Chapter 2* – Affected Environment</u>: Describes the existing, potentially affected environment in the Aliso Creek proposed project area.

<u>Chapter 3* – Plan Formulation</u>: Identifies a range of potential management measures that address specific problems identified in Chapter 1; develops screening evaluation; the basis (strategies) and considerations driving the development of alternative plans; associated screening; and establishment of focused alternative plans that adequately address the objectives established. Describes the evaluation process leading to the final

array of alternatives, summary comparison of impacts of the alternatives, and the identification of a tentatively selected plan that best meets the study objectives.

Chapter 4 – Tentatively Selected Plan: Describes the recommended alternative project. Includes costs, project-specific considerations, design and construction, and project implementation strategy.

Chapter 5* – Environmental Consequences: Discloses the potential environmental impacts of implementing each of the alternatives in the final array. Identifies applicable environmental commitments to avoid or minimize impacts. If applicable, mitigation needs would be addressed.

Chapter 6* – Coordination, Consultation, and Compliance: Describes compliance with appropriate laws, regulations and other requirements; and includes a description of public and agency involvement.

Chapter 7 – Recommendation: Identifies the tentatively selected plan and next steps leading to the final feasibility report.
Chapter 8* – List of Preparers

Chapter 9 – References

Chapter 10* – Acronyms and Glossary

Chapter 11* – Index

Appendices: There are four appendices with more detailed technical information.

Appendix A: Engineering
Appendix B: Environmental
Appendix C: Economics
Appendix D: Real Estate

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CHAPTER 2 AFFECTED ENVIRONMENT*

2.1 INTRODUCTION

This chapter describes the existing natural and human environment in which the proposed Aliso Creek Mainstem Ecosystem Restoration Project (Proposed Project) would be implemented within and adjacent to the Aliso and Wood Canyons Wilderness Park (Wilderness Park). The study area is essentially the Aliso Creek watershed, and includes areas either adjacent to the Wilderness Park or in its vicinity that could be impacted by the Proposed Project. This chapter provides the existing conditions (baseline) in the Aliso Creek watershed and the basis for plan formulation in Chapter 3. The topics in this chapter mirror the topics in Chapter 5, Environmental Consequences, where the forecast of the “future without-project” conditions (No Action Alternative) and “future with-project” conditions are described.

2.1.1 Historic Conditions

Aliso (Spanish for “Alder”) Creek was the name given to the creek by Spanish explorers in the 18th century. These early occupants lived in small villages and gathered fruits, acorns, and wild grains; hunted wild game; and harvested limited crops for food. They utilized fire to clear brush and control vegetation but, overall, had little dramatic effect on the landscape compared to the natural forces (wildfires, floods, etc.) that periodically caused disturbances.

The establishment of the Spanish missions and subsequent concentration of European and indigenous populations led to two practices that changed the natural environment. The first was the cutting of timber for use as a building material, a fuel source, and for the construction of other products including boats and furniture. The second was the introduction of large herds of grazing livestock, which tended to thin or even denude areas of natural vegetation and permitted the establishment of non-native species. Together, these activities slowly began to upset the natural equilibrium of the watershed.

With the opening of the northern California gold mines in 1849, cattle became an important commodity on the west coast and ever larger herds grazed on the fertile coastal valleys of southern California. The rugged and steep upper reaches of the watersheds proved inaccessible to livestock (and humans) remaining largely unaffected. The lower sloped foothills and floodplains, however, were affected by the removal of native vegetation, replacement of native grasses by non-native species, loss of tree cover, alteration of local hydrology, and erosion.

Towards the end of the 19th century, local landowners began moving away from cattle ranching towards agriculture and sheep grazing as a more sustainable and profitable enterprise. Aliso Canyon was used for sheep ranching through the first half of the 20th century. Walnuts, wheat, truck crops, oranges, beets, avocados, and others were all grown at some point.

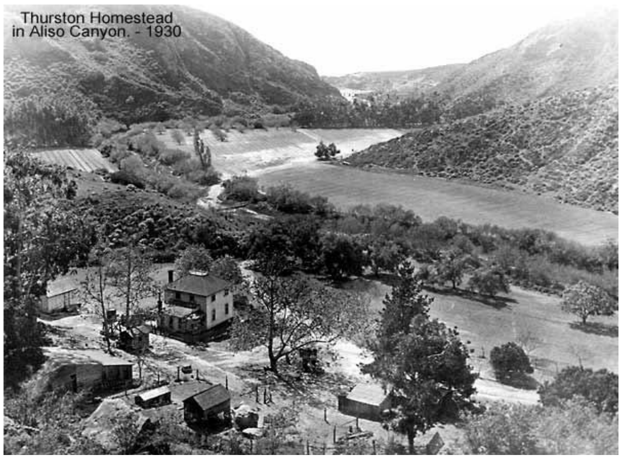


Photo 2.1-1 George Thurston and his family arrived in 1872 in Aliso Canyon from Utah to farm what is now the Ranch at Laguna.

Photo 2.1-2 An early photograph of Aliso Creek (circa 1902) shows the full range of habitat types were present along the Creek with mature canyon and floodplain forests, chaparral-covered mountain slopes, sage-covered hillsides, and dense riparian thickets along the Creek and tributaries.

In the 1960s, when large-scale urbanization came to southern Orange County, a drastic loss of watershed stability occurred and the natural biological systems were no longer able to recover. Noticeable changes include narrowing of the floodplain away from the slopes of the canyons and an increase in scouring and erosion, which has channelized and incised Aliso Creek and deepened both surface and groundwater (OC Parks 2009).

The pattern of urbanization in Orange County has generally been, with some exceptions, a constant movement south and east originating from the northern coastal communities. This progression left the Aliso Creek watershed, relatively free of intense development until the late 1960s. In the 1970s, a land use management plan was developed for the Aliso Creek watershed, which attempted to define policies and broad guidelines that could serve as prototypes for measuring and planning future land use decisions in the unincorporated territories. In the 1960s, when large-scale urbanization came to southern Orange County, a drastic loss of watershed stability occurred and the natural biological systems were no longer able to recover. The plan recognized the importance of the creek as a functional component of the watershed and sought to protect and preserve the corridor as a valuable resource while acknowledging the inevitable development in the area (Orange County 2003).

Urbanization continued at a high rate through the next decade, including a number of modifications and flood control improvements to Aliso Creek. During this same time, the County managed to obtain a significant greenway component along the creek. The cornerstone of this is the Wilderness Park from Moulton Parkway, downstream to the Aliso Creek Inn (now the Ranch at Laguna) near PCH. Upstream of Moulton Parkway the Creek is designated as greenway to approximately the Foothills Transportation Corridor. Further upstream Aliso Creek enters Limestone-Whiting Wilderness Park, another component of the County's Regional Park system. Add to this the protected headwaters within Cleveland National Forest and the inclusion of large portions of Wood Canyon and Sulphur Creek as regional parks, and a significant amount of the Aliso Creek system is managed, to some degree, for the benefit of the ecological system.

Photo 2.1-3 Overview of Aliso and Wood Canyons Wilderness Park. The creek meanders through a narrow coastal canyon, typical in southern California.

Photo 2.1-4 The ACHWEP is a grade control and overflow structure in the Wilderness Park designed to slow water upsteram of the structure.

Photo 2.1-5 Intense stormwater flowing over ACWHEP in 2010.

Photo 2.1-6 Soft-bottomed creek within the Wilderness Park

Photo 2.1-7 Trail/Maintenance roads on either side of the creek run parallel to the incised creek.

2.1.2 Study Reaches

Seventeen study reaches were delineated along Aliso Creek for this Draft IFR (Figure 2.1-1 and Figure 2.1-2). The goal of the delineations was to establish reaches, each with similar hydraulics within itself, that adequately represent the geomorphic conditions along the creek. Channel slope, existing hydraulic and bed controls, geologic features, sediment supply, and hydraulic parameters were considered. General features for each reach are presented below. Some reaches were divided into sub-reaches to further differentiate localized geomorphic conditions or boundaries of the Wilderness Park. The Proposed Project area begins in Reach 4 and ends just upstream of the Reach 12 delineation. Reaches 13 to 17B are reaches outside of the Proposed Project area that provide opportunities for aquatic wildlife connectivity and are under the jurisdiction of local entities committed to stewardship roles to protect riverine resources.

Reach 1: Pacific Ocean Outlet to the First Pedestrian Bridge of the Golf Course at the Ranch at Laguna

Reach 1 extends from the Pacific Ocean outlet to the first pedestrian bridge of the golf course at the Ranch at Laguna Beach property. Due to the outlet collecting littoral sediment drift and from tidal influence, the bridge crossing at the PCH was used as a downstream boundary for modeling purposes. Above the PCH Bridge, the reach is an improved earthen channel 1,570 feet long with concrete side slopes through the Ranch at Laguna Beach. The overall slope is 0.12 percent (0.0012 feet/feet), and the bottom width varies from 25 to 65 feet. Bank heights range from approximately 10 to 15 feet. The east overbank is occupied by a county parking lot, and the west overbank includes the access road to the privately-owned Ranch at Laguna Beach and some maintenance buildings for the South Coast Water District. Manmade and geologic constraints limit the ability of the channel to self-adjust in this reach.

Reach 2: 2,620 feet of Channel through the Golf Course

Reach 2 encompasses 2,620 feet of channel through the golf course property, which includes some riprap-protected banks. The main channel is at a 0.35 percent slope, 10 to 50 feet wide, shallow and sandy, and includes some exposed gravel bars. Bank heights range from 10 to 15 feet. Several pedestrian golf course bridges span this reach. Both overbanks are broad and flat and are occupied by the golf course. Manmade constraints and channelization through this reach limit the ability of the channel to self-adjust.

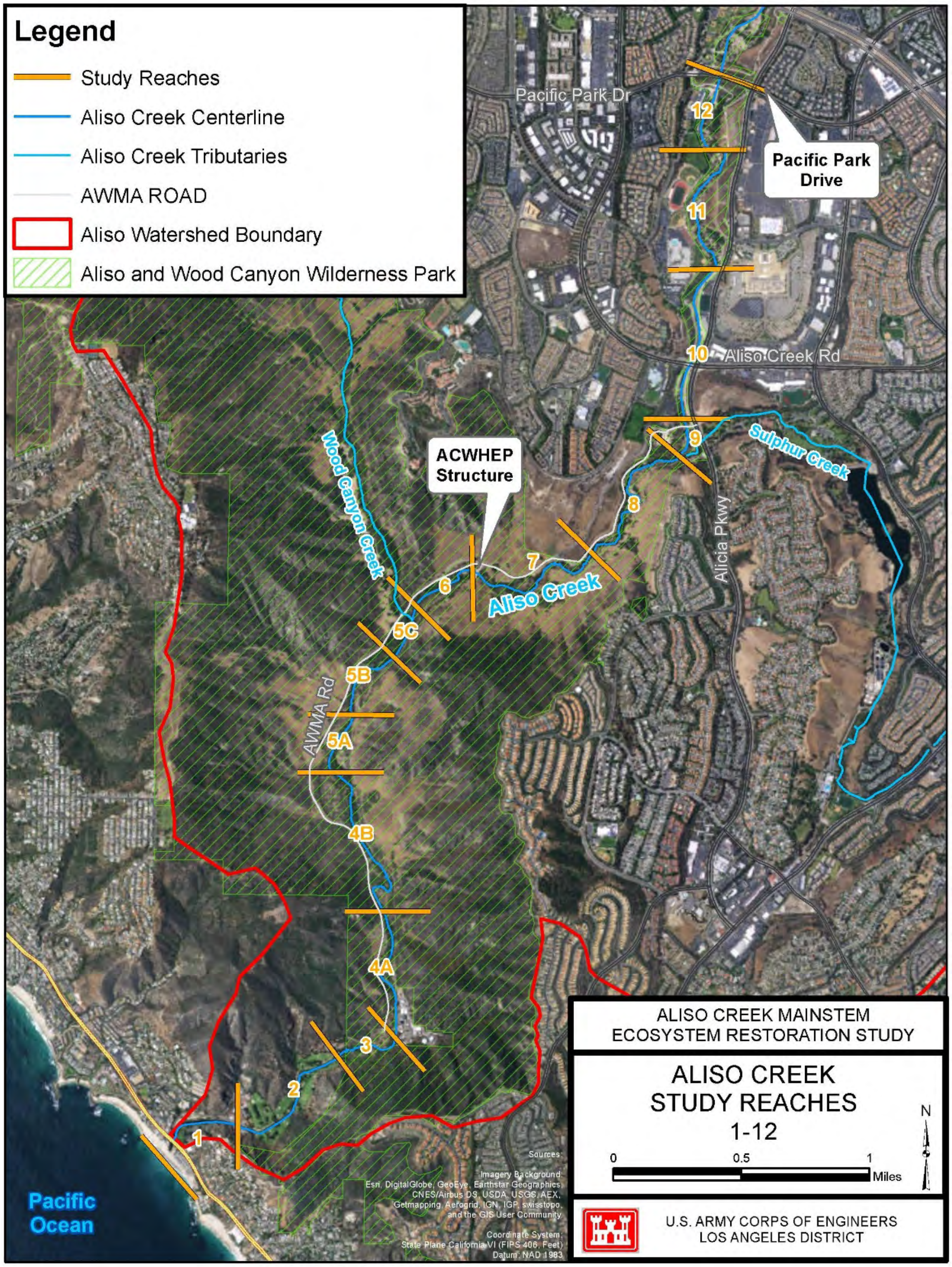


Figure 2.1-1 Lower Aliso Creek Reaches 1 through 12

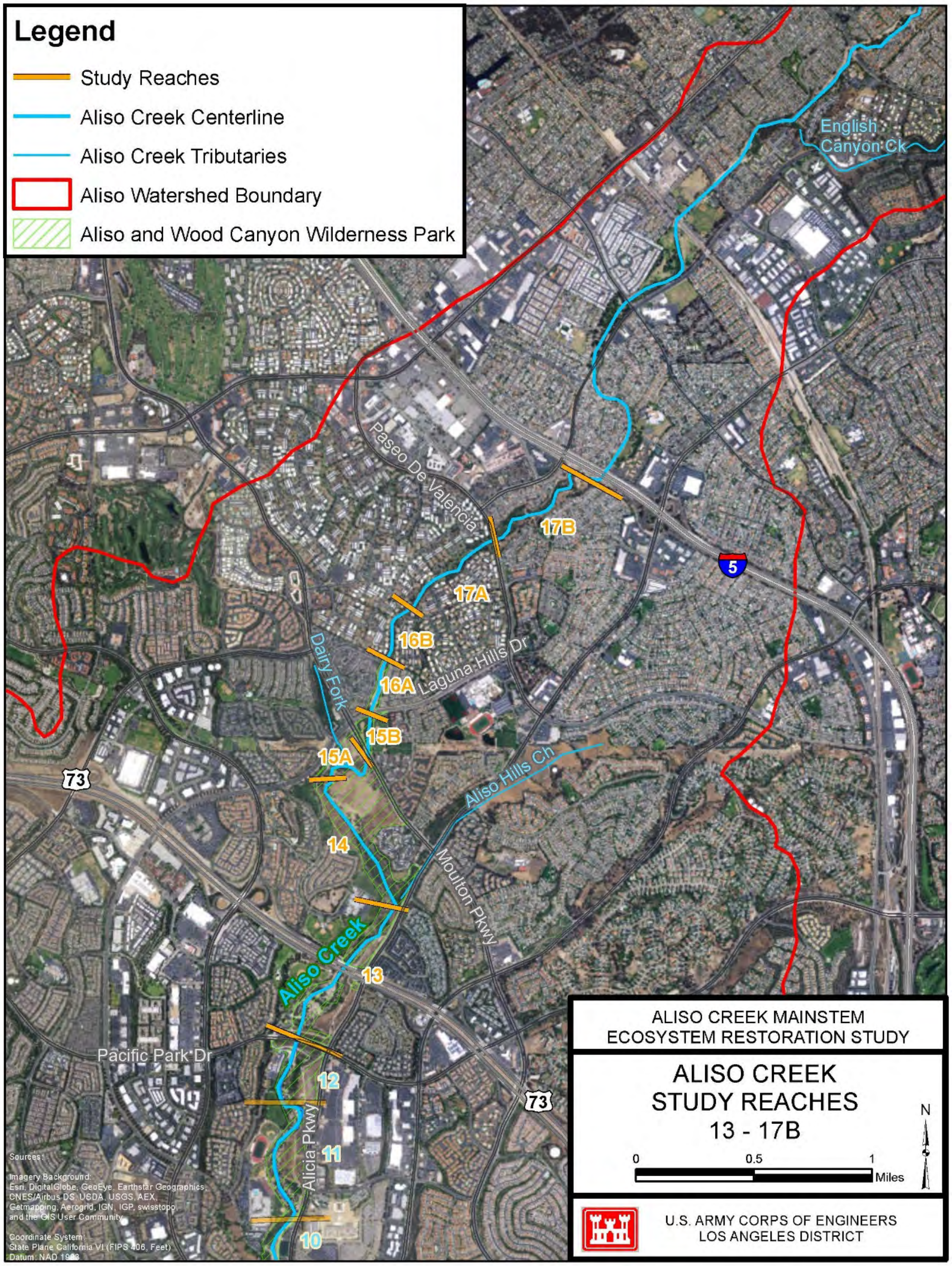


Figure 2.1-2 Upper Aliso Creek Reaches 13 through 17B

Reach 3: Upper End of the Golf Course to the SOCWA CTP Bridge

Reach 3 extends from the upper end of the golf course property to the SOCWA CTP Bridge. The 1,150-foot channel in this reach is natural and unmaintained. It passes through a narrow portion of Aliso Canyon that separates the Wilderness Park from the Ranch at Laguna Beach and has a channel slope of 0.46 percent. The bottom is 23 to 60 feet wide, and overbanks are well vegetated. An unnamed access road follows the right (looking downstream) overbank and connects to the downstream end of AWMA Road. Bank heights are 9 feet on average and consistent within the reach. This reach has achieved a quasi-equilibrium state.

Reach 4A: 2,720 Feet Upstream from the CTP Bridge to the Downstream End of the S-Bend

Reach 4A extends 2,720 feet upstream from the CTP Bridge to the downstream end of the S-bend. The SOCWA treatment plant is located at the lower end of this reach on the east side. The plant discharges treated effluent through a 36-inch concrete pipe that extends underground from the plant through Reaches 1, 2, and 3 to an outfall in the ocean. Buried utility lines are routed upstream from the plant through Reach 9 (after which pipeline easement is routed eastward away from Aliso Creek) and include a 36-inch raw effluent transmission pipeline, two 4-inch force main sludge pipelines, and a Moulton Niguel Water District 18-inch raw effluent pipeline. Within Reach 4A, some riprap is present on the east overbank from past efforts to protect the adjacent utility lines from erosion. The reach has a slope of 0.30 percent and includes some natural grade control structures such as gravel/cobble plugs and exposed bedrock. The bottom width ranges from 8 to 46 feet and consists of sandy bed material in pools upstream of coarse material plugs. Bank heights range from 8 to 20 feet. This reach is vertically stable but erosion and slumping of bank material continues as the channel attempts to achieve equilibrium.

Reach 4B: S-Bend Upstream to a Weathered Sandstone Outcrop that Acts as Grade Control near the Upstream End of the Abandoned Oxbow

Reach 4B follows the S-bend upstream to a weathered sandstone outcrop at streambed grade that acts as grade control near the upstream end of the abandoned oxbow. The 3,260-foot reach has a slope of 0.35 percent with bottom widths ranging from 5 to 40 feet. Some sandy material is present in the reach while the majority of the substrate is coarse gravel and cobble. Bank heights from the S-bend to the downstream end of the oxbow are approximately 15 feet followed by a noticeable increase to 20 feet at the oxbow site. A clay-rich and relatively erosion-resistant deposit is prevalent in the lower elevations of the overlying very steep channel slopes of valley fill, and also makes up some of the streambed substrate materials. Existing banks are high and steep enough that they are in a state of unstable equilibrium. This condition results in episodic bank slope failure. This reach is vertically stable (with respect to streambed incision) but erosion and slumping of geotechnically unstable banks continue as the channel attempts to achieve equilibrium.

Reach 5A: Upstream from the Weathered Sandstone Boundary of Reach 4B to a Thick Clay Layer and Lower Banks of the Creek

Reach 5A extends upstream from the weathered sandstone boundary of Reach 4B to a thick clay layer in the streambed and lower banks of the creek. This 1,480-foot long reach, which ranges from 11 to 45 feet in width, is slowly incising into the clayey substrate material. The valley fill bank materials are of higher cohesion with heights of 20 to 25 feet. Streambed materials are predominately coarse gravels and cobbles, though sand-rich wedges are also found. The average channel slope is 0.30 percent. This reach is expected to continue some further vertical incision, accompanied by additional channel widening due to erosion and slumping of bank materials.

Reach 5B: 1,810 Feet Upstream to Exposed Bedrock

Reach 5B extends for 1,810 feet to exposed bedrock, a geologic grade control. The reach is densely vegetated with an average slope of 0.46 percent and is associated with several riffle areas. Channel widths range from 8 to 60 feet. Bank heights range from 20 to 25 feet and include some riprap to provide localized protection of the AWMA road to the west and adjacent buried utility lines to the east. This reach is vertically stable, however, localized slumping of steepened and high channel banks will continue, especially where flows impinge and erode side slopes.

Reach 5C: 1,080 Feet Upstream to the Confluence of Wood Canyon Creek

Reach 5C extends 1,080 feet upstream to the confluence of Wood Canyon Creek. This reach contains an abundance of sandy bed material and is the flattest of all reaches with an average slope of 0.04 percent (0.0004 feet/feet). Channel bottom widths range from 17 to 37 feet, and bank heights are relatively consistent at 25 feet. Bank slopes are less steep than downstream reaches with more established vegetation. This reach is stable both vertically and horizontally. Localized erosion is expected where the channel impinges on the toe of the disconnected floodplain terrace.

Reach 6: Upstream from the Wood Canyon Creek Confluence 1,300 Feet to the Downstream End of the ACHWEP Drop Structure

Reach 6 continues upstream from the Wood Canyon Creek confluence 1,300 feet to the downstream end of the ACWHEP drop structure. The channel slope in the reach is 0.55 percent, and the bottom widths vary from 16 to 26 feet. The scoured area downstream of the structure is approximately 175 feet wide. The ACWHEP drop structure is approximately 25 feet high. Bank heights in the reach range from 25 to 30 feet and include some areas of riprap stone to protect adjacent utility lines within the east bank. Multiple cobble-boulder riffles occur in this reach, and riprap, likely displaced from the ACWHEP structure or failed bank protection, are present at various streambed locations. The bed elevation in this reach appears to be relatively stabilized. Channel banks are generally vegetated and appear to have stabilized except in the immediate vicinity of the drop structure, where flood flows are directed at the unstable very steep banks.

Reach 7: Crest of the ACWHEP Structure 2,750 Feet Upstream to a Channel Bend where the Bank Height Transitions to 15 Feet

Reach 7 extends from the crest of the ACWHEP structure 2,750 feet upstream to a channel bend where the bank height transitions to 15 feet. Throughout this reach, the grade control appears to arrest the downcutting, except at its upper end. The average channel slope is 0.25 percent. The banks at the lower end of the reach are comprised of alluvium and generally 4 feet high gradually increasing to 10 feet high as the banks transition to valley fill materials. The channel bottom is generally 12 to 37 feet wide. This reach exhibits higher sinuosity than other reaches of the creek. The ACWHEP structure at the downstream end of the reach acts as a sediment trap, which provides vertical stability. The bed material is primarily depositional sand, and small gravel although coarse gravel and cobble riffles are also present. This reach is both vertically and laterally stable.

Reach 8: 3,110 Feet Upstream to the Confluence with Sulphur Creek

Reach 8 extends 3,110 feet upstream to the confluence with Sulphur Creek. The Creek slope is 0.27 percent, and the bottom width varies from 10 to 28 feet. The incision is well pronounced with bank heights of valley fill materials in excess of 30 feet at the upstream end. A thick clay layer lies at the toe of the banks. Reach 8 exhibits sinuosity, the greatest in the watershed, with the bed material switching between gravel and cobble riffles to sand and small gravel in the intervening pools. The outside of a bend has moved laterally and is threatening Aliso Creek Trail. Sections of pavement have been lost, and concrete barriers were placed to prevent vehicles from going over the edge. This reach is vertically stable but additional Creek widening is expected.

Reach 9: 360 Feet Upstream of the Sulphur Creek Confluence to the AWMA Road Bridge Crossing which Marks a Transition to an Engineered Channel

This reach includes the Wilderness Park Ranger Station, park restrooms, parking lot for visitors, and access to the park from Alicia Parkway. The creek has a bottom width that varies from 8 to 18 feet. The area under the AWMA Road Bridge is protected by concrete and includes a sloped grouted stone 3-foot drop. The overall channel slope is 1.0 percent with bank heights of 25 to 30 feet. Though the streambed is vertically stable, erosion and slumping of bank material continues to widen the channel through this reach.

Reach 10: 3,240 Feet of Engineered Channel from AWMA Road Bridge, Under the Aliso Creek Road, and Continuing Upstream Past the Laguna Niguel Skateboard and Soccer Park

Reach 10 is a 3,240-foot stretch of engineered channel from AWMA Road Bridge, passing under the Aliso Creek Road, and continuing upstream past the Laguna Niguel Skateboard and Soccer Park. The realignment was done in 1969 to accommodate the construction of the Chet Holifield Federal Building and Alicia Parkway. Due to the channel straightening and steepness of the grade, two 10-foot-high concrete drop structures were constructed. The side slopes of the channel are laid back at 2H:1V, and are protected with riprap for a distance of about 700 feet downstream of Aliso Creek Road Bridge. The overall average channel slope is 1.0 percent (0.01 feet/feet), although the bed slope between the two drop structures is 0.31 percent (0.0031 feet/feet). The bottom width ranges from 25 to 60 feet and bank heights range from 10 to 15 feet. The engineered channel design precludes assessment of equilibrium within the reach.

Reach 11: 2,670 Feet Upstream of the Engineered Channel to the Major Riprap Grade Control Structure where the Joint Regional Water Supply System (JRWSS) Pipeline Crosses the Creek

Reach 11 extends 2,670 feet upstream of the engineered channel to the major riprap grade control structure where the JRWSS pipeline crosses the creek. Several segments of the west bank are subject to scour and protected with riprap. One segment is fortified with steel piling to protect a portion of the JRWSS alignment. The channel slope is roughly 0.38 percent. The low-flow thalweg shows a consistent bottom width of 30 feet but the entire bottom width, which is heavily overgrown with giant reed (*Arundo donax),* varies in width up to 150 feet. A thick clay layer is present in the bed and toe of the banks. A series of cattail-covered coarse gravel plugs are present along the reach with interspaced sandy pools. The reach exhibits higher sinuosity relative to other reaches. The west overbank is occupied by the Aliso Niguel High School and athletic grounds (outside of the Proposed Project area), and the east overbank is a broad paved area that is a remnant of a previous road and development. Bank heights range from 10 to 20 feet. The reach is expected to further incise and widen.

Reach 12: From the Riprap Drop Structure Upstream 1,270 Feet to the Downstream End of the Pacific Park Drive Outlet Structure

Reach 12 extends from the riprap drop structure upstream 1,270 feet to the downstream end of the Pacific Park Drive outlet structure (8-foot-high by 10-foot-wide triple barrel concrete box culverts). The reach has a slope of 0.51 percent and a bottom width of 27 to 55 feet. The uppermost 250 feet of the reach is engineered and lined with riprap protection. A bike path/maintenance road runs along the top of the west bank, which is protected in places with riprap and subject to further scour erosion where left unprotected. Banks heights are no greater than 10 feet. The left and right overbanks in this reach are up to 500 feet wide, but are no longer inundated except during extreme events (>500-year) due to the peak discharge reduction at the Pacific Park Basin. Coarse gravel plugs/riffles are present along the streambed with intervening stretches of sandy substrate. With a mix of some engineered channel sections and natural grade control provided by plugs, this reach presents a quasi-equilibrium state.

Reach 13: Pacific Park Detention Basin Upstream Under the San Joaquin Hills Transportation Corridor Bridge, Upstream about 4,150 Feet

Reach 13 includes the Pacific Park Detention Basin and extends upstream, passing under the San Joaquin Hills Transportation Corridor bridge, up to a tributary inlet about 4,150 feet upstream across from the Aliso Viejo Middle School. The detention basin culvert reduces the flow conveyance under the Pacific Park Drive roadway, creating backwater upstream in the basin. The reach has a slope of 0.5 percent, with a bottom width up to 150 feet wide and a consistent low-flow thalweg of about 30 feet up to the corridor bridge. Width varies between 25 and 35 feet upstream of the bridge.

Reach 14: From the Tributary Inlet in Reach 13 to the Start of the Channel Bend 1,800 Feet Downstream of Moulton Parkway Bridge crossing

Reach 14 extends from the tributary inlet in Reach 13 to the start of the channel bend at about 1,800 feet downstream of Moulton Parkway Bridge crossing. The 3,180-foot reach has a slope of 0.77 percent. The low-flow channel is incised 3 to 10 feet within a floodplain that is up to 300 feet wide.

Reach 15: A Length of 2,700 Feet from 1,870 Feet Downstream of Moulton Parkway Bridge to a 3-Foot Concrete Drop Structure just Downstream of Laguna Hills Drive Bridge

Reach 15 extends from 1,870 feet downstream of Moulton Parkway Bridge to a 3-foot concrete drop structure just downstream of Laguna Hills Drive Bridge for a total length of 2,700 feet. The channel slope is 1.0 percent. In the portion of the reach downstream of Moulton Parkway (Subreach 15A, which defines the upstream boundary of the Wilderness Park), the channel is much like the previous reach and is incised about 10 feet within a floodplain of up to 400 feet wide. In the 830-foot section between Moulton Parkway and Laguna Hills Drive (Subreach 15B, which is Sheep Hills Park in the City of Laguna Hills), the channel has a width of about 50 feet within a floodplain of about 160 feet.

Reach 16: 3,200 Feet from just Downstream of Laguna Hills Drive to just Upstream of the Avenida Sevilla Bridge

Reach 16 extends for 3,200 feet from Laguna Hills Drive to just upstream of the Avenida Sevilla Bridge. This reach has been modified with graded side slopes of 2.5H:1V and some riprap stone protection; the channel bottom varies between 20 and 65 feet wide. The soft-bottom channel has an overall slope of 0.86 percent. The lower 1,200 feet of the reach (Subreach 16A) is county-owned and maintained for flood control. Marsh vegetation is currently cleared twice a year. The upstream 2,000 feet of the reach (Subreach 16B) is within the City of Laguna Woods, which has a 16-acre conservation easement within the Laguna Woods Community preserving Aliso Creek as a natural riparian stream and freshwater marsh habitat.

Reach 17: 5,370 Feet from just Upstream of Avenida Sevilla to the San Diego Freeway

Reach 17 extends about 5,370 feet from just upstream of Avenida Sevilla to the San Diego Freeway. It crosses under a bridge at Paseo De Valencia and has an overall slope of 0.98 percent. In the 2,000 feet between Avenida Sevilla and Paseo de Valencia, a 15-

to 30-foot-wide modified channel splits a narrow floodplain. The channel bottom is sandy, and the side slopes are protected in stretches by riprap. This stretch of the reach (Subreach 17A) is within the Laguna Woods Community conservation easement. Between Paseo de Valencia and the San Diego Freeway, the channel (Subreach 17B) is within county–owned land and natural, with a meandering low-flow thalweg from 10 to 20 feet wide within a 160- to 260-foot-wide floodplain. The banks and overbanks are largely vegetated but have riprap and concrete protection near the freeway.

2.2 EARTH RESOURCES

2.2.1 Geology

The Aliso Creek watershed is located within the San Joaquin Hills in the northwestern portion of California's Peninsular Range Province. The San Joaquin Hills are composed of Miocene and Pliocene age marine and non-marine origin sedimentary bedrock. Aliso Creek carved its way through the hills and marine terraces formed by tectonic uplift and sea level changes during the Quaternary period. Fluvial erosion of the sedimentary surface layer and recent channel incision of the unconsolidated alluvial deposits have formed the present configuration.

Bedrock in the Proposed Project area is found underlying the alluvium and in hillsides of the surrounding canyon. Outcrops expose the two main formations within the Proposed Project area. The Miocene Monterey and Topanga formations consist of interbedded sandstone, shale, and siltstone sedimentary rock. Where these formations consist of well-bedded clayey siltstones and shales, clay seams along bedding are planes of weakness along which landslides may develop. Within the Proposed Project area, bedrock exposed within the hillsides adjacent to Aliso Creek is predominately Topanga formation in the lower half of the footprint and Monterey Formation in the upper half. Other bedrock outcrops present include San Onofre Breccia, Capistrano formation, and Niguel formation.

2.2.2 Soils

Based on the Department of Agriculture soil classification system, the predominant surficial soil types in the Proposed Project area are Calleguas clay loam, riverwash, Capistrano sandy loam, Sorrento loam, Soper gravelly loam, and Cieneba gravelly loam (NRCS 2009).

Subsurface geotechnical investigations consisting of 10 exploratory boreholes and 23 geophysical survey profiles were conducted in 2009 within the Proposed Project area, and detailed in the *Geotechnical Data Report* (Appendix A-1c). Based on the Universal Soil Classification System, the subsurface soils encountered generally consisted of silty sands, clayey sands, silts, and clays. The upper 30 feet was characterized as loose to medium dense; below 30 feet, the soils were generally dense to very dense. A hard bedrock layer, was found in five of the 10 boreholes, ranging in depth from 27 to 46 feet below ground surface. The prevalence of fatter clays were found at elevations below the active streambed (Appendix A-1f; Figure 3-4).

Groundwater encountered during the 2009 investigations reveal levels at depths ranging from about 14 to 45 feet below ground surface (or about five to 35 feet below the creek bed, as measured offset from the borings). This level was recorded during the initial drilling of the borehole and was not allowed to equilibrate within the hole.

2.2.2.1 Hydric Soils

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as those soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper portion of the soil to support the growth and reproduction of hydrophytic vegetation. The NTCHS hydric soil definition is used by the Corps and the U.S. Environmental Protection Agency (EPA) in their joint responsibilities in the administration of Section 404 of the CWA.

Hydrophytic vegetation typically includes wetland species including rushes, sedges, bulrush, cattails, water moss, grasses, algae, and duckweed. Plant habitats and communities along the creek banks (riparian vegetation) include willows, cottonwoods, alders, and sycamores. Current vegetation types show that the Proposed Project area includes approximately 30 acres of lacustrine habitat and about 31 acres of riverine habitat that would be supported by hydric soils. Figure 2.2-1 shows hydric soils within the Proposed Project area.

2.2.2.2 Hydrologic Soils

The hydrologic soils group can be used to estimate the amount of infiltration that can be expected from a certain soil. This grouping is based on estimates of the intake of water during the latter part of a storm of a long duration, after the soil profile is wet and has an opportunity to swell, without the protective effect of any vegetation. Features such as slope, ground cover, or low permeability materials away from the upper soil profile may impact the soils’ capability to infiltrate water. Under the hydrologic soils group classification system, soils are grouped A to D with “A” having the lowest runoff potential (highest infiltration rates) and “D” having the highest runoff potential (lowest infiltration rates). The predominant soil and rock types in the Proposed Project area include: Calleguas clay loam – Class D, riverwash – Class D, Capistrano sandy loam – Class B, Sorrento loam – Class B, Soper gravelly loam – Class C, and Cieneba-rock outcrop – Class C.

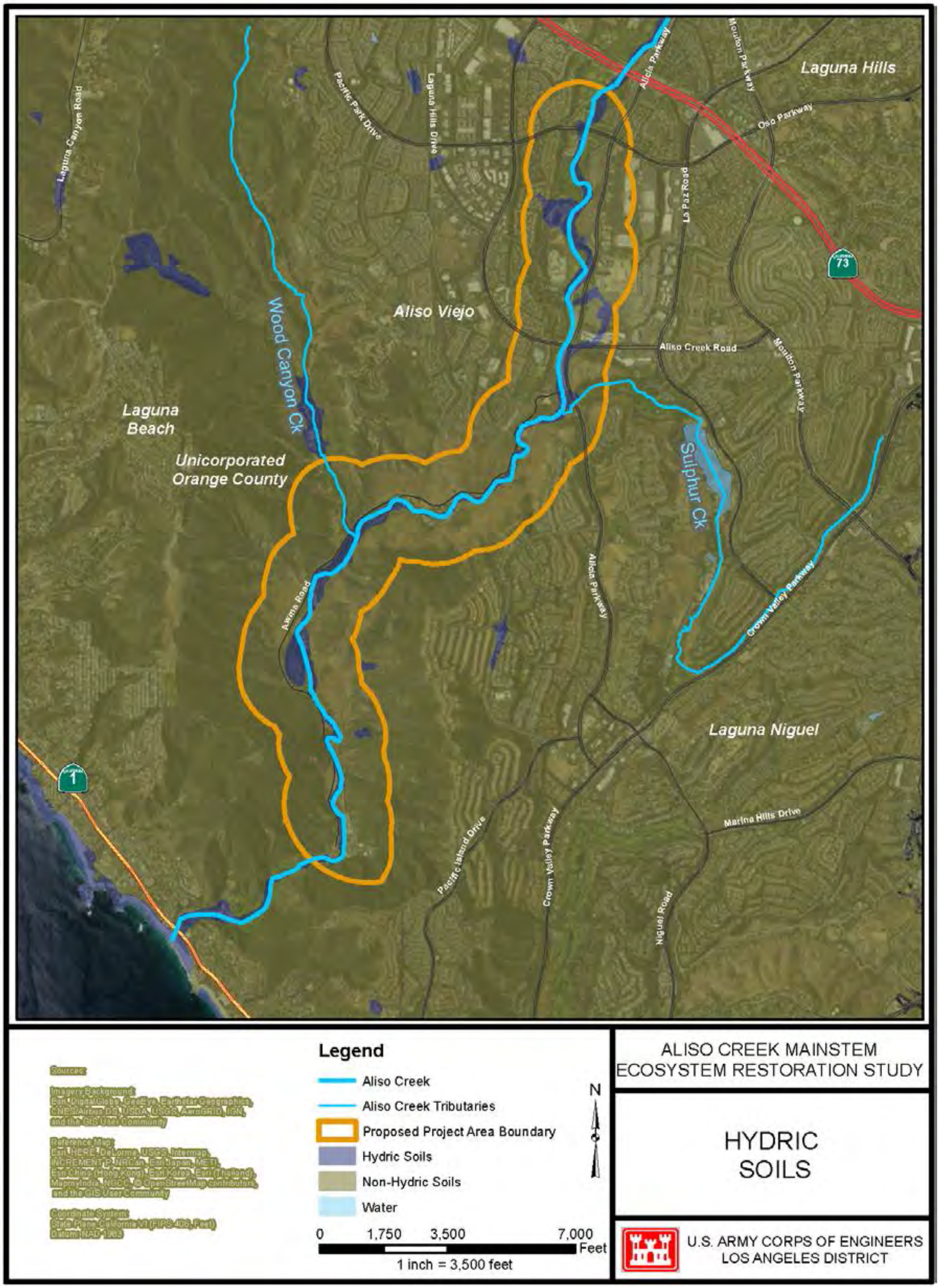


Figure 2.2-1 Hydric Soils in Proposed Project Area

2.2.3 Landslides

Numerous landslides have been mapped within the study area, varying in size from an acre to 25 acres or more (Morton 1974). The landslides mostly range from 10,000 to 20,000 years old, originating during the early Holocene and late Pleistocene. The larger landslides have slide planes located within the bedrock while smaller slides have planes located both within soils and bedrock. Some landslides have been mapped and shown as multiple smaller slides within a larger slide. The ancient landslides occurred along slip surfaces that once daylighted within the ancient canyon floor. They are now inactive and are in a more marginal equilibrium state because the alluvium that has accumulated as valley fill provides support against continued landslide movement. Mapped landslide features within the Proposed Project area are shown in Figure 2.2-2. A preliminary qualitative assessment of landslide risk was conducted for this Draft IFR (Appendix A-1e) and summarized in Chapter 3.8.1.

2.2.4 Seismicity

The Proposed Project area has the potential to experience strong ground shaking from the occurrence of earthquakes centered on nearby faults and more distant regional faults. The dominant active fault systems nearest the Proposed Project area are Newport-Inglewood (4 miles), Whittier-Elsinore (20 miles), San Jacinto (43 miles), and the San Andreas (50 miles). The Newport-Inglewood Fault is interpreted as having the potential for generating the highest onsite ground accelerations in the Proposed Project area (magnitude 6.9).

The California Seismic Hazards Zone Map indicates that there is potential for liquefaction within the Proposed Project area where saturated, unconsolidated silts, sands, and silty sands are present. Liquefaction is mostly confined to the alluvial sediments situated within the floodplain of Aliso Creek.

2.2.5 Geomorphology

The stream profile of Aliso Creek has experienced a recent history of downcutting (incising) as a response to the hydrologic and sediment regime changes in the watershed. The urban development of the watershed has increased the frequency, magnitude, and volume of storm flow runoff, while concurrently decreasing the yield of upland sediment. These changes initiated stages of downstream-progressing streambed degradation and subsequent channel widening in Aliso Creek. In contrast to its pre-development hydrologic regime, Aliso Creek now flows perennially as a result of development. Impervious surfaces such as pavement limit infiltration opportunities and concentrate runoff delivered at higher velocities with less sediment. This rapid-flowing “sediment-starved” water attempts to entrain sediment as it moves downstream in turn resulting in higher rates of erosion of the streambed and banks. As the streambed incises, and less opportunity for overbanking ensues, flows become more concentrated, stronger, and erosive.

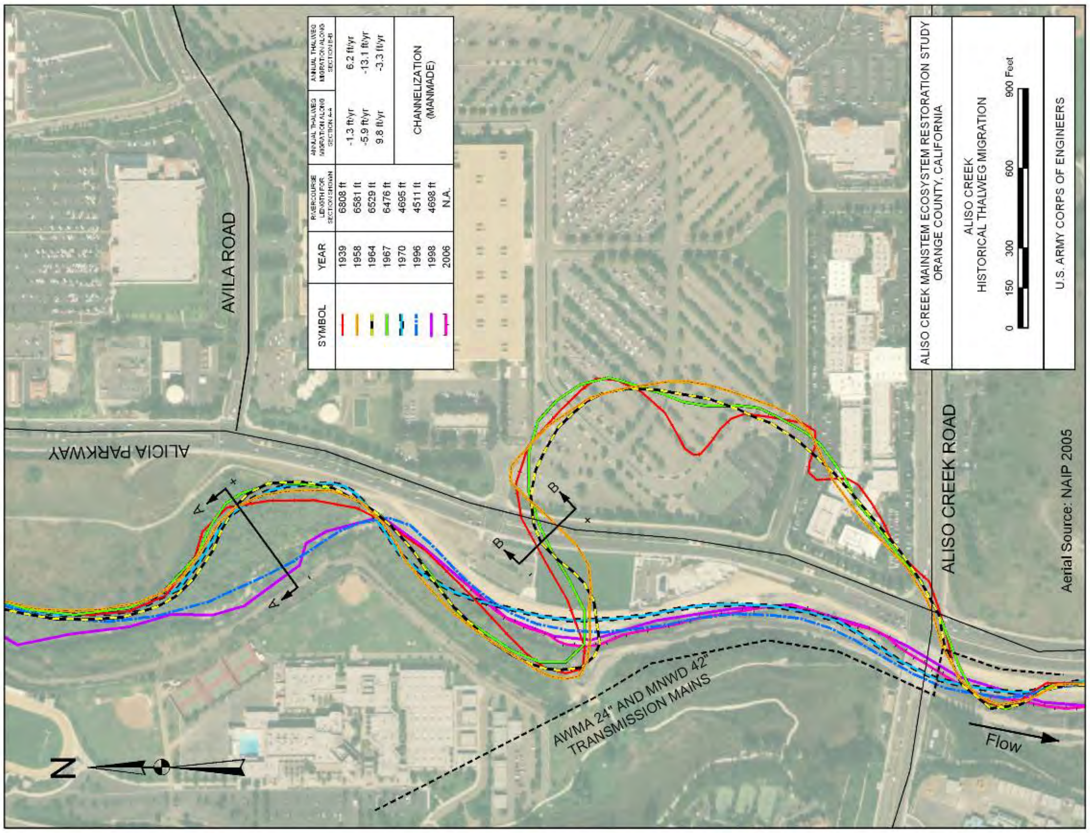
Figure 2.2-2 Area of Historic Landslides in Aliso Canyon

Changes in channel patterns within the watershed have led to reductions in channel lengths and has caused system instability. Several major bends have been cut off in the lower Aliso Creek watershed removing over 1,000 feet of stream length at a time. One very large bend in Aliso Creek was removed around the time of construction of Alicia Parkway and the Chet Holifield Building in 1969. Consequently, the creek was shortened (to the current configuration within Reach 10) by about 1,500 feet resulting in a steeper gradient and a need to construct two 10-foot concrete drop structures. Increased water velocities led to greater erosive potential of flows, and increased bed degradation, as evident in the lower reaches of Aliso Creek. Elimination of this upstream bend in conjunction with the flood of 1980 or 1983 may also have resulted in the loss of a horseshoe bend downstream (approximately 1,600 feet in Reaches 4B and 5A). With the high-velocity flows accompanied with downcutting of the streambed, this downstream bend was abandoned and left “high and dry” after the event. A remnant bend (“oxbow”) still exists, stranded above the current straighter channel that bypassed it. The oxbow has since filled in with sediment. The S-bend, in lower Reach 4B, would be expected to be cut off in the future. Observations following recent storm events indicate evidence of bypassing the lower portion of this bend. It is estimated that the cut off would occur after year 25 of the Corps’ 50-year period of analysis. The effect of this eventual loss would cause additional stream instability (vertical and laterally) for some distance both upstream and downstream of the S-bend. Figure 2.2-3 displays the changes over time to the thalweg alignment as sinuosity has been lost in the channel.

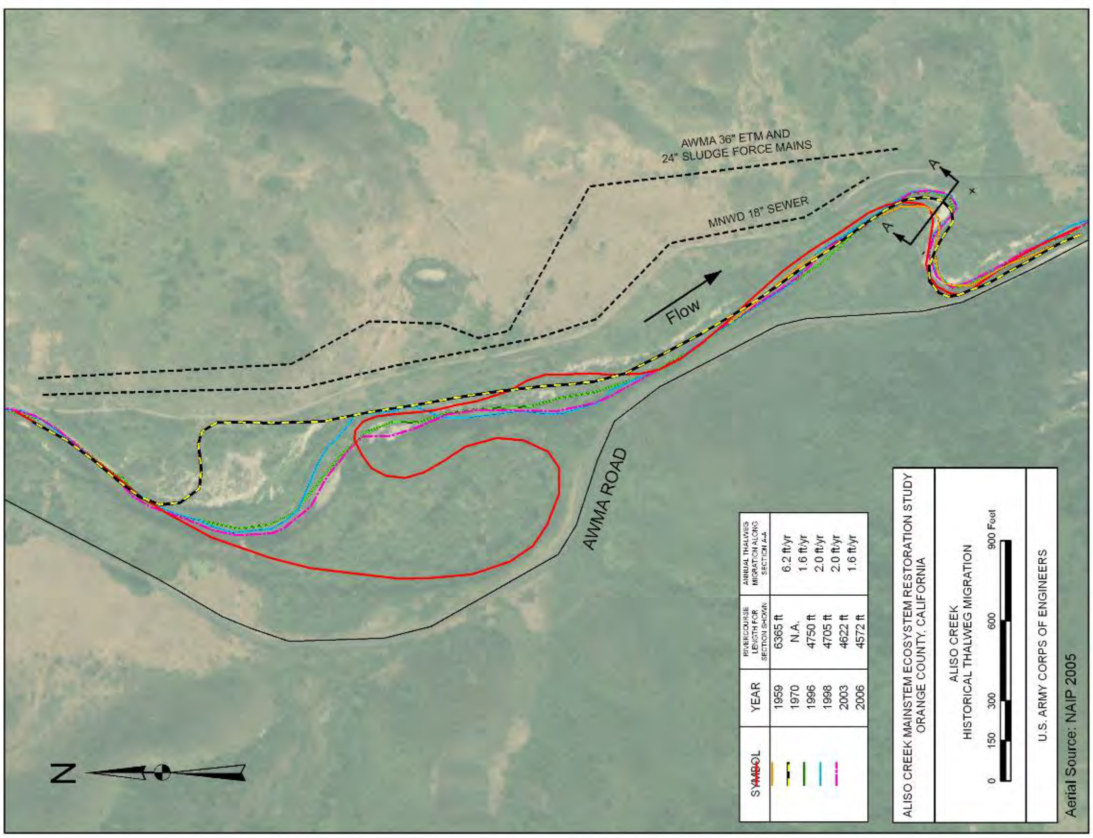
Comparison of historical aerial photographs and topographic mapping of lower Aliso Creek between 1967 and 2006 indicate that the streambed has incised as much as 25 feet (Figure 2.2-4 and Figure 2.2-5), and channel bottom widths increased roughly from 40 to 95 feet since 1967 (Figure 2.2-6). Hydraulic analysis indicates that a 10 percent annual chance of exceedance (ACE) (10-year event) is contained within the incised channel through much of the Wilderness Park. In many locations, an event as large as a 1 percent ACE (100-year event) is also contained (Figure 2.3-2; Appendix A-2a and b).

This confinement of larger flood events within the main channel rather than the creek overtopping onto the floodplain has created a hydrologically disconnected floodplain. This precludes the dissipation of flood energy and increases erosion within the creek during flood events. The loss of floodplain hydrologic connectivity has also reduced groundwater recharge opportunities and lowered floodplain soil moisture. Additionally, in reaches of the stream course where groundwater levels are influenced by channel seepage, a drop in local groundwater levels would be expected as the streambed has incised. The effect of the deeply incised channel to riparian vegetation, especially in the floodplain is described in the Biological Resources section of this chapter.

As the combined influences of lateral erosion and bed degradation widen the stream and flatten the slope, channel velocities and erosion will decrease. If a stream system is allowed to adjust completely, a dynamic equilibrium will ensue within the incised channel system between the watershed hydrology, sediment supply, and channel morphology (shape, size, and slope). The geomorphic evaluation conducted for the study indicates streambed incision within Aliso Creek is beginning to stabilize, and that some reaches within the Proposed Project area have moved toward dynamic equilibrium (Appendix A-1f). For these reaches (5C, 7, and 12), the streambed is vertically stable, and further systematic channel widening is not expected.



Reaches 9, 10, 11



Reaches 4 and 5

Figure 2.2-3 Historical Thalweg Migration

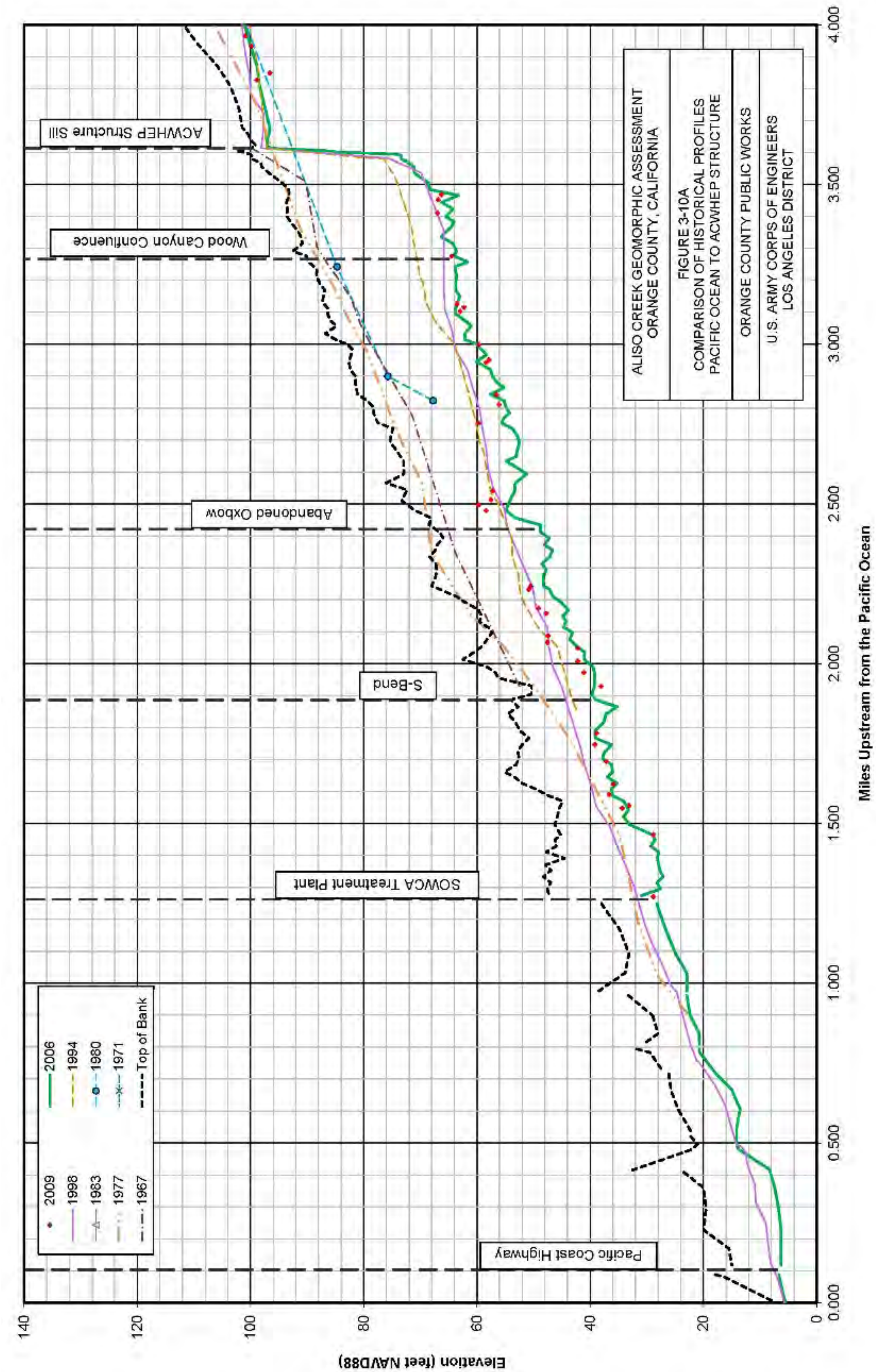


Figure 2.2-4 Historical Streambed Profiles – Pacific Ocean to ACWHEP Structure

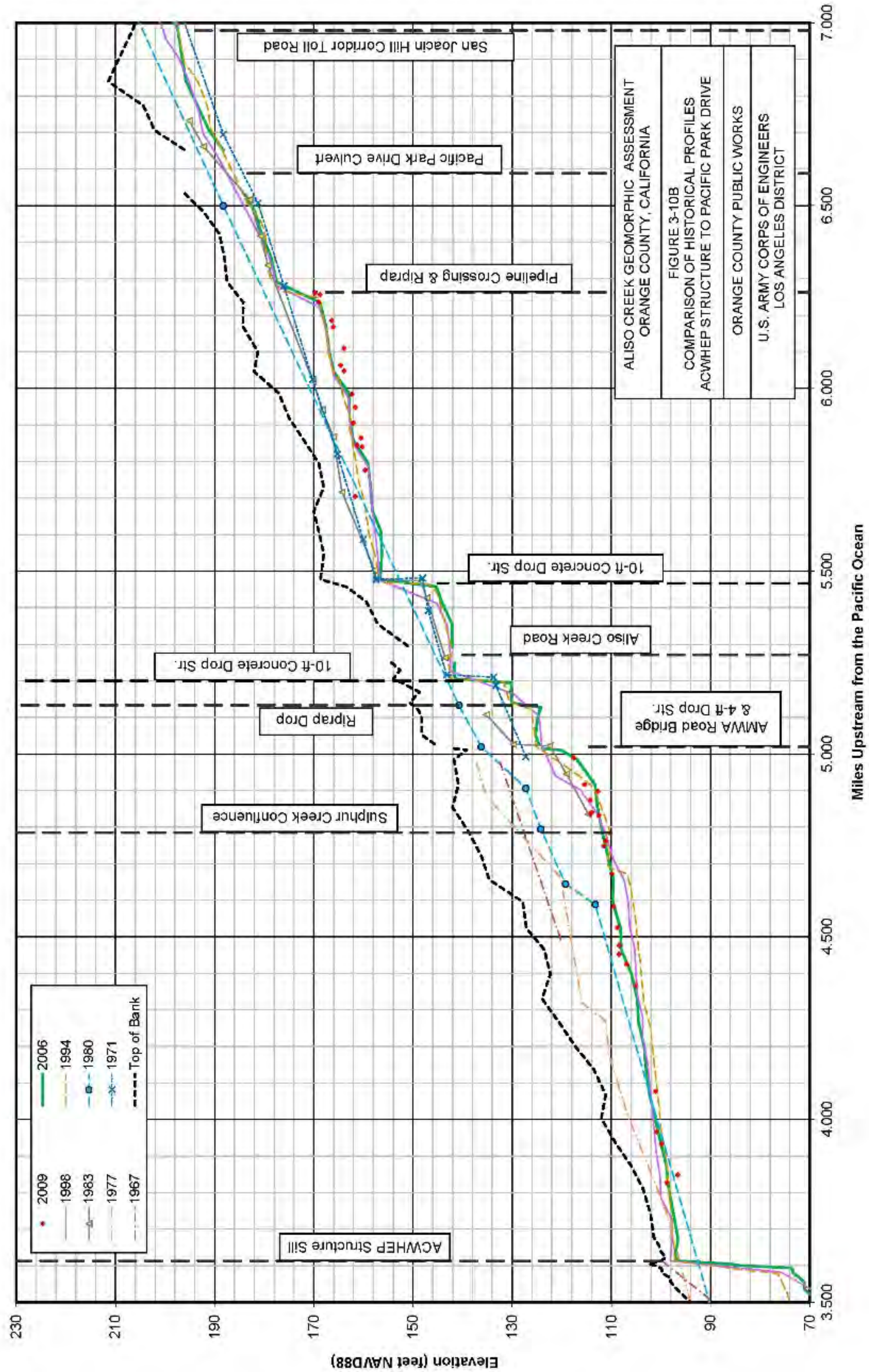


Figure 2.2-5 Historical Streambed Profiles – ACWHEP Structure to Pacific Park Drive

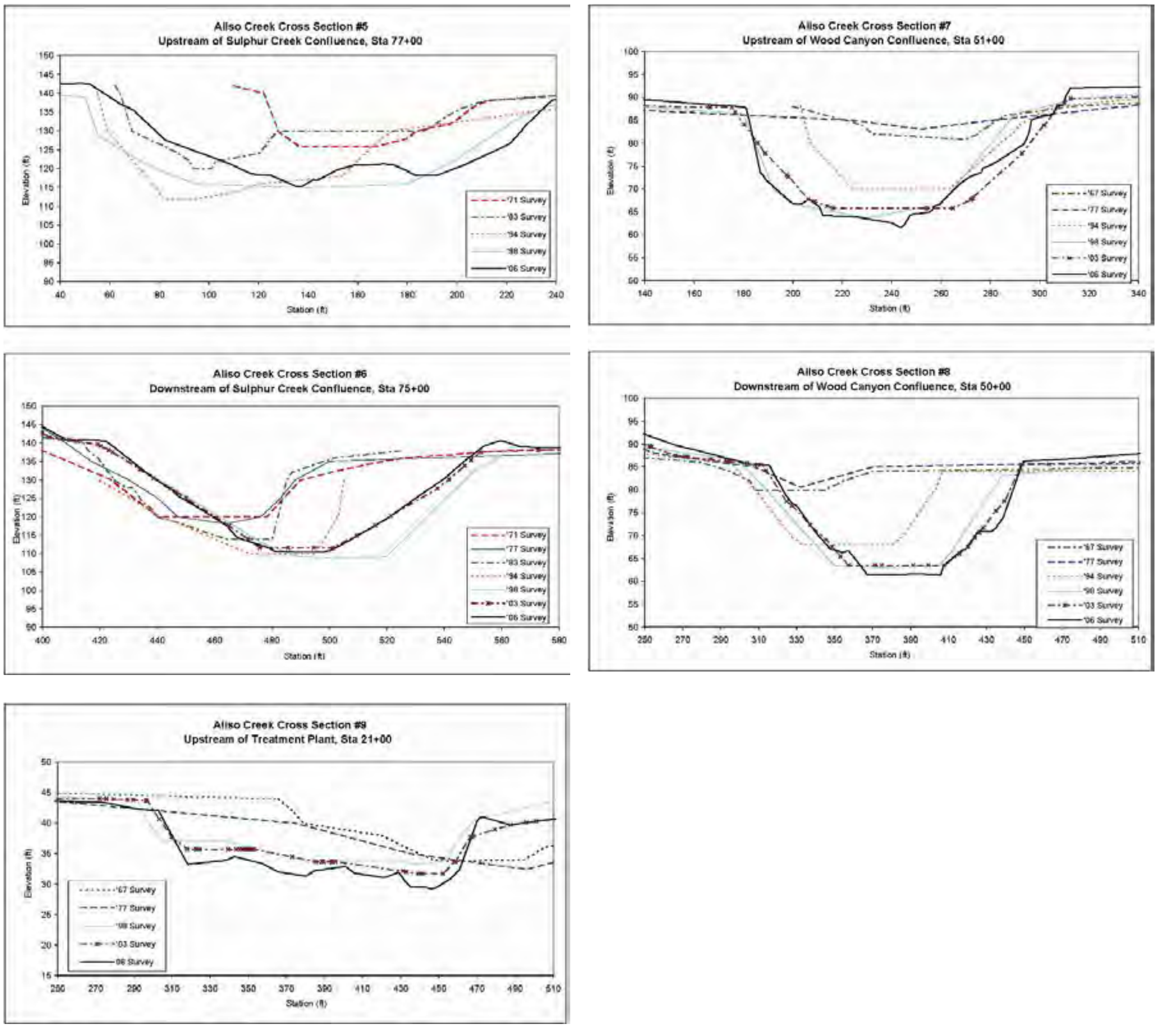


Figure 2.2-6 Comparison of Historical Cross Sections

In general, further incision is likely to be limited within the Proposed Project area. In some reaches, however, creek widening continues to occur as the creek is attempting to attain dynamic equilibrium, as well as from mass bank failures in reaches where the streambank height exceeds the critical bank height (the maximum geotechnically-stable height of a bank based on slope and material). This latter failure mechanism will likely become the primary mode compared to bank failures that are hydraulically induced. Despite these failures, native soils (cohesive silts with sands) lend themselves to holding steeper slopes. Steep creek slopes combined with episodic bank failure limit the growth and establishment of riparian habitat. Where the streamflow locally impinges against the channel slopes, especially in stream bends, continued erosion and bank retreat is possible. Creek adjustments from the various modes of bank failure continue to threaten nearby wastewater and associated infrastructure. It is expected that future contributions from bank and streambed erosion to the amounts of sediment transported downstream to the ocean will not continue at the rates experienced in the 1970s through 1990s (Appendix A-1f).

Photo 2.2-1 Incised Creek Bank

Loss of channel banks immediately adjacent to ascending terrain of the canyon slopes could potentially present a situation where slope stability is adversely impacted where ancient landslides have occurred. Even where landslides are not currently mapped, cuts made into any canyon slopes that rise from the creek could daylight adversely oriented bedding. Where bedding planes dip toward such cuts, landslides could develop along these bedding planes. Any potential slope failures from the surrounding hillsides breaking out to the floodplain could cause a significant change to the stream pattern at the base of the failure, and for some distance both upstream and downstream of the disturbance. A redirected stream could trigger further impacts.

The County of Orange would continue to maintain the ACWHEP structure (Reach 7; described in Section 2.1.2) and two large 10-foot drop structures (Reach 10) in their current configurations as undermining of these structures would result in a very significant headcut to proceed upstream putting existing infrastructure in jeopardy. The AWMA Road crossing at the Wood Canyon Creek confluence (Reach 5C) currently provides grade control for the tributary and would also need to be maintained by the County to prevent a significant headcut upstream in Wood Canyon Creek that would greatly degrade high value natural habitat.

2.1.6 Sediment Transport

2.2.5.1 Sedimentation Trends

One of the key characteristics of geomorphically stable channels is a dynamic balance (or equilibrium) between the sediment supplied to the reach and the sediment transport capacity of the reach.

Aggradation (deposition) occurs when the potential sediment transport capacity within a particular reach is less than that provided by the reach immediately upstream. The reach in consideration will be unable to transport the entire sediment load coming into the reach, thus deposition will occur. Degradation (erosion) occurs when the potential sediment transport capacity in a reach is greater than what is supplied by the upstream reach. The reach in consideration will suspend any available sediment and erode the channel bed. If the two are approximately the same, the reaches are in equilibrium with respect to each other.

A sediment transport model was performed using HEC-RAS 5.0 beta version to characterize the future without-project aggradational and degradational trends for Aliso Creek. The baseline condition serves as a basis to evaluate the effectiveness of proposed action alternatives. The model was run for the existing channel configuration (cross-sectional data and gradients), sediment and flow data, and included existing grade control structures. Bridges were not included in the model to avoid the effects of unreasonable aggradation computations associated with the structures. A flow record was adopted, which utilized a series of available daily flows for a 21-year period including the 100-year hydrograph. Refer to Appendix A-2a for more information.

Results from the model analysis (see Figure 6-5 in Appendix A-2a, representing the end of the simulation period, or about 50 years) indicate that there is a potential five feet of degradation occurring downstream of the regional water supply transmission line crossing (JRWSS) downstream of Pacific Park Drive to Aliso Creek Road. From Aliso Creek Road downstream to the ACWHEP structure, the simulated streambed remains relatively stable with some localized degradation (up to four feet). Downstream of the ACWHEP structure to the SOCWA CTP Bridge, the streambed shows some incision (on the order of one to four feet) within Reaches 4A and 4B.

Downstream of the SOCWA CTP Bridge (outside of the Proposed Project area), more degradation trends are indicated within Reaches 2 and 3, from about one to four feet. These reaches experience flows with relatively high energy gradients and increased sediment transport capacity. Within Reach 1, which includes the upper estuary, the model results indicate a slight aggradational trend to about the PCH Bridge. Downstream of the bridge, the model predicts some slight degradation. The cause of this degradation could be associated with the narrower cross section in this lowest subreach, together with the sediment depositional trend directly upstream, resulting with a subreach capable of a slight increase in sediment transport potential. Model limitations associated with boundary condition effects with the ocean could play a role in these results as well. It is believed, however, that that an aggradational trend would not likely be associated with this subreach, though fluctuations would be influenced by tidal and littoral effects.

The results of the sediment transport model show some consistency with a geomorphic assessment that was also performed. The latter concluded that future vertical adjustments to the streambed profile within the Proposed Project area are expected to be limited. Two locations of probable future streambed degradation were identified where the channel bed is incising through more resistant clay layers. These are located in Reach 5A and 11. Maximum incision was estimated to be up to four feet.

2.2.5.2 Sediment Delivery to the Ocean

Sediment delivered by the Aliso Creek watershed contributes to the coastal littoral processes (longshore movement of sand) associated with the Laguna Beach Group of Littoral Sub-Cells that extends from the Newport Harbor entrance to Dana Point. Aliso Creek is the largest contributor to the sediment budget of this littoral cell compared to the other larger contributing watersheds (Laguna Canyon and Salt Creek) and that from sea-cliff erosion. The landscape along this 13-mile stretch of southern Orange County coastline is characterized by rocky cliffs with headlands and pocket beaches. The short beaches are in dynamic near-equilibrium, and have exhibited remarkable stability over the last 60 years.

The transport of sand from the Aliso Creek watershed supplies Aliso Beach and other beaches of southern Orange County to Dana Point. Sand delivered to the mouth of Aliso Creek originates from upland sources generated by erosion of surface soils and channel supply generated by incision and widening of the channel. It should be noted that as the channel morphology adjusts and approaches dynamic equilibrium conditions, the amount of channel degradation will decrease and the respective contribution of channel supply to sand delivery downstream will decrease under future without-project conditions.

Sediment yield from the Aliso Creek watershed was estimated using multiple approaches. These included estimates of watershed yield (MUSLE[2], LAD Debris Method, Corps Sediment Budget Analysis, and PSIAC[3] method), and previously reported values (Tetra Tech 2009). The resulting bed material yield to the ocean from upland sources (i.e. watershed yield) is estimated to vary between 1,000 to 200,000 tons per year (dry and wet year yield, respectively), with an average annual load of 20,000 to 60,000 tons (Appendix A-1f). Based on more recent HEC-RAS modeling performed, the average annual load range was found to be very similar (Appendix A-2a).

The supply of bed material to Aliso Beach has been artificially elevated over the past two to three decades as thousands of years' worth of alluvial and colluvial sediment has been eroded from the valley fill. Likely this increase in loading has masked the reduction of sand supplied from upland sources due to development of the Aliso Creek watershed.

In light of the relatively consistent, but slightly progradational (delta-forming) beach at the mouth of Aliso Creek, it is likely that the steep shoreface indicates the beach is and has been maintained at/near its holding capacity since the 1920s (Everts Coastal 1997). The absence of a delta off the mouth of Aliso Creek suggests this deficiency following high flow events is probably due to the steep shoreface (USACE 1996). The apparently narrower beaches of the 19th century imply that watershed contributions before the advent of intensive ranching and development were less than the supply between 1927 and 1984. Aliso Beach is one example where less sand was present in the 1920s than 1981. Since the watershed supply of sand is the greatest source to the beach, reductions in the sand supply due to development, and the slowing of channel degradation as the system finds dynamic equilibrium, may result in a beach morphology more similar to that of the 1920s. Further studies would be necessary to confirm this hypothesis.

Sea level rise and potential greater storm surges associated with climate change would compound these coastal effects. Climate change effects in California are expected to bring warmer year-round temperatures and wetter winters. Mean sea level along the California coast is projected to rise, by potentially several feet by year 2100. Rising sea

[2] Modified universal soil loss equation
[3] Pacific Southwest Interagency Committee

level will affect the coastline causing beaches to erode and retreat inland or disappear, depending on local topography and geology, sediment supply from watersheds, and cliff erosion. Coastal wetlands, which usually occur within a few feet of sea level, would tend to move inland if not constrained by existing urban development.

Tidal streams, estuaries, and relatively flat shoreline habitats will be more subject to damage by flooding and erosion. More severe storm surges from the ocean, due to higher sea levels, combined with higher stormwater runoff could significantly increase flood levels by more than the rise in sea level alone. Erosion of beaches would decrease habitat for beach-dependent species (California Climate Change Portal 2017).

2.3 WATER RESOURCES

2.3.1 Hydrology

The Aliso Creek Watershed, like other watersheds in Orange County, has been significantly affected by development. Aliso Creek, once an intermittent stream before the region became heavily urbanized, now flows year-round, augmented in recent decades by significant increases in upstream urban runoff (Orange County Parks 2009a).

A major portion of the watershed lies upstream of a gaging station at Jeronimo Road where discharge data have been collected continuously since 1980. This corresponds roughly to the period of rapidly increasing urbanization in the watershed. Earlier records were collected at the El Toro gage, located approximately 800 feet upstream of Jeronimo Road. Major flood events[4] were recorded at Aliso Creek in 1937, 1969, 1980, 1983, 1992, 1993, 1995, 1998, 2003, 2005, and 2008; the 1998 event is the largest in the record. Historic streamflows recorded in Aliso Creek since 1932 are shown on Figure 2.3-1.

Peak discharge values were adopted from a prior hydrology and hydraulics study conducted by the Corps (Tetra Tech 2009). These values are presented in Table 2.3-1 (refer to Appendix A-2a).

Presently, the Aliso Creek watershed is about 75 percent developed and considered to be at near-full build out. The remaining undeveloped 25 percent of the watershed is comprised of Cleveland National Forest, the Wilderness Park, and other conservation areas, and will remain undeveloped. As retrofitting the urbanized areas with onsite controls to reduce a percentage of the runoff will not yield substantial changes during the wet season, discharge values for wet weather flows adopted for this Draft IFR were considered to remain the same between the existing and future without-project conditions.

[4] Defined for this report as floods having peak flow rates of at least 1,500 cubic feet/second.

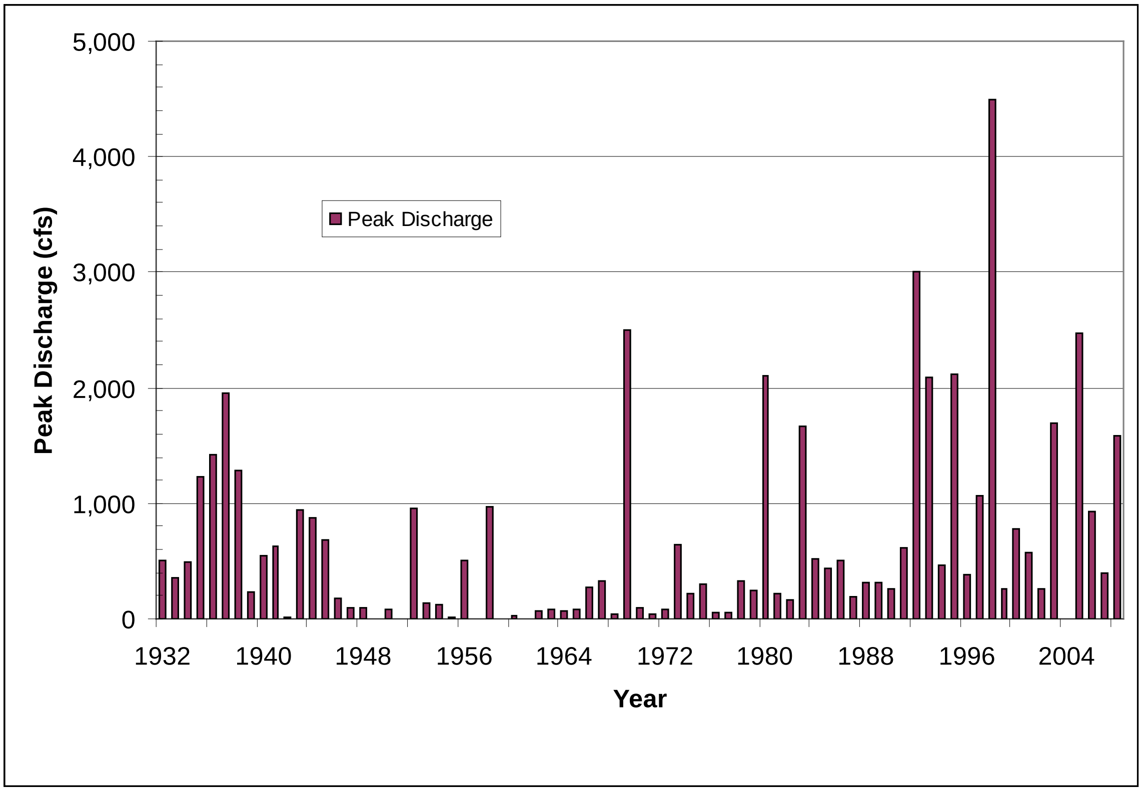


Figure 2.3-1 Peak Discharge History in Aliso Creek

Table 2.3-1 Adopted Peak Discharges (cubic feet/second)

Location	Drainage Area (mi^2)	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	200-Year	500-Year
Jeronimo Road	8.6	670	1,300	1,760	2,400	2,820	3,320	3,900	4,600
Moulton Parkway	10.9	1,020	1,700	2,210	2,650	3,040	3,460	3,780	4,270
Pacific Park Detention Basin Inflow	17.0	1,640	2,550	3,110	3,990	4,640	5,450	6,330	7,430
Pacific Park Detention Basin Outflow	17.0	1,560	2,360	2,830	3,460	3,950	4,450	4,900	5,330
Downstream of Sulphur Creek Confluence	28.1	1,590	2,830	3,810	5,120	6,100	7,240	8,480	10,100
Downstream of Wood Canyon Confluence	31.9	1,600	3,050	4,200	5,500	6,950	8,200	9,600	11,400
Upstream of Abandoned Oxbow	32.5	1,620	3,100	4,250	5,900	7,100	8,300	9,470	11,400
Upstream of SOCWA CTP	33.8	1,650	3,200	4,450	6,050	7,300	8,550	9,620	11,500
Pacific Coast Highway	34.6	1,680	3,300	4,600	6,200	7,400	8,650	9,850	11,600

Statewide water conservation requirements and programs are aimed at reducing urban runoff. Current BMPs include limiting irrigation days and runoff amounts. Dry weather flows could be expected to decrease more over time. It is possible that the perennial nature of the streamflow in the dry season could become ephemeral, or intermittent along segments of the stream course.

As part of this Draft IFR, the 1999 hydrology model was modified. Results presented in the 1999 study[5], as well as those developed and adopted for use in this study, are presented in Table 3.1 of Appendix A-1a.2. These revised discharges will be used as baseline for comparison of the hydrologic effects of the Proposed Project.

The hydrologic analysis indicates that the 50 and 1 percent ACE (2-year and 100-year, respectively) discharges at the mouth of Aliso Creek are 1,680 and 8,650 cubic feet per second (cfs), respectively. However it was noted that the frequency of larger events has increased over the past 20 years compared to any other 20-year period in the hydrologic record.

2.3.2 Floodplain Inundation

In the context of flood risk management, flood inundation of structures is not widespread in the Aliso Creek watershed (Figure 2.3-2). In 1998, a complete survey of structures within the Aliso Creek FEMA 1 percent ACE (100-year) floodplain identified 20 structures at risk of flood inundation, all of which are located in the downstream-most reach of the watershed. Structures prone to flooding included the SOCWA CTP pump house, two maintenance facilities owned by the County and the South Coast Water District, and 17 buildings within the Ranch at Laguna , which often experiences significant damage to its golf course. One of the conclusions of the 2002 Aliso Creek Watershed Management Study was that flood risk management was not economically justified for Federal participation. Current study results indicate that there have not been significant changes in floodplain impacts, and therefore, the 2002 conclusion remains unchanged.

In the context of ecosystem restoration and the importance of a hydrologic connection with its floodplain, the existing Creek is deeply incised with generally steep side slopes and does not experience any flow breakout for the 10 percent ACE (10-year event), except in a few localized areas. One of these areas is immediately upstream of the ACWHEP structure, where, due to the relatively shallow low-flow channel and the immediate surrounding lower topographic relief, the resulting floodplain is approximately 600 feet wide. This is about six times wider than the average floodplain width (about 100 feet). For the 1 percent ACE (100-year event), the existing creek experiences a slight increase in the number of breakouts and size of the floodplain; however, the breakouts are very isolated and not continuous along the creek. Floodplain mapping is presented in Appendix A-2b.

[5] Refers to the Hydraulic and Sediment Analysis Appendix completed in 1999 (subsequently finalized/published in 2002) for the Aliso Creek Watershed Study.

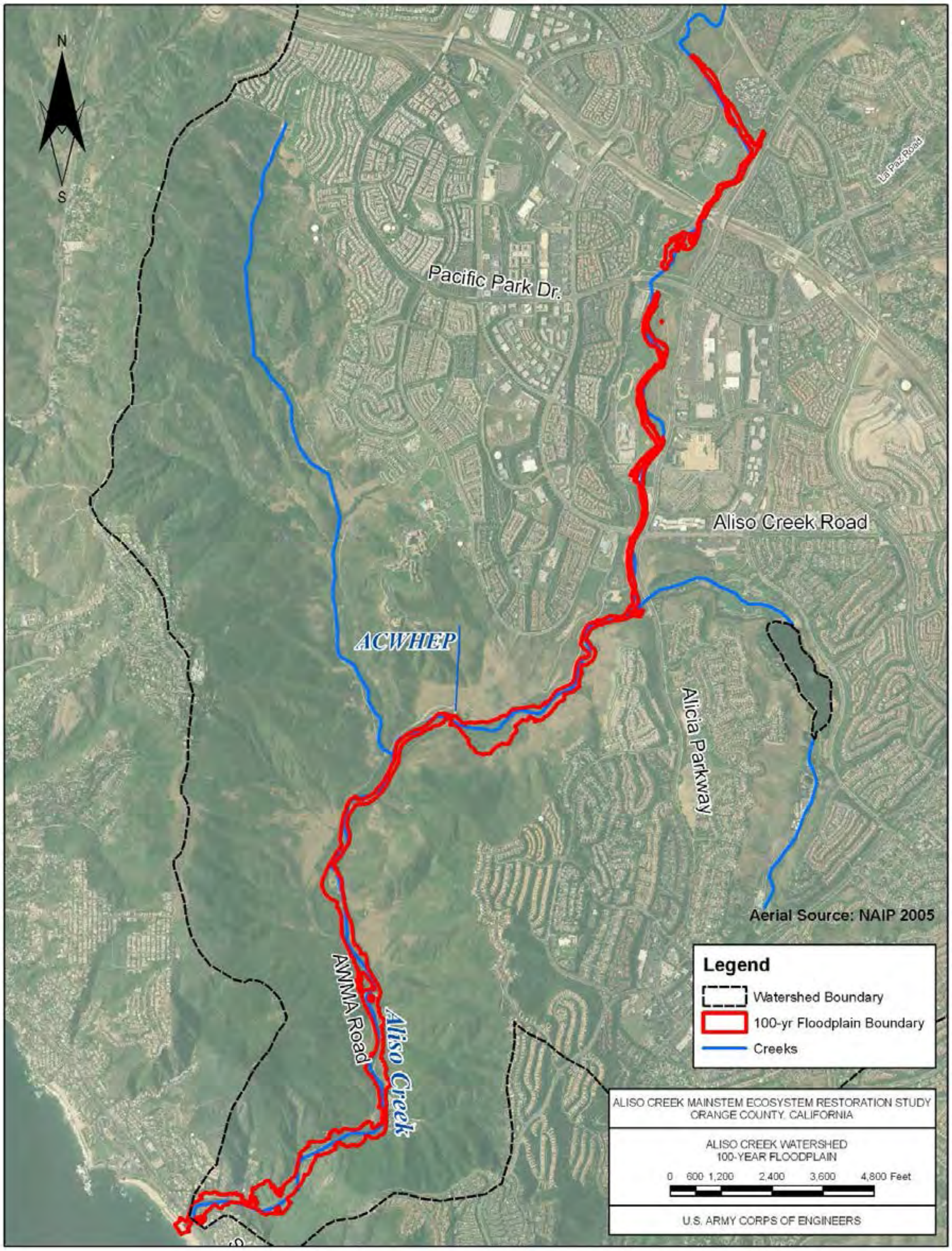


Figure 2.3-2 1 Percent ACE (100-Year) Floodplain

2.3.3 Water Quality

Over the past 40 years, the Orange County Health Care Agency (OCHCA) has tested the coastal waters in Orange County for bacteria that indicate possible presence of human disease-causing organisms. Sampling within the watershed is performed at the mouth of Aliso Creek and on Aliso Beach. Exceedances of the regulatory standards for bacteria indicators at the sampling locations have led to postings of the beach at the mouth of Aliso Creek that identify the potential hazards to human health that can result from contact with water at that location.

Bacteria are a common contaminant in stormwater and sources that include animal excrement, sanitary sewer overflows, garden wastes, organic fertilizers, and manures. Irrigation runoff is likely the primary source for bacteria in the Aliso Creek watershed. Other constituents of concern within the watershed include total suspended solids (TSS), nutrients, heavy metals, and toxicity. There are areas in the watershed where incising of the creek has exposed new sediments and areas where sediments have already settled out. Erosion and resulting sediments can increase TSS in Aliso Creek. Nutrients in the watershed can result from excessive vegetative growth that may deplete dissolved oxygen. Heavy metals can have toxic effects on some receptor species, if at high concentrations. Toxicity refers to effects of water on receptor species. The hardness of water in Aliso Creek causes metals to bind with other complexes in the creek substrate preventing uptake by receptor species. The water may be toxic if it results in mortality of reproductive issues with the receptor species population.

2.3.4 Clean Water Act (CWA) 303(d) List and Total Maximum Daily Loads

The Aliso Creek watershed is under the jurisdiction of the San Diego Regional Water Quality Control Board (RWQCB). The Aliso Creek watershed has been designated as a target watershed for priority water quality enhancement efforts and has multiple impairments listed in the 2010 CWA Section 303(d) list. Water quality constituents of concern within the watershed include TSS, nutrients, heavy metals, selenium, Malathion, and toxicity. Erosion and sediment accumulation can impact the flood capacity as well as benthic community in the creek. Nutrients can result in excessive vegetative growth that may deplete dissolved oxygen. Heavy metals can have toxic effects on some receptor species, if at high concentrations.

Specifically, Aliso Creek is listed as impaired for fecal indicator bacteria (FIB), phosphorus, nitrogen, selenium, and toxicity; the Creek mouth and Aliso are also listed for FIB and toxicity. The creek listings were specifically noted to include 7.2 miles of major tributaries to Aliso Creek; Sulphur Creek, Wood Canyon Creek, Aliso Hills Channel, Dairy Fork Creek, and English Canyon Creek. A draft of the 2014 listing cycle 303(d) list was released in October 2016 for public review, which included new recommended listings for benthic community effects and Malathion for the Creek, and toxicity at the Creek mouth.

In 2010, the RWQCB developed a total maximum daily load (TMDL) for FIB for 20 beaches and creeks in the San Diego Region, including Aliso Creek and Aliso Creek mouth. This TMDL is currently being revised to incorporate EPA's 2012 Recreational Water Quality Criteria and recent scientific findings. TMDLs for phosphorus and toxicity are due by 2019.

FIB has been a primary concern in the watershed over the past decades for the protection of contact recreation beneficial uses (Rec-1) in the creek and at the beach. FIB is a group of bacteria (e.g. total coliform, fecal coliform, *Enterococcus* and E.coli) used as proxies of human fecal contamination and pathogen risks. FIB could originate from various anthropogenic and natural sources including animal (both domestic and wildlife) waste, sanitary sewer overflows, garden wastes, plants and other sources, including regrowth in the environment. Over the past 40 years, the OCHCA and Orange County Stormwater Programs have been monitoring FIB in Aliso Creek and coastal waters.

Photo 2.3-1 Upper Reaches of Proposed Project Area

The data show that beach water quality has been improving since the water body was first listed on the 2002 303(d) list, especially when Aliso Creek did not flow to the ocean during the dry season when the creek outlet is closed as a result of a sand bar that forms naturally, but FIBs still frequently exceeded water quality standards in the creek for *Enterococcus* and at the beach during wet weather when stormwater reaches the ocean. The sand bar does not breach until wet season high flows and wave action open it, or by county maintenance intervention.

Biological scoring tools such as California Stream Condition Index (CSCI) and Index of Biotic Index (IBI) were used to measure the overall stream health. Low CSCI and IBI scores have led to a 303(d) listing for Aliso Creek for benthic community effects in the most recent draft 2014 303(d) listing cycle. It is commonly believed that this impairment is primarily caused by physical factors such as hydrologic alteration (i.e. hydromodification, including both erosion and sediment accumulation) in the stream system, not by individual pollutants (OC Watersheds 2017).

2.3.5 Water Quality Improvement Activities

Various levels of water quality improvement activities have been implemented or planned through local and regional water quality and water conservation efforts by municipalities and water agencies. Those efforts provide water quality benefits by either lowering the pollutant concentration discharged to the creek or by controlling the amount of urban runoff reaching the creek, which in turn reduced the pollutant load.

2.3.5.1 Local and Regional Programs

In response to the statewide water conservation requirements (e.g. Senate Bill No. 7 requiring water consumption reduction by 20 percent by 2020 through water use efficiency and conservation; the 2016 Governor's Executive Order B-37-16 prescribed further requirements on water conservation in response to the multi-year drought), programs and requirements that are aimed at reducing water consumption have been implemented by water agencies. Those programs include tiered rate structures and restrictions on landscape irrigation, which discouraged excessive water usage that creates urban runoff.

Orange County regulations and programs aimed at reducing urban runoff are also included in the National Pollutant Discharge Elimination System (NPDES) permit for MS4 permit, which is renewed every five years and is currently in its fifth term. The MS4 permit requires prohibition of over-irrigation and associated nuisance flows. In response, the MS4 permittees have implemented a number of both structural and non-structural BMPs to comply with the permit by eliminating urban runoff to the maximum extent possible. These BMPs include, but are not limited to, public education, street sweeping, inspections, and structural treatment systems.

In addition to individual municipal and water agency activities, the Integrated Regional Water Management (IRWM) Plan for South Orange County Watershed Management Area has been implemented pursuant to the guidelines and requirements administered by the California Department of Water Resource (DWR). The IRWM Plan as a cooperative effort among all stakeholders in the watershed including MS4 and water agencies includes projects to address a wide range of water quality, water resources, and habitat issues in the watershed. However, the plan does not fully address wet weather issues.

2.3.5.2 Treatment BMPs

In 2002, the County installed a Clear Creek Systems, Inc. (CCS) package plant treatment system at the Springdale Storm Drain Facility (J01P28), a tributary to Aliso Creek that drains a two-square-mile developed area in Aliso Viejo. The treatment system began operation in 2003 and its effectiveness has been evaluated ever since by monitoring the treatment performance of the facility as well as the water quality improvements in the Creek. The monitoring results indicate that the CCS system consistently provides excellent treatment for bacteria with removal efficiency greater than 99 percent. However, this type of structured BMP only performs well for dry weather flows. Rapid bacterial regrowth in the effluent at the confluence with Aliso Creek undermines the benefit of such systems on the overall water quality improvement of Aliso Creek.

Low impact development (LID) requirements have been incorporated for land development projects. This concept focuses on minimizing runoff discharges and treating runoff from development projects by preserving and restoring a site's natural hydrologic cycle, allowing for filtration and infiltration, which can greatly reduce the volume, peak flow rate, velocity, and pollutant loads of urban runoff. Many LIDs have been constructed or planned.

Despite the observed water quality improvement brought forth by these structural BMPs, their cumulative impacts on the water quality in the mainstem of Aliso Creek during wet weather are limited and difficult to quantify.

2.3.6 Groundwater

The San Diego Region Basin Plan designates the Proposed Project area as part of the Aliso hydrologic subarea of the San Juan hydrologic area. The Proposed Project area overlies an area of limited water bearing formations and has historically been a poor and unreliable source of groundwater. Under the Aliso Creek bed, from Santa Margarita Parkway to the San Diego Freeway, alluvial deposits average about 50 to 60 feet in depth and may have underground obstructions that impede groundwater movement.

The basin's alluvium ranges from a mixture of sand, silt, and gravel in the eastern portion to coarse sand near the center, to fine-grained lagoon sediments in the western portion, the latter of which is south of the Proposed Project area (DWR 2004). The alluvium's thickness averages about 65 feet and may be as thick as 125 feet (DWR 2004). The storage capacity of the basin has been estimated between 63,000 and 90,000 acre-feet (DWR 2004). The County of Orange estimated a safe yield of 7,300 acre-feet per year (Orange County 2007). Limited groundwater pumping occurs in the basin, most of it in the upper watershed. It is not likely that extraction activities will increase in the future. Groundwater extraction in the lower watershed area could result in saltwater intrusion and increase total dissolved solids (TDS) levels in the aquifer.

In the lower portions of the groundwater basin, from Wood Canyon Creek to the ocean, groundwater levels have been documented by others to be higher and closer to the creek bed (Engineering-Science 1961). This was attributed to the restricted size of the outlet to the ocean and the presence of a shallow confinement from subsurface geology, and should not be considered as a viable groundwater supply. There are accounts of a 250-acre area within the lower basin that contains artesian groundwater.

Photo 2.3-3 Several drop structures along Aliso Creek within the Proposed Project area were established for flood control purposes.

Photo 2.3-2 At the upstream end of the Proposed Project Area, Aliso Creek has a soft bottom and engineered-compacted fill banks and armored side slopes.

Photo 2.3-4 Before entering the Wilderness Park, Aliso Creek becomes an unarmored creek that extends to the Pacific Ocean.

Photo 2.3-5 At the Aliso Beach, during periods of low flow, a sand berm forms to prevent the creek water from entering the Pacific Ocean, terminating in a pool above the high tide.

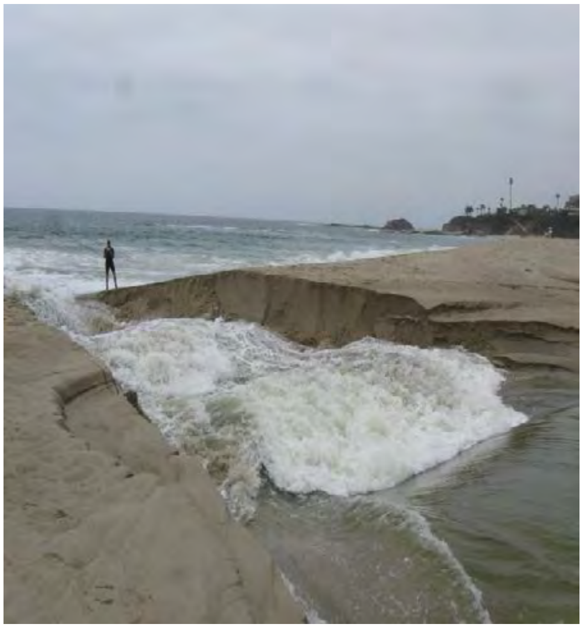


Photo 2.3-6 During periods of higher flows, the sand berm is breached naturally and the creek flows into the Pacific Ocean.

Historically, the Creek had lower flows during the wet season and little or no flow during the dry season, which allowed for the formation of a lagoon at the Creek mouth (South Coast Water District 2008).

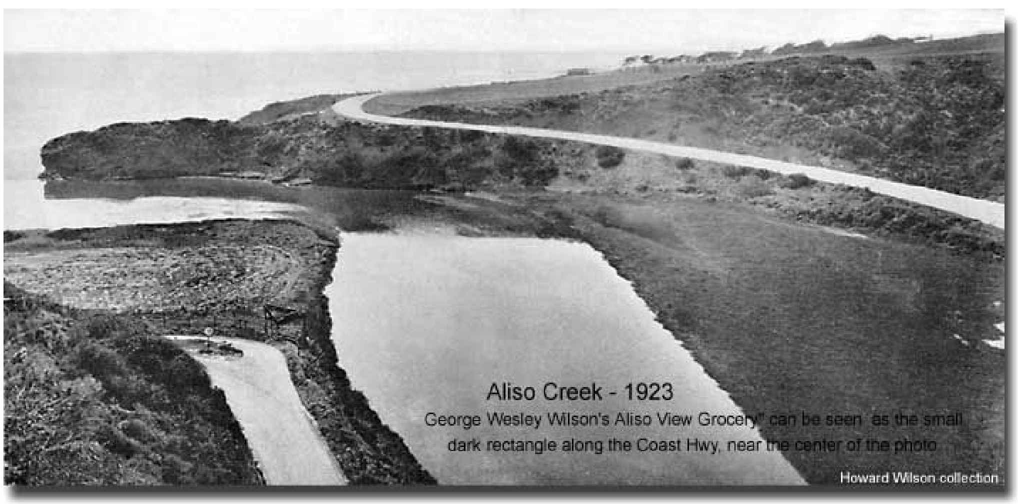


Photo 2.3-7 Historic Creek Mouth Opening

2.3.7 Jurisdictional Determination of Waters of the U.S.

In the absence of adjacent wetlands, jurisdictional limits in non-tidal Waters of the U.S. extend to the ordinary high water mark (OHWM). When adjacent wetlands are present, jurisdiction extends beyond the OHWM to the limit of the adjacent wetlands. Wetlands within Aliso Creek are variable, prone to changes in size and location depending on the severity of storm flows.

Per the 2008 joint U.S. Environmental Protection Agency-Department of the Army guidance implementing the Supreme Court's decision in the consolidated cases *Rapanos v. United States and Carabell v. United States*, which address the jurisdiction over Waters of the U.S. under the CWA, the agencies will assert jurisdiction over relatively permanent non-navigable tributaries of Traditional Navigable Waters (TNW). A non-navigable tributary of a TNW is a non-navigable water body whose waters flow into a TNW either directly or indirectly by means of other tributaries. Non-navigable tributaries of TNWs are relatively permanent where the tributaries typically flow year-round or have continuous flow at least seasonally (e.g., typically three months). Relatively permanent waters do not include ephemeral tributaries, which flow only in response to precipitation and intermittent streams.

Aliso Creek is a direct tributary to the Pacific Ocean, a navigable Water of the U.S. Once an intermittent stream before the region became heavily urbanized, the creek now flows year-round. The two-year storm flow ranges from 1,590 cfs at the ACWHEP structure to 1,680 cfs at the PCH. Likewise, Sulfur Creek and Wood Canyon Creek are creeks that flow for at least three months out of the year. Aliso Creek, Sulfur Creek, and Wood Canyon Creek are therefore relatively permanent non-navigable tributaries of a TNW, and are jurisdictional Waters of the U.S. pursuant to 33 C.F.R. 328.3(a)(5). OHWM encompasses the 10-year floodplain of the creeks.

Wetlands are comprised of three components: availability of water; presence of hydric soils; and presence of wetland vegetation. Though flows are perennial, wetlands are unlikely to be present in areas of the Aliso Creek that are highly eroded or incised. Fringe wetlands or small pockets of wetlands could be present in areas of the creek where floodplains are wide enough to support terraces. At these locations low-energy, sediment-laden flows will occasionally form sandbars that support wetland vegetation such as mule fat (*Baccharis salicifolia*) and small extent of sandbar willow (*Salix. exigu*). However, the diversity of wetland vegetation associated with robust wetlands are absent.

2.4 AIR QUALITY

California is divided geographically into nine air basins. The Proposed Project area is located in the South Coast Air Basin (SCAB), which is bordered by the Pacific Ocean to the west and by San Gabriel, San Bernardino, and Santa Susana Mountains to the north and northeast, and includes all of Orange County, Riverside County, Los Angeles County except for Antelope Valley, and the non-desert portion of San Bernardino County.

Air Quality Management Plan (AQMP)
California Air Resources Board (CARB)
National Ambient Air Quality Standards (NAAQS)
South Coast Air Basin (SCAB)
South Coast Air Quality Management District (SCAQMD)
Southern California Association of Governments (SCAG)
U. S. Environmental Protection Agency (EPA)

Air quality within the Proposed Project area is regulated by the EPA. Orange County falls under the jurisdiction of the South Coast Air Quality Management District (SCAQMD). The SCAQMD in association with the California Air Resources Board (CARB), the Southern California Association of Governments (SCAG), and the EPA developed the 2003 and 2007 revisions to the Regional Air Quality Management Plan (AQMP) for the SCAB. Each of these agencies develops rules, regulations, policies, and goals to comply with applicable legislation. Although EPA regulations may not be superseded, both state and local regulations may be more stringent.

2.4.1 Regional Climate

The Proposed Project area is located in the SCAB under the jurisdiction of the SCAQMD. The regional climate in the SCAB is classified as Mediterranean, characterized by warm, dry summers and mild, moist winters. The region lies in the semi-permanent, high-pressure zone of the eastern Pacific and, as a result, the climate is mild, tempered by cool sea breezes. The region experiences infrequent periods of extremely hot weather, winter storms, or strong northeasterly winds, commonly known as “Santa Ana Winds,” from the desert. The warmest month of the year is typically July, and the coldest is January. The Laguna Beach Monitoring Station 044647 reports an average yearly rainfall of 12.61 inches.

The SCAB is often under a high-pressure system, which contributes to the formation of ozone and smog. The SCAB has a low average wind speed of four miles per hour, and as a result, air contaminants in the SCAB do not readily disperse. On spring and summer days, most pollution is moved out of the SCAB through mountain passes or is lifted by the warm vertical currents produced by the heating of the mountain slopes. From late summer through the winter months, lower wind speeds and the earlier appearance of offshore breezes combine to trap pollution in the SCAB.

The SCAB experiences a persistent temperature inversion as a result of the Pacific high, a large subtropical high pressure system, which holds air contaminants relatively near the ground. Under normal atmospheric conditions, temperature decreases with altitude. During an inversion condition temperature increases with altitude. As the air pollutants rise in the atmosphere they reach an altitude where the ambient temperature exceeds the temperature of the pollutants. This causes the pollutants to sink back to the earth’s surface. This phenomenon acts to trap and concentrate air pollutants near the surface.

In autumn and winter, the area is subject to Santa Ana winds that blow from the inland desert areas through mountain passes, across valleys and coastal basin towards the Pacific Ocean dispersing air contaminants. These conditions tend to last for several days at a time. These winds bring hot temperatures and low humidity often spreading brush fires in the surrounding mountains that endanger wildlife, property, and human life.

El Niño[6] is one of the most widely publicized weather patterns in southern California. El Niño is characterized by an increase in the sea temperatures in the tropical water of the eastern and central Pacific Ocean. The warm water influences the storm patterns globally, bringing heavy rain storms to the coastal regions of the Pacific. Southern California is one of the regions being continuously impacted by El Niño events, which bring warmer than normal winters and severe rain storms. These warm and wetter events occur on an irregular cycle, ranging from two to seven years and each cycle lasts from six months to four years. A La Niña event is the counterpart of an El Niño event. In southern California, La Niña generally brings cooler and drier winter seasons. These two extreme phases of the climate cycle are often referred to collectively as the El Niño/Southern Oscillation (ENSO[7]).

Both the Federal and state governments have established ambient air quality standards for outdoor concentrations of various pollutants to protect public health, as shown in Table 2.4-1.

These standards have been set at levels whose concentrations could be generally harmful to human health and welfare and that protect the most sensitive persons from illness or discomfort with a margin of safety. Table 2.4-1 lists the current California Air Quality Standards (CAAQS) and National Air Quality Standards (NAAQS) for each pollutant.

[6] El Niño – a warming of the ocean current along the coasts of Peru and Ecuador that is generally associated with dramatic changes in the weather patterns of the region; a major El Niño event generally occurs every 3 to 7 years and is associated with changes in the weather patterns worldwide.

[7] ENSO – abbreviation for El Niño-Southern Oscillation, a reference to the state of the Southern Oscillation. Southern Oscillation (SO) - a "see-saw" in surface pressure in the tropical Pacific characterized by simultaneously opposite sea level pressure anomalies at Tahiti, in the eastern tropical Pacific and Darwin, on the northwest coast of Australia.. The SO oscillates with a period of 2-5 years. During one phase, when the sea level pressure is low at Tahiti and high at Darwin, the El Niño occurs. The cold phase of the SO, called “La Niña” by some, is characterized by high pressure in the eastern equatorial Pacific, low in the west, and by anomalously cold sea surface temperature in the central and eastern Pacific. This is called El Niño Southern Oscillation or ENSO.

Table 2.4-1 California and Federal Ambient Air Quality Standards

Pollutant	Averaging Time	California[1] Standard[3]	Federal[2] Standards[3, 4]	Health Effects	Pollutant Characteristics and Major Sources
Ozone (O_3)	1 Hour	0.09 ppm (180 μg/m^3)	N/A	Short term exposure to high concentrations can irritate eyes and lungs. Long term exposure may cause permanent damage to lung tissue.	Ozone is a secondary pollutant that is formed in the atmosphere through reactions between reactive organic gases and nitrogen oxides in the presence of sunlight. Major sources include combustion processes, i (motor vehicles) and evaporative solvents, paints and fuels.
	8 Hours	0.070 ppm (137 μg/m^3)	0.075 ppm (147 μg/m^3)		
Particulate Matter (PM_{10})	24 Hours	50 μg/m^3	150 μg/m^3	May irritate eyes and respiratory tract, decreases in lung capacity, cancer and increased mortality. Produces haze and limits visibility.	Solid or liquid particles in the atmosphere. Sources include dust and fume-producing industrial and agricultural operations, combustion, atmospheric photochemical reactions, and natural activities (e.g., wind-raised dust and ocean sprays.)
	Annual Arithmetic Mean	20 μg/m^3	N/A		
Fine Particulate Matter ($PM_{2.5}$)	24 Hours	No Separate State Standard	35 μg/m^3	Increases respiratory disease, lung damage, cancer, and premature death. Reduces visibility and results in surface soiling.	Solid or liquid particles in the atmosphere. Major sources include fuel combustion in motor vehicles, equipment, and industrial sources, residential, and agricultural burning. May also be formed from photochemical reactions of other pollutants, including nitrogen dioxide, sulfur dioxide and organics.
	Annual Arithmetic Mean	12 μg/m^3	12.0 μg/m^3		
Carbon Monoxide (CO)	8 Hours	9.0 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)	Classified as a chemical asphyxiate, interferes with the transfer of fresh oxygen to the blood and deprives sensitive tissues of oxygen. Exposure to high concentration can cause headaches, dizziness, fatigue, unconsciousness, and even death.	An odorless, colorless gas that is formed by incomplete combustion of fuels. The primary source is the internal combustion engine, primarily gasoline-powered motor vehicles.
	1 Hour	20 ppm (23 mg/m^3)	35 ppm (40 mg/m^3)		
Nitrogen Dioxide (NO_2)[5]	Annual Arithmetic Mean	0.030 ppm (57 μg/m^3)	53 ppb (100 μg/m^3)	Irritating to eyes and respiratory tract.	A reddish brown gas that is a by-product of combustion. Motor vehicles and industrial operations are the main sources.
	1 Hour	0.18 ppm (339 μg/m^3)	100 ppb (188 μg/m^3)		
Lead (Pb)[7,8]	30 days Average	1.5 μg/m^3	N/A	Disturbs the nervous system, kidney	Sources include lead smelters, battery

Table 2.4-1 California and Federal Ambient Air Quality Standards

Pollutant	Averaging Time	California[1] Standard[3]	Federal[2] Standards[3,4]	Health Effects	Pollutant Characteristics and Major Sources
	Calendar Quarter	N/A	1.5 μg/m³	function, immune system. Reproductive system, and developmental systems, and the cardio vascular system.	manufacturing and recycling facilities. Past source was lead gasoline.
	Rolling 3-Month Average	N/A	0.15 μg/m³		
Sulfur Dioxide (SO_2)[6]	24 Hours	0.04 ppm (105 μg/m³)	0.14 ppm (for certain areas)	Irritates upper respiratory tract; injurious to lung tissue. Can yellow leaves of plants. Destructive to marble, iron, and steel. Limits visibility and reduces sunlight.	A colorless acid gas with a strong odor. Fuel combustion, chemical plants, sulfur recovery plants, and metal processing are the main sources of this pollutant.
	3 Hours	N/A	N/A		
	1 Hour	0.25 ppm (655 μg/m³)	75 ppb (196 μg/m³)		
	Annual Arithmetic Mean	N/A	0.30 ppm (for certain areas)		
Visibility-Reducing Particles[9]	8 Hours (10 a.m. to 6 p.m., PST)	Extinction coefficient = 0.23 km@<70% RH	**No Federal Standards**		
Sulfates	24 Hour	25 μg/m³			
Hydrogen Sulfide	1 Hour	0.03 ppm (42 μg/m³)			
Vinyl Chloride[7]	24 Hour	0.01 ppm 0.02 (26 μg/m³)			

μg/m³ = micrograms per cubic meter; ppm = parts per million; ppb = parts per billion; km = kilometer(s); RH = relative humidity; PST = Pacific Standard Time; N/A = Not Applicable

1. 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.
2. 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 three years, is equal to or less than the standard. For PM10, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 μg/m3 is equal to or less than one. For PM2.5, the 24-hour standard is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or less than the standard.
3. Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°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 a reference pressure of 760 torr; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.
4. National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health.
5. 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 standards are in units of ppb. California standards are in units of ppm. To directly compare the national standards to the California standards the units can be converted from ppb to ppm. In this case, the national standards of 53 ppb and 100 ppb are identical to 0.053 ppm and 0.100 ppm, respectively.
6. On June 2, 2010, a new 1-hour SO2 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 SO2 national standards (24-hour and annual) remain in effect until one 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

Table 2.4-1 California and Federal Ambient Air Quality Standards

Pollutant	Averaging Time	California[1] Standard[3]	Federal[2] Standards[3,4]	Health Effects	Pollutant Characteristics and Major Sources

standard is in units of ppb. California standards are in units of parts per million (ppm). To directly compare the 1-hour national standard to the California standard the units can be converted to ppm. In this case, the national standard of 75 ppb is identical to 0.075 ppm.

7. 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.
8. The national standard for lead was revised on October 15, 2008 to a rolling 3-month average. The 1978 lead standard (1.5 µg/m3 as a quarterly average) remains in effect until one 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 standard are approved.
9. 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 “extinction of 0.07 per kilometer” for the statewide and Lake Tahoe Air Basin standards, respectively.

Source: CARB; EPA 2014

2.4.2 Attainment Status

If pollutant concentration levels of any of the criteria pollutants exceed the state or Federal standards established for those pollutants, the state and EPA designate the area “nonattainment” for those pollutants. An area can be designated as a marginal, moderate, serious, severe, or extreme nonattainment area depending upon the level of pollutant concentrations. If standards for pollutants are met in a particular area, the area is designated as being in “attainment” for those pollutants. Areas where, due to a lack of measurements, there is insufficient data to make a determination for certain criteria pollutants are designated “unclassified” for those pollutants, and are typically treated as attainment areas. The attainment status of the Proposed Project area is summarized in Table 2.4-2.

Table 2.4-2 Attainment Status for Federal and Regulated Pollutants

Pollutant	State Designation	Federal Designation
Ozone (8-hour)	Nonattainment	Extreme Nonattainment
Ozone (1-hour)	Extreme Nonattainment	Extreme Nonattainment
PM_{10}	Nonattainment	Attainment/Maintenance
$PM_{2.5}$	Nonattainment	Nonattainment
CO	Attainment	Attainment/Maintenance
NO_2	Attainment	Attainment/Maintenance
Lead	Attainment	Attainment
SO^2	Attainment	Attainment

Source: https://www.arb.ca.gov/desig/adm/adm.htm

The SCAQMD has established regional thresholds of significance for construction activities as shown below in Table 2.4-3.

Table 2.4-3 SCAQMD Air Quality Regional Thresholds

Criteria Pollutant	Construction Emissions lbs/day
Carbon Monoxide (CO)	550
Oxides of Nitrogen (NOx)	100
Particulate Matter (PM_{10})	150
Fine Particulate Matter ($PM_{2.5}$)	55
Oxides of Sulfur (SOx)	150
Volatile Organic Compounds (VOC)	75
Source: SCAQMD 2008	

In addition to the thresholds provided in Table 2.4-3, the SCAQMD provides relevant localized significance thresholds (LSTs) for toxic air contaminants (TACs), odors, and ambient air quality (Table 2.4-4).

Table 2.4-4 Localized Significant Thresholds for the SCAQMD

Criteria Pollutant	Toxic Air Contaminants (TACs) and Odor Thresholds
TACs (including carcinogens and non-carcinogens)	Maximum Incremental Cancer Risk ≥ 10 in 1 million Hazard Index ≥ 1.0 (project increment) Hazard Index ≥ 3.0 (facility-wide)
Odor	Project creates an odor nuisance pursuant to SCAQMD Rule 402
	Ambient Air Quality for Criteria Pollutants [a]
NO_2 1-Hour Average Annual Average	Project is significant if it causes or contributes to an exceedance of the following attainment standards: 0.25 ppm (State) 0.053 ppm (Federal)
PM_{10} 24-Hour Average	10.4 $\mu g/m^3$ (recommended for construction) [b] 2.5 $\mu g/m^3$ (operation)
$PM_{2.5}$ 24-hour average	10.4 $\mu g/m^3$ (construction)[b] & 2.5 $\mu g/m^3$ (operation)
CO 1-Hour Average 8-Hour Average	Project is significant if it causes or contributes to an exceedance of the following attainment standards: 20 ppm (State) 9.0 ppm (State/Federal)

Source: SCAQMD 2008
Notes: lbs/day = pounds per day; ppm = parts per million; ug/m^3 = micrograms per cubic meter; ≥ greater than or equal to
a. Ambient air quality threshold for criteria pollutants based on SCAQMD Rule 1303, Table A-2 unless otherwise stated.
b. Ambient air quality threshold based on SCAQMD Rule 403.

Ozone is not included in Table 2.4-3 or Table 2.4-4. Ozone is not directly emitted from stationary or mobile sources; rather it is formed as the result of chemical reactions in the atmosphere between directly emitted air pollutants, specifically oxides of nitrogen (NOx) and hydrocarbons (VOCs). Therefore, it cannot be directly regulated.

CARB reports one low emitting facility for reactive organic gases (ROG), carbon monoxide (CO), and nitrous oxides (NOx) in the Proposed Project area: the SOCWA CTP. The two closest SCAQMD monitoring stations to the Proposed Project area are in Mission Viejo and Costa Mesa. The Mission Viejo station is representative of the inland areas of the watershed while the Costa Mesa station is representative of coastal areas (Table 2.4-5).

Table 2.4-5 Local Ambient Air Qualtiy for 2014

	Carbon Monoxide		Ozone		Nitrogen Dioxide	
Air Quality Monitoring Station[1]	8-hour ppm	1-hour ppm	8-hour ppm	No. Daye Exceeded State 8 hour standards	1 hour ppb	Average Annual
Mission Viejo	.70	.079	.088	5		
North Coastal (Costa Mesa)	1.7	.090	.079	4	60.6	10.4

[1] National data is used when California data is unavailable.
No PM_{10} or $PM_{2.5}$ data is available at the Costa Mesa monitoring station. No NOx data is available at the Mission Viejo monitoring station.
Source: CARB 2015

Per Section 176(c) of the Clean Air Act Amendments (CAAA) of 1990, the Corps must make a determination of whether the Proposed Project (i.e., Proposed Action) “conforms” to the State Implementation Plan (SIP).

Table 2.4-6 SCAB General Conformity Thresholds

NOx and VOC	PM_{10}	CO and $PM_{2.5}$ and SO_2	CO_2 Equivalent
25 tons/year	70 tons/year	100 tons/year	7,000 tons/year

2.4.3 Greenhouse Gases

Parts of the earth's atmosphere act as an insulating blanket, trapping sufficient solar energy to keep the global average temperature in a suitable range. The blanket is a collection of atmospheric gases called GHGs. These gases, water vapor, carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), ozone, chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6), all act as effective global insulators, reflecting back to earth visible light and infrared radiation. Human activities such as producing electricity and driving vehicles have elevated the concentration of these gases in the atmosphere. Many scientists believe that these elevated levels, in turn, are causing the earth’s temperature to rise. A warmer earth may lead to changes in rainfall patterns, much smaller polar ice caps, a rise in sea level, and a wide range of impacts on plants, wildlife, and humans. See Appendix B-9 for more information on greenhouse gases.

2.5 CLIMATE CHANGE

Climate Change is a change in the average climatic conditions of the earth, characterized by changes in wind patterns, storms, precipitation, and temperature. The baseline by which these changes are measured originates in historic records identifying temperature changes that have occurred in the past, such as during previous ice ages. Many of the recent concerns over global climate change use this data to extrapolate a level of statistical significance, focusing on temperature records from the last 150 years (the Industrial Age) that differ from previous climate changes in rate and magnitude.

2.5.1 Potential Changes and Effects from Climate Change

The many effects of GHG emissions are still being researched and are not fully known, but are expected to include increased temperatures, which could reduce snowpack, which in most areas is a primary source of fresh water. Climate change is expected to exacerbate air quality problems and adversely affect human health by increasing heat stress and related deaths; increase the incidence of infectious diseases, asthma and respiratory health problems; cause sea level rise threatening urban and natural coastal areas; cause variations in natural plant communities affecting wildlife; and cause variations in crop quality and yields. Climate change is also expected to result in more extreme weather events and heavier precipitation events that can lead to flooding as well as more extended drought periods.

Climate models applied to California's conditions project that, under different scenarios, temperatures in California are expected to increase by 3 to 10.5 degrees Fahrenheit (ºF) (CCC 2006). Almost all climate scenarios include a continuing trend of warming through the end of the century given the substantial amounts of greenhouse gases already released and the difficulties associated with reducing emissions to a level that would stabilize the climate. According to the 2006 California Climate Action Team Report, the following climate change effects are predicted in California over the course of the next century.

- A diminishing Sierra snowpack declining by 70 to 90 percent, threatening the state's water supply.
- Increasing temperatures, as noted above, of up to approximately 10ºF under the higher emission scenarios, leading to a 25 to 35 percent increase in the number of days ozone pollution levels are exceeded in most urban areas.
- Coastal erosion along the length of California and seawater intrusion into the Delta from a 4- to 33-inch rise in sea level. This would exacerbate flooding in already vulnerable regions.
- Increased vulnerability of forests due to pest infestation and increased temperatures.
- Increased challenges for the state's important agricultural industry from limited water shortage, increasing temperatures, and saltwater intrusion into the Delta.
- Increased electricity demand, particularly in the hot summer months.

2.5.2 Water Resources

Water supply can be described in terms of indices such as precipitation, snow pack, and runoff. Analysis of data and weather records are studied to determine the trend and the variability in the indices (e.g., precipitation and runoff), which affect water availability.

Most precipitation events in southern California occur between November and March. An analysis by the U.S. National Weather Service (USNWS) in 2008 using data from 1931 through 2005 indicates a long-term trend of increasing annual precipitation (i.e., increase of up to 1.5 inches per decade) in California, especially in northern California.

There is also evidence that the amount of precipitation that occurs on an annual basis is becoming more variable (i.e. periods of both high and low rainfall are becoming more common). A study performed by DWR in 2006 indicated that present day variability in annual precipitation is about 75 percent greater than that of the early 20th century. As stated above, precipitation across California appears to have increased over the past century, and individual water years have become more variable in terms of the amount of precipitation that occurs. It follows, therefore, that similar trends would be observed for runoff. Annual runoff (i.e. runoff measured from October 1 through September 30) and peak runoff (i.e. typically measured for individual storm events) include flows derived from precipitation events, snowmelt, and river base flow. However, most of the water mass present during a peak runoff event is typically derived from concurrent precipitation and/or snowmelt.

It is anticipated that southern California will experience roughly the same amount of total precipitation throughout the 21st century as it received in the last few decades of the 20th century. However, while the amount of precipitation is expected to remain nearly the same, more will fall as rain instead of snow. Precipitation as rainfall shortens the chance to capture water compared to snow stored in mountains, and increases in rainfall precipitation may therefore exacerbate flood risks (UCLA; LARC 2014a).

Climate change is additionally expected to result in more severe drought events (USC 2013). Although droughts are often started by lower-than-usual levels of precipitation, there have been many periods of low precipitation in California's recent and distant past; drought may also be affected by rising temperatures, which contribute to drought's severity, by increasing evaporation and decreasing soil moisture (UCLA; LARC 2014b).

2.5.3 California Wildlife

Rising temperatures and sea level along California's coast will likely change the makeup of entire ecosystems, forcing wildlife to shift their ranges and adapt. Hotter, drier conditions could reduce what is left of these important wetlands. The state bird, the California quail, may disappear from many parts of the state in summer due to changes in climate forcing the bird to migrate to more suitable breeding habitat. Global warming could contribute to more frequent and intense El Niño events, which may encourage toxic algae blooms in bays and estuaries and depress ocean productivity offshore, affecting wildlife throughout the food web.

2.5.4 Health Issues

A community's vulnerability to climate change is determined by the community's ability to anticipate, cope with, resist, and recover from the impact of extreme weather events such as hurricanes, flood, heat waves, air pollution, and infectious diseases. The vulnerability of neighborhoods with low-income and minority inhabitants will be exasperated by lack of adequate social and material resources to cope with these impacts.

Communities-of-color and economically disadvantaged communities have historically borne a disproportionate impact of climate change burden of pollution and health disparities. The incidence of morbidity and premature mortality associated with mounting physical, biological impacts, and economic consequences of climate change are projected to increase.

2.6 NOISE AND VIBRATION

Noise can be defined as unwanted sound or combination of sounds that may interfere with conversation, work, rest, recreation, and sleep, or in the extreme may produce physiological or psychological damage. Sound has two main components to a human ear: pitch and loudness. Sound travels from a source in the form of a wave, which exerts a pressure on a receptor such as a human ear. While the pitch of a sound is generally associated with an annoyance, sound loudness can interfere with activities and can have lasting physiological effects, such as hearing loss.

Factors that influence individual response include the intensity, frequency, and pattern of noise; the amount of background noise present before the intruding noise; and the nature of work or human activity that is exposed to the noise source. The amount of pressure a sound wave exerts is referred to as sound level, commonly measured in decibels (dB). As a reference, a sound level of zero dB corresponds roughly to the threshold of human hearing and a sound level in the range of 120 to 140 dB can produce human pain. Those who are more sensitive to noise such as children and the elderly are at higher risk of being adversely affected by excessive noise levels.

2.6.1 Noise Measurements

The preferred unit for measuring sound is the dB. The dB expresses the logarithmic ratio of the amount of energy radiating from a source in the form of an acoustic wave. The typical human ear is not equally sensitive to all frequencies of the audible sound spectrum. Sound intensity is measured in decibels that are A-weighted (dBA) to correct for the relative frequency response of the human ear. The range of human hearing extends from approximately 3 to 140 dBA.

Equivalent noise level (Leq) is the average noise level on an energy (acoustic energy) basis for any specific time period. The Leq for one hour is the energy average noise level during the hour. The average noise level is based on the energy content (acoustic energy) of the sound. Leq can be thought of as the level of a continuous noise that has the same energy content as the fluctuating noise level. The equivalent noise level is expressed in units of dBA.

Noise sources are classified in two forms: point sources, such as stationary equipment or a water reclamation plant, or individual motor vehicles; and line sources, such as a roadway with a large number of point sources (such as motor vehicles) (Table 2.6-1). Sound generated by a point source typically diminishes (attenuates) at a rate of 6.0 dBA for each doubling of distance from the source to the receptor at acoustically "hard" sites and 7.5 dBA at acoustically "soft" sites. For example, a 60-dBA noise level measured at 50 feet from a point source at an acoustically hard site would be 54 dBA at 100 feet from the source and 48 dBA at 200 feet from the source. Sound generated by a line source typically attenuates at a rate of 3.0 dBA and 4.5 dBA per doubling of distance from the source to the receptor for hard and soft sites, respectively.

Table 2.6-1 Weighted Decibel Scale

Decibels	Effects	Observation	Source
130		Pain Threshold	Hard Rock Band Thunder
120			
110		Deafening	Jet Take-Off
100			Loud Auto Horn at 10 feet
90	Hearing Loss		Noisy City Street
85			
80		Very Loud	School Cafeteria
75			
70	Physiological Effects		Vacuum Cleaner at 10 Feet
65			
60	Interference with Speech	Loud	Normal Speech at 3 Feet
55			
50			Average Office
45	Sleep Interruption	Moderately Loud	Dishwasher in Next Room
40			Soft Radio Music
35			Quiet Residential Area
30			Interior of Average Residence
20	Sleep Disturbance	Faint	Average Whisper at 6 Feet
10			Rustle of Leaves in Wind
5		Very Faint	Human Breathing
0		Audibility Threshold	

Source: Los Angeles County 2008

2.6.2 Sensitive Receptors

Human response to noise varies considerably from one individual to another. Effects of noise at various levels can include interference with sleep, concentration, and communication, and can cause physiological and psychological stress and hearing loss. Given these effects, some land uses are considered more sensitive to ambient noise levels than others. In general, residences, schools, hotels, hospitals, and nursing homes are considered to be the most sensitive to noise. Places such as churches, libraries, and cemeteries, where people tend to pray, study, and/or contemplate are also sensitive to noise. Commercial and industrial uses are considered the least noise-sensitive.

Sensitive receptors upstream of AWMA Road Bridge, immediately adjacent to the Proposed Project area include Wood Canyon Elementary School and the Church of Jesus Christ of Latter Day Saints. Upstream of Aliso Creek Drive to Pacific Park Drive on the west side of the Creek, sensitive receptors include the Journey School and Aliso Niguel High School.

Table 2.6-2 Weighted Decibel Scale

Land Use	Community Noise Equivalent Level, dBA						
	50	55	60	65	70	75	80
Residential Single Family, Duplex, Mobile Home	A	C	C	C	N	U	U
Residential Multifamily	A	A	C	C	N	U	U
Transient Lodging, Motel, Hotel	A	A	C	C	N	U	U
School, Library, Church, Hospital, Nursing Home	A	A	C	C	N	N	U
Auditorium, Concert Hall, Amphitheater	C	C	C	C/N	U	U	U
Sports Arena, Outdoor Spectator Sports	C	C	C	C	C/U	U	U
Playground, Neighborhood Park	A	A	A	A/N	N	N/U	U
Golf Course, Riding Stable, Water Recreation, Cemetery	A	A	A	A	N	A/N	U
Office Building, Business, Commercial, Professional	A	A	A	A/C	C	C/N	N
Agriculture, Industrial, Manufacturing, Utilities	A	A	A	A	A/C	C/N	N

Notes:
A = *Normally Acceptable*. Specified land use is satisfactory, based upon the assumption that buildings involved are conventional construction, without any special noise insulation.
N = *Normally Unacceptable*. New construction or development generally should be discouraged. A detailed analysis of noise reduction requirements must be made and noise insulation features are included in the design of a project.
C = *Conditionally Acceptable*. New construction or development only after a detailed analysis of noise mitigation is made and needed noise insulation features are included in project design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning normally will suffice.
U = *Clearly Unacceptable*. New construction or development generally should not be undertaken.
Source: California Office of Noise Control, Department of Health Services

2.6.3 Local Noise Sources

The primary ambient noise sources within the Proposed Project area include overhead aircraft, minor noise associated with recreation use of trails, visitors congregating at popular trailheads, and occasional truck traffic along the SOCWA CTP private service road. Upstream of AWMA Road Bridge, commercial and industrial areas typically have a higher ambient noise level than residentially zoned areas.

2.6.4 Ground-Borne Vibration

Ground-borne vibration is a measurement in terms of the velocity of the vibration oscillations. As with noise, a logarithmic decibel scale is used to quantify vibration intensity. When evaluating human response, ground-borne vibration is usually expressed in terms of root mean square (RMS) vibration velocity. RMS is defined as the average of the squared amplitude of the vibration signal. The vibration amplitude is expressed in dB using a decibel reference of 1 x 10 –6 inches/second. To avoid confusion with sound decibels, the abbreviation VdB is used for vibration decibel measurements. Table 2.6-3 shows typical vibration levels from various sources as well as the human and structure response to such levels. The threshold of perception for most people is around 65 VdB. Vibration levels in the 70- to 80-VdB range are often noticeable but acceptable. Typically, vibration levels must exceed 100 VdB before building damage occurs, except for historic structures, which usually have a damage threshold of 95 VdB.

Ground-borne vibration could also be perceived as a second noise source. Ground-borne noise could result in rattling windows or other items and in noise radiated from vibrating room surfaces. Ground-borne vibration levels resulting in ground-borne noise are often experienced as a combination of perceptible vibration and low frequency noise.

Sensitive land uses for ground-borne vibration include residences, schools, churches, and hospitals. Outdoor park facilities such as picnic areas or athletic fields are not considered to be sensitive to ground-borne noise or vibration. Certain industrial buildings that use high-resolution imaging equipment, such as electron microscopes and historic structures are also sensitive to ground-borne noise and vibration.

Table 2.6-3 Ground-Borne Vibration Levels

Human/Structural Response	Velocity Level	Typical Source (50 feet)
Minor Cosmetic Damage (fragile buildings)	100	Blasting from construction projects
Difficulty with tasks such as reading a computer screen	90	Bulldozers/Heavy equipment Commuter rail, upper range
Residential Annoyance, Infrequent events	80	Rapid transit Commuter Rail, typical Bus or truck over bump
Residential Annoyance, Infrequent events	70	Rapid transit, typical
Limit of Vibration, sensitive equipment / Threshold of human perception	60 50	Typical background

Source: FTA 1995

2.6.5 Local Sources

Local sources of ground vibration within the Proposed Project area are currently limited to rumbling and vibration caused by trucks coming and going from the SOCWA CTP via either road. Some maintenance activity within the Wilderness Park, in particular, repairing the paved AWMA Road (also referred to as Aliso Creek Trail) that includes asphalt repair would be a source of ground vibration.

2.7 BIOLOGICAL RESOURCES

2.7.1 Introduction

Riparian ecosystems are centers of biological diversity and relationships between terrestrial and aquatic systems. Riparian ecosystems are also environments that are most disturbed by humans and in need of restoration to maintain natural, biotic, genetic variability and ecological integrity. Fundamental qualities of riparian systems are articulated as three basic principles. The basic principles are: flow regime determines the successional evolution of riparian plant communities and ecological processes; riverine corridor serves as a pathway for redistribution of organic and inorganic material that influences plant communities along rivers; and riparian system is a transition zone between land and water ecosystems and is disproportionately plant-species rich when compared to surrounding ecosystems (Nilsson and Svedmark 2002).

The ecological importance of riparian (riverine) areas derives from a range of attributes, such as moisture availability, structural complexity, linear continuity (for migration corridors), distinct microclimate (cooler in summer, protected in winter), diverse food resources (terrestrial and aquatic), and influence on aquatic habitat. Riverine vegetation has a greater influence on channel processes and aquatic habitat in smaller channels than in larger ones. The effect of roots in stabilizing banks, the role of large woody debris in creek processes, the importance of terrestrial food sources as opposed to within creek food production, and the shading effect of bank vegetation are all relatively more important in small channels. Geomorphic and hydrologic processes and conditions important to riparian ecology include flood inundation, the physical effects of high velocity flood flows, stream-groundwater interactions, and the extent and texture of alluvium.

Riparian zones are dynamic. Frequent disturbance events in riparian zones create complex mosaics of landforms and associated biological communities that often are more heterogeneous and varied than those associated with upslope terrestrial landscapes. Flooding is frequent, often annual or even more often a single flood event through miles of river/creek valley. Individual vegetation patches created by flooding in valley surfaces are small discontinuous lands relative to the total area influenced by the disturbance within a river basin.

Geomorphic processes that modify riparian zones operate on time scales ranging from decades to centuries and on spatial scales ranging from localized shifts in channel position involving a few square meters to basin-wide flooding. In addition to fluvial or erosional events that create new geomorphic surfaces, sediment deposition and battering during floods cause less severe but more frequent damage, which may influence the course and rate of vegetation succession.

Fluvial disturbance from floods and the non-fluvial disturbance regimes of adjacent upland areas (e.g. fire, wind, plant disease, and insect outbreaks) are reflected in the histories of distribution and composition of riparian vegetation types (Gregory et al. 1991). Riparian plant communities exhibit a high degree of structural and compositional diversity. The exposed active channel is colonized by herbs and seedlings of shrubs and trees during periods of low discharge in most streams. Frequent flooding within this zone discourages establishment of terrestrial vegetation both by surface erosion and physiological effects of periodic inundation. Floodplains, terraces, or hillslopes immediately adjacent to active channels may be occupied by herbs, shrubs, and structural classes reflecting the history of flooding (Gregory et al. 1991). Magnitude, frequency, and duration of floods diminish laterally away from the active channel and thereby development of riparian vegetation reflects disturbance regimes on these lateral surfaces (Faber et al. 1989). Riparian vegetation types on surfaces closer to the active channel are characterized by younger stands, commonly composed of deciduous shrubs and trees

(Faber et al. 1989). Floodplains farther from the active channel may contain older plant communities composed of either typical riparian species (e.g. willow and cottonwood) or drier site riparian such as sycamores leading into live oak woodlands (Faber et al. 1989).

Vegetation species found only in riparian areas are distinguished as obligate, and species that commonly occur in riparian areas but also occur in upland environments are facultative. Individual riverine species are adapted to a range of conditions within the riparian zone, along gradients of water table depth, soil moisture, and frequency of disturbance. Characteristics typical of obligate riverine vegetation are:

- dependence on a high water table
- tolerance to inundation and soil anoxia
- tolerance to physical damage from floods
- tolerance to burial by sediment
- ability to colonize flood scoured surfaces or fresh deposits
- ability to colonize and grow in substrates with few soil nutrients

The relative importance of these characteristics varies with the river system. Within the lower Aliso Creek ecosystem, dependence on relatively high water tables and ability to survive physical damage from high-velocity flood flows are important characteristics of riparian vegetation.

Similar to most riverine systems, the cottonwood/willow vegetation type is a dynamic community, dependent upon periodic flooding to cycle the community to earlier successional stages (Warner and Hendrix 1985). Periodic floods of large magnitude are essential to depositing fresh alluvium where seeds and vegetative propagules of *Baccharis*, *Salix*, and *Populus* can germinate and take root (Gregory et al. 1991; Richter and Richter 1992). As these seedlings mature they increase channel unevenness and alter flow during small flood events, increasing sediment deposition (Kondolf 1988; Richter and Richter 1992; Stromberg et al. 1993). Sediment deposition builds river terraces, and as they elevate, other plant species colonize, resulting in further diversification in the floodplain community (Richter and Richter 1992). Similarly, the deposition of sediment within a channel with an earthen bottom can also create smaller river terraces as well as maintain riverine plant species recolonization.

The majority of the plant species in the lower Aliso Creek are native riverine with monotypic stands of invasive exotic weed species, such as giant reed (*Arundo donax*). Common plant species present within native plant communities occur in considerable acreages throughout the Aliso Creek watershed; however, they could be significantly impacted due to large stands of invasive plants, such as giant reed, salt cedar, and others. Common native riparian plant species existing within the area of the Proposed Project are adapted to the edaphic and biological conditions of riverine ecosystems and will recolonize the areas with eradication of invasive plants.

The Proposed Project area is located within the South Coast and Peninsular Range regions of the California Floristic Province (Holland 1986). Northwest Habitat Institute

(NHI) identified 239 vegetation polygons within the 691-acre of Combined Habitat Assessment Protocol (CHAP) analysis for the Proposed Project area based on habitat type (Table 2.7-1, Figure 2.7-1, Figure 2.7-2, and Figure 2.7-3) comprising the following eight California Wildlife Habitat Relationships (CWHR) Wildlife Habitat Types, along with further splitting of mapped habitat polygons by structural condition within the same habitat type: Valley Foothill Riparian, Valley Oak Woodland, Riverine, Coastal Scrub, Annual Grassland, Lacustrine, Urban, and Eucalyptus, as described in California's Guide to Wildlife Habitats (Mayer and Laudenslayer 1988). Vegetation communities as defined by Sawyer et.al. (2009) associated with these habitat types are also discussed below. Appendix B-2d provides a more detailed crosswalk.

Table 2.7-1 CWHR Habitat Types by Acreage and Proportion of the CHAP Analysis Area

CWHR Habitat Type	Sum of Acres	Proportion of Project Area (%)
Annual Grassland	212.98	30.8
Coastal Scrub	112.84	16.3
Eucalyptus	0.34	0.05
Lacustrine	30.29	4.4
Riverine	30.88	4.5
Urban	55.46	8.0
Valley Foothill Riparian	247.58	35.8
Valley Oak Woodland	0.89	0.1

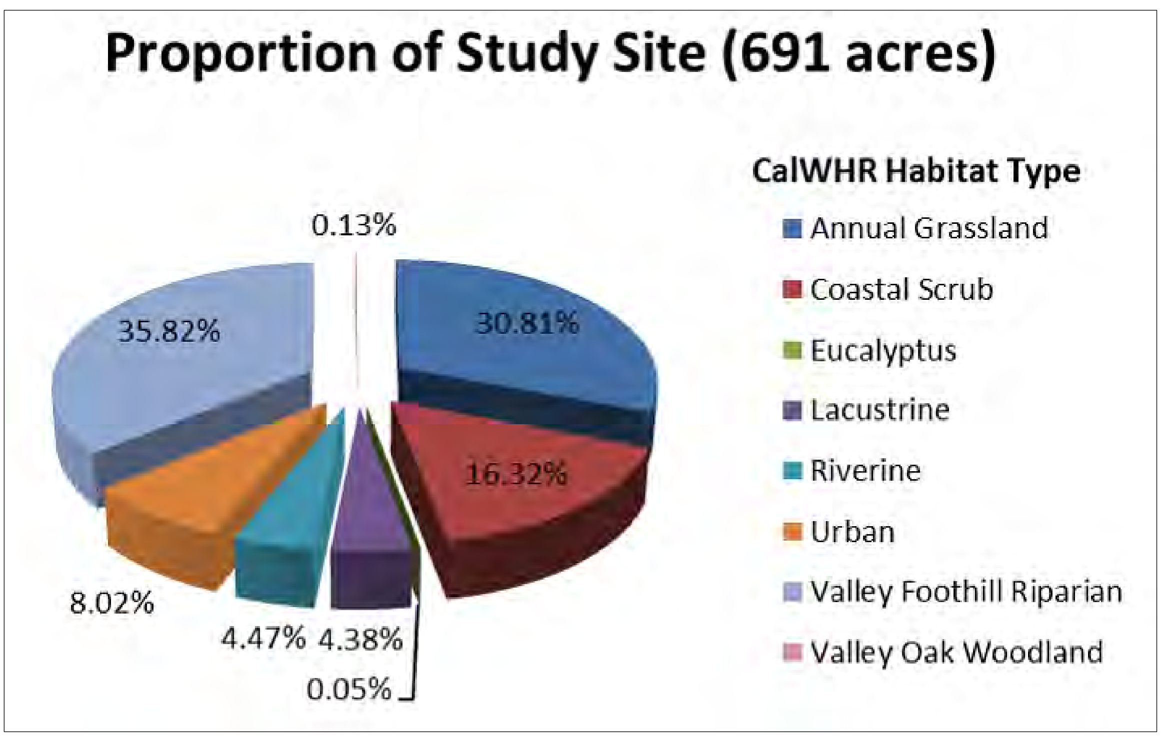


Figure 2.7-1 Proportion of Total Acreage by CWHR Habitat Type

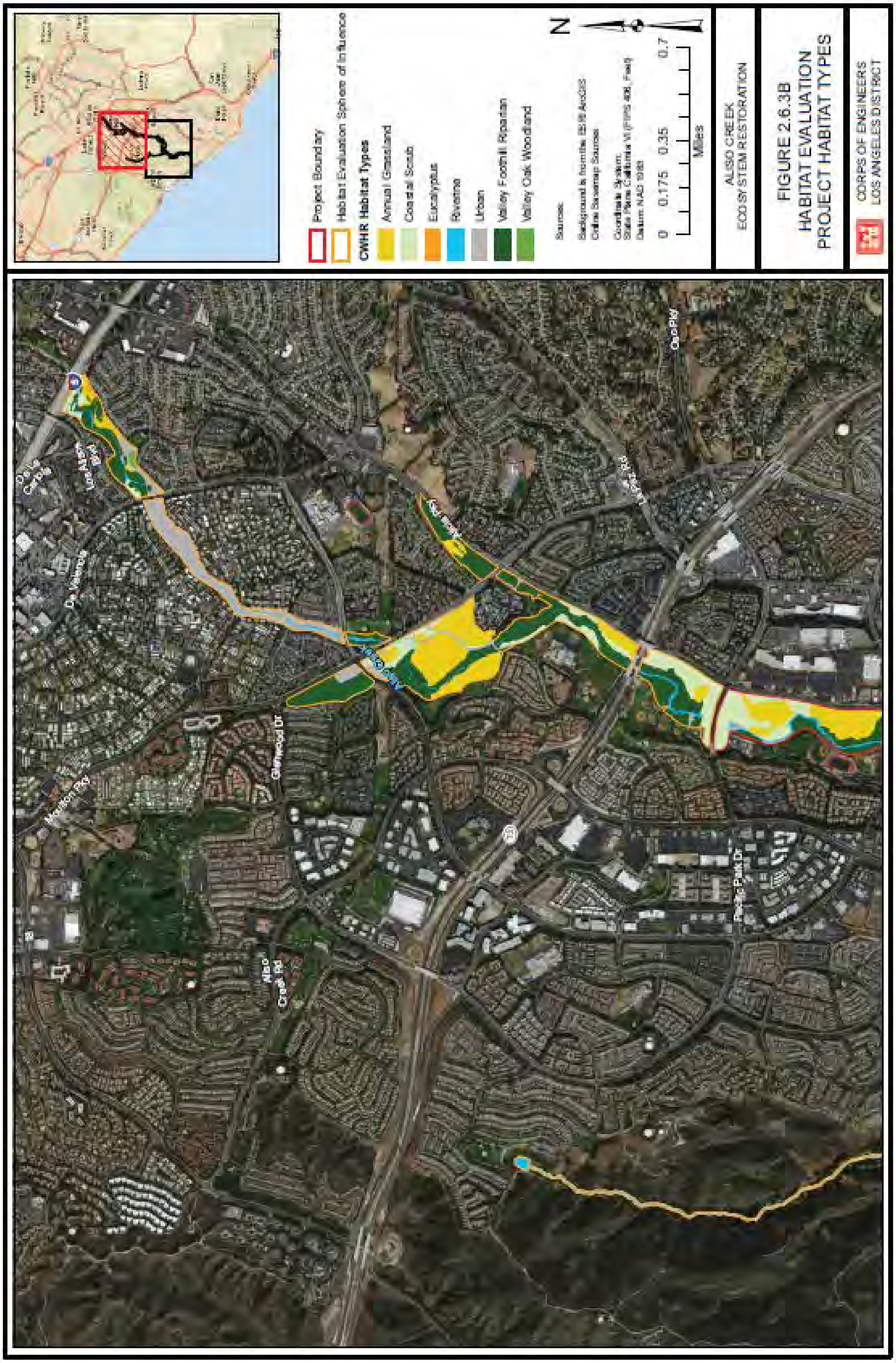


Figure 2.7-2 Project Habitat Types

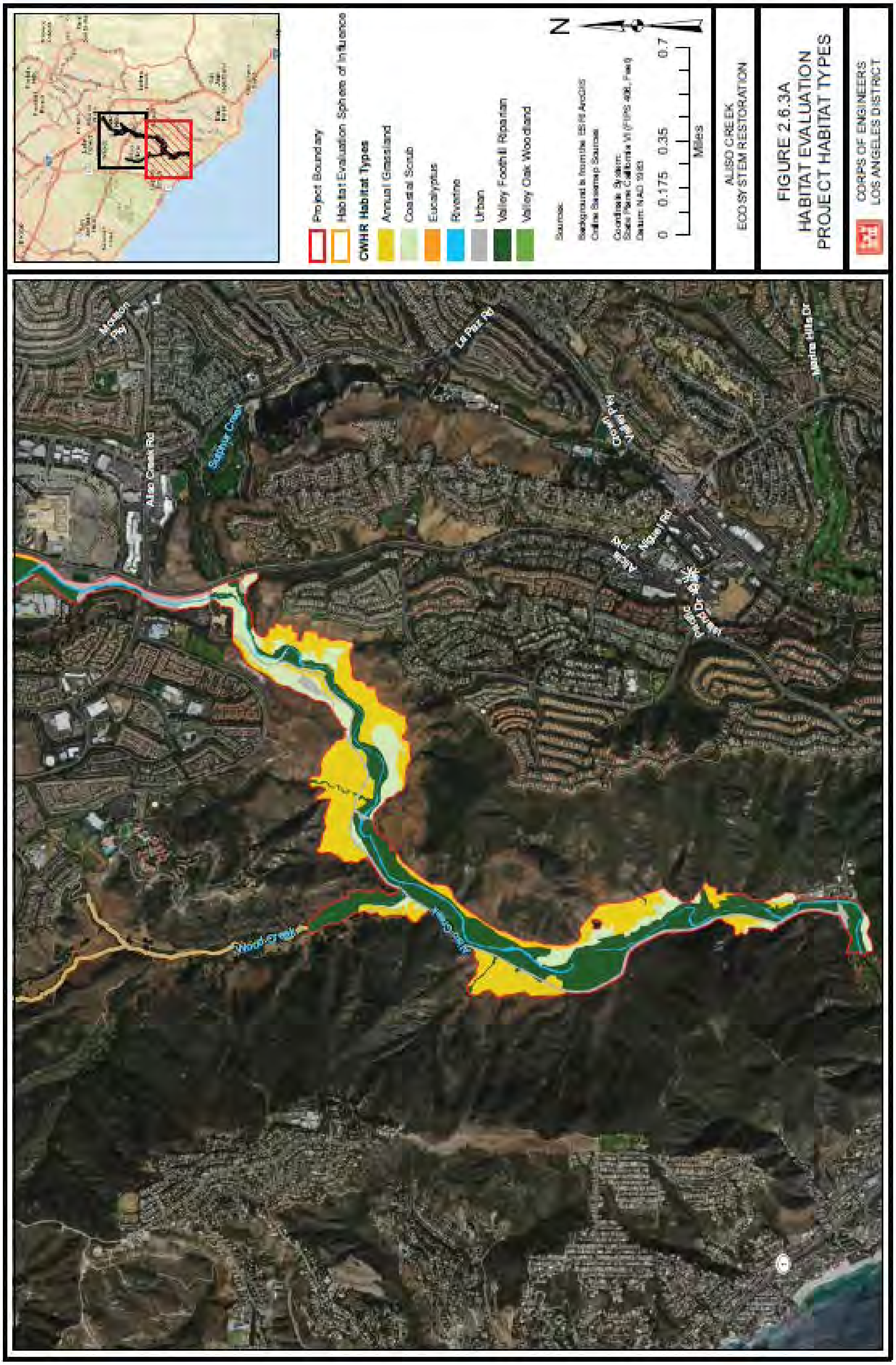


Figure 2.7-3 Project Habitat Types

2.7.2 Plant Resources/Vegetation and Habitat Types

Vegetation types are characterized by the dominant plant species within a given area. The word “dominant” refers to areas that comprise at least 50 percent total cover by a particular species or group of common plant species, such as willow or non-native grasses. Other characteristics involved in determining the vegetation types include qualitative estimates of vegetation composition, structure, and/or density, total vegetation cover, tree height, tree diameter at breast height (dbh) percent cover by trees, percent cover by shrubs, and percent cover by herbs. Some areas are not dominated by vegetation and, therefore, are described by habitat descriptors.

The California Wildlife Habitat Relationship Cover Types are a generalized descriptor of habitat for the various vertebrate wildlife taxa of California that classifies existing vegetation types important to wildlife (Appendix B-2d). This system was developed to recognize and logically categorize major vegetative complexes at a scale sufficient to predict wildlife-habitat relationships. Conversely when describing plant resources of a project study site, the vegetation types (not wildlife) are the predictors of the various vegetation alliances, plant associations, and assorted successional phases. Vegetation patterns are composed of a distinctive assemblage of species that present a characteristic appearance based on size, shape, and spacing of the plants. These distinctive parts of the pattern, called plant communities or vegetation types, are the predictable result of plants’ interaction with specific environments.

2.7.2.1 Vegetation and Habitat Types

Native vegetation types alliances identified within the Proposed Project area are: open stand of *Salix gooddingii* (black willow) Forest Alliance, *Baccharis salicifolia* (mule fat) Shrubland Alliance, small extent of *Salix exigua* (sandbar willow) Shrubland alliance (southern willow scrub) and stands of *Populus fremontii* (Fremont cottonwood) Woodland Alliance that has canopy less than 60 percent closure, highly disturbed, and in most cases dying. However, the Proposed Project area is dominated by non-native invasive plants, *Arundo donax* semi-natural herbaceous alliance (giant reed breaks), and small acreages of *Tamarix* spp shrubland alliance (salt cedar). These areas have outcompeted the native riparian vegetation and formed their own vegetation type alliances and associations within the creek. Much of the giant reed herbaceous alliance and salt cedar Shrubland alliance have undergone some eradication treatment.

- ***Baccharis salicifolia* Alliance**. This alliance can be found as medium-sized stands throughout the Proposed Project area. *Baccharis salicifolia* association) within this alliance was mapped containing mule fat as the dominant shrub with other native shrubs and native and non-native herbs intermixed and almost no tree cover present.
- ***Eriogonum fasciculatum* Alliance**. This alliance can be found within the Proposed Project area as two medium-sized strips of vegetation along the western edge. This alliance is dominated by California buckwheat (*Eriogonum fasciculatum*) and black sage (*Salvia mellifera*), with other native species such as California sagebrush (*Artemisia californica*), coyote bush (*Baccharis pilularis*), bush sunflower (*Encelia*

californica), and coast goldenbush (*Isocoma menziesii*) present in the shrub layer as well. No trees exist within these stands, and the herb layer is dominated by non-native grasses.

- ***Isocoma menziesii* Alliance**. A single medium-sized stand of this alliance can be found along the Proposed Project area's western edge. This stand is heavily dominated by coast goldenbush, with few other shrub species such as California sagebrush and mule fat present. Non-native grasses dominate the herb layer, and no trees are present within the stand.
- ***Populus fremontii* Alliance**. This alliance can be found as one large, continuous stand within the southeastern portions of the Proposed Project area. It is characterized by a large tree cover dominated by various *Salix* species with Fremont cottonwood found throughout. Both black willow and mule fat are typically present within this vegetation category. Herb cover comprises non-native grasses and native herbs such as mugwort (*Artemisia douglasiana*) and curly dock (*Rumex crispus*).
- ***Salix lasiolepis* Alliance**. One medium-sized stand of this alliance can be found near the Proposed Project study area's eastern edge. This alliance contains a small to moderate amount of tree cover dominated by arroyo willow (*Salix lasiolepis*) with a large amount of mule fat within the shrub layer. The understory is dominated by non-native grasses.
- **Semi-Natural Stands**. Semi-natural stands contain vegetation in which past or present human activities significantly influence composition or structure but do not eliminate or dominate spontaneous ecological processes (Sawyer et al. 2009). These vegetation types consist of vegetation stands heavily dominated by non-native vegetation. The amount of non-native cover present within these stands precludes their inclusion within native alliances or associations.
- ***Arundo donax* Semi-Natural Stands**. Found in small strips within the southern portion of the Proposed Project area. These vegetation stands are heavily dominated by dense giant reed (*Arundo donax*) and contain few other plant species.

2.7.2.2 Valley Foothill Riparian

Valley Foothill Riparian woodland in the Proposed Project area occurs adjacent to riverine areas. Dominant species in the canopy layer include Fremont cottonwood and western sycamore (*Platanus racemosa*). Subcanopy trees and shrubs include arroyo willow (*Salix lasiolepis*) and also contains blue elderberry (*Sambucus nigra* ssp. *caerulea* [*mexicana*]), mule fat, western poison oak (*Toxicodendron diversilobum*), and an understory of herbaceous water-dependent plants, including marsh species.

Giant reed dominates the riparian corridor throughout Aliso Creek. Giant reed forms impenetrable stands of highly flammable vegetation that crowds out native plant species and reduces habitat for wildlife. The California Invasive Plant Council (Cal-IPC) provides a rating of high for this species, defined as having "severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Most are widely distributed ecologically." (Cal-IPC 2006)

Riparian communities account for the third largest vegetation type within the Wilderness Park and the largest vegetation type within the Proposed Project area (Table 2.7-1 and Figure 2.7-1). Riparian habitats are associated with stream channels, lakes, or ponds or are dependent upon the existence of perennial, intermittent, or ephemeral surface or subsurface water drainage. In the Wilderness Park, riparian habitats are associated with the perennial streams and floodplains of Aliso Creek and Wood Canyon Creek and range from herbaceous plants to multilayered tree species. Riparian communities are dominated by one or several species of wind-pollinated, winter-deciduous trees adapted to periodic or continuous soil saturation during all or part of the growing season. Within the Proposed Project area, riparian vegetation is found along the length of Aliso Creek and in the lower portions of Wood Canyon Creek (see Figure 2.7-2, Figure 2.7-3, and Appendix B-2a).

The overall riparian community in the Wilderness Park contains as many as eight associations: riparian herb, southern willow scrub, mule fat scrub, southern sycamore riparian woodland, southern coast live oak riparian forest, southern arroyo willow forest, southern black willow forest, and bramble thicket (OC Parks 2009).

2.7.2.3 Valley Oak Woodland

Valley Oak Woodland habitats comprise a considerable amount of the northwest area of the Wilderness Park. Coastal oak woodlands are extremely variable multilayered vegetation communities dominated by trees with an open, mosaic canopy. Woodlands typically occur on or near the base of north-facing slopes and in moist ravines. The overstory consists of deciduous and evergreen hardwoods that are dense and form a closed canopy. The understory is equally variable. In some instances, it is composed of shrubs from adjacent chaparral or coastal scrub, which forms a dense, almost impenetrable understory. Within the Proposed Project area, one small patch of Valley Oak Woodland is mapped adjacent to Aliso Creek, just downstream of I-5 (see Figure 2.7-2, Appendix B-2a, and Appendix B-2b).

Photo 2.7-1 Looking downstrea, the S-Bend with dirt road to SOCWA CTP on the east side (left) and the Aliso Creek Trail (right) to the Ranch at Laguna Beach

2.7.2.4 Riverine (Riparian)

This habitat type refers to open water within the Creek (see Figure 2.7-2 and Figure 2.7-3). Aquatic vegetation occurring in this habitat type includes water moss, algae, and duckweed.

2.7.2.5 Coastal Scrub

The coastal scrub community consists of low, drought-deciduous, and evergreen shrubs that occur generally below 3,000 feet in elevation on steep to moderate, south-facing, exposed slopes of the western mountains. Coastal scrub communities are characterized by low shrubs and an absence of trees.

Photo 2.7-2 Coastal Sage Scrub

Dominant plant species along the south-facing slopes include California sagebrush, California encelia (*Encelia californica*), white sage (*Salvia apiana*), purple sage (*Salvia leucophylla*), and black sage (*Salvia mellifera*), California buckwheat (*Eriogonum fasciculatum*), coyote bush, coastal goldenbush (*Isocoma menziesii*), and golden yarrow (*Eriophyllum confertiflorum* var. *confertiflorum*). The north-facing slopes tend to be dominated by woodier shrubs such as laurel sumac (*Malosma laurina*), lemonadeberry (*Rhus integrifolia*), and toyon (*Heteromeles arbutifolia*) (OC Parks 2009).

The overall coastal scrub community in the Wilderness Park supports five associations; southern coastal bluff scrub, Venturan-Diegan transitional, southern cactus scrub, chenopod scrub, and sage-scrub-grassland ecotone (OC Parks 2009) (see Figure 2.7-2, Figure 2.7-3, Appendix B-2a, and Appendix B-2b).

2.7.2.6 Annual Grassland

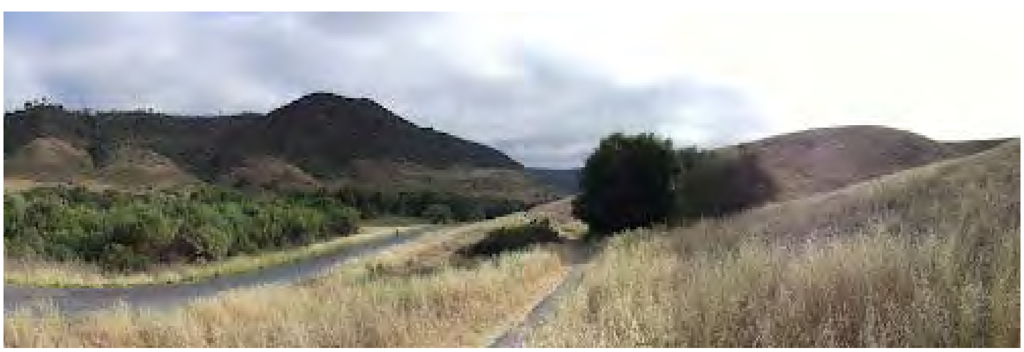


Photo 2.7-3 Annual Grassland

Annual grassland consists of low herbaceous vegetation dominated by grasses that occur on gentle slopes and flatlands, mostly at low elevations. Grassland in the Proposed Project area consists primarily of non-native annual grassland, a community consisting of European grasses that have largely replaced the perennial native grasslands in southern California (Holland 1986) (see Figure 2.7-2, Figure 2.7-3, Appendix B-2a, and Appendix

B-2b). Characteristic species within the Proposed Project area include wild oats (*Avena* spp.), ripgut brome (*Bromus diandrus*), barley (*Hordeum* sp.), and fescue (*Vulpia* sp.). Other non-native species associated with grassland in the Proposed Project area include sweet fennel (*Foeniculum vulgare*), black mustard (*Brassica nigra*), and yellow star thistle (*Centaurea solstitialis*).

2.7.2.7 Lacustrine (Lake and Margins)

The Sulphur Creek Reservoir (outside the Proposed Project area) is located upstream of the confluence of Aliso Creek and Sulphur Creek and is characterized by the presence of open water (see Figure 2.7-2, Figure 2.7-3, Appendix B-2a, and Appendix B-2b).

2.7.2.8 Urban

The Urban habitat type in the Proposed Project area occurs in areas cleared of native vegetation and consists of landscaped lawn, ornamental plantings, and ruderal (weedy) plant species. These areas are located around the SOCWA CTP and some Wilderness Park facilities (see Figure 2.7-2, Figure 2.7-3, Appendix B-2a, and Appendix B-2b).

2.7.2.9 Eucalyptus

Eucalyptus woodland typically consists of dense stands of eucalyptus with a closed canopy and sparse understory vegetation (see Figure 2.7-2, Figure 2.7-3, Appendix B-2a, and Appendix B-2b).

2.7.3 Animal Resources – General Wildlife and Associated Plant Habitats

Wildlife habitats within the Proposed Project area support many common species (OC Parks 2009). Some common bird species found in the Proposed Project area include:

Table 2.7-2 Common Bird Species in Project Area

Common Name	Scientific Name	Common Name	Scientific Name
Great-blue Heron	*Ardea herodias*	Black Phoebe	*Sayornis nigricans*
Mallard	*Anas platyrhynchos*	Ash-throated Flycatcher	*Myiarchus cinerascens*
Cooper’s Hawk	*Accipiter cooperii*	Western Kingbird	*Tyrannus verticalis*
Northern Harrier	*Circus cyaneus hudsonius)*	Western Scrub Jay	*Aphelocoma californica*
Red-tailed Hawk	*(Buteo jamaicensis)*	Common Raven	*Corvus corax*
Northern Harrier	*Circus cyaneus*	Bushtit	*Psaltriparus minimus*
Mourning Dove	*Zeniada macroura*	Common Yellow-throat	*Geothlypis trichas*
Barn Owl	*Tyto alba*	Bewick’s Wren	*Thryomanes bewickii*
Great-horned Owl	*Bubo virginianus*	Wrentit	*Chamaea fasciata*
White-throated Swift	*Aeronautes saxatilis*	Song Sparrow	*Melospiza melodia*
Anna’s Hummingbird	*Calypte anna*	Spotted Towhee	*Pipilo maculatus*
American Kestrel	*Falco sparverius*	California Towhee	*Pipilo crissalis*
Downy Woodpecker	*Picoides pubescens*	Lesser Goldfinch	*Carduelis psaltria*
Northern Flicker	*Colaptes auratus*		

Photo 2.7-4 California Quail

Photo 2.7-5 Anna's Hummingbird

Photo 2.7-6 California Scrub Jay

Photo 2.7-7 Song Sparrow

Photo 2.7-8 Spotted Towhee

Photo 2.7-9 California Towhee

Photo 2.7-10 Southern Pacific Rattlesnake *(Crotalus oreganus helleri)*

Photo 2.7-11 Bobcat *(Lynx rufus)*

Photo 2.7-12 Coyote *(Canis latrans)*

Photo 2.7-13 Mule Deer *(Odocoileus hemionus)*

2.7.4 Special Status Listed Species

Federal and state-listed threatened and endangered wildlife and plant species with the potential to occur in the Proposed Project area were also identified by the CNDDB search (August 2015). Based on habitat present in the Proposed Project area and recent observations, Table 2.7-3 presents the threatened and endangered species with the potential to occur within the Proposed Project area. Natural history and ecology of listed species are found in USFWS 2006, 2007, 2009, 2010; Winchell and Doherty 2008; Corps/NHI 2013.

Table 2.7-3 Federal and State Listed Species with Potential to Occur in the Proposed Project Area

Scientific Name	Common Name	Status	Occurrence/Comments
Plants			
Brodiaea filifolia	Thread-leaved brodiaea	FE, SE	A population of this species has been repeatedly observed on the grassland terraces above Aliso Creek approximately 0.5 miles from the confluence with Wood Canyon Creek (State of California 2015). Surveys detecting the species in this general location occurred in 1996, 1998, 2001, 2009, and 2010 and ranged from 24 plants seen in 1996 to 5,000 in 2001 to 570 in 2010. This is a species with variability in expression from year to year; thus, given the historic data, the population is presumed to be extant. Suitable soil and habitat is present elsewhere in the study area; however, given the extensive survey data and lack of other identified populations, it is reasonable to expect that only the one population is present.
Fish			
Eucyclogobius newberryi	Tidewater goby	FE	Not present based on recent surveys at mouth of Aliso Creek; however, this location is considered for reintroduction of the species based on historical evidence (State of California 2015). A viable population was originally detected in 1976 and 1977 of occurrence from the mouth of Aliso Creek to approximately 1.5 miles upstream. They were not detected in 1984 and the site was dry in 1990. The species was reported by USFWS as last detected in 1996.
Reptiles			
Actinemys marmorata pallida	Southwestern pond turtle*	SSC	Present. USGS conducted surveys in Aliso Canyon in 2010 and trapped 8 pond turtles, 7 near ACWHEP, both up and downstream, and one along Wood Canyon Creek (A. Backlin, USGS, pers. comm. with T. Keeney, USACE Senior Terrestrial Ecologist/Biological Sciences Manager, November 10, 2015). In 2014, four individuals were detected during focused surveys conducted in the sphere of influence habitat assessment area upstream between Aliso Creek Road and the intersection of Aliso Viejo Parkway and Moulton Parkway (GLA 2014)
Birds			
Empidonax traillii extimus	Southwestern willow flycatcher	FE, SE	Riparian habitat supports marginal suitable habitat; however, the species is not currently known or historically reported to occur within the study or project area and the last observation was made in 2002 along Sulphur Creek approximately 1.75 miles upstream of the confluence with Aliso Creek; although the database does not indicate whether this represents a breeding pair or migrant individual (USFWS 2015). A recent protocol survey conducted in 2011 along Aliso Creek between SOCWA CTP and the AWCWP visitor

Table 2.7-3 Federal and State Listed Species with Potential to Occur in the Proposed Project Area

Scientific Name	Common Name	Status	Occurrence/Comments
			center was negative (Dudek 2011). This flycatcher is currently a migrant species to the Proposed Project area.
Vireo bellii pusillus	Least Bell's vireo	FE, SE	Between 2009 and 2015, three protocol surveys have been conducted between SOCWA CTP and the AWCWP park entrance. Four territorial males were detected within the study area upstream of ACWHEP in 2009, 2010, 2013, 2015, 2016 (Corps 2009; T. Keeney, pers. comm. 2009, 2015). Five territories were detected in 2011 (Dudek 2011). Least Bell's vireo were also detected in two locations downstream from the ACWHEP structure; however, these were only documented on one occasion are considered migrant birds passing through to a more suitable breeding area.
Polioptila californica	Coastal California gnatcatcher	FE ST	Inhabits coastal sage scrub for breeding and on occasion will utilize chaparral, grassland, and riparian habitats nearby for dispersal and foraging. California gnatcatchers were observed (along with evidence of breeding) during focused surveys conducted in the downstream portion of the study area in 2005, 2006, and 2007 (PCR 2007; Dudek 2007). Based on these surveys, the species is considered to be present in the study area.

FT = Federally Threatened (U.S. Fish and Wildlife Service)
FE = Federally Endangered (U.S. Fish and Wildlife Service)
SE = State Endangered (California Department of Fish and Wildlife)
ST = State Threatened (California Department of Fish and Wildlife)
SSC = Species of Special Concern (U.S. Fish and Wildlife Service)

**While southwestern pond turtle is not currently state or federally listed, it is under review for Federal listing as of the date of this report and is known to occur within the Proposed Project area. As one of the key species of consideration for the study's restoration goals, this species is included in this section.*

Federal and state-listed threatened and endangered wildlife and plant species with the potential to occur in the study area were also identified by the USFWS Environmental Conservation Online System (ECOS) as well as some taxa in the California Department of Fish and Wildlife (CDFW) CNDDB. Based on habitat present in the study area and recent observations, Table 2.7-4 presents the threatened and endangered species with the potential to occur within the study area. Natural history and ecology of listed species are found in USFWS 2006, 2007, 2009, 2010; Winchell and Doherty 2008; Corps/NHI 2013.

Table 2.7-4 Other Sensitive Plants and Wildlife with Potential to Occur in the Study Area

Common Name	Scientific Name	Status	Occurrence/Comments
Birds			
Cooper's hawk	*Accipiter cooperii*	WL	Observed during surveys conducted for the coastal California gnatcatcher (Corps 2009).
Northern harrier	*Circus cyaneus hudsonius*)	SSC	Observed during recent surveys conducted for the coastal California gnatcatcher (Corps 2009; Keeney, pers. comm. 2009).
Yellow-breasted chat	*Icteria virens auricollis*	SSC	Breeding pairs detected during surveys conducted for the coastal California gnatcatcher (Corps 2009; Keeney, pers. comm. 2009).
Yellow warbler	*Setophaga petechia*	SSC	Breeding pairs detected during surveys conducted for the coastal California gnatcatcher (Corps 2009; Keeney, pers. comm. 2009).
Coastal cactus wren	*Campylorhynchus brunneicapillus sandiegensis*	SSC	Present during surveys in 2006 and 2007 (Dudek 2006 and 2007). Suitable habitat exists within study area (NROC 2007, 2009).
Mammals			
Western bonneted (mastiff) bat	*Eumops perotis californicus*	SSC	Potential to occur in a variety of habitats including woodlands, coastal sage scrub and grasslands.
Amphibians			
Western spadefoot	*Spea hammondii*	SSC	Potential to occur in suitable habitat. Present in adjacent areas (USGS 2009).
Reptiles			
Orange-throated whiptail	*Aspidoscelis hyperythra beldingi*	SSC	Present. Captured during surveys from 2000-2005 (USGS 2009).
Coast (San Diego) horned lizard	*Phrynosoma coronatum* (*blainvillii* population)	SSC	Potential to occur in coastal sage scrub and chaparral. Present in adjacent areas (USGS 2009).
Two-striped garter snake	*Thamnophis hammondii*	SSC	Present. Captured during surveys from 2000-2005 (USGS 2009).
Plants			
Intermediate mariposa-lily	*Calochortus weedii var. intermedius*	1B.2	Occurs on dry rocky slopes in chaparral and coastal scrub (Consortium of California Herbaria 2009). Last observed near the study area in 1984 (State of California 2015).
Cliff spurge	*Euphorbia misera*	2.2	Occurs on rocky slopes and coastal bluffs (Consortium of California Herbaria 2009). Last observed near the study area in 1999 (State of California 2015).
SSC = California Species of Special Concern WL = California Department of Fish and Wildlife watch list species 1B.1 = Considered seriously rare in California and elsewhere by the California Native Plant Society (CNPS) 1B.2 = Considered fairly rare in California and elsewhere by the CNPS 2.2 = Considered fairly rare in California but more common elsewhere by the CNPS			

2.7.4.1 Plants

Brodiaea filifolia

Brodiaea filifolia is a perennial herb with underground bulb-like storage stems in the Themidaceae family. Individual plants are less than 16 inches tall, with narrow leaves and saucer-shaped violet flowers arranged in a loose umbel. Sixty-eight discontinuous occurrences are distributed across southern California from the foothills of the San Gabriel Mountains at Glendora (Los Angeles County), east to Arrowhead Hot Springs in the western foothills of the San Bernardino Mountains (San Bernardino County), and south through eastern Orange and western Riverside Counties to Rancho Santa Fe in central San Diego County, California. This species is usually found in herbaceous plant communities that occur in open areas on clay soils, soils with a clay subsurface, or clay lenses within loamy, silty loam, loamy sand, silty deposits with cobbles, or alkaline soils; they may range in elevation from 100 feet to 2,500 feet depending on soil series. The natural history and ecology is found in USFWS 2009.

The only listed plant taxa is *Brodiaea filifolia* (thread-leaved brodiaea) and its listed critical habitat is found in close proximity to the Proposed Project area (Figure 2.7-4). Only a small portion of the critical habitat is found within the ecosystem restoration boundary.

Proposed critical habitat for *Brodiaea filifolia* was published in the *Federal Register* on December 8, 2004 (USFWS 2004a). On December 13, 2005, the USFWS published in the *Federal Register*, a final rule designating approximately 597 acres of critical habitat for *B. filifolia* (USFWS 2005a).

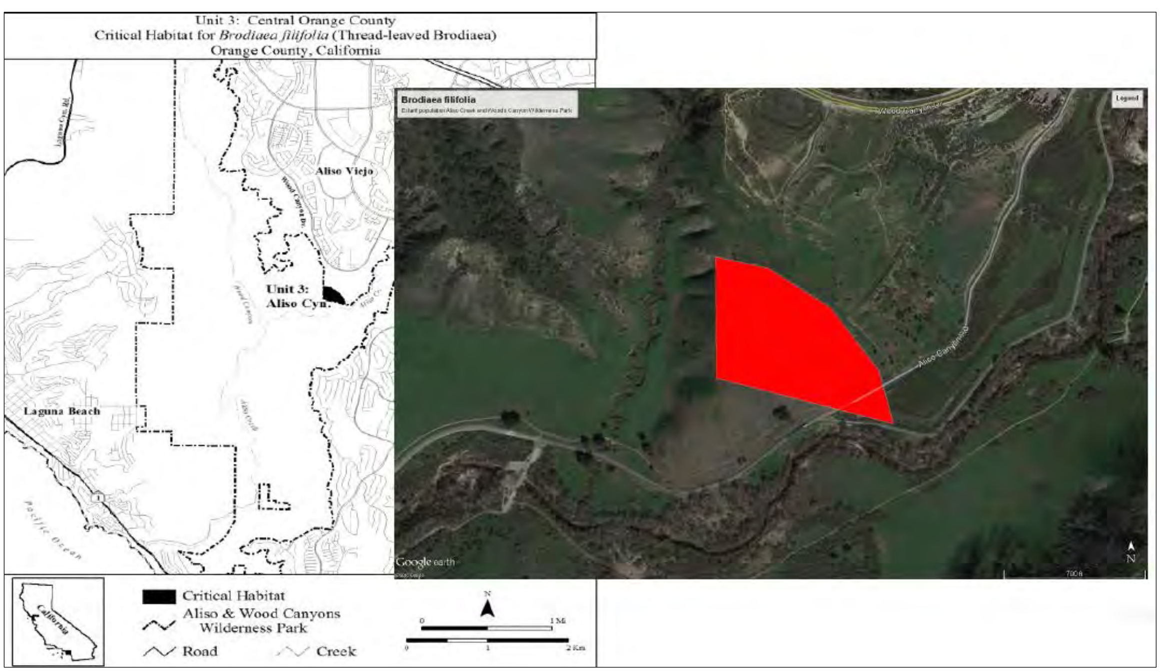


Figure 2.7-4 Critical Habitat of the *Brodiaea filifolia* in Aliso Creek Wilderness Park

2.7.4.2 Animals

Oncorhynchus mykiss **(steelhead)**

It is recognized that there are anecdotal recordings of steelhead takings from the 1950s and 1960s, last sighting in 1972, from Aliso Creek's estuary and Aliso Creek Canyon (approximately 4 miles) before suburban development began. Researchers and long-time residents of the lower Aliso Creek watershed have argued for many years over the presence of steelhead trout in Aliso Creek. Up until 2006 the National Marine Fisheries Service (NMFS) stated that Aliso Creek is a "[coastal basin] with no evidence of historical or extant of *O. mykiss* in anadromous waters." Contrary to that, a 1998 study co-authored by the Corps and USFWS declared that steelhead had inhabited the creek until around 1972 when increased density (urbanization) resulted in poor water quality conditions (pollutants and low oxygen levels) that drove the migration of fish out.

In the mid-2000s, NMFS assessed that there was plausible information to declare that Aliso Creek had been steelhead habitat and the creek was added to the Distinct Population Segment List under the jurisdictional domain of National Oceanic and Atmospheric Administration (NOAA). Only the lower seven miles of the creek was listed because its conditions were amenable to "historical populations". The habitat "termination line" was drawn at about Aliso Creek where it crosses an arterial road – Pacific Parkway in Aliso Viejo.

California Department of Fish and Wildlife ((Titus et al., 2010) mentions Los Alisos Canyon as an area with negative results for steelhead. The Recovery Plan for the species (NMFS 2010) states:

"In addition to the major watersheds considered here, there are a number of smaller watersheds within this BPG (e.g., Aliso, Escondido, Los Penasquitos, and Rose Canyon Creeks) which may also be used by steelhead when conditions are favorable."

While the habitat may be suitable under favorable conditions, the structures above the lagoon would preclude steelhead migration under most flows. The steelhead have not been recorded in the Proposed Project area since 1972, and currently have no potential to be in the Proposed Project area.

Eucyclogobius newberryi **(Tidewater goby)**

The tidewater goby, *Eucyclogobius newberryi*, is a small benthic fish, endemic to California's coastal lagoons, creeks, and marshes (Moyle 1976; Swift et al. 1989). Tidewater goby populations have declined, especially in southern California and San Francisco Bay (Swift et al. 1989, 1993; Lafferty et al. 1996). An apparent range wide decline of 35 percent over six years (1984-1990) prompted the USFWS to list it as an endangered species in 1994 (USFWS, Swenson 1997). This species is threatened by habitat loss and degradation (e.g. development of coastal wetlands and waterways, water diversions, and stream channelization), and to a lesser degree, predation by exotic fishes (USFWS 2007; Lafferty et al. 1996).

Information on the spatial distribution and ecology of the tidewater goby comes from the USFWS (2007).

Distribution

The tidewater goby inhabits discrete locations of brackish water along the California coast. It is found from near the Oregon border south to northern San Diego County. Currently, the majority of the most stable and largest tidewater goby populations consist of lagoons and estuaries of intermediate sizes (5 to 125 acres) that have remained relatively unaffected by human activities (USFWS 2005). Many of the localities where tidewater gobies are regularly present may be “source” populations for localities that intermittently lose their tidewater goby populations.

Ecology

Tidewater gobies generally live for only one year, with few individuals living longer than a year (Moyle 2002). Reproduction occurs at all times of the year, as indicated by female tidewater gobies in various stages of ovarian development (Swenson 1999). The peak of spawning activity occurs during the spring and then again in the late-summer. Fluctuations in reproduction are probably due to death of breeding adults in early summer and colder temperatures or hydrological disruptions in winter (Swift et al. 1989). Reproduction takes place in water between 48 to 77 ºF and at salinities of 2 to 27 parts per thousand (Swenson 1999). Male tidewater gobies begin digging breeding burrows in relatively unconsolidated, clean, coarse sand (averaging 0.5 millimeter [0.02 inches] in diameter), in April or May after lagoons close to the ocean (Swift et al. 1989; Swenson 1995). Swenson (1995) has shown that tidewater gobies also prefer this substrate in the laboratory. Burrows are at least 70 to 100 millimeters (3 to 4 inches) from each other.

The goby was last collected in Aliso Creek in 1978 (USFWS 2005); however, critical habitat was designated in Aliso Creek because “the eight fluctuating populations where gobies exist today [on Marine Corps Base Camp Pendleton] are insufficient in number and quality to remove gobies in this part of the range [southern California] from a high risk of extinction” (65 FR 69693). Thus, it was determined that “unoccupied habitats which can support gobies in the future [including Aliso Creek] play an essential role in the conservation of the goby” (65 FR 69693).’

Aliso Creek is included in the South Coast Recovery Unit (SC) of the recovery plan for the goby (USFWS 2005). Gobies within this unit are morphologically (Ahnelt et al. 2004) and genetically (Dawson et al. 2001) distinct from populations north of the Los Angeles River. As such, persistence of gobies within the SC is essential to recovery of the species (USFWS 2005). Reintroduction of gobies to unoccupied habitat is one of four primary tasks recommended for recovery of the goby (USFWS 2005). Aliso Creek is considered by the USFWS to be one of the most promising locations for reintroduction of a goby population in southern California (outside of Marine Corps Base Camp Pendleton). However, the current lagoon breaching practices (resulting from excess urban runoff) likely preclude successful reintroduction of the goby into Aliso Creek, since regular lagoon breaching during the dry season lowers the water level in the lagoon, potentially stranding gobies and leaving breeding burrows above the water level (USFWS 2005).

The available tidewater goby habitat encompasses approximately 1.25 to 2.5 acres. Ownership at this locality includes: Laguna Beach Country Club (25 percent), Aliso Beach County Park (25 percent), City of South Laguna, public and private (50 percent), and Aliso Creek Golf Course (5 percent). Tidewater gobies were not found here during surveys by C. Swift in 1994 (K. Lafferty, personal communication 2004). Aliso Creek is not designated as “Water Quality Limited” by the State Water Resources Control Board.

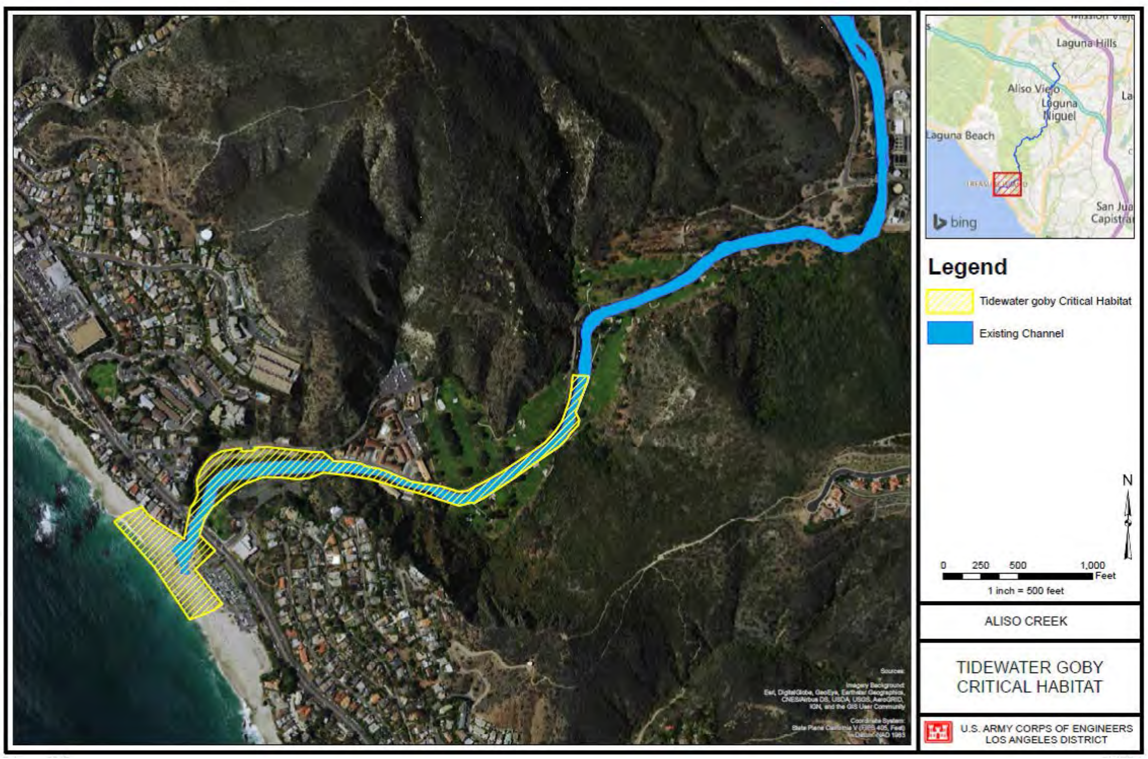


Figure 2.7-5 Available Tidewater Goby Habitat Within Project Area

Actinemys marmorata (Southwestern Pond Turtle)

The southwestern western pond turtle or (*Actinemys marmorata*) (formerly *Clemmys marmorata*) is designated as a “Species of Special Concern” by the State of California. On July 11, 2012, the USFWS was petitioned by the Center for Biological Diversity to list many amphibian and reptile species across the United States. The western pond turtle was one of the species petitioned for listing. In 2015, the USFWS evaluated the information on listing the western pond turtle and based on the USFWS review of the petition and sources cited in the petition, the USFWS found that the petition presents substantial scientific or commercial information indicating that the petitioned action may be warranted for the western pond turtle.

The western pond turtle also known as the Pacific pond turtle or Pacific mud turtle, is the only freshwater turtle native to the North American Pacific Coast west of the Sierra-Cascade divide. The species occurs from extreme southwestern British Columbia (where it has been extirpated) south to Baja California. Isolated populations exist in the Carson and Truckee river systems in extreme western Nevada. The species occurs from sea level to over 5,900 feet in elevation (Bury 1995; Buskirk 2002). The literature describes two subspecies of pond turtles: the northwestern pond turtle (*Actinemys marmorata marmorata*) and southwestern pond turtle (A. *m. pallida*). The species' range stretches from the San Francisco Bay south, along the Coast Ranges into northern Baja California (where they disappeared throughout most of their range). Isolated populations occur along the Mojave River (Camp Cady, Afton Canyon). The southwestern pond turtle (hereafter referred to as pond turtle), is the only turtle species native to Orange County, California.

The ecology and natural history of the pond turtle is from *Southern Pacific Pond Turtle: Single Species Accounting Method White Paper* for Aliso Creek (NHI/Corps 2013). A detailed discussion of diet, behavior, reproduction, population status and threats is in NHI/Corps 2013. The *Southern Pacific Pond Turtle: Single Species Accounting Method* will be further developed and used in the AMHP as part of the habitat suitability monitoring.

<u>Habitat</u>

The species is diurnal and requires aquatic and terrestrial habitats during different times in their life history for foraging, mating, nesting, estivation and overwintering. The pond turtle is primarily a riparian dweller in both permanent and intermittent water bodies. It is found in ponds, lakes, rivers, streams, creeks, marshes, and irrigation ditches, with or without abundant vegetation, and either rocky or muddy bottoms, but usually are rare or absent in canals, impoundments or other habitats heavily altered by humans. In streams, pond turtles prefer standing (lentic, i.e. pools) and slow-moving waters (lotic, i.e. glides), which often occurs in off-channel areas, such as sloughs, side channels and backwater areas. Active pond turtles can remain under water 60 minutes or more, but usually rise to the surface every few minutes to breathe. During dormancy, the species can spend extended periods up to several months under water.

Adult males have larger home range sizes and lengths than adult females and these in turn are larger than those of juveniles. In coastal southern California, four radio-equipped females averaged daily movements of 92 feet, 179 feet, 198 feet, and 286 feet, respectively, during a 30-day period. Pond turtle movements have been shown to be influenced by hydrological flow. A study in southern California showed that females in an intermittent river had significantly larger linear aquatic home ranges then those inhabiting a dammed river where water levels were more stable.

Overwintering can be aquatic or terrestrial. Pond turtles often hibernate underwater, in the muddy bottom of a pool and may estivate during summer droughts by burying in soft bottom mud. They can survive even when streams dry out in most years, by moving onto land and hibernating under dense brush or in wood rat nests. Overwintering and estivation sites are typically located in upland areas; in southern California they may be over 197 feet from water. When turtles choose to overwinter in upland habitats, individuals typically leave the aquatic habitat in late autumn, moving as much as 1,640 feet from the aquatic habitat.

Breeding

The breeding ecology of southwestern pond turtles have been studied by many investigators (Holland 1994; Goodman 1997a; Ernst and Barbour 1989; Ernst et al. 1994; Stebbins 2003; Holland and Bury 1998; Nussbaum et al. 1983; Reese 1996; Bury et al. 2001, Zinner et.al. 1988; Rathbun et.al. 1992; and others).

Females begin laying eggs at a carapace length greater than 4.3 inches when they are probably six or seven years old. Pond turtles nest from April through August, peaking between late May and early July. Nests are typically excavated in upland habitat on the margins of streams or ponds. Under natural conditions, distance of nests from the water average 150 feet from the water, with a range of 5 to 1,640 feet. Nesting sites typically have a southern or western aspect, with slopes of 0 to 46 percent and compact, dry soils. Female pond turtles seem to prefer sites situated on well-drained clay/silt soils dominated by grasses and herbaceous vegetation, but lack shrubs and trees. Soil must usually be at least four inches deep for nesting and nests must have a relatively high internal humidity for eggs to develop and hatch properly.

Females may travel along a waterway as far as 1.2 miles to distant nesting areas if suitable nesting habitat is not available locally. Nests are excavated in either the morning or evening and are usually located along stream or pond margins. Nests have been reported up to 985 feet from water and over 328 feet from the water on hillsides. Six radio-equipped females were found in open, grassy areas with a southern exposure during the nesting season.

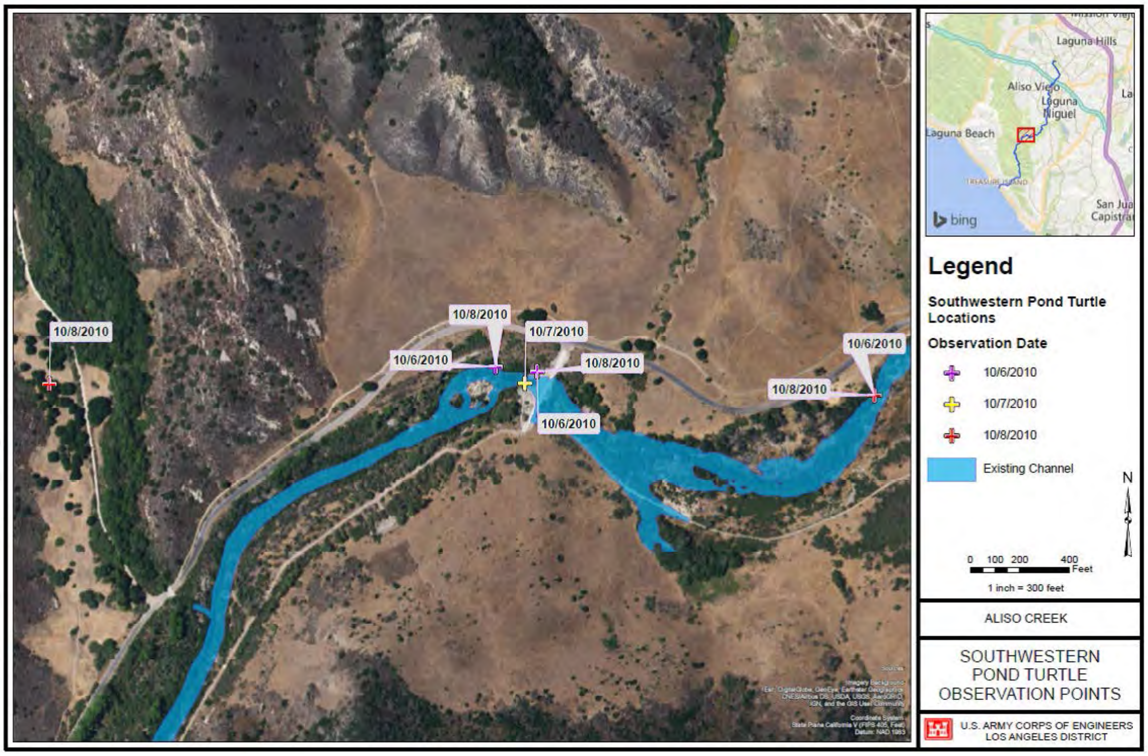


Figure 2.7-6 Southwestern Pond Turtle at Aliso Creek

Southwestern Willow Flycatcher

Historically considered a common riparian habitat species in the southwestern United States, the southwestern willow flycatcher (SWFL) was listed as endangered in California in 1991 and was Federally listed as endangered in 1995. The biology of the SWFL is described in detail. The bird was formerly more common in Orange County but it is unknown when the last one nested (Gallagher 1997).

It is unlikely that the SWFL historically bred along the Aliso Creek due to the ephemeral nature of the creek. There were no documented occurrences of this species within the Proposed Project area. However, SWFL are known to breed at the Marine Corps Base Camp Pendleton and possibly still at the Prado Dam Reservoir.

SWFL occur only during spring and fall migration periods: most of these birds presumably are from the northern race (Hamilton and Willick 1996). These birds prefer willow-dominated riparian habitat although some birds have been observed other types of stream habitat such as salt cedar (*Tamarisk* sp.) dominated.

According to Kus et al. (2003), range-wide flycatcher numbers at 26 sites annually surveyed slightly increased from 131 to 138 territories over the period 1999-2001. Most of this increase is a result of expansion of SWFLs into sites from which they had previously been confirmed absent (Piru Creek, Ventura County; lower San Luis Rey River, San Diego County), rather than increase of existing populations (Kus et al. 2003). Of the three consistently monitored large populations, the lower Santa Margarita and upper San Luis Rey River populations have remained constant in size since 1995, which might be predicted given that these riparian habitats have had long-term management programs (Kus et al. 2003).

Nesting requires dense riparian habitats (cottonwood/willow vegetation) with microclimatic conditions dictated by the local surroundings. Saturated soils, standing water, or nearby streams, pools, or cienegas are a component of nesting habitat that also influences the microclimate and density vegetation component. Habitat not suitable for nesting may be used for migration and foraging

There is no designated critical habitat because the Proposed Project area is inside the Orange County Central-Coastal Natural Communities Conservation Planning/Habitat Conservation Plan (NCCP/HCP).

***Vireo bellii pusillus* (Least Bell's vireo)**

Vireo bellii pusillus once a common breeding summer visitor inhabits and primarily utilizes riparian habitat *Salix gooddingii* Woodland alliance and *Baccharis salicifolia* Shrubland Alliance vegetation types. The vireo (LBVI) is making a strong reoccurrence once their early to mid-successional stage habitat is restored. The LBVI population in the U.S. has increased tenfold since its listing in 1986, from 291 to 2,968 known territories (USFWS 2006). The population has grown during each five-year period since the original listing, although the rate of increase has slowed over the last 10 years. Population growth has been greatest in San Diego County (621 percent increase, Marine Corps Base Camp Pendleton) and Riverside County (2,997 percent increase, Prado Dam Reservoir), with lesser but significant increases in Orange County, Ventura County, San Bernardino County, and Los Angeles County. The population in Santa Barbara County has declined by 54 percent since the original listing.

<u>Habitat Affinity</u>

LBVI's natural history and ecology has been intensively studied for 27 years (1978-2005) by a variety of government, academic, and consulting biologists, from central to southern California including the desert regions. One current manuscript succinctly summarizes the known natural history and ecological data concerning the LBVI (Kus 2002). This publication is part of the California Partners in Flight Riparian Bird Conservation Plan (2004).

LBVIs place their nests in a variety of plants that provide concealment in the form of dense foliage. The most frequently used species include willows (*Salix* sp.), mulefat *(Baccharis glutinosa*), California wild rose (*Rosa californica*), poison oak (*Toxicodendron diversilobum),* mugwort (*Artemisia douglasiana*), and cottonwood, (*Populus fremontii*). Dense brush, willow thickets, mesquite, streamside thickets, and scrub oak in arid regions often near water, and also adjoining uplands are used (Kus and Miner 1989). Nests occur in shrubs or low trees, usually averaging about three feet above ground, are usually in horizontal or downsloping twig forks typically near edge of a thicket. A low, dense shrub layer is considered essential for nesting (Franzreb 1989) and a large degree of vertical stratification is preferred. Willow is the most commonly used vegetation for this need (Kus and Pottinger, personal communications, March 2015). Plant species used for nesting and foraging also include the California wild rose, *Rosa california*, and coastal live oak, *Quercus agrifolia* (Keeney, personal observations and field notes). Most nest sites are located near the ecotone edge openings.

Males are site tenacious and return to the same site to nest in succeeding years. Early to mid-successional riparian habitat is typically used for nesting by the LBVI because it supports the dense shrub cover required for nest concealment as well as a structurally diverse canopy for foraging (Kus 2002; RECON 1989; Franzreb 1989; Hays 1988; Zembal et al 1985; Gray and Greaves 1984; Zembal 1984). Vegetation characteristics of riparian stands between five to 10 years of age are most suitable for nesting LBVI (Kus 1998; RECON 1989; USFWS 1998; Franzreb 1989; Hays 1988; Zembal et al 1985; Goldwasser 1981). Restored riparian in the coastal lowlands of southern California has the habitat structure to support breeding LBVI within 3-5 years particularly if they are adjacent to established riparian areas (Kus 1998).

While LBVIs may visit or forage within young riparian habitat age classes during the first growing season, the nest site selection usually does not occur until a well-developed layered vegetation structure develops, a process that is affected by a variety of ecological variables. Successful occupation of restored sites by vireos is positively affected by the presence of adjacent mature riparian vegetation. However, nest success within younger riparian habitats in restored areas compared to those at reference sites was not significantly different in a habitat suitability analysis of nest habitats in the lower San Luis Rey River area, conducted by Kus (1998) using data from 1989-1993.

Population Demographics and Distribution

There are approximately three to four (possibly five) LBVI territories based on protocol presence/absence surveys over a seven to eight year period since 2009 (Corps 2017; Dudek 2012). There are anecdotal detections of single male LBVI migrating through the riparian habitat, but those detections are rare (two to three over a 10-year period). The Corps performed irregular presences/absences protocol surveys over the last seven years. Each survey detected LBVI in the same locale: Aliso Creek/Sulphur Creek confluence to where the Old AWMA Road (lower road) and Aliso Canyon Road (new upper road) meet, a path (non-linear) distance of about 4,500 feet. Figure 2.7-7 illustrates LBVI detections over 11 years by the Corps surveys as well as single-year surveys by the FWS and Dudek. The upper reaches of Aliso Creek were surveyed for LBVI over the 11-year period but no vireos were heard or observed probably due to the massive infestation of giant reed.

Figure 2.7-7 Least Bell's Vireo Composite Presence/Absence Detections (Corps 2010-2016; Dudek 2010)

Vireo Territory Size and Acreage Demographics

The size of a bird's territory, that is, the space on the ground that is occupied by a single male or a mating pair that is often vigorously defended against intruders, especially those of the same species is an important function in a bird's ecological fitness. For most emberized birds, vocalization by singing attracts a female to the male-defended territory. Furthermore, energetics, the amount of energy spent performing food searches, defending a territory, staying warm, and flight, are imperative to a bird's survival, especially a Neotropical migrant such as the LBVI. So the ability to defend a territory on the ground is focal at the beginning of the nesting season and less essential at its end.

Vireo territory size has been estimated by several investigators (Kus 1984; 2002). Males establish and defend territories through counter-singing, chase, and sometimes physical combat with neighboring males (Kus 2002). Male vireos contest and establish breeding territories that range in size from 0.5 to 7.4 acres. USFWS (1998) documents that most territories average between 0.4 and 1.2 hectares (1 and 3 acres). Kus (2002) reports that territory size ranges from 0.5 to 7.5 acres (Kus 2002); that is, LBVIs will occupy and defend a habitat patch as small as 0.5 acres and as large as 7.5 acres, which is large for a small insectivorous bird. Average territory size from other vireo locales in southern California riverine ecosystems are found in Table 2.7-5.

Table 2.7-5 Average Least Bell's Vireo Territory Size in Southern California

Location/Year	Year/Territory Size	Source
Tijuana River	1991: 2.5 ± 1.2 acres 1992: 2.7 ± 1.4 acres 1993: 1.8 ± 0.8 acres	Kus 1991 Kus 1992 Kus 1993
Sweetwater River	1996: 1.9 ± 0.8 acres	RECON 1998
Prado Basin (Santa Ana River)	1987: 1.9 ± 0.9 acres 1988: 1.6 ± 0.9 acres	Hays 1987 Hays 1988
San Diego River	1987: 2.1 ± 1.0 acres 1988: 1.7 ± 0.9 acres	Kus 1989 Kus 1989

According to the data, the smallest average vireo territory in 1988 nearest to the San Luis Rey River was 1.7 ± 0.9 acres (Kus 1989), which is equivalent to 0.8 acres (1.7 less 0.9). In this analysis, 0.8 acres were assumed to be the smallest territory size that a LBVI would need to sustain its breeding, foraging, and cover requirements even though the literature documents 0.5 acres (Kus 2002) as the smallest territory size.

Vegetation characteristics of riparian stands between five to 10 years of age are most suitable for nesting vireos (Goldwasser 1981; Kus 1998; RECON 1989; USFWS 1998). Kus (1998) further reports that "restored riparian in the coastal lowlands of southern California has the habitat structure to support breeding vireos within 3-5 years particularly if they are adjacent to established riparian areas."

Polioptila californica **(California Gnatcatcher)**

The California gnatcatcher (*Polioptila californica californica*) inhabits coastal sage scrub for breeding and on occasion will utilize chaparral, grassland, and riparian habitats nearby for dispersal and foraging. The subspecies was listed as threatened in 1993 because of habitat loss and fragmentation resulting from urban and agricultural development and the synergistic effects of cowbird parasitism and predation (USFWS 2003). The study area is not within critical NCCP habitat designated for this species, as the species is covered under the Orange County Central-Coastal NCCP/HCP (USFWS 2007).

California gnatcatchers were observed (along with evidence of breeding) during focused surveys conducted in the downstream portion of the study area in 2005, 2006, and 2007 (PCR 2007; Dudek 2007). Based on these surveys, the species is considered to be present in the study area. During additional surveys conducted in May and June of 2009, four California gnatcatcher territories were detected (USACE/RECON 2009). Three of the four pairs observed were accompanied by at least one juvenile. Figure 2.6.6 shows the locations within the study area where California gnatcatchers were observed during the focused surveys.

The *californica* subspecies of the California gnatcatcher has been listed as a Species of Special Concern in California and was listed as threatened by the USFWS in 1993 (USFWS 1993). California gnatcatcher is a focal species under California's NCCP program. Several sub-regional coastal sage scrub focused conservation plans are approved or in the late planning stages throughout southern California.

Final designation of critical habitat for the California gnatcatcher was on October 24, 2000 and final redesignation was in 2007. Critical habitat is designated within a portion of the area of the Proposed Project. Gnatcatchers may forage in this area but are not known to nest within the Proposed Project area (Figure 2.7-7).

The gnatcatcher typically occurs vegetation types consisting of *Artemisia californica, Eriogonum fasciculatum, Rhus integrifolia* composed of relatively low-growing, dry-season deciduous, and succulent plants. Characteristic plants of this community include California sagebrush (*Artemisia californica*), various species of sage (*Salvia* sp.), California buckwheat (*Eriogonum Fasciculatum*), lemonadeberry (*Rhus integrifolia*), California encelia (*Encelia californica*), and *Opuntia* spp. Dense sage scrub is occupied less frequently than more open sites. Mostly absent from coastal areas.

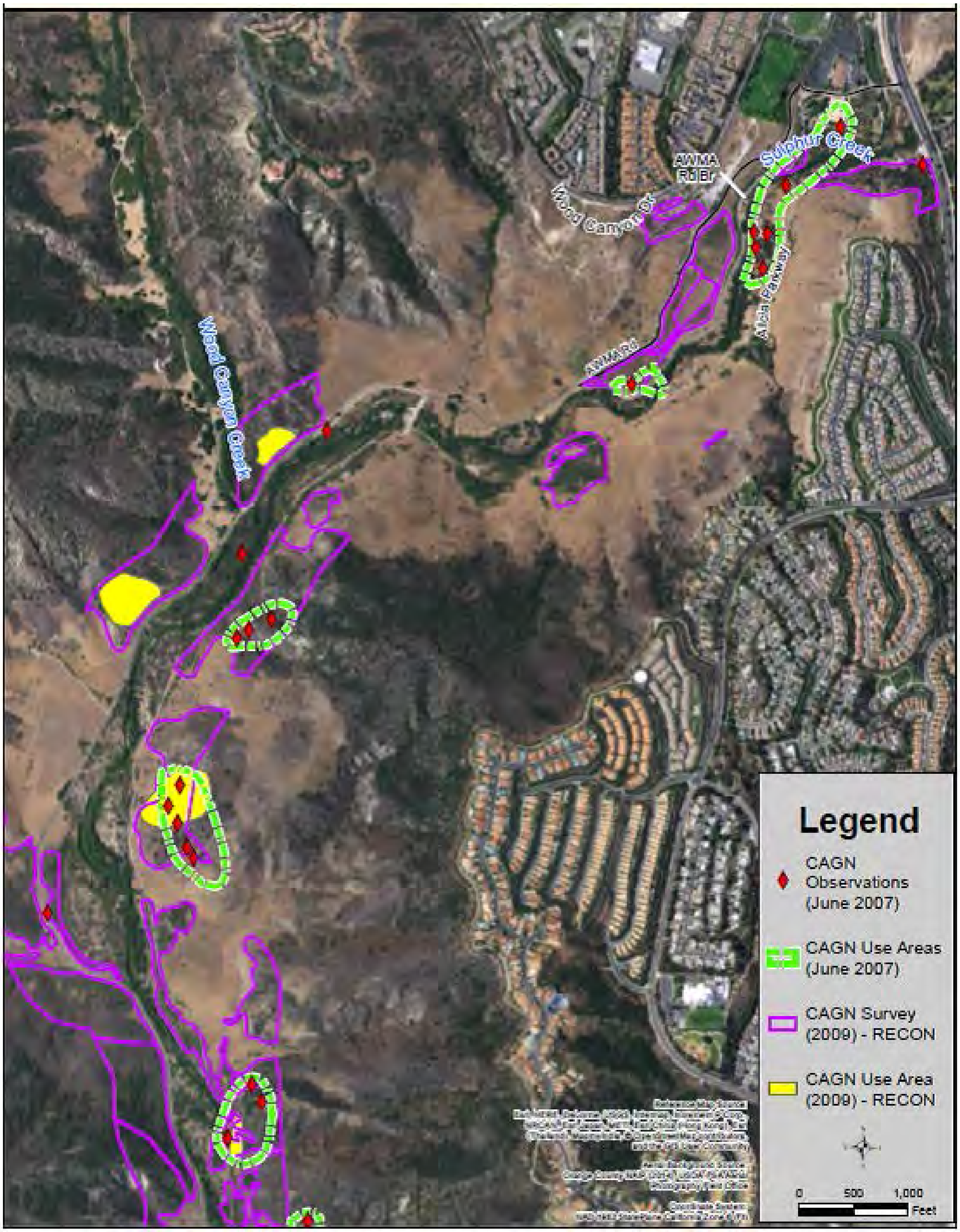


Figure 2.7-8 California Gnatcatcher Habitat Distribution and Detections for Aliso Creek (USACE 2009; Dudek 2011)

2.7.5 Sensitive Plants and Animals –Not Listed

A review of the CNDDB was conducted to identify other sensitive wildlife and plant species listed by the California Native Plant Society that have the potential to occur in the Proposed Project area due to the presence of suitable habitat. Based on the habitat present in the Proposed Project area and recent observations, a list of California species of concern with the potential to occur in the Proposed Project area is provided in Table 2.7-4.

2.7.6 Wildlife Corridors

As described in the NCCP/HCP, the Wilderness Park provides several important wildlife corridors that link wildlife habitat within local open space and wilderness areas (OC Parks 2009). These areas include the Laguna Coast Wilderness Park, James Dilley Greenbelt Reserve, and Crystal Cove State Park to the north and northwest; Laguna Niguel Regional Park to the northeast; and Salt Creek Corridor Regional Park to the east.

2.7.7 Invasive Vegetation

The Proposed Project area is significantly impacted by the presence of invasive riparian plant species which outcompete native riparian species, thereby limiting native species diversity and reducing habitat and food for native wildlife. Appendix B-2a details the percentage of invasive species for the grass/forb layer, shrub layer, and tree layer, respectively.

One of the most prevalent invasive plants in the Proposed Project area is giant reed (NHI 2015), which is an aggressive species with remarkable reproductive abilities. This ability to reproduce quickly allows giant reed to outcompete native species of plants for land, nutrients, and water resources, thus establishing thick, concentrated stands. In addition, mature stands of giant reed can withstand flooding and drought. All of these, combined with ability of giant reed to spread over geographic locations quickly via natural waterways, allow giant reed to overtake large areas very quickly. These factors produce various results that make giant reed extremely undesirable.

Giant reed is an extremely flammable plant even when it is green. The thick stands of giant reed can catch on fire quickly and easily, and through its extensive placement, spread fires rapidly through entire riparian systems. Since giant reed suffocates native vegetation, it alters the food resources for local wildlife. Giant reed is not considered an alternative food resource because of its lack of nutrients. It has only proved to benefit a very small number of species, most of which use giant reed for shelter, not as a food resource.

When flooding occurs in areas heavily populated by giant reed, its stems and rhizomes break off in the flood currents and flow with the flood. These rhizomes and stems deposit themselves in drainage systems, along small agricultural ditches, under bridges, and in other flood control systems. The giant reed then quickly reestablishes itself in these new locations. This pervasiveness causes obstructed waterways and potential structural damage leading to repeated maintenance efforts. Responding to these effects are costly. Giant reed has been identified as the biggest invasive plant species problem in the southern California riparian watershed areas (Santa Margarita and San Luis Rey Weed Management Area 2009).

The Wilderness Park was mapped for invasive plant species and giant reed occupied 71.38 acres (OC Parks 2009). From data mapping the larger Aliso Watershed in 2007, there is a total of 116.7 acres of invasive plant species, with the most prevalent invasive species, giant reed occupying 57 acres (Orange County 2008). In 2006, giant reed was mapped within the Proposed Project area and covered a total of 27.6 acres. NHI updated this mapping using current aerial imagery in 2009 and determined that giant reed had expanded by 5.1 acres to 32.7 acres within the Proposed Project area (NHI 2015b).

There are several restoration projects and mitigation measure implementation occurring within the Proposed Project area, especially with respect to giant reed treatment (Figure 2.7-9). One invasive species removal effort was conducted along Aliso Creek from the confluence with Sulphur Creek downstream to SOCWA CTP. This was funded by Proposition 50 funds and covered approximately 33 acres of giant reed. The initial removal was conducted in 2012, and the project is currently in maintenance. Another project is an ongoing active project funded by Measure M Habitat Restoration funds awarded to OCTA. Approximately 55 acres of area is being treated for invasive giant reed removal. The goals of these projects are eradication of the giant reed; however, there are various methodologies being employed that may hinder meeting this goal (e.g. not removing the root mass, not removing or chipping the treated biomass, or not regularly treating re-sprouted or newly emerged material). Ongoing evaluation of the treatment activities of these other various projects will identify the level of success with the control of this invasive species.

2.7.8 Combined Habitat Assessment Protocol (CHAP) Results: Units

CHAP was utilized to provide an assessment of biological resources based on species, habitat elements or correlates, and habitat functions determined to be present in CWHR cover type polygons within the Aliso Creek study area. A wildlife habitat assessment was conducted at Aliso Creek in May 2009, September 2014, and April 2015. The assessment was conducted at the site level scale. A fine level assessment scale was done over a study area along Aliso Creek that extends approximately 9 miles from I-5 at the north end to the South Coast Water Treatment Plant, which is about 1.2 miles from its mouth in Laguna Beach at the Pacific Ocean. The Aliso Creek project boundary falls most within the Aliso and Wood Canyons Wilderness Park, which is a respite for both wildlife and local residents and operated and maintained by OC Parks. At the South Coast Water Treatment Plant there is ensuing infrastructure (sewer and water pipes; electrical), which are buried parallel to Aliso Creek on both sides.

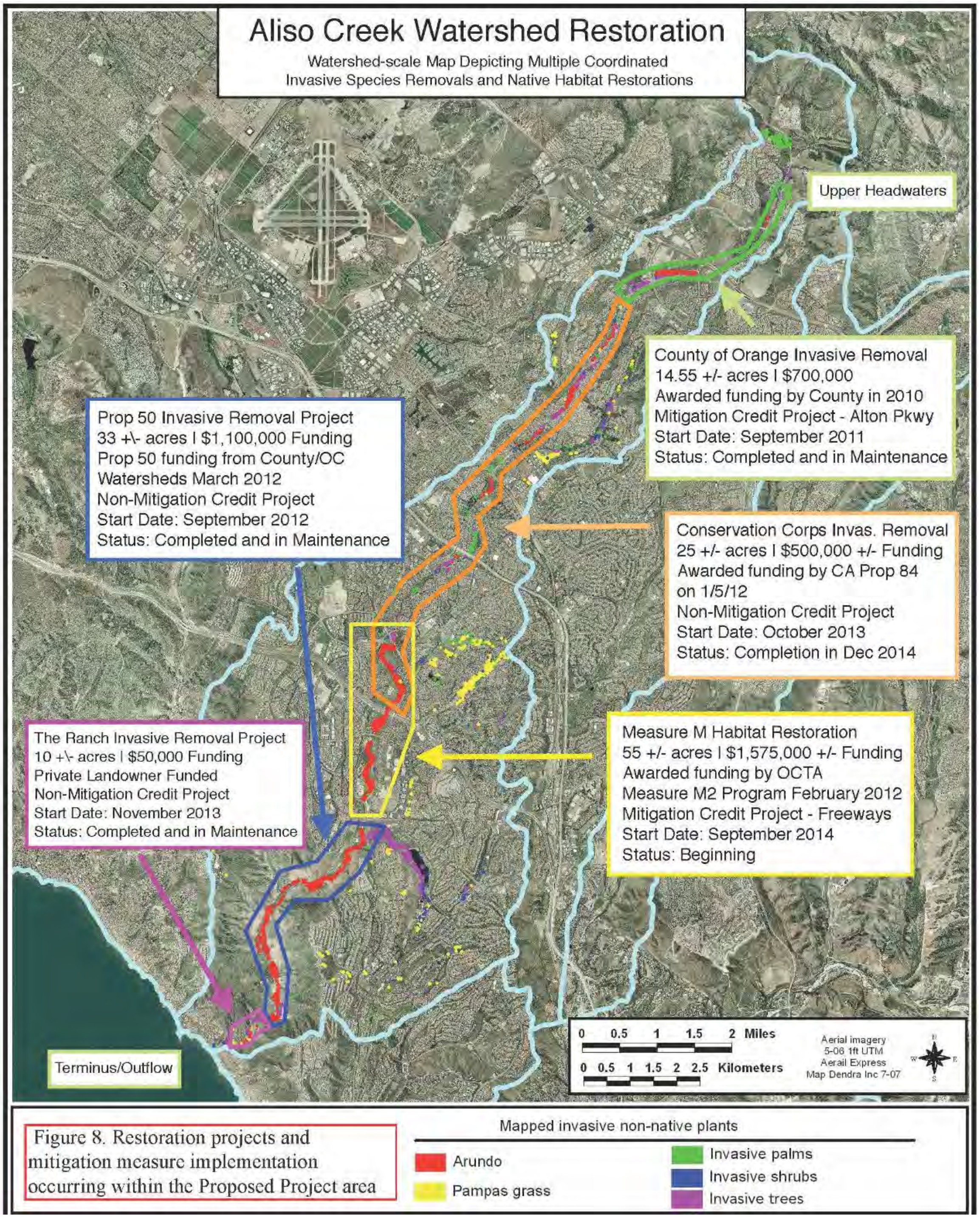


Figure 2.7-9 Restoration Projects and Mitigation Measure Implementation Occurring within the Proposed Project Area

Per-acre value or simply habitat units per acre (HUs/acre) is a method to compare the habitat value of CHAP polygons within the Proposed Project area to establish the highest and lowest functioning areas without any polygon size bias (NHI 2015). Valley Foothill Riparian habitat type has the highest per-acre habitat value of the habitat types, and Valley Foothill Riparian contributes the most to the overall habitat value of the Proposed Project area (Table 2.7-6). Valley Foothill Riparian comprises 41 percent of the Proposed Project area (see Table 2.7-1) and is contributing 55 percent of the overall habitat value of the Proposed Project area. For additional details on the determination of the HU value, see Appendix B-2a.

Table 2.7-6 Existing Conditions Average Habitat Value of Aliso Creek Habitat Types

California WHR Habitat Type	Average Per-Acre CHAP Habitat Value	Sum of CHAP Habitat Units (Hus)	Proportion of Total Hus (%)
Annual Grassland	9.25	1,969.1	22.08
Coastal Scrub	13.45	1,518.0	17.03
Eucalyptus	9.25	3.8	0.04
Lacustrine	14.01	424.5	4.76
Riverine	11.36	350.9	3.94
Urban	4.21	233.6	2.62
Valley Foothill Riparian	17.79	4,403.8	49.39
Valley Oak Woodland	14.00	12.4	0.14

2.8 CULTURAL RESOURCES

Cultural resources are locations of past human activity, occupation, or use on the landscape. The term denotes a wide range of heritage assets including, but not limited to: archaeological sites such as lithic scatters, villages, procurement areas, resource extraction sites, rock shelters, rock art, and shell middens; and historic era sites such as trash scatters, homesteads, railroads, ranches, logging camps, and buildings or structures that are over 50 years old. Cultural resources also include aspects of the physical environment that are associated with cultural practices or beliefs of a living community that are both rooted in that community’s history and are important in maintaining its cultural identity (Parker and King 1998). Commonly referred to as Traditional Cultural Properties (TCP), these areas are afforded the same consideration as other cultural resources.

The term cultural resource is not defined in NEPA and has no statutory definition, but the related term “historic property” is defined in law (54 U.S.C. § 300308) and regulation (36 C.F.R. § 800.16 - Definitions). In general, a historic property is defined as a cultural resource that has met standards of age, integrity, and significance that qualify it as eligible for listing on the National Register of Historic Places (NRHP or National Register). The National Historic Preservation Act (NHPA) is the major piece of legislation that mandates Federal agencies to take into account the effects of their undertakings on historic properties.

There are three main standards that a resource must meet to qualify for listing on the NRHP (36 C.F.R. § 60): age, integrity, and significance. To meet the age criteria, a resource generally must be at least 50 years old. Properties under 50 years of age can be found eligible when the resource is of exceptional significance (36 C.F.R. § 60.4). To meet the integrity criteria, a resource must possess integrity of location, design, setting, materials, workmanship, feeling, and association. Finally, a resource must be significant according to one or more of the following criteria:

(a) be associated with events that have made a significant contribution to the broad patterns of our history; or
(b) be associated with the lives of persons significant in our past; or
(c) embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction; or
(d) have yielded, or may be likely to yield, information important in prehistory or history.

Regulations at 36 C.F.R. Part 800 outline the process through which Section 106 of the NHPA is administered. In general, the regulatory process can be broken into four steps. These are (1) defining the undertaking and assessing whether it has the potential to affect historic properties included on, or eligible for inclusion on, the National Register; (2) making a good faith effort to identify those properties within the area of potential effect; (3) assessing the undertaking's effects on those resources; and (4) taking steps to avoid or mitigate adverse effects if present.

2.8.1 Existing Resources

In order to determine the likely presence of cultural resources located within the Proposed Project area, the Corps requested a records and literature search from the South Central Coastal Information Center (SCCIC). The record search encompassed a quarter mile on either side of Aliso Creek from Pacific Park Drive to the Pacific Coast. The search included a review of all of the archaeological site records and cultural resource reports on file. In addition, the California Points of Historic Interest, the California Historical Landmarks, California Register of Historical Resources, the NRHP, and the California State Historic Resources Inventory were also checked.

Forty-six cultural resources studies of varying types have been conducted within a quarter-mile radius of the Proposed Project area. That includes records searches, field surveys, subsurface significance evaluations, and data recovery. Twenty-four cultural resources have been recorded within the record search area; 23 of these are prehistoric archeological sites. These include aboriginal camps, resources procurement areas, and village sites. Ten of these prehistoric sites have previously been determined to be eligible for the NRHP. The remaining resource is the Aliso Creek Bridge, which carries the PCH over Aliso Creek. The bridge was determined to be eligible for the NRHP under Criterion.

The Aliso Creek watershed, with its limited development, contains a higher than average number of intact cultural resources. The geology and geomorphology of the area suggest that additional sites are likely to be present along the Aliso Creek floodplain, buried beneath alluvial sediments. One archaeological site located within the Wilderness Park but outside of the Proposed Project area is located approximately 18 feet below the surface. The archaeological sites that have been recorded within the Proposed Project area have revealed a variety of site types – containing diagnostic artifacts, human and animal burials – that have added substantial data to our understanding of human settlement within Orange County for the past 2000 years. In addition to the sites' importance to the Juaneño and Luiseño people, the archaeological community within southern California has publically commented on the importance of these sites.

Section 106 of the NHPA, requires that the Federal agency define the area of potential effects (APE) for any Federal undertaking. The APE is the geographical area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties (36 C.F.R. § 800.16). The Corps has defined the APE for the Aliso Creek Ecosystem Restoration Project as an approximately one-quarter mile swath (one-eighth of a mile on either side of the Creek) that begins at Pacific Park Drive and ends a quarter mile south of the SOCWA CTP Bridge. This area covers the anticipated footprint of the altered streambed, the disposal areas, all access roads, a construction zone outside of the project footprint, and a includes a small buffer for visual, auditory and atmospheric impacts, recreational elements, as well as downstream changes in water velocity and flood risk. Fourteen archaeological sites have been recorded within the APE for the Proposed Project.

The impact corridor of the work in the creek intersects with 12 recorded archaeological sites. Six of these sites have previously been determined to be eligible for the NRHP under Criterion D. All 12 archaeological sites were documented prior to 1985 and most were first documented in 1973. While some of the sites have been revisited, these examinations have typically focused on a small area within the sites where projects such as utility lines or road maintenance bisects them. The current state of most of these sites is unknown. Creek erosion and unstable side slopes, road and utility construction, and development have damaged and most likely destroyed major portions of at least three of the sites that have previously been determined to be eligible. Pockets of these sites may still be intact within the APE. Of the 12 sites, one was revisited in 2002 and appears to be sloughed off from a larger site and was recommended as not eligible; however, a formal determination of eligibility was not made. Furthermore, one site appears to have already been destroyed by the creek but remains intact in the uplands.

The Corps has hired a consultant to revisit five of the 12 sites and provide additional details about their current condition. The results of this analysis will be available by late 2017 and will help inform future designs. This section will be updated in the final report to include additional information on project effects regarding these five sites.

2.8.2 Native American Concerns

The Proposed Project area falls primarily within the Juaneño/Luiseño sphere of influence with a Gabrielino presence in the northeastern portion of the Proposed Project area. The Indian Tribes acquired their present names from the association with various missions that had become a dominant element in their lives. The Gabrielino are associated with the Mission San Gabriel Arcángel in San Gabriel, Los Angeles County, the Juaneño with the Mission at San Juan Capistrano, and the Luiseño with the Mission at San Luis Rey de Francia near Oceanside in northern San Diego County.

The Corps requested initial comments from the Native American Heritage Commission (NAHC) in May 2009. While the Sacred Land File Search did not reveal any sacred sites or traditional cultural properties within the literature search area, the NAHC responded that there were numerous prehistoric archeological sites within half a mile of Aliso Creek. The NAHC encouraged the Corps to contact the Tribes who traditionally used the area. The NAHC also separately responded to the notice of preparation (NOP) of this draft EIS/EIR with comments of a generic nature on standard identification and consultation procedures commonly used during the environmental review process. The correspondence with the NAHC can be found in Appendix B-17.

The Corps initiated consultation with the State Historic Preservation Office (SHPO) via letter on August 1, 2017, regarding the Corps APE and has requested that the SHPO work with the Corps to develop a Programmatic Agreement (PA) that lays out how the Corps will satisfy its requirements under Section 106 of the NHPA. The Corps has also concurrently notified the Juaneño Band of Mission Indians, the Juaneño Band of Mission Indians Acjachemen Nation, and the Pauma Band of Luiseño Indians Tribes. The letters are provided in Appendix B-17.

2.9 PALEONTOLOGICAL RESOURCES

Paleontological resources are the recognizable remains of once-living, non-human organisms and early hominids. Identified as fossils, these resources represent a record of history of life on the planet dating back as far as four billion years ago. Paleontological resources can include shells, bones, leaves, tracks, trails, and other fossilized floral or faunal materials.

The Aliso Creek watershed area contains one of the most scientifically important Middle Miocene to Lower Pliocene stratigraphic successions in the western United States (Cooper and Sundberg 1976). Six geologic formations and four non-formational units are exposed within the Wilderness Park. All formations and non-formational units except for recent colluvium and alluvium have produced fossils (OC Parks 2009a).

Table 2.9-1 Paleontological Sensitivity of the Geologic Units within the Wilderness Park

Geological Unit	Sensitivity
Undifferentiated Sespe Vaqueros	Very High
San Onofre Breccia	Low
Topanga Formation	Very High
Monterey Formation	Very High
Capistrano Formation	Very High
Niguel Formation	Moderate
Marine Terrace Deposits (Older Alluvium)	High
Landslide Deposits	Dependent on Source of Material
Recent Colluvium	None
Recent Alluvium	None

Source: OC Parks 2009a

2.10 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

Hazardous, Toxic and Radioactive Waste (HTRW) is identified as a Corps program and Engineer Regulation that requires a survey of all Civil Works related projects for general compliance with the Federal laws of CERCLA (Comprehensive Environmental Restoration Compliance and Liability Act, otherwise known as "Superfund") and RCRA (Resource Conservation and Recovery Act, otherwise known as "hazardous waste law"). Therefore, identification of the current and past land uses is part of the initial HTRW survey process. Typically, this is accomplished by a Phase I Environmental Site Assessment (ESA) and possibly a follow-up Phase II ESA when needed.

The Wilderness Park is maintained as open space with its natural resources intact. The only use of the property historically has been for cattle and sheep grazing and cultivation of barley and oats (OC Parks 2009a). This indicates the land use is consistent and has not changed significantly over a long period of time. Property immediately adjacent and within a quarter-mile distance to the site is used for recreation, residences, and office business. The land use beyond the adjacent vicinity of one quarter miles to the study area is more recent and is heavily developed and is a mix of office and retail business, light industry and residences. This indicates that surrounding and adjacent land use beyond the quarter mile is inconsistent and has changed significantly over time.

A full Phase I or II ESA in accordance with ASTM standards was not deemed necessary for the study area at this time. An ASTM E-1528 transaction screening process was performed for this study instead for this stage of the feasibility study. This standard is an appropriate starting point for assessing the potential HTRW issues in the large study area, for which the land use has remained relatively unchanged over a long period of time. The screening assessment is included in Appendix B-6.

Known HTRW hazards have not been identified within the immediate study area, other than the ongoing surface water pollution that is related primarily to nonpoint sources from land adjacent to and more than one quarter miles from the study area. The screening assessment identified 84 records of sites within or adjacent to the study area where regulated materials have been used or regulated wastes have been generated. These records appear to be for routine issues with little, if any, impact on the project. A complete Phase I ESA will clarify the status of those sites. Future HTRW hazard surveys to be conducted during Preconstruction Engineering and Design (PED) should also address the non-point sources of contamination and their effects to the study area, especially as it relates to surface water.

2.11 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

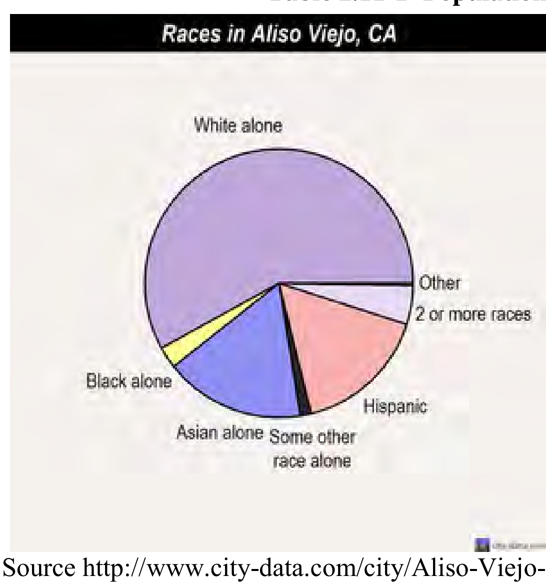
Demographic information describes the general characteristics of a population in a given area. Demographic data was gathered from established electronic data bases, including U.S. Census, individual city websites, and State of California websites. Since the Proposed Project area is limited to the Wilderness Park with no permanent population, the demographic information is a capsule of the cities surrounding the Proposed Project area.

2.11.1 Local Demographics

City of Aliso Viejo

The City has a population of about 50,231 (2014). Median household income was $97,735 compared to $60,190 for the state of California (2013). Approximately 2 percent of families and 4 percent of individuals are below the poverty level. The median home value is 489,079 (2013) compared to $373,100 for the state of California. The unemployment rate is approximately 10 percent (2014).

Table 2.11-1 Population and Races in Aliso Viejo



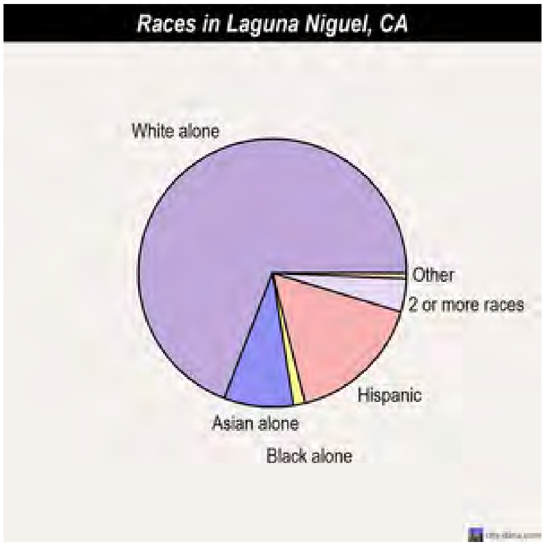
28,928	57.8%	White alone
8,440	16.9%	Asian alone
8,090	16.2%	Hispanic
2,332	4.7%	Two or more races
1,308	2.6%	Black alone
637	1.3%	Other race alone
129	0.3%	American Indian alone

Source http://www.city-data.com/city/Aliso-Viejo-California.html

City of Laguna Niguel

The City has a population of about 65,448 (2015). Median household income was $98,957 compared to $64,500 for the state of California in 2015. The median house value was $738,200 in 2015 compared to $449,100 in the state of California. Approximately 3 percent of families and 4 percent of individuals are below the poverty level. The unemployment rate is approximately 3.9 percent (2015).

Table 2.11-2 Population and Races in Laguna Niguel

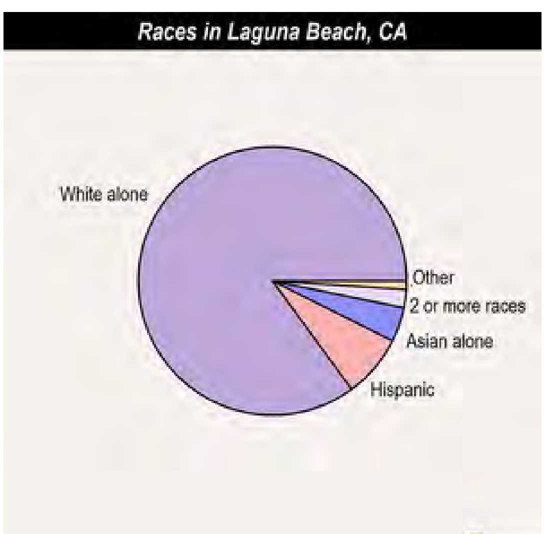


43,735	66.3%	White alone
11,379	17.3%	Hispanic
5,826	8.8%	Asian alone
2,665	4.0%	Two or more races
1,246	1.9%	Black alone
198	0.3%	American Indian alone
106	0.2%	Other race alone
82	0.1%	Native Hawaiian and Other Pacific Islander alone

Source: http://www.city-data.com/city/Aliso-Viejo-California.html

City of Laguna Beach

The City has a population of about 23,341 in 2014. Median household income was $90,017. The median house value was over $1 million in 2015 compared to $449,100 in the state of California. Approximately 3 percent of families and 4 percent of individuals are below the poverty level. The unemployment rate is approximately 3.96 percent (2015).



19,123	80.9%	White alone
1,847	7.8%	Hispanic
1,155	4.9%	Asian alone
728	3.1%	Two or more races
219	0.9%	Black alone
62	0.3%	Other race alone
55	0.2%	Native Hawaiian and Other Pacific Islander alone
29	0.1%	American Indian alone

Source: http://www.city-data.com/city/Laguna-Beach-California.html

2.11.2 Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations (1994), directs Federal agencies and state agencies receiving Federal funds to assess the effects of their actions on minority and/or low-income populations within their region of influence. The order requires agencies to develop strategies to identify and address any disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and/or low-income populations.

The EPA (1998) has published *Guidance for Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analyses,* which indicates that a minority population exists when either:

- The minority population of the affected area is greater than 50 percent of the affected area's general population.
- The minority population percentage of the affected area is meaningfully greater than the population percentage in the general population or other appropriate unit of geographic analysis.

Relevant factors in the analysis of environmental justice include a determination that there is a minority or low-income population in the area of impact; that adverse impact would result; and that the impact would be disproportionately high and adverse on the minority or low-income population either directly, indirectly, or cumulatively. As indicated above, the population below the poverty level adjacent to the Proposed Project area (3 to 4 percent) is less than the 10.3 percent countywide and 15.3 percent statewide. Compared to all of Orange County, the minority population adjacent to the Proposed Project area is at most estimated to be 13 percent as compared with 36 percent for the entire county and as opposed to 57 percent in the entire state.

2.12 LAND USE

2.12.1 Proposed Project Vicinity

The Proposed Project area includes the approximately 3,875-acre Aliso and Wood Canyons Wilderness Park. The majority of the Wilderness Park is in unincorporated Orange County. Dedicated to Orange County in 1979, it is designated in the County's General Plan as a wilderness park, "a regional park in which the land retains its primeval character with minimal improvements and which is managed and protected to preserve natural processes." The Central and Coastal Subregion of the NCCP/HCP also limits development within the Proposed Project area including the Wilderness Park. A deed restriction placed on it in 2001 limits it to county park uses in perpetuity. Orange County owns, operates, and manages the Wilderness Park.

City of Aliso Viejo

As part of unincorporated Orange County, the area of Aliso Viejo experienced substantial growth from 1990 to 2000. It was incorporated as Orange County's 34th city in 2001. The city is approximately six square miles and primarily consists of planned communities. The uses generally include a mix of residential neighborhoods, office and commercial development, and recreational areas. The portion of the city adjacent to Aliso Creek south of Aliso Creek Road is within the coastal zone. The city's general plan, adopted in 2005, includes all of the required elements and no optional elements. The northernmost portion of the study area, from approximately Aliso Creek Road to Pacific Park Drive, is a narrow portion of Wilderness Park along the Aliso Viejo city boundary.

City of Laguna Niguel

Laguna Niguel was primarily built after 1980 and is largely comprised of several master planned communities. The city incorporated in 1989. It is approximately 14.7 square miles and consists predominately of detached single-family residences and several commercial areas. Over one third of the land area is recreation and open space. The general plan contains the seven required elements and an optional Growth Management Element. Several portions of the city are within the coastal zone, including the area adjacent to Aliso Creek south of Aliso Creek Road.

A small segment of the study north of Wilderness Park is within Laguna Niguel near the city boundary. Land uses within the study area include primarily a portion of the Wilderness Park within Laguna Niguel boundaries, other parks and a small area of residential uses and commercial uses in Laguna Niguel to the east of the creek

City of Laguna Beach

Laguna Beach was incorporated in 1927. It is a beach community and artist colony. The city is approximately 9.7 square miles with seven miles of coastline. The general plan includes the seven required elements and optional Historic Element and Scenic Highways Element. Almost the entire city, including the study area within Laguna Beach city limits, is in the coastal zone. Approximately 41 percent of the land is developed, and the remaining 59 percent is recreation/open space and hillsides (Laguna Beach 2000). The study area south of Wilderness Park to the Pacific Ocean is within Laguna Beach.

2.12.2 Mitigation Sites

Aliso Creek Wildlife Habitat Enhancement Project (ACWHEP)

The project includes a grade control structure known as ACWHEP and overflow structure in the Wilderness Park designed to slow water upstream of the structure, provide gravity irrigation to downstream portions of the Creek to support riparian habitat, and provide a creek vehicular crossing to enhance park access. This system was constructed as part of a mitigation bank by the Mission Viejo Company and Orange County to direct water through irrigation lines to riparian terraces.

Southwestern Pond Turtle Habitat

Mitigation for the City of Laguna Hills' Laguna Hills Community Center included the creation of southwestern pond turtle habitat approximately 0.5 miles north of the SOCWA CTP on the east side of Aliso Creek, which began in 2002. The program included creation of a turtle pond and associated wetland and upland habitat, implementation of a predator control plan, and introduction of 39 pond turtles.

SOCWA Bridge Protection

A bridge protection project under Section 14 of the CAP for the SOCWA access bridge over Aliso Creek included implementation of a grade control structure with low-flow channel and restoration of riparian/upland habitat immediately up and downstream of the bridge.

SOCWA Road Alignment

Realignment of a 1,000-foot long segment of the paved SOCWA access road and trail included revegetation of 1.42 acres of native grassland and coastal sage scrub on the west side of the Creek near ACWHEP.

Measure M Habitat Restoration

Approximately $1.6 million was awarded by OCTA to restore habitat on approximately 55 acres as mitigation for freeway construction in Orange County. The habitat rehabilitation efforts are focused on approximately 1.5 miles in Aliso Creek from Moulton Parkway downstream to approximately Avila Road overlapping Reaches 11 to 15.

2.12.3 Historical Land Use

The lands within the Wilderness Park boundaries were historically part of the Rancho Niguel, granted to Juan Avila in 1842. The first major land use change in the watershed was the introduction of livestock grazing and agriculture in the late 1800s. While the conversion of lands for agricultural production had adverse impacts, such as erosion and a reduction in native plant and animal communities, records indicate that the watershed remained relatively stable through the mid-1900s. The first large developments in the watershed (Lake Forest, Leisure World, and Laguna Hills) began in the flatter middle reaches of the watershed. The early impacts of development on the creek system resulted in development restrictions in the lower watershed with the most prominent example being the designation of Aliso and Wood Canyons Regional Park (Wilderness Park) as a protected natural area.

Urbanized areas of the watershed (almost 75 percent) are currently at near-full build out. Undeveloped areas of watershed (25 percent), are comprised of Cleveland National Forest, Aliso and Wood Canyons Wilderness Park, and other conservation areas.

The area adjacent to the Proposed Project area is characterized by a mix of land uses, including open space and recreation, residential, public (i.e., schools, government facilities), and commercial uses. Rapid development and associated infrastructure improvements (i.e., roads and utilities) have occurred over the past 40 years as the area transitioned from agricultural to urban.

2.13 TRAFFIC AND TRANSPORTATION

2.13.1 Regional Roadways

Access to the Proposed Project area is provided by a system of freeways, highways, and local arterial streets within unincorporated Orange County and the cities of Aliso Viejo, Laguna Beach, and Laguna Niguel. Primary regional access to the Proposed Project area vicinity is provided by the PCH (or Highway 1) and the San Joaquin Hills Transportation Corridor (State Route [SR] 73 Toll Road).

The nearest north-south transportation corridor is Alicia Parkway to the east of the Wilderness Park. From Alicia Parkway, AWMA Road Bridge provides access to the Wilderness Park (Figure 2.13-1). The AWMA Road Bridge, the main entrance to the Wilderness Park is owned by Orange County. Due to existing as well as future vehicular and pedestrian safety concerns, the City of Aliso Viejo created a one-way egress from the private service road to Knollwood. Vehicular ingress from Knollwood to the private service road is restricted to only those agencies that have an approved easement agreement with the City of Aliso Viejo.

There is no public vehicle traffic access through the Wilderness Park. Vehicle use in the Wilderness Park is limited to trucks to and from the SOCWA CTP, park ranger, and maintenance vehicles. Several OCTA bus lines run up and down Alicia Parkway. PCH through Orange County is eligible for California Scenic Highway, but has not been so designated to date.

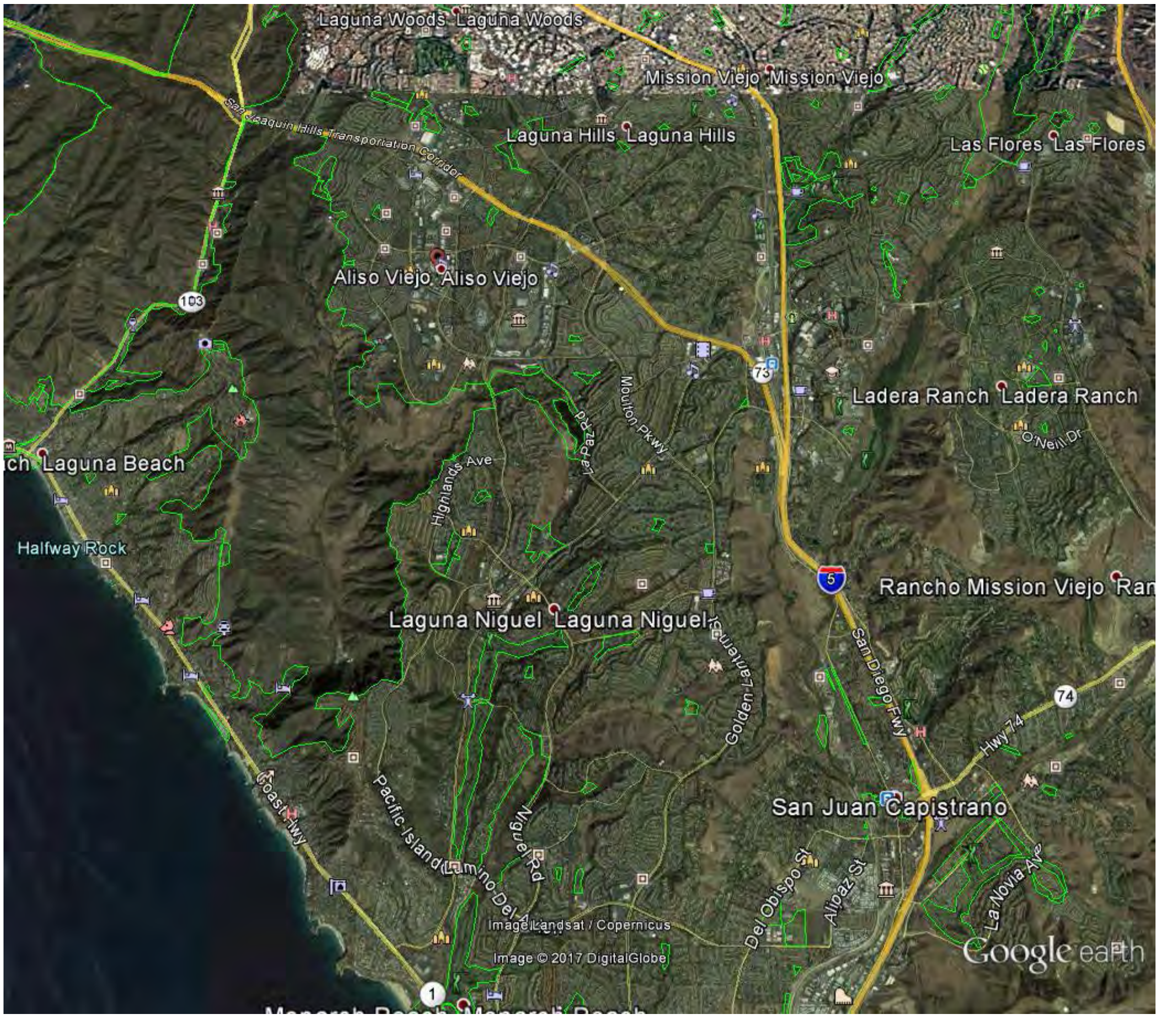


Figure 2.13-1 Regional Roadways

Photo 2.13-2 AWMA Road Bridge crossing Aliso Creek

Photo 2.13-1 Alicia Parkway to the left, riding and bicycling trail to the right, parallel to Aliso Creek

Figure 2.13-2 Access Roads to Proposed Project Area

2.14 PUBLIC HEALTH AND SAFETY

2.14.1 Flood Zone

The Proposed Project area is located within the 100-year flood zone based on the Flood Insurance Rate Map prepared by the FEMA in 2004. Local policies include requiring new development and redevelopment projects to minimize stormwater and urban runoff that drains into Aliso Creek to reduce potential flooding.

2.14.2 Waterway Hazards

Access to the Creek makes the risk of drowning and other water-related accidents a potential health and safety concern, especially during periodic storms when the creek conveys large volumes of fast-moving runoff water to the Pacific Ocean. The Orange County Fire Authority (OCFA) and OC Parks are responsible for clearing trails for public safety and emergency access. In cases of a water emergency, OCFA has staff trained and equipped for land-based river rescues.

2.14.3 Wildfires

The Proposed Project is within a very high or high fire hazard severity zone as designated on the California Department of Forestry and Fire Protection, Fire and Resource Assessment Program Fire Hazard Severity Zone maps (2014). Throughout history, the San Joaquin Hills have been subjected to repeat burning. The most recent firestorms occurred in 1993, in which more than 1,000 structures were destroyed or damaged in three major fires: the Stagecoach fire (October 26), the Laguna Canyon fire (October 27), and the El Toro fire (November 2).

Areas most susceptible to fire have three common characteristics: (1) 30 percent slopes or greater; (2) medium to heavy fuel loading, predominantly coastal sage scrub; and (3) frequent critical fire hazard weather conditions. Canyon slopes meeting these three criteria appear on east facing Laguna Canyon slopes, areas of the Proposed Project including both sides of lower Aliso Canyon, upper Wood Canyon, portions of Sheep Hills and Upper Aliso Canyon. The greatest potential for fire damage exists at the interface between the Wilderness Park and adjacent residential development.

A requirement of the NCCP/HCP is preparation of a Fire Management Plan to provide for short- and long-term fire management policies that are both sensitive to species conservation and provide for effective fire protection of urban development at the urban interface. The Wilderness Park's Resource Management Plan recommends preparation of a specific fire management plan for the Wilderness Park once the fire management plan for the entire NCCP/HCP reserve is adopted (OC Parks 2009). A final plan has not yet been enacted.

2.14.4 Vector Borne Diseases

Vector-borne diseases of concern in southern California include St. Louis encephalitis, Western Equine encephalomyelitis, West Nile virus, and malaria. The Orange County Vector Control District (OCVCD) has responsibility for the control of vectors, including mosquitoes within the Proposed Project area. OCVCD conducts regular surveillance of wetlands and standing water and carries out control through mechanical, biological, and chemical means.

2.14.5 San Onofre Nuclear Generating Station

The Proposed Project area is located approximately 15 miles northwest of the San Onofre Nuclear Generating Station within the Public Education Zone, a 10- to 20-mile radius from the station. Even though the plant has been shut down, the public is required to be informed of Proposed Projects within this zone. Over eight million live within a 50-mile radius of the San Onofre Nuclear Plant. The Nuclear Regulatory Commission (NRC) only requires a 10-mile evacuation zone and does not require a current safe emergency plan for San Onofre (NRC Reg. 50.47).

2.15 UTILITIES

The SOCWA (formerly Aliso Water Management Agency) oversees the transmission of all raw sewage and treated effluent in the watershed (Table 2.15-1). SOCWA CTP facility is located on the east side of Aliso Creek and is approximately 1.2 miles upstream from the Pacific Ocean. The CTP has a design capacity of 6.7 million gallons per day and serves a population of 40,000, which includes the City of Laguna Beach, Emerald Bay Services District, South Coast Water District, and Moulton Niguel Water District (MNWD).

Treated effluent is used for recycled water or discharged to the Pacific Ocean through the Aliso Creek Ocean Outfall. The facility is accessible by way of the SOCWA CTP Bridge via Aliso Creek Trail that parallels the west of Aliso Creek through the Wilderness Park. County staff and the public share a portion of the west access road for Wilderness Park operations, and access to the Wood Canyon trail. SOCWA also has an unimproved (dirt) service road on the east side of Aliso Creek (Aliso Creek Trail East).

An easement for effluent and sludge conveyance pipelines runs along the east side of Aliso Creek. The existing utilities buried along the east bank are owned and operated by the MNWD and SOCWA. These include four pipes carrying wastewater and solids to SOCWA and one pipe carrying solid material out of SOCWA Treatment Plant back up the Creek. At the SOCWA CTP sewer, water pipes, and electrical conduit, are buried parallel to Aliso Creek on both sides (Figure 2.15-1).

Channel degradation from larger flow events has caused infrastructure damage in recent years exceeding $5 million in lower Aliso Creek. Past storms have resulted in erosion that has caused failure of MNWD’s 18-inch sewer line within the Wilderness Park. Threatened wastewater infrastructure vulnerable to bank erosion poses a significant threat to human health and a measurable impact to the environment, valued beach recreation, and the local economy from potential major sewer line failure. SOCWA considers all repairs it implements along Aliso Creek temporary due to instability of the creek banks, thus requiring additional repairs on a regular basis.

The JRWSS is a water supply transmission line, owned by the public utility South Coast Water District that provides a primary source of drinking water for southern Orange County communities. Two locations of the Joint Transmission Main, one parallel and one crossing under the creek are threatened by continuous storm caused scour and erosion of the Creek banks.

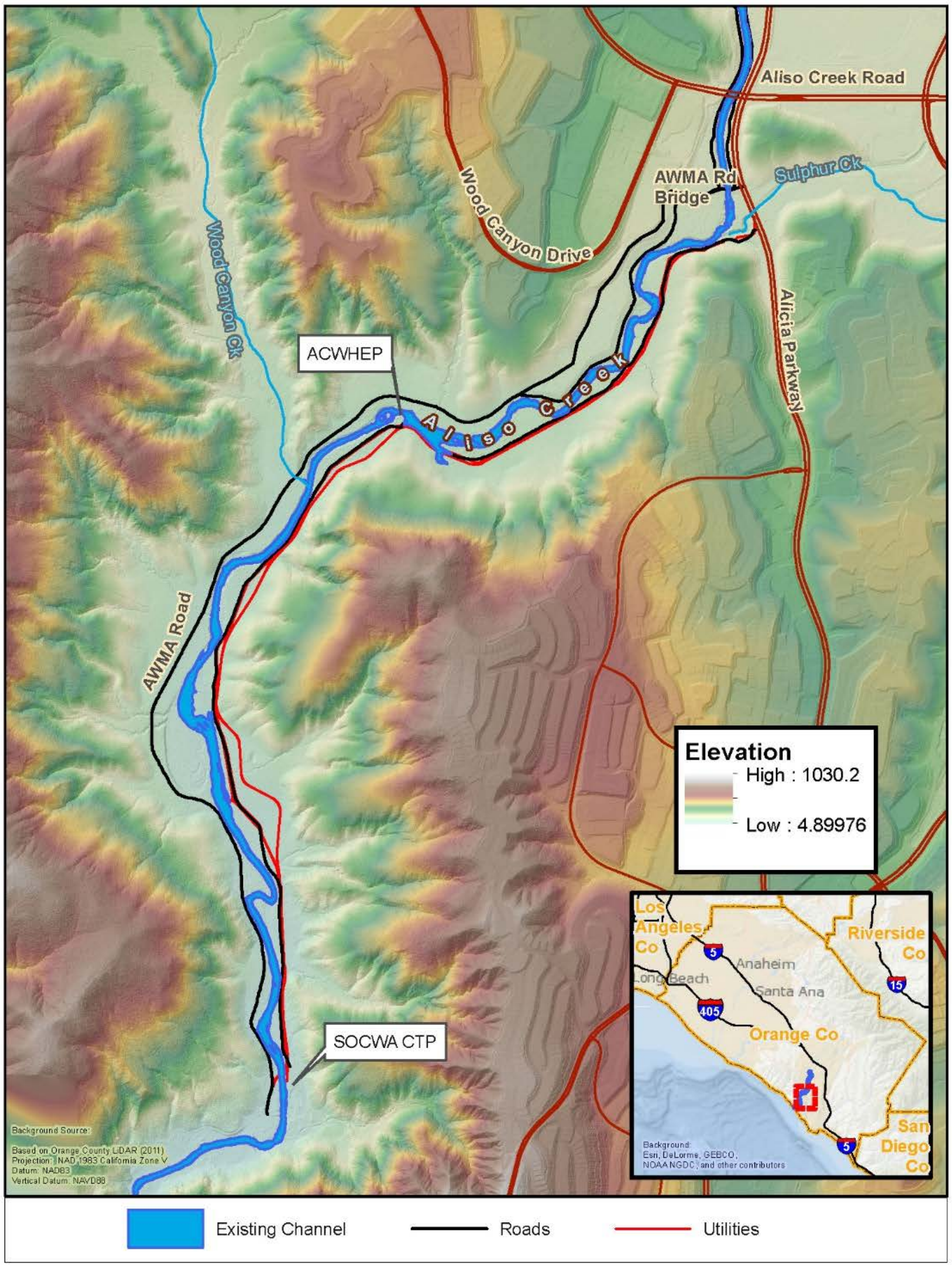


Figure 2.15-1 Utilites in Aliso Canyon

Table 2.15-1 Existing Utilities

Begin Approx Station	End Approx Station	Bank	Utility Type	Ownership	Required Action	Reach
70+00	250+00	East	Utility Pipe	SOCWA/ (MNWD)	Protect in Place	4A - 9
75+00	77+00	East/West	Various (sewer, Storm Drain)	SOCWA	Protect in Place	4A
82+00	n/a	West	Storm Drain	Orange County	Protect in Place	4A
115+50	117+40	West	Irrigation Line	Orange County	Remove, as abandoned	4B
118+00	126+00	West/East	Irrigation Line	Orange County	Remove, as abandoned	4B
133+00	186+80	West	Irrigation Line	Orange County	Remove, as abandoned	5A - 7
152+00	157+00	West	LTP287-Irrigation	Orange County	Remove, as abandoned	5B
154+00	159+00	West	LTP287- Irrigation	Orange County	Remove, as abandoned	5B -5C
157+00	n/a	In channel	Pipe Above Ground	Orange County	Remove, as abandoned	5B
160+00	167+00	West	LTP287- Irrigation	Orange County	Remove, as abandoned	5C
171+00	182+00	West	LTP287- Irrigation	Orange County	Remove, as abandoned	6
184+00	n/a	In channel	Pipe Above Ground	Orange County	Remove, as abandoned	6
205+00	209+00	West	Existing Storm Drain/Culvert	Orange County	Protect in Place (Modify outlet)	7
217+00	n/a	West	Existing Storm Drain/Culvert	Orange County	Protect in Place (Modify outlet)	8
232+00	n/a	West	Existing Storm Drain/Culvert	Orange County	Protect in Place (Modify outlet)	8
236+00	n/a	West	Existing Storm Drain/Culvert	Orange County	Protect in Place (Modify outlet)	8
238+50	241+00	West	Existing Storm Drain/Culvert	Orange County	Protect in Place (Modify outlet)	8
247+00	249+00	East	Various (i.e. Sludge/Utility Pipe, Gas)	SOCWA	Protect in Place	Sulphur
247+00	251+00	East	Various (i.e. Sludge/Water)	SOCWA	Protect in Place	Sulphur
252+50	n/a	West/East	Storm Drain, Water, Sewer	MNWD	Protect in Place	9
263+00	n/a	West /East	Storm Drain	MNWD	Protect in Place (Modify outlet)	10
266+00	n/a	West/East	Storm Drain, Water, Sewer	MNWD	Protect in Place	10
269+00	n/a	West /East	Storm Drain	Orange County	Protect in Place (Modify outlet)	10
273+00	n/a	West /East	Storm Drain	Orange County	Protect in Place (Modify outlet)	10

Table 2.15-1 Existing Utilities

Begin Approx Station	End Approx Station	Bank	Utility Type	Ownership	Required Action	Reach
287+00	n/a	East	Storm Drain	Orange County	Protect in Place (Modify outlet)	11
289+00	292+70	West	Storm Drain	Aliso Viejo	Protect in Place (Modify outlet)	11
301+00	n/a	West	Storm Drain	Aliso Viejo	Protect in Place (Modify outlet)	11
316+00	321+20	West/East	Joint Regional Water Supply	South Coast Water District	Protect in Place	12
319+00	n/a	West	Storm Drain	Aliso Viejo	Protect in Place (Modify outlet)	12
328+00	332+00	Northeast/ Southwest	Wastewater	MNWD	Protect in Place	12
328+00	332+00	Northeast/ Southwest	Wastewater	SOCWA	Protect in Place	12
333+00	n/a	Northeast/ Southwest	Storm Drain	Aliso Viejo	Protect in Place (Modify outlet)	13

2.16 RECREATION

The Proposed Project area lies within the Wilderness Park, owned and operated by OC Parks and is approximately 4,500 acres encompassing the hills, canyons, and floodplain surrounding Aliso and Wood Canyons and portions of the Laguna Canyon/El Toro Cliffs area.

Photo 2.16-1 A three-mile portion of the Aliso Creek Trail extends through the Wilderness Park along the western side of the creek.

Wilderness Park amenities include the Visitor's Center accessed from AWMA Road Bridge with a trailer for the park rangers and some exhibits. The area has a large parking area, picnic tables and portable restroom for Wilderness Park visitors. The Wilderness Park has an extensive trail network with over 30 miles of riding and hiking trails. The Aliso and Wood Canyons confluence provides a trailhead and staging area including a horse watering trough, portable restroom, picnic table, and information kiosk. The west road provides access to the SOCWA CTP for CTP personnel and official CTP vehicles. Currently the east road (Aliso Creek Trail East), on a permanent easement owned by SOCWA, serves as alternate access to the CTP (Figure 2.16-1).

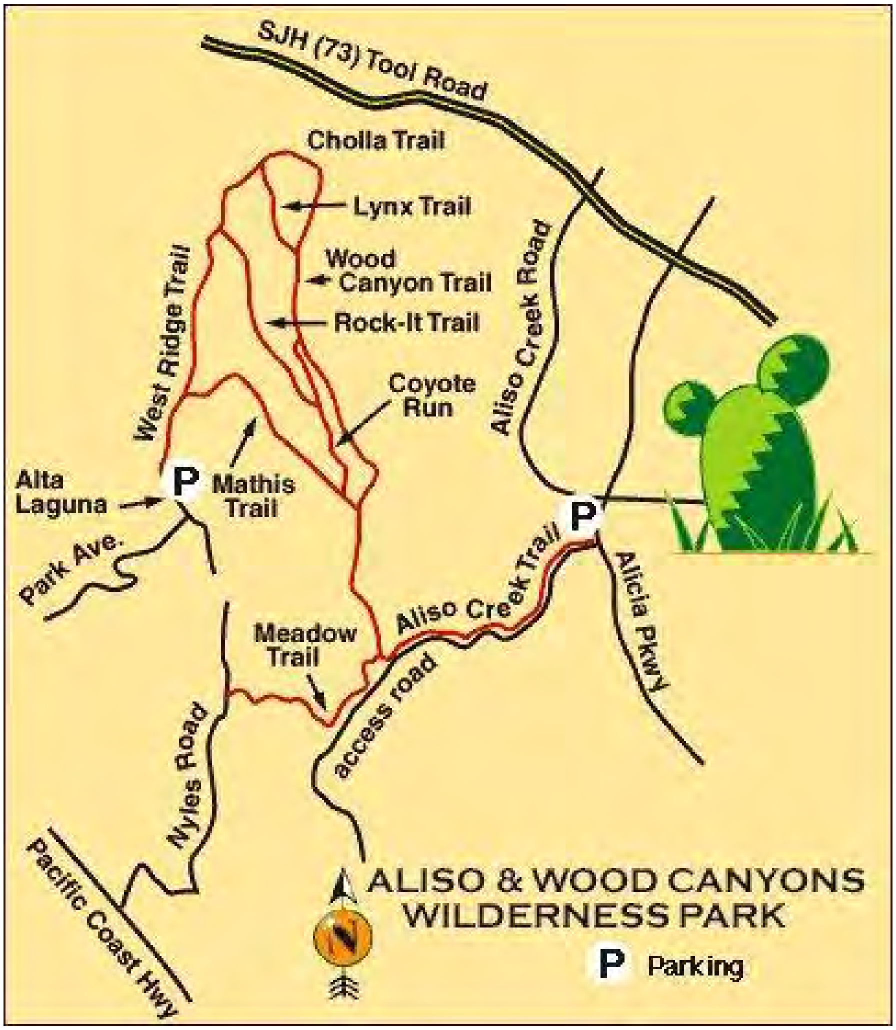


Figure 2.16-1 Wilderness Park Trails

Aliso Creek Regional Bikeway, Riding and Hiking Trail (Trail) connects the Wilderness Park to Whiting Ranch Wilderness in the Cleveland National Forest. The continuous 15 miles of Trail is designed for hikers, bikers, and equestrians traveling through five cities. In 2012, the Secretary of the Interior granted National Recreation Trail status to the regional trail. The Trail also referred to as the "Mountains to the Sea" Trail was adopted by the County of Orange Master Plan of Trails, codified under the Local Coastal Program (LCP) and the public access policies of the California Coastal Act, to connect the headwaters of Aliso Creek in the Cleveland National Forest to the Pacific Ocean at Aliso Beach.

Immediately downstream of the Wilderness Park, and outside the Proposed Project area, the Ranch at Laguna Beach (formerly Aliso Creek Golf Course and Inn) surrounds both sides of Aliso Creek after the creek leaves the Wilderness Park. Recent adjudication for the privately-owned golf course includes opening the bicycle trail from the southern end of the Wilderness Park to PCH.

Photo 2.16-2 The Wilderness Park has an extensive trail network with over 30 miles of riding and hiking trails.

Photo 2.16-3 Public access is restricted on weekdays downstream of the Wood Canyon Creek confluence, available only on weekends and holidays.

2.17 ESTHETIC QUALITY

Esthetics includes viewsheds, odors, lights, and glare. Esthetic resources can be defined as a person's sensory perception of the environment. It includes physical features, such as land, water and air, and spiritual features, such as the beauty of place or the knowledge that such a place exists.

2.17.1 Visual Setting

The Proposed Project area is characterized by broad floodplains, uplands, canyons, ridges, and mountains. Moulton Peak is the highest point in the Wilderness Park at approximately 890 feet and provides views of the canyons, hillsides, and ridgelines of the surrounding area. Distinctive features in the Wilderness Park include geological sites, Dripping Cave, Cave Rock, and a historical site, the Old Corral. Along trails within the Wilderness Park, views of the Creek are largely obscured by riparian vegetation. The creek is visible from residences outside the Proposed Project area located on the ridgelines overlooking the Wilderness Park to the west and east.

2.17.2 Light and Glare

Because of the remoteness of the Wilderness Park, there is little light or glare within the Wilderness Park. Nighttime lighting from the homes on the ridgelines to the east and west of the canyon are the only visible sources of lighting. Ambient nightlight from urbanization is minimal.

Photo 2.17-1 Culverts as outfalls deliver local runoff to the Creek

Photo 2.17-2 Damaged pipelines scattered throughout the Wilderness Park

Photo 2.17-3 Damaged and abandoned pipes and chain-link fencing detract from the scenic quality of the Wilderness Park.

Photo 2.17-4 Bridges are also conduits for water and waste water pipelines.

Photo 2.17-5 Aliso Creek Road Bridge crosses over the Creek upstream of the Wilderness Park.

Photo 2.17-6 Looking west from Ridgeview Park, the view of the creek, canyon, and hills are expansive and visually appealing with the colors and features of the riparian vegetation along the creek in contrast with the upland habitat.

Photo 2.17-7 From the Seaside lookout, the creek is visible on the canyon bottom with the hills covered with coastal scrub vegetation.

Photo 2.17-8 Degraded views include homes located on hillsides and ridgelines that can be seen from trails within the Wilderness Park.

2.18 SUSTAINABILITY

The Corps' Engineering Regulation 200-1-5, *Policy for Implementation and Integrated Application of the USACE Environmental Operating Principles (EOP) and Doctrine,* highlights the Corps' role and responsibilities for sustainability, preservation, stewardship, and restoration of our Nation's natural resources based on the premise that through the restoration and maintenance of environmental health and productivity, both economic development and social equity can be achieved.

Engineering Manual 1110-2-38, *Environmental Quality in Design of Civil Works Projects,* directs the avoidance, destruction, or degradation of natural habitats while preserving and enhancing the natural environment in a manner that fosters and promotes the general welfare of man and nature to exist in harmony. The objective is to fulfill social, economic, and other requirements of present and future generations of Americans.

Sustainability can be broadly defined as "meeting the needs of the present generation without compromising the ability of future generations to meet their own needs". This definition takes into account that there are three "spheres" comprising sustainability (environmental, economic, and social) that need to be considered when developing and evaluating projects and management systems. The three spheres of sustainability are described in Figure 2.18-1.

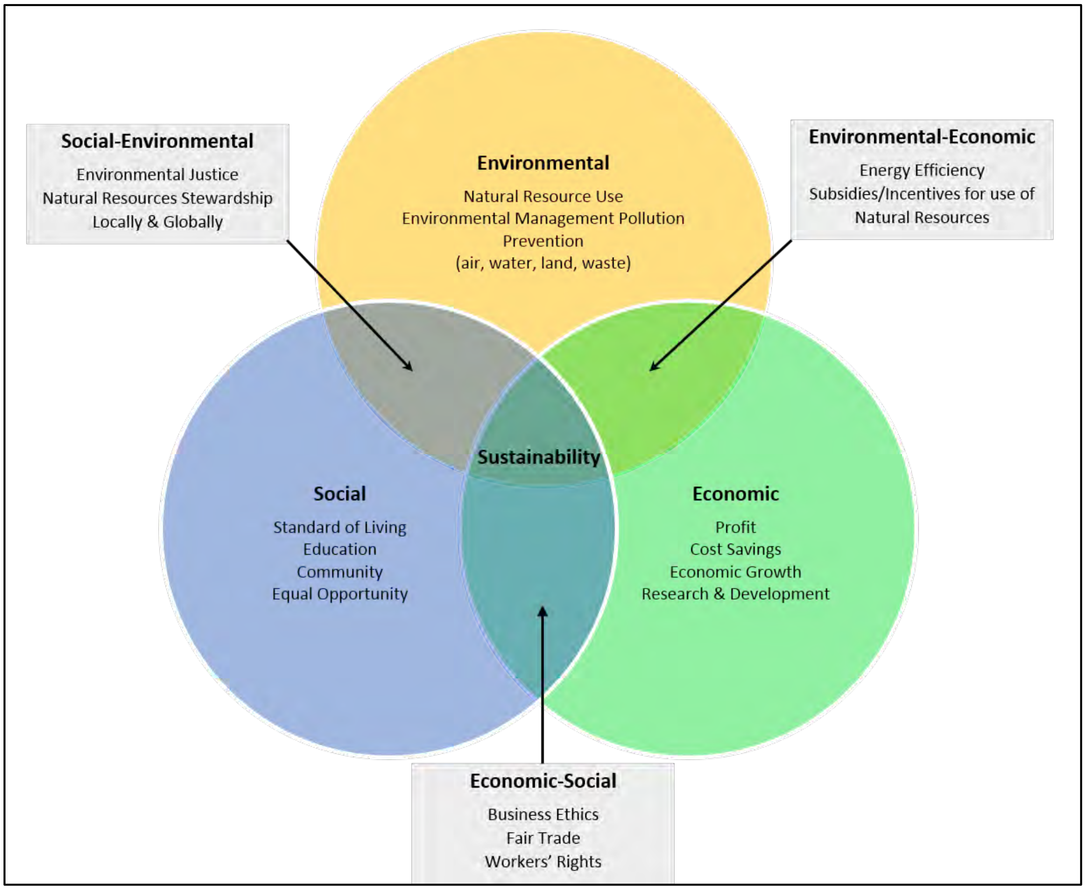


Figure 2.18-1 Three Spheres of Sustainability

For the Corps, applying the goals inherent in this definition to the development and implementation of Corps-led and Corps-cosponsored projects involves approaching the planning, design, construction, and operation phases of these projects with the intention of sustaining natural resources, protecting the environment, achieving economic viability, and promoting a high quality of life.

2.18.1 Environmental Sustainability

Under ideal environmental sustainability conditions in an ecosystem would maintain functionality and biodiversity over time. Characteristics of this ideal ecosystem would include a steady (equilibrium) state, the ability to recover from disturbance (resilience), and evolving plant communities (succession). Because the landscape has been altered, ideal ecosystem function does not exist and achieving it may be no longer possible.

However, critical ecosystem functions can be restored following construction that would help support long-term environmental sustainability.

Open spaces and parks improve environmental sustainability by protecting watersheds by adopting natural resource management practices, improve air quality by increasing tree canopy, and reduce stormwater runoff and flooding through green infrastructure.

The lower Aliso Creek area is highly degraded with loss of habitat and both longitudinal and lateral connectivity throughout the Proposed Project area. Degraded habitat value due to invasive species outcompeting native species has degraded habitat quality throughout the Proposed Project area. This in turn limits native species succession, limiting biodiversity within the Proposed Project area.

2.18.2 Economic Sustainability

Economic sustainability involves creating economic value (in terms of capital and monetary exchanges) from implementing the Proposed Project that would also be sustainable over time.

The positive effect natural open space has on nearby property values can result in higher assessments and thus higher property tax revenues for local governments. Studies have shown that parks that are unattractive or poorly maintained have a negative impact on home values.

The National Recreation and Parks Association reports that nearly one million jobs in the U.S. in 2013 were recreation oriented, with over 126,000 in the state of California, the largest in the nation. This is generated by over $140 million each year in recreation economic activities.

Due to the degradation of Aliso Creek, when a significant storm event occurs, additional downcutting causes erosion of the existing road/trail into the Creek. Costly repairs to reestablish the road/trail for SOCWA CTP access and recreation use is funding that could be used elsewhere for Wilderness Park recreation amenities. Increased amenities and sustainable habitat would draw more people to the Wilderness Park, thus increasing the Wilderness Parks recreation value.

2.18.3 Social Sustainability

Social sustainability is based on the concept that sustainable ecosystems also result in ongoing high quality of life for area residents. Future generations should have the same or greater access to these quality of life benefits as the current generation. This concept encompasses human rights and environmental justice. Social sustainability applies to the provision of recreation and other social amenities.

Psychological benefits gained by visitors to green spaces have shown to increase with their biodiversity, indicating that “green” alone is not sufficient; the quality of that green is important in delivering health benefits. Despite improvements in medical technology that allow humans to heal from numerous diseases and medical conditions, research shows that contact with the green environment still offers great benefits to mental health and psychological well-being from a green environment that provides abundant vegetation.

The social value of open space lies in the opportunities it provides for social interaction, social mixing and social inclusion. It can help facilitate the development of community ties and neighborhood interaction. These social advantages are not always obvious to outsiders or public policymakers. Future generations deserve the opportunity to have a high quality experience while maintaining responsibility of environmental stewardship.

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CHAPTER 3 PLAN FORMULATION AND EVALUATION OF ALTERNATIVES*

3.1 ECOSYSTEM RESTORATION GOALS

Civil Works ecosystem restoration initiatives attempt to accomplish a return of natural areas or ecosystems to a close approximation of their conditions prior to disturbance, or to less degraded, more natural conditions. In some instances a return to pre-disturbance conditions may not be feasible. However, partial restoration may be possible, with significant and valuable improvements made to degraded ecological resources. The need for improving or reestablishing both the structure and function of the riverine biological resources is crucial to the Aliso Creek Ecosystem Restoration, and requires restoration of the geomorphology for long-term success. The goal is to partially or fully reestablish the attributes of a biological functioning, and self-regulating system. While the Corps ecosystem restoration will have temporary negative impacts, what may appear to be severe disturbance during construction will result in a fully functioning, biological, self-regulating system.

Riparian ecosystems are centers of biological diversity and relationships between terrestrial and aquatic systems. Riparian ecosystems are also environments that are most disturbed by humans and in need of restoration to maintain natural, biotic, genetic variability and ecological integrity. Fundamental qualities of riparian systems are articulated as three basic principles. The basic principles are: (1) flow regime determines the successional evolution of riparian plant communities and ecological processes; (2) riverine corridor serves as a pathway for redistribution of organic and inorganic material that influences plant communities along rivers; (3) riparian system is a transition zone between land and water ecosystems and is disproportionately plant-species rich when compared to surrounding ecosystems (Nilsson and Svedmark 2002).

The need to provide a geomorphically stable channel that can support a healthy riparian community requires careful planning when considering project implementation. Despite the need for restoration, Aliso Creek actively supports populations of threatened and endangered species. Consideration for species' specific habitat needs plays a key role in determining the most efficient and least-impactful project implementation plan.

3.2 PLAN FORMULATION PROCESS

This Draft IFR has followed the Corps' six-step planning process as defined *in Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implemental Studies* (Water Resources Council 1983), also known as the Principles and Guidelines (P&G), and as specified in Engineering Regulation (ER) 1105-2-100, Planning Guidance Notebook, as amended. The process identifies and responds to problems and opportunities associated with the Federal objective(s) and specified state and local concerns. This process provides a flexible, systematic, and rational framework to make decisions at each step. It allows the interested public and decision makers to be fully aware of the basic assumptions employed, the data and information analyzed, the areas of risk and uncertainty, and the significant implications of each alternative plan. Iterations of steps are conducted as necessary to formulate effective, complete, efficient, and acceptable plans. The six steps are as follows:

- Specification of the water and related land resource problems and opportunities (relevant to the planning setting) associated with Federal objectives and specific state and local concerns.
- Inventory, forecast, and analysis of water and related land resource conditions within the planning area relevant to the identified problems and opportunities.
- Formulation of alternative plans.
- Evaluation of the effects of alternative plans.
- Comparison of alternative plans.
- Selection of a recommended plan based upon the comparison of alternative plans.

3.3 Summary of Future Without-Project Conditions

Without-project conditions address an inventory of historic and existing conditions and a forecast of future without-project conditions. The without-project condition describes the project area's future if there is no Federal or local action taken to solve the problem at hand. Every alternative plan that is formulated is compared to the same without-project condition. Future without-project conditions are based on forecasting, and are considered the most likely future condition. The following is a summary of future without-project conditions for elements that will have the most direct effect on plan formulation.

3.3.1 Future Without-Project Conditions

- Land Use
  - Urbanized areas of watershed (almost 75 percent) are considered at near-full build out and not expected to decrease.
  - Undeveloped areas of watershed (25 percent), comprised of Cleveland National Forest, Aliso and Wood Canyons Wilderness Park, and other conservation areas will remain undeveloped.

- Hydrology
  - Climate change effects in California are expected to bring warmer year-round temperatures and potentially wetter winters. The Mediterranean seasonal precipitation pattern is expected to continue.
  - Wet season hydrology will not decrease. Retrofitting the urbanized areas of the watershed with onsite controls to reduce a percentage of the runoff will not yield substantial changes during the wet season.
  - Dry weather flows will decrease over time as a result of water conservation BMPs (e.g. limiting irrigation days and runoff amounts) aimed at reducing urban runoff. Perennial nature of stream in dry season could become ephemeral, or intermittent along segments of the stream course.

  - Disconnected floodplain function as result of the deeply incised channel will limit aquifer recharge opportunities from overbank floodwater infiltration. Flow breakouts locations for the 10 percent annual chance of exceedance (10-year event) and the one percent ACE (100-year event) would decrease further from the current few localized creek segments.
  - Limited groundwater extraction activities in the upper watershed are not expected to increase. Aliso Watershed has limited water bearing formations and has historically been a poor and unreliable source of groundwater.

- Water Quality
  - Quality of dry weather flows is expected to improve as a result of BMP stormwater management to comply with MS4 permitting and TMDLs.

- Channel Stability
  - Incision and streambank instability will continue until a dynamic state of equilibrium (stable channel dimension, pattern, and profile) is reached. The expected timeframe is more than 50 years. The nature of the streambank materials will tend to promote steepened slopes.
  - Continued incision, though limited, to segments of reaches both upstream and downstream of the ACWHEP structure is expected. In Reach 11, up to five feet is possible, with downstream magnitudes of up to four feet in segments occurring upstream of the structure. Downstream of ACWHEP, further incision on the order of one to four feet is expected. Further channel widening is expected episodically, especially from channel bank slumping due to geotechnical instabilities. This will likely become the primary failure mechanism of the Aliso Creek banks compared to fluvial (hydraulic) erosion.
  - The S-bend (Reach 4b) is assumed to cutoff after year 25 of the period of analysis. The effect of this loss would cause additional stream instability (vertical and laterally) for a limited distance both upstream and downstream within the Proposed Project area.
  - For channel stability, the county will continue to maintain protection of the ACWHEP structure’s downstream toe as the loss of this structure would result in a very significant headcut placing upstream existing infrastructure in jeopardy. Similarly, the AWMA Road crossing at the Wood Canyon Creek confluence would require continued protection from undermining as a loss, and subsequent headcut would greatly degrade high value natural habitat associated with the tributary.
  - Failure of channel banks immediately adjacent to ascending terrain could potentially have an adverse impact on slope stability including existing landslides and terrain that has not been effected by sliding. Any potential slope failures from the surrounding hillsides affecting the floodplain could cause a significant change to the stream pattern at the base of the failure, and for some distance both upstream and downstream of the disturbance.

- Biological Resources
  - The prevalence of steep streambank slopes will degrade the value of the riparian structure that can establish. Confined riparian vegetation establishing in the deeply incised channel will be subject to higher confined flow forces during large storm events, resulting in higher likelihood of destabilization and loss.
  - Continued decline and narrowing of riverine habitat corridor and biodiversity, primarily due to channel incision and severed floodplain connectivity, creek instability, and vegetation die back from perching effects of lowered groundwater levels. As riparian zone narrows, habitat type conversion would be likely to coastal scrub and annual grasslands.
  - Reduction of wildlife taxa, including Listed and Species of Special Concern, within the Proposed Project area, and contiguous open space areas as riverine habitat value and structure decreases.
  - Aquatic wildlife connectivity remains impeded along lower Aliso Creek, including the connection to Wood Canyon tributary, due to severe channel incision and the presence of large barriers such as the ACWHEP structure. The quality of aquatic habitat in Aliso Creek will continue to deteriorate within a deeply incised channel and fragmented habitat to few non-native aquatic species.
  - Invasive non-native plants, especially giant reed (*Arundo donax*), will continue to persist in the watershed. Complete eradication will be dependent on continued local efforts, guided by an adaptive management plan, and reliant on a combination of various funding sources.
  - Likelihood of wildfire under drought conditions due to older established vegetation. Reestablishment of native species more difficult as outcompeted by faster establishing growing non-natives, and loss of native seed stock from "hot burns."
  - Coastal wetland habitat and function at Aliso Creek estuary will be improved per efforts of Laguna Ocean Foundation and California Coastal Conservancy.

- Utility Infrastructure Threat
  - Wastewater infrastructure will remain at risk from continuing bank erosion posing a significant threat to public safety and a measurable impact to the environment and local economy. SOCWA efforts to protect pipelines at risk from storm flow-induced streambank erosion and undermining will be piecemeal and short-term "band-aid" solutions. Channel incision will continue to threaten the JTM water supply transmission pipeline, requiring periodic intervention to protect from undermining, with an impact to the environment.

- Coastal Effects
  - Decrease in "elevated" sediment supply to coast as Aliso Creek's dynamic equilibrium is reached upstream. Ultimately, the average annual watershed sediment yield is expected to range between 20,000 and 60,000 tons.
  - Downstream of the SOCWA CTP, streambed incision trends are expected (from one to four feet) within Reaches 2 and 3. Within Reach 1, the upper estuary upstream of Pacific Park Drive Bridge may be subject to some slight aggradation.

Downstream of the bridge, aggradation would not be expected within the lower estuary, though fluctuations are dependent on tidal and littoral effects.
- Some beach retreat, locally and downcoast within littoral cell, can be expected, especially with sea level rise potential.

3.4 FORMULATION OF ALTERNATIVE PLANS

Plan formulation is the process of building alternative plans. Each alternative plan shall be formulated in consideration of the specific planning objectives, planning constraints, and planning considerations described in Section 0. Alternatives plans are comprised of a set of one or more management measures functioning together to address one or more planning objectives. A management measures is a feature or activity that can be implemented at a specific geographic location to address one or more planning objectives.

3.5 MANAGEMENT MEASURES

The following sections present measures considered in the formulation process, summarized by category consistent with the established planning objectives. The measures address habitat structure and function, floodplain function, channel stability, and recreation. Some of these measures are mutually exclusive, while other measures must be combined with other measures.

3.5.1 Improvement of Habitat Structure and Function

3.5.1.1 Structural Measures

Remove or Modify Physical Barriers. The presence of the ACWHEP structure and the AWMA Road crossing at Wood Canyon Creek have created 25-foot longitudinal (up or downstream) grade discontinuities along the Aliso Creek mainstem and at the tributary confluence. These physical barriers impair aquatic, amphibious, and terrestrial passage through the riverine and aquatic corridor, and create habitat fragmentation and disconnected refuge. Access to the entire stream network is critical for dispersion of species. This measure would remove or modify these barriers. Other drop structures in the lower Aliso Creek watershed acting as physical barriers would also be assessed for potential modification.

Wood Canyon Landscape Reconnection. The presence of small culverts under the AWMA Road crossing at the Wood Canyon Creek tributary reduce flow rates at the confluence and backup flows in the tributary. A small vehicular bridge (Wood Canyon Bridge) would replace the culverts to improve flow conveyance, provide a more natural transition to the mainstem, and restore a more natural aquatic wildlife linkage between Wood Canyon Cree and Aliso Creek.

Wood Canyon Trailhead Realignment. Approximately 800 feet Wood Canyon trailhead would be realigned to the southwest to create more riparian habitat area upstream of the confluence and the AWMA Road crossing.

Aquatic Wildlife Passage Structures. This measure would address the means for aquatic wildlife movement over otherwise inaccessible instream barriers. Any structure considered for the Wilderness Park would be evaluated to ensure it does not conflict with natural esthetics. Grade control stabilizers described below could also provide this function. These structures would need to address access for over:

- Large physical barriers (25 to 30 feet), namely the ACWHEP structure and the AWMA Road crossing at Wood Canyon Creek
- Smaller to medium physical barriers, such as the AWMA Road bridge at the Wilderness Park entrance (3 feet), and the two concrete vertical drop structures (10 feet) in the vicinity of Aliso Creek Road Bridge.

Reconnect Abandoned Oxbow. This measure would provide hydraulic reconnection to an abandoned oxbow (upper Reach 4B to 5A). The oxbow is currently about 18 feet above the active channel. Restored features could provide refugia and high-value habitat for wildlife. Oxbows provide benefit by slowing velocities during flood flows and creating pockets of lotic waters (pools, riffles, and glides) in which amphibians, such as western pond turtles, salamanders, and native frogs, may reside. Oxbows increase the riverine and riparian habitat structural diversity. Oxbows also assist in developing sand bars and freshwater marsh habitat.

Install Newbury Riffle Weirs. Newbury weirs (also known as Newbury riffles) would be utilized to ensure a pool-riffle regime becomes established with project implementation by creating shallow pools at desired heights along the streambed and spaced at approximately 500-foot intervals. Newbury weir structures do not provide grade stabilization function. Newbury weirs would be constructed of rock in accordance with the Natural Resources Conservation Service restoration handbook (NRCS 2007).

Create Instream Riparian Corridor. Within reaches that are barren of vegetation due to the influence of flood control improvements, this measure would create a riparian corridor to reestablish continuity with adjacent habitats. This would pertain to Reach 10 within the Proposed Project area, which has riprap stone side slopes and no vegetation cover. Adding an instream corridor would require channel widening to increase conveyance capacity.

Bypass Channel at Pacific Park Drive. Provide a low-flow bypass channel to allow aquatic wildlife habitat passage up and downstream of Pacific Park Drive. Riparian vegetation would be planted along the bypass. Pacific Park Drive is supported by an embankment that crosses Aliso Creek that serves to create a floodwater detention basin upstream. The bypass would share the easement through an underpass on the west side for the Aliso Creek Riding and Hiking Trail/service road. A pump would be utilized on the upstream end to feed the low-flow channel.

3.5.1.2 Non-Structural Measures

Preservation of Existing High-Quality Habitat. This measure would protect healthy, high-quality habitat from further ecosystem degradation. Examples include protecting existing riparian stands of significant value, such as willow, cottonwood, sycamore, and mulefat; and marsh habitat remnants in the Wilderness Park. This activity would be appropriate for alternatives that consider limited channel modifications and allow for specific riparian vegetation to remain intact. During preconstruction detail design for the Proposed Project, consideration will also be given to salvaging high-quality stands in place. Alternately, selected mature trees may be boxed and replanted.

Create Freshwater Marsh. Creation of permanently or seasonally flooded areas provides wetland habitat value and function, and opportunities for infiltration and aquifer recharge. Marsh habitat could be within the channel inset floodplain, or associated with a reestablished floodplain. The preference of the Project Delivery Team (PDT) is to allow freshwater marsh to establish naturally, and once established could be maintained through a monitoring and adaptive habitat management program. This measure also provides ancillary water quality improvement benefits (nutrient and sediment sink).

Instream Habitat Improvements. Habitat enhancement features such as placement of erratic clusters of boulders and fallen or downed wood would be used to improve habitat quality. This measure would be most appropriate in settings where long-term benefits would be provided. This measure also provides ancillary water quality improvement benefits.

Exotic Plant Species/Invasive Eradication. This measure includes the removal of exotic invasive plant species within the Proposed Project area. Prior eradication efforts would need to be completed upstream in the watershed to preclude spreading of plants downstream.

Revegetation. Restoration efforts would include revegetation of native California species, including riparian and coastal scrub consistent with the Wilderness Park. Riparian reforestation provides ancillary water quality benefits by providing shade and reducing stream temperatures.

3.5.2 Improvement of Floodplain Function and Channel Stability

3.5.2.1 Structural Measures

Establish Natural Channel Design. Provide a stable channel cross section and gradient that balances the channel’s transport capacity and sediment supply over time, so that the channel does not aggrade or degrade. This concept seeks to replicate the channel forms seen in stable, natural rivers in order to restore stability and functions to degraded rivers.

Streambank Re-Contouring. Channel stability would be improved by recontouring banks into stable slopes. Degraded riparian structure will greatly improve as over-steepened slopes are made less steep (i.e. gentler).

Recontouring of the streambank is different than recontouring of the channel. The latter includes laying back the streambanks slopes, use of natural channel design, and possibly, terracing, and limited channel realignment.

Raise Streambed to Reconnect with Historic Floodplain. This measure would reestablish the hydrologic connection of the Aliso Creek channel with the historic floodplain. Vegetative habitat associated with the existing channel segment to be raised would be lost as an outcome of this measure. Hydrologic reconnection to the floodplain would provide: (1) aquifer recharge; (2) dissipation of floodwater energies and abatement of channel erosion and potential flooding; and (3) ancillary water quality improvement benefits by allowing nutrient-rich fine sediments to precipitate out of the streamflow. This measure would also contribute to improvement of floodplain riparian vegetation habitat due to increased accessibility of root systems to higher groundwater levels. The floodplain groundwater regime would be expected to raise in conjunction with the raising of the streambed elevation, in addition to the more frequent aquifer recharge opportunities from channel overbanking.

Options for raising the streambed elevation include:

- Earthfill by mechanical means to the desired elevation and grade. Materials could be trucked in. However, if possible, the source of materials would be excess excavated earth materials from construction activities related to the project. The use of grade control stabilizers would need to accompany this measure.
- Allow natural depositional processes to fill in sediment. This option would require construction of grade control stabilizers designed to capture sediment over time to the desired streambed elevation and grade.

Raise Streambed to Intermediate Elevation. This measure would raise the streambed to an intermediate elevation between the current streambed and the historic pre-incised streambed elevation, and would construct an associated floodplain. Vegetative habitat associated with the existing channel segment to be raised could be lost as an outcome of this measure. However, some existing high-quality habitat, not affected by the streambed elevation gain, would be preserved. Benefits associated with hydrologic reconnection to the floodplain, including improvements to floodplain habitat quality and to ancillary water quality would result from this measure, though to a lesser degree compared to the measure that raises the streambed to approach the historic pre-incised stream elevation.

Options to raise the streambed elevation would be the same as those described for the measure “Raise Streambed to Reconnect with Historic Floodplain”.

Lower Floodplain Terrace to Connect with Active Channel. This measure would lower the elevation of former floodplain terraces to become an active floodplain hydraulically connected with the stream. One possible area for lowering is the terrace containing the abandoned oxbow area (upper Reach 4B and Reach 5A). This measure would expand the aquatic, riparian, and floodplain ecosystem. Additionally, this measure provides ancillary water quality improvement benefits, especially from increased streamflow overbanking opportunities and dispersal and absorption of nutrients into the reconnected floodplain.

Flatten/Widen Streambed to Accelerate Channel Evolution Sequence. This measure would alter the streambed grades and widen the channel, as needed, to accelerate the on-channel evolution sequence expected in reaches that will further incise and widen to reach a dynamic equilibrium. A new inset floodplain would be incorporated within the channel margins.

Grade Control Stabilizers. These structures would be implemented where the streambed needs to be stabilized to prevent further incision, or to maintain a specific gradient (slope). To prevent undermining by flows, the structures would span the channel width and be keyed into the streambanks. The number of structures required would be dictated by the projected equilibrium slope. Criteria adopted by the PDT establish that the stabilizers be designed with the intent to appear as natural as possible, using natural materials consistent with the Wilderness Park setting, such as large boulders (i.e. rock riffle structures) and allow aquatic species passage.

Design considerations for the grade control stabilizers include:

- Incorporate a low-flow notch at grade control structures to control thalweg alignment.
- Do not incorporate a low-flow notch at grade control structures to allow unrestricted migration of the stream channel across the active channel width.
- Use grouted stone, as needed, to accommodate high-flow velocities at longer grade control structures. For these longer structures, placement of transverse ridge rocks perpendicular to the flow direction would be added to provide zones of low-flow velocity and short pool sections. This would mimic natural streamflow conditions and would create deep enough pools for fish migration along the larger grade control structures. Ungrouted stone would also be placed over the grouted stone in this situation.
- Installation of sheet piles as a fail-safe protection for the grade control stabilizers. A single sheet pile would be embedded at each stabilizer location and would maintain the integrity of the grade change in case of loss of the control structure in a very high flow event and ensuing risk of loss of channel bed in the upstream or downstream direction. The stabilizer would then be rebuilt.
- Integrate need for grade control structures, where beneficial, to also provide protection to wastewater and water supply infrastructure.

Stream Lengthening (Sinuosity). Adding sinuosity (meandering or channel bends) to the system can decrease the gradient and reduce flow velocities and erosion potential, thereby improving channel stability. Creation of stream meanders also promotes aquatic wildlife habitat value. Channels with high sinuosity typically have more and deeper pools at the apex of a meander bend compared to straighter channels, providing more aquatic refugia opportunities. This measure is separate from the abandoned oxbow reconnection measure as it considers new opportunities for stream lengthening.

The 2002 Watershed Management Study evaluated stream lengthening opportunities without the use of grade control and concluded that this measure was not feasible due to insufficient land availability to effectuate an increase in stream lengthening required to reduce gradient sufficiently. Before this measure is eliminated from further pursuit, it warrants further evaluation, including the use of grade control, realignment of utilities infrastructure and/or access roads, or other opportunities not considered in the 2002 study, including relocation of the skate park facilities located along the east overbank in Reach 10.

Armoring Channel (Invert and/or Sideslopes). Exposed armoring of channel sideslopes and/or invert for erosion protection would utilize traditional techniques (e.g. riprap stone).

Utility and Infrastructure Protection In-Place. Protect wastewater utilities or other infrastructure at risk (including access roads) from Aliso Creek stormwater-related erosion or undermining damage. This measure is meant to reduce risk of potential impairment to ecosystem outputs should critical infrastructure be undermined. Protection method options would be traditional (riprap stone, sheet pile walls) or a combination of traditional and bioengineering stabilization methods (e.g. buried riprap stone and an overlying geosynthetic mat with planted vegetation). Flow deflectors would also be considered.

Terracing Floodplain. Establish (excavate) a new floodplain terrace within the incised channel margin.

Detention Basins. This measure would utilize detention basins to reduce peak flows and erosive action downstream and also to support ecosystem restoration. Basin locations would be sought upstream of Aliso Creek Road. A large land requirement is necessary for this measure. Several detention basins already exist in the watershed.

Retention Basins. This measure would utilize retention basins to reduce the total volume of flows, allowing infiltration, groundwater recharge, and support of ecosystem restoration. Basin locations would be sought upstream of Aliso Creek Road. Both inline and offline sites would be considered. A large land requirement is necessary for this measure. (Retention basins differ from detention basins in that they collect and hold stormwater with limited surface outflow, as opposed to the latter which provide temporary storage of stormwater flows).

3.5.2.2 Non-Structural Measures

Managed Sediment Input. The decrease in coarse sediment contribution to the receiving Aliso Creek and tributaries as a result of upstream urbanization could be alleviated by a sediment introduction plan. Options include:

- Reintroduce channel sediment collected from operations and maintenance (O&M) activities. This would also include sediment removed from upstream detention basin clearing. This option will not be further formulated but should be considered in future O&M activities.
- Gravel augmentation wherein gravel and cobbles would be added to the streambed in selected locations with the expectation that they would be mobilized by flood events and deposited to form riffles. This was a recommendation of the USFWS and included a program of periodic augmentation over a period of time as an adaptive management strategy.

Utility Relocations. Relocate segments of wastewater pipeline alignment vulnerable to stream channel instability.

3.5.3 Recreation

Recreation features would be passive, including trail modification, signage, and educational kiosks.

3.6 SCREENING OF MEASURES: INITIAL CRITERIA

Table 3.6-1 lists the management measures developed in the previous section that were subsequently evaluated and eliminated from further consideration in the plan formulation process based on initial screening criteria. The table summarizes the key rationale driving the decision for not meeting the screening criteria. Measures not listed in the table were retained for further consideration. Initial screening criteria include:

- Land requirements: Sufficient availability of land to meet need.
- Effectiveness: The extent to which specified problems are alleviated and specified opportunities achieved.
- Efficiency: Cost effectiveness of alleviating the specified problems and realizing specified objectives.
- Acceptability: Acceptance by state, local entities, and the public, and compatibility of laws, regulations, and public policies.
- Sustainability: Ability to be self-sustaining after the project is in place.

Table 3.6-1 Eliminated Measures from Initial Screening

Measure	Description	Land Required	Effectiveness/ Efficiency	Acceptability	Sustainability
Measures Addressing Channel Instability					
Managed Sediment Input: Gravel Augmentation Option	Coarse sediment augmentation: periodic placement of trucked sediment		Limited value as channel evolution sequence is nearing quasi-equilibrium	Temporary but periodic environmental impacts	Short-term benefits unless replenished
Infrastructure (wastewater pipeline) Relocation	Within Wilderness Park, relocate pipeline in areas vulnerable to channel instability as needed		More efficient to protect in place. Relocation requires greater excavation efforts in adjacent hillslopes. Impacts (costs; geotech)	Environmentally sensitive areas	
Raise Streambed: Allow Natural Deposition to Fill	Construct grade control structures to specific elevation and allow natural sedimentation processes to fill and raise streambed		Long term duration to fill in as relies on many significant storm events	Potentially long duration to fill channel. Acts as wildlife barrier until sediment fills in.	Interim establishing habitat would be transient
Measures Addressing Improvement of Habitat Conditions					
Aquatic Species Passage Structures: Large Size Option	Provide aquatic wildlife access over large barriers (ACWHEP, Wood Canyon confluence)		Significant discontinuity requires large, hardened structure(s) extending 500+ feet within deeply incised channel; or significant realignment of confluence.	Esthetically detracts from natural setting	
Measures Addressing Peak Flow Reduction					
Detention Basin(s)	On or offline basin(s) to capture storm flows to reduce peak discharges, reduced erosion downstream, and provide	Sufficient land is not available unless acquired or flood easement established	System currently has six detention basins. Additional potential sites would be of limited	Adverse impacts: (1) Interruption to sediment flow continuity; and (2) On-line detention / retention basins act as	Peak flow reduction or attenuation of downstream flows would diminish benefits to ecosystem and

Table 3.6-1 Eliminated Measures from Initial Screening

Measure	Description	Land Required	Effectiveness/ Efficiency	Acceptability	Sustainability
	ecosystem function		capacity and would be overwhelmed by floodwater volume of large flood event.	impediments to aquatic species movement	increased floodplain function associated with large flood events
Retention Basin(s)	On or offline basin(s) to capture storm flows to reduce total discharge volumes, promote groundwater recharge and ecosystem function				

3.7 PRELIMINARY ARRAY OF ALTERNATIVES

3.7.1 Basis of Preliminary Array

The preliminary array of alternatives developed was based upon identification of distinct strategies to address the restoration objectives within the Proposed Project area. These "broad-brush" strategies include the option of doing nothing (i.e. No Action) to consideration of less intrusive to more intrusive means.

Foundational to any habitat restoration effort within an incised channel system is to reestablish floodplain functions (Fischenich and Morrow 2000; Harman et al. 2012). To accomplish this, the preliminary alternatives utilize measures that either raise the streambed elevation to better connect to the historic floodplain; allow the streambed to be maintained at its current levels with the inclusion of inset floodplains within the incised channel margins; or accelerate the channel evolution to the estimated final configuration. Measures (or the necessary parameters) to support these preliminary alternatives were also included.

There are five preliminary alternatives. Alternative 1 is the "No Action" plan. The other alternatives are "action" plans. Preliminary Alternatives 2 through 4 are structural alternatives; preliminary Alternative 5 is largely non-structural. The term "structural" implies the need for an element of the alternative to be constructed or assembled onsite.

3.7.1.1 Preliminary Alternative 1

No Action.

3.7.1.2 Preliminary Alternative 2

Maintain the streambed elevation similar to the existing and construct an associated floodplain within the incised channel margin. Provide a stable channel configuration (geometry and slope). Grade control structures would be utilized as needed. Provide streambank protection for vulnerable infrastructure.

3.7.1.3 Preliminary Alternative 3

Raise the streambed to approach the pre-incised streambed elevation to achieve hydrologic reconnection with historic floodplain. Provide a stable channel configuration (geometry and slope). Grade control structures would be utilized. Provide streambank protection for vulnerable infrastructure.

3.7.1.4 Preliminary Alternative 4

Raise the streambed to an intermediate elevation between the current streambed and the historic pre-incised streambed elevation and construct an associated floodplain. Provide a stable channel configuration (geometry and slope). Grade control structures would be utilized. Provide streambank protection for vulnerable infrastructure.

3.7.1.5 Preliminary Alternative 5

Accelerate the expected changes to the channel configuration to establish a dynamic equilibrium consistent with geomorphic modeling theory for channel evolution. An inset floodplain would adjoin a low-flow channel. Provide streambank protection for vulnerable infrastructure.

3.7.2 Screening of Preliminary Alternatives

Initial screening of the preliminary array was conducted to identify those plans that should be carried forward and developed further as the focused array. Initial screening is presented in Table 3.7-1. The screening evaluation concluded that Preliminary Alternative 5 would not be carried forward.

Table 3.7-1 Screening of Preliminary Alternatives Array

Preliminary Alternative	Land Required	Effectiveness/ Efficiency	Acceptability	Sustainability
Preliminary Alternatives to Carry Forward (Retained)				
#2: Maintain streambed elevation similar to existing and construct associated floodplain within incised channel margin.	Lands are owned by Orange County	Recognized technique by stream habitat restoration practitioners in promotion of channel stability, floodplain function, and habitat improvement.	Conceptually acceptable to many stakeholders. Provides opportunity for preservation of existing high quality habitat.	Channel stability enabled by grade control structures (as needed) and streambank protection for infrastructure.
#3: Raise streambed elevation to achieve hydrologic reconnection with historic floodplain.	Lands are owned by Orange County	Recognized technique by stream habitat restoration practitioners in promotion of channel stability, floodplain function, and habitat improvement.	Conceptually acceptable to many stakeholders, but must preclude flooding impacts to structures and infrastructure. Possible overall loss of existing high quality habitat.	Channel stability enabled by grade control structures and streambank protection for infrastructure.
#4: Raise streambed to intermediate elevation and construct an associated floodplain within the remaining incised channel margin.	Lands are owned by Orange County	Recognized technique by stream habitat restoration practitioners in promotion of channel stability, floodplain function, and habitat improvement.	Conceptually acceptable to many stakeholders. Return some reconnection to historic floodplain. Reduces streambed filling need and provides some opportunity for preservation of existing high quality habitat.	Channel stability enabled by grade control structures and streambank protection for infrastructure.
Preliminary Alternative not to Carry Forward (Eliminated)				
#5: Accelerate the expected changes to the channel configuration to establish a dynamic equilibrium. Provide an inset floodplain.	Lands are owned by Orange County	Risk of underestimating the potential for continued geomorphic adjustments could result in increased channel instability and put pipeline infrastructure at greater risk.	Uncertainty in establishing endpoint configuration through modeling makes this alternative undesirable to non-Federal sponsor, Corps, and various stakeholders.	As a non-structural alternative, the use of grade control is not considered. Uncertainty and higher risk undermines sustainability; threat to infrastructure would require high level of intervention (increased use of streambank protection) and adaptive management.

3.8 FOCUSED ARRAY OF ALTERNATIVES

Further formulation, as will be described in this section, was performed to the screened preliminary alternatives plans to develop a focused array of alternatives. Ultimately, the focused array was screened to produce the final array of alternatives identified in Section 3.9.

As described next, assessment of engineering design and ecosystem restoration parameters was used as a basis to guide the development of the focused array of alternatives. This assessment also informed the refinement of measures that were not eliminated as an outcome of the measures screening process.

3.8.1 Engineering Design Input to Plan Formulation

3.8.1.1 Project Site Parameters

The proposed project footprint lies between and Pacific Park Drive (upstream limit) and SOCWA CTP Bridge (downstream limit), a five-mile stretch of Aliso Creek that is contained entirely within the Wilderness Park. This footprint spans Reaches 4A to 12.

Aliso Creek is a natural channel in Reaches 11 and 12 and relatively constrained by development to the west and east. Approximately one mile downstream of Pacific Park Drive, Aliso Creek transitions from a natural channel to an engineered channel (riprap side slopes and soft-bottom) for a distance of 3,240 feet (Reach 10). This reach is under Orange County jurisdiction for flood control purposes. Any potential project features in this reach will not impact flood control capabilities.

Downstream of Reach 10, Aliso Creek flows under the AWMA Road Bridge and enters the main region of Aliso and Wood Canyons Wilderness Park. The natural channel meanders through a mostly undeveloped coastal canyon, flowing through narrow segments and some wider colluvial terraces (Reaches 4A through 9). The channel is highly incised along these reaches and disconnected from its historic floodplain.

Infrastructure. Aliso Creek is flanked to its west by AWMA Road (Reach 4A through 9), and Aliso Creek Riding and Hiking Trail (Reach 10 through 12). To its east, from Reach 4A to 9, the creek is flanked by the SOCWA unimproved (dirt) service road (also referred to the Aliso Creek Trail East) and the wastewater utility easement; and a county service unimproved (dirt) road from Reach 10 through 12. A regional water pipeline crosses the creek in Reach 11.

Cultural Resources. Twelve archaeological sites have been recorded immediately adjacent to the creek and would potentially be directly impacted by ground disturbing activities. Six of these sites have previously been determined to be eligible for the NRHP, while the remaining sites have not been formally evaluated. Excavation along the creek is likely to result in adverse effects to these sites. The wider footprints of Alternatives 3 and 4 would likely have greater impacts than the narrower Alternative 2.

Landslides. Aliso Creek meanders through a relatively deep canyon bounded by moderately to steeply sloped hillsides. Numerous ancient bedrock landslide features are mapped within the east and west facing hillsides, and several on the north-facing hillside. The landslide bodies are identified in Figure 3.8-1. Relatively thick alluvial deposits, which comprise the canyon floor buttress against and provide resistance to the landslide masses. The post-urbanization channel incision and channel widening has possibly reduced this effect. The degree to which landslides were stabilized by the alluvial sediments and the extent to which erosion has disturbed the buttressing effect has not been quantified. The term buttress in this context should not be construed as being equivalent to stable.

Risk-informed decisions were made during the plan formulation process. A preliminary qualitative assessment of the landslides and level of impact that the constructed alternatives may have on the landslide masses was performed by the PDT. The assessment was based on available topography of the hillsides, surficial geologic mapping, and limited subsurface boring data. In the absence of subsurface geometry that could identify a preexisting slide surface or bottom of the landslide mass, a hypothetical geometry was developed for each of the landslide masses potentially affected by potential measures and alternatives. The establishment of this geometry was based on existing information and past experience with landslide investigations associated with the geologic rock formations present at the project site.

The impact of the proposed earthwork for each of the alternatives was evaluated and rated.

- **High.** The impact of the proposed grading to the existing stability of the landslide is considered potentially significant. This does not mean the proposed grading is not feasible, but a detailed investigation of the landslide should be performed and the alternative design in the affected area should be reevaluated in terms of reducing the net excavation or shifting the proposed grading farther from the mapped landslide area.
- **Moderate.** The impact of the proposed grading to the existing stability of the landslide is a design consideration. Altering the proposed design of the alternative in the affected area is not considered necessary at this time. The landslide should be further investigated during the design of the project.
- **Low.** The impact of the proposed grading to the existing stability of the landslide is considered minimal. Although detailed investigation of the landslide is likely not warranted, one deep boring should be performed between the mapped landslide area and the proposed grading to validate the actual conditions relative to the assumptions made.

Figure 3.8-1 Landslide Locations within Project Area

The main basis for establishing potential risk to triggering movement of an existing landslide mass is the assessment of the magnitude of the net change (positive or negative) in earthwork area associated with each proposed alternative in relation to the area of the estimated buttressing mass resisting the affected landslide. In general, removal of buttressing alluvium either by erosion or by grading of cut slopes could have a detrimental impact on the stability of the adjacent ascending slopes, whereas raising of grades by filling of existing low areas could or is likely to have a positive impact on slope stability.

The qualitative evaluation did not identify an existing landslide feature that would necessarily make any of the current proposed measures or alternatives unfeasible. However, it was concluded that the proposed grading could potentially have significant impact on the degree of stability of some of the existing landslides, for example, landslide mass IIa, with the inclusion of the oxbow reconnection.

The results are summarized as follows:

Table 3.8-1 Landslide Risk Evaluation

Landslide Body	I	II	II_a (With Oxbow)	II_a (Without Oxbow)	III	IV	V	V1
Alternative 2	L	L	H	L	M	L	L	L
Alternative 3	L	L	H	L	L	L	M	L
Alternative 4	L	L	H	L	L	L	H	L
Note: Alt 1 is the No Action Alternative.								

For the final feasibility level design, modifications to the proposed design and alignment, where applicable, to facilitate the potential reduction of an identified moderate or high rating will be further addressed and adjustments made to the practicable extent possible. In general however, it is recognized that a reliable evaluation of risks cannot be made until further geotechnical investigations are performed. Potential instabilities to any proximate adjacent ascending canyon slopes that could be caused by actions of alternatives that involve channel widening, or that promote increased potential erosion at the toe of a slope where the stream course impinges on channel bends (where sinuosity exists or has been created), will need to be evaluated. Any induced slope failures could adversely impact other superjacent improvements, including infrastructure facilities. During the PED phase, additional geotechnical investigations will be conducted as warranted for the Proposed Project to further reduce any risk/uncertainty associated with reactivation of ancient slope failures or destabilization of other areas currently unaffected by sliding. Engineering recommendations may include modifications to the Proposed Project alignment to avoid disturbance to unstable canyon slopes; shore unstable canyon slopes; or to provide bank protection from larger fluvial erosion events that could otherwise cause further channel widening in risk areas.

3.8.1.2 Watershed Geomorphic Influence to Project Area

Any plan pursued as an outcome of the current study to address creek instability and habitat degradation in the lower watershed would not be adversely affected by any channel degradation issues upstream or downstream of the project area. There are specific grade control points at the upstream and downstream limits of the Proposed Project area (Pacific Park Drive crossing and CTP Bridge, respectively) to preclude this. Pacific Park Drive, at the upstream end is an embankment crossing with concrete culverts. The CTP Bridge at the downstream end is protected at streambed grade by a grouted stone (designed to allow aquatic wildlife passage). Further downstream, bedrock exposure in the streambed within the golf course reaches provides grade control as well.

3.8.1.3 Proposed Channel Alignment

The channel alignment (pattern or planform) to be pursued for each of the action alternatives will generally follow the current alignment. The alignment within Reaches 9 to 12 reflect a loss of channel bends and channelization alterations from urbanization. Conversely, Reaches 4A to 8 have remained relatively consistent as revealed by 1939 aerial photography images. This alignment reflects topographic and other geologic controls (localized bedrock outcroppings, resistant clay deposits) within the alluvial floodplain. Any adjustments to this alignment have largely been due to the influence of upstream urbanization. Altered hydrology has contributed to some channel migration, and has resulted most notably in the cutoff of the horseshoe bend (Upper Reach 4B and Reach 5A). The S-bend (lower Reach 4B) has seen a progressive elongation in its upper bend and is expected to cut off in the future. [For more information, see Appendix A-1f, Geomorphology Assessment].

3.8.1.4 Stream Lengthening (Sinuosity)

Within the project footprint, opportunities for stream lengthening (adding sinuosity), or relocating adjacent physical constraints to accommodate potential future lateral migration of the stream course, was considered.

In Reaches 9 to 12, considering the buildout of development adjacent to these reaches, opportunities for adding sinuosity were limited to a segment downstream of Pacific Park Drive and in the vicinity of the Skate Park. The latter opportunity would require the relocation of Skate Park facility.

In Reaches 4A to 8, the stream course is constrained, to one extent or another, by AWMA Road to the west and the wastewater pipeline corridor to the east. Relocating these facilities further away from Aliso Creek was assessed. For both sides of the creek, steep hillsides in segments where the canyon narrows would impede relocation of the facilities without significant and costly recontouring of these topographic features. In limited wider areas of the canyon, relocated segments of AWMA Road would require significant cutting (excavating) into the gradually ascending slopes, and grading, to rebuild the road.

On the east side, relocating wastewater utility alignments that lie in closer proximity to the creek would require a deeper trenching operation the further the lines are moved from the creek due to the ascending hillside. There would also be some limitations for relocation of the 18-inch effluent pipeline that relies on gravity flow and would require a specific gradient to maintain optimal flowage.

The main factors for not pursuing these relocations within Reaches 4A to 8 include:

- Potential destabilization of known landslide masses or creation of other unstable slopes, especially for AWMA Road on the west side.
- Potential cultural resource impacts.

- Reaches that would benefit from more lateral space are not evident based on review of 1939 aerial photography.

An exception for relocation consideration was pursued in Reach 8 on the west side currently occupied by an old segment of AWMA Road. This segment referred to as “Old AWMA Road” was abandoned in place due to streambank erosion issues and is no longer utilized by SOCWA operations. It is, however, still utilized by OC Parks and for public recreation. Potential cultural resource impacts would need to be addressed; however, destabilization of adjacent hillside slopes would not be a concern.

Opportunities for adding sinuosity within the established floodplain was identified for one segment just downstream of Wood Canyon Creek confluence.

In general, it should be recognized that cuts made to reroute the channel alignment to improve sinuosity could potentially destabilize existing landslides and adjacent ascending slopes where stream impingement results in erosion at the toe of the slope (see related discussion in Section 3.8.1.1). It is possible that some form of erosion protection would need to be incorporated into the final design of stream sinuosity features. The protection would need to be compatible with ecosystem restoration.

3.8.1.5 Reconnection of Abandoned Oxbow

The reconnection of the abandoned oxbow area (upper Reach 4B and Reach 5A) would reestablish some lost sinuosity function of the creek system. Reconnection would only be considered for preliminary Alternatives 3 and 4, which involve raising the streambed. For Alternative 2, the need to slope back the streambanks along the oxbow to maintain stable slopes would encroach on the west road, with no room to relocate the road due to the proximity of the hillsides. Recontouring of the steep hillside was not considered economically feasible.

As an option to reconnecting the abandoned oxbow to become the main active channel, a split-flow option was also considered. Flows would be split between the existing main channel and the reconnected oxbow. This option was not pursued due to the likelihood that excessive sedimentation within the oxbow would require periodic clearing and temporary disturbance to the ecosystem habitat.

3.8.1.6 Lower Oxbow Terrace

This measure would lower the former perched floodplain terrace (“oxbow terrace”) that contains the abandoned oxbow. Two options were considered: (1) lower the oxbow terrace to create a widened floodplain terrace (10 percent ACE, or 10-year flow event) for the active channel; and (2) lower the oxbow terrace to create a new channel and connect only to two small active dry tributaries entering from the west; there would be no connection to the main channel except for return flows to Aliso Creek at the downstream end of the created channel. The second option would be expected to silt-in with time due to backwater effects from the main channel during higher flow events. This option was eliminated due to its higher maintenance requirements and the intrusive nature to the habitat associated with the operation. The first option was only considered for Alternatives 3 and 4; it was dismissed for Alternative 2 for reasons similar to reconnection of the abandoned oxbow described above.

3.8.1.7 Infrastructure Threat: Reach 4A to Reach 9

As described in Chapter 1, an ecosystem restoration project in lower Aliso Creek watershed would not be sustainable without a solution to the wastewater infrastructure threat within the project area. The infrastructure is comprised of the wastewater utility lines located along an easement on the east bank, and also the SOCWA CTP's main access road (AWMA Road) to the west of Aliso Creek. Failure of this critical public infrastructure would cause undesired impacts to the restored area.

Notwithstanding the goal for a restoration project to provide for a "stable" channel configuration (i.e. in dynamic equilibrium) that does not significantly aggrade or degrade, there remains an inherent infrastructure threat due to uncertainties in the effects of potential localized scouring during larger storm events, especially at outside bends where fluvial forces are the greatest. Streambank protection against stormflow erosion threat to critical infrastructure would be warranted.

Choosing the current alignment, as described earlier in this section, is an effective choice. There is a higher degree of certainty in defining areas where the facilities are vulnerable to potential bank erosion threat and progressive channel migration. Areas requiring protection would be fairly limited and would occur mostly where the canyon narrows, and the creek alignment is in close proximity to the utility corridor. Other solutions that could entail reconfiguring the creek alignment would not produce a scenario that would require less associated infrastructure streambank protection.

Riprap stone buried under compacted fill was previously described as a measure to address utility and infrastructure protection in-place. Streambank protection would be constructed along specific segments of the channel banks of Reaches 4A to 9 where the proposed channel alignment is in close proximity to existing wastewaster utilities or to the west access road. This method of protection would be the selected type for the proposed design where infrastructure is at risk. Specific types of native riparian vegetation would be planted over the segments that are protected. The buried riprap would be designed to provide erosion protection against the 1 percent ACE (100-year event). A toedown depth of six feet below the streambed elevation will be provided to protect against potential undermining scour effects.

Excavation that could potentially destabilize existing landslides or adjacent ascending canyon slopes will need to be evaluated during PED when considering construction of buried bank protection.

As an alternate to riprap bank protection, sheetpiling was also considered but found not to be a cost-effective solution. Compared to riprap stone, sheetpile is more costly from a material and installation perspective. In addition, for Alternative 2 (and its variations) that do not raise the streambed elevation, sheetpiling would potentially not be viable as the length of the sheetpile required (height of bank to be retained, plus anticipated scour depth) would likely exceed the structural capability of the sheet pile.

3.8.1.8 Infrastructure Threat: Reach 11

Other critical infrastructure within the project area is the water transmission main associated with the JRWSS. The JRWSS provides a primary source of drinking water for more than 2000,000 residents in southern Orange County communities. There are two locations of the JTM that are threatened by Aliso Creek. One location runs in close proximity to the west bank and is protected with a sheetpile wall. In the other location, the pipeline crosses the creek in proximity to the current streambed elevation. These sites are both located in Reach 11. Continued incision in this reach is a threat to undermining the JTM. The strategic placing of required grade control (rock riffles) necessary for the proposed restoration project would provide incidental NED benefits to the project due to the protection of this pipeline.

3.8.1.9 Bank Erosion

Although protection of infrastructure is essential to the success of the project, it is also the intent of the restoration project to allow bank erosion to continue as a natural geomorphic process where infrastructure is not threatened, where bank erosion will not result in larger upslope stability problems. Bank erosion (including scouring) is integral to the functioning of the ecosystem. It is a process that promotes riparian vegetation succession stages and creates dynamic habitats essential for aquatic and riparian plants and animals. Although the action alternatives establish conditions promoting a state of dynamic equilibrium, natural fluvial geomorphic processes and adjustments to the creek morphology will continue. Consideration to destabilization of existing landslides and adjacent ascending slopes where stream impingement results in erosion at the toe of the slope are applicable as described under “Stream Lengthening (Sinuosity)” above, and in Section 3.8.1.1.

3.8.1.10 Natural Channel Design (Regime Channel)

The development of the channel parameters is guided by fluvial geomorphology principles referred to as *natural channel design* whose goal is to create a stable stream channel, and functions that balance the watershed’s flow of water and sediment over time, so that the channel does not significantly aggrade or degrade (Harman et al. 2012).

In erodible materials, a stream will shape its cross sections in accordance with its flow, slope, sediment, and alignment, irrespective of its initial geometry. Using hydraulic and sediment transport relationships regarding the channel geometry, it is possible to estimate the equilibrium slope and *regime* channel width (channel widths that carry their design flow without significant degradation or aggradation are said to be *in regime*) for specific discharge and sediment inflow conditions. Since the goal is to evaluate the long-term conditions toward which the channel is adjusting, the analysis is performed using dominant (channel-forming) discharge. The dominant discharge is defined as the increment of discharge that carries the most sediment over a long period of time. In perennial, self-adjusted streams, the dominant discharge is often assumed to be the same as the bankfull discharge.

In general, bankfull discharge in stable perennial channels has been found to correspond to flows with an ACE of approximately 99.9 to 40 percent (1- to 2.5-year). Aliso Creek is a perennial stream, but is deeply incised, so the bankfull discharge estimate is not directly applicable. For ephemeral streams, the dominant discharge tends to be associated with larger, less frequent flood peaks than in perennial streams, due to the absence of sustained flows and the flashy nature of the storm hydrographs. The dominant discharge for lightly developed watersheds will typically be in the range of the 20 to 10 percent ACE (5- to 10-year) peak event. In more highly developed watersheds, the frequency of the dominant discharge is typically less because runoff (and sediment transport) associated with the more frequent storms tends to increase dramatically. As a result, the frequency of the dominant discharge is typically in the range of the 33 to 20 percent ACE (3- to 5-year) flood peak (Mussetter 2009). Because of this uncertainty in determining the dominant discharge, it was decided that the flow capacity associated with each action alternative that will be further developed in the plan formulation process should accommodate the range of flows between the 50 and 10 percent ACE (2- and 10-year) flood peaks.

3.8.1.11 Streambank Recontouring

The streambed recontouring measure identified in Section 3.5 addresses improvement of channel stability. This is accomplished by recontouring the steepened channel banks to a gentler and more stable slope. The prevalence of steep streambank slopes (1H:1V [horizontal to vertical], to near vertical) degrades the value of the riparian structure that can establish. Channel slopes would be graded to a stable 3H:1V slope. Laying back of the streambank slopes would inherently widen the riparian vegetation corridor.

Recontouring of the streambank is different than recontouring of the channel. The latter includes laying back the streambanks slopes, use of natural channel design, and possibly, terracing and limited channel realignment.

3.8.1.12 Terracing Floodplain

The use of terracing (or benching) fulfills two important functions: (1) the value provided by floodplain terraces to channel hydraulics (dissipation of flood energy) and to the ecosystem habitat structure and function; and (2) a source of fill material for alternatives requiring raising the streambed elevation (versus importing fill materials from off-site). With lateral space constraints due to the general canyon topography, a single-level terrace system was chosen to establish a floodplain that would be inundated at more frequent flow events, specifically for storm events exceeding the 50 percent ACE (2-year) event.

The more frequent flooding would promote early successional riparian vegetation favored by some wildlife, due to scouring action. Terracing promotes vertical structure of restored riparian habitat, with multi-layers in mature willows and cottonwoods in the less frequently inundated higher channel slopes and overbanks, and lower ecotonal edges created by riparian shrubs in the lower channel slopes and terraces. Average terracing widths of 50 feet were chosen for each side of the channel to maintain appropriate regime channel parameters. However, the design would also consider placing a wider terrace on only one side of the channel, where viable, as the (horizontal) alignment of the channel is modeled.

Terracing would be incorporated for alternatives that raise the streambed elevation only. For alternatives that do not raise the streambed elevation, the creation of inset floodplain terracing within the highly incised channel was not pursued. The rationale was that this would have extended the incised channel margins and resulted in substantial excavation (i.e. hundreds of feet), impacting a wider footprint of historic floodplain and associated habitat, and adjacent infrastructure. Additionally, there would be higher risks to stability of adjacent hillside slopes that might be prone to landslide destabilization as potential buttressing alluvium is removed. Any existing inset floodplains would be maintained to the full extent practicable.

3.8.1.13 Grade Control Stabilizers (Rock Riffles)

In developing alternatives that involve raising the streambed elevation, grade control stabilizers would be required to maintain the newly established slopes and to keep localized scouring within tolerable limits. Moreover, as the new streambed gradient would be made less steep than the current gradients to render a more stable (equilibrium) slope, and to account for the removal of existing drop structures (e.g. ACWHEP and the two 10-foot vertical drop structures), the inclusion of sloped “steps” was necessary to accommodate the elevation gain required in intervals along the stream course. This can be accomplished by the use of sloped rock riffle structures, spaced 400 to 700 feet apart. The selected spacing is based on geomorphic recommendations (approximately five to seven times the average channel width) to promote the establishment of pool and riffle regimes.

The rock riffles would be designed to provide longitudinal connectivity for aquatic wildlife passage, withstand the flow forces of the one percent ACE (100-year) storm event, and to protect the raised streambed from long-term degradation. Environmental guidelines for fish passage recommend a maximum slope of five percent for rock riffles. A shallow pool (18 inches deep or more) within each riffle structure would be incorporated to provide flow energy dissipation and serve as a resting area with lower velocities for aquatic wildlife. A riffle “height” would generally be limited to 18 inches high. The height is defined as the difference between the top of the structure at its upstream end and the downstream streambed elevation. At the upstream end, the top of the riffle boulders will be close to the streambed elevation. The establishment of the riffle crest height dictates the overall length of the sloped (5 percent) structure in the downslope direction required to connect with the streambed elevation at the downstream end, and hence its overall longitudinal footprint. Using a higher riffle height would result in the need for less structures compared to selecting a smaller riffle height. The higher structures would require a much longer footprint, however, and would also generate higher localized flow velocities just downstream. As these higher velocities could warrant the need to grout the structures, the need for larger structures would be avoided as much as possible. Additionally, higher structures would create a longer traverse distance for aquatic species to negotiate in their movement in the upstream or downstream direction. The 18-inch riffles would be constructed of large, ungrouted boulders embedded below the streambed to a specified thickness, with the top layer exposed at streambed grade. There would be the need for some larger (six-foot) riffle structures upstream of AWMA Road Bridge. These would be associated with the removal of the two large 10-foot drop structures in Reach 10 and the protection of the JRWSS water transmission main crossing in Reach 11. Grouted boulders within these longer sloped structures will be overlain by ungrouted boulders, forming intermittent smaller step pools, to maintain a more natural appearance.

To ensure integrity of the established elevations and grades of the restored streambed in case of loss or damage of a riffle structure during a very large storm event, a buried sheetpile (likely vinyl, for cost effectiveness and durability) would be placed at each riffle location. In case of damage from a storm event, the riffle structure would subsequently need to be repaired. Any riffle design system that would replace the large drop structures in Reach 10 would need to maintain the same level of protection as the current structures.

3.8.1.14 Newbury Riffle Weirs

For alternatives that do not raise the streambed, grade control would not be necessary for streambed stability purposes as a regime channel design would create a channel streambed at an equilibrium slope (i.e. dynamically stable). However, the use of Newbury riffle weirs can be considered for the creation of pools and riffles. Although the restored stream would create pools and riffles on its own, Newbury weirs would provide this habitat features sooner and at selected locations. Spacing as described for rock riffles above would be utilized. Newbury weirs, also constructed with boulders at a five percent slope, lie above streambed grade and create a pool upstream of them. For preliminary design purposes, an 18-inch Newbury weir height was selected.

3.8.1.15 Basis for Preliminary Alternative 2 Channel Parameters

The concept for Alternative 2 to is to maintain a stable streambed elevation similar to the existing elevation and constructing an associated floodplain within the incised channel margins. Due to the degree of existing channel incision (20 feet or more along various reaches within the Wilderness Park), the goal was to limit the amount of excessive excavation that would result from recontouring the channel side slopes to more gentle slopes. The consideration, therefore, to create inset floodplain terraces was dismissed as described in the Section 3.8.1.12. Any existing inset floodplains would be maintained to the full extent practicable. The decision was to incorporate a single trapezoidal regime channel for Alternative 2. An equilibrium slope of 0.4 percent was selected and corresponds well with the average bed slope downstream of the ACWHEP structure.

3.8.1.16 Basis for Preliminary Alternative 3 Channel Parameters

The concept for Alternative 3 is to raise the streambed to approach the pre-incised streambed elevation to achieve hydrologic reconnection with historic floodplain. The channel configuration, developed from regime channel principles, incorporates a low-flow channel, flanked by a floodplain bench on one or both sides, within a wider channel. The low-flow channel capacity has a 50 percent ACE (2-year event), while the wider channel has a 10 percent ACE (10-year) capacity. The design established an equilibrium channel slope of 0.25 percent, which is consistent with the observed streambed profile of the stable geomorphic reach upstream of the ACWHEP structure.

The determination of how high to raise the streambed elevation relative to its pre-incised condition was dictated primarily by the selected equilibrium slope (0.25 percent), and the interval (500 to 700 feet) and rise (18 inches) of the riffle structures. In comparing the elevation of the raised streambed in the vicinity of Wood Canyon Creek confluence to the historic streambed, Alternative 3 streambed elevation would be similar to the circa 1967 streambed elevation.

Presently, segments of the access roads on the east and west sides of Aliso Creek within the Proposed Project area are considered to be within the one percent ACE (100-year) floodplain and subject to inundation. The impacts of potentially more frequent or wider inundation effects, resulting from raising the streambed elevation, including the CTP facility, were conducted as part of this study and presented in Section 3.8.12.2.

3.8.1.17 Basis for Preliminary Alternative 4 Channel Parameters

The concept for Alternative 4 is to raise the streambed to intermediate elevation between the current streambed and the historic pre-incised streambed elevation, and construct an associated floodplain.

Alternative 4 uses the same geomorphically stable channel and equilibrium slope as that adopted for Alternative 3. For Alternative 4, only one profile of streambed raising was considered instead of assessing various increments. A single streambed gradient would provide more distinct outputs, in relation to induced floodplain area effect and associated habitat value output, when comparing outputs generated from Alternative 2 or 3. The existing streambed elevation at the location of the ACWHEP structure would require lowering to meet the new streambed elevation. More riffle structures (18 inches high) than Alternative 3 would be needed upstream of the ACWHEP location to transition the streambed to meet the upstream grade at the AWMA Road Bridge.

3.8.1.18 Comparison of Channel Geometries

An example of the channel geometries for preliminary Alternatives 2, 3, and 4 are shown in Figure 3.8-2. Each cross-section shown includes the existing channel outline at the specific station indicated. (The established stationing is displayed in the Engineering Design drawings, Appendix A-1a.2).

The recommended design slope angle for all channel side slopes within the 10-year flood channel on this project is 3H:1V. Other than excavation, fill, and compaction activities to bring slopes to proper grades, the channel slopes will remain unimproved (with only natural vegetation). The 3H:1V side slopes are intended to assist in providing a geomorphically stable channel. Slopes above the 10-year flow level will remain unaltered (including currently over-steepened slopes) wherever possible. Where cut and fill slopes are proposed above the 10-year flood level to accommodate constraints such as encroaching infrastructure, side slopes may be as steep as 2H:1V. Slopes steeper than 3H:1V that may experience inundation by channel flows present a risk of slope instability. Detailed geotechnical studies will be needed during PED phase to establish the appropriate stable slope gradient at each location of the project.

The three stations shown are:

- Station 170+00 is in Reach 6, just upstream of Wood Canyon Creek confluence
- Station 160+00 is in Reach 5C, just downstream of Wood Canyon Creek confluence
- Station 135+00 is in Reach 5A, in the abandoned oxbow area

3.8.1.19 Earthwork Balancing

It is desirable in engineering design practice to balance onsite excavation (cut) and fill to the maximum extent practicable. Balanced cut/fill implies there would be little or no excess material after the required earth fill is placed. This practice reduces the reliance on importing or excessing materials, costs, and transport impacts (e.g. traffic and air quality). This practice would be an important consideration for alternatives that require the channel streambed elevation to be raised. Fill for the streambed would be excavated from adjacent areas inside the channel width and the adjacent floodplain to create floodplain terraces. The feasibility-level design effort of the alternatives resulted in varying quantities of excess materials. Alternatives that included reconnection of the abandoned oxbow added a significant increase in excess excavated materials. It is expected that further refinement during final design in the PED phase of the selected plan could provide a more favorable cut/fill balance (i.e. less excess materials). Refinement would also necessitate consideration where applicable of cuts in the alluvial materials that are located in proximity to ascending terrain that could destabilize adjacent slopes.

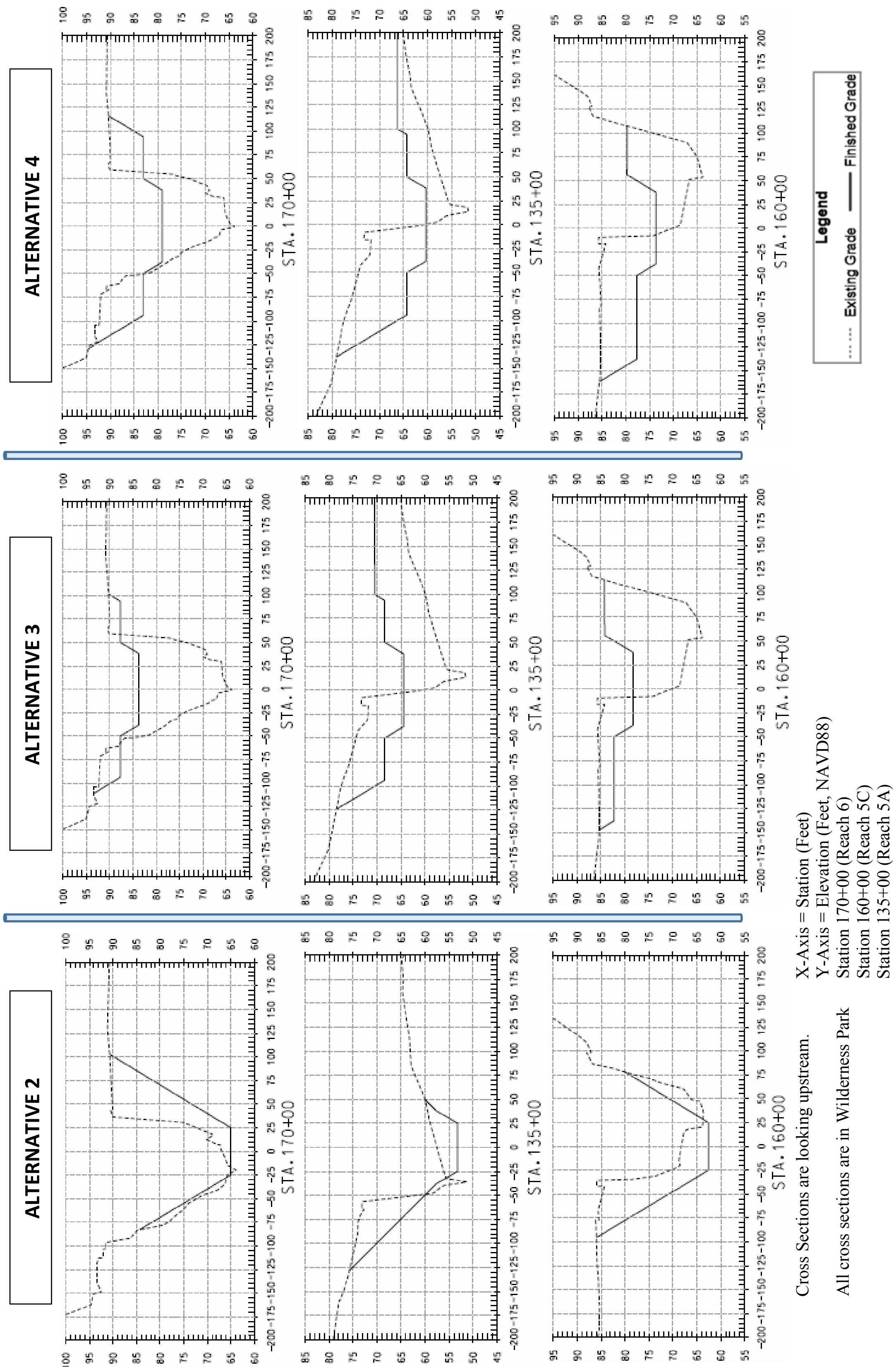

Figure 3.8-2 Cross-section Channel Geometries for Alternatives 2, 3, and 4

3.8.1.20 Disposal of Excess Materials

Excess materials from earthwork operations would be placed in designated areas on adjacent hill slopes in existing grasslands of the Wilderness Park. Numerous potential sites were identified. Two locations with the largest capacity were identified, both on the west side. One site is just upstream of Wood Canyon Creek confluence, the other, in the vicinity of the abandoned oxbow area. The disposal sites would be contoured to the existing slopes and seeded with native grasses or planted with coastal sage scrub, as determined in final design. Areas identified for disposal are not in locations that would negatively impact the existing bedrock landslides. They would typically add to the buttressing effect of the existing overburden and increase the stability of existing bedrock landslides.

3.8.2 Ecosystem Restoration Input to Plan Formulation

3.8.2.1 Mitigation sites

There are some existing mitigation sites and one former compensatory mitigation site within the Wilderness Park. Most of these mitigation sites are in association with non-Federal actions. A brief description of these mitigation sites, current disposition and the relation of these sites to the Proposed Project alternatives are summarized in Table 3.8-2.

The CHAP habitat evaluation treated the habitat value of any mitigation sites that would be affected by the Proposed Project as baseline condition values. No NER benefits were claimed from outputs generated by mitigation projects. For Reaches 11 and 12, where there is currently a mitigation site, habitat gain associated with the Proposed Project only captured the difference over future without-project conditions for those reaches. The OCTA mitigations sites are shown in Figure 3.8-3.

3.8.2.2 Channel Connectivity

Any plan would consider connectivity, including longitudinal (upstream and downstream), lateral (riparian floodplain) and vertical (subsurface to above ground). Longitudinal connectivity (also referred to as aquatic species, or landscape, connectivity) represents the ability of aquatic species to migrate upstream and downstream along a continuous corridor that meets their habitat requirements. Across large vertical barriers, achieving longitudinal connectivity depends upon how much the streambed will be raised to overcome the grade elevation discontinuity. The existing barriers include: Wood Canyon confluence (25+ feet; Reach 5C); ACWHEP structure (25+ feet; Reach 7); Sulphur Creek Confluence (8 feet; Reach 9); AWMA Road Bridge (4 feet; Reach 9); two large concrete drop structures (10 feet each; Reach 10) in the vicinity of Aliso Creek Road bridge; and the Joint Regional Water Transmission Line Crossing (9 feet; Reach 12). Longitudinal connectivity is also compromised by a segment of channel corridor that lack instream vegetative habitat (Reach 10) and also by a 600-foot-long culvert at Pacific Park Drive (Reach 12).

Table 3.8-2 Mitigation Sites within Wilderness Park

Development Name/Project Name	Status	Proposed Project Area (PPA) Impact	Resolution
Aliso Creek Wildlife Habitat Enhancement Project (ACWHEP)	Terminated by signatories – October 2012	N/A	N/A
Southwestern Pond Turtle Habitat/City of Laguna Hills	Active	None. Site is outside of PPA	N/A
OCTA Measure M Funded Invasive Removal /Native Replanting	Active	Mitigation efforts in Reaches 11 and 12. Other mitigation efforts in Reaches 13-15A are outside of the PPA.	Language has been included in the OCTA draft HMMP that stipulates that should a Federal project be implemented within the HMMP project boundaries, the Corps and jurisdictional authorities will evaluate whether modifications to the permit (Long Term Management Plan) and site protection instrument are warranted.
SOCWA CTP Bridge Protection/CAP Section 14	Active. Turned over to non-Federal sponsor.	No expected impact as specific project work is in channel and adjacent to mitigation site on west overbank.	N/A
AWMA Road Realignment/SOCWA	Active	1.42 acres of grassland/coastal sage scrub habitat to west of Aliso Creek, downstream of ACWHEP	N/A
Wood Canyon Creek/OC Parks	Active	None. Mitigation sites upstream of PPA	N/A

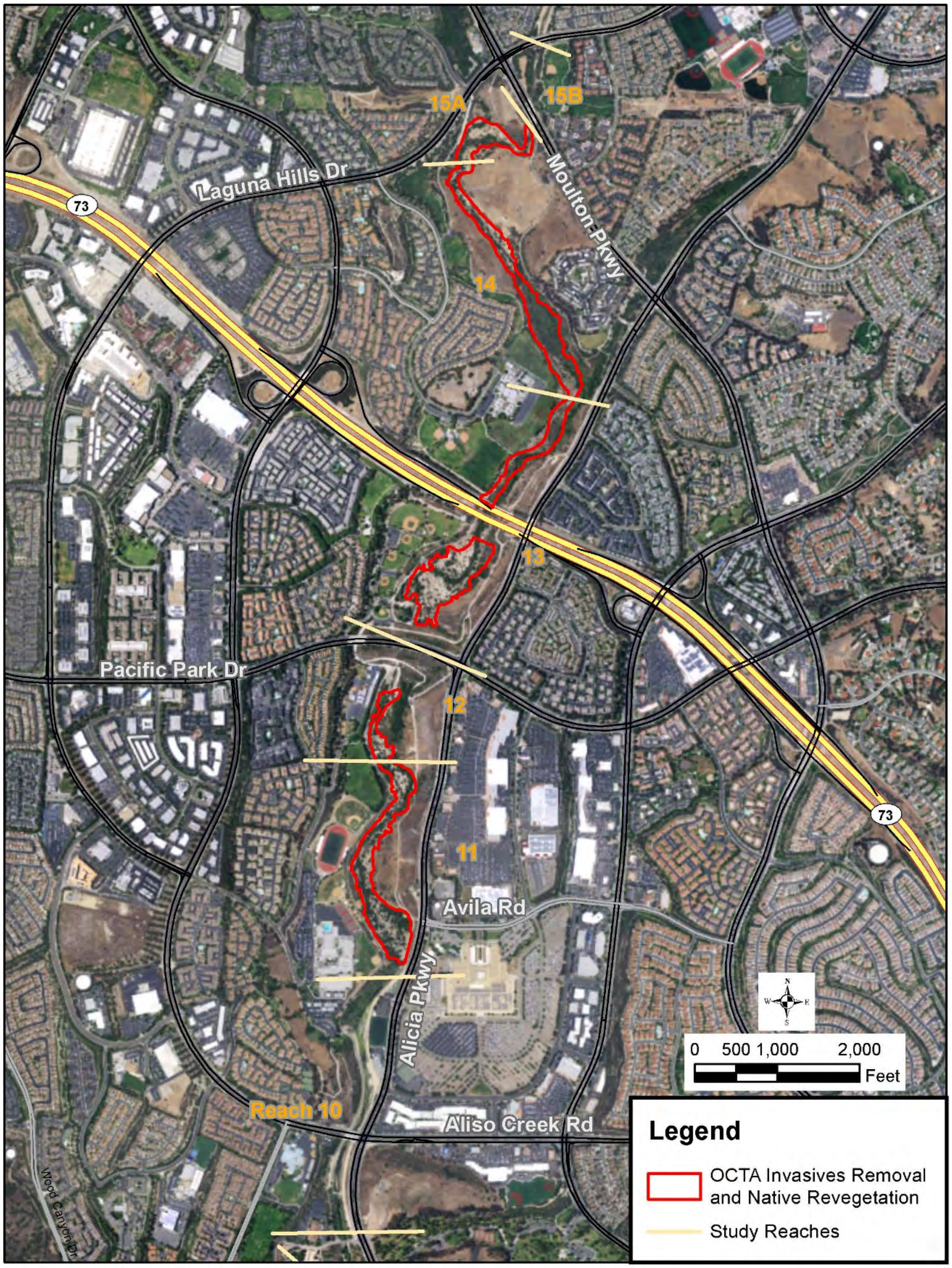

Figure 3.8-3 OCTA Compensatory Mitigation Sites within the Wilderness Park

A foundational decision in the formulation process is how the ACWHEP structure will be addressed in the development of the focused array of alternatives. As an outcome of the initial screening process, the construction of large structures to facilitate aquatic species passage was eliminated. Consequently, any alternative that would maintain the current or similar streambed elevation would maintain the ACWHEP structure intact. As a result, aquatic species connectivity will not be established at the ACWHEP structure for Alternative 2 or any of its variations. The use of riffle structures to make up for the elevation gain necessary to eliminate the ACWHEP structure was considered but not pursued as this would require a sequence of higher riffle height structures, which would be inconsistent with the restoration intent. For Alternatives 3 and 4, and any variations thereof, the ACWHEP structure would be removed as streambed raising negates the need for a large drop structure.

Lateral connectivity (floodplain connectivity) refers to the periodic inundation of the floodplain from the channel and the benefits of resulting exchange of water, sediment, organic matter, nutrients, and organisms. This is especially important in deeply incised channels, such as Aliso Creek, which have lost their connectivity with the riparian floodplain due to significant streambed degradation. Diminished access of streamflow overbanking across the floodplain, and the lowering of groundwater levels in the floodplain result in a decline of riparian and floodplain habitat biodiversity, and shrinking of its areal extent, culminating in habitat type conversion. Within the incised channel, restricted and narrowed riparian and aquatic habitat is subject to confined high flows during large storm events, resulting in the increased likelihood of plant community, habitat, and aquatic wildlife destabilization and loss. Lateral connectivity is enhanced by a channel system that includes sinuosity.

Vertical connectivity provides for a healthy ecosystem structure and function. It is the ability of a system to promote an aquatic and riparian habitat with vertical structure (multilayer canopy and height) and diversity. Key influences are a stable channel, where the banks are not steep and subject to erosion; groundwater levels in relative proximity to support root zones; and a system that improves surface and groundwater exchange, for example through use of terraced floodplains.

3.8.2.3 Wood Canyon Creek Tributary Connection

Wood Canyon Creek joins Aliso Creek at Reach 5C. Currently, the streambed of Aliso Creek has incised about 25 feet below the streambed level of Wood Canyon Creek occurring upstream of the AWMA Road crossing at the confluence. The road crossing provides protection against headcutting upstream into Wood Canyon Creek. The county, however, must periodically place grouted riprap stone on the downstream side of the crossing. Two 30-inch culverts, at a length of 20 feet each, cross under the road to convey Wood Canyon Creek flows.

The construction of large structures to facilitate aquatic species passage was eliminated as an outcome of the initial screening process, as described earlier in Section 3.6. For consideration of any alternative that would maintain the current streambed elevation (i.e.

Alternative 2 and its variations), aquatic species connectivity at the Wood Canyon confluence was not further pursued. The discontinuity downstream of the road crossing would require substantial regrading of the streambed gradient transition connecting the two stream systems, including a significant length (over one mile) of Wood Canyon Creek upstream of the confluence; significant habitat impacts would result. Lateral regrading of the tributary channel banks would also be necessary. As an option, the use of numerous, very closely-spaced, higher riffle height structures were considered but discarded as this action would be esthetically inconsistent with the restoration intent.

For alternatives that raise the streambed elevation (i.e. Alternatives 3 and 4, and their variations), to facilitate aquatic species connectivity at Wood Canyon Creek, the culvert crossing at AWMA Road would need to be removed ("daylighted") and replaced with a small vehicular bridge. Long culverts in general are less conducive to aquatic wildlife passage. In the formulation process, the inclusion of a bridge is considered as an additional measure (feature) that is evaluated as an incremental step in the development of Alternative 3 or 4, and variations thereof. This measure allows full connectivity to the Wood Canyon Creek riverine system, recognizes the habitat value uplift, and is called "Wood Canyon Landscape Reconnection."

3.8.2.4 Sulphur Creek Tributary Connection

Sulphur Creek joins Aliso Creek from the east at Reach 9. The initial 600 feet of Sulphur Creek, from its confluence with Aliso Creek upstream to the drop structure located at the Alicia Parkway Bridge box culvert outlet, has experienced downcutting and streambank erosion. This segment of the tributary is located within the Wilderness Park, to which Alicia Parkway marks a boundary. Both SOCWA wastewater infrastructure adjacent to the creek and cultural resources in the proximity are threatened.

The eight-foot drop structure is an impediment to aquatic species passage. Reestablishment of aquatic species connectivity between the tributary and Aliso Creek mainstem will not be pursued as upstream of Alicia Parkway is a regional park, which includes Laguna Niguel Lake (formerly Sulphur Creek Reservoir), formed by a dam. The park facility is owned by Orange County. The lake, which is fed from Sulphur Creek and a storm drain, is managed for recreational fishing and stocked with nonnative fish.

Management measures for the Proposed Project would include placing screens on upstream side of the Alicia Parkway culvert to minimize exotic species dispersal downstream to Aliso Creek. Screen openings would be sized to inhibit adult reptiles and amphibians (e.g. red-eared sliders and bull frogs) from moving downstream. Management of juveniles passing the screen would be need to be pursued under an adaptive management program as part of the Proposed Project. The screens would require clearing following a large storm event. Trash booms placed upstream, including at Sulphur Creek reservoir, could help reduce debris.

The confluence area, including side slopes and stream bottom of the tributary segment within the Wilderness Park would be lined with riprap to dissipate flow energies from

Sulphur Creek and provide erosion protection to infrastructure and cultural resources. The side slope stone would be buried under compacted fill in combination with a geosynthetic mat to allow riparian vegetation to establish.

3.8.2.5 Freshwater Marsh Creation

As freshwater marsh is expected to establish naturally (by seeds or rhizomes in soil, or washed down from upstream); no feature to create a designated marsh area has been included in the formulation process at this time. Freshwater marsh is typically found along the edges of pools, runs, in backwaters, or slow moving segments of oxbows and sinuous creeks or rivers. Due to their high ecosystem value, once marshlands establish, study recommendations would identify specific areas where marsh could be maintained by way of an adaptive habitat management program.

3.8.2.6 Connectivity Upstream of Project Limit: Pacific Park Drive Bypass and Stewardship Reaches

Opportunities for increased aquatic species connectivity would be realized by connecting to riverine reaches (13 to 17B) upstream of the Proposed Project footprint limit. No specific work would be performed within these additional reaches requiring Federal participation, with the exception of the inclusion of a bypass channel at Pacific Park Drive. The Pacific Park Drive, at the upstream boundary of Reach 12, is a roadway built on top of an embankment that crosses Aliso Creek. The embankment is associated with the Pacific Park detention basin facility (located within Reach 13). The Pacific Park Drive Bypass, which would incorporate aquatic and riparian elements to enable aquatic species passage, would also be utilized as a corridor for certain mammals, such as deer, which currently do not use the existing 600-foot-long culvert under Pacific Park Drive. The upstream end of the bypass would be located within the initial 500 feet of Reach 13. The bypass alignment would provide a low-flow channel feature connecting Aliso Creek upstream and downstream of Pacific Park Drive, via an alignment that passes through the embankment at the Aliso Creek Bikeway/OC Parks access road underpass on the west side. A pump system would be utilized upstream to redirect some streamflow through the bypass (refer to Appendix A-1b for more information).

With the inclusion of the Pacific Park Bypass, aquatic species connectivity would be extended for 3.5 miles from Pacific Park Drive to the I-5 Freeway. The landowners associated with Reaches 13 to 17B are Orange County, the City of Aliso Viejo, and the City of Laguna Woods. These entities would continue to pursue stewardship practices in protecting natural resources in accordance with their adopted RMPs. Some of these reaches (13 to 15A) are associated with ongoing OCTA mitigation efforts, which comprise of invasive removal and native vegetation replanting. Reach 16A, under OC Flood Division jurisdiction, would require the short reach to be managed to allow the establishment of freshwater marsh. The remaining reaches would not require any changes from current management practices. Reaches 16B and 17A are part of a conservation easement owned by the City of Laguna Woods.

The CHAP habitat evaluation treated the riverine habitat value of these Reaches 13 to 17B as secondary benefits associated with the aquatic species connectivity made possible by the Pacific Park Drive Bypass. Any potential uplift due to mitigation efforts in these upstream reaches were not factored in and simply treated as existing conditions.

Additional opportunities for aquatic species connectivity further upstream of Reach 17B were not considered. Upstream of the I-5 Freeway a modified stretch of channel includes a long series of small drop structures.

3.8.2.7 Exotic Plant Species/Invasives Eradication

Various nonnative invasive plant species removal efforts are associated with Aliso Creek in a cooperative effort led by the County of Orange. *Arundo donax* (giant reed) is the primary invasive plant species, although salt cedar, castor bean, fennel, and some pampas grass are present. Grant funding has been used for some efforts, while others are tied to mitigation credit projects. Within the project site, from AWMA Road Bridge to the SOCWA CTP Bridge, the county recently completed an invasive removal project with Proposition 50 grant funding. Complete eradication will require continuing efforts, including a long-term management plan. Upstream of the AWMA Road Bridge to the upstream limit of the project site at Pacific Park Drive, an OCTA mitigation credit project is underway for invasive removal and native vegetation replanting. The OCTA effort continues upstream from Pacific Park Drive to Moulton Parkway. Upstream of Moulton Parkway to the headwaters of Aliso Creek, other invasive removal efforts (with grant funding or for mitigation credit) have occurred recently. Downstream of the Wilderness Park, removal efforts have occurred at the golf course with private landowner funding.

3.8.3 Methodology to Develop the Focused Array of Alternatives

3.8.3.1 Longitudinal Extent of Alternatives

An important step in the formulation process was to establish the basis for defining the longitudinal extent of the channel alignment that would be associated with any developed alternative of the focused array. The basis was chosen to be the capability for aquatic species connectivity, as this was considered a limiting factor.

Table 3.8-3 shows the incremental channel segments, established by reaches, taking into account the physical limits imposed by aquatic species connectivity impediments[8]. These were defined for preliminary action alternatives. For example, for Alternative 2 (i.e. maintain a similar to existing streambed elevation), the upstream limit of the first increment, starting from the SOCWA CTP Bridge at the downstream limit of the

[8] Under without-project conditions, the major impediments to aquatic species connectivity within the Proposed Project limits of Aliso Creek mainstem include the 25-foot high ACWHEP structure; the engineered channel in Reach 10 barren of riparian vegetation and including two 10-foot drop structures; and Pacific Park Drive embankment/large ungated box culvert crossing at the upstream end of the project. At the Wood Canyon Creek confluence, the AWMA Road/culvert crossing and associated 25-foot streambed elevation drop downstream is a connectivity impediment to the tributary.

Proposed Project, would be the ACWHEP structure impediment, which would remain in place for this alternative (as concluded in Section 3.8.2.1). For Alternatives 3 and 4 (i.e. raise the streambed to approach the historic floodplain, or to an intermediate streambed elevation, respectively), the upstream limit for the first increment would instead be to the AWMA Road Bridge, as the reach directly upstream of this location (Reach 10) is an impediment. For these two alternatives, the ACWHEP structure would be removed as streambed raising eliminates the need for this large grade control structure.

3.8.3.2 Establishment of Base Alternatives

For each action preliminary alternative, the "minimum" alternative was established and identified as the *base* alternative. A base alternative is defined here to indicate an alternative that possesses the minimum number of measures necessary to achieve the basic goal of that alternative (e.g. maintain streambed similar to existing), and to create a sustainable aquatic and riparian habitat structure and function that is contiguous to the riverine corridor in the lowermost portion of the watershed. There is only one base alternative associated with each preliminary action alternative; its limits are defined by the first increment. Table 3.8-3 identifies the measures associated with each base alternative.

Once Base Alternatives 2, 3, and 4 were established, formulation of the focused array of alternatives consisted of assessing additional measures, associated with the various increment extents, which could be combined with each base alternative to create variations of the alternatives. The process of adding the combinable additional measures (while satisfying any established dependencies between measures) was through the use of Cost Effectiveness/Incremental Cost Analysis (CE/ICA), described in Section 3.8.8. Table 3.8-3 includes the additional measures that would be considered solely, or in various combinations, with the base alternatives, and similarly those that were considered with the other increments. These additional measures, refined from measures presented in Section 3.4, are fully described in Section 3.8.6.

In the following section, descriptions are presented of the No Action Plan (Alternative 1) and for Base Alternatives 2, 3, and 4.

Table 3.8-3 Establishment of Restoration Increments, Base Alternatives, and Relevant Measures

Increment Extent	Reaches	Justification for Extent Selected	Base Alternatives Measures	Additional Measures under Consideration[1, 2]
Preliminary Alternative 2 (Maintain similar as existing streambed elevation)				
1st: SOCWA CTP to ACWHEP	4A – 6	Length: 2.2 mi. Upstream limit is the ACWHEP structure, a significant barrier.	BASE ALTERNATIVE 2 - Establish natural channel design (regime) - Streambank recontouring - Revegetation - Exotic plant species/invasive eradication - Utilities/infrastructure protection in place (Reaches 4A-9)[3] - Sulphur Creek streambank and streambed protection; and exotic species screens	- Sinuosity downstream of Wood Canyon Creek - Newbury riffle weirs
2nd: ACWHEP to AWMA Road Bridge	7 – 9	Length: 1.4 mi. Upstream limit coincides with entrance to main region of Wilderness Park, and at the existing grouted drop structure at AWMA Road Bridge that acts as a control point.	(Not Applicable)	- Recontour channel between ACWHEP and AWMA Rd Bridge - Newbury riffle weirs
3rd: AWMA Road Bridge to Pacific Park Drive	10 – 12	Length: 1.4 mi. Upstream limit coincides with the downstream end of the ungated outlet structure of Pacific Park Drive detention basin. This segment of the project area would be evaluated as one increment due to the dependency of Reach 10 to Reach 11 and 12. Restoration benefit for Reach 10, an engineered reach barren of vegetation, would create an instream riparian corridor needed to provide aquatic species connectivity to the two other reaches in the increment.		- Newbury riffle weirs - Widen channel in Reach 10 and remove two 10-foot drop structures - Recontour channel:1,400 feet upstream of Aliso Creek Rd Bridge to Pacific Park Dr - Skate Park/soccer field relocation - Sinuosity at Skate Park/soccer field - Sinuosity downstream of Pacific Park Drive

Table 3.8-3 Establishment of Restoration Increments, Base Alternatives, and Relevant Measures

Increment Extent	Reaches	Justification for Extent Selected	Base Alternatives Measures	Additional Measures under Consideration[1, 2]
4th: Pacific Park Drive to I-5	Upstream of 12	Length: 3.5 mi. Upstream limit is I-5, as immediate reaches upstream are altered. Stewardship reaches pursued by stakeholders. Not part of Federal project. Requires Pacific Park Drive bypass feature at embankment crossing to establish aquatic species connectivity to upstream reaches.		- Pacific Park Drive bypass
Preliminary Alternatives 3 and 4 (Raise streambed to approach historic streambed or to intermediate elevation, respectively.)				
1st: SOCWA CTP to AWMA Road Bridge	4A – 9	Length: 3.6 mi. Upstream limit coincides with entrance to main region of Wilderness Park, where a rock riffle would be constructed at the AWMA Rd Bridge, replacing an existing small grouted drop structure. Streambed raising eliminates need for ACWHEP structure. A shorter increment extent was not considered to allow for maximum aquatic species connectivity gain that results from this 1st increment under with-project conditions.	BASE ALTERNATIVES AND 4 - Establish natural channel design (regime) - Streambank recontouring - Revegetation - Exotic plant species/invasive eradication - Utilities/infrastructure protection in place[3] - Sulphur Creek streambank and streambed protection; and exotic species screens - Raise streambed/reconnect historic floodplain (Alt 3) - Raise streambed/ intermediate elevation (Alt 4) - Remove physical barriers (ACWHEP) - Grade control stabilizers (rock riffles)	- Reconnect oxbow - Lower oxbow terrace - Sinuosity downstream of Wood Canyon Creek
2nd: AWMA Road Bridge to	10 – 12	Length: 1.4 mi. Upstream limit coincides with the downstream end of the ungated outlet structure of Pacific Park	(Not Applicable)	- Widen channel in Reach 10 and remove two 10-foot drop structures

Table 3.8-3 Establishment of Restoration Increments, Base Alternatives, and Relevant Measures

Increment Extent	Reaches	Justification for Extent Selected	Base Alternatives Measures	Additional Measures under Consideration[1, 2]
Pacific Park Drive		Drive detention basin. This segment of the project area would be evaluated as one increment due to the dependency of Reach 10 to Reach 11 and 12. Restoration benefit for Reach 10, an engineered reach barren of vegetation, would create an in-stream riparian corridor needed to provide aquatic species connectivity to the two other reaches in the increment.		- Recontour channel:1,400 feet upstream of Aliso Creek Rd Br to Pacific Park Drive - Skate Park/soccer field relocation - Sinuosity at Skate Park/soccer field - Sinuosity downstream of Pacific Park Drive
3rd: Pacific Park Drive to I-5	Upstream of 12	Length: 3.5 mi. Upstream limit is I-5, as immediate reaches upstream are altered. Stewardship reaches pursued by stakeholders. Not part of Federal project. Requires Pacific Park Drive bypass feature at embankment crossing to establish aquatic species connectivity to upstream reaches.		- Pacific Park Drive bypass
Wood Canyon Creek Confluence	No reach designations for tributary	Length: confluence area, 1,000 feet maximum. Consideration of Wood Canyon Creek aquatic species reconnection is dependent only on the first increment above. A restored contiguous system would result within the more substantive portion of the Wilderness Park and would not dependent on the 2nd and 3rd increment.		- Wood Canyon Creek landscape reconnection - Wood Canyon trail realignment

[1] Refined measures as presented in Section 3.8.6.
[2] Additional measures include sub-measures, as pertinent: establish natural channel design (regime); revegetation; and exotic plants species/invasives eradication.
[3] Utilities/infrastructure protection consists of buried riprap at specific locations. Extent of protection necessary under base alternative exceeds increment limit as protection from critical infrastructure threat is needed at reaches indicated upstream to ensure no undermining of ecosystem benefits downstream.

3.8.4 Description of Base Ecosystem Restoration Alternative Plans (and No Action Plan)

3.8.4.1 Alternative 1: No Action Plan

Under this alternative, the Federal government would take no action to restore ecosystem function or value within the Aliso Creek study area. The streambed and channel banks would continue to erode (vertically and horizontally) in reaches that are not yet dynamically stable, until a more stable geomorphic equilibrium condition (channel size and pattern) and new very limited inset floodplain is developed. The channel evolution sequence for this system could require more than 50 years. The incision of the streambed is expected to continue an additional three to four feet over the next 10 years in some reaches upstream and downstream of the ACWHEP structure (Tetra Tech 2014). The incised channel would be of sufficient depth to continue to preclude most overbanking from occurring, except for less frequent, very large storm events. Without overbanking, the opportunity for flood flow infiltration (aquifer recharge) to the historic floodplain and abatement of floodwater energy is repressed, resulting in a changed floodplain habitat. The S-bend (lower Subreach 4B), a distinct geomorphic feature offering channel complexity and associated habitat biodiversity (including freshwater marsh), would likely be cut off within the period of analysis (estimation – after year 25), a fate similar to the abandoned oxbow in the upper portion of the same subreach.

The riparian vegetation on the historic floodplains would likely continue to degrade in quality and would become more narrow, due to type converting to more upland composition as the connection to the water table is reduced below the maximum rooting depth of the predominate riparian species. This effect on the vegetative community is currently apparent in the more shallow rooted individuals as the vegetation is transitioning from a dense willow tree and shrub canopy to a more open canopy, mostly late successional, riparian community. The prevalence of steep streambed slopes would continue to degrade the value of the riparian structure that can establish within the incised channel, favoring a more haphazard community. Invasive species would outcompete native riparian species as unstable conditions, including higher flow velocities and erosive power from confined flows that can uproot the native vegetation, favor reestablishment of faster growing exotics. The outcome would be a riverine habitat of degraded function and structure, less suitable to support wildlife diversity, including species of special status. Significant barriers created by the ACWHEP structure and the perched tributary at Wood Canyon Creek would remain, promoting isolation of aquatic resources and degradation of aquatic habitat function and value.

Flood flows would continue to pose an imminent threat to public water supply, wastewater infrastructure, and public safety, with impacts to the environment and local economy, which relies on the recreational use and high esthetic value of the coastal region. SOCWA emergency efforts to protect pipelines at risk would be piecemeal and provide only short-term solutions.

Failure of channel banks immediately adjacent to ascending terrain could have an adverse impact on slope stability including existing landslides and terrain that has not been effected by sliding. Any potential slope failures from the surrounding hillsides affecting the floodplain could cause a significant change to the stream pattern at the base of the failure, and for some distance both upstream and downstream of the disturbance.

3.8.4.2 Base Alternative 2: Maintain Similar Streambed Elevation within Incised Channel Margins

The channel improvements for Base Alternative 2 are designed to provide a geomorphically stable channel (i.e. regime channel) within the existing incised channel margins from the SOCWA CTP Bridge at downstream limit to the ACWHEP structure at the upstream limit. These limits comprise Reaches 4A through 6.

The channel alignment would generally follow the existing channel alignment, and would utilize a single trapezoidal configuration with a bottom width of 50 feet and a top width of 95 feet. Bank slopes within the 10 percent ACE (10-year) would be recontoured to a stable 3H:1Vv slope. Existing inset terraces would be maintained as much as possible. An equilibrium streambed slope of 0.4 percent would be utilized.

The riparian corridor along the graded creek banks would be restored with site-derived riverine vegetation types (*Salix-Populus* Forest/Woodland Alliance, *Salix-Baccharis* Forest Alliance, *and Baccharis* Shrubland Alliance). Freshwater marsh (*Typha* herbaceous alliance) habitat would establish naturally, and once established could be maintained in designated areas, to be determined through the adaptive habitat management program. All exotic/invasive plants would be eradicated over time where present within the project area, as necessary, including giant reed, Pampas grass, and castor bean. The riparian and aquatic corridor vegetation along Aliso Creek would remain segmented by the significant elevation discontinuities at the ACWHEP structure and at the confluence with Wood Canyon Creek tributary. Aquatic wildlife connectivity would not be established to Wood Canyon, or upstream of ACWHEP. With a geomorphically stable channel, the S-bend would remain intact.

Streambank protection against stormflow erosion threat to critical infrastructure would consist of riprap stone buried under compacted fill. Streambank protection would be constructed along specific segments of the channel banks of Reaches 4A to 9 where the proposed channel alignment is in close proximity to existing wastewater utilities or to the west access road. The confluence area of Sulphur Creek (side slopes and stream bottom) would be lined with riprap to dissipate flow energies from the tributary and to protect adjacent infrastructure and cultural resources. Side slope stone protection would be buried under compacted fill in combination with a geosynthetic mat to allow riparian vegetation to establish.

At the Sulphur Creek confluence, screens would be placed on the upstream side of the culvert at Alicia Parkway to prevent the entry of exotic aquatic wildlife from upstream Sulphur Creek and reservoir.

3.8.4.3 Base Alternative 3: Raise Streambed Elevation to Reconnect to Historic Floodplain

The extent of the proposed improvements for Base Alternative 3 starts at the SOCWA CTP Bridge on the downstream end and continues to the AWMA Road Bridge at the upstream limit. These limits comprise Reaches 4A through 9.

Base Alternative 3 will raise the existing streambed to approach the pre-incised stream elevation (circa 1967) to improve hydrologic reconnection with the historic floodplain. An intermediate floodplain will also be constructed within the raised channel margin. The ACWHEP structure will be removed. Raising of the streambed will be transitioned, starting from upstream of the SOCWA CTP Bridge (Subreach 4A) and continuing upstream to reestablish connection at an elevation close to that of the ACWHEP structure (Reach 7). Upstream of ACWHEP, some additional streambed raising will occur along the remaining reaches to the AWMA Road Bridge. This alternative will reestablish connectivity for aquatic wildlife movement across the ACWHEP structure site. Aquatic wildlife passage, however, at Wood Canyon would be limited due to the AWMA Road crossing, which includes two small culverts. Streambed riprap protection will be provided at the confluence transition to preclude scouring.

The channel improvements for Base Alternative 3 are designed to provide a geomorphically stable channel (i.e. regime channel). The channel will be constructed to have a compound trapezoidal configuration. Specifically, a 200-foot-wide channel with a capacity for up to the 10 percent ACE (10-year flow event) would be constructed. This channel would contain a low-flow channel with a 100-foot top width and a 50 percent ACE (2-year) capacity, flanked by floodplain terraces (benches) on one or both sides. The inset floodplain terracing would be inundated when flows exceed the low-flow channel capacity. An equilibrium channel slope of 0.25 percent would be used. All side slopes will be a stable 3H:1V.

The riparian corridor on the overbanks, along the recontoured creek banks, and the inset floodplain terrace in Reaches 4A through 9 will be restored with site-derived riverine vegetation types (*Salix-Populus* Forest/Woodland Alliance, *Salix-Baccharis* Forest Alliance, *and Baccharis* Shrubland Alliance). Freshwater marsh (*Typha* Herbaceous Alliance) habitat would establish naturally, and once established could be maintained in designated areas, to be determined through the adaptive habitat management program. All exotic/invasive plants will be eradicated over time where present within the project area, as necessary, including giant reed, Pampas grass, and castor bean.

Riffle structures acting as grade control stabilizers, consisting of buried large boulders, will be placed in a series transverse to the channel and spaced at intervals required to support a projected equilibrium slope along the creek alignment. A sheetpile will be driven at each location to ensure streambed grade integrity is maintained in case of damage or loss of the riffle structure during a significant storm event. The riffle structures will promote pool and riffle habitat and allow fish passage. With a geomorphically stable channel, the S-bend will remain intact.

Streambank protection against stormflow erosion threat to critical infrastructure will consist of riprap stone buried under compacted fill. Streambank protection will be constructed along specific segments of the channel banks of Reaches 4A to 9 where the proposed channel alignment is in close proximity to existing wastewater utilities or to the west access road. The confluence area of Sulphur Creek (side slopes and stream bottom) would be lined with riprap to dissipate flow energies from the tributary and to protect adjacent infrastructure and cultural resources. Side slope stone protection would be buried under compacted fill in combination with a geosynthetic mat to allow riparian vegetation to establish.

At Sulphur Creek confluence, screens will be placed on the upstream side of the culvert at Alicia Parkway to prevent the entry of exotic aquatic wildlife from upstream Sulphur Creek and reservoir.

3.8.4.4 Base Alternative 4: Raise Streambed Elevation and Establish Intermediate Floodplain Connection

The extent of the proposed improvements for Base Alternative 4 starts at the SOCWA CTP Bridge on the downstream end and continues to the AWMA Road Bridge at the upstream limit. These limits comprise Reaches 4A through 9.

Base Alternative 4 would raise the existing streambed to an intermediate elevation between the current and the historic streambed, and construct an associated floodplain within the raised channel margin. Raising of the streambed would be transitioned, starting from upstream of the SOCWA Bridge (Subreach 4A) and continuing upstream to the ACWHEP structure (Reach 7). The elevation at the ACWHEP structure would be lowered to establish connection with the raised streambed downstream. The ACWHEP structure would be removed. Upstream of the ACWHEP structure, the streambed elevation would be lowered within Reach 7 to transition to the downstream elevation. Alternative 4 would reestablish connectivity for aquatic wildlife movement upstream of the ACWHEP structure. Although raising of the stream to an intermediate elevation would reduce the significant elevation discontinuity at the Wood Canyon Creek confluence, aquatic wildlife connection potential would not be achieved without additional regrading of the Wood Canyon Creek transition through the confluence area. Additionally for full restoration of aquatic wildlife passage, modifications to the AWMA Road crossing at the Wood Canyon Creek confluence, which includes two small culverts, would be required. Streambed riprap protection will be provided at the confluence transition to preclude scouring.

The channel improvements for Base Alternative 4 are designed to provide a geomorphically stable channel (i.e. regime channel). The channel will be constructed to have a compound trapezoidal configuration. Specifically, a 200-foot-wide channel with a capacity for up to the 10 percent ACE (10-year flow event) would be constructed. This channel would contain a low-flow channel with a 100-foot top width and a 50 percent ACE (2-year) capacity, flanked by floodplain terraces (benches) on one or both sides. The inset floodplain terracing would be inundated when flows exceed the low-flow channel capacity. An equilibrium channel slope of 0.25 percent would be used. All side slopes will be a stable 3H:1V.

The riparian corridor on the overbanks, along the recontoured creek banks, and the inset floodplain terrace in Reaches 4A through 9 would be restored with site-derived riverine vegetation types (*Salix-Populus* Forest/Woodland Alliance, *Salix-Baccharis* Forest Alliance, *and Baccharis* Shrubland Alliance). Freshwater marsh (*Typha* Herbaceous Alliance) habitat would establish naturally, and once established could be maintained in designated areas, to be determined through the adaptive habitat management program. All exotic/invasive plants would be eradicated over time where present within the project area, as necessary, including giant reed, Pampas grass, and castor bean.

Riffle structures acting as grade control stabilizers, consisting of buried large boulders, would be placed in a series transverse to the channel and spaced at intervals required to support a projected equilibrium slope along the creek alignment. A sheetpile would be driven at each location to ensure streambed grade integrity is maintained in case of damage or loss of the riffle structure during a significant storm event. The riffle structures would promote pool and riffle habitat and allow fish passage. With a geomorphically stable channel, the S-bend will remain intact.

Streambank protection against stormflow erosion threat to critical infrastructure would consist of riprap stone buried under compacted fill. Streambank protection would be constructed along specific segments of the channel banks of Reaches 4A to 9 where the proposed channel alignment is in close proximity to existing wastewater utilities or to the west access road. The confluence area of Sulphur Creek (side slopes and stream bottom) would be lined with riprap to dissipate flow energies from the tributary and to protect adjacent infrastructure and cultural resources. Side slope stone protection would be buried under compacted fill in combination with a geosynthetic mat to allow riparian vegetation to establish.

At the Sulphur Creek confluence, screens would be placed on the upstream side of the culvert at Alicia Parkway to prevent the entry of exotic aquatic wildlife from upstream Sulphur Creek and reservoir.

3.8.5 Additional Restoration Plans: USFWS Proposed Alternatives

In addition to the Corps' formulated ecosystem plans, the USFWS has suggested three preliminary alternatives for consideration in a PAL submitted to the Corps, dated August 28, 2015. Due to the timing of the submittal of the alternatives, the Corps was not able to pursue any feasibility-level engineering design work, habitat evaluation or cost assessment efforts for the USFWS alternatives prior to the required economic assessment conducted as part of the formulation process. As a result, these alternatives were evaluated in a qualitative manner, consistent with the evaluation metrics adopted for all the alternatives under consideration, and with the intention to pursue further analysis, as warranted, as part of the Corps' process undertaken to develop the recommended plan.

As noted in the letter, the USFWS recognized the value of restoring the streambed to pre-incision conditions that existed several decades ago; however, the agency noted concern that the Corps' proposed alternatives would largely eliminate the existing riparian systems as a result of substantial channel and streambank grading, with an ensuing lag time for habitat reestablishment. The USFWS is also concerned with the Corps use of significant grade control features associated with streambed raising alternatives. All of the USFWS alternatives would leave the discontinuity at the ACWHEP structure and at Wood Canyon Creek confluence in place. The USFWS indicated support for measures considered by the Corps upstream of AWMA Road Bridge. In the letter, they advocate the implementation of long-term use of gravel augmentation practices to address balances in the sediment regime and reduction of the erosive effects of sediment-starved water. The suggested alternatives are summarized below.

3.8.5.1 USFWS Alternative A

Alternative A proposes that substantial fill (rock and/or soil) would be imported and placed in the incised portions of the channel within the Wilderness Park. This would partially restore the creek streambed to historic conditions, likely seven to 14 feet above the current streambed grade. To limit impacts to existing vegetation, only the steeper slopes would be graded to a variable 1.5H:1V to 3H:1V, as appropriate. All graded soil material would be placed in the channel with the imported fill and not exported offsite. Most of the work would be performed along the channel bottom leaving riparian areas along the creek relatively undisturbed.

The ACWHEP structure would be modified as hydrologically necessary, including notching of the top, if appropriate, to improve upstream sediment transport processes. Substantial large rock would likely be needed at the base of ACWHEP to prevent erosion during design storm events and to form a pool. A series of riffles, comprised of large river-rounded rock, would be constructed downstream within the channel, at appropriate intervals, to help create and maintain pool-glide-riffle-run morphology and reduce stream competency. These rock riffles would be ungrouted and a portion of the placed rock would be buried within the channel side slopes. A matrix of sand, soil, and gravel would be placed over the imported fill material at a depth of about two to five feet in the morphology of natural pool-glide-riffle-run sequences complementary to the large rock geomorphology noted above. A portion of this matrix would be expected to be eroded, transported, and deposited within and through the park during most storm flow events. Substantial gravel augmentation matrix stockpiles would be placed along the channel for additional self-entrainment during large storm flow events, so as to protect the stream from future long-term incision during design storm events. If needed, additional gravel augmentation stockpiles would be placed along Aliso Creek upstream of the Park and at the ACWHEP structure (and possibly at other locations) for ease of future mechanical augmentation (e.g. by front-end loader) by local entities on an infrequent, as-needed basis.

3.8.5.2 USFWS Alternative B

Alternative B is similar to Alternative A, but includes less imported fill and gravel augmentation quantities and depths. Fill in the form of predominantly soil would be imported and placed within the incised portions of the channel within the Wilderness Park, to a depth of about two to five feet; cobble, gravel, and sand matrix augmentation to a depth of about two to three feet would be placed upon that. The creek invert elevations would be partially restored to historic conditions, likely to a total of four to eight feet above existing invert grade. Cut material from steep slope lay-back activities would also be placed within the channel at the same time as the soil fill. No export of graded soil material would occur from the project area. Most of the construction work on the creek would be performed linearly along the channel bottom, leaving relatively large riparian areas along the creek generally undisturbed.

Other aspects related to ACWHEP structure modification, placement of rock riffles to provide natural channel geomorphology, and gravel augmentation processes are similar to Alternative A above.

3.8.5.3 USFWS Alternative C

Alternative C would be similar to the Corps' Preliminary Alternative 2 strategy. However, to limit impacts to existing vegetation, it would reduce the laying back of channel slopes to only those areas with existing slopes steeper than 1V:1H, and then only to a variable 1.5V:1H to 3V:1H slope, based on the current condition/functions of areas that would be disturbed by grading and to create natural slope variability. Cut soil material from slope layback grading would be added as fill to portions of the channel thalweg, but no soil fill would be imported. Rounded river rock, cobble, gravel, and sand would be added to the streambed through augmentation efforts, though in reduced quantities compared to Alternative B.

3.8.5.4 Evaluation/Screening of USFWS Alternatives

For Alternatives A and B, the loss of channel capacity as a result of raising the streambed would likely cause more lateral instability as the creek would compensate by widening. Recontouring of only the steepest streambank slopes to reduce the angle, while leaving other segments unaltered, could further favor channel flow instabilities. Especially in the shorter term, large episodic contributions of sediment load from streambank failures during large storm events will potentially pose situations of undesired flooding and debris flow impacts, and more prevalently in any flow constricted areas. Due to the increased risks, the adjacent infrastructure would require more extensive protective features. Alternatives A and B were screened out due to the inherent high risks associated with unpredictable slope failures, channel migration, and impacts to infrastructure and property from heavy sediment-laden flows potentially resulting during large storm events.

Alternative C is considered less risky than Alternatives A and B, as channel conveyance is not compromised. However, similar risks identified above as associated with selective recontouring of streambanks would apply to Alternative C. As a result, the siting and extent of infrastructure protective features will need to consider this level of uncertainty. Unlike the Corps-led alternatives, a regime channel design would not be pursued. Alternative C will be carried forward for further evaluation and comparison with other developed alternatives of the focused array. The upstream limit of Alternative C would be at the ACWHEP structure for similar reasons as described in Table 3.8-3 for Alternative 2.

Regarding the use of gravel augmentation operation/processes, there is some question regarding its effectiveness for this system. A geomorphic assessment of lower Aliso Creek (Appendix A-1f) indicates that the channel system is already close to a state of quasi-equilibrium (limited future vertical incision). Similar to Alternatives A and B, there is an inherent risk with the introduction of large amounts of sediment to the system, which could lead to unintended flooding consequences (flow "bulking" effects).

3.8.6 Refinement of Ecosystem Restoration Measures

The array of additional measures to be considered for combination with the base alternatives are defined next. These additional measures are refinements of measures established in Section 3.5. The array of additional measures is presented in Table 3.8-4.

Table 3.8-4 Array of Additional Measures

Additional Measure	Description
Reconnect oxbow	An abandoned oxbow (upper Reach 4B and 5A) will be reconnected to become the main active channel through the area, based on the historical channel alignment, to restore riparian habitat in the oxbow.
Lower Oxbow Terrace	The oxbow terrace would be lowered to create a widened floodplain terrace (10 percent ACE – 10-year flow event) for Aliso Creek.
Sinuosity downstream of Wood Canyon Creek confluence	The channel alignment will be lengthened in this subreach to provide more sinuosity at this location.
Construction of Newbury riffle weirs	Newbury riffle weirs will be constructed along the channel streambed to create shallow pools. (Applies to Alternative 2 only; see Section 3.8.1.4)
Wood Canyon Landscape Reconnection	A small vehicular bridge (Wood Canyon Bridge) would replace the AWMA Road crossing and small double culverts over the Wood Canyon Creek tributary (within Reach 5C) to improve flow conveyance, eliminate the vegetation overgrowth, and restore a more natural passage for aquatic species between the tributary and mainstem. *Note: This measure will not be considered for Alternative 2 (refer to Section 3.8.2.3)*
Wood Canyon Trailhead Realignment	An 800-foot length of Wood Canyon trailhead would be realigned to the southwest to create more riparian habitat area upstream of the confluence and the AWMA Road crossing. *Note: This measure will not be considered for Alternative 2 as the habitat benefits gained would not be as valued without component of aquatic species connectivity to the tributary.*

Table 3.8-4 Array of Additional Measures

Additional Measure	Description
Recontour existing channel between ACWHEP structure and the AWMA Road Bridge	Steep existing channel banks will be recontoured to stable side slopes (3H:1V) between the ACWHEP structure and the AWMA Road Bridge in order to stabilize the incised main channel. (Applies to Alternative 2 only).
Widen Channel in Reach 10 and remove two 10-foot- high vertical drop structures	The east bank for approximately 2,000 feet in the vicinity of Aliso Creek Road Bridge (Reach 10) will be widened, using a sheetpile wall. Some rock riffles will be incorporated. The widened channel is necessary to create an instream riparian habitat corridor, which is currently non-existent due to engineered channel. Some raising (few feet) of creek elevation is needed in segments. The existing two 10-foot-high vertical drop structures within Reach 10 will be removed and replaced with a series of rock riffle structures to enable aquatic wildlife connectivity. *[Dependency with: Recontouring of existing channel from 1,400 feet upstream of Aliso Creek Road Bridge to Pacific Park Drive. Without inclusion of restored Reaches 11 and 12, there would be no aquatic wildlife connectivity with upstream high value restored habitat.]*
Recontouring of the existing channel from 1,400 feet upstream of the Aliso Creek Road Bridge to Pacific Park Drive	The existing channel (Reaches 11 and 12) will be raised, recontoured, and widened to include terracing and a series of rock riffles. This feature will also improve flow dynamics downstream of Pacific Park Drive and will improve habitat quality. This measure would deter further streambank erosion along west bank in segments that are threatening Aliso Creek Hiking and Riding Trail. Additionally, measure promotes aquatic species passage at major impediment at JRWSS crossing, as well as protection of this regional water pipeline. *[Dependency with widening channel in Reach 10; removal of two 10-foot-high vertical drop structures. Without inclusion of the restored Reach 10 riparian corridor, there would be no aquatic wildlife connectivity with downstream.]*
Skate park/soccer field relocation	A recreational complex (City of Laguna Niguel), which includes a skate park, soccer field, and parking lots, on the east bank of Aliso Creek upstream of the Aliso Creek Road Bridge will be relocated. The area will be regraded to be used as additional riparian habitat.
Sinuosity at skate park	The channel alignment will be lengthened to provide more sinuosity at this location. *[Dependency with Skate Park/soccer field relocation.]*
Sinuosity downstream of Pacific Park Drive	The channel alignment will be lengthened along the subreach to provide more sinuosity.
Pacific Park Drive Bypass	Introduction of Pacific Park Drive Bypass channel to provide aquatic wildlife connectivity at Pacific Park Drive embankment crossing. Utilizes pump system at upstream end to capture a portion of incoming flows into bypass. *[Dependency with removal of two 10-foot drop structures; widening in vicinity of Aliso Creek Bridge; and recontouring 1,400 feet upstream of Aliso Creek Bridge to Pacific Park Drive; or same components plus sinuosity downstream of Pacific Park Drive (calculated as net change).]*

3.8.7 Pre-CE/ICA Formulation Decisions

Prior to conducting CE/ICA, a refinement assessment was conducted that led to formulation decisions, including screening of the additional measures identified in Table 3.8-4. Decision making was based on input from environmental, hydraulics, sediment transport modeling, engineering design, and from agency coordination. A summary of the refinement assessment is provided in Table 3.8-5.

Table 3.8-5 Refinement Decisions/Screening

Description	Decision	Rationale
Alt. 2: Upstream Limit	Upstream limit is ACWHEP structure. *No measures will be considered upstream of ACWHEP in any combination with Base Alternative 2.*	As ACWHEP structure will remain a significant streambed discontinuity (25+ feet), there would be the disjunction of upstream and downstream mobility for aquatic species, including amphibians and special status species such as southwestern pond turtle. Any restoration efforts upstream of ACWHEP that would increase populations could present injury or mortality risk to these species should they be swept downstream over ACWHEP in a high-flow event.
Alt. 2: Use of Grade Control: Newbury Riffle Weirs	As the need for Newbury weirs is solely to promote earlier formation of pool and riffle systems, the use of this structure is not mandatory.	Sediment transport analysis results confirm reconfigured channel geometry and slope (0.4 percent) is close to dynamic equilibrium conditions. Placement of Newbury weirs would promote pool and riffle sequence to supplement channel's ability to form this regime naturally.
Alt. 2: Reconnect Oxbow	Oxbow reconnection will not be pursued for Alternative 2.	Deeply incised oxbow could render a limited habitat gain. The large footprint associated with the necessary regrading of streambank slopes would impact adjacent infrastructure.
Alt. 3 and 4: Wood Canyon Landscape Reconnection (Aquatic Species Connection)	Aquatic species connection to Wood Canyon tributary will be provided for Alternative 3 only. The measure will not be pursued for Alternative 4.	Remaining streambed grade discontinuity at confluence requires riprap streambed protection to preclude scouring. For Alternative 3, the 5 percent (or less) grade of the tributary connection downstream of the AWMA Road crossing would allow aquatic species migration. For Alternative 3, the study team preference was to avoid riprap-lining protection at the transition and instead to regrade the lower approximately 700 feet of the confluence for final design consideration. Use of some small rock riffle structures upstream of the AWMA Road crossing would decrease this total length. For Alternative 4, an 8 to 10 percent slope would necessitate a sequence of at least two closely-spaced, higher riffle height structures that would be esthetically inconsistent with the restoration intent. Alternately, the pursuit of a more gentle gradient transition would require substantial tributary streambed and streambank regrading, which would result in significant

Table 3.8-5 Refinement Decisions/Screening

Description	Decision	Rationale
		impacts, especially to the habitat. Alternative 4 reestablishment of aquatic species connectivity at Wood Canyon was therefore eliminated.
Alt. 2 and 4: Wood Canyon Trailhead Realignment	Wood Canyon Trailhead Realignment will not be pursued for Alternatives 2 and 4. Pursue only for Alternative 3.	The benefits provided by this measure would not be fully utilized without the presence of aquatic species connection at the confluence.
Alt 3 and 4: Lower Oxbow Terrace	Measure screened out	Incrementally larger amount of excavation and demands on disposal area. Landslide destabilization concerns as larger loss of buttressing effects from alluvial fill removal.
Alt 3 and 4: Skate park/soccer field relocation	Measure screened out	No viable sites for relocation could be identified. Considerations included the City of Laguna Niguel, and a nearby Federal parking lot (Chet Holifield Federal Building). Decision based on feedback from GSA and also local governmental agencies.
Alt 3 and 4: Sinuosity at skate park	Measure screened out	Not viable due to screened out Skate park/soccer field relocation.

Based on the outcome of the refinement assessment, Table 3.8-6 below summarizes the retained additional measures, their pertinent reaches, and their relevance for combining with the base alternatives to form alternative variations to develop the focused array using CE/ICA.

<table>
<tr><th colspan="6">Table 3.8-6: Relevance of Additional Measures in Generating Focused Array from Base Alternatives</th></tr>
<tr><th rowspan="2">Additional Measure</th><th rowspan="2">General Area</th><th rowspan="2">Specific Reaches</th><th colspan="3">Base Alternative Combinability</th></tr>
<tr><th>Alt 2</th><th>Alt 3</th><th>Alt 4</th></tr>
<tr><td>Reconnect Oxbow</td><td rowspan="3">SOCWA CTP to ACWHEP</td><td>upper 4B – 5A</td><td>x</td><td>✓</td><td>✓</td></tr>
<tr><td>Lower Oxbow Terrace</td><td>upper 4B – 5A</td><td>x</td><td>x</td><td>x</td></tr>
<tr><td>Sinuosity downstream of Wood Canyon Creek confluence</td><td>5C</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Recontour existing channel between ACWHEP structure and the AWMA Road Bridge (Alternative 2 only)</td><td>ACWHEP to AWMA Rd Bridge</td><td>7 - 9</td><td>x</td><td>-</td><td>-</td></tr>
<tr><td>Widen channel in Reach 10 and remove two 10-foot drop structures</td><td rowspan="6">AWMA Road Bridge to Pacific Park Drive</td><td>10</td><td>x</td><td>✓</td><td>✓</td></tr>
<tr><td>Recontour channel from 1,400 feet upstream of the Aliso Creek Road Bridge to Pacific Park Drive</td><td>11-12</td><td>x</td><td>✓</td><td>✓</td></tr>
<tr><td>Skate Park/soccer field relocation</td><td>upper 10</td><td>x</td><td>x</td><td>x</td></tr>
<tr><td>Sinuosity at Skate Park</td><td>upper 10</td><td>x</td><td>x</td><td>x</td></tr>
<tr><td>Sinuosity downstream of Pacific Park Drive</td><td>11</td><td>x</td><td>✓</td><td>✓</td></tr>
<tr><td>Pacific Park Drive Bypass</td><td>12 – limited 13</td><td>x</td><td>✓</td><td>✓</td></tr>
<tr><td rowspan="3">Construction of Newbury riffle weirs (Alternative 2 Only)</td><td>SOCWA CTP - ACWHEP</td><td>4A- 6</td><td>✓</td><td rowspan="3">-</td><td rowspan="3">-</td></tr>
<tr><td>ACWHEP to AWMA Rd Bridge</td><td>7- 9</td><td>x</td></tr>
<tr><td>AWMA Rd Bridge to Pacific Park Drive</td><td>10 - 12</td><td>x</td></tr>
<tr><td>Wood Canyon Trailhead Realignment</td><td rowspan="2">Wood Canyon Confluence</td><td>west of 5C</td><td>x</td><td>✓</td><td>✓</td></tr>
<tr><td>Wood Canyon Landscape Reconnection</td><td>tributary to 5C</td><td>x</td><td>✓</td><td>✓</td></tr>
<tr><td colspan="6">Note: ✓ - Applicable x - Eliminated - - Measure does not apply</td></tr>
</table>

3.8.8 Habitat Analysis

Corps guidance requires that the ecosystem related benefits of proposed alternatives be subjected to detailed economic analysis, allowing an explicit comparison of the costs and benefits associated with the alternatives. Consequently, it is necessary that the environmental benefits of the alternatives be based on some quantifiable unit of value. Since restoration value is difficult to monetize, instead of calculating benefits in monetary terms, Corps ecosystem restoration projects calculate the value and benefits of restored habitat using established habitat assessment methodologies. Comparing the alternatives in this manner facilitates the determination of the most cost-effective restoration alternative that meets restoration goals.

For this study, benefits (or outputs) have been quantified using the CHAP approach for the existing, future without-project, and future with-project conditions. Detailed information regarding the CHAP analysis is provided in Appendices B-2a through B-2c.

3.8.8.1 Results

An overall baseline CHAP assessment was originally performed for an analysis area extending 8.5 miles from the SOCWA CTP to I-5 as shown in Figure 3.8-4 (described in Section 2.7.8). The CHAP analysis area encompasses 691 acres and includes California Wildlife Habitat Types such as Valley Foothill Riparian, Riverine (Open Water), Coastal Scrub, Annual Grassland, and Urban. The baseline existing condition assessment calculated these acres to have a CHAP value of 8,916.2 HU. The CHAP evaluation calculated the future projections HUs for 25 years (8,346.3 HUs) and 50 years (6,862.3 HUs). The calculated average annual HUs is 8,117.8.

It should be noted that the with-project conditions analysis was conducted on a smaller subset of the baseline CHAP analysis area established for without-project conditions. The CHAP with-project analysis area for each restoration alternative is based on the footprint of the design (the spatial extent to which the landscape is being affected). The overall baseline study area encompasses all areas being evaluated in the alternatives analysis (and beyond), therefore a comparison between the alternative (or measure) and the baseline was attained by clipping the Geographic Information Systems (GIS) layer for the baseline to the exact extent of each alternative (or measure). Once the individual acreages of each base alternative and additional measure are established, the acreages are multiplied by the per-acre value to obtain habitat units. The HUs were calculated for existing, year 5, year 25, and year 50. Table 3.8-7 summarizes the AAHUs for the without-project (i.e. No Action), and the net AAHU increase generated by the with-project condition for the base alternatives and measures.

Figure 3.8-4 Baseline CHAP Analysis Area

Table 3.8-7 CHAP AAHUs for Restoration Footprints

Base Alternatives and Measures	AAHUs for No Action	Net AAHUs (over No Action)
Alt 2 Base	**719.5**	**569.9**
Sinuosity (Stream Lengthening) downstream of Wood Canyon Creek	132.6	19.5
Newbury Riffle Weir	98.5	12.6
Alt 3 Base	**1,823.6**	**2847.2**
Reconnect Oxbow	283.7	177.2
Sinuosity (Stream Lengthening) downstream of Wood Canyon Creek	121.5	7.9
Wood Canyon Realign Trail	102.1	56.4
Widen Channel and Recontour Channel[1]	541.8	451.5
Sinuosity (Stream Lengthening) downstream of Pacific Park Drive	338.4	59.8
Wood Canyon Landscape Reconnect	N/A[2]	1029.7
Pacific Park Drive Bypass Channel	10.7	1212.6
Alt 4 Base	**1,475.6**	**2153.6**
Reconnect Oxbow	267.0	193.5
Sinuosity (Stream Lengthening) downstream of Wood Canyon Creek	119.0	10.4
Widen Channel and Recontour Channel	541.8	450.7
Sinuosity (Stream Lengthening) downstream of Pacific Park Drive	338.1	59.8
Pacific Park Drive Bypass Channel	10.7	1212.6

[1] Widen Channel: Widening in the vicinity of the Aliso Creek Road Bridge; includes removal of two 10-foot drop structures and planting of riparian corridor.
Recontour Channel: Recontouring of the existing channel from 1,400 feet u/s of the Aliso Creek Road Bridge to Pacific Park Drive.
[2] As aquatic species connectivity is not present under the No Action condition, no baseline value assigned.

3.8.9 Cost Effectiveness and Incremental Cost Analysis

3.8.9.1 Input to CE/ICA

Cost Effectiveness and Incremental Cost Analysis (CE/ICA) was conducted using the IWR Planning Suite software (IWR-Plan). The CE/ICA is a planning tool that formulates alternative plans by considering all possible combinations of individual measures, taking into account which measures can be combined together and those that are dependent on each other. CE/ICA identifies cost-effective plans, to be considered as the focused array of alternatives, and the subset of cost-effective plans that are the most efficient in producing ecosystem restoration output, referred to as Best Buy Plans. This subset of plans is considered the final array of alternatives. The CE/ICA process assists in the identification of the NER Plan. The Corps' objective in ecosystem restoration is to contribute to NER, whose outputs are increases in the net quantity and/or quality of desired ecosystem resources. The NER plan is generally identified as the Best Buy Plan that reasonably maximizes restoration outputs relative to costs.

Table 3.8-8 below groups each base alternative with the relevant array of additional measures for consideration in combining to form alternative variations. For each base alternative and additional measure, the table shows the monetary cost and the environmental output. Costs include both total cost and average annual cost (AAC). The IWR Plan software was used to compute interest during construction and average annual costs based upon the total project first cost and periods of construction for each measure. The environmental output results were calculated from the CHAP model and are expressed in terms of average annual habitat units (AAHUs). The annualized AAHUs were calculated using IWR Plan's annualizer feature and based on linear interpolation of the shift in value over the period of analysis (50 years).

The USFWS Alternative C was not included in the CE/ICA analysis as there were no costs or habitat units generated for this alternative (refer also to Section 3.8.5). However a qualitative evaluation was pursued as part of the focused array analysis in Section 0.

Table 3.8-8 Total Costs, Average Annual Costs, and AAHUs for Base Alternatives and Measures

Base Alternatives and Measures [including CE/ICA Letter Codes[1]]	Total Cost[2]	AAC	Net AAHUs (over No Action)	AAC/ AAHU
Alt 2 Base [A]	$27,482,595	$1,157,547	569.9	$2,031
Sinuosity (Stream Lengthening) downstream of Wood Canyon Creek [B]	$1,351,524	$52,982	19.5	$2,723
Newbury Riffle Weir [C]	$263,164	$10,368	12.6	$823
Alt 3 Base [D]	$66,892,268	$2,805,831	2,847.2	$985
Reconnect Oxbow [E]	$5,197,620	$206,743	177.2	$1,167
Sinuosity (Stream Lengthening) downstream of Wood Canyon Creek [F]	$431,569	$17,052	7.9	$2,146
Wood Canyon Realign Trail [G]	$40,108	$1,772	56.4	$31
Widen Channel and Recontour Channel[3] [H]	$22,336,744	$889,853	451.5	$1,971
Sinuosity (Stream Lengthening) downstream of Pacific Park Drive [I]	$1,915,401	$74,127	59.8	$1,239
Wood Canyon Landscape Reconnect [J]	$978,592	$37,330	1,029.7	$36
Pacific Park Drive Bypass Channel [K]	$772,115	$29,577	1,212.6	$24
Alt 4 Base [L]	$75,788,945	$3,162,206	2,153.6	$1,468
Reconnect Oxbow [M]	$4,154,523	$163,837	193.5	$847
Sinuosity (Stream Lengthening) downstream of Wood Canyon Creek [N]	$337,858	$13,225	10.4	$1,269
Widen Channel and Recontour Channel [O]	$22,151,081	$876,490	450.7	$1,945
Sinuosity (Stream Lengthening) downstream of Pacific Park Drive [P]	$1,913,426	$73,845	59.8	$1,235
Pacific Park Drive Bypass Channel [Q]	$771,154	$29,541	1212.6	$24

Notes:
1. CE/ICA letter codes are not the same codes identified for “additional measures” in the following technical appendices: Design, Hydrology and Hydraulics, and Cost.
2. Total Costs do not include Interest during Construction (IDC) costs. Average Annual Costs (AAC) include IDC costs.
3. Widen Channel = Widening in the vicinity of the Aliso Creek Road Bridge; includes removal of two 10-foot drop structures and planting of riparian corridor.
Recontour Channel = Recontouring of the existing channel from 1,400 feet upstream of the Aliso Creek Road Bridge to Pacific Park Drive.

3.8.9.2 Combinability and Dependencies

All measures that are combinable with each base alternative will establish an associated array of completed alternatives. Combinability and dependency relationships are described below.

Alternative 2

Minimum Alternative: Base.
Combinability: All measures (pertinent to Alternative 2) combinable/additive to Base.
Dependencies: None between measures

<u>Alternative 3</u>

Minimum Alternative: Base.

Combinability/Dependencies:

1. Base cannot be combined solely with Pacific Park Drive Bypass Channel (PPDBC).
2. If PPDBC is present, widen channel and reconfigure channel, or widen channel and reconfigure channel and sinuosity downstream of Pacific Park Drive.
3. If sinuosity downstream of Pacific Park Drive is present, then widen channel and reconfigure channel.

<u>Alternative 4</u>

Minimum alternative and combinability/dependencies are similar to Alternative 3.

3.8.9.3 Cost Effective Analysis

After inputting all the costs and output for the proposed measures into the IWR Plan as well as the combinability and dependencies of measures established by the PDT, the model calculated 105 possible combinations (including No Action).

Figure 3.8-5 is a scatterplot of the restoration measure combinations generated by IWR Plan. The costs and outputs (net AAHUs over No Action) shown in the figures and tables of the CE/ICA are in average annual terms.

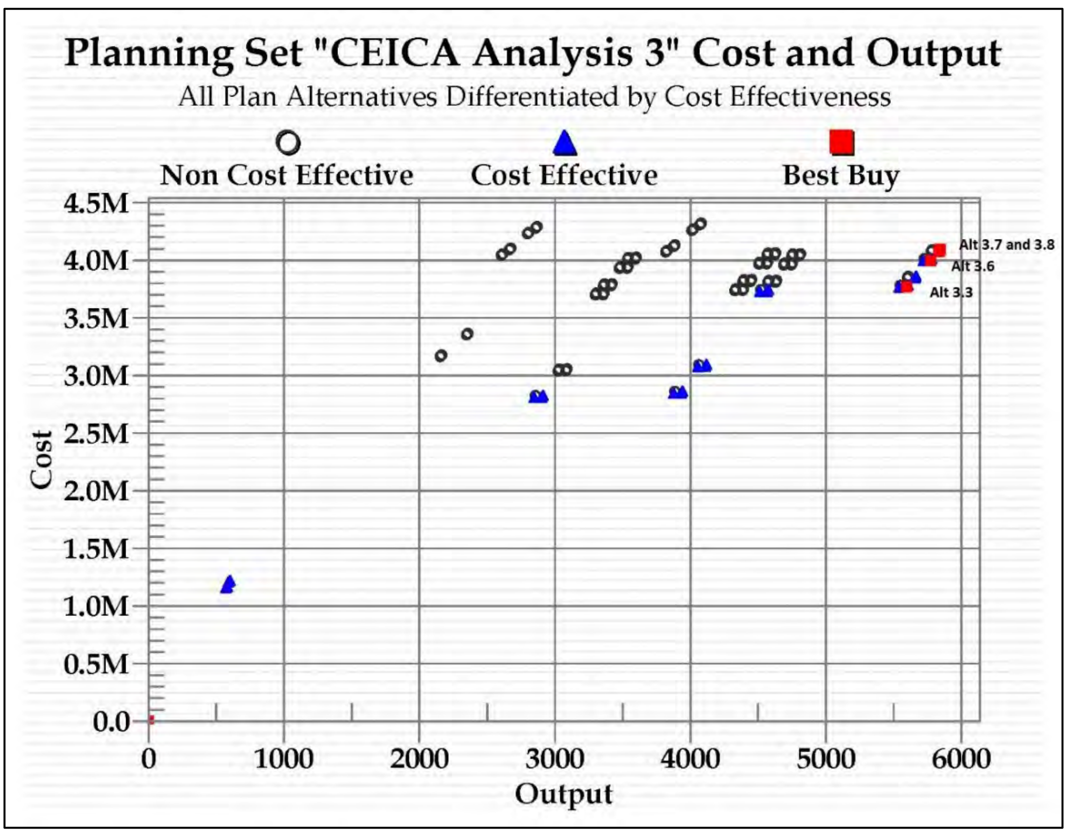

Figure 3.8-5 Average Annual Cost and AAHUs for All Plan Combinations

After all possible plan combinations are identified, the next step is to identify those plans that are cost effective. "Cost effective" means that, for a given level of non-monetary output, no other plan costs less, and no other plan yields more output for less money. Table 3.8-9 shows those plans that were screened as cost effective. The table shows that 27 plans were identified as cost-effective plans. Note that the corresponding lettering output generated by IWR Plan shown in the table corresponds to the letter codes associated with each base alternative and measure as presented in Table 3.8-8. (In Table 3.8-9, the numeral "1" that follows each letter indicates that the base/measure is activated, whereas a "0" (not included in the table) would indicate non-activation of the base/measure). The plans generated by CE/ICA include only combinations with either Base Alternatives 2 or 3. There were no cost-effective plans associated with Base Alternative 4.

Table 3.8-9 Identification of Cost Effective and Best Buy Plans

Plan No.	Name	AAC	AAHUs	AAC/ AAHU	Best Buy?	Focused Array No.
1	No Action Plan	$0	0.0	$0	✓	1.0
2	A1	$1,157,547	569.9	$2,031		2.1
3	A1C1	$1,167,916	582.5	$2,005		
4	A1B1	$1,210,529	589.3	$2,054		2.2
5	A1B1C1	$1,220,898	601.9	$2,028		2.3
6	D1	$2,805,831	2,847.2	$985		3.1
7	D1G1	$2,807,603	2,903.5	$967		
8	D1F1G1	$2,824,655	2,911.5	$970		
9	D1J1	$2,843,161	3,876.9	$733		
10	D1G1J1	$2,844,933	3,933.2	$723		3.2
11	D1F1G1J1	$2,861,985	3,941.2	$726		
12	D1E1J1	$3,049,904	4,054.1	$752		
13	D1E1G1J1	$3,051,676	4,110.4	$742		
14	D1E1F1G1J1	$3,068,728	4,118.4	$745		
15	D1H1K1	$3,725,261	4,511.3	$826		
16	D1G1H1K1	$3,727,033	4,567.7	$816		
17	D1F1G1H1K1	$3,744,085	4,575.6	$818		
18	D1H1J1K1	$3,762,591	5,541.0	$679		
19	D1G1H1J1K1	$3,764,363	5,597.4	$673	✓	3.3
20	D1F1G1H1J1K1	$3,781,415	5,605.3	$675		
21	D1G1H1I1J1K1	$3,838,490	5,657.2	$679		3.4
22	D1F1G1H1I1J1K1	$3,855,542	5,665.2	$681		3.5
23	D1E1H1J1K1	$3,969,334	5,718.2	$694		
24	D1E1G1H1J1K1	$3,971,106	5,774.6	$688	✓	3.6
25	D1E1F1G1H1J1K1	$3,988,158	5,782.5	$690		
26	D1E1G1H1I1J1K1	$4,045,233	5,834.4	$693	✓	3.7
27	D1E1F1G1H1I1J1K1	$4,062,285	5,842.4	$695	✓	3.8

3.8.9.4 Incremental Cost Analysis

Incremental cost analysis is used as a tool to compare the additional costs to the additional outputs of an alternative, or measure (feature). The analysis consists of examining increments of plans or project features to determine their incremental costs and incremental benefits. Increments of plans continue to be added and evaluated as long as the incremental benefits exceed the incremental costs. When the incremental costs exceed the incremental benefits, no further increments are added. Incremental analysis helps identify and display variations in costs among different increments of restoration measures and alternative plans. The incremental cost analysis compares the incremental costs for each additional unit of output from one cost-effective plan to the next to identify "best buy" plans.

The first Best Buy Plan (D1G1H1J1K1) has the lowest incremental cost per unit of output over the No Action Plan. Per letter code convention in Table 3.8-8, this plan corresponds to:

- Base Alternative 3 (Letter "D")
- Wood Canyon Trailhead Realignment (Letter "G")
- Widen Channel and Recontour (Letter "H")
- Wood Canyon Landscape Reconnection (Letter "J")
- Pacific Park Drive Bypass Channel (Letter "K")

The next Best Buy Plan (D1E1G1H1J1K1) is identified by calculating and comparing the incremental cost per unit of output over the last identified Best Buy Plan (D1G1H1J1K1). The processing of incremental cost continues until the last best buy plan is selected (D1E1F1G1H1I1J1K1). Table 3.8-9 above identifies the Best Buy Plans.

The last column of Table 3.8-9 indicates plans (and assigned designation numbers) that were selected by the PDT to include in the focused array of alternatives. Some of the cost-effective plans that are identified are not Best Buy plans. Further discussion will be included in the next section, including descriptions of these selected alternatives.
Table 3.8-10 below summarizes the final results of the CE/ICA. As shown, five Best Buy Plans (including the No Action plan) were identified. The table shows both costs and outputs in average annual terms. The first Best Buy Plan is Alternative 3.3. The incremental AAC per AAHU is $673. The next Best Buy Plan is identified as Alternative 3.6. The incremental AAC/AAHU for this Best Buy Plan is $1,167 (or about twice the incremental cost per output for Alternative 3.3). The next Best Buy Plan is Alternative 3.7. This plan has only a slightly higher incremental cost per output than Alternative 3.6. The largest Best Buy Plan is Alternative 3.8. The incremental AAC/AAHU for this plan ($2,145) is substantially higher than the smaller plans.

Table 3.8-10 Incremental Cost Analysis – Best Buy Plans
(FY16 Price Levels; FY 17 Discount Rate, 2.875%)

Name	AAC	AAHUs	AAC/ AAHU	Incremtl. AAC	Incremtl. AAHUs	Incremtl. AAC/AAHU
No Action Plan	$0	0	$0	$0	0	$0
Alternative 3.3	$3,764,363	5,597	$673	$3,764,363	5,597	$673
Alternative 3.6	$3,971,106	5,775	$688	$206,743	177	$1,167
Alternative 3.7	$4,045,233	5,834	$693	$74,127	60	$1,239
Alternative 3.8	$4,062,285	5,842	$695	$17,052	8	$2,145

Figure 3.8-6 shows a box plot of the incremental average annual cost per incremental gain in output for the five Best Buy Plans. Of particular note for this graph is that the incremental cost per output for the largest Best Buy Plan is significantly higher than that of the smaller Best Buy Plans.

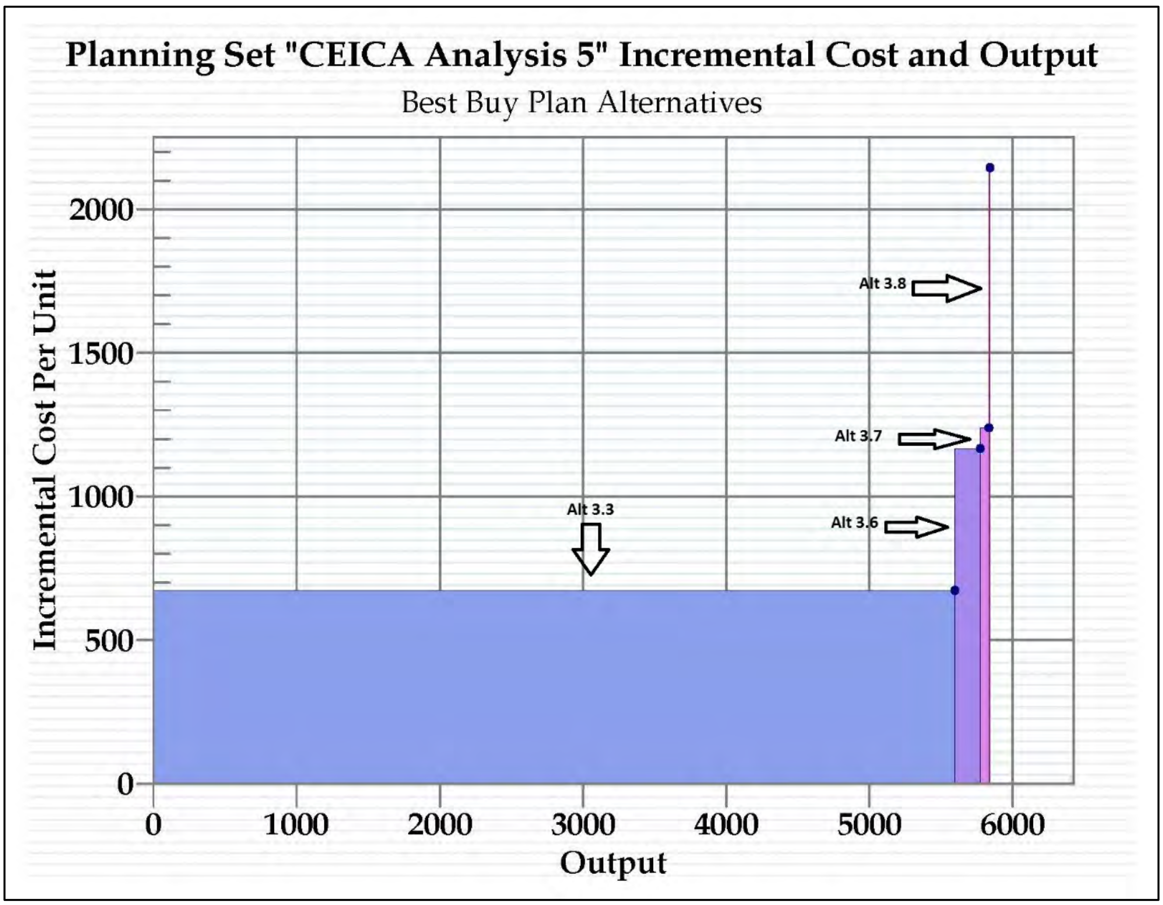

Figure 3.8-6 Incremental Average Annual Cost per AAHU for Best Buy Plans

3.8.10 Post-CE/ICA Cost Estimate Revision (Real Estate)

The baseline cost estimate for real estate requirements presented in the Draft Real Estate Plan for the TSP is approximately $17,115,000. This cost differs from the real estate cost derived from the CE/ICA output associated with the TSP. The real estate cost for the TSP associated with CE/ICA outputs is $16,523,000 (refer to Table C29 in Appendix C-1).

The basis for the difference in real estate costs is due to some omitted estates, as described below. The estates, and their respective costs, had been identified following the completion of the CE/ICA.

The values reflected in the CE/ICA did not include costs for a temporary road easement on the west side of Aliso Creek associated with a portion of Reach 7 to Reach 9; and a temporary habitat reservation area easement (required for the temporary vireo habitat area described in Section 4.3.2.6), on the east side of Aliso Creek within Reaches 7 and 8. Also not included were permanent road easement costs associated with OMRR&R access needs for the Proposed Project area within Reaches 10 to 12 and a limited segment within the downstream-most portion of Reach 13.

The need for the identified temporary easements and respective extents are applicable, and in the same amount (approximately $235,000) for all Alternative 3 variations established by the CE/ICA. The permanent road easements are applicable and consistent for all alternative variations extending upstream of Reach 9. The estimated value of the identified permanent easements is approximately $300,000. This cost, distributed proportionately over the key channel segments that comprise the majority of the extent between Reach 10 and lowermost Reach 13, with a total cost of almost $20 million, would have a negligible effect on the CE/ICA accounting. The omission of the temporary and permanent easement estates also proportionately reduces the non-Federal administrative costs related to the provision of the respective LERRDs by approximately $54,000. The CE/ICA had revealed a significant increase in outputs in the transition from Alternative 2 variations to Alternative 3 variations. This trend would remain unchanged should the omitted items be included in the analysis.

The need to rerun CE/ICA is not warranted as the inclusion of the omitted items would not affect the outcome of the analysis, and ultimately the TSP identification.

3.8.11 Focused Array of Alternatives

Table 3.8-11 summarizes the focused array of alternatives of ecosystem restoration plans, including the No Action plan. Alternatives 1 through 3.8 represent the cost-effective alternative plans that were identified by the CE/ICA analysis. This array does not comprise all Best Buy Plans. This array was selected to satisfy NEPA requirements to consider a broad range of alternatives in the evaluation process. Alternative 4 and its variations were not included as none were shown to be cost-effective by CE/ICA.

The criteria that was used to establish which alternatives from CE/ICA to include in the focused array that were not Best Buy Plans (Alternatives 1; 3.3; 3.6; 3.7; and 3.8) follow below. These criteria are based upon further discussions of the PDT. These plans are: 2.1, 2.2, 2.3, 3.1, 3.2, 3.4, and 3.5. The focused array also includes the USFWS Alternative C. Other USFWS alternatives (A and B) were previously screened out (Section 3.8.5.4).

- For Alternative 2 variations, the alternative that only considered the addition of Newbury weirs was not included. The eventual formation of pools and riffles without these added structures warranted this decision.
- For a restored contiguous and biodiverse system within the main portion of the Wilderness Park (i.e. downstream of the main entrance at AWMA Road Bridge), if aquatic species connectivity to Wood Canyon Creek confluence was not attained, Alternative 3 variations that provided connection to Pacific Park Drive were not considered.
- For Alternative 3 variations with an upstream limit of AWMA Road Bridge and inclusion of Wood Canyon Creek connectivity, no other additive features were further considered to add to effectiveness or efficiency metrics as aquatic species viability risk was already a concern without these.
- Alternative 3 variations whose sole sinuosity feature was the downstream of Wood Canyon confluence location were not considered due to the limited benefit of this feature.
- For Alternative 3 variations with an upstream limit of AWMA Road Bridge and no inclusion of Wood Canyon Creek connectivity, only one alternative was considered. Additional features creating new variations would not increase aquatic species connectivity benefits.
- Alternative 3 variations that did not include the Wood Canyon trail realignment but included the Wood Canyon Creek connection were not considered. The small incremental investment to include the trail realignment was worth it for the synergy it provides (i.e. widened riparian zone).

Table 3.8-11 Descriptions of Focused Array of Alternatives for Ecosystem Restoration

Alternative	Description
1	**No Action**
2	**Maintain Streambed Elevation Similar to Existing**
2.1 (aka "Base 2")	Restore from SOCWA CTP to ACWHEP • Recontour all streambanks to a stable slope
2.2	Same as Alternative 2.1 Add: • Sinuosity downstream of Wood Canyon confluence
2.3	Same as Alternative 2.2 Add: • Newburry weirs
3	**Raise Streambed Elevation Approach Historic Levels**
3.1 (aka "Base 3")	Restore from SOCWA CTP Bridge to AWMA Road Bridge • Recontour streambanks to stable slopes. • Widen channel to include 50 percent ACE (2-year) floodplain terraces. • Rock riffle structures. • Remove ACWHEP.
3.2	Same as Alternative 3.1 Add: • Wood Canyon landscape reconnection • Wood Canyon trailhead realignment
3.3 **Best Buy Plan**	Restore from SOCWA CTP Bridge to Pacific Park Drive Same as Alternative 3.2 Add: • Remove two 10-foot high drop structures • Widen channel in vicinity of Aliso Creek Road Bridge • Recontour channel up to Pacific Park Drive • Pacific Park Drive bypass
3.4	Same as Alternative 3.3 Add: • Sinuosity downstream of Pacific Park Drive
3.5	Same as Alternative 3.3 Add: • Sinuosity downstream of Pacific Park Drive • Sinuosity downstream of Wood Canyon confluence
3.6 **Best Buy Plan**	Same as Alternative 3.3 Add: • Reconnect Abandoned Oxbow
3.7 **Best Buy Plan**	Same as Alternative 3.3 Add: • Reconnect Abandoned Oxbow • Sinuosity downstream of Pacific Park Drive
3.8 **Best Buy Plan**	Same as Alternative 3.3 Add: • Reconnect Abandoned Oxbow • Sinuosity downstream of Pacific Park Drive • Sinuosity downstream of Wood Canyon confluence
USFWS	
C	Similar to Alternative 2; however, streambanks graded back only in areas with steep slopes. Features include: • Riffles to promote pool-riffle regime • Gravel Augmentation Program (utilizing stockpiles)

3.8.12 Focused Array Analysis

3.8.12.1 Evaluation of Focused Array

The evaluation of the focused array of alternatives allows assessment and appraisal of the effects of the with-project conditions of each plan, and comparison to the future without-project conditions. Following evaluation and subsequent comparison of the focused array, the final array of alternatives will be selected, from which a tentatively selected plan will be identified.

Table 3.8-12 summarizes the evaluation of the focused array of alternatives. Accompanying each evaluation of a Corps-led formulated alternative is a brief description of the alternative and a display of AAHUs; total project first costs (i.e. costs to implement the project); and real estate costs of lands to be acquired for the project, with relative percentage of first costs.

The criteria established by the PDT to be the most important in the evaluation of the focused array of alternatives are presented below. The metrics adopted assist to identify the performance of an alternative plan and provide a basis for comparison on how well study objectives are met. These criteria inform the categories of aquatic species connectivity and viability; floodplain connectivity; quality and expanse of riparian habitat, including successional stage diversity; protection of critical infrastructure, and the relative need for disposal sites.

- Habitat Improvement and Connectivity
  - Fate of ACWHEP Structure
  - Floodplain Hydrology Connectivity (for the 2-, 10-, and 100-year, or Q2, Q10 and Q100, respectively)
  - Associated Groundwater Rise for Root Connection
  - Riparian Vegetation
  - Aquatic Wildlife Connectivity
  - Aquatic Wildlife Benefit
- Critical Infrastructure Protection
- Excess Earthwork Materials Requiring Disposal
  - Quantities (yd3)

Table 3.8-12 Focused Array Evaluation

Alt	Description	AAHUs (net over No Action)	Restoration First Cost ($M)	Land Value Tot. ($M) (%)	Disposal (10^3 cy)	Metrics Evaluation
1	**No Action**	-	-	-	-	
2	**Maintain Similar Streambed Elevation**					
2.1	"Base 2" Restore from SOCWA CTP to ACWHEP; Recontour all streambanks to a stable slope.	570	27.5	7.7 (28%)	170	**Reach**: SOCWA CTP to ACWHEP (2.2 mi total) **ACWHEP Structure**: Remains intact **Q2 Floodplain Area**: No change over No Action **Q10 and Q100 Floodplain Area**: Slight increase (7%; 15%) over No Action **Associated Groundwater Rise**: None, as streambed not raised **Riparian Vegetation**: Entrenched channel vegetation (100-ft top width channel) subject to higher flow regimes and recurring loss, leading to less structural diversity (mostly early successional); overbank riparian remains narrow, less dense, mostly late successional (mature) community **Aquatic Wildlife Connectivity**: No connection to Wood Canyon, or upstream of ACWHEP **Aquatic Wildlife Benefit**: Genetic diversity at risk; species dispersion compromised by ACWHEP **Infrastructure Protection**: SOCWA utility corridor and AWMA (Reaches 4A-9).
2.2	Same as 2.1 plus: Sinuosity downstream of Wood Canyon.	589	28.8	7.9 (28%)	215	
2.3	Same as 2.2 plus: Newbury weirs to ensure establishment of pool/riffle regime.	602	29.1	7.9 (27%)	215	
3	**Restore Historic Streambed Elevation**					
3.1	"Base 3" Restore from SOCWA CTP to AWMA Road Bridge; Recontour streambanks to stable slope; Widen	2,847	66.9	12.7 (19%)	30	**Reach**: SOCWA CTP to AWMA Rd bridge (3.6 mi total) **ACWHEP Structure**: Removed

Table 3.8-12 Focused Array Evaluation

Alt	Description	AAHUs (net over No Action)	Restoration First Cost ($M)	Land Value Tot. ($M) (%)	Disposal (10^3 cy)	Metrics Evaluation
	channel; 50% ACE (2-year) floodplain terraces; Riffle structures (grade control and promote pool/riffle regime); Remove ACWHEP.					**Q2 Floodplain Area**: Substantial increase (90%) over No Action **Q10 and Q100 Floodplain Area**: Moderate (58%; 46%) increase over No Action **Associated Groundwater Rise**: Yes; with streambed raising. Benefits riparian margin in historic floodplain. **Riparian Vegetation**: Broader band of riparian vegetation within 200-foot (top width) terraced channel, with more heterogeneous structural diversity (early and mid-successional). Overbank riparian corridor widens due to local raised groundwater, establishing denser, multilayer canopy tree and shrub, mid to late successional community. **Aquatic Wildlife Connectivity**: No connection to Wood Canyon, or upstream of AWMA Bridge. **Aquatic Wildlife Benefit**: Genetic diversity at risk; no dispersion upstream of AWMA bridge due to lack of vegetation in Reach 10. **Infrastructure Protection**: SOCWA utility corridor and AWMA Road (Reaches 4A-9)
3.2	Same as 3.1 plus: Wood Canyon landscape reconnection and trailhead realignment.	3,933	67.9	12.8 (19%)	60	Same as 3.1, except: **Aquatic Wildlife Connectivity**: Connection to Wood Canyon tributary. **Aquatic Wildlife Benefit**: Genetic diversity at risk; no dispersion upstream of AWMA Bridge.

Table 3.8-12 Focused Array Evaluation

Alt	Description	AAHUs (net over No Action)	Restoration First Cost ($M)	Land Value Tot. ($M) (%)	Disposal (10^3 cy)	Metrics Evaluation
3.3	**Best Buy Plan** Restore from SOCWA CTP to Pacific Park Drive. Same as 3.2 plus: Remove two 10-foot high drop structures; Widen channel at Aliso Creek Road bridge; Recontour channel to Pacific Park Drive; Pacific Park Drive bypass.	5,597	91.0	15.7 (17%)	130	**Reach**: SOCWA CTP to Pacific Park Drive (5.0 mi total) **ACWHEP Structure**: Removed. **Q2 Floodplain Area**: Substantial increase (112%) over No Action. (Note: Stewardship miles not included) **Q10 Floodplain Area**: Substantial increase (94%) over No Action. (Note: Stewardship miles not included) **Q100 Floodplain Area**: Moderate increase (61%) over No Action. (Note: Stewardship miles not included) **Associated Groundwater Rise**: Yes; with streambed raising. Benefits riparian margin in historic floodplain. **Riparian Vegetation**: Broader band of riparian vegetation within 200-foot terraced channel, with heterogeneous structural diversity (early and mid-successional). Overbank riparian corridor widens due to local raised groundwater, establishing denser, multilayer canopy tree and shrub, mid- to late-successional community. **Aquatic Wildlife Connectivity**: Connection to Wood Canyon Creek tributary, and to Stewardship reaches upstream of Pacific Park Drive to I-5 Freeway. **Aquatic Wildlife Benefit**: Promotes genetic diversity.

Table 3.8-12 Focused Array Evaluation

Alt	Description	AAHUs (net over No Action)	Restoration First Cost ($M)	Land Value Tot. ($M) (%)	Disposal (10^3 cy)	Metrics Evaluation
						Infrastructure Protection: SOCWA utility corridor and AWMA Road selectively protected between CTP to Sulphur confluence. Realigned and raised reach between Skate Park and Pacific Park Drive for flow dynamics and habitat improvement, also provides ancillary benefits resulting from protection against west bank erosion threat to OC Parks service road/trail and to JRWSS (regional water supply line crossing).
3.4	Restore from SOCWA CTP to Pacific Park Drive. Same as 3.3 plus: Sinuosity downstream of Pacific Park Drive.	5,657	92.9	16.3 (18%)	170	Similar to 3.3, with additional gain to floodplain areas due to added sinuosity.
3.5	Restore from SOCWA CTP to Pacific Park Drive. Same as 3.3 plus: Sinuosity downstream of Pacific Park Drive; Sinuosity downstream of Wood Canyon.	5,665	93.4	16.4 (18%)	180	Similar to 3.3, with additional small gain to floodplain areas due to added sinuosity.
3.6	**Best Buy Plan** Restore from SOCWA CTP to Pacific Park Drive. Same as 3.3 plus: Reconnect Oxbow.	5,775	96.2	16.5 (17%)	300	Similar to 3.3, with some additional gain to floodplain areas due to added sinuosity.
3.7	**Best Buy Plan** Restore from SOCWA CTP to Pacific Park Drive. Same as 3.3 plus: Sinuosity downstream of	5,834	98.1	17.2 (18%)	340	Similar to 3.3, with some additional small gain to floodplain areas due to added sinuosity.

Table 3.8-12 Focused Array Evaluation

Alt	Description	AAHUs (net over No Action)	Restoration First Cost ($M)	Land Value Tot. ($M) (%)	Disposal (10^3 cy)	Metrics Evaluation
	Pacific Park Drive; Reconnect Oxbow.					
3.8	**Best Buy Plan** Restore from SOCWA CTP to Pacific Park Drive. Same as 3.3 plus: Sinuosity downstream of Pacific Park Drive; Reconnect Oxbow; Sinuosity downstream of Wood Canyon.	5,842	98.6	17.3 (18%)	350	Similar to 3.3, with some additional small gain to floodplain areas due to added sinuosity.
C	USFWS Alternative Similar to Alt 2, however, only lay back steep slopes where applicable. Incorporate riffles to promote pool and riffle system; Utilize gravel augmentation (mechanical or stockpiles).	No habitat evaluat ion perfor med.	No cost estimates developed.			**Reach**: SOCWA CTP to ACWHEP (2.2 mi total). **ACWHEP Structure**: Remains intact. **Q2 Floodplain Area**: Similar to Alt 2: No change over No Action. **Q10 and Q100 Floodplain Area**: Similar to Alt 2: Slight increase over No Action. **Associated Groundwater Rise**: None, as streambed not raised **Riparian Vegetation**: Entrenched channel vegetation (100-foot top width channel) subject to higher flow regimes and recurring loss, leading to less structural diversity (mostly early successional); overbank riparian remains narrow, less dense, mostly late successional (mature) community **Aquatic Wildlife Connectivity**: No connection to Wood Canyon, or upstream of ACWHEP **Aquatic Wildlife Benefit**: Genetic diversity at risk; species dispersion

Table 3.8-12 Focused Array Evaluation						
Alt	**Description**	**AAHUs (net over No Action)**	**Restoration First Cost ($M)**	**Land Value Tot. ($M) (%)**	**Disposal (10^3 cy)**	**Metrics Evaluation**
						compromised by ACWHEP **Infrastructure Protection**: SOCWA utility corridor and AWMA (Reach 4A-9).

3.8.12.2 Comparison of the Focused Array

Table 3.8-13 and Table 3.8-14 summarize the comparison of the focused array of alternatives. Metrics include how the alternatives compare in meeting the planning objectives, risk and uncertainty associated with bank erosion and threat to infrastructure, project sustainability (key factors for operability), flooding impacts to the east and west access roads, and potential impacts related to geotechnical issues (landslides) and cultural resources.

The action alternatives developed by the PDT (2.1-2.3; and 3.1-3.8) utilize principles of natural channel design (regime channel) to create a stable stream channel and functions that seek to balance the watershed’s flow of water and sediment loads over time, so that the channel does not significantly aggrade or degrade. The USFWS’ Alternative C does not use the regime channel design concept and seeks to reduce stream degradation by maintaining a periodic introduction of sediment to the system by way of stockpiled materials strategically placed within channel and floodplain system.

All alternatives will require recontouring of the channel geometry, though those grouped under Alternatives 2 and 3 will require more extensive earthwork operations, especially in regrading channel side slopes to more gentle angles.

Table 3.8-13 Focused Array Comparison: Ecosystem Restoration Metrics

			Objective 1 Restoration of Riverine Habitat Structure and Function							**Objective 2 Floodplain Connect; Channel Stability**		
Alt	**Description (*Best Buy Plan)**	**Project Footprint**	**ACWHEP Removed**	**Aliso Aquatic Wildlife Connect (mi)**	**Wood Canyon Connect Aquatic**	**Aquatic Wildlife Genetic Diversity**	**Riparian Veg Benefit: Channel**	**Riparian Veg Benefit: Overbank**	**Groundwater Rise**	**Floodplain Function Increase (net over No**	**Sinuosity Gain (net over No Action)**	**Channel Stability (and no. of Riffles)**
1	No Action	-	No	2.2	0	At risk; barrier at ACWHEP	Unstable. Limited to early succes'l; frequent loss	Narrow; less dense; mostly late succes'l	No	-	-	-
2	Maintain Similar Streambed Elevation											
2.1	Base 2	SOCWA to ACWHEP (Rch. 4A-6)	No	2.2	0	At risk; barrier at ACWHEP	Limited to early succes'l; frequent loss	Narrow; less dense; mostly late succes'l	No	Slight	None	Yes; regime
2.2	2.1 + Sinuosity (WC)										Slight	
2.3	2.2 + Newbury Weirs										Slight	Yes; regime; (11)
3	Restore Historic Streambed Elevation											
3.1	Base 3	SOCWA to AWMA Br (Rch. 4A-9)	Yes	3.6	0	At risk; barrier at first 10-ft drop structure	Early and mid-succes'l	Wider, denser, mid-to late succes'l	Yes	Moderate	None	Yes; regime (34)
3.2	Base 3 + WC connect + WC Trailhd				3.5							
3.3*	3.2 +Widen/Recontour Chl +PPDBC	SOCWA to Pac Park Dr (Rch. 4A-12)	Yes	5 (Plus 3.5 mi Steward-ship reaches to I-5)	3.5	Promotes genetic diversity; Barriers removed	Early and mid-succes'l	Wider, denser, mid-to late succes'l	Yes	Substantial	None	Yes; regime
3.4	3.3 + Sinuosity (PPD)										Slight	(47)
3.5	3.3 + Sinuosity (PPD+WC)											
3.6*	3.3 + Oxbow										High	Yes; regime (46)
3.7*	3.3 + Oxbow + Sinuosity (PPD)											

Table 3.8-13 Focused Array Comparison: Ecosystem Restoration Metrics												
			Objective 1 Restoration of Riverine Habitat Structure and Function							Objective 2 Floodplain Connect; Channel Stability		
Alt	**Description (*Best Buy Plan)**	**Project Footprint**	**ACWHEP Removed**	**Aliso Aquatic Wildlife Connect (mi)**	**Wood Canyon Connect Aquatic**	**Aquatic Wildlife Genetic Diversity**	**Riparian Veg Benefit: Channel**	**Riparian Veg Benefit: Overbank**	**Groundwater Rise**	**Floodplain Function Increase (net over No**	**Sinuosity Gain (net over No Action)**	**Channel Stability (and no. of Riffles)**
3.8*	3.3 + Oxbow + Sinuosity (PPD, WC)											
	USFWS Alternative											
C	Similar to Alt 2; limited grading	SOCWA to ACWHEP (Rch. 4A-6)	No	2.2	No	At risk; Barrier at ACWHEP	Limited to early succes'l; frequent loss	Narrow; less dense; mostly late succes'l	No	Slight	Slight; entrenched	No short term stability

Table 3.8-14 Focused Array Comparision: Erosion Damage Reduction and Other Metrics

			Reduce Erosion Risk Damage		Other Metrics			
Alt	**Description (*Best Buy Plan)**	**Project Footprint**	**Infrastructure Protection**	**Risk and Uncertainty (Bank Erosion)**	**Project Sustainability**	**West & East Access Roads Flooding Impacts**	**Geotechnical (Potential Risk)**	**Cultural Resources (Potential Risk)**
1	No Action	NA	Piecemeal; emergency actions by SOCWA	High	NA	0.3 mi west side; 0.6 mi east side for 1% ACE (100-yr) storm event	Some risk; though generally low	Some potential losses
2	Maintain Similar Streambed Elevation							
2.1	Base 2	SOCWA to ACWHEP	Yes for AWMA Road and wastewater utilities	Low	Requires ensuring ACWHEP structure integrity	Similar to No Action	Some risk; though generally low with some potential moderate.	Relatively less potential impacts as smaller footprint than Alternative 3 variations
2.2	2.1 + Sinuosity (WC)							
2.3	2.2 + Newbury Weirs							
3	Restore Historic Streambed Elevation							
3.1	Base 3	SOCWA to AWMA Br	Yes for AWMA Road and wastewater utilities	Low		Some increase (15%) over No Action, mostly due to 1% ACE	Some risk; though generally low with some potential moderate. Raising streambed may assist buttressing effect.	Potential impacts
3.2	Base 3 + WC connect + WC Trailhead							
3.3*	3.2 +Widen/Recontour Chl +PPD Bypass	SOCWA to Pac Park Dr	Yes for AWMA Road and wastewater utilities; and water supply crossing (JRWSS)	Low	Requires PPD Bypass for connection to upstream Stewardship reaches.			
3.4	3.3 + Sinuosity (PPD)							
3.5	3.3 + Sinuosity (PPD+WC)							
3.6*	3.3 + Oxbow						Some risk; though generally low with some potential moderate to high. Raising streambed may	
3.7*	3.3 + Oxbow + Sinuosity (PPD)							
3.8*	3.3 + Oxbow + Sinuosity (PPD, WC)							

Table 3.8-14 Focused Array Comparision: Erosion Damage Reduction and Other Metrics								
			Reduce Erosion Risk Damage		**Other Metrics**			
Alt	**Description (*Best Buy Plan)**	**Project Footprint**	**Infrastructure Protection**	**Risk and Uncertainty (Bank Erosion)**	**Project Sustainability**	**West & East Access Roads Flooding Impacts**	**Geotechnical (Potential Risk)**	**Cultural Resources (Potential Risk)**
							assist buttressing effect.	
	USFWS Alternative							
C	Similar to Alt 2; limited grading	SOCWA to Pac Park Dr	Yes; for AWMA Road and wastewater utilities, but requires more protection than Alt 2 due to inherent uncertainty	Moderate	Requires ensuring ACWHEP structure integrity. Utilizes long term gravel augmentation. Higher costs for streambank protection and gravel augmentation renders this alternative less efficient than Alternative 2 variants, and possibly not cost effective.	Generally similar to No Action, but more uncertainty	Some risk; though generally low with some potential moderate.	Likely more potential impacts than Alternative 2 variations

Alternatives 2.1 to 2.3, and C, all of which rely on maintaining the current significantly incised channel system, would support a relatively narrow riparian zone. As the floodplain is largely disconnected from the channel system, floodplain riparian vegetation community will remain less dense, open canopy, and mostly late successional (mature). The entrenched channel vegetation will be subject to higher flow regimes and recurring loss, leading to less structural diversity, and favoring early successional plant communities.

Alternatives that raise the streambed elevation (3.1 to 3.8), and in turn, reestablish floodplain function, promote a more diverse riparian habitat with higher ecological structure and function. A broader band of riparian vegetation will establish within the terraced channel, with more heterogeneous structural diversity (early and mid-successional stages). The floodplain riparian corridor will widen due to the influence of higher groundwater levels associated with the raised channel, establishing denser, multi-layer canopy tree and shrub, mid to late successional plant communities.

As shown in Table 3.8-13, the alternatives that raise the streambed require rock riffles to provide grade control stabilization along the various reaches. The rock riffles also promote the formation of pool and riffle sequences. The addition of the oxbow reconnection feature (Alternatives 3.6 to 3.8) eliminates the need for one riffle, as the associated channel lengthening provides a more gradual slope transition. For alternatives that maintain similar streambed elevations, only Alternatives 2.3 and C incorporate streambed structures, though solely for ecosystem purposes.

The presence of manmade barriers along lower Aliso Creek creates impediments to aquatic wildlife movement, leading to isolation of aquatic species and putting population viability (genetic heritage) in question (i.e. at risk), for example for the southwestern pond turtle.

Alternative 2 variations and Alternative C do not connect above the ACWHEP structure nor to Wood Canyon tributary, and are therefore similar to the No Action plan in that they provide very limited benefit for aquatic species longitudinal dispersal. For alternatives that raise the streambed elevation, Alternatives 3.3 to 3.8 provide the most critical linkages that make possible the connection to Wood Canyon Creek tributary and the connection to Pacific Park Drive as a result of its removal of several barriers. In addition, these alternatives include the Pacific Park Drive Bypass feature, which would extend the longitudinal connectivity for aquatic wildlife upstream of the project limit by an additional 3.5 miles.

The benefits of channel sinuosity increases are most realized by alternatives that include reconnecting the oxbow. The oxbow adds about 850 feet to the channel length, whereas sinuosity segments downstream of Pacific Park Drive and Wood Canyon confluence add 32 and 60 feet, respectively. Though the additive habitat value of one or both of the two shorter segments to the riparian corridor is an improvement, the habitat value associated with increasing morphologic diversity and ecological functions that would result from adding the single longer segment has much greater value (refer to Table 3.8-9, net AAHUs).

Floodplain reconnection is a key component to restoration benefits. Comparison of without- and with-project conditions beneficial floodplain extent are shown in Figure 3.8-7 to 3-8, representing the 50, 10 and 1 percent ACE (2-, 10- and 100-year, respectively). These floodplains represent the main Aliso Creek alignments and do not reflect inclusion of any of the three sinuosity features mentioned above. Alternative 2 provides very little increase over No Action for any of the floodplains. Alternative 3 provides a substantial increase for the two-year floodplain. In similar reaches, there is substantial gain in the 10-year floodplain for Alternative 3 compared to Alternative 2. In similar comparisons for the 100-year floodplain, there is moderate increase for Alternative 3.

Adverse effects from flood inundation associated with channel overbanking to the west and east access roads for without- and with-project conditions are also shown in Figure 3.8-7 to 3-8. Under Alternative 1 (without-project condition), there is very limited flooding on the east or west side (approximately half-a-mile for each), mostly related to the 100-year event. Alternative 2 (and likely for C) results in similar road inundation to the No Action. For Alternative 3, the increase to the length of road inundation over No Action is fairly limited (about 15 percent over the total road length from SOCWA CTP to AWMA Road Bridge). In general, depths of overflow would remain fairly shallow as sheet flow, with flows returning to the channel as streamflow elevations subside, likely within minutes to an hour. Some flows would collect and pond in topographic swales. The SOCWA CTP is not affected by flooding for any of the alternatives. As the increase in both the extent of roads inundated and the depths of inundation are very minor, the corresponding impacts to traffic/access would also be very minor. Accordingly, no flood mitigation measures were included to address induced flooding in these areas other than paving the existing east dirt access road in Reaches 4A to 9. (Note: Raising of the road segments to avoid flooding was considered but dismissed. Culverts would be needed to drain ponding water from the backside of the road embankment. Accompanying exposed protective rock armoring required on the channel side would have esthetic implications).

All the alternatives, except C, will have excess materials for disposal on site. Of these alternatives, 3.1 provides a more favorable balanced earthwork with just 30,000 cubic yards. The highest excess sediment is associated with Alternatives 3.6 through 3.8. Alternative C assumes that all material resulting from the laying back of steep slopes would be placed in the channel streambed to be transported naturally downstream by fluvial processes.

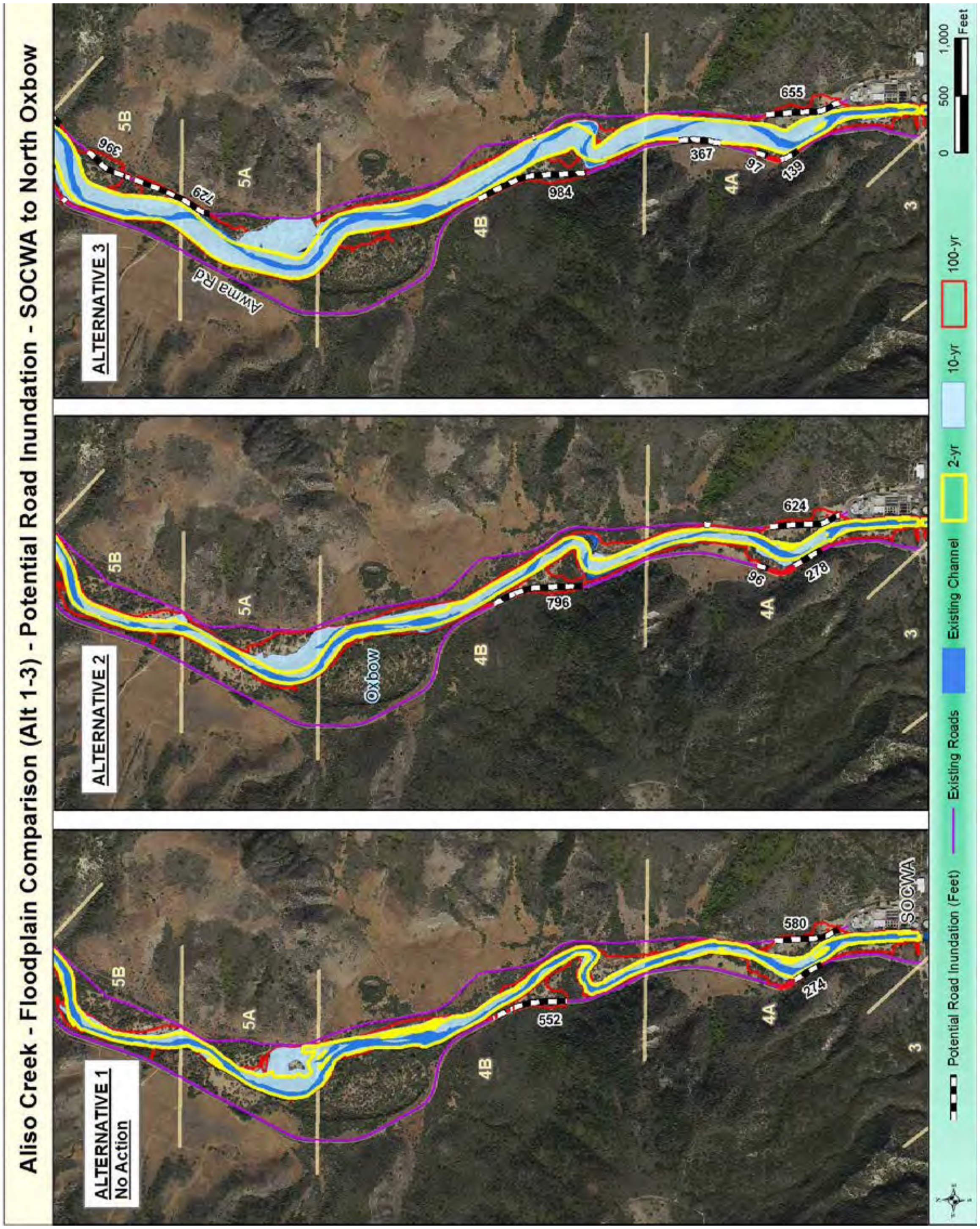

Figure 3.8-7 Floodplains Comparisons: SOCWA to North of Oxbow

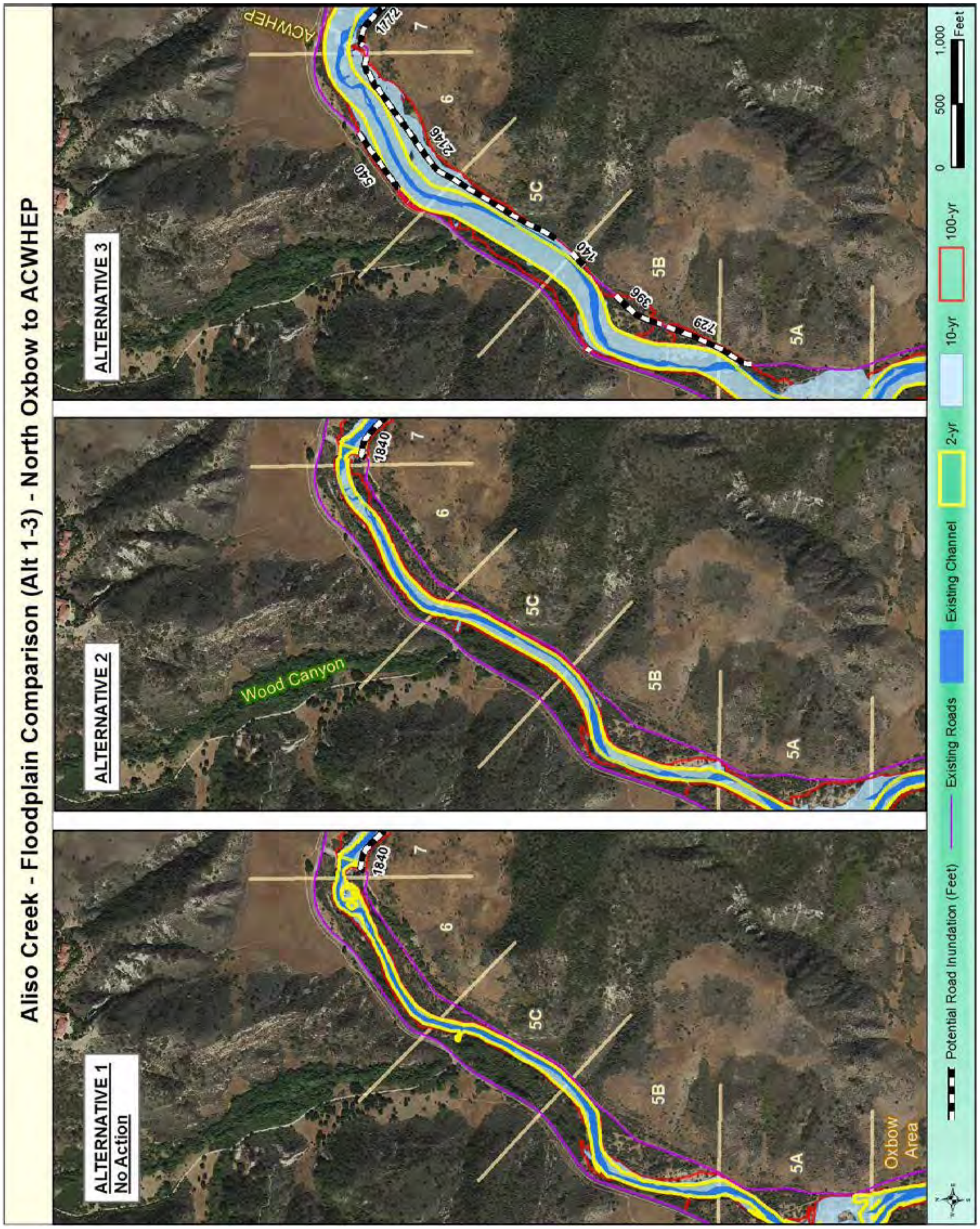

Figure 3.8-8 Floodplains Comparisons: North Oxbow to ACWHEP Structure

Figure 3.8-9 Floodplains Comparisons: ACWHEP Structure to AWMA Bridge

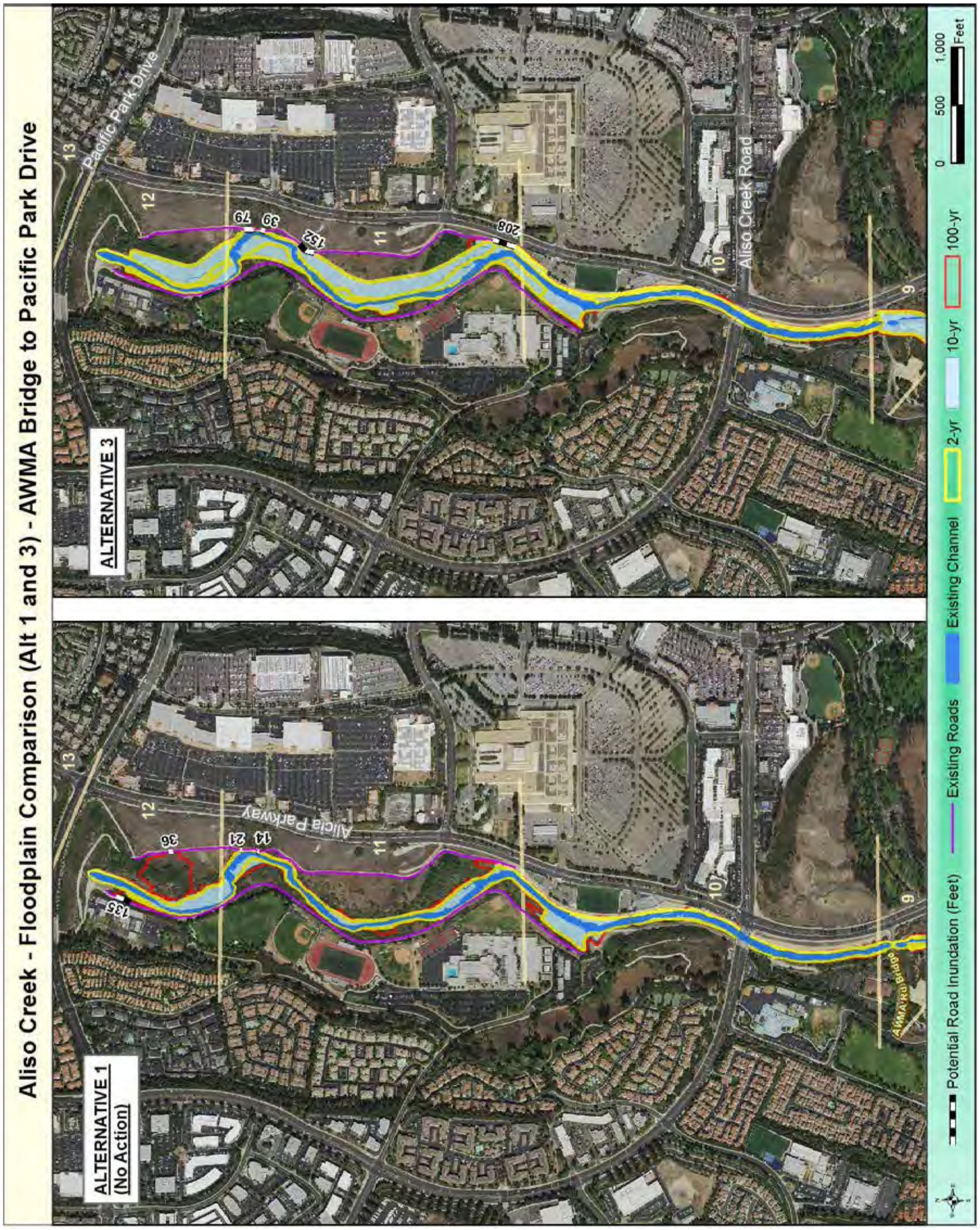

Figure 3.8-10 Floodplains Comparisons: AWMA Bridge to Pacific Park Drive

All the alternatives will incorporate streambank protection to reduce the threat of erosion damage to wastewater infrastructure, thereby precluding or minimizing loss of ecosystem restoration outputs. Alternative C will require relatively more streambank protection to reduce the higher erosion risk to infrastructure due to the likely unstable nature of flows that could result from selective recontouring of the only the steepest slopes. Alternatives 3.3 to 3.8, in addition, provide protection to the regional water supply line (JRWSS) in Reach 11 as an incidental benefit related the use of a riffle structure for streambed grade control.

- Geotechnical Risks

There is a risk that the planned excavations to remove or grade alluvial soils associated with the proposed channel alignments of the focused array of alternatives may potentially reactivate identified ancient slope failures (landslide masses) associated with the project area located between Reaches 4A and 7 (refer to Figure 3.8-1), or potentially destabilize some other areas currently unaffected by sliding. The alluvium in some cases may be providing a buttressing effect on the stability of adjacent topographic slopes. From a relative perspective, raising of the streambed elevation associated with Alternatives 3.3, 3.6, 3.7, and 3.8 (as compared to Alternatives 2.1 to 2.3, and C, which do not) would likely enhance the stability of the ascending natural slopes and the existing landslides that previously impacted those slopes. However, in some cases, stream channel widening as a result of the channel grading may adversely impact the ascending topography. Risk-informed decisions have been made during the plan formulation process (refer to Section 3.8.1.1). Although a qualitative landslide evaluation did not identify an existing landslide feature that would necessarily make any of the current proposed measures or alternatives unfeasible, it was concluded that the proposed grading could potentially have significant impact on the degree of stability of some of the existing landslides. This was especially pertinent for alternatives that include the reconnected oxbow (Alternatives 3.6, 3.7, and 3.8). During detailed project design work (PED), prior to construction, additional geotechnical investigations will be conducted to reconcile any potential destabilization concerns and recommend adjustments, as needed, to project design and construction, including any warranted mitigation (intervention) measures.

- Cultural Resources Risk

Twelve archeological sites have been recorded immediately adjacent to Aliso Creek in the project area and would potentially be impacted by ground disturbing construction activities. Six of these sites have previously been determined to be eligible for the NRHP. Creek erosion, unstable channel side slopes, and other development including road and utility construction, have damaged and most likely destroyed major portions of at least three sites that have previously been determined to be eligible. The current state of most of the 12 sites is unknown. Pockets of these sites may still be intact within the APE. The Corps is currently revisiting five of the 12 sites to provide more detail on their current condition. This information will be used to further inform the Final IFR and the project effects to these five sites. Should project construction have adverse effects to sites determined to be eligible for the NRHP, the Corps would address measures to avoid, minimize, or if necessary, mitigate these impacts. A more comprehensive cultural resource inventory of the APE will occur during PED.

The wider channel design footprints (up to 200-foot top width) associated with Alternatives 3.3, 3.6, 3.7, and 3.8 could likely have an incrementally larger impact than the narrower footprints (up to 95-foot top width) associated with Alternatives 2.1 to 2.3, and C. Alternatives that include the oxbow reconnection feature (3.6 to 3.8) may possibly greater impacts to one cultural resource site.

In the Sulphur Creek confluence area, all action alternatives would include riprap stone protection along the tributary streambed and buried under the channel side slopes (as described in Section 3.8.2.4). This action would also protect cultural resources in the area.

Project construction will also require the establishment of two permanent disposal areas for excess excavated materials. The identified disposal areas either overlap or are immediately adjacent to recorded archeological sites, one of which pertains to the 12 sites mentioned above. For most of the alternatives, disposal area impacts to the archeological sites will likely be avoided. However, two alternatives with the greatest quantities of excess materials (Alternatives 3.7 and 3.8) may possibly impact the two archeological sites.

3.8.12.3 Screening Criteria Considerations for the Focused Array

The Principles and Guidelines (1983) suggest the use of four criteria in the screening process of alternative plans. These are effectiveness, completeness, efficiency, and acceptability.

Effectiveness

Effectiveness is the extent to which an alternative plan alleviates the specified problems, and achieves the specified opportunities. An effective plan contributes to the attainment of planning objectives.

Alternatives 2.1 to 2.3, and C address problems related to floodplain hydrologic connectivity and opportunities to a more stable channel and geomorphic regime. However, these alternatives do not make significant contributions to the planning objectives in terms of improved function and structure of restored aquatic and riparian habitat or connectivity linkages within Aliso Creek mainstem or to Wood Canyon Creek to benefit the viability of aquatic species; and increases to floodplain function.

Conversely, Alternatives 3.3, 3.6, 3.7, and 3.8 make significant contributions to the key elements mentioned above. Additionally, the benefits of increased channel meander (sinuosity) are realized by Alternatives 3.6 to 3.8, especially in the reconnection of the abandoned oxbow. Reestablishment of the oxbow would incrementally return lost channel pattern complexity, flow variability and increased morphologic diversity, and ecosystem function within Reach 4B and 5A.

All the alternatives of the focused array would provide for streambank protection of threatened infrastructure, thereby minimizing loss of ecosystem restoration benefits. Alternative 3.3, 3.6, 3.7, and 3.8, however, provides protection to the regional water supply crossing (JRWSS) in Reach 11 as an ancillary benefit of ecosystem restoration, in addition to protecting SOCWA facilities and AWMA Road (refer to Section 3.8.12.4).

Completeness

Completeness is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects. All the alternatives in the focused array are considered complete in that they have considered activities required by others. The boundary limits of all the alternatives are within the Wilderness Park, and therefore under the jurisdiction of Orange County. The county continues to coordinate actively with SOCWA, whose facilities lie adjacent to the project and were considered in the plan formulation process.

Alternatives 2.1 to 2.3, and C extend for 2.2 miles from the SOCWA CTP Bridge to the ACWHEP structure. Alternatives 3.3, 3.6, 3.7, and 3.8 extend for five miles from the SOCWA CTP Bridge to the Pacific Park Drive.

The benefits of Alternatives 3.3, 3.6, 3.7, and 3.8 are increased by their connection to an additional 3.5 miles upstream of Pacific Park Drive, contiguous with the Federal project limit, that provide ancillary connectivity and access to quality aquatic and riparian habitat. These upstream reaches are within parcels owned by Orange County, the City of Laguna Hills, and the City of Laguna Woods. Orange County intends to continue to utilize BMPs (invasive species control) within these reaches of the creek in its ownership (Reaches 13 to 15A, 16A, and 17B). The General Plans adopted by the City of Laguna Hills and the City of Laguna Woods reflect these communities' intentions to maintain the land use along Aliso Creek as open space (15B) and conservation easement (Reaches 16B and 17A), respectively. Though beneficial to the Federal project, the inclusion of the additional reaches is not essential to the success of the Federal project objectives. However, at a minimum, the lower 1.7 miles of the extension (Reaches 13 to 15A) are within the boundary of the Wilderness Park and would be maintained as such into perpetuity. Reaches 14 and 15A are areas of Aliso Creek of associated sightings of southwestern pond turtle individuals, a California Species of Special Concern and currently a species under review for Federal listing.

Efficiency

Efficiency is the extent to which an alternative plan is the most cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment. The individual components or measures of an alternative were selected after careful consideration of alternate means, including costs, of accomplishing a similar goal. Alternatives 2.1 to 2.3 and Alternatives 3.3, 3.6, 3.7, and 3.8 were established to be cost effective in the CE/ICA, with the latter grouping additionally identified as the most efficient and referred to as Best Buy Plans. Alternative C was not included in the CE/ICA as there were no costs or habitat units generated for this alternative (refer to Sections 3.8.8). Similar to Alternatives 2.1 to 2.3, Alternative C maintains a similar streambed elevation within the incised channel margins. The higher costs associated with providing more streambank protection for threatened infrastructure than the Alternative 2 variations, in addition to the incremental costs associated with maintaining a program of gravel augmentation, would make Alternative C a relatively less-efficient solution, and possibly not cost effective.

Acceptability

Acceptability is the workability and viability of the alternative plan with respect to acceptance by state and local entities and the public, and compatibility of existing laws, regulations, and public policies. Alternatives 2.1 to 2.3 and Alternatives 3.3, 3.6, 3.7, 3.8 and Alternative C comply with applicable laws, regulations, and public policies, and any adverse effects would be mitigated as identified in Chapter 5. An ecosystem restoration project in the Proposed Project area enjoys support by many stakeholders. Some stakeholders have expressed concerns regarding the loss of existing riparian habitat within the project footprint as a result of construction, and the potential impacts to cultural resources.

In addressing the acceptability evaluation criterion, key risks and uncertainties associated with the alternatives are important to consider, as these may have influence on project implementability. These would include potential geotechnical risks associated with landslides and impacts to cultural resources, as described in Section 3.8.12.2. For the feasibility phase of the project, the level of effort being undertaken by the PDT to address these issues will provide sufficient support to inform the decision on the identification of a TSP.

3.8.12.4 Assessment of NED Incidental Benefits

Reaches 4A to 9

For Reaches 4A to 9, a spreadsheet model was developed to evaluate the expected erosion risk annual damages and costs to the infrastructure (AWMA Road on the west bank and the wastewater pipelines on the east bank) under without-project conditions, and the potential benefits from the focused array of alternatives (except Alternative C for which a quantitative analysis could not be performed), which may reduce these risks. The location and lateral extent of necessary streambank protection is similar for each alternative due to the similar channel patterns of the alternatives. The model was constructed using Microsoft Excel, with the Palisade @Risk add-in that allows lifecycle simulations to be performed with uncertainties defined for input parameters and outputs expressed in probabilistic terms.

The damages and costs evaluated within the model are expressed as average annual values and calculated utilizing the FY16 Federal discount rate of 2.875 percent with a period of analysis of 50 years. All damages and costs are expressed at an FY16 price level.

For without-project conditions, SOCWA conducted an erosion assessment of the channel to categorize the vulnerability and impacts of erosion for both channel banks (Tetra Tech 2012). The assessment included the identification and evaluation of locations where erosion of the banks could lead to exposure/undermining of the existing pipelines and AWMA Road located throughout the study reaches. The results of this study established various segments of both channel banks that are at risk to incur significant impacts from erosion.

The @Risk model was developed to evaluate the overall costs that SOCWA or the county would incur from emergency actions to ensure that the SOCWA pipeline and AWMA Road are protected from damages by erosion. According to the information provided by these agencies, the majority of the expected costs that would be incurred are the costs of implementing an emergency action (placement of dumped riprap stone) that would protect the road or pipeline before the erosion causes damages to the infrastructure. The model incorporates the latest estimates of costs that would most likely be incurred to implement these emergency actions in the future. The model also accounts for the residual damages/costs that are expected to be incurred after the implementation of the restoration alternatives.

The @Risk model evaluated the benefits of implementing with-project streambank protection consisting of the placement of buried engineered riprap on the east and west banks of the creek at specified locations and lengths. The protection is designed to withstand up to the one percent ACE (100-year event). In addition, a riprap feature is included at the confluence with Sulphur Creek that covers about the first 500 feet of the tributary streambed and lower side slopes with riprap stone protection.

Figure 3.8-11 shows erosion risk location areas (impact areas) along the east and west banks of the creek where the use of streambank protection is needed for the project. Table 3.8-15 summarizes the results of the with- and without-project average annual erosion damages for necessary streambank protection at the impact areas. The results of the erosion evaluation show a net reduction of average annual damages of $646,000 for the impact areas associated with the east bank (wastewater utilities) and the west bank (AWMA Road).

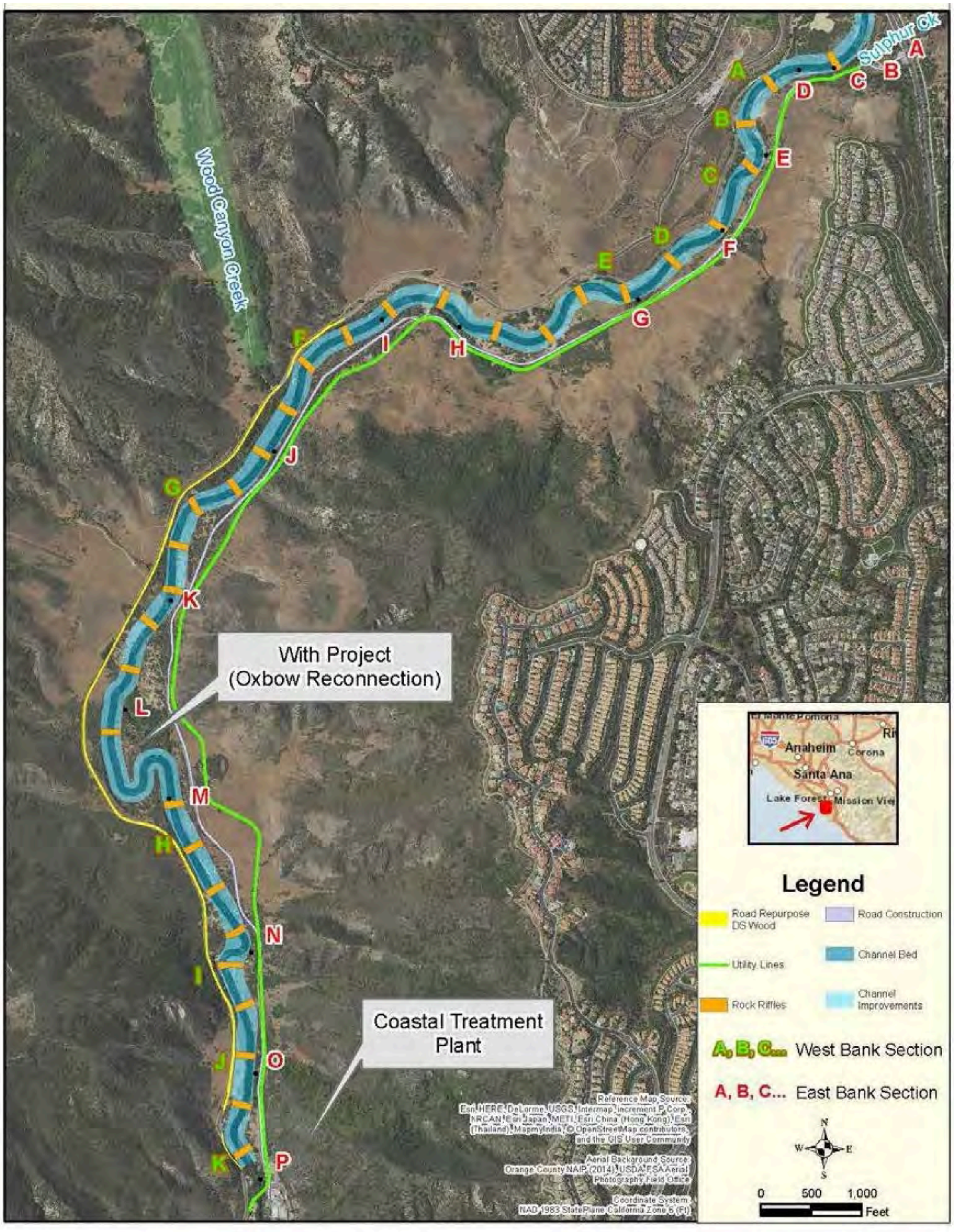

Figure 3.8-11 Erosion Impact Areas

Table 3.8-15 With- and Without-Project Average Annual Erosion Damages (FY 16 Price Levels, 2.875% Discount Rate)

East Bank (Wastewater Utilities)				West Bank (AWMA Road)			
Impact Area	**Total Without Project Annual Damages**	**Total With-Project Annual Damages**	**Net Reduction Annual Damages**	**Impact Area**	**Total Without Project Annual Damages**	**Total With-Project Annual Damages**	**Net Reduction Annual Damages**
A	$23,462	$8,416	$15,046	A	$21,732	$3,187	$18,545
B	$42,595	$7,839	$34,756	B	$13,815	$1,500	$12,315
C	$39,032	$1,575	$37,457	C	$41,308	$2,250	$39,058
D	$19,837	$1,875	$17,962	D	$31,321	$2,999	$28,322
E	$30,599	$3,749	$26,850	E	$57,683	$0	$57,683
F	$42,130	$2,250	$39,880	F	$27,387	$4,124	$23,263
G	$2,708	$3,374	-$666	G	$21,928	$2,999	$18,929
H	$12,265	$2,625	$9,640	H	$28,320	$3,899	$24,421
I	$2,582	$3,749	-$1,167	I	$14,792	$1,650	$13,142
J	$63,680	$8,998	$54,682	J	$50,860	$3,007	$47,853
K	$59,218	$3,749	$55,469	K	$15,565	$1,875	$13,690
L	$11,716	$1,875	$9,841				
M	$50,534	$3,749	$46,785				
N	$2,069	$3,749	-$1,680				
O	$13,398	$6,749	$6,649				
P	$540	$3,562	-$3,022				
Total	**$416,365**	**$67,883**	**$348,482**	**Total**	**$324,711**	**$27,490**	**$297,221**

As shown on Table 3.8-15, four of the sixteen impact areas have slightly higher damages with implementation of the NER Plan/TSP relative to without-project conditions. The reason is due to: (1) based upon the risk based analysis, without project average annual damages/costs are minimal in these areas because there is very low probability of erosion triggering the placement of riprap (resulting in without-project costs) in the first half of period analysis; and 2) under with-project conditions, more costly lateral protection included in the NER Plan/TSP (relative to the cost of riprap assumed under the without-project condition) is subject to potential damages throughout the period of analysis. However, it should be noted that the combined increase in damages for these four impact areas is very minor (only $6,500) and is insignificant relative to the overall reduction in erosion damages throughout the SOCWA reaches of $348,000. In addition, it is important to note that the without-project damages are likely underestimated since the erosion rates only account for fluvial forces and not channel bank slumping due to geotechnical instabilities. This additional erosion factor was not included in the analysis due to the significant cost of incorporating such analysis, especially given the relatively small cost of bank protection relative to other restoration features.

Reach 11

In Reach 11 under without-project conditions there are two locations where the 42-inch JTM of the JRWSS is vulnerable to damage by erosive undermining actions of Aliso Creek. Reach 11 was identified by the geomorphic analysis for the study to be an unstable reach, subject to continued incision up to three to four feet. The JTM passes to the west of Aliso Creek approximately 2,200 feet downstream of Pacific Park Drive. At this location, the west bank of the creek is fortified by a steel piling retaining wall designed to protect the JTM from erosion and migration of the creek. Since the time of sheetpiling driving (circa 1990), there has been about six feet of streambed incision (scour) at this location. An evaluation conducted for South Coast Water District (HDR 2008), concluded that additional scour at this location would threaten undermining of the sheetpiling. The second location is approximately 1,200 feet downstream of Pacific Park Drive. The JTM at this location passes under Aliso Creek and is encased in concrete and protected by riprap overlain by exposed grouted stone. There is a driven sheetpile on the upstream side of the crossing. Undercutting on the downstream side is evident, and a seven- to eight-foot deep scour hole has formed. The 2008 evaluation concluded that the pipeline is at risk of being undercut by potential additional scour.

The restoration project in Reach 11 for Alternatives 3.3, 3.6, 3.7, and 3.8 would be raising the creek bed by about seven feet, terracing for riparian establishment, and providing a riffle structure at the JTM crossing to facilitate aquatic passage. As the threat to the JTM would be significantly diminished as an outcome of the environmental restoration features, this would be considered incidental flood risk reduction benefit for the project.

3.9 FINAL ARRAY OF ALTERNATIVES/PLAN RECOMMENDATION

3.9.1 Identification of Final Array

The final array of action alternatives that best satisfy the criteria for effectiveness, completeness, efficiency, and acceptability were selected by the PDT includes Alternatives 3.3, 3.6, 3.7, and 3.8. These four alternatives best meet the key planning objectives and the significance of plan outputs associated with restoration of aquatic and riparian habitat structure and function, aquatic species connectivity and viability, floodplain connectivity, and the improvement of geomorphic channel stability. The four alternatives provide wastewater infrastructure protection to the one percent ACE (100-year event) and greatly limit the potential compromise of ecosystem restoration outputs due to erosion damage to pipelines. These alternatives also provide erosion protection to the JTM regional water supply pipeline crossing in Reach 11 as an ancillary benefit resulting from the restoration project features.

The final array of alternatives, including the No Action Plan, are described in the following section.

3.9.2 Alternative Descriptions

3.9.2.1 Alternative 1: No Action

Under Alternative 1, the Federal government would take no action to restore ecosystem functions or values within the Aliso Creek study area. The streambed and channel banks will continue to erode (vertically and horizontally) until a more stable geomorphic equilibrium condition (channel size and pattern) and new very limited inset floodplain is developed. The channel evolution sequence for this system could require more than 50 years. The incision of the streambed is expected to continue an additional three to four feet in some reaches upstream and downstream of the ACWHEP structure. The incised channel will be of sufficient depth to continue to preclude most overbanking from occurring, except for less frequent, very large storm events. Without overbanking, the opportunity for flood flow infiltration (aquifer recharge) to the historic floodplain and abatement of floodwater energy is repressed, resulting in a changed floodplain habitat. The S-bend (lower Subreach 4B), a distinct geomorphic feature offering channel complexity and associated habitat biodiversity (including freshwater marsh), will likely be cut off within the period of analysis (estimation after year 25), a fate similar to the abandoned oxbow in the upper portion of the same subreach.

The riparian vegetation on the historic floodplains will likely continue to degrade in quality and will become more narrow, due to type converting to more upland composition as the connection to the water table is reduced below the maximum rooting depth of the predominate riparian species. This effect on the vegetative community is currently apparent in the more shallow rooted individuals as the vegetation is transitioning from a dense willow tree and shrub canopy to a more open canopy, mostly late successional, riparian community. The prevalence of steep streambed slopes will continue to degrade the value of the riparian structure that can establish within the incised channel, favoring a more haphazard community. Invasive species will outcompete native riparian species as unstable conditions, including higher flow velocities and erosive power from confined flows that can uproot the native vegetation, favor reestablishment of faster growing exotics. The outcome will be a riverine habitat of degraded function and structure, less suitable to support wildlife diversity, including species of special status. Significant barriers created by the ACWHEP structure and the perched tributary at Wood Canyon Creek will remain, promoting isolation of aquatic resources and degradation of aquatic habitat function and value.

Streambank erosion from flood flows will continue to pose an imminent threat to public water supply, wastewater infrastructure, and public safety, with impacts to the environment and local economy, which relies on the recreational use and high esthetic value of the coastal region. SOCWA emergency efforts to protect pipelines at risk will be piecemeal and provide only short-term solutions.

Failure of channel banks immediately adjacent to ascending terrain could have an adverse impact on slope stability including existing landslides and terrain that has not been effected by sliding. Any potential slope failures from the surrounding hillsides affecting the floodplain could cause a significant change to the stream pattern at the base of the failure, and for some distance both upstream and downstream of the disturbance.

3.9.2.2 Alternative 3.3

Alternative 3.3 (Figure 3.9-1) would raise the existing streambed elevation to pre-incised elevations (circa 1967) within the Wilderness Park to improve hydrologic connection with the historic floodplain over a length of five miles from the downstream limit of the SOCWA CTP Bridge upstream to Pacific Park Drive (Reach 4A to 12). In general, the overall existing channel pattern will be followed. This alternative will increase the 100-year floodplain area by 60 percent over the without-project condition.

With the exception of Reach 10, the stream channel between Reaches 4A and 12 will be recontoured to extend the existing 10-year-level floodplain width by over 90 percent, while incorporating an inset floodplain terrace on one or both sides of the active low-flow channel. Specifically, the existing channel would be widened to a 100-foot top width to contain a low-flow channel capable of conveying all flows less than a two-year-level flood event. Inset floodplain terracing adjacent to the low-flow channel would convey flows up to the 10-year flow event, and would extend the overall top width of the recontoured channel to 200 feet. An equilibrium channel slope of 0.25 percent would be used. All channel side slopes will be a stable 3H:1V. Soil materials for streambed raising would be generated by excavation necessary to widen the channel necessary to create the inset terracing. For Reach 10 (upstream of AWMA Road bridge to just north of the Skate Park), the channel along the east bank will be widened to allow a riparian habitat corridor planted on top of a four-foot-high floodplain bench ranging in width from three to 56 feet. A sheetpile wall will be utilized as the east bank for a total distance of 2,000 feet. The west side of the channel in this reach will not be altered from the existing riprap protected 2H:1V slope.

Raising of the streambed will allow removal of the ACWHEP structure (Reach 6) and the two large concrete drop structures (Reach 10), and will significantly decrease the elevation discontinuity at the Wood Canyon confluence (Reach 5C). The streambed will be raised incrementally from downstream to upstream using a series of 47 sloped rock riffle structures spaced 600 to 800 feet apart, and transverse to the channel alignment, between the SOCWA CTP and Pacific Park Drive (Reach 4A to 12). The largest gain in streambed elevation would be between Reaches 4B and 6 with a range from seven to 21 feet. Streambed elevation raising upstream of the ACWHEP structure to AWMA Road Bridge would range from approximately two to nine feet. Streambed raising upstream of AWMA Road Bridge (Reach 9) will be much less than downstream, i.e. ranging between zero and five feet. Of the 47 riffles, 34 would lie within the reaches from the SOCWA CTP Bridge to the entrance at AWMA Road Bridge (Reaches 4A to 9).

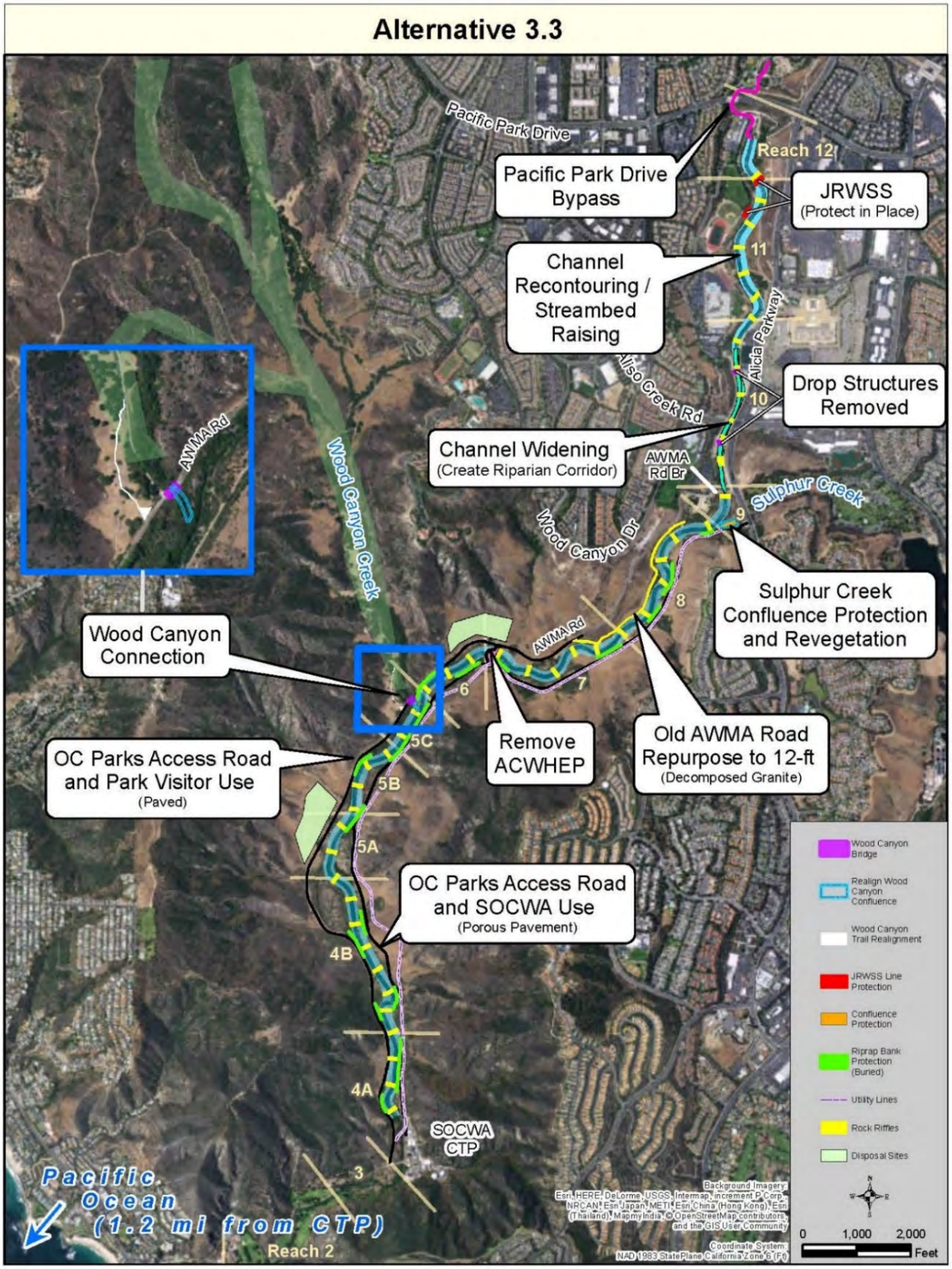

Figure 3.9-1 Alternative 3.3

The rock riffle structures will act both as riffles and as grade control stabilizers. The sequencing of riffle structures will allow the formation of intermittent pools between the structures. The riffle structures will promote pool and riffle habitat and allow aquatic wildlife passage. The riffles will consist of buried large angular riprap boulders set at streambed grade for a minimum depth of 33 inches. The majority of riffle structures would be 18-inch high (i.e.18-inch differential between the crest of the riffle and the downstream end), and sloped at five percent. The slope of the streambed between the riffles will be a stable 0.25 percent. Three six-foot riffles, sloped at five percent, would be necessary in Reach 10 where the two large 10-foot vertical structures would be removed. These larger riffles would require grouting of the stone, overlain by ungrouted stone. One six-foot riffle would be constructed in Reach 11, where the JTM crosses Aliso Creek. Sheetpiling will be included at each riffle location to maintain streambed grade integrity, should there be loss of stone in a large storm event.

The riparian corridor along the overbanks, the recontoured creek banks and terraces will be restored with site-derived riverine vegetation types (*Salix-Populus* Forest/Woodland Alliance, *Salix-Baccharis* Forest Alliance, *and Baccharis* Shrubland Alliance). Freshwater marsh (*Typha* Herbaceous Alliance) habitat would establish naturally, and once established could be maintained in designated areas, to be determined by the Adaptive Management Team. The riparian corridor within Reach 10 will also be planted with appropriate vegetation types. All exotic/invasive plants will be removed where present within the project area, including giant reed, Pampas grass, and castor bean.

Alternative 3.3 will reestablish connectivity for aquatic wildlife movement along five miles of Aliso Creek as existing barriers to migration will be removed, including the ACWHEP structure (Reach 7) and the two large concrete drop structures (Reach 10). Additionally at the existing embankment crossing at Pacific Park Drive (Reach 12), a low-flow stream diversion channel will be constructed to pass through the bikeway underpass. A pump system, installed on the upstream side, will provide a continuous low-flow water supply from the creek. The inclusion of the Pacific Park Drive bypass feature extends the Aliso Creek aquatic species connectivity upstream of Pacific Park Drive project limit by an additional 3.5 miles to the I-5 Freeway, resulting in 8.5 miles of connectivity enabled by the project. These additional reaches are referred to as the stewardship reaches and designated as Reaches 13 to 17. These reaches do not require Federal participation and are being pursued solely by local entities. Additional detail is provided in Section 3.8.2.6.

At the Wood Canyon Creek confluence, aquatic habitat passage with Aliso Creek will also be restored, providing connection to an additional 3.5 miles of habitat. The AWMA Road culvert crossing at Wood Canyon Creek will be replaced with a small bridge to span the tributary creek crossing and accommodate vehicular and park visitor use (e.g. cycling, pedestrian). The lower 700 feet of Wood Canyon Creek will be regraded to a limited extent to transition naturally into Aliso Creek. Additionally, the initial 800 feet of Wood Canyon Trail will be realigned to the west by about 75 feet to remove it from the riparian vegetation habitat at Wood Canyon Creek.

At Sulphur Creek confluence, screens will be placed on the upstream side of the culvert at Alicia Parkway to prevent the entry of exotic aquatic species from upstream Sulphur Creek and reservoir.

For reduction of streambank erosion threat to critical infrastructure, the SOCWA wastewater utility corridor and the AWMA Road will be protected with buried riprap stone at identified critical locations between the SOCWA CTP Bridge and Sulphur Creek confluence (Reaches 4A through 9). The buried riprap locations are shown on Figure 3.9-1. The first 600 feet of confluence area of Sulphur Creek would be lined with riprap (side slopes and stream bottom) to dissipate flow energies from the tributary and to protect adjacent infrastructure and cultural resources. Side slope stone protection would be buried under compacted fill. Side slopes protected with buried riprap stone will incorporate a geosynthetic mat to allow appropriate riparian vegetation to establish.

Ancillary benefits associated with Reach 11 improvements from channel recontouring and rock riffle grade control include protection against west bank erosion threat to OC Parks service road/trail and to major JRWSS infrastructure (JTM regional water supply line crossing providing a primary source of drinking water for southern Orange County communities).

Channel modifications related to the ecosystem restoration project will affect a remnant section of the original AWMA Road (referred to "Old AWMA Road") located on the west side of the creek within Reaches 7 and 8. This section of the road is currently used by OC Parks and the public to access AWMA Road, which parallels Aliso Creek further downstream on the west side. The road segment will be relocated for a short distance to the west of the realigned channel, reduced in width to 12 feet (from currently about 20 feet), and converted from an asphalt paved surface to decomposed granite.

Alternative 3.3 will require onsite disposal of 130,000 cubic yards of excess excavated materials. Two disposal sites will be contoured into adjacent grassland hill slopes and planted with coastal sage scrub and seeded grasses.

To address the risk of increased flooding of the roads resulting from the restoration project, Alternative 3.3 would also include debris removal from the affected roadway segments as needed. (The maintenance costs associated with debris removal would be similar for all action alternatives of the final array, and presented in Table 4.3-1). For the east road, paving of the existing dirt access road between Reaches 4A to 9 would be warranted to better protect the usability and integrity of the road pursuant to any overbank flood events that could potentially affect various segments. The paving used would be porous to reduce some runoff and promote infiltration of overflows.
Access for OMRR&R of the project footprint between Reaches 4A and 9 will be provided on the west side by AWMA Road and the east side by a new access road. The east road will follow the alignment of the existing unpaved road. In addition to OMRR&R, the non-Federal sponsor intends to utilize the east access road for use by SOCWA. The AWMA Road (west side) would be solely dedicated for use by OC Parks (OMRR&R and Ranger operations) and the park recreational users (pedestrian and

cyclists). For Reaches 10 through 12, OMRR&R activities will be carried out utilizing the existing paved Aliso Creek Bikeway and the unpaved Aliso Creek Trail to the west and east side, respectively, of Aliso Creek. Maintenance activities will include periodic inspections, especially after storm events, of the channel system and features and appropriate repair of any damages that could impact proper function; removal of trash and debris; and vegetation management. Access roads will need periodic resurfacing. Sites used for disposal and planting will also be included in the inspections, and maintained, as necessary.

For project implementation, heavy construction equipment will be used for earthwork activities such as grading, excavating, and placement of fill. Types of equipment will include excavators, compactors, loaders, pavers and trucks. No borrow sites will be needed for project implementation. To limit both esthetic and adverse impacts to the habitat and wildlife, Alternative 3.3 will be constructed over four years in phases. Construction access, staging areas, and construction phasing, are described in Chapter 4.

3.9.2.3 Alternative 3.6

Alternative 3.6 incorporates the same features as Alternative 3.3 and additionally includes reconnection of the abandoned oxbow (Figure 3.9-2).

Reconnection of the abandoned oxbow between upper Reach 4B and lower Reach 4A will require realigning the active channel to follow a stream course similar to that of the mid-1960s observed from aerial imagery. The current active channel would be filled in and replanted. The reconnected oxbow would provide an important gain in sinuosity of about 850 feet and morphological diversity, which promotes and supports unique habitat structures and ecological functions.

The inclusion of the reconnected oxbow eliminates the need for one rock riffle (grade stabilizer), as the additional stream lengthening reduces the longitudinal grade in the reach. The total number of rock riffles needed for Alternative 3.6 is 46, of which 33 would lie within the reaches from the SOCWA CTP Bridge to the entrance at AWMA Road Bridge (Reaches 4A to 9).

Alternative 3.6 will require on-site disposal of 300,000 cubic yards of excess excavated materials. Project implementation and OMRR&R activities would be similar to Alternative 3.3.

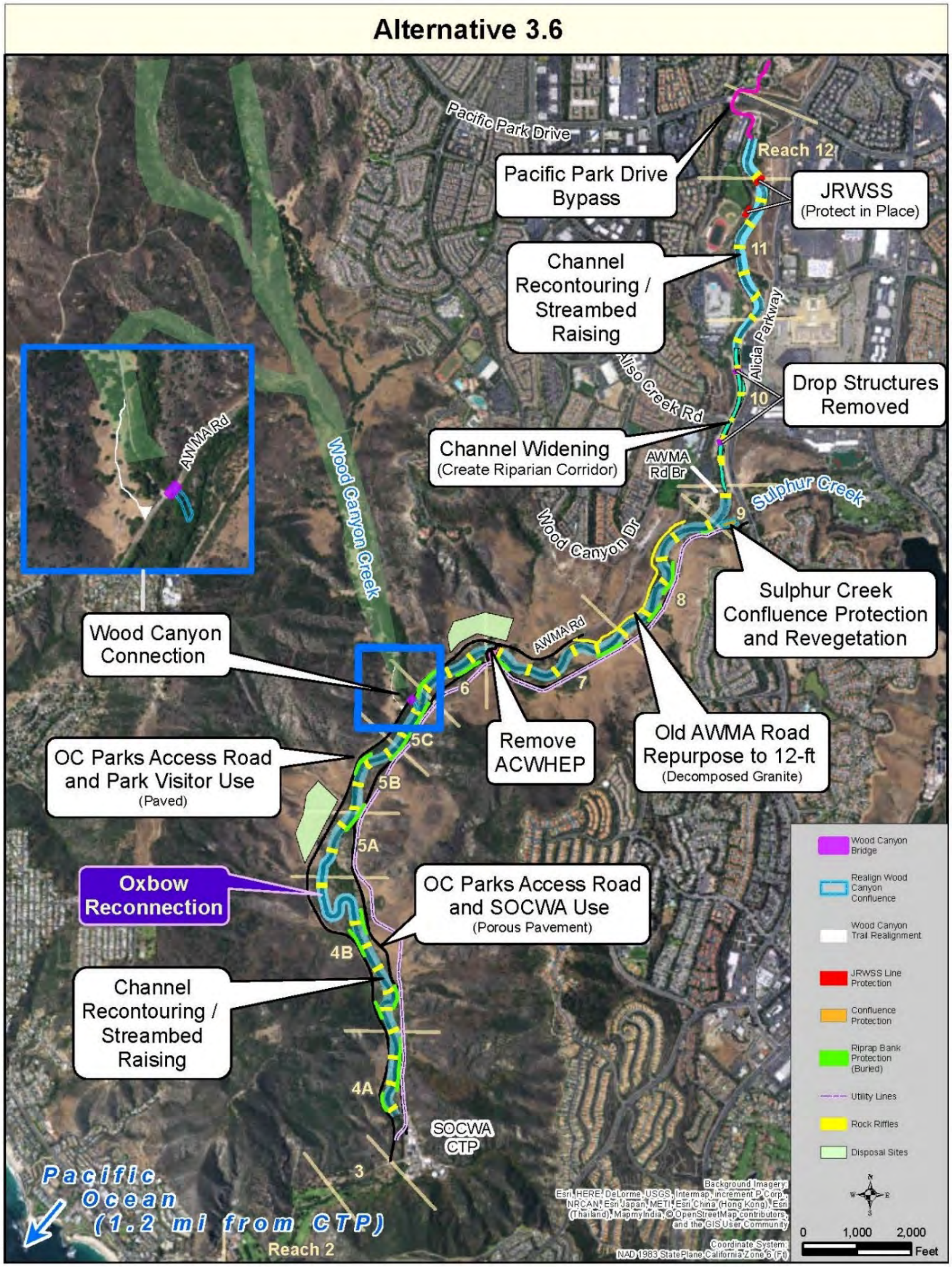

Figure 3.9-2 Alternative 3.6

3.9.2.4 Alternative 3.7

Alternative 3.7 incorporates the same features as Alternative 3.3 and additionally includes reconnection of the abandoned oxbow (850 feet of lengthened channel) and added sinuosity (32 feet) downstream of Pacific Park Drive (Figure 3.9-3).

The inclusion of the reconnected oxbow eliminates the need for one rock riffle (grade stabilizer), as the additional stream lengthening reduces the longitudinal grade in the reach. The total number of rock riffles needed for Alternative 3.7 is 46 (situated similarly as Alternative 3.6). For the added sinuosity downstream of Pacific Park Drive, the channel would be excavated, as necessary, to create the additional length; portions of the active channel no longer needed would be filled in and planted in a consistent manner with other areas of work.

Alternative 3.7 will require onsite disposal of 340,000 cubic yards of excess excavated materials. Project implementation and OMRR&R activities would be similar to Alternative 3.3.

3.9.2.5 Alternative 3.8

Alternative 3.8 incorporates the same features as Alternative 3.3 and additionally includes reconnection of the abandoned oxbow (850 feet of lengthened channel), added sinuosity (32 feet) downstream of Pacific Park Drive (as in Alternative 3.7), and added sinuosity (59 feet) downstream of the confluence with Wood Canyon Creek (Figure 3.9-4).

The inclusion of the reconnected oxbow eliminates the need for one rock riffle (grade stabilizer), as the additional stream lengthening reduces the longitudinal grade in the reach. The total number of rock riffles needed for Alternative 3.8 is 46 (situated similarly as Alternative 3.6). For the added sinuosity downstream of Pacific Park Drive and Wood Canyon Creek, the channel would be excavated as necessary to create the additional lengths; portions of the active channel no longer needed would be filled in and planted in a consistent manner with other areas of work.

Alternative 3.8 will require onsite disposal of 350,000 cubic yards of excess excavated materials. Two disposal sites will be contoured into adjacent grassland hill slopes and planted with coastal sage scrub. Project implementation and OMRR&R activities would be similar to Alternative 3.3.

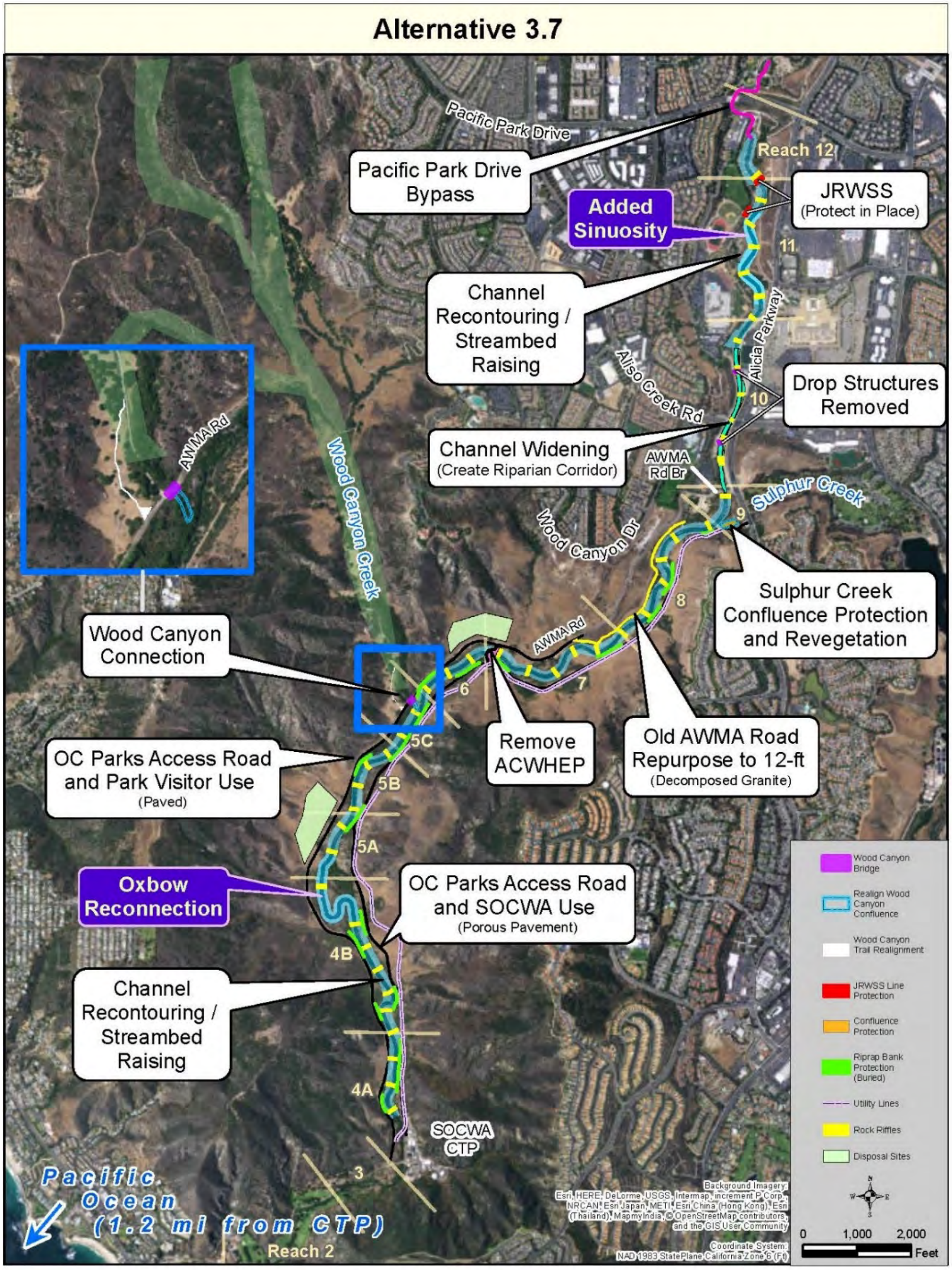

Figure 3.9-3 Alternative 3.7

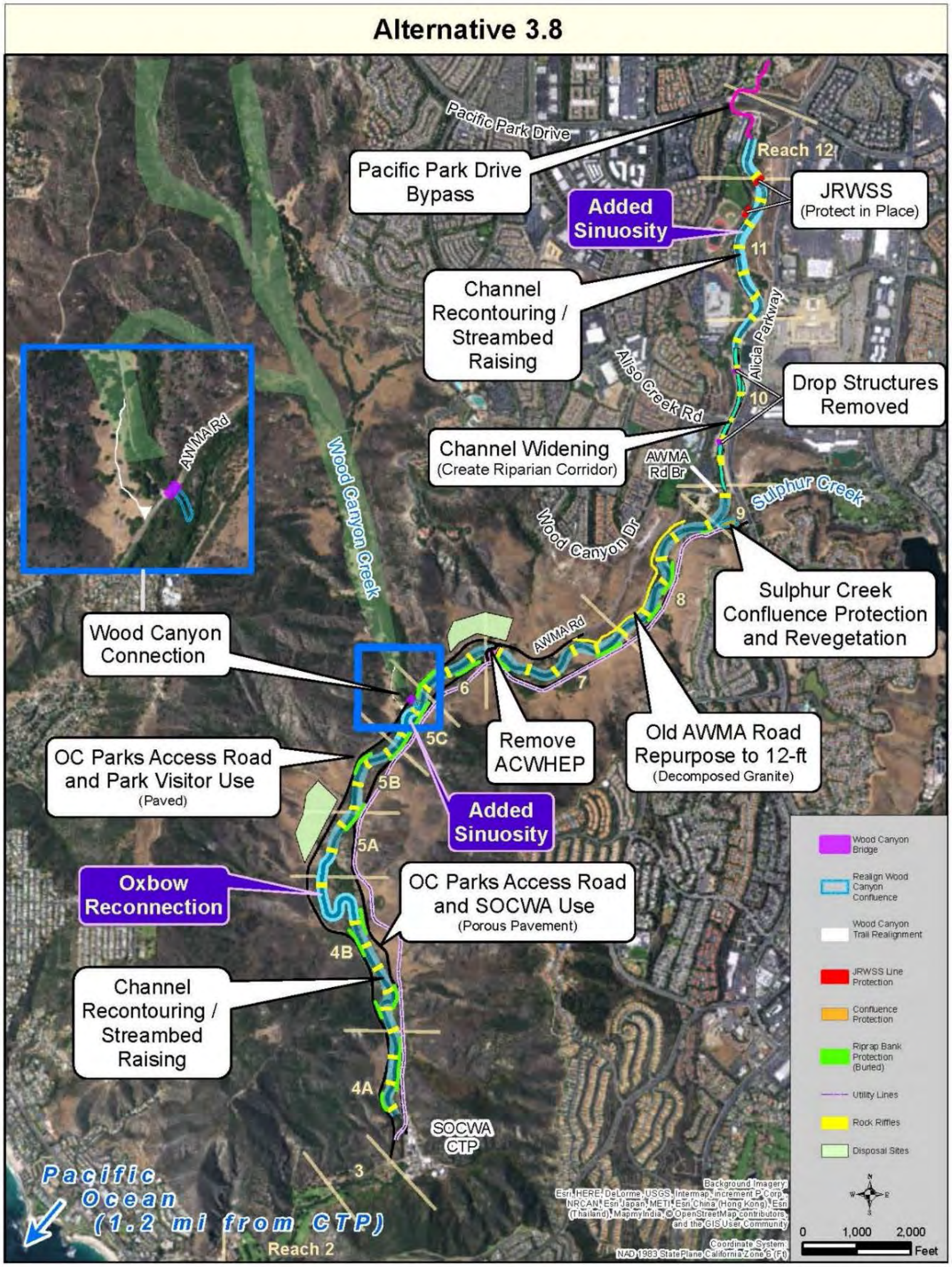

Figure 3.9-4 Alternative 3.8

3.9.3 Evaluation and Comparison of the Final Array: System of Accounts

The Principles and Guidelines (1983) established four accounts to facilitate evaluation and display of the effects of alternative plans: NED, environmental quality (EQ), regional economic development (RED), and other social effects (OSE). In lieu of the NED account, increases in ecosystem restoration values of national outputs, expressed in non-monetary units (habitat units), are evaluated for consideration in the identification of the NER Plan. Due to the relative similarities between the final array of alternatives, RED and OSE will be presented after the selection of the TSP. NED incidental benefits related to streambank erosion protection for both wastewater and water supply conveyance are also similar between the final array.

3.9.3.1 National Ecosystem Restoration (NER)

Table 3.9-1 displays incremental costs, incremental habitat value outputs, and incremental cost per habitat value. The selection of the NER Plan is presented in Section 3.9.4.

Table 3.9-1 Economic Outputs of Final Array Action Alternatives (FY16 Price Levels)

	Alternative 3.3	Alternative 3.6	Alternative 3.7	Alternative 3.8
Average Annual Habitat Units				
Net Increase AAHU (Over No Action)	5,597	5,775	5,834	5,842
Incremental AAHU	5,597	177	60	8
Gross Project Costs				
First Costs	$91,611,965	$96,809,585	$98,724,986	$98,156,555
Interest During Construction	$3,238,387	$3,248,643	$3,251,585	$3,251,963
Total Gross Investment	$94,850,352	$100,058,228	$101,976,571	$102,408,518
Annual Costs				
Total Annual Costs of Gross Investment	$3,599,389	$3,797,018	$3,869,816	$3,886,207
Annual Cost of Maintenance (OMRR&R)	$187,446	$196,560	$197,890	$198,550
Total Average Annual Costs (AAC)	$3,786,835	$3,993,578	$4,067,706	$4,084,757
Incremental AAC	$3,786,835	$206,743	$74,127	$17,052
Incremental AAC/AAHU	$673	$1,167	$1,239	$2,145

3.9.3.2 Environmental Quality

Table 3.9-2 presents a brief summary of the beneficial and adverse effects associated with the final array of alternatives, with an emphasis on the environmental resources that have the most significant influence pertaining to plan formulation.

3.9.4 Identification of National Ecosystem Restoration Plan

Based on the assessment of the final array of alternatives (3.3, 3.6, 3.7, and 3.8) by the PDT, the plan that reasonably maximizes NER outputs relative to costs, meets planning objectives, reasonably avoids constraints, and provides significant ecosystem outputs is Alternative 3.6. This alternative is designated as the NER Plan and is also identified as the TSP.

In terms of costs and output metrics developed from CE/ICA (Table 3.9-1), Alternative 3.6 provides 5,775 AAHUs, an increase of 177 or 3 percent gain over Alternative 3.3, at an incremental AAC of $206,743. In comparing plans, it is useful to show the change in cost from one plan to another in a "per unit" basis. This would be in terms of average annual costs per average annual habitat units. Alternative 3.6 has an incremental AAC/AAHU of $1,167, which is 73 percent higher than that of Alternative 3.3 ($673). The incremental investment in cost of Alternative 3.6 over Alternative 3.3 is considered worthwhile to pursue for riverine habitat improvement for the following reasons.

Compared to Alternative 3.3, Alternative 3.6 adds the stream reconnection through the abandoned river meander/oxbow associated that would provide an important gain in sinuosity (about 850 feet of lengthened channel) and a corresponding benefit to increased morphologic variability and ecological function within the Aliso Creek system. The reconnected oxbow reach would provide an opportunity to create a wider areal expanse as a result of its high radius of curvature and pattern complexity that in turn would promote a mosaic of habitat types, including riparian forest or woodland, open ponded water, and freshwater marsh within one distinct area. This areal expanse of riparian and aquatic ecosystem (net gain of over 500 feet in width and 10 additional acres, compared to Alternative 3.3) would be unique within the watershed, and also lies within the heart of the Wilderness Park, where the coastal canyon floodplain is the widest. Amphibians, such as the southwestern pond turtle, currently a California Species of Special Concern but likely to be Federally listed, the Federally threatened red-legged frog (if reintroduced by the regulatory agencies), and salamander would benefit from the greater prevalence of moist soils. Slow moving waters promoted by the high radius sinuosity and resulting gentler stream grade would provide important refugia habitat. The reconnected meander oxbow area would allow for the development of a wider expanse of a heterogenetic, multilayered habitat structure of functional riparian habitat for breeding, foraging, and cover/resting opportunities that will benefit bird species including the Federally endangered least Bell's vireo and southwestern willow flycatcher, and the Federally threatened California gnatcatcher, as well as a variety of neotropical migrants species, and California Species of Special Concern, including yellow-breasted chat, Swanson's thrush, yellow warbler, and yellow-headed blackbird.

<table>
<tr><th colspan="6">Table 3.9-2 Final Array Comparison: Beneficial and Adverse Effects</th></tr>
<tr><th>Resource</th><th>Description</th><th>Alternative 1 (No Action)</th><th>Alternative 3.3</th><th>Alternative 3.6</th><th>Alternatives 3.7 and 3.8</th></tr>
<tr><td rowspan="6">Earth Resources</td><td rowspan="2">Construction Impacts</td><td rowspan="2">None</td><td colspan="3">Short term, temporary and less than significant. Impacts further reduced with Environmental Commitments.</td></tr>
<tr><td>Disposal to onsite areas: 130,000 cubic yards. Beneficially adds to buttressing effect against potential landslides.</td><td>Disposal to onsite areas: 300,000 cubic yards. Beneficially adds to buttressing effect against potential landslides.</td><td>Disposal to onsite areas: 340,000 and 350,000 cubic yards, respectively. Beneficially adds to buttressing effect against potential landslides.</td></tr>
<tr><td>Channel Geomorphology</td><td>Some further incision (varies from five feet maximum to 1 foot minimum, and widening as channel seeks dynamic equilibrium (est. 50 year min)</td><td colspan="3">Streambed raised to approach historic pre-incised elevation. Geomorphically stable channel.</td></tr>
<tr><td>Sediment Yield to Ocean</td><td>As dynamic equilibrium approaches, average sediment delivery range approaches 20,000 to 60,000 tons/year</td><td colspan="3">Similar yield to No Action but occurs sooner.</td></tr>
<tr><td>“S” Bend (Reach 4B)</td><td>Expected cutoff after 25 years of this distinctive feature, which offers channel complexity and associated habitat biodiversity (including freshwater marsh)</td><td colspan="3">“S” bend remains intact.</td></tr>
<tr><td>Landslides</td><td>Loss of channel banks immediately adjacent to ascending canyon slopes could potentially compromise slope stability where ancient landslides have occurred. Cuts made into canyon slopes that expose adversely oriented bedding could potentially develop landslides along those</td><td>Based on qualitative evaluation, some risk, though generally low. Some potential moderate risk to one ancient slide area, to be further addressed during Pre-Construction Engineering and Design (PED) phase.</td><td colspan="2">Based on qualitative evaluation, some risk, though generally low. Some potential moderate risk to one ancient slide area, and higher risk to second one to be further addressed during Pre-Construction Engineering and Design PE) phase.</td></tr>
</table>

Table 3.9-2 Final Array Comparison: Beneficial and Adverse Effects

Resource	Description	Alternative 1 (No Action)	Alternative 3.3	Alternative 3.6	Alternatives 3.7 and 3.8
		bedding planes. The degree to which landslides toes are stabilized by relatively thick canyon alluvium fill and extent to which fluvial erosion has disturbed the buttressing effect has not yet been quantified.	Raising streambed may bolster buttressing effect, increasing overall resistance to potential sliding.		
Earth Resources (continued)	Coastal Effects	Upper estuary subject to slight aggradational trends; less likely in lower estuary, though fluctuation dependent on tidal and littoral effects. As Aliso Creek is the largest sediment contributor in the littoral cell, some potential narrowing of downcoast beaches to Dana Point over time due to reduction of sediment yield. Sea level rise could compound these effects.	Impacts to estuary and supply of sand to downcoast beaches expected to be similar to No Action.		
Water Resources	Construction Impacts	None	Short term, temporary and less than significant. Impacts further reduced with Environmental Commitments.		
	Floodplain Hydrologic Connectivity	Severely incised channel provides limited floodplain breakout for 10-year and 100-year flows. Current acres of floodplain: 2-year (56 ac); 10-year (78 ac); and 100-year (106 ac).	Raised streambed elevation increases floodplain widths by 112% for 2-year; 94% for 10-year, and 61% for 100-year.		
	Flood Inundation to Infrastructure	Limited flooding to east (unpaved) and west (AWMA	Total increase of 15% inundation (i.e. to total lengths of roads) over No Action. Corresponding impacts to access expected to be minor. No flood mitigation measures warranted except for paving of east road. Coastal Treatment Plant is not affected.		

Table 3.9-2 Final Array Comparison: Beneficial and Adverse Effects

Resource	Description	Alternative 1 (No Action)	Alternative 3.3	Alternative 3.6	Alternatives 3.7 and 3.8
		Road) access roads within Reaches 4A to 9.			
	Groundwater Levels	Disconnected floodplain function will continue to provide very limited aquifer recharge opportunities.	Groundwater levels expected to incrementally rise along the raised streambed course, and for some distance laterally, due to channel seepage direct influence. Additionally, use of embedded sheet pile to accompany transverse rock riffle structure locations will raise local groundwater levels directly upstream of the structures for a limited distance as groundwater flows in the vicinity of the structures would tend to mound.		
Biological Resources	Construction Impacts	None.	With the establishment of temporary suitable habitat areas adjacent to the Proposed Project area, impacts to biological resources would be minimal, and short term. Environmental Commitments will further reduce impacts.		
	Riverine and Floodplain Ecosystem	Continued decline and narrowing of riverine habitat corridor and biodiversity, primarily due to channel incision and severed floodplain connectivity, creek instability, and vegetation die back from perching effects of lowered groundwater levels. As riparian zone narrows, habitat type conversion would be likely to coastal scrub and annual grasslands. The prevalence of steep streambank slopes will degrade the value of the riparian structure that can establish within the channel margins.	With a hydrologically restored connection and a more stable geomorphic system, the quality of the aquatic, riparian, and floodplain ecosystem would be significantly increased within the restored area. Greater and more complex vegetation structure would develop, supporting a greater species richness, including federal and state listed special species. Disposal sites would be planted with coastal sage scrub and grasslands.		
			No added sinuosity.	Reconnection of abandoned oxbow would add an important gain in stream sinuosity and a corresponding benefit to increased morphologic variability and ecological function.	
					Some additional limited net gains in sinuosity (30 feet for Alternative 3.7; and 90 feet total for Alternative 3.8).
	Aquatic Species Connectivity	Aquatic wildlife connectivity remains impeded along lower Aliso Creek, including the connection to Wood Canyon tributary, due to severe	Increased aquatic species connectivity for resulting from removal of manmade impediments would facilitate the reproductive viability of aquatic species. Within the Proposed Project area, connectivity would increase to 5 miles for the Aliso Creek mainstem (compared to 2.2 miles for No Action); and 3.5 miles for Wood Canyon (compared to limited/no connectivity under No Action). The inclusion of the Pacific Park Bypass increases the overall aquatic		

Table 3.9-2 Final Array Comparison: Beneficial and Adverse Effects

Resource	Description	Alternative 1 (No Action)	Alternative 3.3	Alternative 3.6	Alternatives 3.7 and 3.8
		channel incision and the presence of large barriers such as the ACWHEP structure. The quality of aquatic habitat in Aliso Creek will continue to deteriorate within a deeply incised channel and fragmented habitat to few non-native aquatic species.	species connectivity of the mainstem by an additional 3.5 miles upstream, for a total of 8.5 miles.		
Cultural Resources	Construction Impacts	None. Areas of identified cultural resources are largely protected from new development and would not be expected to change from existing conditions. It is probable, however, that sites may be disturbed or lost both by other human actions and through natural processes such as erosion.	For all action alternatives, with implementation of Environmental Commitments, direct and indirect impacts would be minimized, but with the partial to complete destruction of up to 12 archaeological sites and the potential for impacting human burials, impacts would be significant and adverse.		
			Impacts to cultural resources from disposal sites footprints would likely be avoided.	Impacts to cultural resources from disposal sites footprints would likely be avoided. Potentially slightly greater impact on cultural resources compared to Alternative 3.3 due to inclusion of reconnected oxbow	Impacts to cultural resources from disposal sites footprints would likely result from at least one of the disposal sites. Incremental greater impacts to cultural resources due to inclusion of reconnected oxbow and added sinuosity downstream of Wood Canyon confluence for both Alternative 3.7 and 3.8.
Utilities	Construction Impacts	None. Public agency wastewater infrastructure would remain at risk from continuing bank erosion posing a significant threat to public safety and a measurable impact to the environment and local	Buried streambank protection at key locations would provide erosion protection up to the 1% annual chance of exceedance (100-year event) to SOCWA wastewater utilities lines and west (AWMA Road) access road (Reaches 4A to 9). JTM regional water supply line would be protected from channel undermining effects (Reach 11).		

Table 3.9-2 Final Array Comparison: Beneficial and Adverse Effects

Resource	Description	Alternative 1 (No Action)	Alternative 3.3	Alternative 3.6	Alternatives 3.7 and 3.8
		economy. SOCWA efforts to protect pipelines at risk from storm flow-induced streambank erosion and undermining will be piecemeal and short-term “band-aid” solutions. Channel incision will continue to threaten the JTM water supply transmission pipeline, requiring periodic intervention to protect from undermining, with an impact to the environment.			

The rationale why Alternative 3.7 or Alternative 3.8 was not selected as the NER Plan is as follows.

In addition to the oxbow reconnection, Alternative 3.7, compared to Alternative 3.6, adds the feature "sinuosity downstream of Pacific Park Drive" within Reach 11. Due to the relative narrowness of the floodplain within this reach (which lies in the more northern portion of the Wilderness Park where urbanization has constrained the floodplain laterally), this feature only provides a very small gain in sinuosity, or about 30 feet in length. Alternative 3.7 provides 5,834 AAHU, or a one percent gain over Alternative 3.6. Although the incremental AAC/AAHU are relatively close for the two alternatives, the relatively limited aquatic habitat ecological benefit that Alternative 3.7 provides and the incremental 40,000 cubic yards of excess materials requiring disposal makes the selection of this alternative less desirable compared to Alternative 3.6.

Alternative 3.8 is similar to Alternative 3.7, but also adds the feature "sinuosity downstream of Wood Canyon Creek" in Reach 5C. This feature adds about 60 feet of additional stream lengthening. With the limited incremental gain in AAHU (less than one percent), and the significant increase in incremental AAC/AAHU (about 73 percent higher than Alternative 3.7 at $2,145 versus $1,239), the additional investment is not warranted.

3.9.4.1 Regional Economic Development (RED) and Other Social Effects (OSE)

RED

The RED account considers the different perspectives between the Federal government, contributing to the nation as a whole, and local communities directly impacted by water resource planning. Local communities and regions directly impacted by water resource planning may consider impacts at the state, regional, or local level a more relevant measure. From the Federal perspective, transferring employment opportunities and resources from one region of the nation to another to construct a water resource project does not in itself constitute national economic development and therefore regional economic impacts may not be fully captured in the NED account. However, from a regional or local perspective the transfer of employment opportunities and resources to construct a project in the region, as opposed to other regions, can be a significant benefit to the local economy in terms of more local employment, spending, and production. The Federal perspective is addressed principally in the NED account while the regional or local perspective is addressed principally in the RED account. A detailed discussion of RED is provided in the Economic Appendix (Appendix C).

Based on estimated direct impacts to employment and income due to the demand for goods and services, it is projected that about 658 fulltime equivalent (FTE) jobs to be created from direct employment from constructing the NER Plan over the period analysis in the local region. The NER Plan is projected to create an additional 451 additional FTE jobs, by indirect and induced effects that support or compliment that construction effort. The regional capture rate, which is the region's direct output as a share of total spending, is around 79 percent. Since much of the labor and equipment comes from within the region, we expect the capture rate to be high as shown.

Overall, the NER Plan should lead to $73.5 million in gross regional product (GRP) and about 1,109 additional job opportunities within the region. The impact to the state would be of greater magnitude although less relative importance due to the large size of the California economy. Approximately $105 million in GRP and about 1,410 jobs would be created statewide.

OSE

The OSE account describes the potential effects of the proposed project alternatives in areas that are not dealt with explicitly in the accounts presented above. The Principles and Guidelines state that the OSE, when included in Corps documents, should "display plan effects on social aspects, such as community impacts, health and safety, displacement, energy conservation and others."

For the analysis, the region of influence (ROI) for direct social effects is defined as Orange County. This ROI area definition extends beyond the potential construction impact area and was chosen based on the assumption that all direct social effects, if any, associated with a project of this type would be confined to this area. The selection of Orange County as the ROI for the project was also based on the assumption that the county is the market area for the majority of users of Aliso and Wood Canyons Wilderness Park.

This OSE describes the potential effects of NER Plan construction and the effects after construction is completed. The OSE account explores the following categories of effects from the implementation of the NER Plan. This is described in Appendix E, and summarized below.

- Displacement/impacts to population. Short-term construction effects to displacement of population are not expected to be significant.
- Public health and safety. Improved community well-being through recreational esthetic improvements brought by restoration, and diminished risk to public health due to protection of wastewater utilities and reduced likelihood of sewage spill threat to receiving beach community.
- Displacement/impacts to minorities and special interest groups. No adverse impacts to minorities or special interest groups.
- Displacement/impacts to business. Beneficial impacts to businesses due to potential increase of tourism and recreation draw resulting from restoration project.
- Displacement/impacts to recreational areas. Beneficial recreational impacts to community. Limited access during construction could cause increased attendance in other regional parks.
- Community growth. No expected community growth as a direct result of project.

- Project impacts and connectivity of the community. Expected increase in community cohesion due to the high quality experience and well-being promoted by the restored riverine system.

3.10 RECREATION PLAN

The formulation for recreation is considered ancillary to ecosystem restoration at an appropriate scope and scale compatible with the restoration features. As a function of the formulation process, a corresponding recreation plan is formulated after identification of the final array and in the case of this study, after the identification of the TSP.

The recreation plan developed for the TSP was commensurate with the scope and scale of the proposed restoration in a manner that does not impair the restoration outputs. The plan will be consistent with the specific planning objective to increase the passive recreation experience associated with the Proposed Project.

The Wilderness Park offers many opportunities for recreation use, including hiking, running, cycling, equestrian use, and nature viewing with an extensive network of trails. Public access is not authorized within the riverine system.

The recreation plan will be limited to the construction of five kiosks within the Proposed Project area. The kiosks, to be located along the west side of Aliso Creek along the access roads (Aliso Creek Bikeway to the north of the park entrance at AWMA Road Bridge; AWMA Road to the south), will provide increased public awareness and appreciation of the riverine ecosystem and specific restoration features of the TSP.

An evaluation of recreation benefits was conducted using a unit day value method for a period of analysis between 2026 and 2075. Recreational benefits associated with the TSP total to approximately $308,000 in incidental equivalent annual recreation benefits. The addition of the kiosks provide an incremental equivalent annual benefit of approximately $11,000. The benefit-to-cost ratio of the recreation plan is 11, with net benefits of $10,000. Additional detail is provided in the Economics Appendix (Appendix C).

There are two modifications to segments of existing recreation trails that are required as a result of the TSP. This includes a segment that was once part of AWMA Road along the west side of the creek in Reaches 7 and 8. This segment is identified as “Old AWMA Road” by this study, but referred to as pertaining to the “Aliso Creek Trail” by OC Parks. The segment will be relocated westward to accommodate the channel widening and floodplain creation features in these reaches. The road segment will be reduced in width to 12 feet (from 20 feet) and will have its asphalt pavement replaced with decomposed granite. The other modification is the relocation of the Wood Canyon Creek trailhead to allow expansion of the Wood Canyon riparian zone at the confluence. These modifications are part of the TSP and separate from the recreation plan.

CHAPTER 4 TENTATIVELY SELECTED PLAN

4.1 PLAN OUTPUTS

4.1.1 Ecosystem Restoration

As described in Chapter 3, the plan formulation process resulted in the selection of Alternative 3.6 as the NER Plan and the TSP. Figure 4.1-1 displays the components of the TSP.

The TSP restores 191 acres of aquatic and riparian habitat throughout the five miles of the proposed project area between the SOCWA CTP Bridge and Pacific Park Drive (Reaches 4A-12). Together with the upstream reaches (13 to 17, as shown in Figure 4.1-2) that are outside of, but contiguous to, the Federal Proposed Project area, the TSP reconnects 371 acres of this habitat type for 8.5 miles to the I-5 Freeway. Removal or modification to manmade structures that act as aquatic wildlife impediments within the Federal project footprint would increase connectivity for aquatic species to 8.5 miles throughout the reconnected area between the SOCWA CTP and the I-5, and would reestablish lateral connectivity to the 3.5-mile-long high-quality habitat of the Wood Canyon Creek tributary. The ecosystem outputs are summarized in Table 4.1-1. System-wide aquatic and terrestrial wildlife connectivity associated with the TSP is displayed in Figure 4.1-3.

Within the TSP Proposed Project area, recontouring of the streambanks to gentler side slopes, and the creation of a widened channel margin that incorporates inset floodplain terracing, would provide greater stability to the creek system, especially for larger flow events. With raising of the streambed elevation, localized groundwater levels associated with Aliso Creek would rise incrementally, improving the interface with riparian vegetation root systems to support a more extensive riparian habitat. Additionally, the lateral hydrologic connectivity to the 10-year floodplain would almost double to 151 acres; while the 100-year floodplain would increase by about 60 percent to 171 acres. The inclusion of inset floodplain terraces would more than double the two-year floodplain to 118 acres. Table 4.1-2 provides a summary of hydrologic connectivity.

With a hydrologically restored connection and a more stable geomorphic system, the quality of the aquatic, riparian, and floodplain ecosystem would be significantly increased within the restored area. The TSP would enable greater and more complex vegetation structure to develop, comprising of stands of trees (willow, sycamore, and cottonwood) with varying heights and canopies, dense shrub understories (arroyo willow, sandbar willow, mulefat), and herbaceous plants that interface with open water and freshwater marsh habitat. This vegetation structure, or stratification, would support a greater species richness, including Federal and state-listed special species. The increased connectivity for aquatic species resulting from removal of manmade impediments would facilitate the reproductive viability of aquatic species.

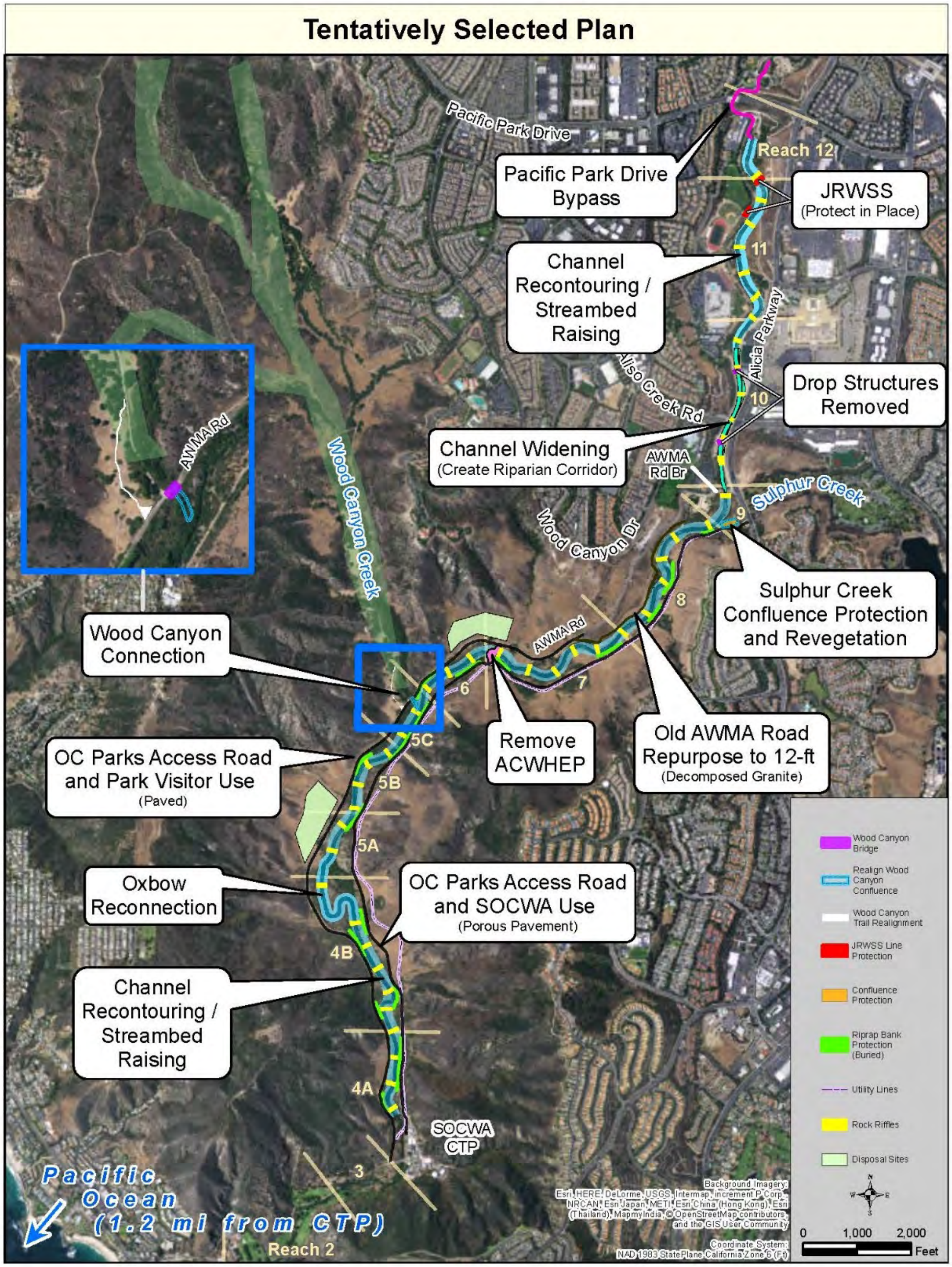

Figure 4.1-1 Tentatively Selected Plan

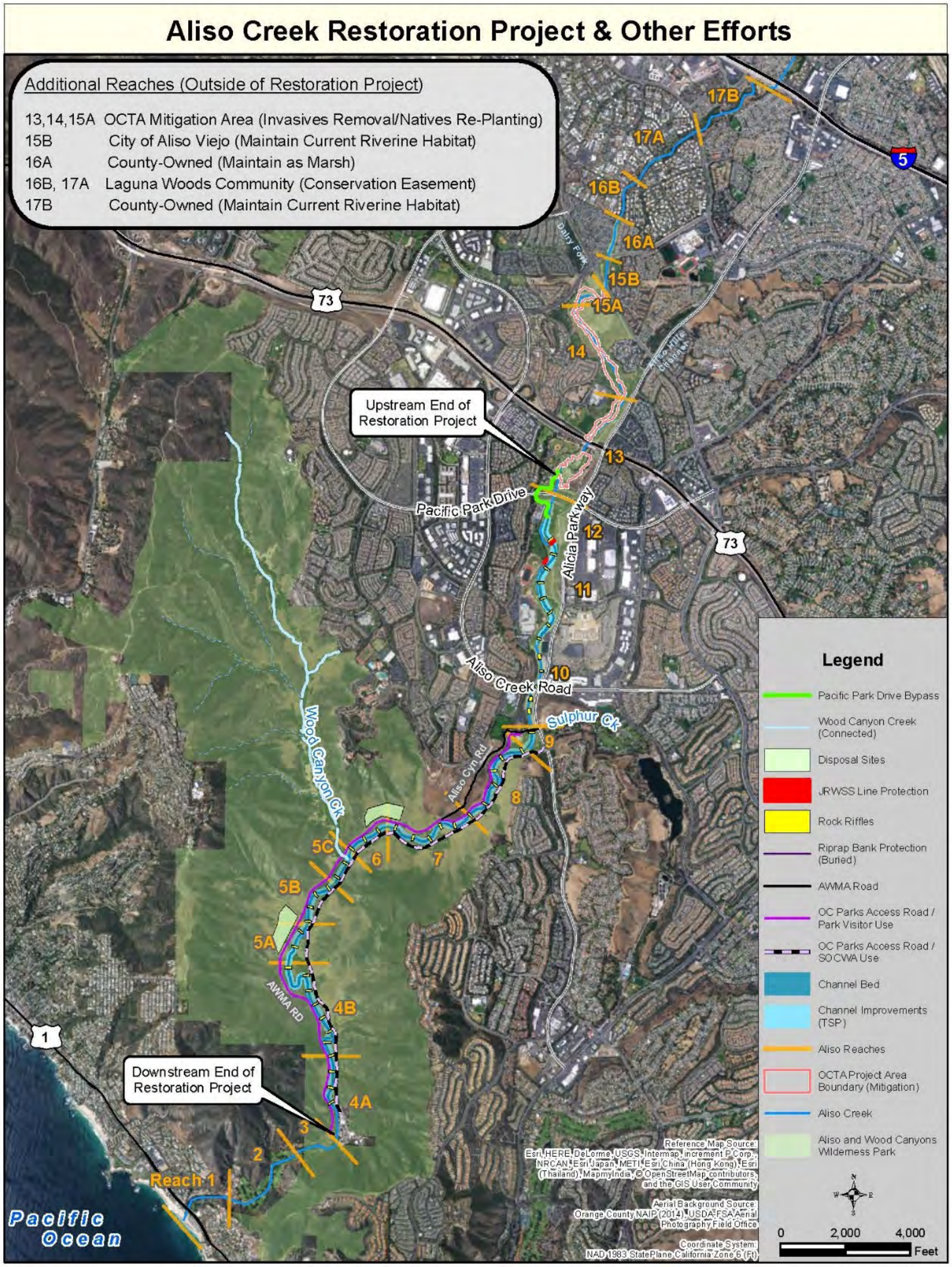

Figure 4.1-2 Tentatively Selected Plan and Stewardship Reaches

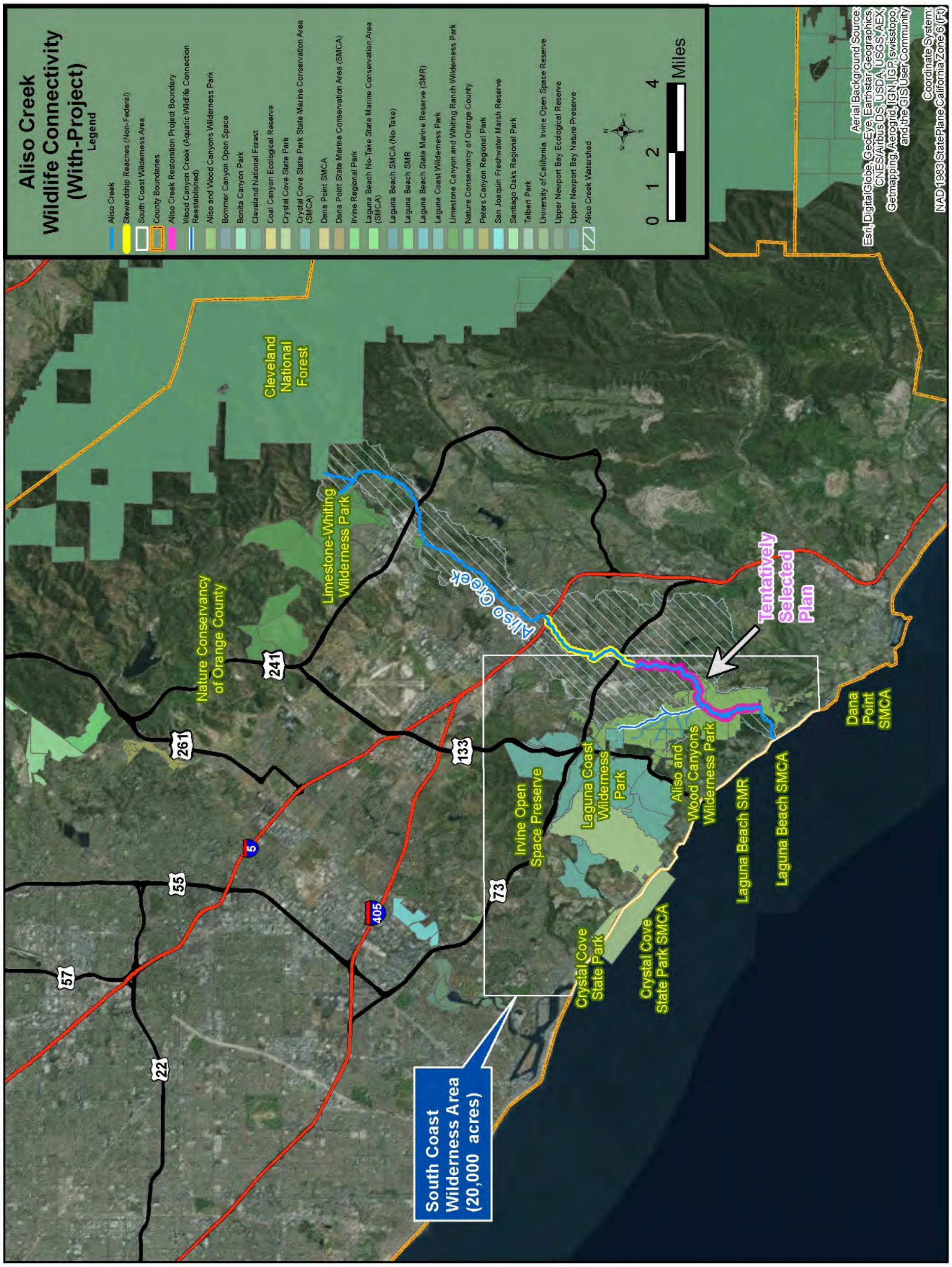

Figure 4.1-3 Systemwide Aquatic and Terrestrial Wildlife Connectivity

Table 4.1-1 Ecosystem Outputs Associated with the TSP

Description		Habitat Value (HU) Year 0	Habitat Value (HU) Year 50	HU Incr. Gain at Year 50	Riverine (Aquatic and Riparian) (acres) Year 0	Riverine (Aquatic and Riparian) (acres) Year 50	Riverine Incr. Gain at Year 50	Aquatic Species Connectivity
No Action[1]		2,994	2,350	-	154	99	-	2.2 miles
TSP	Restored Habitat Area (Direct Restoration)	5,626	6,541	178% over No Action	191	191	93% over No Action	5 miles (Aliso Creek)
	Reconnected Habitat Area							
	Wood Canyon Creek	1,030	1,030	-	84	84	-	3.5 miles
Stewardship Reaches[2]	Pacific Park Drive to I-5	1,198	1,198	-	96	96	-	3.5 miles
Restored Habitat Area plus Reconnected Habitat Area		7,853	8,768	273% over No Action	371	371	275% over No Action	8.5 miles (Aliso Creek); 3.5 miles (Wood Canyon Creek trib)
HU Net Gain (over No Action)		4,859	6,418					
AAHU[3] Net Gain (over No Action)		5,775						
AAHU No Action		2,762						

[1] Area of No Action Alternative encompasses same area to be pursued under with-project actions for restored habitat areas.
[2] Stewardship reaches comprise additional reaches upstream of the Proposed Project upstream limit, from Pacific Park Drive to the I-5 Freeway. These reaches are under the jurisdiction of either Orange County, the City of Aliso Viejo, or the City of Laguna Woods.
[3] AAHU is average annual habitat unit value over a 50-year period of analysis (Years 0, 5, 25, and 50).

Table 4.1-2 Floodplain Connectivity Increases Associated with the TSP

Footprint	2-Year Floodplain (acres)	2-Year Incremental Gain	10-Year Floodplain (acres)	10-Year Incremental Gain	100-Year Floodplain (acres)	100-Year Incremental Gain
Without-Project (Existing)	56	-	78	-	106	-
TSP (Restored Habitat Area[1])	118	112% over Without-Project	151	94% over Without-Project	171	61% over Without-Project

[1] Does not include reconnected habitat area of Wood Canyon Creek tributary.

Figure 4.1-4 compares existing conditions to a forecast of future without-project (No Action) conditions and also to with-project conditions. The representation depicts a 50-year forecast period. The area represented extends from the SOCWA CTP area to just upstream of the ACWHEP structure.

For existing conditions, the quality of the riparian vegetative communities reflects a degraded state as a result of the hydrologic disconnection with the historic floodplain and an associated lowered groundwater table. In the channel overbanks areas, there is evidence of perched dead and dying riparian vegetation. The riparian vegetation is prevalently in late successional (mature) stages in the overbank areas; and largely in early successional (young) stages within the active channel margins as a result of creek instabilities and exposure to higher concentrated flows within the incised system. Under the future without-project scenario, the significantly incised channel system would support a narrowed riparian zone. Further channel sinuosity function is lost with the bypassing of the S-bend. The habitat type within the historic floodplain margin will have transitioned from riparian to coastal scrub and annual grassland communities. The without-project condition assumes there will be at least one occurrence of fire within the Proposed Project area due to vegetation types becoming older (i.e. more senescence). [There are no records of wildlife fires occurring in Aliso Creek and Wood Canyons Wilderness Regional Park]. For the with-project condition (i.e. the restoration scenario), the riparian communities would support a variety of successional stages (early, mid, and late) based on their spatial relationship to the main channel, the established floodplain terraces, and the historic floodplain. This scenario promotes a heterogeneous multi-structural riparian habitat community.

The TSP would also provide water quality improvement as an output of ecosystem restoration. These benefits were not quantified and are considered ancillary to the Proposed Project. The increased hydrologic connection to the floodplain would allow more opportunity to settle out fine suspended sediments and their associated nutrient loads, thereby promoting improved instream and coastal receiving water quality.

In addition to ecosystem restoration benefit outputs, the TSP provides incidental erosion damage reduction benefits. These benefits are associated with the protection of regional wastewater conveyance and water supply infrastructure from streambank and streambed erosion threat. For SOCWA wastewater conveyance infrastructure, there is a net reduction of average annual damages of $646,000 within the Proposed Project area for bank erosion protection features related to the TSP. These features are necessary to safeguard the restoration benefit outputs. For the JTM water supply transmission infrastructure, a quantitative damage reduction analysis was not performed. However, the current erosion threat to the pipeline crossing would be significantly diminished as an outcome of the ecosystem restoration features that are related to the strategic placement of required grade control (rock riffles) structures. Benefits related to erosion damage reduction are considered as incidental to the construction of the ecosystem restoration project.

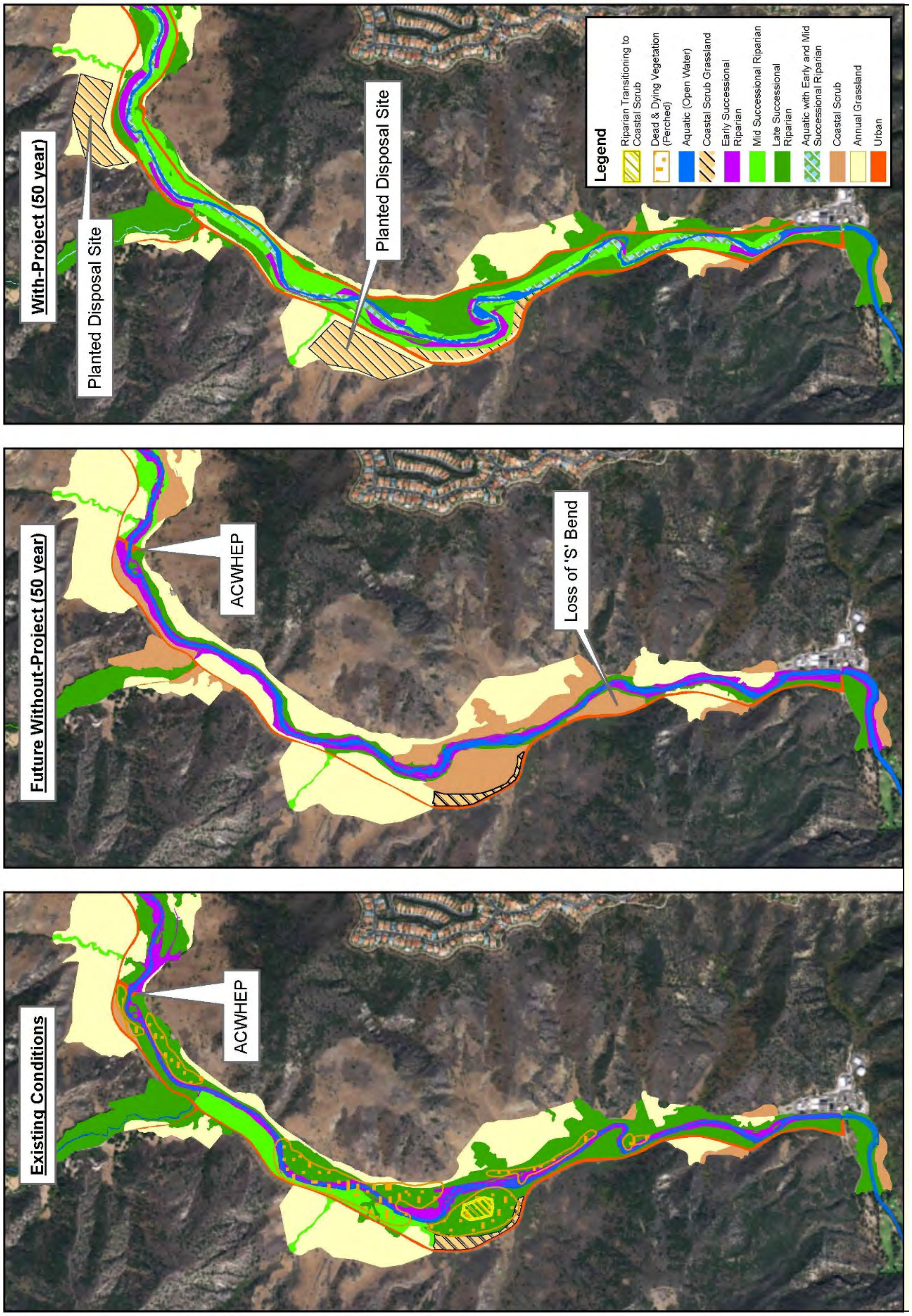

Figure 4.1-4 Changes in Habitat Types and Successional Stages (Conceptual)

4.1.1.1 Stewardship Reaches 13-17b

Though not critical to aquatic species sustainability, the reconnection to 3.5 miles of additional aquatic and riparian habitat between Pacific Park Drive and the I-5 Freeway would provide a beneficial increment to the TSP, providing a larger reconnected area of this habitat type.

For the additional 3.5 miles of the Aliso Creek riverine corridor (Reaches 13 to 17B) upstream of the Proposed Project limit, the various land owners of the subreaches (Orange County, Aliso Viejo Community Association, and the City of Laguna Woods), would continue to pursue stewardship practices in protecting and maintaining natural resources in accordance with their adopted RMPs. These additional reaches of Aliso Creek mainstem would not involve any implementation actions by the Federal government. Figure 4.1-3 shows the TSP in context with the other local efforts.

Following is a description of the stewardship reaches of non-Federal entities, ownerships, and the respective disposition:

- Reaches 13 to 15A – the first 1.8 miles of Aliso Creek upstream of Pacific Park Drive that is owned by Orange County and is within the Wilderness Park boundary. OCTA mitigation activities are currently underway within these reaches. The mitigation activities are for habitat restoration and have long-term maintenance obligations. Reaches 14 and 15 are associated with detection of southwestern pond turtle individuals, a California Species of Special Concern.
- Reach 15B – a short soft-bottom reach within Sheep Hill Park in the City of Laguna Hills. The park is owned and maintained by the Aliso Viejo Community Association. No changes to current maintenance practices of the riparian reach would be necessary.
- Reach 16A – a short 1,200-foot-long soft-bottom engineered reach owned by Orange County and under jurisdiction of OC Flood Division that would modify the vegetation management plan to allow the establishment of freshwater marsh habitat.
- Reach 16B and 17A – a conservation easement owned by the City of Laguna Woods. No changes to current maintenance practices would be necessary.
- Reach 17B – a natural channel segment downstream of the I-5 Freeway.

4.1.2 Recreation Plan

The objective of the recreation plan is to enhance the passive recreational experience associated with the Proposed Project. The recreation plan formulated for the NER Plan was developed through coordination with the non-Federal sponsor to take advantage of existing recreation facilities, as well as proposed ecosystem restoration improvements, while complying with Corps policies and regulations pertinent to recreation improvements at ecosystem restoration projects.

The recreation plan includes the construction of five interpretive kiosks within the Proposed Project at key locations. The kiosks will be located along points of recreational access for the public, which includes the Aliso Creek Bikeway and AWMA Road, both paralleling the west side of Aliso Creek within the Wilderness Park. The kiosks provide educational value and are intended to increase public understanding and appreciation of the restored habitat and diverse ecosystem functions within the Wilderness Park. Proposed locations of the kiosks are as follows:

- Vicinity of Pacific Park Drive, west side along Aliso Creek Bikeway
- Vicinity of Ranger Station/Visitor Area
- Three locations along AWMA Road between the Ranger Station and SOCWA CTP Bridge.

Based on the economic recreation benefits analysis performed using a unit day value method, there are two benefit categories considered: enhanced recreation experience associated with the NER project and that associated with the recreation plan (i.e. the addition of the kiosks). For benefits related to the ecosystem restoration project, the TSP provides $308,000 in incidental equivalent annual recreation benefits, or a 32 percent gain over without-project conditions. For benefits related to the kiosks, there is an incremental gain of $11,000 in equivalent annual recreation benefits, or a 0.8 percent increase over benefits related to the ecosystem restoration project. The recreation plan has a benefit-to-cost ratio of 11. Additional details of the economic analysis is provided in Appendix C-1.

4.2 LANDS, EASEMENTS, RIGHTS-OF-WAY, AND DISPOSAL SITES (LERRDs)

The majority of the land associated with the project footprint is owned by the County of Orange, and is within the boundaries of the Wilderness Park. The TSP would require approximately 174.16 acres in fee ownership, 21.37 acres of permanent easements, and 30.16 acres of temporary easements. The non-Federal sponsor would be responsible for providing approximately 2.15 acres of in-fee land. The non-Federal sponsor would also need to provide 1.11 acres of land required for permanent road easements; 2.04 acres of land for temporary road easements; and 0.28 acres of land for temporary work area easements. The non-Federal sponsor would acquire these estates from private and public entities. A total of 24.13 acres of lands already owned by the non-Federal sponsor would be utilized for two disposal sites. No borrow sites would be necessary for implementation of the TSP. No facility or utility relocations would be necessary for implementation of the TSP. The proposed utility actions would be to protect in place, remove as abandoned, and protect in place and modify.

4.3 PLAN IMPLEMENTATION

4.3.1 Revisions to Limits of OCTA Compensatory Mitigation Areas

Within Reaches 11, 12, and 13, the Proposed Project would displace the portions of OCTA compensatory mitigation areas[9] that are within the boundaries required for the

[9] Currently undergoing 404 permit application

Federal project. Prior to implementation of the Proposed Project, coordination would occur between the Corps, OCPW, OCTA, USFWS, CDFW, and SWRCB to consider the necessary actions, which could include revisions to the OCTA Habitat Mitigation and Monitoring Plan (HMMP) and to the Long-Term Management Plan (LTMP). The LERRD interests relative to the Proposed Project have included the affected HMMP areas.

4.3.2 Design and Construction Considerations

4.3.2.1 Geotechnical Investigations

Geotechnical investigations would be conducted during the PED phase to supplement those conducted during the feasibility phase. These investigations would be necessary to better address the existing level of stability and reduce any potential risk of reactivation of identified ancient slope failures (landslide masses), or destabilization of some other areas currently unaffected by sliding, as a result of the planned excavations and grading of alluvial soils associated with the channel alignment. (Refer to related discussions presented in Section 3.8.1.1.) Additionally, any segments of the proposed alignment that are adjacent to an identified unstable ascending slope, whose stability could be undermined should localized channel widening result during larger storm events, would need to be evaluated for risk level in coordination with the engineering team.

The recommended design angle for side slopes within the proposed 10-year flow channel is 3H:1V, which is assumed to assist in providing a geomorphically stable configuration. Existing slopes above the 10-year flood level will remain unmodified where possible. Proposed cut and fill slopes above the 10-year flood level may be assumed to be as steep as 2H:1V. The majority of both channel side slopes and upper slopes are intended to remain unlined and in a naturally vegetated condition. Slopes steeper than 3H:1V that may experience inundation by channel flows present a risk of slope instability. Detailed geotechnical studies will be needed during the PED phase to establish the appropriate stable slope gradient at each location of the project. Where slopes are not found to be adequately stable, designs will be modified to either flatten the slopes, add reinforcement or revetment, add biotechnical stabilization measures, or some other stabilizing measures.

The outcome of the geotechnical investigations would allow reconciliation of any potential destabilization concerns and recommend adjustments, as warranted, to project design and construction, including any protective mitigation measures.

4.3.2.2 Cultural Resources Investigations

A comprehensive cultural resource inventory of the APE would occur during the PED phase to supplement site investigations conducted during the feasibility phase. The Corps, in consultation with the California SHPO and the Affected Tribes, would execute a programmatic agreement (PA) prior to PED. The PA will layout the procedures for the cultural resource inventory, the evaluation of any resources located during the inventory, and a process for avoiding, minimizing, and mitigating any adverse effects. If adverse effects to resources determined to be eligible for the NRHP cannot be avoided, the Corps, California SHPO, the Affected Tribes, and the County of Orange would execute a Memorandum of Agreement during PED specifying a treatment plan, which would be undertaken by the Corps prior to or during the project construction period to address adverse effects.

4.3.2.3 Paleontological Assessment

During the PED phase, the project paleontologist will consult the results of planned geotechnical investigations performed in PED to inform a paleontological survey. The intent of this survey is to establish the likelihood of encountering potential significant fossil bearing formations currently buried by recent alluvium within the excavation footprint. It is anticipated that paleontological monitoring would be conducted during construction activities; associated costs are assumed to be part of construction management costs. Any discovered significant fossil resources would be salvaged under the direction of the project paleontologist.

4.3.2.4 HTRW

No HTRW hazards have been identified within the immediate project area, other than the ongoing surface water quality impairments that is related primarily to nonpoint sources from land usage adjacent to and more than 0.25 miles from the Proposed Project area. An environmental database screening assessment conducted during the feasibility phase identified 84 records of sites within or adjacent to the proposed project area where regulated materials have been used or regulated wastes have been generated. These records appear to be of routine issues with little, if any, impact on the Proposed Project. During PED, a Phase I ESA would be completed to clarify the status of those sites; associated efforts would be funded from the PED budget.

4.3.2.5 Diversion and Control of Water

Control of surface water flow would be necessary during construction as Aliso Creek is a perennial stream. Due to the length of the project, implementation would be divided into multiple construction reaches and phased, with work efforts generally initiating from the downstream end. At the upstream end of each construction reach, the entire channel flow would likely be diverted out of the channel by means of a diversion pipe. It is expected that dewatering efforts would also be necessary for construction related to the placement of riffle structures and streambank protection foundation (toedown). Dewatering can be accomplished by use of sump pumps and supplemented as needed with dewatering wells. The Corps will develop a plan for diversion and control of water and obtain the appropriate permits prior to commencement of construction activities.

4.3.2.6 Construction Phasing and Habitat Restoration Considerations

To limit esthetic impacts related to the temporary loss of vegetation habitat and adverse impacts to the habitat and wildlife during construction, the TSP would be constructed over four years in phases as shown in Figure 4.3-1. Phases 1 through 4 would be constructed consecutively in each year, starting from the downstream project limit at the SOCWA CTP Bridge moving upstream. Phase 0 (from AWMA Road Bridge to Pacific Park Drive), would be started at approximately the same time as Phase 1.

Each phase would be cleared and grubbed of all vegetation prior to earthmoving and grading operations for the channel. Giant reed and other invasives removal have been conducted during past activities and are in maintenance within the Proposed Project area in a cooperative effort led by the County of Orange. Any exotic and invasive species encountered during clearing and grubbing operations would also be removed.

Genetic plant material would be collected far enough in advance of each phase of construction, from the reaches of the chronological phase to undergo construction. The plantings would be allowed to establish initially in a nursery before being brought onsite during an acclimation period prior to planting. Mature trees that are in healthy and good growth form may be boxed and used. Use of Aliso Creek vegetation for pole stock (i.e. large cuttings of branches or trunks of riparian species) may also be used in the restoration design.

The planting restoration of each phased construction site would begin when the channel construction activities have been completed. It is possible that native plant restoration could begin once channel construction operations have completed substantial portions of a phase length. A detailed restoration plan would be developed in the PED phase. Supplemental water may be necessary the first year, except during the rainy season, to taper off in frequency over the second and third year. By the fourth year, supplemental water may no longer be necessary.

It is anticipated that freshwater marsh vegetation types would restore on its own by seed or rhizomes in the soil, or washed down from upstream sources. During PED, more detailed restoration design can incorporate specific areas for freshwater marsh, open water refugia, or backwater areas as desired.

As a minimization measure to limit effects to least Bell’s vireo occupied habitat within Phase 4 reaches, suitable temporary vireo riparian habitat would be created in an adjacent area to the Phase 4 reach just to the east of the east road within a nine-acre area. A shallow swale would be excavated and planted with vireo structural riparian habitat. The creation of this habitat would be implemented during the PED phase one year prior to construction of Phase 1 with the emphasis on creating the structural conditions of the habitat for the species to use for nesting.

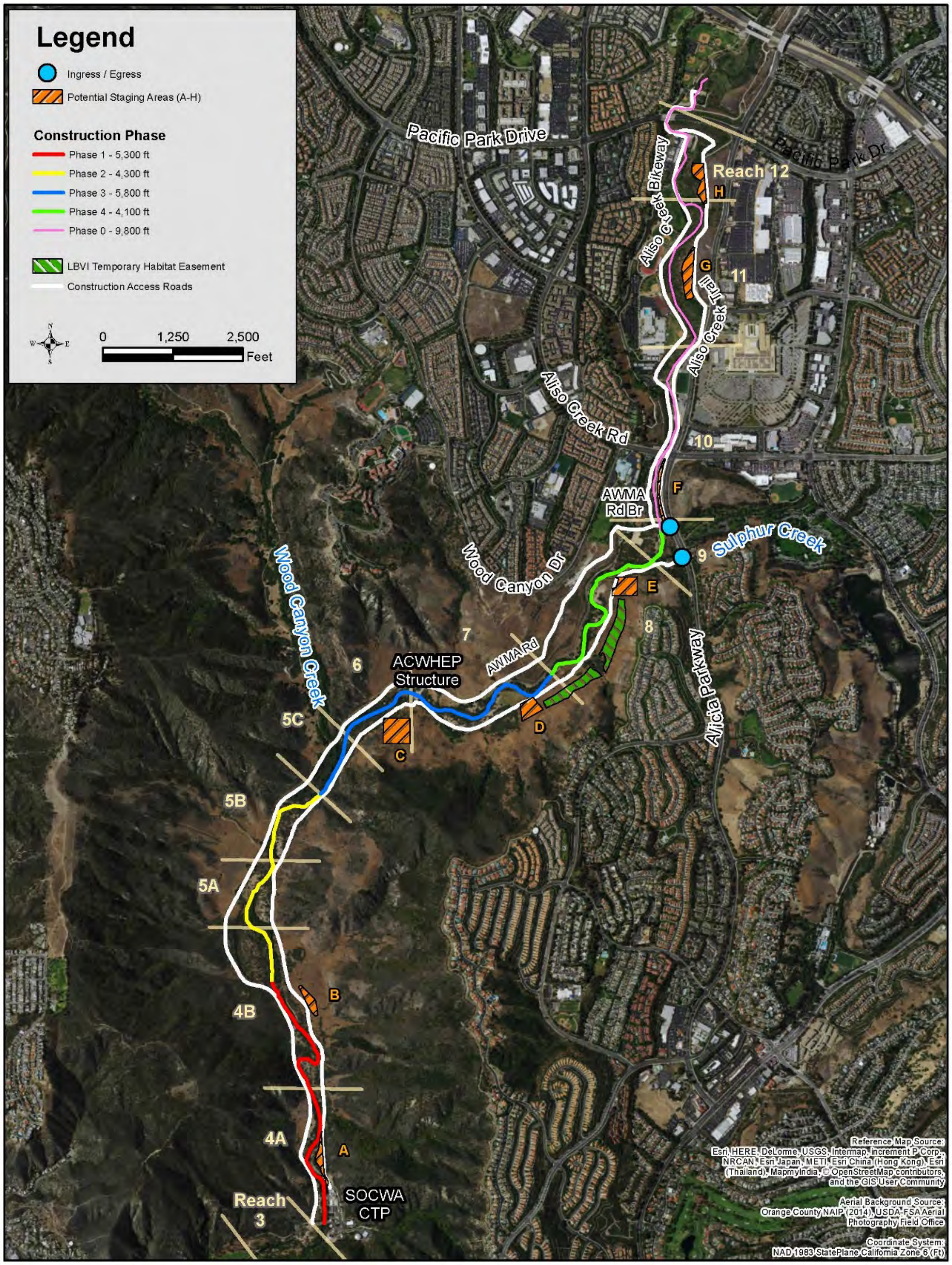

Figure 4.3-1 Construction Phasing and Temporary Easements

4.3.2.7 Construction Access and Staging Areas

For construction downstream of the AWMA Road Bridge, the points of project ingress and egress would be located at the east trail parking lot off Alicia Parkway just south of Sulphur Creek, which leads to the existing east dirt access road; and also at the main entrance of the Wilderness Park at the AWMA Road Bridge, which leads to the paved AWMA Road along the west bank of Aliso Creek. Access to construction reaches upstream of AWMA Road Bridge (i.e. Phase 0) would be via the main entrance of the Wilderness Park. The west side access road would be the paved Aliso Creek Bikeway to the west of the bridge. The east side unpaved maintenance road would be accessed from just east of the bridge crossing in the vicinity of the main entrance.

It is anticipated that transfers of excavated material between the Phase 0 reaches to downstream areas (including the two disposal areas) would be needed. Because of the limited height underneath Aliso Creek Road Bridge, vehicles hauling the material may need to drive along Alicia Parkway for a short distance, which would require frequent traffic control.

Potential staging areas include relatively flat open spaces along the east bank. The staging areas were selected on the basis of factors such as presence of a relatively flat and uniform ground slope (~2 percent), and avoidance of sensitive vegetation habitat or potential archeological sites. Figure 4.3-1 depicts ingress/egress points and staging areas.

4.3.3 Adaptive Habitat Management Plan

An adaptive management plan (AHMP) is being developed for this restoration effort. In general, the monitoring of project performance and outputs, which is part of the AHMP, is necessary to assure that the project is functioning in accordance with its objectives. The AHMP provides the framework and guidance to identify actions needed to oversee the habitat management activities within the restored project area. It provides a structured process for recommending decisions, with an emphasis on uncertainty about resources response to management actions and the value of reducing that uncertainty to allow improved management. A standing committee comprised of representatives of the Corps, OCPW, OC Parks, and various resource agencies will be responsible for implementing and overseeing the AHMP.

Specifically, the AHMP:

- Establishes the framework for effective monitoring, evaluation of data, and for future implementation of habitat management activities in the project area.
- Provides the process for identifying future actions related to habitat management activities in the project area.
- Establishes criteria, thresholds, and processes for vegetation and wildlife evaluation and modification of implementation activities.

The Corps and the non-Federal sponsor are responsible for carrying out the monitoring and adaptive management activities after construction for each project phase or component until ecological success criteria are met. Although Section 2039 of WRDA 2007 allows up to 10 years of cost-shared monitoring when necessary, the plan anticipates that only five years of monitoring and adaptive management would be required for habitat to mature sufficiently to be self-sustaining and to meet ecological success criteria. With the identified project phasing spanning four years, these activities would commence immediately following completion of each phase. The staggering of monitoring and adaptive management activities would extend the total period to nine years (assuming a five-year period for each phase starting in the year after construction of the phase). Estimated costs of the proposed AHMP have been included in the project cost estimate and would be shared equally between the Federal government and the non-Federal sponsor.

The AHMP will continue to be refined during the PED phase of the Proposed Project. The draft AHMP is provided in Appendix B-8.

4.3.4 Operations, Maintenance, Repair, Rehabilitation & Replacement (OMRR&R) Considerations

The non-Federal sponsor is responsible for providing all requirements and 100 percent of the costs associated with operating and maintaining the project including any repairs, replacements, or rehabilitation of project features that are needed to continue obtaining project benefits. Table 4.3-1 presents a summary of the OMRR&R costs associated with the TSP on an average annual basis.

Table 4.3-1 Annual OMRR&R Costs

Item	Annual Cost
Inspections	$25,000
Channel	$59,800
Disposal Site	$2,900
Riffle Structure	$34,800
Landscaping	$42,100
Old AWMA Road DG Trail	$700
East Road Access	$7,349
AWMA Road Access	$2,785
Buried Streambank Protection	$15,300
Sulphur Creek Riprap Protection	$6,300
TOTAL ANNUAL OMRR&R	**$197,000**

Project features would be inspected to verify performance and identify damages or repair needs quarterly, and after major flood events. Cleanup and minor repairs would also occur at least quarterly. Inspection would include evaluation of scour, sedimentation, and integrity of streambank and grade control structures.

An OMRR&R Manual, also known as an Operation and Maintenance Manual, would be developed as part of turning the project over to the non-Federal sponsor. The manual will describe the specific requirements expected for properly operating and maintaining project features to assure they will continue to function. The OMRR&R requirements for the proposed project features are described in general below.

4.4 ECONOMIC SUMMARY

4.4.1 First Costs

Table 4.4-1displays the details of the first costs required for implementing the TSP. This includes costs for all real estate interests, construction of the ecosystem restoration features, monitoring and adaptive management measures, cultural resources data recovery, and costs to construct the recreation features. The first cost of the project also includes the cost for the PED phase, the next phase of study. The PED costs are estimated to be 10 percent of total construction costs and include such products as the final detailed design, the plans and specifications for the construction contract, further development of real estate requirements, and costs for developing and executing a Project Partnership Agreement (PPA) for the construction phase. The first cost of the project also includes supervision and administration (S&A) costs of construction activities and engineering during construction (EDC) (6.5 percent and 5.5 percent, respectively).

For cultural resources, costs are associated with data recovery. Data recovery of significant archeological properties is at full Federal cost up to one percent of construction costs. In the event that data recovery costs exceed the one-percent level, those costs in exceedance would be cost shared by the Federal government and the non-Federal sponsor, consistent with the ecosystem restoration cost-share limits. Cultural resources mitigation, other than data recovery, would similarly follow the same cost-share limits established for ecosystem restoration. During PED, measures will be pursued to avoid or minimize adverse effects that would result from project implementation whenever feasible on eligible properties.

Table 4.4-1 Economic Analysis of the TSP
(FY16 Price Level; FY17 Discount Rate 2.875%)

Item	Amount
NER First Cost	
Real Estate	$17,115,000
Construction	$61,454,200
PED (including EDC)	$9,525,400
Construction Management (S&A)	$3,994,500
Monitoring and Adaptive Management	$3,517,000
Cultural Resources (Data Recovery)	$703,400
Geotechnical Investigations	$500,000
Total NER First Cost	**$96,809,500**
NER Average Annual Cost	
Annual Cost of Total Gross Investment	$3,797,000
OMRR&R	$196,600
Total Average Annual Cost (AAC)	**$3,993,600**
Total AAC per Average Annual Habitat Unit (AAHU)	**$692**
Restored plus Reconnected Habitat	**371 Acres**
NER Average Annual Benefits	
Net AAHU	5,775
Incidental Streambank Erosion Protection (Wastewater Conveyance)	$646,000
Incidental Streambank Erosion Protection (Water Supply Conveyance)	Not quantified. Protects water supply for more than 200,000 residents
Recreation	
First Cost	$25,000
AAC	$1,000
Average Annual Benefits	$11,000
Benefit-to-Cost Ratio	11
Incidental Annual Recreation Benefits (NER)	$308,000
Total Project First Cost	**$96,834,500**

4.5 PROJECT COST SHARING

The apportionment of total project costs between the Federal government and the non-Federal sponsor is displayed in Table 4.5-1.

Standard cost-sharing policy for ecosystem restoration projects is described in current guidance (ER 1105-2-100) as follows:

- The non-Federal share will be 35 percent of the project or separable element implementation costs (PED and construction) allocated to ecosystem restoration.
- The non-Federal sponsor is responsible for providing 100 percent of the LERRD and OMRR&R.

- The value of LERRD shall be included in the non-Federal sponsor's 35 percent share. Where the LERRD exceeds the non-Federal sponsor's 35 percent share, the sponsor will be reimbursed for the value of LERRD, which exceeds its 35 percent share.
- Table 4.5-1 also include a line item for Federal administrative costs. These costs represent Federal administration and review activities relating to the non-Federal sponsor's provision of LERRD for the project, and are therefore a cost-shared component of the project and are not part of LERRD.
- Recreation costs will be shared equally.

Table 4.5-1 Federal and Non-Federal Apportionment of Total Project First Cost

Item	Federal	Non-Federal	Total (Rounded)
Real Estate			
Non-Federal Sponsor LERRD	0	15,500,000	15,500,000
Non-Federal Sponsor Administrative Costs	0	1,550,000	1,550,000
Federal Administrative Costs	65,000	0	65,000
Subtotal – Real Estate	65,000	17,050,000	17,115,000
Construction			
Construction	61,454,200	0	61,454,200
PED (including EDC)	9,525,400	0	9,525,400
Geotechnical Investigations	500,000	0	500,000
Construction Management (S&A)	3,994,500	0	3,994,500
Subtotal – Construction	75,474,100	0	75,474,100
Monitoring/Adaptive Management			
Monitoring	1,406,800	0	1,406,800
Adaptive Management	2,110,200	0	2,110,200
Subtotal Monitoring/Adaptive Management	3,517,000	0	3,517,000
Pre-Adjusted Total Cost-Share Amount (65/35)	79,056,100	17,050,000	96,106,100
Adjustment for Cost-Share	-16,587,135	16,587,135	0
Total (65/35)	**62,468,965**	**33,637,135**	**96,106,100**
Percent of Total	*65%*	*35%*	
Other Costs			
Recreation (50/50)	12,500	12,500	25,000
Cultural Resources (Data Recovery; Initial Federal)	703,400	0	703,400
Total Cash Contribution	**63,184,865**	**16,599,635**	**78,784,500**
Total Project Cost	**63,184,865**	**33,649,635**	**96,834,500**

4.6 ENVIRONMENTAL OPERATING PRINCIPLES

The Corps has reaffirmed its commitment to the environment by formalizing a set of "Environmental Operating Principles" (EOPs) applicable to all of its decision-making and programs. These principles foster unity of purpose on environmental issues, reflect a new tone and direction for dialog on environmental matters, and ensure that employees consider conservation, environmental preservation, and restoration in all Corps activities. The principles are described in Engineering Circular 1105-2-4040 "Planning Civil Work Projects under the Environmental Operating Principles," 1 May 2003; and reissued August 7, 2012, as part of the Corps Headquarters memorandum signed by Lieutenant General Bostick entitled: Reissuance of the Environmental Operating Principles.

The study addresses the Corps EOPs as below:

- Foster sustainability as a way of life throughout the organization.
  - Monitoring will be used to implement adaptive management measures to meet and sustain the targeted Aliso Creek Mainstem ecosystem restoration objectives.
- Proactively consider environmental consequences of all Corps activities and act accordingly.
  - Avoid and minimize impacts on environmental resources/habitats.
  - Avoid and minimize impacts on cultural resources.
- Create mutually supporting economic and environmentally sustainable solutions.
  - NER improves degraded aquatic and riparian ecosystem structure and function, riverine and floodplain connectivity, stream channel stability and protection of critical infrastructure.
- Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the Corps, which may impact human and natural environments.
  - NEPA, FWCA, ESA, and all relevant requirements will be met.
- Consider the environment in employing a risk management and systems approach throughout life cycles of projects and programs.
  - Minimize impacts on surrounding habitats through adaptive management.
  - Communicate impacts and residual risk to stakeholders and the public.
- Leverage scientific, economic, and social knowledge to understand the environmental context and effects of Corps actions in a collaborative manner.
  - Coordinate with the Ecosystem Planning Center of Expertise (ECO-PCX) and extensively utilize the broad knowledge and experience of active participants involved with the study process from the resource agencies.
- Employ an open, transparent process that respects views of individuals and groups interested in Corps activities.
  - Actively listen and respond to the public, addressing, and incorporating comments and concerns during the planning process and for future design and implementation.

4.7 USACE CAMPAIGN PLAN AND STRATEGIC PLAN

The *USACE Campaign Plan Goal 2 to Transform Civil Works and the Sustainable Solutions to America's Water Resources Needs: Civil Works Strategic Plan 2014-2018* guided this effort for preparation of the Draft IFR. The Corps worked with the non-Federal sponsor and stakeholders following the Corps' six-step plan formulation process, as well as the extensive review process. The Corps is delivering an enduring and essential solution that meets the Nation's needs under Goal 2, which seeks to, "Deliver enduring and essential water resources solutions through collaboration with partners and stakeholders".

These Campaign Plan and Strategic Plan priorities are supported by the NER Plan through the following:

- Incorporated, through the adaptive management plan, measures to account for potential environmental/cultural changes.
- Provided, through the OMRR&R plan, assurance of engineering, economic, and environmental sustainability of the proposed project over its 50-year economic life.
- Employed a peer review process and obtained supported of the non-Federal sponsor.
- Employed an integrated, comprehensive systems – based approach by planning and designing project features as a system including up and downstream projects.
- Employed risk – based concepts in planning and conceptual design and will continue to do so in construction and OMRR&R.
- Employed a continuous assessment of study policy issues through coordination with the Corps regional and headquarters levels, assessing and modifying organizational behavior, as needed.
- Used a dynamic independent review process.
- Employed adaptive planning and engineering systems developing a Monitoring and Adaptive Management Plan cost shared for five years after construction to allow for unexpected changes and response to necessary modifications following construction.
- Used a rationale for restoration alternatives focused on sustainability and applied ecological and engineering principles.
- Applied ecological and engineering principles in design of alternatives to locate project features where appropriate ecologically and to restore creek functions.
- Considered the need for review and inspection of completed works by considering the future ecosystem restoration needs.
- Effectively communicated risk using public involvement vehicles and discussions with the non-Federal sponsor and with key stakeholders.
- Established public involvement early in the study process.
- Managed and enhanced technical expertise and professionalism with an interdisciplinary team from the Corps, Federal and local agencies, the non-Federal sponsor, and contractor personnel. Shared and learned from multiple disciplines within and outside the Corps.

4.8 DIVISION OF PLAN RESPONSIBILITIES

The WRDA of 1986 (Public Law 99-662) and various administrative policies have established the basis for the division of Federal and non-Federal responsibilities in the construction, maintenance, and operation of Federal water resource development projects accomplished under the direction of the Corps. Anticipated Federal and non-Federal responsibilities are described in this section. The final division of specific responsibilities would be formalized in the PPA.

4.8.1 Federal Responsibilities

The estimated Federal share of the total first cost of the project is not more than 65 percent of the costs of the NER Plan, limited to costs of construction. The Federal Government’s responsibilities are anticipated to be:

- Sharing a percentage of the costs for PED, including preparation of the Plans and Specifications, which is cost-shared at the same percentage that applies to construction of the project.
- Sharing a percentage of the construction costs for the project.
- Administering contracts for construction and supervision of the project after authorization funding and receipt of non-Federal assurances.

4.8.2 Non-Federal Responsibilities

Federal implementation of the recommended project would be subject to the non-Federal sponsor agreeing to comply with applicable Federal laws and policies, including but not limited to:

a. For the NER Plan, provide 35 percent of total project costs as further specified below:
    1. Provide 35 percent of design costs in accordance with the terms of a design agreement entered into prior to the Federal Government’s commencement of design work for the project;
    2. Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material all as determined by the Federal Government to be required or to be necessary for the construction, operation, and maintenance of the project;
    3. Provide, during construction, any additional funds necessary to make its total contribution equal to 35 percent of design and construction costs;

b. Shall not use Federal Program funds (those funds provided by a Federal agency, plus any non-Federal contribution required as a matching share therefor) to meet any of the non-Federal obligations for the project unless the Federal agency providing the funds verifies in writing that the funds are authorized to be used for the project.

c. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) that might reduce the outputs produced, hinder operation and maintenance of the project, or interfere with the proper function of the project.

d. Shall not use the project, or real property interests required for construction, operation, and maintenance of the project, as a wetlands bank or mitigation credit for any other project.

e. Comply with all applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended (42 U.S.C. 4601-4655), and the Uniform Regulations contained in 49 Code of Federal Regulations Part 24, in acquiring lands, easements, and rights-of-way required for construction, operation, and maintenance of the project, including those necessary for relocations, the borrowing of materials, or the disposal of dredged or excavated material; and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

f. For so long as the project remains authorized, operate, maintain, repair, rehabilitate, and replace the project, or functional portions of the project, including any mitigation features, at no cost to the Federal Government, in a manner compatible with the project’s authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government.

g. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon real property interests that the non-Federal sponsor now or hereafter owns or controls to inspect the project, and, if necessary, to undertake any work necessary to the functioning of the project, including operation, maintenance, repair, rehabilitation, or replacement of the project.

h. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, rehabilitation, and replacement of the project and any betterments, except for damages due to the fault or negligence of the United States or its contractors.

i. Keep and maintain books, records, documents, or other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of three years after final accounting.

j. Comply with all applicable Federal and state laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964 (42 U.S.C. 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto; the Age Discrimination Act of 1975 (42 U.S.C. 6102); the Rehabilitation Act of 1973, as amended (29 U.S.C. 794) and Army Regulation 600 7 issued pursuant thereto; and 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 (labor standards originally enacted as the

Davis-Bacon Act, the Contract Work Hours and Safety Standards Act, and the Copeland Anti-Kickback Act).

k. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 96-510, as amended (42 U.S.C. 9601-9675), that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction, operation, and maintenance of the project. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the non-Federal sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigations in accordance with such written direction.

l. Assume, as between the Federal Government and the non-Federal sponsor, complete financial responsibility for all necessary remediation and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction, operation, and maintenance of the project.

m. Agree, as between the Federal Government and the non-Federal sponsor, that the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, repair, rehabilitate, and replace the project in a manner that will not cause liability to arise under CERCLA.

n. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 U.S.C. 1962d-5b), and Section 103(j) of the Water Resources Development Act of 1986, Public Law 99-662, as amended (33 U.S.C. 2213(j)), which provide that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until each non-Federal interest has entered into a written agreement to furnish its required cooperation for the project or separable element.

4.9 NON-FEDERAL SPONSOR'S FINANCIAL CAPABILITY

The non-Federal sponsor has committed to provide its share of total project costs, as well as all LERRD required for the Proposed Project. The non-Federal sponsor has committed to performing all OMRR&R required for the Proposed Project. The non-Federal sponsor has also made a commitment to undertake all necessary response and remediation for CERCLA contaminants required for the proposed project, including providing lands free of soil contamination prior to construction of the project features on those lands and handling groundwater contamination during construction activities. The non-Federal sponsor's self-certification of financial capability will be provided prior to the circulation of the Final IFR.

4.10 PROJECT PARTNERTSHIP AGREEMENT

Prior to advertisement for the first construction contract, a Project Partnership Agreement would be required to be signed by the Federal Government and OCPW, requiring formal assurances of local cooperation from OCPW. This agreement would be prepared and negotiated during the PED Phase.

4.11 APPROVAL AND IMPLEMENTATION

The necessary reviews and activities leading to approval and implementation of the NER Plan are listed below:

a. Environmental Impact Statement Filing. After circulation of the Final IFR for state and agency review, as well as public review, the Corps Los Angeles District files the Final IFR together with the proposed report of the Chief of Engineers with EPA.

b. Environmental Impact Report Certification. The Final IFR is circulated for public and agency review and comment a minimum of 10 days before consideration by the OCPW. At a public hearing, the OCPW decides whether to recommend approval of the EIR and forward the document to the Orange County Board of Supervisors for certification. If adopted, a Notice of Completion is filed with the OCPW.

c. Chief of Engineers Approval. The Chief of Engineers signs the report signifying approval of the project recommendation and submits the following to ASA(CW): the Chief of Engineers Report, the Final IFR, and the unsigned ROD.

d. ASA(CW) Approval. The ASA(CW) reviews the documents to determine the level of administration support for the Chief of Engineers recommendation. The ASA(CW) formally submits the report to the Office of Management and Budget (OMB). OMB reviews the recommendation to determine its relationship to the program of the President. OMB may clear the release of the report to Congress.

e. Project requires congressional approval for construction.

f. Funds could be provided, when appropriated in the budget, for preconstruction, engineering and design (PED), upon issuance of the Division Commander’s public notice announcing the completion of the Final IFR and pending project authorization for construction. Surveys, model studies, and detailed engineering and design for PED studies are accomplished first, and then plans and specifications are completed upon receipt of funds.

Construction is performed with Federal and non-Federal funds, once the construction project is advertised and awarded.

CHAPTER 5 ENVIRONMENTAL CONSEQUENCES*

5.1 INTRODUCTION

This chapter describes how the future without-project (No Action Alternative) conditions and the future with-project Alternatives (3.3, 3.6, 3.7, and 3.8) described in Chapter 3 would affect the natural and human resources within and around the Proposed Project area.

The evaluation of impacts is based upon a comparison of conditions with and without the implementation of an alternative plan. The future without-project condition describes the condition that is expected to prevail in the future if the No Action Alternative is selected, and is described for each resource. The No Action Alternative characterizes the conditions likely to prevail in the Proposed Project area within the next 50 years if neither the Corps nor OCPW implements an action alternative to restore the Aliso Creek ecosystem. The action alternatives evaluated in this chapter are the "future with-project" condition to directly compare to the baseline (existing) conditions described in Chapter 2, Affected Environment. The future with-project condition describes the condition that is expected to prevail in the future if a particular alternative is implemented. Chapter 5 mirrors the relevant resources presented in Chapter 2 and presents the predicted effects on the natural and human environment.

The No Action Alternative is mandated by NEPA and other laws and regulations. For purposes of this analysis, the No Action Alternative for NEPA and the No Project Alternative for CEQA are the same. Under NEPA and CEQA, the terms "effects" and "impacts" may be used synonymously (40 C.F.R. §1508.8; CEQA Guidelines §15358). This Draft Feasibility Report and Environmental Impact Statement/Environmental Impact Report (Draft IFR) analysis strives to make a distinction between adverse impacts and beneficial effects that would result from implementation of the Proposed Project.

5.1.1 Threshold of Significance

Significance varies with the setting of the Proposed Action Alternatives. The significance of an action is analyzed in contexts such as society as a whole, the affected region, the affected interests, and the locality. Both the context and intensity of an impact are considered. Intensity is the degree to be considered including uniqueness and whether beneficial or adverse. The significance thresholds for each resource are used to evaluate the significance of any effects, and measures are proposed to avoid, minimize, or mitigate significant effects, as applicable.

The NEPA analysis typically adopts or adapts the CEQA thresholds of significance stated for each resource as appropriate from Appendix G of the CEQA Guidelines. In the case of the air quality and greenhouse gas analysis, the NEPA analysis does not adopt the CEQA thresholds and instead applies separate significance criteria in accordance with the

Clean Air Act. In the case of environmental justice, the NEPA analysis adopts significance criteria aligned with the Executive Order on environmental justice.

5.1.2 Impact Analysis

The environmental impacts analysis addresses the resources and potential impacts that would likely occur from implementation of the Proposed Action Alternatives. An impact consequence or effect is defined as a modification to the human or natural environment that would result from the implementation of an action.

The three types of impacts that may occur when an action takes place include: (1) direct impacts, (2) indirect impacts, and (3) cumulative impacts. Direct impacts are impacts, which are caused by the action and occur at the same time and place. Indirect impacts are those impacts, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Cumulative impacts result from individually minor but collectively significant actions taking place over a period of time.

Impacts may be temporary (short-term), long lasting (long-term), or permanent. For this Draft IFR, temporary effects are defined as those that would be less than three years after completion of the Proposed Project. Long-term impacts are defined as those that would be three to 50 years in duration.

The impacts on each resource may be significant, less than significant, significant and unavoidable, or no impact. Significant impacts are those that would result in substantial changes to the environment and should receive the greatest attention in the decision-making process. Mitigation, avoidance, minimization, or compensation measures may be proposed for implementation, to reduce the severity of the impact.

The level of significance of an impact is identified and described based on NEPA criteria:

- **Less than significant:** An impact that would result in no substantial or potentially substantial change to the resource and would not require mitigation. A significant impact can also be reduced to less than significant with the implementation of feasible avoidance, minimization, or mitigation measures.
- **Significant:** An impact that would cause a substantial or potentially substantial change to the resource. Avoidance, minimization, or mitigation measures would be implemented where appropriate and feasible to avoid or reduce significant adverse impacts to less than significant.
- **Significant and unavoidable:** An impact that would result in a substantial or potentially substantial impact on the resource and could not be reduced to a level of less than significant even with implementation of any appropriate feasible mitigation.

The evaluation of potential environmental impacts is based on the Proposed Project alternatives and assumptions that were identified during the technical and environmental study periods. The affected environment and evaluation of environmental impacts presented address the resources and potential impacts that would likely occur from implementation of the Proposed Project.

Where impacts are identified, recommended mitigation measures, BMPs, and /or other environmental commitments are provided in order to avoid, minimize, or reduce environmental impacts to less than significant.

5.1.3 Planning Horizon

The period of analysis is the same for each alternative plan. The period of analysis for this study is 50 years. The base year is anticipated to be 2026 with, for the action alternatives, a four-year period of construction through 2026. The timeframe is used for baseline and alternative evaluation to allow for a consistent basis for comparison between the No Action Alternative and action alternatives.

5.2 EARTH RESOURCES

5.2.1 Assumptions

Several locations within the Proposed Project are relatively close to mapped ancient landslides occurring on the adjacent hillsides. The slide planes of the larger landslide masses are deeper within the hillside bedrock but daylight within the ancient canyon floor. Relatively thick alluvial deposits, which comprise the existing canyon floor, buttress against and provide resistance to the landslide masses. The post-urbanization channel incision and channel widening has potentially reduced this effect. The degree to which landslides were stabilized by the alluvial sediments and the extent to which erosion has disturbed the buttressing effect has not been quantified. Actions pursued by the Proposed Project alternatives to raise the streambed elevation would likely have a positive incremental buttressing effect. Excavations to widen the channel may in some areas remove or grade alluvial soils that potentially provide stability for these landslides. During the PED phase, additional geotechnical investigations would be conducted as warranted for the Proposed Project to further reduce any risk/uncertainty associated with reactivation of ancient slope failures or destabilization of other areas currently unaffected by sliding. Engineering recommendations may include modifications to the Proposed Project alignment to avoid destabilization to unstable canyon slopes; shoring of unstable canyon slopes; or providing bank protection from fluvial erosion events at the edge of the channel margin that could otherwise cause further widening in potential risk areas.

With corrective measures in place as needed, it is assumed that the Proposed Project would not result in environmental consequences associated with destabilization of ancient landslides or to other adjacent hill slopes.

The Proposed Project involves an extensive amount of earthwork in both excavation and fill quantities in order to raise the creek invert to the historic elevation. Much of the excavated material is expected to be reused within the creek as fill material. Excess material would be disposed to the maximum extent possible at two designated sites to the west of Aliso Creek (Figure 5.2-1) on canyon hills in open grassy areas. The lower site (adjacent to Reaches 5A and 5B) would be approximately 13 acres; the upper site (adjacent to Reaches 6 and 7) would be approximately 11 acres. These sites were evaluated for potential impacts to the existing landslides as part of the preliminary landslide evaluation. Based on indication that these fill areas would generally be less than six to eight feet deep, the proposed areas are not in locations that would negatively impact the existing bedrock landslides, but would add to the buttressing effect and increase the stability of the existing landslide areas. The disposal sites would be planted with coastal sage scrub habitat and seeded native grasses.

For disposal of excess excavated materials that are not considered suitable for use as project fill, one of Orange County's landfill or disposal areas would be considered, including Prima Deshecha Landfill (limit of 4,000 tons per day) in San Juan Capistrano, the Frank R. Bowerman Landfill (limit of 11,500 tons per day) in Irvine, both located off of I-5, or the Olinda Landfill (limit of 8,000 tons per day) near Brea. If any of the landfills reaches capacity during the day, disposal may be diverted to one of the other landfills (OC Landfills). It is anticipated that haul trip lengths would average approximately 40 miles per roundtrip. The landfills often accept dirt and would count it as recycling when they need dirt to provide for cover over trash. Quantities of unsuitable materials would not be anticipated to be extensive. The results of subsurface investigations from 2009 revealed the prevalence of less desirable materials (fat clays) generally at depths below the areas of channel widening (Appendix A-1f; Figure 3-4). It is assumed that quantities of unsuitable excavated materials would not exceed 1,000 cubic yards, or about 60 truck trips, and would be staggered over the first three years of construction.

5.2.2 Thresholds of Significance

A significant impact would occur if the Proposed Project:

- Geologic or topographic features were permanently and adversely destroyed, permanently covered, or materially and adversely modified. Substantially altered topography beyond that which would result from natural erosion and deposition.
- Destroyed, permanently covered, or materially and adversely modified one or more distinct and prominent geologic or topographic features. Such features may include, but are not limited to, hilltops, ridges, hill slopes, canyons, ravines, rock outcrops, water bodies, streambeds, and wetlands. Substantially altered topography beyond that which would result from natural erosion and deposition.

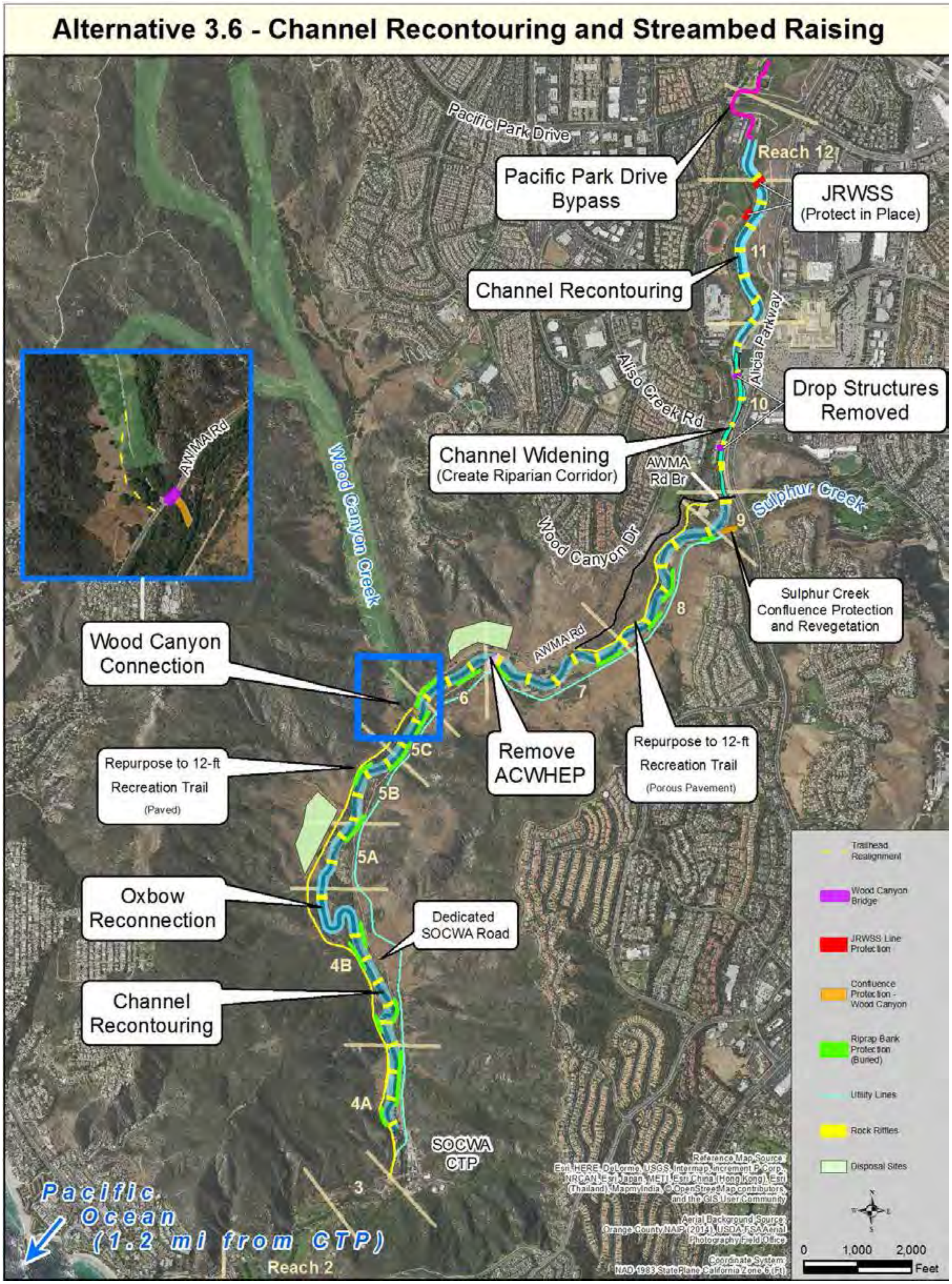

Figure 5.2-1 Aliso Creek Proposed Project Area with Disposal Sites
(Disposal sites are the same for Alternatives 3.3, 3.6, 3.7, and 3.8)

- Substantially and permanently altered the physical or chemical quality of sediments or soils.
- Permanently triggered or accelerated geologic processes, such as erosion or sedimentation brought about by disturbance of landforms.
- Substantially increased wind or water erosion of soils or loss of topsoil, either on or offsite.

5.2.3 Alternatives Analysis

The Proposed Project area alternatives would raise the existing streambed elevation to approach the historic pre-incised stream elevation within the Wilderness Park, and increase the floodplain hydrologic connectivity. Grade control stabilizers (rock riffle structures and embedded sheetpiling) would be required to maintain the established elevations and grade of the streambed. The creek alignment for the alternatives would be similar and generally follow the current alignment. The creek geometry would be recontoured to widen the existing 10-year floodplain from its current average 100-foot width to 200 feet. Side slopes would be graded for improved stability (3H:1V). Inset floodplain terracing, varying in width from 50 to 100 feet would be included with all action alternatives. The action alternatives would provide for a geomorphically stable channel as natural channel design principles (i.e. regime channel, refer to Section 3.8.1.10) were pursued. The inclusion of the rock riffle structures would provide for vertical stability along the raised streambed profile. Potential scouring in the streambed segments between riffle structures would allow for formation of pools ranging from two to four feet in depth.

The Proposed Project alternatives would be expected to show relatively similar general sedimentation trends downstream of the CTP Bridge as the No Action alternative. The current system is already experiencing reaches that are beginning to stabilize and future contributions from bank and streambed erosion are not expected to continue at the rates experienced in the 1970s through 1990s within the Proposed Project reaches. Sediment transport analysis performed concluded that sediment yields to the ocean for Alternatives 2, 3, and 4 variations would be an average of about 40,000 tons per year. Adverse impacts to the estuary and to the supply of sand to the beaches as a result of the Proposed Project alternatives would be less than significant, and would be expected to be similar to the No Action alternative.

Excess excavated materials associated with the Proposed Project alternatives would be: 130,000; 300,000; 340,000; and 350,000 cubic yards for Alternative 3.3; 3.6; 3.7; and 3.8, respectively. Excess excavated materials associated with grading required for the Wood Canyon Creek reconnection (for approximately 700 feet) would be 31,000 cubic yards. This feature would be common to all action alternatives. Construction activities related to the Sulphur Creek confluence area would not result in excess excavated materials.

5.2.3.1 No Action Alternative/Future Without-Project Conditions

Under the No Action Alternative, no Federal project nor a project by the non-Federal sponsor would be implemented. The incised creek would not be restored to pre-incised elevations and restoration of plant communities would not occur. No earth moving would occur, and no excess material would be placed on adjacent slopes. Canyon hillside erosion would continue as it does currently.

SOCWA would continue to provide emergency protection to threatened wastewater infrastructure and also to the AWMA Road, which serves as the primary access to the CTP. Emergency protection would comprise of placing dumped riprap stone along the segments of the streambank where loss of streambank and damage risk from fluvial erosion exists. While placement of exposed riprap stone protects the threatened infrastructure, periodic repairs would be necessary as the level of protection offered by the non-engineered protection is likely to be vulnerable to storm events with a probability of less than a 10 percent ACE (10-year event).

Geology

For the No Action Alternative, topography, seismicity and geology would remain relatively similar to current conditions. Some changes can be expected in the distribution of surficial sediments (alluvial and colluvial debris).

In channel segments that are in close proximity to ascending terrain that includes mapped ancient landslides, or otherwise adversely oriented geologic bedding or jointing planes, any continued erosion of buttressing alluvium could have a potential detrimental impact on stability. Additional detailed geotechnical investigations would be needed to estimate the risk at any key location. Smaller slide masses with shallower rupture surfaces could potentially mobilize periodically due to seismic activity, saturated slope soil conditions or slope instability. Mapped smaller masses are generally further set back from Aliso Creek, and typically within side canyons. Potential failure of these smaller masses would not result in blockage or significant encroachment of the active floodplain. Failure of a larger landslide mass could cause significant blockage of the active floodplain, damage to infrastructure, and debris flow impacts downstream.

Geomorphology and Sedimentation Trends

Within the Proposed Project area, the potential for future vertical degradation (incision) of Aliso Creek for the No Action Alternative is likely limited to a few locations. Hydraulic and geomorphic analysis conducted indicate that there would be a potential five feet of degradation occurring downstream of the regional water supply transmission line crossing (JRWSS) downstream of Pacific Park Drive to Aliso Creek Road. From Aliso Creek Road downstream to the ACWHEP structure, the streambed would remain relatively stable with some localized degradation (up to four feet). Downstream of the ACWHEP structure to the SOCWA CTP Bridge, the streambed would be subject to some incision (on the order of one to four feet) within Reaches 4A and 4B.

Downstream of the Proposed Project area, some degradation trends are expected (from one to four feet) within Reaches 2 and 3. Within Reach 1, the upper estuary upstream of Pacific Park Drive Bridge may be subject to some slight aggradation. Downstream of the bridge, aggradation would not be expected within the lower estuary, though fluctuations are dependent on tidal and littoral effects.

Photo 5.2-1 Continued erosion and downcutting of side slopes along the west side of the creek. Bank erosion has caused the road to be moved further west towards the canyon hillsides.

OCPW would continue to maintain the ACWHEP structure and two large 10-foot drop structures in their current configurations. Future undermining of these structures could result in a significant headcut putting existing infrastructure in jeopardy. The AWMA Road crossing over the Wood Canyon Creek confluence currently provides grade control. Continued maintenance by OCPW would prevent significant headcut upstream that would degrade the natural habitat.

The S-bend located toward the downstream end of the Proposed Project would expected to be cut off in the future, and estimated to occur after about 25 years. The effect of this eventual loss would cause additional stream instability (vertical and laterally) for a distance both upstream and downstream of the S-bend.

In some reaches, creek widening would continue to occur as the creek attempts to attain dynamic equilibrium, and also from mass bank failures in reaches where the streambank height exceeds the critical bank height. This latter failure mechanism would likely become the primary mode compared to hydraulically induced bank failures. Despite these failures, native soils (cohesive silts with sands) lend themselves to holding steeper unstable slopes. Steep creek slopes combined with episodic bank failure limit the growth and establishment of riparian habitat. Where the streamflow locally impinges against the channel slopes, especially in stream bends, continued erosion and bank retreat is possible. Creek adjustments from the various modes of bank failure continue to threaten nearby wastewater and associated infrastructure.

Sediment Delivery to the Ocean

As the channel morphology adjusts and approaches dynamic equilibrium conditions, the amount of channel degradation will decrease and the respective contribution of channel supply to sand delivery downstream will decrease under future without-project conditions. The annual bed material yield would likely approach the estimated values of the watershed yield, varying between 1,000 to 200,000 tons per year (dry and wet year yield, respectively), with an average annual load of 20,000 to 60,000 tons.
As Aliso Creek is the largest sediment contributor in the littoral cell, significant decreases in sediment discharge, even though gradual over time, would potentially result in narrower beaches from Aliso Creek to Dana Point over time.

Sea level rise and potential greater storm surges associated with climate change would compound these effects. Climate change effects in California are expected to bring warmer year-round temperatures and wetter winters. Mean sea level along the California coast is projected to rise, by potentially several feet by year 2100. Rising sea level would affect the coastline causing beaches to erode and retreat inland or disappear, depending on local topography and geology, sediment supply from watersheds and cliff erosion.

5.2.3.2 Alternative 3.3 – Raise the Streambed to Approach the Pre-Incised Elevations

Construction

The streambed would be raised incrementally from downstream to upstream, incorporating a series of sloped rock riffle structures (with embedded sheetpiles) to stabilize the overall streambed gradient longitudinally, spaced 600 to 800 feet apart between the SOCWA CTP and Pacific Park Drive. Removal of the ACWHEP structure may require temporary bracing of soils directly upstream to stabilize supported materials.

Alternative 3.3 would produce an estimated 130,000 cubic yards of excess material to be disposed onsite. This alternative would have the least amount of excavated material compared to Alternative 3.6, 3.7, and 3.8. Excess material would be disposed of at the designated disposal areas, or at a local landfill if unsuitable as fill. Excess excavated materials from Wood Canyon Creek would also be disposed onsite. As this feature is common to all action alternatives, the relative impacts would be similar as described for Alternative 3.3.

- Geologic or topographic features were permanently and adversely destroyed, permanently covered, or materially and adversely modified. Substantially altered topography beyond that which would result from natural erosion and deposition

Excavated soil from the channel widening and laying back of channel bank side slopes would permanently alter the creek configuration, and would be substantial change. However, this would provide a more stable channel configuration (cross-section) over the current unstable channel conditions, and one whereby raising the streambed to approach the pre-incised elevations and including inset floodplain terraces within the widened channel would be beneficial rather than adverse. Additionally, the inclusion of grade control stabilizers, constructed as rock riffles, would provide an aquatic habitat benefit as these features would promote the creation of a pool and riffle regime. Channel grading associated with Wood Canyon Creek confluence area (approximately 700 feet) would require some reworking of the streambed gradient to make it less steep, and inclusion of some riffle structures for grade control. Channel side slopes would be graded as needed.

Fill heights at the disposal site locations would generally be less than six feet deep in the upper areas. The excess soil would be placed and the hill slope area recontoured to ensure minimum impact to the existing topography and to maintain drainage, habitat, and access for wildlife and esthetic quality. The topographic variation created by the disposal areas would be compatible with the surrounding hilly landscape. Disposal sites would be planted with coastal sage scrub and native grasses. While changes to the local topography associated with the disposal sites would be considered substantial, the changes would increase the stability of the existing landslide area, which would be considered beneficial. Geologic or topographic features would not be permanently or adversely modified.

- Substantially and permanently altered the physical or chemical quality of sediments or soils.
- Permanently triggered or accelerated geologic processes such as erosion or sedimentation brought about by disturbance of landforms.

As construction would be conducted in phases, reuse or on-site disposal areas for excavated material would be pursued during each phase. During each phase, temporary stockpiling could occur at the disposal or at staging sites. Soil compaction impacts would be associated both of these types of sites.

During PED, soils from the disposal areas would need to be sampled and characterized as part of the geotechnical investigations to establish compatibility with excess excavated materials from channel improvements. If the soils are significantly different regarding physical properties (sand, clay, and silt proportions), an interface could be created between the in-situ and fill materials impacting movement of water between them. Lack of permeability could result in erosion or potential debris flow of the fill layer. Adequate drainage capability would be considered in the design.

Disposal site locations would not negatively impact the existing bedrock landslides. The disposal sites would be compacted, contoured, and sloped to facilitate drainage. Planted coastal sage scrub and seeded native grasses once established, would help control erosion.

The physical or chemical quality of sediments or soils would not be substantially and permanently altered, and there would be no permanently triggered or accelerated geologic processes brought about by disturbance of landforms.

- Substantially increased wind or water erosion of soils or loss of topsoil, either on or offsite.

During construction or prior to vegetation reestablishing, there could be minor, temporary increased wind or water erosion of soils or loss of topsoil. Any movement of excess soil could trigger fugitive dust, which could be significant with winds, in particular Santa Ana wind. Disposal areas and soil stockpiled for future use would be covered and/or watered to minimize fugitive dust and other wind or water erosion. Soil would be stockpiled for the shortest time possible to minimize erosion due to rain and wind. The alternative would not substantially increase wind or water erosion of soils or loss of topsoil. Impacts would be less than significant.

Impacts while similar to Alternatives 3.6, 3.7, and 3.8, which are detailed below, would be less in intensity and duration (likely by a few months) as Alternative 3.3 does not include the oxbow reconnection and other channeling lengthening features (downstream of Wood Canyon Creek and Pacific Park Drive).

Operations and Maintenance

There would be no significant impacts to earth resources during operations and maintenance as activities. The activities would be largely related to debris clearing, replanting, and periodic repair/replacement to riffle structures or buried slope protection, and resurfacing of road/trail pavement materials.

Monitoring

During the monitoring period following construction, monitoring would occur to collect data and identify need for future habitat management activities within the restored creek. There would be minimal impact to earth resources.

5.2.3.3 Alternative 3.6 – Raise the Streambed to Approach the Pre-Incised Elevations with Oxbow

Construction

Construction activities would be similar to Alternative 3.3.

Alternative 3.6 would produce 170,000 cubic yards increase over Alternative 3.3, or a total of 300,000 cubic yards. Alternative 3.6 would reconnect the abandoned oxbow returning the channel alignment through the lower portion of Reach 5A/upper portion of Reach 4B to a historic alignment that was lost in the mid-1980s. The current channel within the affected portions of the reaches would be filled.

- Geologic or topographic features were destroyed, permanently covered, or materially and adversely modified. Substantially altered topography beyond that which would result from natural erosion and deposition

Similar to Alternative 3.3, though the changes to the creek configuration would be considered substantial, the outcome of a more stable channel, the raised streambed, and inclusion of inset floodplain terraces would be beneficial rather than adverse. The reconnected oxbow would return an important geomorphic and habitat feature to the system that was previously lost.

Due to the greater amount of excess soil associated with Alternative 3.6, activities would be greater in scope, intensity, and duration while similar to Alternative 3.3, but less than Alternatives 3.7 and 3.8. Compared to Alternative 3.3, fill heights at the disposal locations for Alternative 3.6 would potentially be higher, though not exceeding seven to eight feet deep in the upper areas. Similar to Alternative 3.3, while changes to the local topography associated with the disposal sites would be considered substantial, the changes would increase the stability of the existing landslide area, which would be considered beneficial. Geologic or topographic features would not be permanently or adversely modified.

- Substantially and permanently altered the physical or chemical quality of sediments or soils.
- Permanently triggered or accelerated geologic processes such as erosion or sedimentation brought about by disturbance of landforms.

The incremental activities over Alternative 3.3 associated with Alternative 3.6 would occur in Phase 2 construction (refer to Section 4.3.2.6 for construction phasing), where the oxbow reconnection activities would occur. Though more excess excavated material would need to be placed at the disposal sites, it would be likely that similar soil compaction impacts as Alternative 3.3 would be associated with short-term stockpiled areas. The physical or chemical quality of sediments or soils would be substantially and permanently altered, and there would be no triggered or accelerated geologic processes brought about by disturbance of landforms.

- Substantially increased wind or water erosion of soils or loss of topsoil, either on or offsite.

Impacts while similar to Alternative 3.3, would be greater in intensity and duration as Alternative 3.3 does not include the oxbow reconnection. Overall, the alternative would not substantially increase wind or water erosion of soils or loss of topsoil.

Operations and Maintenance

Impacts would be similar to Alternative 3.3.

Monitoring

Impacts would be similar to Alternative 3.3.

5.2.3.4 Alternatives 3.7 and 3.8 – Raise the Streambed to Approach the Pre-Incised Elevations with Oxbow and Stream Lengthening Sinuosity

Construction

Alternative 3.7 would produce an increase of 210,000 cubic yards over Alternative 3.3 to be disposed, or a total of 340,000 cubic yards. This is the result of additional measures beyond 3.3 and includes reconnection of the historic oxbow within the creek footprint and creating creek sinuosity downstream of Pacific Park Drive. Alternative 3.8 produces an increase of 10,000 cubic yards over Alternative 3.7, or a total of 350,000 cubic yards due to the incremental addition of sinuosity downstream of Wood Canyon Creek.

- Geologic or topographic features were destroyed, permanently covered, or materially and adversely modified. Substantially altered topography beyond that which would result from natural erosion and deposition

The beneficial impacts associated with changes to the channel configuration and reconnected oxbow would be similar to Alternative 3.6. The sinuosity increases associated with the added segments downstream of Pacific Park Drive and Wood Canyon Creek would provide incremental stream lengthening benefits.

Because of a greater amount of excess soil, impacts while similar to Alternatives 3.3, would be greater in scope (disposal site footprint, height potentially up to 7- to 8-feet in upper areas), intensity, and duration (several months). Similar to Alternative 3.3, while changes to the local topography associated with the disposal sites would be considered substantial, the vegetation changes brought by the creation of high-value coastal sage scrub habitat would be considered beneficial. Geologic or topographic features would not be permanently and adversely destroyed, covered, or modified and would not be beyond that which would result from natural erosion or deposition. Additionally, vegetation changes brought by the creation of high-value coastal sage scrub habitat would be considered beneficial.

- Substantially and permanently altered the physical or chemical quality of sediments or soils.
- Triggered or accelerated geologic processes such as erosion or sedimentation brought about by disturbance of landforms.

The incremental activities over Alternative 3.3 associated with Alternative 3.7 would occur in Phase 2 construction (refer to Section 4.3.2.6 for construction phasing), related to the oxbow reconnection, and in Phase 0 construction related to the sinuosity feature downstream of Pacific Park Drive. Alternative 3.8 would be similar to Alternative 3.7 but would add incremental activities in Phase 3 related to the sinuosity feature downstream of

Wood Canyon Creek. Both these alternatives would result in relative increases of excess excavated material placed at the disposal sites. Soil compaction impacts would be greater than Alternative 3.3 for both Alternative 3.7 and 3.8 due to the incremental use of short-term stockpiled areas associated with Phase 0. Due to the proximity of the upper disposal area to the Phase 3 activities, no incremental need for short-term stockpile areas and associated impact would result. The physical or chemical quality of sediments or soils would not be substantially and permanently altered, and there would be no triggered or accelerated geologic processes brought about by disturbance of landforms.

- Substantially increased wind or water erosion of soils or loss of topsoil, either on or offsite.

Impacts while similar to Alternatives 3.3 would be greater in scope and longer in duration with the inclusion of stream lengthening measures. Overall, the alternative would not substantially increase wind or water erosion of soils or loss of topsoil.

Operations and Maintenance

Impacts would be similar to Alternative 3.3.

Monitoring

Impacts would be similar to Alternative 3.3.

5.2.4 Summary

For all action alternatives, impacts to earth resources would differ in the amount of excess soil to be disposed of at the designated onsite disposal areas on the adjacent canyon hill slopes. Duration of construction would increase from Alternative 3.3 through Alternative 3.8. For all action alternatives impacts would be short term and temporary and less than significant. With implementation of **Environmental Commitment ER-1 through ER-12**, direct and indirect impacts would be further reduced.

5.2.5 Environmental Commitments

For all action alternatives the following measures would be implemented before, during, and after construction as applicable. These include:

ER-1 An Erosion and Sedimentation Control Plan would be prepared during PED. The Plan shall identify measures to be implemented to minimize the erosion effects of grading and excavation. Erosion control methods to be described in the Plan and implemented may include:

- Avoiding soil disturbance during periods of heavy precipitation or high winds.
- Keeping disturbed areas to the minimum necessary for construction.
- Reducing surface water flows across graded or exposed areas.

- Using straw bales, soil mats, or silt fences to stabilize disturbed areas.
- Using culvert, ditches, water bars and sediment traps to control runoff and erosion.
- Bioengineering techniques for erosion control.

ER-2 The Erosion and Sedimentation Control Plan will be referenced on the grading plans.

ER-3 The following guidelines shall be followed where channel grading activities are undertaken in order to ensure no destabilization of any potential adjacent landslide slope, as verified by a site-specific geotechnical analysis during the final design:

- Excavation cuts should not be made below or near existing landslides and should not be made until the stability of nearby slopes has been confirmed by additional geologic and geotechnical investigation. Permanent excavations will not be made where adverse geologic structure (bedding planes that dip out of the slope) are present unless appropriate permanent stabilization measures are implemented.
- All grading in these areas shall be performed under the observation of a qualified engineering geologist, who shall make recommendations regarding grading details or further geotechnical analysis that may be required based on conditions uncovered at the site.
- Temporary slopes should not be excavated at gradients steeper than 1.5H:1V. Permanent excavation slopes must be no steeper than 2.25H:1V.

ER-4 Slope stability measures shall be implemented at each construction and borrow site.

ER-5 All suitable excavated fill material shall be stockpiled for the shortest period of time possible. If any unsuitable material is found or generated, it would be disposed at a commercial landfill or approved site.

ER-6 All clearing, grading, earth moving, and excavation would cease during periods of winds greater than 20 miles per hour (averaged over one hour) when disturbed material is easily windblown, or when dust plumes of 20 percent or greater opacity impact public roads, occupied structures, or neighboring property.

ER-7 Watering would take place a minimum of twice daily on unpaved/untreated roads and on disturbed soil areas with active operations to minimize fugitive dust.

ER-8 All fine material transported offsite would be sufficiently watered or securely covered to prevent excessive dust.

ER-9 Stockpiles of soil or other fine loose material would be stabilized by watering or other appropriate method to prevent windblown fugitive dust.

ER-10 Areas temporarily disturbed by construction would be returned to preconstruction conditions by ripping, grading and revegetating. Barren areas would be seeded and /or planted with native vegetation to reduce potential erosion.

ER-11 Prior to Proposed Project implementation, during the PED phase, additional geotechnical investigations will be conducted as warranted for any specific landslide masses to further reduce any risk/uncertainty.

ER-12 During PED, soils from the disposal areas would need to be sampled and characterized as part of the geotechnical investigations to establish compatibility with excess excavated materials from channel improvements. For excess excavated materials to be placed at disposal sites, construction specifications would require to mix the excess soils well before placing, including scarifying the receiving sites to a specific depth and incorporating a drainage layer system. Specifications would also direct preferential separation of any excavated highly clayey materials to be set aside and only used as fill for streambed raising, or for hauling off-site if unsuitable for use as fill.

5.3 WATER RESOURCES

5.3.1 Assumptions

No substantial changes to wet weather hydrologic conditions are anticipated. The Aliso Creek watershed is currently nearly at full buildout.

Due to the instability caused by erosion and high energy flows, size and locations of wetlands that maybe present in Aliso Creek are highly variable. Prior to each phase of construction, the project area would be surveyed for the current location of jurisdictional wetlands.

5.3.2 Thresholds of Significance

A significant impact would occur to water resources if the Proposed Project:

- Caused substantial interference with groundwater supplies, recharge, or direction and rate of groundwater flow.
- Caused a violation of any water quality standard, waste discharge requirement, or otherwise substantially degrades water quality.
- Substantially altered the existing drainage pattern of the site or area, including the alteration of the course of a stream or river in a manner that would result in a substantial increase in erosion or siltation on or off site.
- Substantially altered the existing drainage pattern of the site or area, including the alteration of the course of a stream or river in a manner that would result in a substantial reduction in the quantity of surface water.
- Increased substantial erosion or sedimentation in relation to existing conditions.

5.3.3 Alternative Analysis

The Proposed Project alternatives would raise the existing Aliso Creek streambed elevation to approach the historic pre-incised stream elevation and thereby increase floodplain hydrologic connectivity. For all action alternatives the footprint would be generally similar to the existing alignment. Increases over the existing floodplain footprints would be about 112 percent for the two-year event; 94 percent for the 10-year event; and 61 percent for the 100-year event. There would be beneficial ancillary effects associated with increased floodplain aquifer recharge. Increased riverine and floodplain physicochemical functions associated with ecosystem restoration (i.e. temperature and oxygen regulation, and processing of organic matter and nutrients) would provide ancillary water quality benefits to instream and coastal receiving waters.

Regrading required at the Wood Canyon Creek confluence area would alter the existing floodplain connection frequency, as the confluence currently experiences backwater effects due to the constriction of flows through the existing culverts at the AWMA Road crossing. The replacement of the culverts with a bridge and new streambed gradient transition to tie in with the raised Aliso Creek would change the floodplain overbanking frequency in the Wood Canyon confluence area.

Groundwater levels would be expected to have an associated incremental rise along the raised streambed course and for some distance laterally due to the direct influence from channel seepage. Additionally, the use of embedded sheetpile to accompany transverse rock riffle structure locations would have the effect of raising the local groundwater levels directly upstream of the structures for a distance along the stream course as groundwater flows in the vicinity of the structures would tend to mound. The rate of groundwater flow could slow in the vicinity of the sheet piles. The use of vinyl sheetpiles are anticipated for long-term durability. Riparian habitat would benefit from the increased groundwater elevation. During drought periods, or should future dry weather flows subside due to the effects of water conservation BMP efforts, the groundwater rise effect associated with the inclusion of sheetpiles would help sustain riparian habitat, as well as contribute to intermittent or perennial stream flows.

5.3.3.1 No Action Alternative/Future Without-Project Conditions

Under the No Action Alternative no Federal project would be implemented nor a project by the non-Federal sponsor. The incised creek would not be restored to pre-incised elevations and restoration of native plant communities would not occur.

As described in Section 5.2.3.1, SOCWA would continue to provide emergency protection to threatened wastewater infrastructure and also to the AWMA Road, which serves as the primary access to the CTP. The periodic construction activities associated with these actions would result in a temporary and limited spike in turbidity impacts to surface water quality.

Hydrology

No substantial changes to the wet weather hydrologic conditions are anticipated. The Aliso Creek watershed is currently at nearly full buildout. The undeveloped upper area of the watershed is within the Cleveland National Forest and the lower undeveloped area of the watershed is within the Wilderness Park. Both areas are protected from development.

Evolving water management strategies and established morphologic and hydrogeologic conditions would be expected to produce the following future conditions:

- Climate change in California is expected to bring warmer year-round temperatures and potentially wetter winters. The Mediterranean seasonal precipitation pattern is expected to continue (cal-adapt.org).
- Wet season hydrology as a result of regional and local BMPs would not decrease. Retrofitting the public and private lands within urbanized areas of the watershed with onsite controls to reduce a percentage of the runoff would not yield substantial changes during the wet season.
- Dry weather flows would decrease over time as a result of water conservation regional and local BMPs (e.g. limiting irrigation days and runoff amounts) aimed at reducing urban runoff. Regulations and programs aimed at reducing runoff are included in the MS4 permit and local programs. The perennial nature of the creek in dry season could become intermittent.
- Water quality impairments would lessen with the continued implementation of regional and local BMPs within the watershed.
- Disconnected floodplain function as result of the deeply incised creek would exacerbate the already limited aquifer recharge opportunities from overbank floodwater infiltration.
- Groundwater extraction activities in the upper watershed are limited and not expected to increase. The Aliso Creek watershed has limited water bearing formations and has historically been a poor and unreliable source of groundwater.

5.3.3.2 Alternative 3.3 – Raise the Streambed to Approach the Pre-Incised Elevations

Construction

The five-mile length of the project would be divided into multiple construction reaches and phased, with work efforts generally initiating from the downstream end. At the upstream end of each construction reach, the entire channel flow would be diverted out of the channel by means of a diversion pipe. Flows would be reintroduced to the channel system downstream of the active phase. It is expected that dewatering efforts would also be necessary for construction related to the placement of riffle structures and streambank protection toedown foundation. Dewatering would be accomplished by use of sump pumps, and supplemented as needed with dewatering wells.

During construction, environmental commitments would be implemented to minimize impacts to the creek's water within the Proposed Project area.

- Caused substantial interference with groundwater supplies, recharge, or direction and rate of groundwater flow.

Alternative 3.3 would provide for increased groundwater recharge opportunities associated with improved floodplain connectivity. The slowing of groundwater flow rates associated with the inclusion of sheetpiles at riffle structure locations would not be a significant impact and would be localized effect in general; the overall groundwater flow direction would not be affected due to the natural topographic gradient to the ocean.

Construction dewatering would cause temporary declines in localized groundwater within an influence area. Water extracted from the dewatering operation would be introduced as surface streamflow downstream of the work area.

- Caused a violation of any water quality standard, waste discharge requirement, or otherwise substantially degrade water quality.

Alternative 3.3 would require ground-disturbing work and use of construction equipment within the creek. There would be temporary impacts to water quality during construction. However, there would be no long-term or substantial impairments of water quality and no violation of any water quality standard or waste discharge requirement.

When fully isolated from surrounding flows, work within Aliso Creek would result in minimal or no increases in turbidity. During construction, permanent fill would be discharged into waters of the U.S. Upon completion of each phase, waters flowing across newly constructed areas would result in temporary increases in turbidity as flows mobilize unconsolidated soils and other loose particles. Turbidity would return to baseline levels in short order upon establishment of dynamic equilibrium within the water column. Use of construction vehicles increases the potential for accidental release of fuels, solvents, or other petroleum-based contaminants.

- Substantially altered the existing drainage pattern of the site or area, including the alteration of the course of a stream or river in a manner that would result in a substantial increase in erosion or siltation on or offsite.

The existing drainage pattern of the Proposed Project area would not be significantly impacted, nor altered during construction. The recontouring of the creek would provide a more stable channel, and would maintain erosion and aggradation within the creek to a dynamic equilibrium.

- Substantially altered the existing drainage pattern of the site or area, including the alteration of the course of a stream or river in a manner that would result in a substantial reduction in the quantity of surface water.
- Substantially increased erosion or sedimentation in relation to existing conditions.

During construction, Alternative 3.3 would cause reduction of surface water due to diversion activities within the reaches affected by the construction phase. This would be a temporary impact. There would not be increased sedimentation. Where diverted flows are reintroduced downstream of the construction reaches, there would be localized erosion occurring at the discharge point. This adverse impact would be temporary, not substantial, and less than significant. Implementation of Environmental Commitments would further reduce any impacts.

Post-construction Alternative 3.3 would not cause any reduction of the quantity of surface water.

Operations and Maintenance

Maintenance of ecosystem restoration features would be conducted under this alternative by the non-Federal sponsor. The activities would be largely related to debris clearing, replanting, periodic repair/replacement to riffle structures or buried slope protection, and resurfacing of road/trail pavement materials.

Movement of vehicles within the channel and discharges of fill material within waters of the U.S. associated with small-scale, routine maintenance activities would temporarily increase turbidity within the immediate work area. Dewatering structures such as coffer dams would be utilized for lengthy or complex maintenance activities. When fully isolated from surrounding flows, work within waters of the U.S. would result in minimal or no increases in turbidity. There would be no significant impacts.

Monitoring

During the monitoring period following construction, monitoring would occur to collect data and identify need for future habitat management activities within the restored creek. There would be minimal impact to earth resources.

5.3.3.3 Alternative 3.6 – Raise the Streambed to Approach the Pre-Incised Elevations with Oxbow

Construction

The implementation of Alternative 3.6 would be similar to Alternative 3.3 and include reconnection of the 850-foot long oxbow.

- Caused substantial interference with groundwater supplies, recharge, or direction and rate of groundwater flow.

Construction dewatering impacts would be similar to Alternative 3.3, but would be slightly longer in duration by several months to reestablish the historic oxbow during the second phase of construction. Overall, impacts would be similar to Alternative 3.3 and would be less than significant.

- Caused a violation of any water quality standard, waste discharge requirement, or otherwise substantially degrades water quality.

Construction turbidity impacts would be similar to Alternative 3.3, but slightly more intense for a short duration (days) due to the inclusion of the historic oxbow reconnection. Overall, impacts would be similar to Alternative 3.3 and would be less than significant.

- Substantially altered the existing drainage pattern of the site or area, including the alteration of the course of a stream or river in a manner that would result in a substantial increase in erosion or siltation on or offsite.

The existing drainage pattern of the Proposed Project area would not be significantly impacted, nor altered during construction. The reconnection of the abandoned oxbow would return the drainage pattern in Reaches 4B and 5B closer to pre-1980s conditions. The recontouring of the creek would provide a more stable channel, and would maintain erosion and aggradation within the creek to a dynamic equilibrium.

- Substantially altered the existing drainage pattern of the site or area, including the alteration of the course of a stream or river in a manner that would result in a substantial reduction in the quantity of surface water.
- Increased substantial erosion or sedimentation in relation to existing conditions.

Impacts would be similar to Alternative 3.3, but would be slightly longer in duration by several months to reestablish the historic oxbow during the second phase of construction. Overall, impacts would be similar to Alternative 3.3 and would be less than significant.

Operations and Maintenance

Impacts would be similar to Alternative 3.3.

Monitoring

Impacts would be similar to Alternative 3.3.

5.3.3.4 Alternatives 3.7 and 3.8 – Raise the Streambed to Approach the Pre-Incised Elevations with Oxbow and Creek Lengthening Sinuosity

Construction

The implementation of Alternative 3.7 and 3.8 would be similar to Alternative 3.3 and include reconnection of the 850-foot long oxbow. In addition, Alternative 3.7 would add 30 feet of sinuosity downstream of Pacific Park Drive. Alternative 3.8 would add similar sinuosity downstream of Pacific Park Drive and 60 feet of sinuosity downstream of the Wood Canyon Creek confluence.

- Caused substantial interference with groundwater supplies, recharge, or direction and rate of groundwater flow.

Construction dewatering impacts would be similar to Alternative 3.3, but would be slightly longer in duration by several months in Phase 2 to reestablish the historic oxbow during the second phase of construction; an additional month in Phase 3, and an additional month in Phase 0. Overall, impacts would be similar to Alternative 3.3 and would be less than significant.

- Caused a violation of any water quality standard, waste discharge requirement, or otherwise substantially degrades water quality.

Construction turbidity impacts would be similar to Alternative 3.3, but slightly more intense for a short duration (days) due to the inclusion of the historic oxbow reconnection. The shorter sinuosity additions associated with the segments downstream of Pacific Park Drive and Wood Canyon Creek should not result in an appreciable difference from Alternative 3.3. Overall, impacts would be similar to Alternative 3.3 and would be less than significant.

- Substantially altered the existing drainage pattern of the site or area, including the alteration of the course of a stream or river in a manner that would result in a substantial increase in erosion or siltation on or offsite.

The existing drainage pattern of the area would not be significantly impacted, nor altered during construction. Impacts would be similar to Alternative 3.3.

- Substantially altered the existing drainage pattern of the site or area, including the alteration of the course of a stream or river in a manner that would result in a substantial reduction in the quantity of surface water.
- Increased substantial erosion or sedimentation in relation to existing conditions.

Impacts would be similar to Alternative 3.3, but would be slightly longer in duration by four to six months to the incremental construction required for the historic oxbow reconnection and establishment of additional sinuosity in two other reaches. Overall, impacts would be similar to Alternative 3.3 and would be less than significant.

Operations and Maintenance

Impacts would be similar to Alternative 3.3.

Monitoring

Impacts would be similar to Alternative 3.3.

5.3.4 Summary

For all action alternatives impacts would be short term, temporary, and less than significant. Impacts would be further reduced with implementation of **Environmental Commitment WR-1 through WR-5**.

5.3.5 Environmental Commitments

For all alternatives the following measures would be implemented before, during, and after construction to minimize impacts to water in the creek. These include:

WR-1 A Storm Water Pollution Prevention Plan (SWPPP) shall be prepared to reduce the potential for accidental release of fuels and other toxic materials. The SWPPP would be reviewed and approved by Corps team members. Consistent with Federal and state regulations, all other applicable permits for construction shall be obtained. Workers shall be educated on measures included in the SWPPP at the preconstruction meeting or prior to beginning work in the Proposed Project Area. The SWPPP shall include such actions as having hazardous waste cleanup equipment and spill kits staged onsite, using the appropriate size and gauge drip pans and absorbent diapers.

WR-2 Spill kits shall be in close proximity to the fuel truck in case of fuel or other fluid spills. Contractor equipment shall be checked for leaks prior to operation and repaired as necessary. "No-fueling zones" shall be designated on construction plans. Fluids released because of spills, equipment failure (broken hose, punctured tank) or refueling would be immediately controlled, contained, and cleaned-up per Federal and state regulations. All contaminated materials will be disposed of promptly and properly to prevent contamination of the site. To reduce the potential for spills into the channel during refueling, refueling of portable equipment shall occur outside of the creek. The barriers shall be such that spills shall be contained and easily cleaned-up. Someone shall be present to monitor refueling activities to ensure that spillage from overfilling, nozzle removal, or other action does not occur.

WR-3 Stockpile sites, parking areas, and staging areas shall be located to avoid erosion into open water.

WR-4 Turbidity curtains or other turbidity control measures shall be used in instances when construction activities are adjacent to open water and during high-low periods when construction activities must continue.

WR-5 When a storm event is forecast to occur within 48 hours, work shall stop and all equipment and vehicles moved outside the active floodplain.

5.4 AIR QUALITY

5.4.1 Assumptions

The Proposed Project alternatives would raise the existing creek bed elevation to approach the historic pre-incised elevation within the Wilderness Park. The creek alignment for the alternatives would be similar and would generally follow the current alignment. All the Proposed Project alternatives include an enhanced natural reconnection with Wood Canyon Creek that would require some grading at the confluence for a distance of about 1,000 feet upstream of the tributary confluence. It is assumed that some excavation of sediment would be done upstream for fill material downstream to minimize stockpiling of excess soil to be used as fill.

5.4.2 Thresholds of Significance

There could be significant impacts to air quality if the Proposed Project:

- Exceeds SCAQMD daily emissions thresholds.
- Exceeds General Conformity Rule *de minimis* thresholds.
- Exposed sensitive receptors to substantial pollutant concentrations.
- Created objectionable odors affecting a substantial number of people.

Regarding compliance with the Clean Air Act, for any criteria pollutants for which the air basin is not in attainment status, if the total direct and indirect emissions from the Proposed Project are below the applicable General Conformity *de minimis* emission thresholds, the Proposed Project is exempt from performing a comprehensive Air Quality Conformity Analysis and would be considered to be in conformity with the SIP.

5.4.3 Alternative Analysis

For the Action Alternatives, the Air Quality Program Model for air emission criteria pollutants: CalEEMod 2013. 2 program calculated emissions for the Proposed Project, calculating daily maximum and annual average criteria pollutants as well as total or annual GHG emissions. CalEEMod uses sources such as the USEPA AP-42 emission factors and CARB vehicle emission models. The winter pounds per day (lbs/day) emissions are typically higher in air pollutant air emissions when compared to the summer lbs/day; therefore, the winter lbs/day are referenced as the maximum lbs/day instead.

5.4.3.1 No Action Alternative/Future Without-Project Conditions

Under the No Action Alternative no Federal project would be implemented nor a project by the non-Federal sponsor. The incised creek would not be restored to pre-incised elevations and restoration of plant communities would not occur. Equipment for construction and trucks bringing materials to the site and carrying debris away from the Proposed Project site would not be needed.

Modeling indicates that the continued use of fossil fuels including transportation, movement of goods and services, manufacturing, and human and natural sources would continue to increase regionally. Even though population growth in the cities surrounding the Proposed Project area is not projected to increase significantly, it is likely that vehicle trips would increase over time, identified as the main air pollution source in the region. Local and regional planning agencies are focusing on land use planning to reduce travel needs. These efforts would reduce future air emissions; however, it is not expected that air quality would substantially change from existing conditions without a substantial increase in alternative fuel vehicles.

5.4.3.2 Alternative 3.3 – Raise the Streambed to Approach the Pre-Incised Elevations

Under Alternative 3.3, the construction area is approximately five miles long and approximately 200 feet wide. The existing streambed would be raised to approach the historic pre-incised creek elevation and 47 rock riffles would be constructed. Onsite disposal of 130,000 cubic yards of excess material on slopes would be followed by planting of native species for erosion control.

Construction

- Construction Phase – Over a four-year work period (2022 through 2026) the total construction duration would be 780 days. Daily construction assumes an eight-hour work day, five days a week.
- Site Preparation – Site preparation work is approximately 95 acres.
- Demolition – Demolition of ACWHEP structure and the two large concrete drop structures, approximately 9,224 tons of construction debris to be removed.
- Construction Personnel – Approximately 50 laborers would be at the construction work site daily.
- Specific details on assumptions made as to construction equipment and use duration can be found in the Air Quality Appendix.

Alternative 3.3 would result in air quality construction impacts daily and during each year of construction. See Table 5.4-1 and Table 5.4-2 for comparison of estimated daily emissions (maximum daily construction lbs/day) to the SCAQMD threshold and comparison of estimated annual emissions (maximum construction tons/year) to the Federal thresholds. Daily construction emissions are shown in Table 5.4-1. Annual construction emissions are shown in Table 5.4-2.

Table 5.4-1 Comparison of Alernative 3.3 Daily Construction Emissions to SCAQMD (lbs/day)

Construction	ROG/ VOC	NOx	CO	SO_2	PM_{10}	$PM_{2.5}$	GHG/CO2e
Alt. 3.3 Maximum Daily lbs/day	9.3083	80	119.4387	0.3608	23.4429	6.9603	28,433.6737
SCAQMD Daily lbs/day	75	100	550	150	150	55	No criteria unless industrial facilities; 10,000 MT/yr CO2eq for industrial facilities

Table 5.4-2 Comparison of Alternative 3.3 Annual Construction Emissions to General Conformity *de minimis* Thresholds

Construction	ROG/ VOC	NOx	CO	SO_2	PM_{10}	$PM_{2.5}$	GHG (MT/yr)
Alt. 3.3 Average Tons/Year	0.5246	2.2980	7.6389	0.0237	1.4983	0.4461	1,693.4025
Federal Tons/Year	100	100	100	100	70	100	Recommends that agencies quantify a proposed agency action's projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools that are suitable for the proposed agency action

Based on the above, Alternative 3.3 construction daily emissions for ROG/VOC, NOx, CO, SO_2, PM_{10}, $PM_{2.5}$, and GHG are below the daily SCAQMD thresholds and would result in less than significant impacts. Furthermore, Alternative 3.3 construction annual emissions are below General Conformity *de minimis* thresholds. Impacts from emissions would be temporary and would return to pre-project conditions following completion of construction.

- Exposed the sensitive receptors to substantial pollutant concentrations.

Since the Proposed Project footprint for Alternative 3.3 would extend from SOCWA CTP Bridge to Pacific Park Drive, schools and the church located upstream of AWMA Road Bridge would be sensitive receptors in the vicinity. There would be trucks delivering and taking away materials, but would not be doing so on Sunday and would avoid school arrival and departure times. Furthermore, the pollutant concentrations emitted from such trucks would not be considered substantial because once equipment and materials are brought onto the Proposed Project site, most traffic coming and going offsite would be worker vehicles.

- Created objectionable odors affecting a substantial number of people.

Since construction would occur over a four-year period with one phase implemented each year, the Aliso Creek Trail would be closed below Wood Canyon confluence during Phases 1 and 2 (first 2 years) and above Wood Canyon confluence during Phases 3 (3rd year) and 4, there would be few Wilderness Park users near the construction area that would be exposed to construction caused odors.

Operations and Maintenance

Current maintenance is limited to emergency repair and trash and debris removal from the road/trail. Operations and maintenance would continue as needed for these activities, and would include additional activities based on actions triggered by the AHMP. Impacts to operations and maintenance would be less than significant.

Monitoring

There would be no significant impacts to air quality during monitoring as monitoring would be periodic during the year and involve a few vehicles to and from the Proposed Project area.

5.4.3.3 Alternative 3.6 – Raise the Streambed to Approach the Pre-Incised Elevations with Oxbow

Construction

Alternative 3.6 would be similar to Alternative 3.3 with the addition of reestablishing the historic oxbow. There would be an increase in excess sediment removed from the creek with onsite disposal of 300,000 cubic yards of creek substrate on adjacent hill slopes.

- Construction Phase – Over a four-year work period (2022 through 2026) the total construction duration would be 876 days. Daily construction assumes an eight-hour work day, five days a week.
- Site Preparation – Site preparation work is approximately 95 acres.
- Demolition – Demolition of ACWHEP structure and the two large concrete drop structures, approximately 9,224 tons of construction debris to be removed.
- Construction Personnel – Approximately 50 laborers would be at the construction work site daily.

Alternative 3.6 would result in air quality construction impacts daily and during each year of construction. See Table 5.4-3 and Table 5.4-4 for comparison of estimated daily emissions (maximum daily construction lbs/day) to SCAQMD threshold and comparison of estimated annual emissions (maximum construction tons/year) to Federal thresholds. Estimated construction emissions are below the SCAQMD thresholds. Estimated construction emissions are below General Conformity *de minimis* Thresholds.

Table 5.4-3 Comparison of Alernative 3.6 Daily Construction Emissions to SCAQMD (lbs/day)

Construction	ROG/ VOC	NOx	CO	SO_2	PM_{10}	$PM_{2.5}$	GHG/CO2e
Alt. 3.6 Maximum Daily lbs/day	9.3083	80.0378	124.8747	0.3777	24.5645	7.2835	29,756.4399
SCAQMD Daily lbs/day	75	100	550	150	150	55	No criteria unless industrial facilities; 10,000 MT/yr CO2eq for industrial facilities

Table 5.4-4 Comparison of Alternative 3.6 Annual Construction Emissions to General Conformity *de minimis* Thresholds

Construction	ROG/ VOC	NOx	CO	SO_2	PM_{10}	$PM_{2.5}$	GHG (MT/yr)
Alt. 3.6 Average Tons/Year	0.5480	2.3889	7.9863	0.0248	1.5700	0.4668	1,772.2141
Federal Tons/Year	100	100	100	100	70	100	Recommends that agencies quantify a proposed agency action's projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools that are suitable for the proposed agency action

Based on the above, Alternative 3.6 construction daily emissions for ROG/VOC, NOx, CO, SO_2, PM_{10}, $PM_{2.5}$, and GHG are below the daily SCAQMD thresholds and would result in less than significant impacts. Furthermore, Alternative 3.6 construction annual emissions are below General Conformity *de minimis* thresholds. Impacts from emissions would be temporary and would return to pre-project conditions following completion of construction.

- Exposed the sensitive receptors (schools, day care centers, hospitals, retirement homes, convalescence facilities, and residences) to substantial pollutant concentrations.

As with Alternative 3.3, schools and the church located upstream of AWMA Road Bridge would be sensitive receptors in the vicinity. There would be trucks delivering and taking away materials, but would not be doing so on Sunday and would avoid school arrival and departure times. Any emissions would not be substantial and, as with Alternative 3.3, impact would be less than significant.

- Created objectionable odors affecting a substantial number of people.

Since construction would occur over a four-year period with one phase implemented each year, the Aliso Creek Trail would be closed below Wood Canyon confluence during Phase 1 and 2 (first 2 years) and above Wood Canyon confluence during Phase 3 (3rd year) and 4, there would be few Wilderness Park users near the construction area that would be exposed to construction caused odors.

Operations and Maintenance

There would be no significant impacts to air quality during operations and maintenance. Impacts would be similar to Alternative 3.3.

Monitoring

Impacts would be similar to Alternative 3.3.

5.4.3.4 Alternative 3.7 – Raise the Streambed to Approach the Pre-Incised Elevations with Oxbow and One Creek Sinuosity Length

Under Alternative 3.7, an area of approximately five miles long and 200 feet wide reconnects 850 feet of length in an abandoned oxbow, adds sinuosity of 32-foot length, installs 46 rock riffles, onsite disposal of 340,000 cubic yards creek substrate on slopes, and planting of native vegetation.

Construction

- Construction Phase – Over a four-year work period (2022 through 2026) the total construction duration would be 901 days. Daily construction assumes an eight-hour work day, five days a week.
- Site Preparation – Site preparation work is approximately 95 acres.
- Demolition – Demolition of ACWHEP structure and the two large concrete drop structures, approximately 9,224 tons of construction debris to be removed.
- Construction Personnel – Approximately 50 laborers would be at the construction work site daily.

Alternative 3.7 would result in air quality construction impacts daily and during each year of construction. See Table 5.4-5 and Table 5.4-6 below for comparison of estimated daily emissions (maximum daily construction lbs/day) to SCAQMD threshold and comparison of estimated annual emissions (maximum construction tons/year) to Federal thresholds.

Table 5.4-5 Comparison of Alernative 3.7 Daily Construction Emissions to SCAQMD (lbs/day)

Construction	ROG/ VOC	NOx	CO	SO_2	PM_{10}	$PM_{2.5}$	GHG/CO2e
Alt. 3.7 Maximum Daily lbs/day	9.3083	80.0378	125.2203	0.3788	24.6350	7.3039	29,870.3509
SCAQMD Daily lbs/day	75	100	550	150	150	55	No criteria unless industrial facilities; 10,000 MT/yr CO2eq for industrial facilities

Daily construction emissions are shown in Table 5.4-5 above. Estimated construction emissions are below the SCAQMD thresholds. Annual construction emissions are shown in Table 5.4-6.

Table 5.4-6 Comparison of Alternative 3.7 Annual Construction Emissions to General Conformity *de minimis* Thresholds

Construction	ROG/ VOC	NOx	CO	SO_2	PM_{10}	$PM_{2.5}$	GHG (MT/yr)
Alt. 3.7 Average Tons/Year	0.6425	2.8000	9.3636	0.0291	1.8410	0.5473	2,077.9728
Federal Tons/Year	100	100	100	100	70	100	Recommends that agencies quantify a proposed agency action's projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools that are suitable for the proposed agency action

Based on the above, Alternative 3.7 construction daily emissions for ROG/VOC, NOx, CO, SO_2, PM_{10}, $PM_{2.5}$, and GHG are below the daily SCAQMD thresholds and would result in less than significant impacts. Furthermore, Alternative 3.7 construction annual emissions are below General Conformity *de minimis* thresholds. Impacts from emissions would be temporary and would return to pre-project conditions following completion of construction.

- Exposed the sensitive receptors (schools, day care centers, hospitals, retirement homes, convalescence facilities, and residences) to substantial pollutant concentrations.

Since the Proposed Project footprint for Alternative 3.7 would be similar to Alternative 3.3, schools and the church located upstream of AWMA Road Bridge would be sensitive receptors that would be directly impacted. There would be trucks delivering and taking away materials, but would not be doing so on Sunday and would avoid school arrival and departure times. However, impacts would still be less than significant.

- Created objectionable odors affecting a substantial number of people.

Since construction would occur over a four-year period with one phase implemented each year, the Aliso Creek Trail would be closed below Wood Canyon confluence during Phase 1 and 2 (first 2 years) and above Wood Canyon confluence during Phase 3 (3^{rd} year) and 4, there would be few Wilderness Park users near the construction area that would be exposed to construction caused odors.

Operations and Maintenance

There would be no significant impacts to air quality during operations and maintenance. Impacts would be similar to Alternative 3.3.

Monitoring

Impacts would be similar to Alternative 3.3.

Construction

5.4.3.5 Alternative 3.8 – Raise the Streambed to Approach the Pre-Incised Elevations with Oxbow and Two Creek Sinuosity Lengths

Alternative 3.8 would be similar to Alternative 3.3 with the addition of reestablishing the historic oxbow, adds sinuosity of 32-foot and 59-foot length at two locations, and installs 46 rock riffles. There would be an increase in excess sediment removed from the creek with onsite disposal of 350,000 cubic yards of creek substrate on adjacent hill slopes.

- Construction Phase – Over a four-year work period (2022 through 2026) the total construction duration would be 916 days. Daily construction assumes an eight-hour work day, five days a week.
- Site Preparation – Site preparation work is approximately 95 acres.
- Demolition – Demolition of ACWHEP structure and the two large concrete drop structures, approximately 9,224 tons of construction debris to be removed.
- Construction Personnel – Approximately 50 laborers would be at the construction work site daily.

Alternative 3.8 would result in air quality construction impacts daily and during each year of construction. See Table 5.4-7 and Table 5.4-8 for comparison of estimated daily emissions (maximum daily construction lbs/day) to SCAQMD threshold and comparison of estimated annual emissions (maximum construction tons/year) to Federal thresholds. Daily construction emissions are shown in Table 5.4-7. Annual construction emissions are shown in Table 5.4-8.

Table 5.4-7 Comparison of Alernative 3.8 Daily Construction Emissions to SCAQMD (lbs/day)

Construction	ROG/ VOC	NOx	CO	SO_2	PM_{10}	$PM_{2.5}$	GHG/CO2e
Alt. 3.8 Maximum Daily lbs/day	9.3083	80.0378	125.5976	0.3800	24.7168	7.3273	29,933.0866
SCAQMD Daily lbs/day	75	100	550	150	150	55	No criteria unless industrial facilities; 10,000 MT/yr CO2eq for industrial facilities

Table 5.4-8 Comparison of Alternative 3.8 Annual Construction Emissions to General Conformity *de minimis* Thresholds

Construction	ROG/ VOC	NOx	CO	SO_2	PM_{10}	$PM_{2.5}$	GHG (MT/yr)
Alt. 3.8 Average Tons/Year	0.7079	3.0841	10.3187	0.0321	2.0293	0.6032	2,290.1365
Federal Tons/Year	100	100	100	100	70	100	Recommends that agencies quantify a proposed agency action's projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools that are suitable for the proposed agency action

Based on the above, Alternative 3.8 construction daily emissions for ROG/VOC, NOx, CO, SO_2, PM_{10}, $PM_{2.5}$, and GHG are below the daily SCAQMD thresholds and would result in less than significant impacts. Furthermore, Alternative 3.8 construction annual emissions are below General Conformity *de minimis* thresholds. Impacts from emissions would be temporary and would return to pre-project conditions following completion of construction.

- Exposed the sensitive receptors to substantial pollutant concentrations.

Since the Proposed Project footprint for Alternative 3.8 would be similar to Alternative 3.3, schools and the church located upstream of AWMA Road Bridge would be sensitive receptors that would be directly impacted. There would be trucks delivering and taking away materials, but would not be doing so on Sunday and would avoid school arrival and departure times. However, impacts would still be less than significant.

- Created objectionable odors affecting a substantial number of people.

Since construction would occur over a four-year period with one phase implemented each year, the Aliso Creek Trail would be closed below Wood Canyon confluence during Phase 1 and 2 (first 2 years) and above Wood Canyon confluence during Phase 3 (3rd year) and 4, therefore there would be few Wilderness Park users near the construction area that would be exposed to construction caused odors.

Operations and Maintenance

There would be no significant impacts to air quality during operations and maintenance. Impacts would be similar to Alternative 3.3.

Monitoring

Impacts would be similar to Alternative 3.3.

5.4.4 Summary

For all action alternatives, impacts to air quality would differ slightly in emissions during construction. While equipment used for all action alternatives would be the same, the duration of construction increases from Alternative 3.3 through Alternative 3.8. For all action alternatives impacts would be short term and temporary and below *de minimis* thresholds. With the implementation of **Environmental Commitments AQ-1 through AQ-13,** impacts although less than significant would be further minimized during construction. Local air quality would return to pre-project conditions following completion of construction.

5.4.5 Environmental Commitments

Implementation of the following environmental commitments would minimize air quality impacts associated with any of the Proposed Action alternatives. With a multi-year construction schedule, these measures would minimize impacts from short-term construction emissions from all the Proposed Action alternatives.

AQ-1 A Fugitive Dust Emission Control Plan would be developed and implemented. Measures to be incorporated into the plan would include:

- Water unpaved road access and other disturbed areas of the active sites as necessary or apply CARB certified soil binders.
- Install wheel washers/cleaners or wash the wheels of trucks and other heavy equipment where vehicles exit the site or unpaved access roads.
- Increase the frequency of watering, or implement other additional fugitive dust mitigation measures, of all disturbed fugitive dust emission sources when wind speeds (as instantaneous wind gusts) exceed 20 miles per hour.

AQ-2 Diesel engine idle time would be restricted to no more than ten minutes duration.

AQ-3 All on-road construction vehicles would meet all applicable California on-road emission standards and would be licensed in the State of California.

AQ-4 Activities and operations on unpaved roads areas would be minimized to the extent feasible during high wind events to minimize fugitive dust.

AQ-5 Vehicle speeds shall be limited to 15 miles per hour on unpaved surfaces.

AQ-6 All off-road construction diesel engines not registered under CARB's Statewide Portable Equipment Registration Program, which have a rating of 50 horsepower 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). If a Tier 3 or Tier 3-equivalent engine is not available for a particular item of equipment, Tier 2-compliant engines shall be allowed on a case-by-case basis.

AQ-7 Diesel catalytic converters, diesel oxidation catalysts, and diesel particulate filters as certified and/or verified by the EPA or CARB shall be installed on equipment operating onsite.

AQ-8 Idling of heavy-duty diesel trucks during loading and unloading shall be limited to five minutes; auxiliary power units should be used whenever possible.

AQ-9 Keep roadways next to the Proposed Project site clean and frequently remove daily project-related accumulated silt and debris.

AQ-10 Maintain all equipment as recommended by manufacturers' manuals.

AQ-11 Shut-down any equipment not in use for more than 30 minutes.

AQ-12 Substitute electric equipment whenever possible for diesel- or gasoline-powered equipment.

AQ-13 If equipment is operating on soils that cling to wheels, use a "grizzly" or other such device using rails, pipes, or grates to dislodge mud, dirt, and debris from the tires and undercarriage of vehicles on the road exiting the project site, immediately before the pavement in order to remove most of the soil from vehicle tires.

5.5 CLIMATE CHANGE

5.5.1 Assumptions

While the risks and impacts of climate change are forecast, but ultimately unknown for the long-term, certain assumptions can be made based on existing information. As already observed in the past few years, climates are gradually changing with increased periods of hotter than usual weather in the southwest. Storms are becoming less frequent and periodically causing increased local flood damages than previously recorded.

The impacts of climate change would be similar under all the Proposed Project alternatives. The predictions of fewer, but more intense storms, would impact the Proposed Project alternatives dependent on the extent of erosion control measures implemented, the flow conveyance of the creek, restoration of the historic floodplain elevation, and other elements, which could be impacted in a more intense storm event. Increased temperatures, even by a few degrees as forecast, are expected to reduce the growth zone of vegetation, driving these zones northwards as local temperatures rise. Restoration of vegetation must be suitable and adaptable to the verities of climate change as the 21st Century progresses. The AHMP (Appendix B-8) would provide means for project stewardship as well as triggers to implement changes or new management techniques to insure sustainable habitat within the changing climate zone.

5.5.2 Thresholds of Significance

There could be significant impacts on climate change if the Proposed Project:

- Caused variations in natural plant communities affecting wildlife sustainability.
- Exacerbated weather condition, causing extreme events resulting in an increased risk to life and property.
- Caused an increase in heat stress followed by related deaths.
- Increased the incidence of infectious diseases, asthma, and respiratory health problems.

5.5.3 Alternative Analysis

Construction of the Proposed Project would add to GHGs within the larger region, but the Proposed Project by itself would not change regional climate trends. None of the action alternatives would have a direct impact on climate change. Climate change impacts would be felt on a much broader scale than the Proposed Project area. The restoration of native riverine plant species and the implementation of an AHMP (Appendix B-8) would not directly impact climate change,

5.5.3.1 No Action Alternative/Future Without-Project Conditions

Under the No Action Alternative, no Federal project nor a project by the non-Federal sponsor would be implemented. The incised creek would not be restored to pre-incised elevations and restoration of plant communities would not occur. Equipment for construction and trucks bringing materials to the site and carrying debris away from the Proposed Project site would not be needed.

As the 21st Century progresses, climate change is expected to cause sea level rise threatening urban and natural coastal areas; cause variations in natural plant communities affecting wildlife; cause variations in crop quality and yields; exacerbate air quality problems that would adversely affect human health by increasing heat stress and related deaths; and increase the incidence of infectious diseases, asthma, or respiratory health problems. Climate change is also expected to result in more extreme weather events and heavier precipitation events that can lead to flooding as well as more extended drought periods in the southwest. Changes in weather and rainfall patterns could alter the flow of the creek and runoff patterns, as well as increase the chance for extreme flooding and droughts. This could exacerbate existing problems such as channel instability, degraded water quality, loss of wildlife habitat, and flood damage.

Anticipated increased temperatures and associated health risks as a result of climate change may cause urban dwellers to seek relief in cooler areas, including natural areas and parks. This may result in a higher use of the Wilderness Park for passive recreation in the future.

5.5.3.2 Action Alternatives

Construction

All alternatives would be implemented over four years in various increments or phases as seen in Table 5.7-2. Phase 0, Pacific Park Drive to AWMA Road Bridge would be restored at the same time Phase 1 is being restored at the lower portion of the Proposed Project area (SOCWA CTP).

- Caused variations in natural plant communities affecting wildlife sustainability.

With the implementation of either Alternative 3.3, 3.6, 3.7, or 3.8, restoration in the creek bed to the pre-incised elevation of the floodplain would impact existing native habitat during construction. Native habitat would be restored from Pacific Park Drive to SOCWA CTP Bridge, providing a greater quality of habitat that would be sustainable with the expected climate change through the 21st century. As the Proposed Project would be constructed in four phases over four years, existing vegetation would only be cleared and grubbed at the beginning of each phase for that particular length of the creek, with future phase vegetation left in place. As part of each length of each phase contouring is completed, planting for habitat restoration would be implemented.

- Exacerbated weather condition, causing extreme events resulting in an increased risk to life and property.
- Caused an increase in heat stress followed by related deaths.
- Increased the incidence of infectious diseases, asthma and respiratory health problems.

Alternatives 3.3, 3.6, 3.7, and 3.8 would not exacerbate weather conditions, cause an increase in heat stress deaths, nor the increase of infectious diseases.

Operations and Maintenance

The activities would be largely related to debris clearing, replanting, and periodic repair/replacement to riffle structures or buried slope protection, and resurfacing of road/trail pavement materials. There would not be significant impacts during operations and maintenance activities.

Monitoring

During the monitoring period following construction, monitoring would occur to collect data and identify need for future adaptive habitat management activities within the restored creek. There would not be significant impacts caused by monitoring activities.

5.5.4 Summary

For all action alternatives, the impacts on climate change would be less than significant when compared to a regional, national, or even international context. For all action alternatives impacts would be short term and temporary and with implementation of **Environmental Commitment CC-1**, direct and indirect impacts would be less than significant.

5.5.5 Environmental Commitments

CC-1 Implement the AHMP for long-term sustainability with the changing climate.

5.6 NOISE and VIBRATION

5.6.1 Assumptions

Noise caused by construction upstream of AWMA Road Bridge would impact the Church of Jesus Christ of Latter Day Saints, the Wood Canyon Elementary School, and upstream of Aliso Creek Road, the Journey School and Aliso Niguel High School on the west side of Aliso Creek between Pacific Park Drive and Aliso Creek Road. On the east side of the Creek, the Laguna Niguel Skate and Soccer Park would be a sensitive receptor.

5.6.2 Thresholds of Significance

A significant impact would occur if the Proposed Project:

- Exceeded Federal, state, and local noise standard levels significantly during construction.
- Increased noise levels above the existing ambient condition creating a nuisance to the surrounding community.

In general, human sound perception is noticeable at 3 dBA, while a change of 5 dBA is clearly noticeable. Empirical studies have shown people begin to notice changes in environmental noise level around 5 dBA. Average increases in noise levels less than 5 dBA cannot be definitively considered as producing an adverse impact. For increases above 5 dBA, the greater the noise level change, the greater the impact.

5.6.3 Alternative Analysis

Construction, although typically short term, can be a significant source of noise. Construction noise levels are most notable when it takes place near sensitive land uses, occurs at night, and/or occurs in early morning hours. For most construction activities, the dominant noise source is usually an internal combustion engine (Table 5.6-1). Mobile off-road equipment such as bulldozers and loaders would move around the construction site, while on-road trucks and automobiles would transport equipment, material, and workers to and from the construction area.

Noise generated by construction activities generally fluctuates depending on the construction phase, the quantity and type of equipment in use, and the duration of use. The impact of construction noise on a receptor would depend upon the level of construction activity on a given day and the related noise generated by that activity; the distance between construction activities and the noise-sensitive use; the presence or absence of barriers between the noise source and the receptor; and the ambient noise levels in the area.

Table 5.6-1 Construction Equipment Noise Levels

Operation	Equipment	Pieces of Equipment and Duty Cycle	Maximum Noise Level of Individual Pieces at 50 feet (dB(A) L_{max})	Hourly Noise Level of Individual Pieces at 100 feet (dB(A) L_{eq})
Clearing	Excavator	4	80	71
	Bulldozer	4	85	72
	Loader	4	85	69
	Dump Truck	4	88	67
Sediment Management	Scraper	2	89	74
	Bulldozer	2	85	72
	Loader	4	85	69
	Dump Truck	16	84	67
Grading	Bulldozer	4	85	72
	Grader	4	85	75
	Loader	4	85	69

Source: Federal Highway Administration 2015

5.6.3.1 No Action Alternative/Future Without-Project Conditions

Under the No Action Alternative no Federal project would be implemented nor a project by the non-Federal sponsor. The incised creek would not be restored to pre-incised elevations and restoration of plant communities would not occur due to construction activities. With no construction, noise levels would not increase within the Wilderness Park. Noise levels would not be expected to increase significantly unless the number of trucks coming and going from the SOCWA CTP were to increase.

Since much of the Aliso Creek watershed is either fully developed or set aside as permanent open space, substantial new development, which could generate noise adjacent to the Proposed Project area, is unlikely. Ambient noise levels may increase over time as a result of population growth, which could generate higher noise levels associated with traffic and greater park use.

With the anticipated trail connection to PCH through the Ranch at Laguna (golf course) downstream of the Wilderness Park in the near future, an increase in trail users including bicyclists would be anticipated. With limited amenities along AWMA Road/Aliso Creek

Trail, noise levels would remain similar to current levels unless there was a significant increase in trail users in the future.

With no construction implemented, construction equipment would not increase local vibration within the Wilderness Park. Vibration would continue to be limited to trucks coming and going from SOCWA CTP. An increase in trucks to and from SOCWA CTP would increase vibration along the trails/roads within the Wilderness Park, but would have little or no impact on residents on hill ridges overlooking the Wilderness Park.

5.6.3.2 Action Alternatives

Construction

Alternative 3.3, 3.6, 3.7, and 3.8 would each be implemented over four years in various increments or phases. Phase 0, Pacific Park Drive to AWMA Road Bridge would be restored at the same time Phase 1 is being restored at the lower portion of the Proposed Project area (SOCWA CTP).

For all alternatives, construction would include the disposal of the ACWHEP structure, grading to restore pre-incised creek elevation floodplain, construction of pools and riffles, bank stabilization, and native vegetation planting.

- Exceed Federal, state, and local standards.
- Exceed levels above existing ambient levels causing a nuisance.

Large trucks entering and exiting the Proposed Project area may be considered a nuisance to those at the Visitor’s Center, the Wood Canyon Elementary School, and the Church of Jesus Christ of Latter Day Saints with noise caused by the truck motor noise and travelling on local roadways. Noise would also be created by construction equipment such as bulldozers, graders, and other construction equipment. No work would be done on Sunday, and there would be few people at the church on other days of the week.

Alternative 3.6 would also include reestablishing 850 feet of the historic oxbow downstream of the Wood Canyon confluence. As the construction schedule would be 876 days, 94 days (about 3 months) longer than Alternatives 3.3 (780 days), Alternative 3.6 would have a longer period of localized noise within the Wilderness Park.

Alternatives 3.7 and 3.8 would be slightly longer in duration at 901 days and 916 days, respectively. Since the Proposed Project area is well removed from facilities outside the Wilderness Park that would be impacted for most of the construction period, and no work would be done on Sundays, impacts would be minimal.

Operation and Maintenance

Operations and maintenance activities would periodically increase noise levels due to emergency repair and trash and debris removal from the road/trail. Operations and maintenance would continue as needed for these activities. Noise levels would be expected to be similar to current levels within the Wilderness Park. Impacts would be less than significant.

Monitoring

Impacts during monitoring would be less than significant as monitoring would be periodic during the year and involve a few vehicles to and from the Proposed Project area.

5.6.4 Summary

For all action alternatives, impacts from noise and vibration differ due to the duration of construction increasing from Alternative 3.3 through Alternative 3.8. For all action alternatives, impacts would be short term and temporary and with implementation of **Environmental Commitment N-1 through N-4**, direct and indirect impacts would be less than significant.

5.6.5 Environmental Commitments

Implementation of the following environmental commitments would minimize noise impacts associated with any of the Proposed Action Alternatives.

N-1 All equipment shall include noise reduction measures, as applicable. These measures shall include, but may not be limited to, properly operating and maintaining mufflers, correct placement of equipment engine covers, and ensuring that small loading equipment is equipped with rubber tires. Equipment shall be maintained in accordance with manufacturer's recommendations. All machinery shall be equipped with the best available exhaust mufflers and "hush kits," as applicable.

N-2 Construction activities likely to create noise and dust shall be restricted to the hours of 7 a.m. to 5 p.m. Residents and other sensitive receptors within half-a-mile of construction activity shall be notified one week prior to construction activity. The notifications shall describe the character of the activities and their duration to enable sensitive receptors to modify their activities to reduce potential impacts.

N-3 As part of the Proposed Project's advanced notification to all residences and property owners, a contact person name and phone number shall be provided.

N-4 Noise producing signals, including horns, whistles, alarms, and bells shall be limited to safety warning purposes only.

5.7 BIOLOGICAL RESOURCES

5.7.1 Introduction

The Proposed Project area has a deeply incised creek channel. The relationship between riparian vegetation response and channel incision is indirect and may not be immediately obvious. Vegetation in Aliso Creek channel currently appears to be functional. Incision channel changes are often discontinuous in time and space, involving lags in geomorphic (Graf 1980) and biological responses to changes in physical conditions. There have been few quantitative attempts to link the rate, magnitude, and duration of water table declines to riparian vegetation response.

The consequences of incision to riparian ecosystems is dependent on several factors, including the magnitude and extent of channel incision and its effect on the water table in the adjacent floodplain aquifer, the texture of alluvial sediments, the degree of hydraulic connection between the aquifer and stream, the site-specific water table regime, and the climatic setting (Scott et al. 1990). There are a number of natural and human-influenced factors in arid and semi-arid regions that contribute to stream channel instability, including enhanced sedimentation and erosion (Warner 1994).

The severe downcutting of the creek bed in the project footprint has occurred over a series of decades due to massive increase of urban development in the Aliso Creek watershed and further exacerbated with the construction of ACHWEP. The downcutting is so severe that bedrock has been exposed and native tree roots are no longer reaching ground water, resulting in continual degradation of the system and severely restricting and straightening the floodplain.

5.7.2 Threshold of Significance

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the USFWS or CDFW.
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by the USFWS or CDFW.
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors.

5.7.3 Alternative Analysis

Impacts of the habitat types due to construction will not have significant adverse effects in time and space. Phasing of the restoration effort will allow early successional stages riparian habitat to be present and potentially occupied by early successional stage adapted wildlife. Adjacent habitat types will be present providing the necessary wildlife criteria of breeding, foraging, and cover requirements. The biological monitoring of construction activities and the initial operation and maintenance of the restoration parcels will not cause any adverse effects or impacts on the biological resources.

5.7.3.1 No Action Alternative/Future Without-Project Conditions

The future without-project conditions related to biological resources was assessed by NHI (2015b). To undertake this assessment, several projections, predictions, and assumptions were made to assess habitats over the 50-year time period, based on the current condition trends and climate change. These are detailed in Appendix B-2a. To determine future conditions, the CHAP method was used to determine changes in species, habitat, and functions from the baseline condition, and estimate future conditions at 25 years and 50 years. A complete description of the methodology used for this analysis is provided in Appendix B-2b. Based on this evaluation, future without-project conditions in the study area are projected to include:

- Potential for an increase in non-viable wildlife populations within 25 years and between 25 and 50 years. At least three species are expected to have non-viable populations, and three species are expected to be decreasing within 25 years. Two additional species would be considered non-viable and seven species would support decreasing populations in 50 years.
- An increase in the potential for fire based on changes to the environmental conditions including at least one significant fire burning over 1,000 acres within the 50-year period of analysis. This would be expected to decrease the extent of riparian habitat, while non-native annual grassland habitat and sage scrub and chaparral habitats would be selected for recovery post fire. Wildlife abundance and diversity, particularly riparian species, would significantly decrease for 50-100 years.
- An increase in invasive plant species, particularly giant reed at a rate of 7.4 percent per year, which could reach a 90 percent coverage within 50 years. There are several invasive plant treatment and removal projects in place that have goals at controlling giant reed to 0-10 percent. However, the efficacy of the measures employed, which may affect the level of reduction and spread over the next 50 years are unknown at this time.
- Further degradation of the hydro-geomorphological features of the Proposed Project area, including an additional incision of three to four feet in some reaches upstream and downstream of the ACWHEP until equilibrium is reached. Further incision will continue to separate the floodplains from the main creek and, coupled with the steepness of these walls, will preclude overbanking of the creek flow during large storm events, further isolating the floodplain within the banks of the creek. Instead, what is present is an open canopy of mature sycamores and cottonwoods with no tree recruitment and an open shrub canopy with scattered mule fat and non-native grasses.
- In particular, this could affect the S-bend portion of the floodplain, a geomorphic feature located downstream of ACWHEP that supports freshwater marsh. As the floodplain is cut off from the natural hydrologic flood regime, this area will become hydrologically isolated and the freshwater marsh will be lost. In addition to the degradation of riparian habitat within the larger adjacent floodplain from the loss of the natural hydrologic flood regime, the habitat in the incised creek is also subject to

further degradation. As the creek continues to incise and the slopes become steeper, the flood flows will have a higher velocity and have more erosive power that will both uproot the native vegetation that is currently established and favor faster growing invasive species (e.g. giant reed).

- Changes to the hydrologic conditions will result from the hydro-geomorphological changes described above, changes in local ordinances reducing the amount of runoff from adjacent developments, and climate change. This would lead to continued loss of willow-cottonwood riparian habitat as the water table is lowered below the rooting depth required by many native species. The persistence and increase in the lack of connectivity in the watershed between sections of the mainstem of Aliso Creek and the connection between Aliso and Wood Canyon Creeks would result in continued loss of native habitat.

Overall wildlife habitat value of the study area would steadily decline from existing conditions to 50 years without project. HUs and per-acre habitat values would decrease for all habitat types

The No Action alternative would be beneficial in the short term, because it would allow present vegetation communities and wildlife to remain in Aliso Creek. The creek is adjusting to current stressors (primarily the AWCHEP structure and urbanization of the watershed) and would eventually find a new equilibrium. However, this alternative is not ideal, because until the creek reaches equilibrium it will be difficult to maintain healthy riparian vegetation and adjacent infrastructure, such as roads, pipelines, and utility structures. Erosion rates will be high, degrading water quality and discharging heavy sediment loads downstream.

The riparian system downstream of the ACHWEP is currently unstable. The incision of the streambed is expected to continue an additional three to four feet in some reaches upstream and downstream of the ACWHEP structure until geomorphic equilibrium is reached. Although the existing vegetation on the terraces above the creek currently supports native Valley Foothill Riparian vegetation, further incisions will continue to separate the floodplains from the creek. The incision and the steepness of these walls would preclude much overbanking of the creek flow even during large storm events, further isolating the floodplain within the banks of the creek. The vegetation on the historic floodplains would likely continue to degrade in quality and would begin converting to more upland composition as the connection to the water table is reduced below the maximum rooting depth of the predominate riparian species. This effect on the vegetative community is already apparent in the more shallow rooted individuals as the vegetation is transitioning from a dense willow tree and shrub canopy to a more open canopy riparian community. If the floodplains were connected more to the creek, one would expect to see more densely packed tree canopies of willow, sycamores, and cottonwoods, with a very dense understory of arroyo willow, sandbar willow, mule fat, and riparian sub-shrubs and herbaceous vegetation. Instead, what is present is an open canopy of mature sycamores and cottonwoods with no tree recruitment and an open shrub canopy with scattered mule fat and non-native grasses. In particular, this could affect the

S-bend portion of the floodplain, a geomorphic feature located downstream of the ACWHEP that supports freshwater marsh.

As the floodplain is cut off from the natural hydrologic flood regime, this area would become hydrologically isolated, and the freshwater marsh would be lost. In addition to the degradation of riparian habitat within the larger adjacent floodplain from the loss of the natural hydrologic flood regime, the incised creek causes further degradation. As the creek continues to incise and the slopes become steeper, the flood flows would have a higher velocity and have more erosive power that would both uproot the native vegetation that is currently established and select for faster growing invasive species (e.g. giant reed).

In summary, while the current state of the habitat cover type does provide value from a wildlife perspective, the instability of the system would continue to affect the quality and functionality of the habitat, further degrading the habitat quality for riparian wildlife species in the future.

5.7.3.2 Action Alternatives

The major overarching objective is to restore Aliso Creek to a multilayered, structurally diverse riparian habitat type with a perennial aquatic habitat that will be subject to overbank flooding periodicity. The analysis for these four alternatives is very similar, changing with the implementation of habitat complexity "elements."

The Proposed Project repairs the most degraded characteristic of Aliso Creek – the geomorphology as well as restoring ecosystem functions processes such as the oxbow that has been cut off due to creek channel incision. All four action alternatives provide system stability because they allow peak streamflow to expand laterally onto the floodplains, where streamflow velocity is reduced by contact with soil and vegetation in the floodplains. This reduced flow velocity over existing conditions would minimize channel incision and bank erosion. Lower in-channel streamflow velocities would help preserve and manage aquatic taxa and wildlife habitats over the long term. Frequent inundation of the floodplains would increase water supply to riparian vegetation communities on the floodplains and help recharge groundwater reservoirs. The alternatives expand the floodplain area appropriate for riparian vegetation community establishment. Because of the raised channel invert and connection to the floodplains, all alternatives also provide access to surface and groundwater supply, which provides the best opportunity for long-term persistence of these riparian communities (Corps/Recon 2016).

The pool/riffle structure of the Proposed Project along with a wider creek channel would allow for fisheries habitat. It will also allow, importantly, for southwestern pond turtles, a taxa petitioned as a Federally-listed species, currently present within the Proposed Project area. Pond turtles require both terrestrial and aquatic habitat. Currently, there are no basking sites for pond turtles due to the severe creek incision of up to 30 feet, and access to breeding sites is limited.

There are two critical measures within the Aliso Creek alternatives that, combined with the baseline and other alternative measures, bring enormous habitat diversity and species richness. First is connectivity (longitudinal, lateral, and vertical) throughout the project reconnecting habitat that has been disconnected for decades. All alternatives in the final array of alternatives provide connectivity: (1) laterally, by reconnecting the creek to near its historic floodplain; (2) longitudinally, by removing the drop structures at the northern end of the wilderness park, recontouring channel up to Pacific Park Drive, and providing for a bypass at Pacific Park Drive; and (3) vertically, by raising the streambed elevation to near historic levels. Second is restoring the oxbow as an essential refugia for a vast array wildlife (fisheries, amphibians, reptiles, birds, small mammals, such as squirrels and rabbits, and megafauna, such as deer, bobcat, and coyote). The oxbow provides a large wide landmass of various riparian habitat types with lentic waters. Alternatives 3.6, 3.7, and 3.8 add this critical feature.

Alternative 3.7 also adds some sinuosity downstream of Pacific Park Drive, and Alternative 3.8 adds sinuosity both downstream of Pacific Park Drive and downstream of the Wood Canyon confluence. Adding the sinuosity measures as currently configured does not enhance or improve the overall habitat conditions because the sinuosity measures are too small to make a substantial difference in habitat complexity. This is evidenced by the overall change in HUs for the different alternatives (Table 5.7-1). Alternative 3.3 shows an increase of 5,597 HUs over the No Action alternative during the period of analysis. Alternative 3.6, with the addition of the reconnection of the abandoned oxbow, shows an overall increase of 5,775 HUs over the No Action alternative and an incremental increase of 177 additional HUs over Alternative 3.3. Alternatives 3.7 and 3.8 show an overall increase of 5,834 and 5,842 HUs, respectively, during the period of analysis over the No Action alternative, with an incremental increase of 60 and eight HUs, respectively, over Alternative 3.6. Alternatives 3.7 and 3.8 yield higher HUs, however, these alternatives do not produce the Best Buy alternative when analyzed with the construction costs.

Table 5.7-1 CHAP Habitat Units Alternatives Analysis

Alt	Description	AAHUs (net over No Action)	Alternative Description
3	Raise Streambed Elevation to Approach Historic Levels		
3.3	1. Restore from SOCWA CTP to Pacific Park Drive 2. Recontour streambanks to stable slope 3. Widen channel; 50 percent ACE (2-year) floodplain terrace 4. Riffle structures (grade control and promote pool/riffle regime) 5. Remove ACWHEP 6. Wood Canyon landscape reconnection and trailhead realignment 7. Remove two 10-foot high drop structures 8. Widen channel at Aliso Creek Road Bridge 9. Recontour channel to Pacific Park Drive 10. Pacific Park Drive bypass	5,597	1. REACH: SOCWA CTP to AWMA Rd bridge (3.6 miles) 2. ACWHEP STRUCTURE: Removed 3. Q2 FLOODPLAIN AREA: Substantial increase (90 percent) over No Action 4. Q10 AND Q100 FLOODPLAIN AREA: Moderate (58 and 46 percent) increase over No Action 5. ASSOCIATED GROUNDWATER RISE: Yes; with streambed raising. Benefits riparian margin in historic floodplain. 6. RIPARIAN VEGETATION: Broader band of riparian vegetation within 200-foot (top width) terraced channel, with more heterogeneous structural diversity (early and mid-successional). Overbank riparian corridor widens due to local raised groundwater, establishing denser, multilayer canopy tree and shrub, mid-to-late successional community. 7. AQUATIC WILDLIFE CONNECTIVITY: No connection to Wood Canyon, or upstream of AWMA Bridge. 8. AQUATIC WILDLIFE BENEFIT: Genetic diversity at risk; no dispersion upstream of AWMA Bridge. 9. INFRASTRUCTURE PROTECTION: SOCWA utility corridor and AWMA Road (Reach 4A-9).
3.6	1. All actions of Alternative 3.3 with additional action 2. Reconnect oxbow	5,775	1. Similar to Alternative 3.3, with some additional gain to floodplain areas due to added sinuosity. 2. REACH: SOCWA CTP to Pacific Park Drive (5 miles); plus BMP connectivity to I-5 (additional 3.5 miles). 3. ACWHEP STRUCTURE: Removed. 4. Q2 FLOODPLAIN AREA: Substantial increase (112 percent, not including BMP miles) over No Action. 5. Q10 FLOODPLAIN AREA: Substantial increase (94 percent not including BMP miles) increase over No Action. 6. Q100 FLOODPLAIN AREA: Moderate increase (61 percent, not including BMP miles) over No Action. 7. ASSOCIATED GROUNDWATER RISE: Yes; with streambed raising. Benefits riparian margin in historic floodplain. 8. RIPARIAN VEGETATION: Broader band of riparian vegetation within 200-foot

Table 5.7-1 CHAP Habitat Units Alternatives Analysis

Alt	Description	AAHUs (net over No Action)	Alternative Description
			terraced channel, with heterogeneous structural diversity (early and mid-successional). Overbank riparian corridor widens due to local raised groundwater, establishing denser, multilayer canopy tree and shrub, mid-to-late successional community. 9. AQUATIC WILDLIFE CONNECTIVITY: Connection to I-5 Freeway. 10. AQUATIC WILDLIFE BENEFIT: Promotes genetic diversity. 11. INFRASTRUCTURE PROTECTION: SOCWA utility corridor and AWMA Road selectively protected between CTP to Sulphur confluence. Realigned and raised reach between Skate Park and Pacific Park Drive for flow dynamics and habitat improvement, also provides ancillary benefits resulting from protection against west bank erosion threat to OC Parks service road/trail and to JRWSS (regional water supply line crossing).
3.7	1. All actions of Alt 3.3 with additional action 2. Reconnect oxbow 3. Sinuosity downstream of Pacific Park Drive	5,834	1. Similar to Alternative 3.3, with some additional gain to floodplain areas due to added sinuosity.
3.8	4. All actions of Alt 3.3 with additional action 5. Sinuosity downstream of Pacific Park Drive 6. Reconnect Oxbow 7. Sinuosity downstream of Wood Canyon	5,842	1. Similar to Alternative 3.3, with some additional small gain to floodplain areas due to added sinuosity.

Physical Construction Activities

Any of the alternatives would be implemented over four years in various increments or phases as seen in Table 5.7-2. Construction would take place over four phases. Phase 0, Pacific Park Drive to AWMA Road Bridge, would be restored at the same time Phase 1 is being restored at the furthest downstream reaches of the Proposed Project area.

Table 5.7-2 Phase Implementation

Phase	Length (feet)	Area
0	7,275	Pacific Park Drive to AWMA Road
1	4,545	OCWA to below lower oxbow
2	3,570	Lower oxbow to mid-canyon
3	4,656	Mid-canyon to upper/ lower road fork
4	4,773	Upper/lower road fork to AWMA Road

Each of the proposed disposal sites will be graded and engineered to curtail soil movement and restored with coastal sage scrub mix from Aliso Creek genetic stock for California gnatcatcher (CAGN). Native perennial grasses may also be used, if appropriate.

Construction is limited to four years. The construction component of the restoration will focus on widening, terracing, and developing pool and riffle structures in the creek to reestablish the groundwater connection upon which riparian habitat depends. Planting of native species would be accomplished from a native plant design and would commence once the restoration of the phase/reach geomorphology has completed 2,500 linear feet. Therefore, the vegetation type restoration would occur in a manner that promotes riparian structural habitat within 12 to 18 months. Phase 1 restoration would be planted with larger plants to achieve a more diverse riparian structural condition in a shorter period of time. Thus, for the geomorphology to be restored, the existing vegetation would be removed in incremental phases. **Environmental Commitments B-1 through B-7** would be implemented to minimize impacts during construction.

5.7.4 Restoration

The primary intent of monitoring is to develop adaptive management actions appropriate to assess and achieve the Project's restoration goals and objectives for operation and maintenance (O&M). Restoration actions that would be undertaken to achieve the Project objectives are the results of monitoring. The O&M and monitoring activities will be assessed in comparison to project objectives and decision-making triggers to evaluate whether the project is functioning as planned and whether adaptive management actions are needed to achieve project objectives.

The results of monitoring would be used to evaluate project status and adaptive management needs. Ecological success of a project feature will be confirmed when desired outcomes have been achieved, measured by meeting or exceeding the five-year achievement thresholds identified.

The success and analysis of the restoration is straight away. There is now an excellent breadth of experience and knowledge for restoring southern California coastal riparian ecosystems successful based on detailed success criteria. It is the comparison to a similar "reference site" in an immensely coastal urbanized environs that becomes the issue – where to find a reference site.

5.7.4.1 Plant Resources

To restore Aliso Creek riverine vegetation types, restore periodic overbank flooding, allow for aggradation (natural deposition), as well as degradation (erosional processes and scour), including raising the natural groundwater, the vegetation must be removed to allow for the geomorphology restoration to occur.

Many riparian ecosystem restoration projects achieve success because they recognize the importance of restoring the hydrologic regime. In other words, these projects are restoring flows of water and sediment in sufficient quantities and with appropriate temporal and spatial patterns. Other projects have proceeded without recognition of the need to incorporate environmental streamflow requirements into management plans. To increase success rate of riparian ecosystem restoration, the geomorphology is central to the success of the ecosystem restoration.

The impacts to the riverine vegetation types with implementation of the Aliso Creek ecosystem restoration would be short term (one to three years) but with long-term beneficial results commencing at year four. The long-term restoration has been formulated to provide flow conveyance capacity while minimizing adverse effects to special status listed species. Of critical importance is the reconnection and restoration of the Aliso Creek oxbow. Once abundant along rivers and creek systems, a variety of off-channel habitats, including adjacent wetlands and side channels, provided extensive areas of protected habitat. Oxbows are another form of this habitat type. An oxbow is an arc or crescent-shaped body of water located in creek or river beds. These are typically formed when the water “takes a short cut” through the narrow “neck” between bends, or meanders, as in Aliso Creek, cutting the oxbow off from the main flow. Aliso Creek once had a large oxbow where the current Chet Holifield Federal Building, also known as the “Ziggurat” building, and Alicia Parkway is now located. The remaining oxbow is in Aliso Creek, but has been cut off from the intense downcutting of the incised creek.

In discussions with experienced coastal southern California riparian/riverine restoration ecologists, vegetation structure of *Salix gooddingii* Forest Alliance, *Populus fremontii* Woodland Alliance, *Baccharis salicifolia* Shrubland Alliance, *Salix. exigua* Shrubland Alliance, *Salix lasiolepis - Salix gooddingii* Shrubland and Forest Alliance, *Salix laevigata* Shrubland Alliance, *Isocoma menziesii* Shrubland Alliance and all their various vegetation type associations, would begin to form within nine to 12 months after planting (Tomsovic and Whittaker**,** personal communication, December 2016).

Genetic plant material from Aliso Creek restoration site would be collected in advance of construction. Mature trees that are in healthy and good growth form may be boxed and used. It is known that there is no greater advantage with using larger container stock or boxed plant material. At the three- to five-year interval, the growth form and maturity would be similar to the use of large container stock. Use of Aliso Creek vegetation for pole stock may also be utilized in the restoration design. Because the water table would be brought higher, native plants would seek water, and their roots would be drawn downward.

Timing of the restoration planting is planned to take advantage of winter precipitation if possible. Restoring each phased construction site would begin when the geomorphology has been reestablished. It is possible that native plant restoration could begin once the geomorphology restoration has completed 2,500 feet moving upstream (Phase 1) or downstream (Phase 0). Nonetheless, an in-depth restoration plan would be developed in PED phase.

It is anticipated that freshwater marsh, *Schoenoplectus americanus* Herbaceous Alliance and *Typha domingensis* Herbaceous Alliance, would restore on its own. Freshwater marsh and open water refugia may be incorporated into the restoration construction design.

Giant reed removal has been conducted within the Proposed Project area in a cooperative effort led by the County of Orange. A review of treatment methods is in *Explanation/Details of Arundo Treatment Methods that will be used by the County of Orange on Arundo Control and Revegetation Projects in South Orange County* (Finch 2008), herein referred to as the Arundo Treatment Methods document. A review of this document is found in Appendix B-3. The removal methodology specifies that reports would be provided each year that document maintenance activities and site progress. These reports were not available at the time of this evaluation.

Invasive species eradication in the Proposed Project area would have positive effects on the implemented vegetation community values and would benefit the creek downstream by minimizing the dispersal potential for invasive plants, such as giant reed. Another positive impact includes the reduction of fire risk along Aliso Creek. The biological, chemical, and physical function and value goals are detailed in the AHMP (Appendix B-8).

After construction is complete, a greater number of acres of riparian and wetland habitat would be restored within the study area under each alternative. As a byproduct of project implementation, more areas of coastal sage scrub habitat would be added to the Aliso Creek Regional Park. All alternatives would result in the same acreage of restoration as the footprint for restoration is the same.

5.7.4.2 Animal Resources

The habitat restoration process moves a given area from a degraded state of relatively low habitat quality toward a target of improved condition of habitat quality and quantity. Assessment of the current condition relative to the restoration target design is followed by consideration of which management options that are likely to increase habitat quality. The question of how habitat quality is measured is, of course, a key concern. This is related to the requirements of the particular species of concern or guild of species; although indices such as habitat evaluation scores of CHAP are used where it has been established that these provide meaningful insights into an area’s suitability for all taxa of the project restoration site.

There is a meaningful understanding of the relationship between the particular management actions or habitat restoration and the degree of increase in habitat quality. It is clear that given the current degradation of riparian habitat such as Aliso Creek’s deep incision, a depauperate hydrological system that no longer functions (e.g. no overbank flooding in Aliso Creek), wildlife taxa (primarily mammals, reptiles, and amphibians) are currently occupying suboptimal to marginal habitat. Animal species are possibly being excluded from their preferred habitats by a range of factors including a simple lack of preferred functional habitat. Even birds, although dispersal friendly, have habitat that lacks the necessary multilayer vegetation composition and structure.

There would be direct and indirect effects to existing vegetation used by wildlife for habitat and the temporary dispersal and movement of common wildlife species inhabiting the proposed restoration extent. The effects of the restoration, nearly all temporary by themselves, would not reduce general wildlife populations below self-sustaining levels in the Proposed Project area. Over a three to five-year period, wildlife taxa and their population would return to levels at or better than preconstruction conditions. There is adjoining dispersal habitat to the west of Wood and Laguna Canyons; adjoining dispersal habitat to the south through the Ranch at Laguna; dispersal habitat from the north since most of Aliso Creek is still intact with no dams and limited channelization; and limited dispersal habitat from the east (Laguna Niguel). Although short-term impacts may occur as a result of proposed restoration, these potential impacts would not be long term and are considered less than significant. In many aspects, the biological diversity should increase over the next 50 years of the restoration effort with increased population levels of the more common animal taxa.

Megafauna may increase in population size but not in diversity. The San Joaquin Hills are cut off from connections to the Santa Ana Mountains. There is a three- to four-mile urban landscape gap between San Joaquin Hills and the Santa Ana Mountains.

Wildlife species that utilize the open aquatic areas, wetlands, and riparian areas along the creek may be temporarily impacted by construction in those areas, but will experience long-term beneficial effects from restoration in those areas. These species are able to move to alternative locations if they are disturbed by construction activities and, therefore, are not anticipated to be adversely effected.

There would be no permanent loss of native habitat or impacts to wildlife under any action alternatives. Thus, no significant adverse impacts will result. All action alternatives will result in beneficial effects to the aquatic ecosystem through the expansion of open water area, soft river bottom area, riparian zones, wetlands, and connection to tributaries.

Invertebrates

The riparian vegetation type alliances would provide habitat within 18 months. Vegetation association would resprout from natural vegetation, various restoration plant material methods (i.e. poles), and from seed and rhizomes from adjacent habitat left intact. The vegetation management of willow/cottonwood/mulefat vegetation type association would decrease some invertebrate species population while increasing others for about one to two years or less. Invertebrate species population should be restored to this riverine system with the possible addition of taxa not observed in the riparian habitat in many decades, such as butterflies. The invertebrate assemblages (e.g. beetles, spiders, aquatic insects, etc.) would not change in response to the riparian silviculture (tree growth and harvesting) treatment in the vegetation management. For the most part, some invertebrate families would undergo some reductions, while most invertebrate species would have no apparent effect to their populations from the action.

However, impacts to affecting invertebrate distribution and habitat use would be short term, minor, and insignificant. Pathways would still persist for dispersal out of and back into the restored habitat from all directions of the restoration site, especially the San Joaquin Hills, and eventually from the north at Pacific Park Drive. There would be a great deal of riparian habitat as well as the adjacent coastal sage and chaparral habitats immediately adjacent to the Proposed Project area. The Aliso Creek Canyon ranges from 250 feet (SOCWA) to over 3,500 feet in width of available habitat that is adjacent to the restoration site, which would be 200 to 300 feet in width.

Amphibians and Reptiles

Ecosystem support roles of wetland herpetofauna include: (1) serving as links in food chains; (2) processing dead organic matter and making it available to detrital food chains; (3) physically modifying the wetland habitat so that it supports a more diverse or abundant fauna; and (4) controlling populations of nuisance organisms. Many of the reptiles associated with riparian habitats are the opposite of amphibians in life history strategy. They differ by using these areas for food and cover, but move to the habitat edge or to drier land to deposit eggs (Clark 1979).

The most important factor affecting amphibian and reptile distribution and habitat use is horizontal and vertical habitat availability. Jones (1986) identified nine microhabitat components and attributes that are important determinants of amphibian and reptile abundance: lotic water, permanent lentic water, temporary lentic water, rock, litter/debris vegetation, live vegetation, dead vegetation, plant species, and soil. Microhabitat components are site-specific, physical entities that provide environmental conditions necessary for a wide variety of ecological functions such as reproduction, foraging, predator avoidance or escape, thermoregulation, and resting. Litter (e.g. fallen logs, leaves), plant root structure, horizontal vegetation structure, substrate moisture, pH, light intensity, as well as soil depth, texture, and diversity are critical elements for amphibians and reptiles to utilize an area. Removal or reduction of rotting logs and associated litter creates insufficient moisture for egg development and adult survival for many amphibian species.

However, impacts affecting amphibian and reptile distribution and habitat use would be short term, minor, and less than significant. Pathways would still persist for dispersal out of and back into the restored habitat from all directions of the restoration site, especially the San Joaquin Hills, and eventually from the north at Pacific Park Drive. There would be a large amount of riparian habitat as well as the adjacent coastal sage and chaparral habitats immediately adjacent to the restoration site. The Aliso Creek Canyon ranges from 250 feet (SOCWA) to over 3,500 feet in width of available habitat that is adjacent to the restoration site, which would be 200 to 300 feet in width. The southwestern pond turtle relocation out of Aliso Creek during construction and potential relocation into the restoration project area will be coordinated with CDFW, USFWS, and USGS Western Ecological Research Center (WERC), San Diego Field Station.

Birds

When a vegetation type alliance reaches four or five years of age, it begins to exhibit the structural diversity required for breeding by the least Bell's vireo (Franzreb 1989; Hendricks and Rieger 1989). However, a more recent example illustrates that several least Bell's vireo have occupied several territories and nested in restored habitat within 18 months during restoration activities on the Lower San Luis Rey River (Corps/RECON 2014). This was due to using pole cuttings, one-year-old container stock, as well as salvaging and boxing mature trees and shrubs in the habitat surrounding the restoration site, as would be implemented at the Proposed Project area in the Wilderness Park.

A vast array of riparian birds, including yellow-breasted chat (*Icteria virens*), yellow warbler (*Denroica petechia*), and many other obligate species including the southwestern willow flycatcher and least Bell's vireo, as well as resident facultative riparian bird species inhabit the heterogeneous community for many decades after restoration. The riparian habitat vegetation type forest and Shrubland alliances would undergo the natural vegetation type succession from sapling (one year), pole (one to two years), immature (three to five years), and mature (>10 years). Canopy closure (>60 percent) from mature willows and cottonwoods would provide shade for herbaceous and shrub understory. Older riparian gallery forests would be utilized by Cooper's hawk (*Accipiter cooperii*), warbling vireo (*Vireo gilvus*) and other species, but as a stand ages, the diversity of the flora and fauna within the vegetation types declines unless there is annual flooding, channel migration, and large overbank flood events that will maintain this cycle of succession thereby maintain a mosaic of diverse natural communities (Gregory et al. 1991).

Riparian habitats along major creek systems, such as Aliso Creek are important seasonally to birds, especially Neotropical migrants. Based on the distribution and position of the Aliso Creek watershed landscape, and its proximity to riparian habitat, it provides important habitats for many breeding bird species, acts as important stopover habitat for migrating birds, as well as providing wintering habitat for birds that reside year-round.

In riparian landscapes dominated by forest and woodland habitat blocks, activities that remove relatively small percentages of the overall forest only cause a temporary reduction in habitat for forest-interior species (i.e. those that rely on large blocks of forested habitat). While removal of large acres of forest trees can negatively affect forest interior species, there are some benefits to species that depend on early-successional forests (Rosenberg et al. 1999). The effects of restoration openings or activities make edge effects on birds manifested in several different ways but more importantly rejuvenates a habitat that is dying. This is clearly observed with dead or dying willow trees because their long root systems are no longer in groundwater but are now perched.

Creation and maintenance of edge habitats (ecotones) was once a paradigm in wildlife management (Giles 1971). Ecologists have learned that while edge habitats increase diversity by attracting many common species (especially game animals like deer and rabbits, and even some Neotropical migrant birds like indigo buntings (*Passerina cyanea*), forest-interior species may be reduced in population size or may disappear from areas that have a high degree of edge habitat for several years but return once the forest interior has reached is mature multilayer mosaic structural form.

Fischer (2000) has stated that riparian zones provide important seasonal habitats for a large number of bird species. Recent investigations have shown that riparian habitats must meet certain minimum width criteria to provide suitable habitat for most bird species. To encourage a diverse avian community, riverine corridors should be as wide and long as possible, and be relatively free from improved roads, human settlements, and other potential impacts. If avian habitat is a management objective, managers should consider maintaining riparian parcels that are at least 200 to 300 feet wide. With the overbank floodplain being reconnected, Aliso Creek restoration will meet this objective.

The riparian restoration would incorporate many buffer management criteria. Avian species richness (diversity) would not experience a major decrease because of the restoration construction phasing over four years, utilizing a large amount of pre-grown, Aliso Creek genetic stock plants that will be acclimated to the Aliso Creek environmental conditions for several years on site. Furthermore, essential Neotropical migrant bird riparian habitat types will be increased by widening the creek to a top width of 200 feet. Habitat width will be increased during epochs of overbank flooding allowing for more riparian habitat types to be available for Neotropical migrant birds moving through the environs. This would leave a great deal of riparian habitat intact, primarily old growth riparian forest and woodland.

However, impacts affecting bird distribution and habitat use would be short term, minor, and less than significant. Pathways would still persist for dispersal out of and back into the restored habitat from all directions of the restoration site, especially the San Joaquin Hills, and eventually from the north at Pacific Park Drive. There will be a large amount of riparian habitat as well as the adjacent coastal sage and chaparral habitats immediately adjacent to the restoration site.

Mammals

Riverine habitat features important to mammals include woody and herbaceous strata, diversity of food and cover plants, structural diversity (stumps, snags, fallen logs, vines), friable soil, leaf litter, available surface water, invertebrates and other prey items, and thermal cover. Instream flows and water quality are also important for aquatic and semi-aquatic species that feed on plant and animal matter in or along the stream (Ohmart and Anderson 1986). Many mammal species use a broad range of forest/woodland/ shrubland/grassland habitat types, and differences in distribution within riparian ecosystems may be subtle (DeGraaf and Yamasaki 2000).

Microhabitats, especially in regard to food and cover, may be the primary factors in small mammal distribution in riparian areas (DeGraaf et al. 1992). Studies have shown that many small mammals are more abundant in the denser herbaceous groundcover that results from overstory removal riparian system (Dickson and Williamson 1988). In the southeast, riparian zones are especially important to mammals along streams that bisect young or regenerating forest stands (Dickson and Williamson 1988). These areas provide habitat diversity and edge for a variety of species.

Mammals are important to riparian ecosystems, but their occurrence and dependence on riparian areas is highly variable. Many mammals use riparian habitats for food, water, and cover, especially in arid and semi-arid regions, but few species are restricted to riparian areas. The impacts of riparian habitat modification and disturbance are not as clear for most mammals as they are for birds, reptiles, and amphibians. As with other wildlife, activities that potentially affect mammal populations are varied. However, specific impacts have not been determined for most mammals, especially nongame species. Populations of some small mammals may increase after vegetation management due to the increase in ground-level vegetation, increased ground-level cover, and greater food production for some species (McComb and Noble 1980; Wesley, Perkins, and Sullivan 1981). Healy and Brooks (1988) have also reported that intermediate thinning treatments had minimal or ephemeral effects on the numbers and composition of small mammals in hardwood forests of West Virginia and Massachusetts.

However, impacts affecting mammal distribution and habitat use would be short term, minor, and less than significant. Pathways would still persist for dispersal out of and back into the restored habitat from all directions of the restoration site, especially the San Joaquin Hills, and eventually from the north at Pacific Park Drive. There would be a large amount of riparian habitat as well as the adjacent coastal sage and chaparral habitats immediately adjacent to the restoration site.

5.7.5 Special Status Listed Species: Threatened and Endangered Species

The Affected Environment (Section 2.7) Biological Resources indicates four Federal listed taxa: thread-leaved brodiaea, least Bell's vireo, California gnatcatcher, and the southwestern willow flycatcher. The only listed critical habitat is the lagoon outside the Proposed Project area at the terminus of Aliso Creek for tidewater goby. The southwestern pond turtle is present within the Proposed Project area, and as a sensitive species has been petitioned for listing.

The USFWS definitions for effects determination is being employed (*Biological Assessment Preparation* 12.1 *Advanced Training Manual Version 02-2015*) for ESA Section 7(a) (2) determinations:

- ***No effect*** (NE) means no effect whatsoever, including any beneficial, highly improbable, or insignificant effects that may result from the project.
- ***Not likely to adversely affect*** (NLTAA) is the appropriate determination if direct and indirect effects of a Federal project (including any interrelated and interdependent activities) are expected to be discountable, insignificant, or completely beneficial.
- ***Likely to adversely affect*** (LTAA) is the appropriate determination if any adverse effect on listed species may occur as a direct or indirect result of a project (including any interrelated or interdependent actions), and these effects are not discountable, insignificant, or entirely beneficial.

Source: USFWS Craig W. Aubrey, Chief, Division of Environmental Review, Nov 2016; John Morse, National Section 7 Coordinator, Dec 2016; Jon Avery, Carlsbad Office, Federal Projects Coordinator, April 2017

5.7.5.1 Plants

Brodiaea filifolia **(thread-leaved brodiaea)**

Distribution of known *Brodiaea filifolia* (thread-leaved brodiaea) inhabits a small parcel within the Wilderness Park (Figure 2.7-4). The Aliso Creek ecosystem restoration effort would not affect the known distribution or listed critical habitat of *Brodiaea filifolia.* The extant distribution is outside of the Proposed Project area. A clear fence line can be observed as indicated via Google Earth running from northwest to southeast terminating at the ingress/egress automatic gate at Aliso Canyon Road. This fence line is the southern boundary of the listed critical habitat. A small swath of listed critical habitat is immediately adjacent to the Proposed Project area. Nonetheless, a *Brodiaea filifolia* plant survey of the critical habitat would be implemented. A qualified (through knowledge and experience) and certified biologist (CNPS) of listed and rare plants would perform the listed and rare plant surveys.

The Aliso Creek Ecosystem Restoration project would have **no effect** on the thread-leaved brodiaea because only a small parcel of the critical habitat is within the Wilderness Park, but it is **not** part of the Proposed Project construction implementation area. A survey for thread-leaved brodiaea would be completed during Phase 3 construction. The thread-leaved brodiaea critical habitat will be recorded via GPS, fenced off, and monitored during construction.

5.7.5.2 Fish

Eucyclogobius newberryi **(tidewater goby)**

The Aliso Creek “lagoon” is listed critical habitat for the tidewater goby (*Eucyclogobius newberryi)* as illustrated in Figure 2.7-5 of the Affected Environment (Chapter 2). Aliso Creek estuary is part of the South Coast Recovery Unit, Sub-Unit SC-1 (OR–1) and is not currently occupied. Nonetheless, the recovery plan (USFWS 2005) states that Aliso Creek

"… does possess the PCE that could support tidewater goby. On an intermittent basis, OR–1 possesses a sandbar across the mouth of the lagoon or estuary during the late spring, summer, and fall that closes or partially closes the lagoon or estuary, and thereby provides relatively stable conditions (PCE 1c). PCE 1a and 1b occur throughout the unit, although their precise location during any particular time period may change in response to seasonal fluctuations in precipitation and tidal inundation."

Historically, a large population of tidewater goby was documented at the creek's mouth by Swift et al. (1989), from a study period that ranged from March 1973 to January 1977. The tidewater goby, which depended on the transient lagoon at the mouth for survival, has declined in number because of modifications to its habitat. Tidewater gobies were last collected at Aliso Creek in 1978. Swift et.al. (1993) tidewater gobies were not found at Aliso Creek during surveys. Aliso Creek is not designated as "Water Quality Limited" by the SWRCB.

Therefore, Aliso Creek is a location historically occupied by tidewater goby, now extirpated but with a potential for reintroduction to the site. Implementation of the Aliso Creek Ecosystem Restoration project will have **no effect** on tidewater goby because the tidewater goby is extirpated from the Aliso Creek estuary.

The Proposed Project **may affect** the tidewater goby critical habitat due to potential sediment transport through Aliso Creek to the estuary but the project **will not destroy or adversely modify** tidewater goby critical habitat. The rationale is based on: (1) Aliso Creek has undergone severe downcutting over several decades; (2) tantamount to the project is restoring the geomorphology of the creek system; (3) the Proposed Project implementation is divided into distinct phases so as to reduce the sediment transport downstream to the estuary; and (4) water and sediment quality essential feature of tidewater goby critical habitat may be affected by a sediment transport that temporarily increases turbidity. However, it is anticipated those effects would be temporary and minimal because suspended particles will settle out within a short timeframe without measurable effects on water quality. Nonetheless, turbidity will be monitored in Aliso Creek downstream of active construction as well as the Aliso Creek estuary to distinguish storm flow from effects related to construction.

5.7.5.3 Amphibians and Reptiles

***Actinemys marmorata pallida* (southwestern pond turtle)**

The southwestern pond turtle *(Actinemys marmorata pallida)* is a resident reptile within the Wilderness Park. It is not a Federal listed taxon, but has been petitioned to be proposed as a listed species by the USFWS. For this Proposed Project, the Corps is taking a proactive position and including an effect analysis that could be applied should the species be listed in the future.

The Aliso Creek Habitat Mitigation Plan prepared for the Laguna Canyon Foundation by Derek Ostensen & Associates concerning *Actinemys marmorata pallida* states:

"General habitat assessments and trapping have occurred within that southern portion of Aliso Creek and it has been determined that there is a regionally significant population residing within the park. Studies and surveys have included mitigation southwestern pond turtles relocations (Goodman pers comm.), USGS trapping (Schuster pers comm.), and general habitat surveys (Nerhus, pers obs). The general population estimation in this area is approximately 150 southwestern pond turtles and may be larger since prior published data."

However, the USGS WERC/SDFS conducted surveys in Aliso Canyon in 2010 and trapped only eight pond turtles, seven near ACWHEP, both up and downstream, and one along Wood Canyon Creek (A. Backlin personal communication November 10, 2015). In 2014, four individuals were detected during focused surveys upstream between Aliso Creek Road and the intersection of Aliso Viejo Parkway and Moulton Parkway (GLA 2014). The statement in the Aliso Creek HMMP is incorrect and again introduces error into the literature. Personal discussions with pond turtle experts at USGS WERC (Robert Fisher, PhD; Adam Backlin, PhD) have indicated that "relatively large numbers" of the species do not exist inside AWCWP or the Proposed Project area generally.

The Corps will perform surveys in the Proposed Project area two years prior to construction implementation during the PED phase. As part of the biological resources environmental commitments, a plan of action would be developed through USGS WERC in collaboration with CDFW and USFWS to relocate southwestern pond turtles found during the PED survey. The location for southwestern pond turtle relocation out of Aliso Creek during construction and relocation back into the restoration project area will be coordinated with CDFW, USFWS, and USGS WERC San Diego Field Station. This would only entail the turtles in Aliso Creek and not Wood Canyon.

The project **may affect** southwestern pond turtle since pond turtles are known to occur in the Proposed Project area and would need to be translocated to habitat identified in the collaboration with CDFW/USGS/USFWS so they are not harmed. However, the project **is not likely to adversely affect** southwestern pond turtle because: (1) any turtles present will be translocated outside the Proposed Project area to a habitat locale deemed appropriate; (2) a crucial and essential objective of the Proposed Project is to restore the aquatic and terrestrial habitats for southwestern pond turtle; and (3) based on the restoration implementation succession, pond turtles will be reintroduced into habitat deemed appropriate by USGS/CDFW/USFWS.

5.7.5.4 Birds

***Empidonax traillii extimus* (southwestern willow flycatcher)**

The southwestern willow flycatcher *(Empidonax traillii extimus)* is a migrant bird through the Wilderness Park. Nesting has not been documented for the southwestern willow flycatcher in presences/absences surveys by the Corps (2009, 2010, 2013, 2015, and 2016) and Dudek (2011).

The Proposed Aliso Creek Ecosystem Restoration Project would have **no effect** on the southwestern willow flycatcher as birds migrating through the Proposed Project area would have extant riparian habitat throughout the Proposed Project site since: (1) the project is phased over four years; (2) a large portion of riparian habitat outside of the proposed 200-foot-top-wide channel would still contain mature riparian habitat *(Salix gooddingii-Populus fremontii* Woodland Alliance) as well as understory species (*Baccharis salicifolia* Shrubland Alliance and *Salix lasiolepis* Shrubland Alliance); and (3) there is no listed southwestern willow flycatcher critical habitat within the Proposed Project area. Southwestern willow flycatcher presence/absence surveys would be performed during the first two years of construction. .

***Polioptila californica* (California gnatcatcher)**

It is well established that the California gnatcatcher *(Polioptila californica)* is a resident within the coastal sage (*Salvia, Eriogonum, Artemisia*) Shrubland Alliances and uses these Alliances as its primary habitat for breeding. While the CAGN clearly depends on coastal sage Shrubland Alliances, the species regularly uses other habitat types, such as riparian (*Salix, Populus*) Forest Alliances for protection, food resources, and cooling during hot summers (Campbell et al. 1998).

The CAGN generally disperses short distances through contiguous, undisturbed habitat, but juvenile gnatcatchers are capable of dispersing over longer distances across fragmented and highly disturbed sage scrub habitat, such as that found along utility corridors or remnant mosaics of habitat adjacent to developed lands. Published dispersal surveys indicate that CAGN were observed regularly in riparian, grassland areas, including weedy fields, especially those adjacent to coastal sage scrub (Campbell et al. 1998). Although no quantitative data were collected, CAGN appeared to use these habitat types more frequently during the non-breeding season for the purpose of dispersal. As coastal sage scrub becomes more fragmented and CAGN populations more isolated, short-distance dispersal would become more difficult, and the long-distance dispersal may not be sufficient to maintain genetic diversity and inter-population movement.

CAGN were observed and heard using some parts of the Proposed Project site in a 2009 protocol focused survey (USACE 2009). Figure 2.7-8 in Chapter 2 illustrates suitable CAGN coastal sage habitat with four use areas in which CAGN were observed or heard. Some coastal sage habitat is inside the Proposed Project area, but these parcels would not be degraded or destroyed during construction except for possibly one area on the east side across from the Wood Canyon confluence where the canyon is narrow.

Final designation of critical habitat for the CAGN was on October 24, 2000, and April 24, 2003, but Aliso Creek was not designated since it is inside the County of Orange (Central/Coastal) NCCP/HCP (1996).

The Proposed Project **may affect** the CAGN because it is a resident bird taxa known to inhabit several parcels of the coastal sage Shrubland Alliance vegetation type within the Proposed Project area. However, the Proposed Project **is not likely to adversely affect** *Polioptila californica* because: (1) the Proposed Project would be implemented in four phases; (2) construction will be accomplished outside the nesting season; (3) coastal sage Shrubland Alliance vegetation type in the immediate proximity to the project site; (4) the disposal sites west of Aliso Creek would be restored to coastal sage Shrubland Alliance vegetation type; (5) protocol focused survey's would be accomplished for three consecutive years prior to the construction in the PED phase by qualified permitted biologists; and (6) a qualified biological monitor would be present on site during all construction phases.

***Vireo bellii pusillus* (least Bell's vireo)**

One of the primary reasons for the ecosystem restoration of riparian habitat at Aliso Creek is the creation of habitat for endangered or threatened taxa. It is a unique opportunity in coastal Orange County to reestablish *Salix gooddingii* Woodland alliance and *Baccharis salicifolia* Shrubland Alliance vegetation types, where periodic overbank flooding, backwater refugia, multi-structural habitat is restored through repairing the geomorphology. This in turn would create riparian habitat for an extensive diversity of birds that would inhabit and utilize the restored land. One of these taxa is the least Bell's vireo (LBVI), Federal and state listed as an endangered species.

As illustrated and discussed in Chapter 2, there are approximately three to four (possibly five) LBVI territories based on protocol presence/absence surveys over a seven- to eight-year period since 2009 (Corps 2017; Dudek 2012). There are anecdotal detections of single male LBVI migrating through the riparian habitat, but those detections are rare (two to three over a 10-year period).

The phasing of the Proposed Project would be beneficial for the extant LBVI population. Restoration of the riparian habitat in which the population of LBVI breed is in Phase 4. This is the area between the upper and lower road junction near Aliso Creek Road to AWMA Road Bridge. This parcel is approximately 4,773 feet in length. Construction of this expanse has four to five LBVI territories.

The Proposed Project **may affect LBVI** because existing riparian habitat would be removed to restore the geomorphology of Aliso Creek. However, the Proposed Project **is not likely to adversely affect LBVI** because prior to existing habitat restoration, riparian habitat (*Salix gooddingii-Populus fremontii* Woodland Alliance; *Baccharis salicifolia* Shrubland Alliance; *Salix lasiolepis* Shrubland Alliance) would be created 100 to 300 feet east of the current riparian habitat as a minimization measure. It has been clearly demonstrated through literature that LBVI are site-tenacious; that is, successful nesting adult vireos return to the same nesting area and often the same nesting plant as the previous year. However, riparian habitat that is created would meet the needed structural conditions necessary for LBVI nesting with the goal to create four to five LBVI territories at a minimum of 1.7 acres per LBVI territory. This would be about nine acres for five LBVI territories. Figure 5.7-1 illustrates about 16 acres, thus, there would be an additional seven acres than is needed for five LBVI territories.

Figure 5.7-1 Proposed Least Bell's Vireo Minimization Measure Restored Habitat Prior to Construction

The success criteria of the Phase 4 habitat creation would be: (1) if LBVI utilize the created habitat in three to four years after implementation; or (2) if the habitat structural conditions meet the LBVI habitat suitability models developed by USGS or Caltrans for LBVI riparian habitat creation and restoration. After Phase 4 has been restored, the created habitat can be left in place as additional restored riparian habitat.

LBVI protocol presence/absence surveys would be implemented every year through PED, construction, and eight years post-construction (three years for implementation; five years for post-construction monitoring).

5.7.6 Wildlife Movement Corridors

The Central Orange County HCP recognizes the Aliso Creek as an important north-south wildlife corridor along its alignment, between higher elevation areas and the ocean, and east-west along its major tributaries. Movement among habitat types or between patches of similar vegetation occurs within corridors of vegetative cover acceptable to these species particularly in areas of increasing human pressure on natural resources. These corridors can be critical for certain wildlife species to find adequate food, water, nesting or denning sites, and breeding opportunities, or to allow seasonal movements. Substantial historical and recent human impacts to wetlands, woodlands, chaparral, and endemic native plants and animal populations have created degraded natural communities and a fragmented mosaic of isolated native natural communities. This loss of habitat has resulted in the elimination of many historical wildlife populations and/or the reduction of population sizes of many species. While it is recognized that corridors are important for small animals and birds, they may not be so effective for larger animals, especially if the corridors are narrow and surrounded by urbanization. The San Joaquin Hills are located west of the Proposed Project area, and are a sizeable landscape expanse of open space.

Aliso Creek is part and partial of the San Joaquin Hills ecosystem; it is at the east side of the San Joaquin Hills. Most of the major canyons are of north-south orientation, however, megafauna would continue to utilize the various tributaries and ridges as a corridor to Aliso Creek. Wildlife movement corridors (e.g. structures that facilitate movement between suitable sites) and habitat edges (e.g. identifiable transitions between communities or landscape features) often coincide. Vegetation clearing may reduce the quality and abundance of resources along the creek corridor, making this corridor less attractive or useful to wildlife for a short period of time (18 months to 3 years). These actions also create new edge habitat within the riparian community, defined by vegetation, soil and hydrological conditions. More importantly, the Aliso Creek restoration reconnects or makes the existing habitat connections much more viable with the San Joaquin Hills. Lateral connectivity will be established from The Ranch at Laguna near the Pacific Ocean to I-5, a distance of nearly nine miles. It is uncertain if a continuous lateral connection would be made from I-5 to the Santa Ana Mountains, a distance of eight to 10 miles due to the Aliso Creek restoration. Birds can easily use Aliso Creek riverine corridor to move to and from the Santa Ana Mountains. Megafauna, such as ubiquitous coyote, can move between the Proposed Project site and Santa Ana Mountains.

Removal of vegetation may also create inundated or open sandy areas that preferentially conduct surface and subsurface flows. Since these features would also occur naturally after significant flood events, migration of amphibians and other water-dependent species may be facilitated under these conditions. Since sizeable landscape expanse of open space is found to the north of the restoration project, riverine ecosystem vegetation and habitat would continue to be present for Neotropical migrant birds, therefore, impacts to wildlife corridors will be less than significant.

5.7.7 Summary

The *Ecosystem Restoration Review: Aliso Creek Ecosystem Restoration Project, Orange County, California* (Appendix B-3) outlines methods and alternatives for habitat restoration in Aliso Creek watershed that are likely to bring positive change to the system. From the information provided, the restoration approach that would best support establishment of self-sustaining native vegetation communities and riparian habitat for native animal species is Alternative 3.6, since it would provide the widest floodplain area and best connectivity from the channel to the floodplain. These large floodplain areas would: (1) provide the greatest area for lower and middle riparian vegetation communities; (2) provide the lowest in-channel streamflow velocity during peak flows, thereby reducing incision and channel erosion rates; (3) provide the most reliable and hospitable aquatic habitats by reducing water velocity and rates of erosion/sedimentation; and (4) provide the best protection for adjacent infrastructure by minimizing bank erosion. With the presence of existing suitable habitat areas adjacent to the Proposed Project, impacts to biological resources would be minimal and short term. The Proposed Project would create an overall major benefit to the Aliso Creek aquatic ecosystem in the long term.

Impacts from O&M and monitoring activities are expected to be less than significant. Maintaining design grades, elevations, contours, and conveyance may require limited earthmoving activities on a periodic basis. Most structural repairs would be like-for-like. Impacts will be temporary in nature. Invasive species removal throughout the project footprint would typically be performed by proven eradication methods. With ongoing eradication of non-native species, presence of perennial flows, and presence of a seedbank within the soil matrix, native riparian vegetation is expected to reestablish in affected areas. Thus, impacts would be temporary. During maintenance activities, noise and presence of visual forms associated may trigger startle response by wildlife during the outset of construction and the temporary abandonment of the immediate areas around the construction footprint. Wildlife are expected to reclaim affected areas upon completion of the maintenance. In-channel work may require temporary onsite relocation of pond turtles to other parts of Aliso Creek.

The No Action alternative would be beneficial in the short term, because it would allow present vegetation communities and wildlife to remain in Aliso Creek. The creek is adjusting to current stressors (primarily the ACWHEP structure and urbanization of the watershed) and would eventually find a new equilibrium. However, this alternative is not ideal, because until the creek reaches equilibrium it would be difficult to maintain healthy riparian vegetation and adjacent infrastructure such as roads, pipelines, and utility structures. Erosion rates would be high, degrading water quality and discharging heavy sediment loads downstream.

5.7.8 Environmental Commitments

The following commitments would be implemented as part of any action alternative:

BIO 1 Qualified Biologist Oversight. A qualified biologist would be responsible for overseeing compliance with protective measures for the biological resources during clearing and construction activities within designated areas.

BIO 2 Thread-leaved brodiaea
- A survey for thread-leaved brodiaea would be completed during Phase 3 construction.
- The thread-leaved brodiaea critical habitat would be collected via GPS, fenced off, and monitored during construction.

BIO 3 Tidewater Goby Critical Habitat
- Turbidity will be monitored in Aliso Creek downstream as well as the Aliso Creek lagoon estuary, and recorded on a daily basis and distinguished from storm flow and from construction.

BIO 4 California Gnatcatcher
- The Proposed Project would be accomplished in four phases.
- Construction would be accomplished outside the nesting season.
- Coastal sage Shrubland Alliance vegetation type in the immediate proximity to the Proposed Project area would be monitored.
- The disposal sites west of Aliso Creek would be restored to coastal sage Shrubland Alliance vegetation type.
- Protocol-focused surveys would be accomplished for two consecutive years prior to the construction in the PED phase by qualified permitted biologists
- A qualified biological monitor knowledgeable and experienced with CAGN ecology would be present onsite during all construction phases.

BIO 5 Least Bell's Vireo
- The creation of this habitat for LBVI would begin three years prior to construction of Phase 4 with the main emphasis on creating the structure of the habitat for vireos to use for nesting. Excavation and plantings of Aliso Creek genetic stock plants would be employed with growth monitoring and weed eradication for four years prior to Phase 4 construction.
- The LBVI riparian habitat creation would be in areas that would support *Salix gooddingii-Populus fremontii* Woodland Alliance, *Baccharis salicifolia* Shrubland Alliance, *Salix lasiolepis* Shrubland Alliance vegetation types.
- LBVI protocol presence/absence surveys would be implemented every year from 2019 through PED, construction, and eight years post-construction (3 years for implementation; 5 years for post-construction monitoring).

BIO 6 Southwestern Pond Turtle
- The Proposed Project area would be surveyed two years prior to construction implementation during the PED phase.

- As part of the biological resources environmental commitments, a plan of action would be developed through USGS WERC in collaboration with CDFW /USFWS to relocate southwestern pond turtles found during the PED survey.

BIO 7 Employee Education Program. An employee education program would be developed. Each employee (including temporary, contractors, and subcontractors) would participate in a training/awareness program prior to working on the Proposed Project. Prior to the onset of construction activities, the contractor would provide all personnel who would be present on work areas within or adjacent to the Proposed Project area the following information:

- A detailed description of all listed species including color photographs.
- The protection any listed species receives under the Endangered Species Act and possible legal action or that may be incurred for violation of the Act.
- The protective measures being implemented to conserve all listed species during construction activities associated with the Proposed Project.
- A point of contact if listed species are observed.
- Issue identification cards to shift supervisors with photos, descriptions, and actions to be taken upon sighting for the listed species that may be encountered during construction.

5.8 CULTURAL RESOURCES

5.8.1 Assumptions

The following analysis is based on previous cultural resource inventories, site records, historic maps, and geomorphic studies. Approximately half of the APE has been surveyed for cultural resources. Non-surveyed or inadequately surveyed areas would be examined in the next phase of the study prior to more detailed designs and before any ground disturbing activities. Potential impacts are based on preliminary designs and assumes a worst-case scenario. It is anticipated that in future design phases minor redesigns can avoid or minimize some of the impacts discussed below.

5.8.2 Thresholds of Significance

The concept of adverse effect under the NHPA and significant impact under NEPA are similar in concept but are not equivalent terms. A broad range of impacts from very minor to major would be classified as an adverse effect but the context and intensity of these impacts may not meet the threshold of NEPA significance. NEPA requires consideration of the degree to which the action may adversely affect properties listed in or eligible for listing in the NRHP. For example, a farmhouse or TCP, that is eligible under Criterion A, may be adversely affected by the introduction of visual intrusions because these intrusions would diminish its integrity of location, setting, and feeling. This would be an adverse effect under NHPA but may not meet the threshold of significance under NEPA. The demolition of the property, however, would most likely constitute a significant impact because its destruction would preclude its eligibility for the NRHP.

Under CEQA, a project may have a significant effect on the environment if it may cause a substantial adverse change in the significance of a historical resource. Under CEQA, historic resources are resources that are either listed in or eligible for listing in the California Register of Historic Places (CRHP), or if it is included in a local register of historic resources. Properties that are eligible for the NRHP are almost always eligible for the CRHP so for the purposes of this document, historic properties are assumed to be historic resources and would also be considered to be historically or culturally significant for the purposes of CEQA as well as NEPA. An adverse effect would be considered a significant impact under NEPA and CEQA if:

- Even after minimization and mitigation, the remaining impacts to the property would diminish the integrity of a historic property's location, design, setting, materials, workmanship, feeling, or association to the point that implementation of the alternative would result in a substantial adverse change to the property's eligibility status.
- The alternative would result in the physical destruction, damage, or alteration of all or a substantial part of an archaeological site that is eligible for the NRHP
- The alternative would cause damage to a unique archaeological resource pursuant to State CEQA Guidelines section 15064.5 and Public Resources Code section 21083.2, subdivision (g).
- The alternative would disturb or is likely to disturb any human remains, including those interred outside formal cemeteries.
- The implementation of the alternative would result in a major modification of a National Historic Landmark or property meeting the criteria of a National Historic Landmark as defined in 36 C.F.R. 27 Part 6.

5.8.3 Alternatives Analysis

5.8.3.1 No Action Alternative/Future Without-Project Conditions

Under the No Action alternative, no Federal project nor a project by the non-Federal sponsor would be implemented. The incised creek would not be restored to pre-incised elevations, ACWHEP would not be removed, and restoration of plant communities would not occur. The Proposed Project area would continue to be primarily built out or preserved as open space/recreation.

Areas of identified cultural resources are largely protected from new development and would not be expected to change from existing conditions under the No Action alternative. Excavation or other ground disturbing activities from possible future projects could potentially disturb cultural resources in the vicinity. However, if any projects are approved and implemented, project proponents would be required to identify and protect cultural resources within the Proposed Project area. It is probable, however, that sites may be disturbed or lost both by other human actions that are not project related and through natural processes such as erosion.

5.8.3.2 Action Alternatives

Cultural resources are geospatial resources that are most clearly impacted by ground-disturbing activities. Ground disturbance would result from site preparation, grading, bank removal, channel widening, concrete removal, excavations for native vegetation planting, excavations for removal or alteration of existing structures, and the removal and regrading of the AWMA Road/Aliso Creek Trail on the west side of the Creek through the Wilderness Park.

If prehistoric or historic archaeological sites are present, ground disturbance can directly damage artifacts and features or alter the spatial relationship of artifacts, features, and other deposits and destroy their research potential. This can result in the permanent loss of information relevant to the site function, dates of use, plants and animals used, past environments, ethnicity, and other important research questions. Ground disturbance can also damage unmarked burials or other sites that may be important to contemporary Native Americans as ancestral locations or for traditional cultural or religious purposes. The alternatives may change the physical setting of historic buildings and structures. New construction for ecosystem restoration may also alter drainage patterns and channel morphology, exposing buried archaeological resources and causing impacts due to erosion.

All four action alternatives share the same base action of raising the incised creek bed elevation by recontouring the creek to have a top width of 100 feet for the two-year-flow channel, and 200 feet for the 10-year-flow channel, from AWMA Road Bridge to the SOCWA CTP Bridge. The ACWHEP and drop structures would be removed and rock riffle grade control structures would be added. The amount of excavation varies by alternative. Twelve archaeological sites have been recorded along Aliso Creek and fall within the area that would be directly affected by the excavation. Six of these have previously been determined to be eligible for the NRHP; however, the sites were recorded over 30 years ago, and their current condition is unknown. Five of the 12 previously recorded archaeological sites are currently being revisited. Additional information about their condition and eligibility will be included in the Final IFR. The alternatives vary in the amount of impact that would occur to each site.

Section 304 of the NHPA prohibits Federal agencies from publicly disclosing specific information about cultural resources that could lead to their harm through vandalism or looting regardless of their eligibility. Therefore, specific site locations are not discussed in this analysis.

Based on the mapping from previous surveys, there are 12 sites that fall within the direct impact area of all four action alternatives. The general footprint would be the same for Alternatives 3.3, 3.6, 3.7, and 3.8. The differences would be the increasing amounts of work within the incised creek and the addition of project features such as increased sinuosity. All of the action alternatives would likely result in adverse impacts to existing cultural resources and significant impacts under NEPA. The California SHPO, the Affected Tribes, and any other consulting parties would be involved in the development of a Memorandum of Agreement (MOA) and development of a treatment plan to address the adverse effects.

Alternative 3.3 – Raise the Streambed to Approach the Pre-Incised Elevations

Construction

The footprint of Alternative 3.3 intersects with 12 recorded archaeological sites. As previously discussed in Chapter 2, at least six of these sites have previously been determined to be eligible for the NRHP under Criterion D. The archaeological sites were documented 30 to 40 years ago, and while some of the sites have been revisited, the current state of most of these sites is unknown. Human burials have been documented at two of the sites. Creek erosion and unstable side slopes, road and utility construction, and development have damaged and most likely destroyed major portions of at least three of the sites that have previously been determined to be eligible. Pockets of these sites may still be intact within the Corps' APE. Of the 12 sites, one was revisited in 2002 and appears to be sloughed off from a larger site and was recommended as not eligible; however, a formal determination of eligibility was not made. Lastly, one site appears to have already been destroyed by the creek but remains intact in the uplands.

Alternative 3.3 would entail a minimum of 70 feet of excavation through 12 of the archaeological sites that are located along the creek. It is likely that five to seven of these sites have retained enough integrity to still be eligible for the NRHP. Excavation of the creek bank would result in an adverse effect to these sites through their partial to complete destruction, if they are determined eligible. Human burials have been documented at two of the sites, although these areas are outside of the direct impact corridor; other burials may be present. The Corps would work with the non-Federal sponsor, the California SHPO, the Affected Tribes, and any other consulting parties to avoid, minimize, and if necessary, mitigate these impacts. Data recovery in the form of archaeological excavation is a likely form of mitigation.

Two potential disposal areas have been identified. One disposal area overlaps with archaeological site CA-ORA-403, which is also impacted by the work in the channel. The second disposal area slightly overlaps with another archaeological site CA-ORA-400. Alternative 3.3 would generate approximately 130,000 cubic yards of excess material, the least among the alternatives. The smaller amount of excess material would mean that less of the disposal area would be needed and impacts to the two sites could be avoided. CA-ORA-403 is included as part of the 12 sites discussed above, but CA-ORA-400 is exclusive to the disposal area and would not be impacted by channel construction activities.

Alternative 3.3 would involve diverting water around ACWHEP and downstream to SOCWA CTP Bridge during construction. This could cause a temporary increase in erosion downstream. Environmental commitments would be implemented to reduce these temporary impacts and ensure that the Proposed Project does not cause increased erosion of cultural resources during construction. Once the proposed creek is established, the new creek design is anticipated to minimize scour and bank erosion.

In summary, Alternative 3.3 would entail a minimum of 70 feet of excavation through the 12 archaeological sites that are located along Aliso Creek. It is likely that five to seven of these sites have retained enough integrity to still be eligible for the NRHP. If they are determined to have retained integrity, excavation of the creek bank would result in an adverse effect to these sites through their partial destruction. It is expected that impacts to CA-ORA-400 and additional impacts to CA-ORA-403 associated with the disposal area can easily be avoided.

Based on the current designs and the assumption that some of the sites have retained enough integrity to be eligible for that NRHP, the alternative would result in an adverse effect under the NHPA and a significant impact under NEPA. The alternative would involve the partial destruction of up to 12 archaeological sites and the potential for impacting human burials is present.

Operations and Maintenance

A process for addressing future operational and maintenance activities would be addressed in the Programmatic Agreement. Anticipated O&M activities, such as road maintenance, replacement of riprap after storm events, and vegetation and trash removal, would occur within areas already analyzed for cultural resources and impacted by the Proposed Project construction. In addition, Orange County has a RMP in place that includes steps for ensuring that cultural resources are considered and protected. No significant impacts to cultural resources are expected as a result of operations and maintenance.

Monitoring

There would be no significant impacts to cultural resources during monitoring as monitoring would be periodic during the year and involve a few vehicles to and from the Proposed Project area. If monitoring revealed that the proposed riparian plantings were not successful and that the areas need to be replanted, these replanting would occur in previously inventoried areas, and the implementation of maintenance activities would comply with any avoidance or minimization measures or other environmental commitments put in place for the original construction. No additional impacts are anticipated. In the unlikely event that monitoring revealed that additional previously unanalyzed activities were necessary, these undertakings would be analyzed separately as part of future Section 106 reviews.

Alternative 3.6 – Raise the Streambed to Approach the Pre-Incised Elevations with Oxbow

Construction

The implementation of Alternative 3.6 would raise the creek invert to approach the pre-incised floodplain elevation and includes the additional measure of reconnecting the historic oxbow within the creek footprint. Alternative 3.6 would involve the disposal of approximately 300,000 cubic yards of excess excavated material. This is 170,000 cubic yards more than Alternative 3.3. Impacts to cultural resources would be the same as Alternative 3.3 with additional impacts to archaeological sites at the oxbow reconnection. One archaeological site has been recorded near the oxbow reconnection. It has not been evaluated for inclusion on the NRHP. This site would be adversely affected under Alternative 3.3 but could be more greatly affected and mostly destroyed by the reconstruction of the oxbow. The site may have already been destroyed by erosion and stream movement. If the site is still intact and it is eligible for listing on the NRHP, then Alternative 3.6 would have an incrementally greater impact on cultural resources.

The two disposal areas identified for Alternative 3.3 would also be used for Alternative 3.6. While this alternative would generate up additional material, the entire disposal areas would not be needed, and impacts to the two sites located there would be avoided.

As with Alternative 3.3, water would be diverted around ACWHEP downstream to SOCWA CTP Bridge during construction. This could cause a temporary increase in erosion downstream. Environmental commitments would be implemented to reduce these temporary impacts and ensure that the Proposed Project does not cause increased erosion of cultural resources during construction. Once the proposed channel is established, the new channel design is anticipated to minimize channel scour and bank erosion.

In summary, Alternative 3.6 has the potential to have a slightly greater impact on cultural resources compared to Alternative 3.3, owing to the destruction of a potentially eligible site at the oxbow reconnection. All other impacts are expected to be the same. As with Alternative 3.3, data recovery in the form of archaeological excavation is a likely form of resource mitigation. The California SHPO, the Affected Tribes, and any other consulting parties would be involved in the development of a MOA and development of a treatment plan to address the adverse effects.

Based on the current designs and the assumption that some of the sites have retained enough integrity to be eligible for that NRHP, the alternative would result in an adverse effect under the NHPA and a significant impact under NEPA. The alternative would involve the partial destruction of up to 12 archaeological sites and the potential for impacting human burials is present.

Operations and Maintenance

Impacts to cultural resources would be the same as Alternative 3.3.

Monitoring

Impacts to cultural resources would be the same as Alternative 3.3.

Alternatives 3.7 and 3.8 – Raise the Streambed to Approach the Pre-Incised Elevations with Oxbow and Creek Lengthening Sinuosity

Construction

Alternatives 3.7 and 3.8 would raise the creek invert to approach the pre-incised floodplain elevation, reconnect the historic oxbow within the creek footprint, and would increase the sinuosity of the creek downstream of Pacific Park Drive (Alternative 3.7 and 3.8) and downstream of the Wood Canyon confluence (Alternative 3.8). Impacts to cultural resources would be greater in scope with a larger project footprint than Alternatives 3.3 and 3.6. As with the other action alternatives, Alternatives 3.7 and 3.8 would involve the removal of at least 70 feet of 11 archaeological sites along the creek and the potential destruction of another site at the oxbow reconnection. Regarding impacts from the increased sinuosity, the area between Pacific Park Drive and the confluence of Sulphur Creek has not been inventoried, but based on the high site density located elsewhere along the creek, additional ground disturbance in this area could foreseeably impact additional sites that have a moderate to high likelihood of being eligible for the NRHP.

One exception is the area between AWMA Road Bridge and the skate park where the creek has been highly disturbed by the construction of an engineered channel in early 1970s by OCPW. In addition, the increased sinuosity below Wood Canyon proposed under Alternative 3.8 could have a larger impact on one of the 11 sites than Alternatives 3.3, 3.6, or 3.7. Overall, both Alternatives 3.7 and 3.8 would have significant impacts to cultural resources because they are assumed to result in the partial or complete destruction of archaeological sites that are eligible for the NRHP.

Alternative 3.7 would produce approximately 340,000 cubic yards of excess material, and Alternative 3.8 would produce approximately 350,000 cubic yards of excess material that would be disposed of at two identified potential locations. Each of these disposal areas either overlap or are immediately adjacent to a previously recorded archaeological site. The large amount of excess material requires more of the disposal area to be used, and upland impacts to site CA OR 403 is more likely to occur under these alternatives. Impacts to a 13th site (CA-OR 400) at the second disposal location could occur, but based on the site boundary, impacts associated with the disposal can likely be avoided

As with Alternatives 3.3 and 3.6, Alternatives 3.7 and 3.8 would involve diverting water around ACWHEP and downstream to SOCWA CTP Bridge during construction. The amount of temporary erosion or sediment in the creek during construction is expected to be greater than Alternatives 3.3 or 3.6 due to the additional ground disturbance below Pacific Park Drive and Wood Canyon. This could cause a temporary increase in erosion downstream of the archaeological sites. Environmental commitments would be implemented to reduce these temporary impacts and ensure that the alternative does not cause increased erosion of sensitive sites. Once the proposed channel is established, the new channel design is anticipated to minimize creek scour and bank erosion.

In summary, Alternatives 3.7 and 3.8 would involve impacts to at least 12 archaeological sites, of which five to seven likely retain enough integrity to be eligible for the NRHP. Disposal activities would have a greater impact on one of these sites. Additional impacts could occur to as of yet undiscovered sites in areas that have not been surveyed for cultural resources between Pacific Park Drive and Sulphur Creek. Alternative 3.8 would have an incrementally greater impact on one of the 12 sites than Alternative 3.7. If these sites have retained enough integrity to still be eligible for the NRHP, the alternatives would result in an adverse effect to these sites. The Corps would work with the non-Federal sponsor, the California SHPO, the Affected Tribes, and any other consulting parties to avoid, minimize, and if necessary, mitigate these impacts. Data recovery in the form of archaeological excavation is a likely form of mitigation. Impacts under Alternatives 3.7 and 3.8 would be incrementally greater than under Alternatives 3.3 and 3.6.

Based on the current designs and the assumption that some of the sites have retained enough integrity to be eligible for that NRHP, the alternative would result in an adverse effect under the NHPA and a significant impact under NEPA. The alternative would involve the partial to complete destruction of up to 12 archaeological sites and the potential for impacting human burials is present.

<u>Operations and Maintenance</u>

Impacts to cultural resources would be the same as Alternative 3.3

<u>Monitoring</u>

Impacts to cultural resources would be the same as Alternative 3.3

5.8.4 Summary

For all action alternatives, with implementation of **Environmental Commitment CR-1 through CR-7**, direct and indirect impacts would be minimized, but with the partial to complete destruction of up to 12 archaeological sites and the potential for impacting human burials, impacts would be significant and adverse.

5.8.5 Environmental Commitments

The following commitments would be implemented as part of the Proposed Project alternatives:

CR-1 In consultation with the California SHPO, the County of Orange, and the Affected Tribes, the Corps will prepare and execute a Programmatic Agreement (PA) that lays out the procedures for meeting the agency's responsibilities under Section 106. The PA shall require a cultural resource inventory of the entire APE and lay out steps for avoiding, minimizing, and if unavoidable, mitigating adverse effects. The PA will be executed prior to the approval of the project.

CR-2 An archaeologist meeting the Secretary of the Interior's Qualification Standards shall monitor all construction activities in areas where there is a potential for buried resources. The monitor shall immediately notify the Corps' onsite construction supervisor of any discovery. The Corps onsite construction supervisor shall temporarily stop construction in the area of the discovery. The discovery area and a surrounding buffer zone shall then be clearly delineated. Ground disturbing activities can resume outside the delineated buffer zone. Should previously unknown historic or archaeological remains be discovered, the Corps would comply with 36 C.F.R. § 800.13.

CR-3 When construction crews are working within 20 meters of an eligible or unevaluated cultural resource, which has not been previously mitigated and approved for construction activities, the edge of the site, including a 10-meter site buffer will be fenced off, thus ensuring that no construction equipment inadvertently strays into the culturally sensitive area.

CR-4 When construction crews are working within the boundaries of an archaeological site, the construction easement will be clearly delineated to ensure that no construction equipment inadvertently stays into a culturally sensitive area.

CR-5 Cultural resource block inventories and evaluations shall be conducted early in the next design phase so that avoidance and impact minimization measures for cultural resources can be incorporated into project design.

CR-6 If human remains are encountered during excavations associated with this Proposed Project, all work must halt, and the County Coroner must be notified (Section 7050.5 of the California Health and Safety Code). The coroner will determine whether the remains are of forensic interest. If the coroner, with the aid of the supervising archaeologist, determines that the remains are prehistoric, the coroner will contact the NAHC. The NAHC will be responsible for designating the most likely descendant (MLD), who will be responsible for the ultimate disposition of the remains, as required by Section 5097.98 of the Public Resources Code. The MLD should make his/her recommendations within 48 hours of their notification by the NAHC. This recommendation may include (a) the nondestructive removal and analysis of human remains and items associated with Native American human remains; (b) preservation of Native American human remains and associated items in place; (c) relinquishment of Native American human remains and associated items to the descendants for treatment; or (d) other culturally appropriate treatment.

CR-7 If diverting water around ACWHEP is found to likely cause a temporary increase in erosion at eligible cultural resources downstream, the Corps will ensure that erosion control measures are in place for the duration of the erosion causing conditions. Erosion control measures could include, but are not limited to the placement of geotextile fabrics, vegetative plantings, mulches or topsoil, or other barriers along the riverward edge of any eligible cultural resources, limiting the amount of water runoff to below erosive levels, and sequencing construction activities to reduce erosion.

5.9 PALEONTOLOGICAL RESOURCES

5.9.1 Assumptions

It is anticipated that all, or the majority of excavation activities necessary for the Proposed Project would be within recent alluvial deposits located within the floodplain. Paleontological resources would likely not be impacted by excavation activities in recent alluvium as these deposits are not associated with the presence of fossils. During the PED phase, the project paleontologist would review the results of planned geotechnical investigations performed in PED. This information would be basis for the paleontological survey to establish the likelihood of encountering potential significant fossil bearing formations currently buried by recent alluvium. It is anticipated that paleontological monitoring would be conducted during construction activities.

5.9.2 Thresholds of Significance

The Proposed Project would have a significant impact on paleontological resources if it:

- Directly or indirectly destroyed a unique paleontological resource or site or unique geologic feature.
- Resulted in increased public accessibility to known fossil-bearing localities.

Unique paleontological resources are significant, nonrenewable fossils that are rare or unique regionally, diagnostically, or taxonomically. This definition includes vertebrate and invertebrate fossils that are previously unknown within the given context, or fossils that will aid in further scientific interpretations. CEQA Guidelines indicate that a project that directly or indirectly destroys a unique paleontological resource, site, or a unique geologic feature may be considered to have a significant effect on the environment unless mitigated (PRC Section 21082.2; State CEQA Guidelines Section 15064, Appendix G).

A fossil may be considered significant if it provides data useful in determining the age(s) of a rock unit or sedimentary stratum, therefore contributing to an increased knowledge of the depositional history of a region and the timing of geologic events therein. A paleontological resource may also be considered significant if it provides important information on the evolutionary trends among organisms, particularly relating living inhabitants of the earth to extinct organisms, or if it demonstrates unusual or spectacular circumstances in the history of life. The significance of a paleontological resource may also be determined by its relative abundance, or lack thereof, within a region. For example, if a fossil type is in short supply or is not found in other geologic locations, and it is in danger of being depleted or destroyed by the elements, vandalism, or commercial exploitation, the resource is likely to be considered significant.

5.9.3 Alternative Analysis

5.9.3.1 No Action Alternative/Future Without-Project Conditions

Under the No Action alternative, no Federal project nor a project by the non-Federal sponsor would be implemented. The incised creek would not be restored to pre-incised elevations, ACWHEP would not be removed, and restoration of native plant communities would not occur. Areas of identified paleontological resources within the Wilderness Park would not be subjected to development. Continued erosion of the creek could expose geological formations to the elements, which could be considered significant. Any type of loss or deterioration of fossils would generally be associated with physical weathering of the associated geologic unit, or by theft or vandalism.

5.9.3.2 Action Alternatives

Construction

- Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.
- Resulted in increased public accessibility to known fossil-bearing localities.

Excavation activities associated with the construction of any the Proposed Project alternatives could potentially uncover buried fossil bearing formations. These formations would need to be surveyed and analyzed to determine whether removal is practicable or modification of the Proposed Project is necessary. It is anticipated that all, or the majority of excavation activities necessary for the Proposed Project, would be within recent alluvial deposits located within the floodplain. Paleontological resources would not likely be impacted by excavation activities in recent alluvium as these deposits are not associated with the presence of fossils. However, if a newly discovered unique paleontological resource or site or unique geologic feature is directly or indirectly destroyed, the impact would be significant. In addition, Orange County has a RMP (OC 2009a) that includes steps for ensuring that paleontology resources are preserved. Therefore, significant impacts are not anticipated. Further, **Environmental Commitments PR-1 through PR-5** would be implemented to further reduce potential impacts.

Operations and Maintenance

Anticipated operation and maintenance activities, such as road maintenance, replacement of riprap after storm events, and vegetation and trash removal would occur within areas already analyzed by the Proposed Project construction. No significant impacts are expected as a result of operations and maintenance.

Monitoring

There would be no significant impacts to paleontology resources during monitoring as monitoring would be periodic during the year and would not include any earth disturbance activities within the Proposed Project area.

5.9.4 Summary

For all action alternatives, impacts to paleontological resources would increase as the area of buried fossil bearing formations exposed during construction would increase from Alternative 3.3 through Alternative 3.8. For all action alternatives impacts would be short term and temporary and with implementation of **Environmental Commitment PR-1 through PR-5**, direct and indirect impacts would be less than significant.

5.9.5 Environmental Commitments

The following commitments would be implemented as part of the Proposed Project alternatives:

PR-1 Prior to Proposed Project implementation, during the PED phase, conduct a paleontological assessment survey under the direction of a state certified paleontologist to identify the potential for significant fossil resources to be uncovered during excavation. If identified, they would be avoided and/or PR-2 through PR-5 will be implemented.

PR-2 A state certified paleontologist shall monitor all construction activities in areas where there is potential to uncover buried resources. The monitor shall immediately notify the Corps' onsite construction supervisor of any discovery. The Corps' onsite construction supervisor shall temporarily stop construction in the area of the discovery. The discovery area and a surrounding buffer zone shall then be clearly delineated. Ground disturbing activities can resume outside the delineated buffer zone. Should previously unknown significant fossil resources be discovered, any pursuant salvage activities conducted would be under the direction of the state-certified paleontologist.

PR-3 Prior to any geotechnical stabilization measures necessary in adjacent rock slopes in advance of creek construction, a paleontological assessment survey under the direction of a state-certified paleontologist would be conducted to identify the potential for significant fossil resources. If significant fossils are identified they should be scientifically salvaged prior to initiation of construction activities, under the direction of the state-certified paleontologist.

PR-4 A qualified vertebrate paleontologist shall monitor deep excavations that extend into the older deposits. Sediment samples shall be collected and processed to determine the small fossil potential in the Proposed Project area. The monitor will be equipped to recover fossils and sediment samples during excavation and will have the authority to temporarily halt or divert equipment to allow for recovery of large or numerous fossils. If the final engineering design determine that the older alluvium deposits would not be disturbed, then paleontological monitoring would not be necessary.

PR-5 Any fossils recovered during monitoring shall be prepared to a point of identification and preservation and be deposited in an accredited and permanent scientific institution. A report detailing the findings with an appended itemized inventory of identified specimens shall be prepared. The report and inventory shall be submitted to the scientific institution where the fossils are deposited. With receipt of the report, inventory, and verification of acceptance of the specimens by the scientific institution, mitigation will be deemed complete.

5.10 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

5.10.1 Assumptions

Given the previous land uses of the Proposed Project area, it is unlikely that any hazardous material sites would be discovered during construction of any of the Proposed Project alternatives. Impacts could occur from hazardous materials brought onsite including fuels and oils for construction equipment.

5.10.2 Thresholds of Significance

A significant impact would occur if the Proposed Project:

- Caused soil contamination, including flammable or toxic gases, at levels exceeding Federal, state, and local hazardous waste limits established by 40 CFR Part 261.
- Resulted in the mobilization of contaminants, creating potential pathways of exposure to workers, the public, or other sensitive receptors to contaminated or hazardous materials and such exposure exceeds permissible exposure levels set by the Federal Occupational Safety and Health Administration (OSHA) in Title 29 C.F.R. Part 1910.
- Exposed the general public to hazardous situations through the transport, use, storage, or disposal of hazardous materials.
- Created a significant hazard to the public or environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment.

5.10.3 Alternatives Analysis

5.10.3.1 No Action Alternative/Future Without-Project Conditions

Under the No Action alternative, no Federal project nor a project by the non-Federal sponsor would be implemented. The incised creek would not be restored to pre-incised elevations, ACWHEP would not be removed, and restoration of native habitat would not occur. Hazardous or toxic equipment fluids such as fuels, oils, and grease would not be introduced into the Proposed Project area as a result of the use of these compounds during construction. Accidental fuel and oil spills from would continue to occur as under current conditions unless there was a change in operations and maintenance activities.

Without the Proposed Project, maintenance within the Wilderness Park would continue, and repairs to the trails would continue as needed due to erosion of the incised Creek. Conditions related to hazardous waste and materials are not expected to change.

5.10.3.2 Action Alternatives

Construction

Hazardous or toxic equipment fluids such as oils and grease may be introduced into the Proposed Project area as a result of the use of these compounds during construction. Exposure to existing hazardous or toxic compounds may result from spillage or leakage of containment units if they are inadvertently damaged during Proposed Project implementation.

Any fuels, oils, and other hazardous materials used onsite during construction would adhere to hazardous material use laws. The longer construction activities occur onsite, or the greater the intensity of activities, the greater the possibility of an accidental spill. Therefore, Alternatives 3.6, 3.7, and 3.8 would have a greater potential for an accidental spill to occur. Alternative 3.3 would occur over 780 days; Alternative 3.6 would be 94 days longer; Alternative 3.7 would be 25 days longer than Alternative 3.6; and Alternative 3.8 would be 15 days longer than Alternative 3.7. The longer the construction period the greater the possibility for spillage or a leak to occur.

Operation and Maintenance

There would be no significant increase in HTRW spill incidents than what currently exists. Accidental fuel and oil spills would continue to occur as under current conditions unless there was a change in operations and maintenance activities.

Monitoring

During the monitoring period, there would be several vehicles on the Aliso Creek Trail, but none in the creek. There would be no impact during the monitoring period.

5.10.4 Summary

For all action alternatives, the potential impacts from HTRW would differ in the duration of construction. Duration of construction would increase from Alternative 3.3 through Alternative 3.8. For all action alternatives, impacts would be short term and temporary and with implementation of **Environmental Commitment HW-1 through HW-6**, direct and indirect impacts would be less than significant.

5.10.5 Environmental Commitments

The following commitments would be implemented as part of the Proposed Project alternatives:

HW-1 Compliance with all applicable local, regional, state, and Federal laws, policies, and regulations regarding the transportation, storage, handling, management, and disposal of hazardous materials and wastes.

HW-2 The contractor shall prepare Solid and Hazardous Materials and Waste Management Plan.

HW-3 Contractors shall have an accidental spill prevention and response plan in-place for all hazardous materials that may be used onsite. In the event of a spill or release of hazardous substances at the construction site, the contaminated soil shall be immediately contained, excavated, and treated per Federal and state regulations developed by the EPA, as well as local hazardous waste ordinances.

HW-4 Only trained contractors or personnel shall participate in the application of pesticides and herbicides. Such personnel shall adhere to regulations and guidelines for the safe application of pesticides, including, but not limited to storage and handling of materials, operation of application equipment, suitable climatic conditions for application, and avoidance of sensitive receptors. The herbicides used would need to be approved for use in or near water.

HW-5 During construction, should an area of suspected contamination be encountered, construction activity in the area shall cease and soil sampling shall be conducted to determine the nature and extent of the potential contamination. If testing indicates that contamination does exist, the area shall be cleaned up in accordance with applicable Federal and state regulations.

5.11 SOCIOECONOMICS/ENVIRONMENTAL JUSTICE

5.11.1 Assumptions

Future projection data was gathered from various web sites indicating overall state and regional trends for southern California to acquire the most current information as well as projected changes used to plan future community needs. Projected demographic changes have been included to make reasonable assumptions about future impacts on life and property.

Local forecasts through 2060 are not available in meaningful estimates, but the California Department of Finance estimates that by 2060, both the black and the white populations will have increased in size, but decreased in proportion to the total population. Hispanics will comprise nearly half (48 percent) of all Californians. Asians will also grow significantly in population, but only marginally relative to the total population (just over

13 percent). The non-Hispanic white population will decline to 30 percent from the current 39 percent, and the black population from six to four percent. This demographic trend would impact the cities surrounding the Proposed Project area that may change use patterns of the Wilderness Park.

5.11.2 Thresholds of Significance

A significant impact would occur to socio-economic resources if the Proposed Project:

- Created a loss in community facilities, events, population, or major industry that would result in an overall loss in community cohesion.
- Created a disproportionately high and adverse human health or environmental impact on minorities, low-income residents, or children.
- Disrupted emergency services or created a public health risk that could not be avoided by the public, especially if it would particularly affect the health and safety of children.
- Resulted in climate change cause/increase in heat stress causing a disproportionate number of deaths.
- Resulted in the fiscal and physical ability of the local governmental agencies to meet the needs of the public following the project-related changes in the local population.

5.11.3 Alternative Analysis

Since the area surrounding the Wilderness Park is fairly built-out, with high median incomes and low minority populations, there would be no significant change to local demographics or considerations under environmental justice. Impacts from any of the alternatives would vary slightly, based on length of construction and number of workers utilizing local services such as gas and food.

Long-term, the restoration efforts would increase the desirability of use of the Wilderness Park, creating a larger user base, potentially drawing visitors from greater distances, creating minor local economic stimulus for passive recreation oriented goods and services. Therefore, it is unlikely that impacts associated with any of the alternatives would be disproportionately borne by low income or minority populations. As a result, there would be less than significant impacts on socioeconomics and environmental justice.

5.11.3.1 No Action Alternative/Future Without-Project Conditions

Under the No Action alternative, no Federal project nor a project by the non-Federal sponsor would be implemented. The incised creek would not be restored to pre-incised elevations and restoration of plant communities would not occur. Socioeconomic trends are not expected to change substantially.

Since the area surrounding the Wilderness Park is fairly built-out, population growth is not expected to increase significantly. Employment and income in the region would adjust to overall economic conditions. Minority and low-income populations would also remain similar to existing conditions, and environmental justice is not expected to change under the future without-project condition.

5.11.3.2 Action Alternatives

Construction

- Created a loss in community facilities, events, population, or major industry that would result in an overall loss in community cohesion.

The Proposed Project would be implemented on designated open space/recreation land within the Central and Coastal Subregion of the NCCP/HCP, which would have little impact on surrounding cities' growth or population. The Proposed Project would not significantly impact the local economy as the number of workers anticipated for implementation of the Proposed Project would not cause an increase in facilities, local businesses, or housing. Since the Proposed Project is well removed and remote with the Wilderness Park, there would be no disruption in community cohesion.

- Created a disproportionately high and adverse human health or environmental impact on minorities, low-income residents, or children.
- Disrupted emergency services or created a public health risk that could not be avoided by the public, especially if it would particularly affect the health and safety of children.

The demographic trends of the area indicate a medium-high median income and a predominantly white population with no significant change forecast. The Proposed Project area is in a remote area in the Wilderness Park with limited access. There would be no onsite disruption of emergency services in the area surrounding the Wilderness Park. Equipment and vehicles accessing the site may impact local emergency services on local roadways.

- Resulted in climate change cause/increase in heat stress causing a disproportionate number of deaths.
- Resulted in the fiscal and physical ability of the local governmental agencies to meet the needs of the public following the project-related changes in the local population.

There would not be a significant impact on local population, housing, labor, or any of the identified thresholds of significance of the Proposed Project alternatives. The areas surrounding the Wilderness Park are well developed and well-built out with little open space outside of identified open spaces per local General Plans.

There would be a loss of recreation opportunities during construction of Alternative 3.6 for a longer period of time than Alternative 3.3, but less than Alternatives 3.7 or 3.8 with the closure of the existing trails adjacent to the creek as each phase is implemented. This would be during construction, and therefore short term and temporary as the trails would be reopened upon completion of restoration activities. None of the other identified thresholds would be impacted in such a way that would cause a significant impact. Therefore, socioeconomic and environmental justice impacts in the area of the Proposed Project would be less than significant. With the implementation of **Environmental Commitments SE-1, SE-2, and SE-3** during construction of the Proposed Project, any impacts would be further reduced.

Operation and Maintenance

Impacts to area socioeconomics would be less than significant during operations and maintenance. No additional labor force would be introduced for operations and maintenance.

Monitoring

Impacts to socioeconomics during monitoring would be less than significant as monitoring would occur periodically during the year. Vehicles would remain on road adjacent to the creek.

5.11.4 Summary

For all action alternatives, impacts to socioeconomics and environmental justice would be similar except for the difference in duration of construction as duration would from Alternative 3.3 through Alternative 3.8. For all action alternatives impacts would be short term and temporary and with implementation of **Environmental Commitment SE-1 through SE-5**, direct and indirect impacts would be less than significant.

5.11.5 Environmental Commitments

The following commitments would be implemented as part of the Proposed Project alternatives:

SE-1 Initiate, in cooperation with local communities, a comprehensive recreation mitigation plan to address how all affected recreational opportunities would possibly be maintained during the construction period, including news releases, and Corps' and/or non-Federal sponsor's website.

SE-2 Limit offsite truck hauling on weekends to accommodate Wilderness Park user access and recreation-related traffic adjacent to the Proposed Project area.

SE-3 Prepare a Traffic Safety Plan in coordination with local emergency services.

5.12 LAND USE

5.12.1 Assumptions

County and local city general plans identify the Wilderness Park as open space/recreation. General plans may be subject to change as local needs change. The Central and Coastal Subregion of the NCCP/HCP also limits development within the Wilderness Park including the Proposed Project area. While there is little risk, it must be acknowledged that changes may occur in the future. A deed restriction placed on it in 2001 limits it to county park uses in perpetuity.

5.12.2 Thresholds of Significance

A significant impact would occur to land use if the Proposed Project:

- Conflicted with established land uses after construction.
- Conflicted with any resource management plan.

5.12.3 Alternative Analysis

5.12.3.1 No Action Alternative/Future Without-Project Conditions

Under the No Action alternative, no Federal project nor a project by the non-Federal sponsor would be implemented. The incised creek would not be restored to pre-incised elevations and restoration of plant communities would not occur. Land use would not change over the planning horizon as the land is protected by the Central and Coastal Subregion of the NCCP/HCP.

While the population within south Orange County is not expected to increase significantly that would cause a change in land use of the Proposed Project area, the vicinity is primarily built-out or preserved as open space/recreation. The only opportunities for new development within the area would be build-out of isolated vacant parcels (i.e. several vacant parcels designated as Business Park are located in Aliso Viejo west of Aliso Creek Drive) or redevelopment of sites that are currently developed.

5.12.3.2 Action Alternatives

Construction

There are no established communities within the Proposed Project site, and surrounding residential developments do not depend on the site for access to other neighborhoods or uses, such that a change in use on the site would cut off access to or from an established community. Therefore, there would be no impact (direct, indirect, or cumulative) related to dividing established communities as a result of any of the Proposed Project alternatives.

Under all action alternatives, the land use would not change as the Wilderness Park is protected as designated open space under the various local city general plans as well as the Central and Coastal Subregion of the NCCP/HCP, which the County of Orange approved via Resolution No. 96-254A on April 16, 1996. Land use adjacent to the Wilderness Park is not likely to change in the near future as there is residential development on the surrounding hill ridges and education, recreation, and commercial development adjacent to the Wilderness Park upstream of the Project area.

- Conflicted with established land uses after construction.

The implementation of either Alternative 3.3, 3.6, 3,7, or 3.8 would not conflict with established land uses, create impacts to adjacent land uses, disrupt or divide a community, nor create incompatibilities between existing land uses. During construction, local roadways would be temporarily impacted as equipment and materials are delivered. This may cause traffic delays or necessitate use of detours, which can cause frustration for motorists. Peak morning and afternoon "drive-times" would be avoided as best practicable.

- Conflicted with any resource management plan.

The Central and Coastal Subregion of the NCCP/HCP is implemented by the Nature Reserve. The plan's goals and objectives are to preserve and restore habitat for the California gnatcatcher. The implementation of Alternatives 3.3, 3.6, 3.7, or 3.8 would benefit the Wilderness Park with restoration of riparian habitat for native species.

Operations and Maintenance

There would be no impacts to land use caused by operations and maintenance of the Proposed Project

Monitoring

There would be no changes to land use caused by monitoring of the restored Proposed Project.

5.12.4 Summary

For all action alternatives, impacts to land use would differ in the amount of excess soil to be disposed on the adjacent canyon hill slopes. Duration of construction would increase from Alternative 3.3 through Alternative 3.8. For all action alternatives, impacts would be less than significant. Implementation of **Environmental Commitments LU-1 and LU-2** would further reduce these impacts.

5.12.5 Environmental Commitments

The following commitments would be implemented as part of the Proposed Project alternatives:

LU-1 Maintain coordination with Nature Reserve.

LU-2 Coordinate with OC Parks the closure of Wilderness Park trails during construction by phase to minimize impacts to recreation use within the Wilderness Park.

5.13 TRAFFIC and TRANSPORTATION

5.13.1 Assumptions

An increase in businesses, recreation use, new roads, or new public venues could contribute to increased traffic and decreased accessibility in the Proposed Project vicinity or neighboring communities with added construction vehicles accessing the Proposed Project site.

5.13.1.1 Thresholds of Significance

A significant impact would occur to transportation and traffic if the Proposed Project:

- Caused closure of a major roadway to through traffic with no suitable alternative route available.
- Restricted access to or from adjacent land uses with no alternative access.
- Caused an increase in vehicle trips associated with additional commuter trips resulting in an unacceptable reduction of emergency services.
- Created an increase in roadway wear in the vicinity of the work zone as a result of heavy truck or equipment movements, resulting in noticeable deterioration of roadway surfaces.
- Conflicted with planned transportation improvements in the area.
- Caused significant delays to emergency vehicles with no alternative access routes.

5.13.2 Alternative Analysis

The contractor would be required to abide by local jurisdictions and provide a Traffic Safety Management Plan. Minor traffic impacts such as delays as trucks and equipment access the site would be avoided by scheduling deliveries for non-peak traffic hours, offset work schedules, and other measures. For all alternatives, achieving a balance between excavation and fill may also require frequent transfers of excavated material between the upstream and downstream areas. Because of the limited height underneath the bridges, vehicles hauling the material may need to drive along Alicia Parkway for a short distance, which would require frequent traffic control.

Access into the Wilderness Park would be from AWMA Road Bridge. Construction traffic would impact traffic to the Church of Jesus Christ of Latter Day Saints and the Wood Canyon Elementary School. AWMA Road Bridge also provides access to the residential area, west of the park off of Wood Canyon Dr.

5.13.2.1 No-Action Alternative/Future Without-Project Conditions

Under the No Action alternative, no Federal project nor a project by the non-Federal sponsor would be implemented. The incised creek would not be restored to pre-incised elevations, ACWHEP would not be removed, and restoration of plant communities would not occur. With no construction of the Proposed Project, there would be no truck traffic bringing supplies to the Proposed Project area, and no removal of construction debris from the Proposed Project area. No construction workers would be coming and going from the Proposed Project site. There would be no additional impact to local roadways by not implementing the Proposed Project. There would be no additional impact to local roadways by not implementing the Proposed Project.

Within the Wilderness Park, truck traffic to and from the SOCWA CTP would continue with little change. Trail use in the Wilderness Park would continue, with limited access during times of repair or realignment due to damage from creek erosion. When the Ranch at Laguna opens the trail through the golf course from the downstream end of the Wilderness Park continuing the Aliso Creek Trail to PCH, it is expected that there would be an increase in use, especially bicyclists, using this means of alternate transportation.

5.13.2.2 Action Alternatives

Construction

It is anticipated that once construction equipment has been moved onsite, equipment would remain on site for the duration of construction said equipment would be in use. Equipment requiring major repair or replacement would be removed from the construction area, but would most likely be infrequent. Types and amount of construction equipment would be similar for all alternatives as the work to be done is similar, differing in length of duration

Four haul routes have been identified leading into the Proposed Project area within the Wilderness Park.

1. From Alicia Parkway to Aliso Creek Road, to Knollwood, to Aliso Canyon Road in the Wilderness Park to AWMA/recreation trail on the west side of the creek.
2. From Alicia Parkway to Aliso Creek Road, to Knollwood, to AWMA Road/recreation trail on the Wilderness Park through the Park Maintenance Yard.
3. From Alicia Parkway to AWMA Road, crossing the AWMA Road Bridge to the Wilderness Park Visitor's Center entrance into the Wilderness Park to the AWMA Road/recreation trail on the west side of the creek.

4. From Alicia Parkway, enter the Wilderness through the gate just south of where Sulphur Creek crosses under Alicia Parkway to the Wilderness Park, and continue following Sulphur Creek to its confluence with Aliso Creek, then parallel to Aliso Creek on the east side. To move from one side of the creek to the other without entering the creek bed, crossing would occur over the ACWHEP structure on the east side.

- Caused closure of a major roadway to through traffic with no suitable alternative route available.
- Restricted access to or from adjacent land uses with no alternative access.
- Caused an increase in vehicle trips associated with additional commuter trips resulting in an unacceptable reduction of emergency services.
- Created an increase in roadway wear in the vicinity of the work zone as a result of heavy truck or equipment movements, resulting in noticeable deterioration of roadway surfaces.
- Conflicted with planned transportation improvements in the area.
- Caused significant delays to emergency vehicles with no alternative access routes.

The closest major roadway is Alicia Parkway to the east of the Wilderness Park. Construction-related traffic would travel Alicia Parkway from the Santa Ana Freeway (I-5) to AWMA Road Bridge and/or Aliso Park Drive to access the Wilderness Park. Since Alicia Parkway is three lanes in each direction with a center median, truck traffic accessing the Proposed Project site within the Wilderness Park would cause temporary closure of one lane at times in the southbound direction. Impacts to traffic would be minimized by avoiding peak late afternoon travel times as people return home from work. Lane closures for turning from Alicia Parkway onto or off of AWMA Road and/or Aliso Park Drive would be temporary and limited to non-peak travel times and non-peak school arrival and departure times.

The Wilderness Park is fairly remote from existing transportation corridors and the area is fairly well built-out with significant planned infrastructure in place. None of the alternatives would restrict access to adjacent land use or cause an increase in commuter trips resulting in an unacceptable reduction in emergency services nor conflict with transportation improvements in the area.

Trucks bringing materials onsite and removing excess material and sediment are anticipated to cause at least minor damage to existing roadways including AWMA Road and Aliso Park Drive. There could be minor damage to Alicia Parkway near these intersections during construction. **Environmental Commitment TT-4** would require repair of these roads as necessary. Thus, impacts would be reduced to less than significant.

Alternative 3.3 would occur over 780 days; Alternative 3.6 would be 94 days longer; Alternative 3.7 would be 25 days longer than Alternative 3.6; and Alternative 3.8 would be 15 days longer than Alternative 3.7. However, since ACWHEP and the grade control structures would be removed and material hauled to a landfill as construction debris under all alternatives, these impacts would be the same for all. Material for bank stabilization and construction of pools and riffles would be the same for all alternatives. The longer the construction period, the more construction worker traffic would be entering and exiting the construction area. Impacts to traffic and transportation would be temporary during construction activities; impacts would be less than significant with implementation of **Environmental Commitments TT-1 through TT-9** during construction of the Proposed Project.

Operation and Maintenance

There would be no significant impacts to roadways, transportation corridors or delays to emergency vehicles as operations and maintenance would be limited to the Wilderness Park.

Monitoring

There would be no significant impacts to roadways, transportation corridors or delays to emergency vehicles as post-construction monitoring would be limited to the Wilderness Park and would require minimal use of vehicles or road.

5.13.3 Summary

For all action alternatives, impacts to traffic and transportation would be similar as once construction equipment is brought to the Proposed Project site, the equipment would remain onsite. Materials for pool and riffles complexes would be the same as would sheetpile and riprap for bank stability. Removal of debris would be the same as for all action alternatives; ACWHEP and both drop structures would be removed and hauled to a landfill that accepts construction debris. Duration of construction would increase from Alternative 3.3 through Alternative 3.8. For all action alternatives, impacts would be short term and temporary and with implementation of **Environmental Commitment TT-1 through TT-10**, direct and indirect impacts would be minimized. Impacts would be less than significant.

5.13.4 Environmental Commitments

The following commitments would be implemented as part of the Proposed Project alternatives:

TT-1 The contractor shall prepare a Traffic Safety Management Plan (TSMP) for the Proposed Project in coordination with the local jurisdictions having authority over specific roadways. The TSMP would be submitted and approved by the various jurisdictions before any onsite construction commences. The Plan would include the following provisions:

- Temporary traffic control devices shall be identified in accordance with Caltrans' California Manual on Uniform Traffic Control Devices. This may include slow-moving-vehicle warning signs, barriers for separating construction and non-construction traffic, use of traffic control flagmen, and any additional measures required for safely passing non-construction traffic through and around construction areas and access points.

- Schedule worker shift changes to minimize existing background traffic peak periods, if feasible.
- Establish procedures for coordinating with local emergency response agencies to ensure dissemination of information regarding emergency response vehicle routes affected by project construction. Proper notification and coordination with the local emergency response agencies will be critical for these road closures to ensure that emergency vehicle access is not affected.
- If additional haul routes are required, existing roadways should be selected that would result in the least amount of impact to existing background traffic.
- Provide dedicated turn lanes for vehicles entering and exiting the Proposed Project site from local roadways to minimize impacts to vicinity traffic.
- Observe and comply with each city's traffic plan, including designated truck routes, as applicable.

TT-2 Public streets would be kept operational, particularly during the morning and evening peak hours of traffic. If required, any lane closures would be minimized during peak traffic hours.

TT-3 Haul routes shall be designed to minimize distances to the work site and avoid heavily congested areas or large residential communities to the maximum extent feasible.

TT-4 If damage to roads occurs, the contractor shall coordinate repairs with the affected public agencies to ensure that any impacts to area roads are adequately repaired. Roads disturbed by trucks or equipment shall be properly restored to ensure long-term protection of road surfaces. Such repairs shall occur as part of the active construction period.

TT-5 The contractor shall obtain all applicable permits and clearances from appropriate agencies for transporting and hauling equipment and debris.

TT-7 During construction, a haul route for construction traffic shall be reviewed and approved by the City of Mission Viejo. The haul route should avoid heavily congested intersections to the extent feasible.

TT-8 To the extent feasible, construction worker travel and all construction truck traffic to and from the site should avoid peak traffic hours.

TT-9 If during the proposed construction work it becomes apparent that street closures would be necessary, the contractor would be required to obtain an Encroachment Permit from the City of Mission Viejo Public Works prior to the commencement of construction activities. Conditions mandated by the encroachment permit would ensure that short-term road closure impacts would be minimized.

TT-10 Weight limitations of AWMA Road Bridge may limit the use of that route to access the construction areas by certain types of trucks, particularly those hauling heavier construction equipment. The contractor would coordinate weight limitations with SOCWA and the City of Mission Viejo.

5.14 PUBLIC HEALTH and SAFETY

5.14.1 Assumptions

There is always the chance of unexpected disasters such as flooding, wildfires, drowning, and other accidents to recreation users as well as construction workers. Preventative measures can be implemented, but can only do so much. Personal safety must always be a priority when in an open wilderness area.

5.14.2 Thresholds of Significance

An impact would have a significant impact on public health and safety if the Proposed Project:

- Increased exposure of people or structures to flooding hazards.
- Created conditions that would present potential dangers to the public or attract the public to a potentially hazardous area (e.g. attractive nuisances).
- Created mosquito breeding conditions in an amount that would require increased levels of mosquito abatement programs to maintain mosquito populations at pre-project levels.
- Introduced hazardous materials during construction without proper handling or use protocols.
- Created environmental health and/or safety hazards due to the routine transport, use, or disposal of hazardous materials.
- Attracted or exposed the public to active construction sites, materials, and equipment storage areas that present potential unmanaged dangers or expose the public to potentially hazardous areas.

5.14.3 Alternative Analysis

5.14.3.1 No-Action Alternative/Future Without-Project Conditions

Under the No Action alternative, no Federal project nor a project by the non-Federal sponsor would be implemented. The incised creek would not be restored to pre-incised elevations, ACWHEP would not be removed, and restoration of plant communities would not occur. There would be no impacts to the safety of construction workers or Wilderness Park visitors due to the Proposed Project not being constructed.

Under the No Action alternative, continued access to the creek makes the risk of drowning and other water-related accidents a potential health and safety concern, especially during periodic storms when the creek conveys large volumes of fast-moving runoff water to the Pacific Ocean.

An increase in the potential of fire over the next 50 years can be expected due to climate change, potential vegetation types becoming older, and the increasing prevalence of fire-prone invasive species such as giant reed (*Arundo donax*), which burns at intense heat when dry due to its habit of growing in dense monotypic stands. It is estimated that such a fire would burn about 1,750 acres before being extinguished.

Erosion of the banks of the incised creek would continue until equilibrium is reached with erosion of the trails adjacent to the creek, creating unsafe conditions until the trails were repaired.

5.14.3.2 Action Alternatives

Construction

Since construction would occur over a four-year period with one phase implemented each year, the AWMA Road/Aliso Creek Trail would be closed below Wood Canyon confluence during Phase 1 and 2 (first 2 years) and above Wood Canyon confluence during Phase 3 (3rd year) and 4; therefore, there would be few Wilderness Park users near the construction area.

Flood events would be contained within the proposed reconfiguration of the historic floodplain. Some overbanking would occur in designated areas with a greater than a one percent chance of exceedance. Since the Wilderness Park is uninhabited, there is little chance of risk to life and property damage as in an urban area. None of the proposed alternatives would increase the exposure of people or structures to flooding hazards.

As under the No Action alternative, continued access to the creek makes the risk of drowning and other water-related accidents a potential health and safety concern, especially during periodic storms when the creek conveys large volumes of fast-moving runoff water to the Pacific Ocean.

An increase in the potential of fire over the next 50 years can be expected due to climate change, potential vegetation types becoming older, and the increasing prevalence of fire-prone invasive species such as giant reed (*Arundo donax*), which burns at intense heat when dry due to its habit of growing in dense monotypic stands. It is estimated that such a fire would burn about 1,750 acres before being extinguished. It would be a hot fire, eventually restoring fire-adaptive chaparral and coastal sage, but decimating the riparian vegetation habitat, which would continue to increase the non-native grasslands, destroy the special status plant taxa, and cause the habitat for riverine breeding birds to be lost for up to five years. The diversity of breeding birds for all various vegetation/habitat types would be devastated with loss of reptiles and small mammals as well as large mega fauna for at least 50 to 100 years or more. The wildlife corridor to the Santa Ana Mountains from Aliso Creek is meager at best. Mule deer, mountain lion, and bobcat could be extirpated within 50 to 100 years.

- Increased exposure of people or structures to flooding hazards.
- Created conditions that would present potential dangers to the public or attract the public to a potentially hazardous area (e.g. attractive nuisances).

Implementation of any of the Proposed Project alternatives would not increase exposure of people or structures to flooding hazards as the reconfigured creek would contain most flood events with some limited overbanking during the 100-year storm event (1 percent ACE) within the Wilderness Park. There are no permanent structures within the Wilderness Park that have been constructed to withstand temporary inundation due to flooding. Beneficial impacts from recontouring and terracing the incised creek would potentially reduce safety risks of people accidentally falling or stumbling into the existing incised creek.

- Created mosquito breeding conditions in an amount that would require increased levels of mosquito abatement programs to maintain mosquito populations at pre-project levels.

The raising of the incised creek to the historic floodplain is not anticipated to increase or create breeding conditions for mosquitos requiring increased abatement programs. For all alternatives if there is ponded water, mosquitoes may become a problem. Orange County vector control has substantial experience with BT (Bacillus thuringiensis, a naturally occurring bacterial disease of insects) for controlling mosquitoes without diesel and insecticide chemicals. However, the creek is perennial, and ponded water is not anticipated under the proposed restoration plan.

- Introduced hazardous materials during construction without proper handling or use protocols.
- Created environmental health and/or safety hazards due to the routine transport, use, or disposal of hazardous materials.
- Attracted or exposed the public to active construction sites, materials, and equipment storage areas that present potential unmanaged dangers or expose the public to potentially hazardous areas.

Handling and transportation of hazardous materials used during construction would be in compliance with measures identifies in Section 5.10.5. For all Proposed Project alternatives, access to the construction site or area would be limited with fencing and closure of the recreation trail at various times depending on the area or phase being constructed.

Operations and Maintenance

Under all alternatives, there would be no impact by future operations and maintenance on public health and safety as operation and maintenance activities would be periodic and not increase significantly over current conditions.

Monitoring

Under all alternatives, there would be no impact by future restoration monitoring on public health and safety as monitoring activities would be periodic, not include use of hazardous materials, and be limited to within the creek.

5.14.4 Summary

For all action alternatives, impacts would be less than significant, short term, and temporary, and with implementation of **Environmental Commitments PS-1 through PS-11** and **HW-1 through HW-5** during construction of the Proposed Project direct and indirect impacts would be further reduced.

5.14.5 Environmental Commitments

The following measures would reduce potential public health and safety impacts regardless of the alternative implemented:

PS-1 Contractor shall prepare a Public Safety Management Plan to maintain public health and safety during all phases of construction. Components of the plan would include:

- Notifying the public of the location and duration of construction activities, closing pedestrian and bicycle paths and trails, and restricting other impacted recreation.
- Coordinating with the public and local jurisdictions to minimize impacts and plan contingencies for maintaining emergency response, emergency evacuation plans and capacity of emergency services during construction.
- Posting signs locating construction sites and warning of the presence of construction equipment.
- Fencing construction staging areas.
- Providing temporary walkways (with appropriate markings, barriers, and signs to safely separate pedestrians from vehicular traffic) and posting detour signs where a sidewalk or pedestrian or bicycle path or trail would be closed during construction.

PS-2 All contractors shall prepare and implement a Worker Health and Safety Plan to be approved by the Corps' Safety Office prior to start of construction activities. At a minimum, the plan would include:

- All appropriate worker, public health, and environmental protection equipment and procedures.

- Designated heavy equipment traffic circulation route plans.
- Emergency evacuation routes and procedures.
- Emergency response procedures.
- Most direct route to a hospital and safe air ambulance landing zone.
- Name of the Site Safety Officer.
- Documentation that all workers have reviewed and signed the plan.

PS-3 Contractor shall consult with local jurisdictions to ensure that construction activities do not impede adopted emergency response plans.

PS-4 Prior to construction activities, the contractor shall notify relevant fire and police of traffic management methods to be used to ensure access at all times.

PS-5 A Communication Plan shall be developed by the Corps' Public Affairs Office (PAO) and implemented during all construction activities. This plan shall describe how local authorities shall be notified of public safety concerns, incidents, and emergencies.

PS-6 Fluids released because of spills, equipment failure (broken hose, punctured tank) or refueling would be immediately controlled, contained, and cleaned-up per Federal regulations. All contaminated materials would be disposed of promptly and properly to prevent contamination of the site. Someone would be present to monitor refueling activities to ensure that spillage from overfilling, nozzle removal, or other action does not occur.

PS-7 Construction employees shall strictly limit their activities, vehicles, equipment, and construction materials to the proposed footprint and designated staging areas and routes of travel. The construction area(s) shall be the minimal area necessary to complete the project and shall be specified in the construction plans. All personnel onsite shall be instructed that their activities are restricted to the construction areas.

PS-8 Contractor shall not allow ponding or puddles of standing water to remain within the construction area that would be subject to mosquito breeding.

PS-9 All work and staging areas will be clearly marked and appropriately guarded to ensure public safety.

PS-10 No smoking shall be allowed within the Wilderness Park, and no open fires shall be permitted without proper accident prevention measures. Only those fires required for construction would be allowed with strict controls as detailed in the plans and specifications.

PS-11 The construction contractor will develop a fire prevention and response plan appropriate for the use of heavy equipment in a high fire hazard area prior to the initiation of construction.

5.15 UTILITIES

5.15.1 Assumptions

Because of the remote area of the Wilderness Park, existing utilities are limited to various utility lines to and from the SOCWA CTP at the downstream end of the Proposed Project area and electricity to the Wilderness Park ranger office trailer.

5.15.2 Thresholds of Significance

A significant impact would occur if the Proposed Project:

- Required a substantial modification to existing utility facilities that would have an adverse environmental impact on sensitive resources, recreation amenities, land uses, or the local community.
- Caused reduction in services that increased life safety risk.
- Created a hazardous situation, exposing people to danger that could not be mitigated.

5.15.3 Alternative Analysis

5.15.3.1 No-Action Alternative/Future Without-Project Conditions

Under the No Action alternative, no Federal project nor a project by the non-Federal sponsor would be implemented. The incised creek would not be restored to pre-incised elevations, and restoration of plant communities would not occur. Changes to the geomorphology such as continued downcutting of the creek could increase the risk of damage to the SOCWA pipelines, causing an accidental break, exposing the area to waste material and contaminated water, creating a health hazard.

SOCWA efforts to protect pipelines at risk from stormflow-induced creek bank erosion would continue with piecemeal and short-term “band-aid” solutions. Utility infrastructure would remain at risk from continuing bank erosion posing a significant threat to human health and a measurable impact to the environment and local economy.

5.15.3.2 Action Alternatives

Construction

For all alternatives, impacts would be similar with the protection of the SOCWA CTP pipelines along the east and west sides of the creek.

Implementation of Alternatives 3.3, 3.6, 3.7, or 3.8 would not directly significantly impact existing utilities within the Proposed Project area. Stabilization of the creek banks from AWMA Road Bridge to SOCWA CTP Bridge would minimize future erosion, reducing erosion of steep creek banks that expose existing pipelines to and from SOCWA

CTP. The stabilization of the creek bank would be beneficial following completion of restoration activities.

There would be no substantial modifications to existing utility facilities that would have an adverse environmental impact on sensitive resources, recreation amenities, land uses, or the local community. There would be no reduction in serves that increased life safety risk. Implementation of the action alternatives would not create a hazardous situation. There would be no significant impact to utilities.

Operation and Maintenance

Operations and Maintenance activities would have no significant impact on existing utility lines to and from SOCWA CTP.

Monitoring

Monitoring activities would have no significant impact on existing utility lines to and from SOCWA CTP.

5.15.4 Summary

For all action alternatives, impacts to utilities would be similar. Duration of construction would increase from Alternative 3.3 through Alternative 3.8. For all action alternatives, impacts would be short term and temporary, and in the long term, beneficial with stabilization of the creek banks by raising the creek bed to the historic floodplain. **Environmental Commitment U-1** would minimize impacts during construction.

5.15.5 Environmental Commitments

The following commitments would be implemented as part of the Proposed Project alternatives:

U-1 If utility service disruption is necessary, residents and businesses in the Proposed Project area would be notified a minimum of seven and two days prior to service disruption through local newspapers, and direct mailings to affected parties.

5.16 RECREATION RESOURCES

5.16.1 Assumptions

The AWMA Road/Aliso Creek Trail will be opened at the upstream end on the Ranch at Laguna, just downstream of the SOCWA CTP Bridge. This condition was made by the California Coastal Commission on the Ranch at Laguna's proposed renovations.

Construction could impact existing recreation amenity use through excessive noise, fugitive dust, additional construction traffic, limited access or use of existing recreation amenities due to the Proposed Project's construction area and duration of construction.

5.16.2 Thresholds of Significance

A significant impact would occur to recreation resources if the Proposed Project:

- Permanently prevent access to recreation and/or open areas.
- Resulted in construction or operational activities that substantially conflict with recreational uses.
- Substantially diminished the quality of the recreational experience.
- Increased the use of existing neighborhood and regional parks or other recreation facilities such that substantial physical deterioration of the facility would occur or be accelerated.
- Resulted in a permanent loss of recreational opportunities or resources.

After construction is completed, all equipment would be removed from the work areas. All disturbed areas and recreation activities would be restored or replaced to at least pre-project conditions. Recreation visitation would be expected to increase over time as visitors learn of the Proposed Project's completion and restoration of recreation facilities.

5.16.3 Alternatives Analysis

Impacts to existing recreation resources within the Proposed Project area would be similar, differing in length of construction time for all the alternatives.

5.16.3.1 No-Action Alternative/Future Without-Project Conditions

Under the No Action alternative, no Federal project nor a project by the non-Federal sponsor would be implemented. The incised creek would not be restored to pre-incised elevations, and restoration of plant communities would not occur. The recreation element of the Proposed Project, that is, implementation of five kiosks would not occur.

Without additional passive recreation amenities and restoration of the creek, the continued erosion of the creek banks would cause trails on both sides of the creek to erode, limiting Wilderness Park use until repaired or realigned. Trails would need to be relocated further away from the creek towards the hill slopes with coastal sage scrub. Were this to occur, there would be a loss of this coastal scrub habitat that would be hard to replace. Habitat within the incised creek would continue to degrade, which would lessen the recreational experience and lead to fewer Wilderness Park visitors.

5.16.3.2 Action Alternatives

For all alternatives, construction would occur over a four-year period with one phase implemented each year except for the first year during which two phases would be implemented. Work to be performed in the Proposed Project area includes construction activities that would temporarily impact accessibility to hiking/riding trails while construction and restoration activities are underway. In the long term, passive recreational activities within the Wilderness Park would be enhanced by raising the creek to pre-incised elevations by the creek stabilization, minimizing further erosion of the existing trail and improving recreational value with the restoration of native riparian vegetation and aquatic habitat.

All alternatives would increase the recreational experience of current and new users by improving the recreation setting of the Proposed Project area.

Construction

- Permanently prevent access to recreation and/or open areas.
- Resulted in construction or operational activities that substantially conflict with recreational uses.

During the construction of Phase 1 and Phase 2 (downstream of the creek's confluence with Wood Canyon Creek), the AWMA/Aliso Creek Trail would remain open upstream of the confluence for Wilderness Park users to access the Wood Canyon Creek Trail.

During Phase 3, the trail would be closed between the Wilderness Park Visitor's Center at AWMA Road Bridge downstream to the Wood Canyon Creek Confluence. These impacts would be short term and temporary during construction, and the AWMA Road/Aliso Creek Trail would reopen following construction.

- Substantially diminished the quality of the recreational experience.

The quality of the recreation experience would be diminished during construction over the estimated four-year period of construction. The overall recreation experience would be improved following completion of the Proposed Project when native habitats are restored, and the increase in potential for viewing native fauna and flora would improve the recreation experience. This impact would be short term and temporary, and therefore not substantial and would be less than significant.

- Permanently increased the use of existing neighborhood and regional parks or other recreation facilities such that substantial physical deterioration of the facility would occur or be accelerated.

While there are many other trail use opportunities close to the Wilderness Park, trails for similar recreation use may be found on the OC Parks website (http://OCParks.com/parks/trails). These trails could therefore anticipate additional use during the four-year construction period, resulting in an indirect impact caused by the construction activities of the Proposed Project. Increased use of other trail systems could cause increased wear on those systems, resulting in increased maintenance. This impact would be short term and temporary, and therefore less than significant.

- Resulted in increased risk to recreationists in or adjacent to the Proposed Project vicinity.

There would not be an increased risk to recreation users. With the stabilization of the creek and reduction of erosion potential, risk to recreation users under normal conditions would be improved.

- Resulted in a permanent loss of recreational opportunities or resources.

There would be no permanent loss of recreation opportunities within the Wilderness Park as recreation use would be restored following completion of construction activities. Use of existing trails would be curtailed during construction for safety and access needs. Impacts would be temporary during construction as the trails would reopen following construction. This impact would be short term and temporary, and therefore less than significant.

Operation and Maintenance

Operations and maintenance following construction would primarily occur within the restored creek so there would be minimal impact to recreation users within the Wilderness Park.

Monitoring

During the monitoring period following construction, monitoring would primarily occur within the restored creek so there would be no or minimal impact to recreation users within the Wilderness Park.

5.16.4 Summary

For all action alternatives, impacts to recreation use within the Wilderness Park would be short term and temporary during construction. Trail closure would be the same for all the action alternatives as the trail would be closed in phases as described above. Indirect impacts to other similar regional parks may require additional maintenance as a result of limited trail use in the Wilderness Park. Duration of construction would increase from Alternative 3.3 through Alternative 3.8. For all action alternatives, impacts would be short term and temporary and with implementation of **Environmental Commitment RR-1 and RR-2**, direct impacts would be less than significant.

5.16.5 Environmental Commitments

RR-1 Provide notices and information on current recreation use status during the construction period through local media and signage.

RR-2 All recreation uses would be detoured from the area for safety of workers and the public.

5.17 ESTHETIC QUALITY

5.17.1 Assumptions

The size and location of staging areas will be further detailed during PED phase as final design is completed. Construction activity within the Proposed Project area would be visible to the residents located on the surrounding hill line ridges. Construction equipment would remain onsite overnight and when not in use.

5.17.2 Thresholds of Significance

A significant impact would occur to esthetic resources if the Proposed Project:

- Created direct, permanent changes to important existing scenic characteristics of a landscape that is viewed by a large number of people.
- Caused a substantial, demonstrable negative esthetic effect on a scenic vista or view open to the public.
- Permanently damaged natural scenic resources, including trees, rock outcroppings, and water features.
- Created a new source of substantial light or glare, which would adversely affect day or nighttime views in the area.

5.17.3 Alternative Analysis

5.17.3.1 No-Action Alternative/Future Without-Project Conditions

Under the No Action alternative, no Federal project nor a project by the non-Federal sponsor would be implemented. The incised creek would not be restored to pre-incised elevations, ACWHEP would not be removed, and restoration of plant communities would not occur. Until the incised creek reaches equilibrium in the future, vegetation within the creek would degrade or be lost, and vegetation adjacent to the creek would be lost as the creek widens due to continued erosion.

Continued creek bank erosion would force the trails on either side of the creek to be repaired or realigned, causing disruption in recreation user potential. With ACWHEP remaining in place, the scenic quality of the area would continue to be degraded with continued downcutting and continue to be visibly unsightly to Wilderness Park users. The forecast impacts of climate change would cause dry weather flows to decrease over time. Changes in creek geomorphology would also change the visual appearance of Aliso Creek, including continued downcutting, straightening, and widening of the creek. Loss of scenic quality would have a major impact on potential Wilderness Park users who would no longer want to visit the Wilderness Park. Views from homes overlooking the Wilderness Park would be less attractive. Light and glare would not change significantly as no additional development would occur in the Wilderness Park.

5.17.3.2 Action Alternatives

For all action alternatives, construction activities would encompass the area of the creek from SOCWA CTP Bridge upstream to Pacific Park Drive. The Proposed Project construction activities would temporarily degrade the esthetic quality of the Proposed Project area while restoration activities are underway.

During the construction of Phase 1 and Phase 2 (downstream of the creek's confluence with Wood Canyon Creek), the Aliso Creek Trail would remain open upstream of the confluence for Wilderness Park users to access the Wood Canyon Creek Trail. Trails and amenities upstream of the confluence with Wood Canyon would not be impacted and would remain open.

During Phase 3, the trail would be closed between the Wilderness Park Visitor's Center at AWMA Road Bridge downstream to the Wood Canyon Creek Confluence. These impacts would be short term and temporary during construction and the AWMA Road/Aliso Creek Trail would reopen following construction.

Implementation of all alternatives would permanently change the topography of the site by reconnecting the creek to its historic floodplain, creating a variety of habitat types at different elevations for greater resiliency to predicted climate change, and establishing a more natural sinuous channel. However, the invert of the creek would not be increased such that scenic vistas would be obscured from across the Proposed Project area. Thus, implementation of all alternatives would result in less-than-significant direct impacts on scenic vistas after restoration activities have been completed.

Impacts to esthetic quality would be similar to all alternatives, differing in length of construction time. Long-term, the esthetic quality of the Proposed Project area would improve with improvement in water quality, removal of invasive species, and other actions of restoration. All action alternatives would result in overall visual improvement with restoration of the historic floodplain and restoration of native habitats, increasing use of the Proposed Project area by megafauna and other species, and increasing viewing pleasure.

Construction

- Created direct, permanent changes to important existing scenic characteristics of a landscape that is viewed by a large number of people.

The Proposed Project area would be visible from higher elevations, which have views of Aliso Creek. The area would be visible from scenic overlooks and other trails located within the Wilderness Park. Restoration activities would temporarily change views of the Project site as the earth moving equipment and materials, stockpiled soil fill, a potential for visible dust plumes, and debris piles could be seen from most viewpoints along internal trails. These changes are temporary and most views would be available from various viewpoints once restoration activities are completed. The impact would be temporary and less than significant.

- Caused a substantial, demonstrable negative esthetic effect on a scenic vista or view open to the public.

There would be a direct significant impact on scenic quality during construction due to the placement of excess soil on the surrounding hill slopes removed from the creek. Residents on the ridge lines to the east and west of the Wilderness Park would have their views of the canyon hillsides with non-native grassland and oak woodland disturbed as excess soil is placed on hillsides. These areas would be seeded or planted with native coastal sage scrub following completion of grading/contouring activities. Since the trails adjacent to the creek would be closed during construction, impacts would be limited to these residents. The impacts would be short term, and therefore less than significant with the restoration of these areas.

The presence of construction equipment trucks entering and leaving the Wilderness Park would be considered a negative effect on scenic vistas, as vistas would be blocked during construction activities. This would be temporary and short term during construction, and with the restoration of the historic floodplain and restoration of native habitats, the scenic quality of the Proposed Project area is anticipated to improve.

- Permanently damaged natural scenic resources, including trees, rock outcroppings, and water features.

During construction, there would be removal of existing trees and other features within the existing incised creek. With the stabilization of the creek bed and restoration of native habitat within the creek, these impacts would be short term and temporary and would not be substation or significant.

- Create a new source of substantial light or glare, which would adversely affect day or nighttime views in the area.

Nighttime security lighting of staging areas located within the Wilderness Park would cause additional light and glare that would be viewed from the residences on the hill ridges to the east and west of the canyon. Additional sources of light or glare may be caused by early morning and early evening, as lighting would be used during early morning and evening work activities. Work would occur Monday through Friday between the hours of 7:00 a.m. and 5:00 p.m. Thus, construction lighting would be limited to a few hours a day, with most lighting use occurring during hours when the sites are partially lighted by natural dusk conditions. Given the topography of the area, with residential land use at higher elevations, it is unlikely that construction lighting would directly impact these areas. Construction lighting would be aimed toward the activity and would be mostly contained within the area where work would be occurring. Evening construction lighting could result in substantial light and glare during the evening on areas with direct views of the site if lighting is not controlled and directed appropriately.

Since evening viewers would be limited to residents on hill ridges overlooking the Wilderness Park during construction, impacts would be temporary and less than significant.

Operation and Maintenance

Operations and maintenance following construction would primarily occur within the restored creek so there would be minimal impact to scenic vistas within the Wilderness Park.

Monitoring

No impacts to scenic vistas are anticipated during monitoring as monitoring would not involve equipment that would cause a significant impact and would be limited to the creek bed and adjacent areas several times during the year.

5.17.4 Summary

For all action alternatives, impacts on the esthetic quality of the Proposed Project area would be similar as the construction footprint, disposal sites, and staging areas are the same. Impacts to esthetic resources would increase in duration from Alternative 3.3 through Alternative 3.8. Impacts would be short term and temporary and with implementation of **Environmental Commitment ER-1 through ER-6**, direct and indirect impacts would be less than significant. Long-term, the impacts to the esthetic quality of the Proposed Project site would be beneficial with a sustainable restored habit that reflects the biodiversity of the canyon and creek.

5.17.5 Environmental Commitments

The following measures would minimize adverse impacts on esthetic quality of the Proposed Project vicinity during construction and to return areas temporarily disturbed to pre-project conditions.

ER-1 Construction contractors shall ensure that all temporary construction lighting shall be designed and installed to be fully shielded (full cutoff) and to minimize glare and obtrusive light by limiting outdoor lighting that is misdirected, excessive, or unnecessary. Construction lighting shall be oriented away from nearby land use areas that are not being affected by construction.

ER-2 Work and staging areas would be kept orderly and free of trash and debris.

ER-3 A storage area for collection and storage of recyclable and green waste materials would be kept within the work area. All trash and debris would be removed from the work area at the end of each day.

ER-4 Signs would be posted prohibiting trespassing within the “construction zone.”

ER-5 Restore native vegetation as soon as practicable following construction activities.

ER-6 Confine vehicular traffic to routes of travel to and from the project site, and prohibit cross-country vehicle and equipment use outside designated work and storage-staging areas.

5.18 SUSTAINABILITY

5.18.1 Assumptions

The Wilderness Park is protected as a regional park in perpetuity. Some measure of economic and social sustainability would be maintained; however, the quality of life provided by the Wilderness Park would decline over time without restoration of the historic floodplain, and restoration of native habitat.

Ecological diversity and abundance may be impacted through reduction in size of protected natural areas or the reduction in quality of natural areas. Quality of natural areas may be affected by the degradation of air quality, water quality, noise levels, soil condition, and vegetation condition. Economic sustainability may be negatively impacted if financial viability were compromised as a result of the Proposed Project.

5.18.2 Thresholds of Significance

A significant impact would occur to sustainability if the Project:

- Changed in economic, ecological, or social sustainability in the use, visitation, or management of the Proposed Project.
- Ecosystems could not sustain functionality and retain current levels of abundance and biodiversity over time.
- Inability of social sustainability to ensure future generations have the same or greater access to social resources as the current generation.
- Inability of economic sustainability factors to retain the value of an area, both in terms of capital and monetary exchanges over time.

5.18.3 Alternative Analysis

5.18.3.1 No-Action Alternative/Future Without-Project Conditions

Opportunities that may exist to reconnect fragmented habitats, restore and protect high quality native habitat areas, and minimize local flood damages that would provide self-supporting quality of life experience for local area residents may become lost.

Under the No Action alternative, the area would degrade slowly due to outside factors such as climate change and increased use of the road/trails caused by an increased demand for passive recreation amenities. Invasive species would outcompete native species for limited water.

With limited or reduced recreation amenities, use would decline, reducing social interaction, and economic value of the area. This includes funding to maintain the restoration and to manage the Wilderness Park.

5.18.3.2 Action Alternatives

- Changed in economic, ecological, or social sustainability in the use, visitation, or management of the Proposed Project.
- Ecosystems could not sustain functionality and retain current levels of abundance and biodiversity over time.
- Inability of social sustainability to ensure future generations have the same or greater access to social resources as the current generation.
- Inability of economic sustainability factors to retain the value of an area, both in terms of capital and monetary exchanges over time.

Under all action alternatives, environmental sustainability would improve functionality and biodiversity with the restoration of native riverine species within and adjacent to Aliso Creek. Characteristics of this restored ecosystem would include a steady (equilibrium) state, the ability to recover from disturbance (resilience), and evolving plant communities (succession). The restoration of critical ecosystem functions following construction would help support long-term environmental sustainability. However, restored habitats must also be managed long-term through an adaptive management program to ensure success given the predictions of climate change.

Economic sustainability involves creating economic value (in terms of capital and monetary exchanges) from implementing the Proposed Project that would also be sustainable over time. The positive effect natural open space has on nearby property values can result in higher assessments, and thus higher property tax revenues for local governments. This could include reduced repair and maintenance costs when funds could be used elsewhere. Restoration of the riverine habitat within the Wilderness Park would entice more users of the educational and passive recreational nature of the park, which in turn leads to increased community value of the park.

Social sustainability applies to the provision of recreation and other social amenities. In this case the restoration of the riverine habitat of the Aliso Creek through the Wilderness Park. Sustainable ecosystems also result in ongoing high quality of life for park visitors and area residents. A sustainable restored ecosystem would provide future generations with the opportunity to have a higher quality experience or better compared to present generations, while maintaining responsibility of environmental stewardship.

Overall, there would be no significant impact to sustainability.

5.18.4 Summary

For all action alternatives, impacts to sustainability of the Proposed Project area would be short term and temporary during construction. With the completion of construction and restoration of native habitats, long-term sustainability would be beneficial.

5.19 CUMULATIVE IMPACTS

The CEQ has defined cumulative effects as “the impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions.” Cumulative effects can result from individually minor, but collectively significant, actions occurring over a period of time (40 CFR 1508.7). The CEQ guidance further indicates that it is not practical to analyze cumulative effects for other than those truly meaningful environmental effects. The CEQ guidelines define cumulative impacts similarly, stating:

“Cumulative impacts” refers to two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts. (a) The individual effects may be changes resulting from a single project or a number of separate projects. (b) The cumulative impact from several projects is the change in the environment which results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable probable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time. (CCR, Section 15355).”

This section describes the past and present activities that have contributed to current conditions within the vicinity of Aliso Creek. This section also addresses present and reasonably foreseeable projects in the immediate vicinity as well as overall development trends in the area.

5.19.1 Past Actions

The following projects implemented over the past 40 years have, to one degree or another, influenced the current configuration of the Aliso Creek upstream and downstream through the Wilderness Park. Construction of the Chet Holifield building and removal of the S-bend and straightening of the Creek along with urban development and infrastructure including schools and parks, have limited any reconfiguration of the creek outside the Wilderness Park. Several restoration projects have been implemented that have increased water quality flowing into Aliso Creek. BMPs will continue within the region.

Aliso Creek Inn and Golf Course
The area was originally home to George and Sarah Thurston. The property was turned into a golf course in the 1940s and was renamed the Laguna Beach Golf Course in 1956. In the 1960s, the 62-room inn was added. The resort was renamed the Aliso Creek Inn

and Golf Corse in 1978. Severe flooding in 2010 caused the golf course to be closed for several months with up to four feet of water covering the golf course. The property is now referred to as the Ranch at Laguna.

Church of Jesus Christ of Latter Day Saints

The Church of Jesus Christ of Latter Day Saints is located on the north side or upstream of AWMA Road Bridge on the west side of Aliso Creek. The church was constructed prior to 1994.

Journey School

The Journey School is located south of Pacific Park Drive on the west side of Aliso Creek.

Wood Canyon Elementary School

The Wood Canyon Elementary School was laid out and partially constructed in the early 1990s. The school is located south of Aliso Creek Road on the west side of Aliso Creek.

Aliso Niguel High School

Aliso Niguel High School was constructed in the 1980s and is located upstream of Aliso Creek Road on the west side of Aliso Creek.

Wood Canyon Villa Apartments

Located west of Wood Canyon Drive, the extensive complex was laid out and construction began in the early 1990s. Construction of all the buildings took several more years to complete.

Residential Areas Overlooking the Wilderness Park

On both sides of the Wilderness Park to the east and west, residential areas on the far side of the canyon hills were laid out with streets and infrastructure during the late 1980s and early 1990s. Most construction began shortly thereafter and continued through the late 1990s. To the east, residential communities include Hill Crest, Palmilla, and Coronado Pointe.

Aliso Village Shopping Center

The Aliso Village Shopping Center was laid out, and construction began in the late 1980s. Construction continued through the mid-to-late 1990s with additional retail outlets. Renovations to attract new tenants were completed in 2014, which included Whole Foods Market. The shopping center is located south of Aliso Creek Road between Aliso Creek Parkway and La Paz Road.

Chet Holifield Federal Building

The “Ziggurats” (the form references ziggurats, ancient Mesopotamian temples) Building was originally constructed for Rockwell International, a multifaceted company that worked in the manufacturing arena for defense and space industries.

Photo 5.19-1 Completed in 1971, Rockwell never occupied the building; the company no longer required it after a defense contract it was relying on never came to fruiting. The company offered to trade the building to the Federal government in exchange for three surplus governmnet facilities of equal value. In 1974, GSA assumed control of the building.

The Department of Homeland Security and the Internal Revenue Service are the main tenants in the building. The Chet Holifield Federal Building is located at the southern end of the Aliso Village Shopping Center east of the Wilderness Park.

Laguna Apartments Slope Repair

Repairs were completed in January of 2015.

Laguna Niguel Skate Park

The skate park, located east of Aliso Creek between the creek and Aliso Creek Parkway, immediately upstream of Aliso Creek Road, was constructed in 2002 to 2003. The park also includes a soccer field and Extreme Boot Camp.

Sulphur Creek Section 206 Aquatic Ecosystem Restoration project (City of Laguna Niguel)

This cost-shared project between the Corps and the City of Laguna Niguel, included two areas: (1) aquatic ecosystem restoration of approximately 37 acres within 8,000 linear feet, completed in 2008, and (2) restoration of approximately 7.7 acres within an approximate 2,000 linear feet of Aliso Creek, completed in 2009. Both areas include five-year restoration and monitoring programs.

Aliso Creek Wildlife Habitat Enhancement Project

The ACWHEP includes a grade control structure (known as ACWHEP) and overflow structure in the Wilderness Park designed to slow water upstream of the structure, provide gravity irrigation to downstream portions of the creek to support riparian habitat, and provide a creek vehicular crossing to enhance park access.

This system was constructed as part of a mitigation bank by the Mission Viejo Company and Orange County to direct water through irrigation lines to riparian terraces. The project created new wetlands and enhanced existing marshland. However, the structure no longer functions as intended, and severe erosion and incision of the stream is occurring downstream. The irrigation lines are currently broken and no longer convey water to the terraces. Aliso Creek and its bank areas immediately downstream of the ACWHEP structure have experienced significant erosion following the installation of this project. The irrigation system was damaged in winter storms of 1997-1998.

Pursuant to an extensive period (2010 through 2012) of negotiations between the signatories of the ACWHEP Agreement, consisting of Orange County, Shea Properties (successor to Mission Viejo Company), USFWS, and CDFW (formally CDFG), the parties agreed to terminate the ACWHEP agreement in its entirety, with no right of survivorship or other obligations. The termination agreement was signed 2 October 2012. The County will retain the existing restrictive covenant for the ACWHEP parcels in place, limiting the ACWHEP site to Aliso and Wood Canyons Wilderness Park purposes. With the termination of the ACWHEP agreement, the ACWHEP was no longer precluded from consideration as part of a prospective ecosystem restoration Federal project.

The **Central and Coastal Subregion of the Natural Community Conservation Plan (NCCP)/Habitat Conservation Plan (HCP)** also limits development within the Proposed Project area including the Wilderness Park.

Clear Creek System

In 2002, the County of Orange installed Clear Creek Systems, Inc. (CCS) package plant treatment system to implement BMPs at the Springdale Storm Drain. Springdale Storm Drain (Facility J01P28) is a tributary to Aliso Creek and conveys runoff water from a developed area of approximately two square miles in the city of Aliso Viejo.

The package plant treatment system filters and disinfects approximately 100,000 gallons per day of urban runoff. The treated water is discharged at the stormdrain outlet approximately 50 feet from the creek. The CCS discharges the backwash water containing suspended particles and sediments to the Moulton Niguel Water District sewer facility and is eventually discharged via the SOCWA ocean outfall line into the ocean.

J01P01 Munger Storm Drain Sand/Media Filter

The Munger Storm Drain/Sand Media Filter was intended to treat dry season urban runoff from the Munger Storm Drain (J01P01) prior discharging into Aliso Creek by the removal of suspended solids, bacteria, and other pollutants. The system includes a pre-sedimentation vault, pump station/wet well, and sand filter vault, with gravity discharge. The filter system is currently inactive while a system expansion is engineered to provide improved treatment of Munger Drain runoff.

Narco Channel Wetlands

The City of Laguna Niguel received a $1.4 million grant from the SWRCB to implement a wetlands improvement project along approximately 1,000 feet of Narco Channel, a tributary to Aliso Creek north of the study area. The area was transformed from an earthen and rock-lined trapezoidal channel to a natural drainage corridor for water quality improvement and wildlife habitat enhancement purposes. Construction of the project was completed in January 2008.

Wood Canyon Emergent Wetland Project

The City of Aliso Viejo established a wetland habitat using native riparian/wetland vegetation to enhance water quality, flood control, and channel protection at the beginning of the Aliso Creek at the headwaters of the Wood Canyon Creek.

Wood Canyon Creek
Habitat restoration was conducted at four mitigation sites for a project that established access road crossings at Wood Canyon Creek. The mitigation sites are located within and immediately adjacent to the creek crossings upstream of the proposed Federal project that would occur in the vicinity of the Aliso Creek confluence.

English Creek Aquatic Habitat Restoration Project Completed.

Glenwood Wetland
Constructed by the City of Aliso Viejo at the northeast corner of Glenwood and Golf Drive.

Aliso Hill Channel (J05)
Constructed wetland completed in 2002 as a mitigation project for Laguna Hills Community Center project and provides bacterial water quality improvements during dry weather.

Wetland Capture and Treatment at J03P02 Completed 2004.

Aliso Creek Water Harvesting Project
Diverts 0.8 MGD Aliso Creek water for filtration with salts removed through a microfiltration process that blends this water with South Coast Water District's recycled water to lower overall salt content.

SOCWA Bridge Protection
A bridge protection project under Section 14 of the Continuing Authorities Program for SOCWA access bridge over Aliso Creek included implementation of a grade control structure with low-flow channel and restoration of riparian/upland habitat immediately up and downstream of the bridge.

SOCWA Road Alignment
Realignment of a 1,000-foot-long segment of the paved SOCWA access road and trail included revegetation of 1.42 acres of native grassland and coastal sage scrub on the west side of the creek near ACWHEP.

Southwestern Pond Turtle Habitat
Mitigation for the City of Laguna Hills Community Center included the creation of southwestern pond turtle habitat approximately 0.5 miles north of the SOCWA CTP on the east side of Aliso Creek beginning in 2002. The program included creation of a turtle pond and associated wetland and upland habitat, implementation of a predator control plan, and introduction of 39 pond turtles. The pond has been dry since August 2005 and currently supports no aquatic habitat. The turtles likely migrated to Aliso Creek. The Proposed Project area does not include this site

5.19.2 Present Actions

The Ranch at Laguna Beach

Formerly the Aliso Creek Inn and Golf Course, currently the inn and golf course are undergoing renovation with conditions imposed by the California Coastal Commission that includes floating an easement for a public trail along the northern border and reconnecting the trail from the Wilderness Park to the Pacific Ocean through the property, as well as restoring habitat along the Creek. Additional requirements by the Coastal Commission include allowing camping within the property to accommodate lower income demographic groups.

Wilderness Park Entry Improvement Project

The Entry Improvement Project is located at the Wilderness Park main entrance on AWMA Road just west of the AWMA Road Bridge. The project is being financed by a $675,000-grant from the Safe Neighborhood Parks, Clean Water, Clean Air and Coastal Protection Bond Act of 2000 (Proposition 12) administered by the State Coastal Conservancy. Improvements include native landscaping, parking, trailhead improvements, and new trails. The grant also covers the planning and design of the visitor-serving and administrative park buildings scheduled for later Phase 2 development. The project is nearing completion and will be completed prior to start of construction of the Restoration Proposed Project.

Invasive Removal Projects in Aliso Creek

- Proposition 50 Invasive Removal Project. Removal of approximately 33 acres of invasive species with $1 million in funding from Proposition 50 from Orange County Watersheds in March 2012. The project was completed and currently in maintenance.
- The Ranch Invasive Removal Project. A private landowner funded 10 acres for $50,000 initiated in November 2013 and currently in maintenance phase.
- County of Orange Invasive Removal. In 2010, $700,000 was awarded by Orange County for invasive removal on approximately 14.5 acres as mitigation for Alton Parkway. The project was initiated in September 2011 and is currently in a maintenance phase.
- Conservation Corps Invasive Removal. In 2012, $500,000 was awarded by California Proposition 84 for non-mitigation invasive removal. The project was initiated in October 2013 and completed on December 2014. The project is currently in a maintenance phase
- Measure M Habitat Restoration. OCTA awarded $1,575,000 to restore habitat on approximately 55 acres as mitigation for freeway construction in Orange County. The habitat rehabilitation efforts are focused on approximately 1.5 miles in Aliso Creek from Moulton Parkway downstream to approximately Avila Road overlapping Reaches 11 to 15. This land is owned by Orange County and managed by OC Parks. Approximately 30 acres of invasive species would be removed. A site protection instrument will be recorded over the project site for the purpose of ensuring long-term protection of its conservation values. OCTA has its own NCCP/HCP to cover freeway projects funded through Measure M2 transportation funding. Language has been included in the draft HMMP that stipulates that, should a Federal project be

implemented within the HMMP project boundaries, the Corps and jurisdictional authorities will evaluate whether modifications to the permit (Long Term Management Plan) and site protection instrument are warranted. The project was initiated in September 2014 and is currently in a maintenance phase.

5.19.3 Future Actions

Dairy Fork Wetlands Restoration Project

The restoration project is projected to naturally treat urban runoff from four cities before it reaches Aliso Creek. Dairy Fork is located southwest of the intersection of Moulton Parkway and Alicia Parkway.

City of Aliso Viejo

Homewood Suites, a four-story, 129-suite hotel at Vantis Drive, located between Pacific Park Drive and Highway 73.

City of Laguna Niguel

Sun Point Subdivision of existing tract for 71 new single-family homes.

South Orange County Wastewater Authority (SOCWA)

- Coastal Treatment Plant Export Sludge Force Main Project. This project would replace 16,600 feet of two existing four-inch pipelines between the CTP and Alicia Parkway with one six-inch force main parallel to the Moulton Niguel Water District sewer line within the existing east trail right-of-way from the CTP to the Regional Treatment Plant.
- Aliso and Sulphur Creek Confluence Stabilization. In Conceptual Development – Stabilization of both east and west creek banks to protect existing MNWD and SOCWA infrastructure and to protect sensitive cultural resources; environmental restoration of surrounding habitat on Sulphur Creek from Alicia Parkway to confluence of Aliso and Sulphur Creek; on east bank of Aliso Creek to approximately 250 feet south of confluence.
- Aliso Creek Rip Rap Repair. In Conceptual Development – Repair and construction of existing riprap structures. A 500-foot section of the east bank of Aliso Creek that is approximately 500 feet south of the ACHWEP Structure.
- Aliso Creek through Aliso Creek Golf Course. Protection for the land outfall line. Two high risk erosion areas at the confluence with Sulphur Creek and downstream of the ACWHEP structure.
- SCWD Maintenance Facility, Interceptor Sewer, Lift Station and Force Main Protection Project. Protection for sewer lift station, maintenance facility, pipelines, force main, and road immediately adjacent to and facilities within Aliso Creek between Aliso Beach and the Coastal Treatment Plant.
- Recycled Water Facilities Protection. Aliso Creek protection of pipelines and pump station along and adjacent to the mouth of Aliso Creek at PCH.
- City of Laguna Beach North Coast Interceptor Force Main Protection Project**.** Protection of NCI sewer force main located within Aliso Creek

5.20 CUMULATIVE IMPACT ANALYSIS

5.20.1 Introduction

Guidance from the CEQ and CEQA has been followed in the preparation of this analysis.

5.20.2 Earth Resources

The potential for cumulative impacts related to geology, soils, and seismic hazards is potentially significant under both the action alternatives and the No Action alternative, since landslides, seismic activity, and erosion related to these resources could contribute to cumulative impacts related to past, present, or reasonably foreseeable future projects.

Soil erosion could occur due to the extensive amount of ground clearing and earthwork involved with construction of the project. Landslides have occurred in various areas of the Wilderness Park and could continue with the placement of excess soil on the surrounding hill slopes. Seismic activity would continue as the Newport-Inglewood Fault is located just offshore from the Proposed Project area with or without implementation of any of the construction alternatives.

5.20.3 Water Resources

Cumulative impacts to hydrology, the floodplain, and water quality are expected to be beneficial under the restoration alternatives. Planning efforts by local and regional agencies are in progress to develop comprehensive plans addressing hydrologic conditions and water quality from a regional perspective. These collectively influence flood risk management and water quality issues within the lower watershed.

Another beneficial cumulative impact would result from the various measures within the alternatives that would increase the riparian and native habitats. Restoration measures would help improve hydrologic conditions and water quality for cumulative projects located within and in the vicinity of Aliso Creek.

Despite being fairly well built-out, the effect of further upstream development could increase urban runoff with increased impervious surfaces and may result in an increased risk of flooding downstream and within the creek, but such development would also likely result in a reduction of sediment input to the creek and would not contribute to increased sediment outflow to the ocean. The Proposed Action would result in an increase of average annual sediment delivery to the ocean over current conditions; however, the increase to the littoral zone is not considered to be significant. Therefore, no significant adverse cumulative impacts are expected.

5.20.4 Air Quality

Due in part to the highly urbanized and dense areas, the SCAB currently does not meet all NAAQS or the equivalent California Ambient Air Quality Standards. With respect to the NAAQS, the SCAB is currently in extreme nonattainment for ozone (precursors: VOC or NOx) and nonattainment for $PM_{2.5}$; and partial nonattainment for lead. Estimated construction and operational emissions associated with all action alternatives would not exceed RSTs. Thus, construction and operational emissions would not result in significant cumulative impacts to air quality.

5.20.5 Climate Change

The continued use of fossil fuel vehicles is the largest sector contributor to climate change in southern California, which would remain similar under the No Action and implementation of any of the action alternatives without the decrease of this type of motor vehicle in the region. Cumulative impacts to climate change would be less than significant as the region is fairly built-out, and designated areas of open space have been dedicated to such use in perpetuity.

5.20.6 Noise and Vibration Quality

Cumulative noise impacts typically occur when multiple projects affect the same geographic areas simultaneously, or when sequential projects extend the duration of noise impacts on a given area over a longer period. Noise impacts are primarily localized because sound levels decrease relatively quickly with increasing distance from the source; therefore, the cumulative noise setting would be limited to the area subject to audible increase in noise levels with construction and development of cumulative projects. Cumulative noise impacts from implementing the Proposed Project, together with other reasonably foreseeable development activities in the study area, would result primarily from temporary construction activities and would be subject to local noise ordinance provisions.

5.20.7 Biological Resources

The area of consideration for biological resources includes the lower watershed of the creek and its tributaries. The restoration measures in the action alternatives would contribute to beneficial cumulative impacts to biological resources. These impacts would increase the amount of wildlife habitat; provide greater ecological/biological benefits; aid in linking isolated habitats; help increase the amount of open space; and help expand species diversity. These impacts would be beneficial from a regional perspective since they would benefit wildlife species that may migrate outside of the study area. These benefits would also accrue to past, present, and reasonably foreseeable projects that are located along or in the vicinity of the creek. Cumulative impacts would continue to be beneficial.

Construction activities would require excavation of surface and sub-surface materials and the subsequent disposal of these materials. However, any cumulative adverse impacts to biological resources as a result of construction activities would be addressed through the implementation of BMPs and stormwater requirements of local and state agencies as well as the Corps. Similar measures would be implemented as part of any other planned or reasonably foreseeable developments within the area of consideration. In conjunction with other habitat restoration efforts proposed or being planned in the area, these measures would have a significant, beneficial cumulative impact.

5.20.8 Cultural Resources

Past developments in the study area have resulted in the loss or destruction of the spatial integrity of prehistoric and historic archaeological resources through ground-disturbing activities. However, much of the current and future development would be subject to Federal, state, and local reviews that include some level of consideration and protection for cultural resources, which would lessen these impacts.

The action alternatives, combined with cumulative developments in, and in the vicinity of, the area of consideration would be conducted in the context of environmental and cultural resource compliance review as prescribed by state and Federal guidelines and regulations for the identification, handling, and preservation of cultural resources. Cumulative developments in the planning stage within and in the vicinity of the study area, would be subject to these provisions. These provisions are designed to identify cultural resources, assess impacts, and avoid adverse effects.

To the extent that other cumulative projects have caused or may cause cultural resource impacts, NEPA and CEQA require consideration of mitigation for significant cultural impacts. Based on the current designs and the assumption that some of the sites have retained enough integrity to be eligible for that NRHP, the Proposed Project alternatives would result in an adverse effect under the NHPA and a significant impact under NEPA. The alternatives would involve the partial to complete destruction of up to 12 archaeological sites and the potential for impacting human burials is present. To minimize adverse impacts, environmental commitments identified in Section 5.8.5 would be implemented for all alternatives.

5.20.9 Paleontology Resources

Paleontological resources may have been lost through past agricultural soil disturbance. Current and future development would be subject to Federal, state, and local reviews that includes some level of consideration and protection of paleontological resources, which would lessen these impacts.

5.20.10Hazardous, Toxic, and Radio-active Waste

Cumulative impacts related to HTRW would be less than significant since there are no known sites within a half-mile radius of the Proposed Project, and the historical land use of the site has been agriculture. The San Onofre Nuclear Plant (now closed) is located approximately 16 miles southeast of the Wilderness Park. Cumulative impacts would be less than significant.

5.20.11Socioeconomics/Environmental Justice

Under the No Action alternative, no displacement of housing or industrial uses would occur and no significant impacts to socioeconomic and environmental justice would result.

During construction under any of the action alternatives, temporary employment opportunities for construction workers would occur. The action alternatives, in conjunction with the cumulative projects, would not result in a labor shortage. It is not anticipated that all the projects would enter the construction phase simultaneously. Even if the schedules of the projects overlap, construction worker demand could be met with the large labor pool present in Orange County. This demand would not displace housing or people. The action alternatives would not disproportionately affect minorities, low-income residents, or children. Therefore, the action alternatives would not incrementally contribute towards creating a cumulative impact during construction in conjunction with the cumulative projects identified above.

5.20.12Land Use

The implementation of any of the alternatives would be consistent with the applicable general plans and community specific plans of Orange County, local cities, and the Central and Coastal Subregion NCCP/HCP that limits development within the Proposed Project area including the Wilderness Park.

These general plans, as well as the land use plans by county and regional planning agencies, address the Wilderness Park as open space and the creek as an asset for the region along with its long-term and recognized importance for flood risk management, water quality, and wildlife habitat.

There would be no significant cumulative land use impacts with any of the alternatives since present land uses would continue in conformance with adopted community and general plans.

5.20.13Traffic and Transportation

The area of consideration for traffic and transportation includes the highways, streets, and transit corridors that serve both the Proposed Project vicinity as well as the greater southern California region and beyond. Numerous roadways through the area to and from the I-5 have been constructed as development has occurred including the nearest major roadway, Aliso Parkway to the east of the Wilderness Park, and Proposed Project area to keep pace with the growth and infrastructure, especially for emergency response. Traffic volume has increased by those who use the conduit of roads for commuting from residential areas in the local coastal hills to business centers along the I-5 corridor and access to the coast.

This Proposed Project would generate truck trips delivering equipment and materials to the project area at project commencement. All other project-related activities would be confined within the project area. Construction is estimated to be completed in multiple phases over several years. Potential impacts to local traffic conditions associated with commuting workers would therefore be negligible with the implementation of a Traffic Control Plan and adherence to environmental commitments including avoidance of local school start and end times during the week.

The restoration measures in the various alternatives, together with these past, present, and reasonably foreseeable future projects, would expand open space and parkland opportunities and would not likely result in a significant cumulative impact to the regional transportation system.

5.20.14Public Health and Safety

The area of consideration for public health and safety includes the Wilderness Park and immediate vicinity. Implementation of restoration measures under any of the action alternatives would result in less-than-significant potential cumulative impacts involving school safety, HTRW, methane zones, and infectious diseases associated with the project. Because implementation of the restoration measures and other reasonably foreseeable recreation amenities that would increase the opportunities for the public to interact with the creek, the cumulative risk of water-related injury could increase. This cumulative risk would be greatest with the development of recreational activities with direct access to the creek. This risk would be greatest during and following seasonal flooding events. The recontouring and terracing of the incised creek resulting from the Proposed Project would potentially reduce the safety risk of people falling or stumbling into the creek.

Under the No Action alternative, continued access to the creek makes the risk of drowning and other water-related accidents a potential health and safety concern, especially during periodic storms when the creek conveys large volumes of fast-moving runoff water to the Pacific Ocean.

Existing public health and safety agencies providing emergency services would be utilized to address any cumulative impacts to public health and safety.

5.20.15Utilities

The area of consideration, including surrounding lands within the Wilderness Park would continue to be used as a utility corridor for SOCWA CTP. Implementation of any of the proposed alternatives would occur within areas primarily designated for open space and would not conflict with potential new facilities as the existing SOCWA utility corridor through the Wilderness Park is an easement to the north and east side of the creek. Cumulative impacts would be addressed through various plans currently adopted or in progress, including long-term infrastructure needs. These planning efforts would ensure that cumulative impacts associated with the restoration measures and cumulative utility projects within the reaches are less than significant.

5.20.16 Recreation Resources

The area for recreation comprises the Wilderness Park. Implementation of any of the alternatives would contribute to cumulative beneficial recreation impacts for the residents surrounding the study area. The restoration measures would increase riparian habitats that could present a recreation resource through attractive and esthetic features both within and along Aliso Creek. Communities surrounding the study area have documented the need for more parks and open space in general plans and in various community plans. The restoration measures would occur in areas that could connect with existing recreational areas upstream and downstream of the Wilderness Park.

While there would be limited access during construction, which could cause an increase in other regional parks with similar trail and nature amenities, these impacts would be lifted once construction was completed, adding beneficial amenities to the Wilderness Park.

5.20.17 Esthetic Quality

Implementation of any of the alternatives would result in beneficial impacts for esthetic resources. Restoration of riparian habitat, raising the creek bed and additional passive recreation amenities would provide a beneficial cumulative impact to esthetic resources. The Proposed Project in itself and when combined with cumulative projects would not likely result in new sources of significant light or glare that would result in potential impacts. Therefore, the overall cumulative esthetic impacts would be beneficial but less than significant.

5.20.18 Sustainability

A sustainable restored ecosystem would provide future generations with the opportunity to have a high quality experience or better compared to present generations, while maintaining responsibility of environmental stewardship. Restoration would entice more users of the educational and passive recreational nature of the park, which in turn leads to increased community value of the park. Sustainable ecosystems also result in ongoing high quality of life for park visitors and area residents. However, restored habitats must also be managed long-term through an adaptive management program to ensure success given the predictions of climate change. Overall, impacts would be beneficial and less than significant.

5.21 GROWTH INDUCING IMPACTS

NEPA defines indirect effects as those that include growth-inducing effects or other effects related to induced changes in population density or growth rate (40 C.F.R § 1508.8). CEQA Guidelines, Section 15126.2(d) requires a discussion of growth-inducing impacts of a proposed action. An action is defined as growth-inducing when it:

- Fosters economic growth, population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment.
- Removes obstacles to population growth.
- Results in further taxes to existing community service facilities.
- Encourages or facilitates other activities that could significantly affect the environment, either individually or cumulatively.

Growth inducement is generally dependent upon the presence or lack of existing utilities and public services in an area. The provision of new utilities and services can induce growth in an undeveloped area. Growth inducement can also occur if a Proposed Action makes it feasible to increase the density of development in surrounding areas. Development pressure in the Proposed Project area would persist with or without implementation of the proposed action. The proposed action would not induce growth because it would not provide the types of services or incentives listed above. Instead, it would protect existing services and restore historic natural conditions.

5.22 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

NEPA requires consideration of the relationship between short-term uses of the environment and the impacts that such uses may have on the maintenance and enhancement of long-term productivity of the affected environment. Within the context of this analysis, “short-term” refers to the construction period for the action alternatives and three years following, while “long-term” refers to the operational life of the Proposed Project (assumed to be 50 years) and beyond.

Short-term impacts caused by the Proposed Project would be similar for any of the action alternatives. These impacts would occur during and immediately after construction and would result in adverse effects to cultural resources, and mitigation measures would be implemented to minimize these adverse impacts, including revised construction design of the Proposed Project.

However, the long-term impacts that would occur over the life of the Proposed Project would result in overall beneficial effects. Overall, the Proposed Project would provide minor and temporary short-term losses during construction while resulting in significant beneficial impacts to the long-term environmental restoration of the Proposed Project area.

Temporary adverse construction-related effects include potential detours and local road closures, water quality turbidity and diversion, temporary losses of vegetation and habitat, increased air emissions, temporary loss of recreation amenities, and changes to esthetics. Environmental commitments would be implemented to lessen the severity of construction impacts as much as reasonably feasible. Some impacts to recreation and biological resources, for example, would be compensated for with temporary measures until the completion of the construction activities when recreational use of Wilderness Park trails could be reopened.

Long-term beneficial impacts would result from the restoration of the aquatic, wetland, and riparian habitats within the creek. Additional habitat would provide greater biodiversity and value for wildlife in the area, as well as provide other cumulative benefits, such as water attenuation for flood abatement, and esthetic improvement. Removal of non-native vegetation and replacing it with native plants would further increase wildlife habitat. Long-term impacts would occur with the Proposed Project, including changes in hydrology and water resources.

Secondary long-term benefits of restoration efforts would include improvements to esthetic quality, water quality, and recreation access and availability, especially to those populations that do not have equal availability of recreational opportunities. Ecological restoration would provide significant and long-term improvement in the condition of the creek for native wildlife populations that once occurred, and in doing so, would enhance the well-being of the human population that surrounds Aliso Creek.

Although there could be long-term adverse and significant impacts to cultural resources, these impacts would be minimized by implementation of ECs and through design refinements during PED. In addition, avoidance, minimization, and mitigation measures determined through the Section 106 consultation process would also be implemented.

In addition, the land use designation of the Wilderness Park would remain under the Subregion Plan in perpetuity. Recreation amenities would be improved for long-term use with additional trail amenities such as informational kiosks. Esthetics would improve with the restoration of native habitats supported by the restored hydrological regime and overall floodplain function. The long-term maintenance and enhancement productivity and beneficial effects of the Proposed Project would outweigh its potentially significant short-term uses and impacts to the environment.

5.23 IRREVERSIBLE AND IRRETRIEVABLE ENVIRONMENTAL COMMITMENT OF RESOURCES

NEPA regulations (40 C.F.R. § 1502.16) and CEQA Guidelines (Section 15126.2[c]) dictate that an EIS/EIR must consider irreversible or irretrievable commitments of resources. An irreversible commitment of a resource is one that, once committed to the proposed project, would continue to be committed throughout the life of the project (in this case, 50 years). An irretrievable commitment of resources refers to those resources that, once used, consumed, destroyed, or degraded during construction or operation, would cause the resource to be unavailable for use by future generations. Construction of the Proposed Project would include many features considered permanent, which may be deemed irreversible.

Construction of the Proposed Project, including associated support actions, would result in an irretrievable and irreversible commitment of natural resources through the direct consumption of fossil fuels and use of materials. The Proposed Project would also include features necessary to minimize future streambank erosion.

Also, some loss of production of certain resources, such as forage for wildlife, would occur during the time that these habitats are unavailable due to the project with the eradication of non-native vegetation and the restoration of the historic floodplain. This loss of foraging habitat would be minimized with natural recruitment or planting of native vegetation in other areas for wildlife foraging during the construction phase. There would be an irretrievable commitment of some non-recyclable building materials (gravel and cement) and fuel for construction equipment. An undetermined amount of energy (gasoline, diesel oil) would be spent on the Proposed Project, and for operation and maintenance. The Proposed Project would not result in offsets from other energy development.

Cultural resources, such as prehistoric sites, historic properties, and cultural landscapes are non-renewable resources. The preference is to avoid impacts to identified sites. However, a Programmatic Agreement would define a process for addressing any cultural resource sites eligible for or on the NRHP that cannot be avoided during proposed project construction. Inadvertent or accidental destruction of cultural resources during construction that might occur despite avoidance, minimization, or mitigation measures would be an irretrievable commitment of resources.

Use of human resources during construction would be an irreversible loss of labor supply for other projects. However, labor opportunities are desired in the Proposed Project area, and this use of human resources represents beneficial employment opportunities. Financial resources have already been obligated by the non-Federal sponsor, the Corps, and other resource agencies, for the planning and review of the Proposed Project. The expenditure of funds would continue throughout PED, permitting, and construction phases of the Proposed Project should the project be approved. Construction would require expenditure of non-Federal sponsor and Federal funds for the costs of construction. Resources to be committed if the Proposed Project is approved include expenditure of Federal and non-Federal sponsor funding, labor, energy, and project materials to build, operate, and maintain the proposed project. Such financial resources would not be available for other uses.

Long-term (up to 10 years post construction), the Adaptive Habitat Management Plan criteria and triggers would continue with minimum use of fuels and other resources as prescribed by Corps' implementation guidance and the requirements of the County of Orange Central and Coastal Subregion NCCP/HCP.

Long-term, the implementation of the Proposed Project to restore the historic floodplain and restore native habitat within the Proposed Project area would outweigh the commitment of these resources with a sustainable project that would be able to withstand climate change as well as provide long-term flood risk management within the Wilderness Park for the recreation use and quality of life of regional and local park users. Therefore, these benefits are expected to outweigh the commitment of these resources.

5.24 EFFECTS NOT FOUND TO BE SIGNIFICANT

CEQA Guidelines (Section 15128) require a brief discussion of various possible significant effects of a project that were determined to be not significant and not considered during the environmental analysis process. As stated in the CEQA Guidelines: "An EIR shall contain a statement briefly indicating the reason that various possible significant effects of a project were determined to not be significant and were therefore not discussed in detail in the EIR."

5.24.1 Agricultural and Forestry Resources

No significant impacts were identified with respect to conversion of prime farmland, unique farmland, or farmland of statewide importance to non-agricultural use or conflict with existing agricultural zoning or a Williamson Act contract. No impacts were identified that would involve other changes in the existing environment, which could result in the conversion of farmland to non-agricultural use or conversion of forest land to non-forest use.

5.24.2 Mineral Resources

No significant impacts were identified that would result in the loss of availability of a known mineral resource or the loss of a locally important mineral resource recovery site. Therefore, no impacts associated with mineral resources would occur.

5.24.3 Population and Housing

It is expected that Proposed Project construction jobs would be filled from the local labor force and would not cause people to move to the local area seeking employment. None of the alternatives would displace existing housing or substantial number of people, necessitating the construction of replacement housing elsewhere, because there is no existing housing or other residential use within the Proposed Project site. Therefore, none of the alternatives would induce substantial population or employment growth resulting in a need to construct replacement housing elsewhere. None of the alternatives propose to construct housing or extend infrastructure, such as new roads or utilities that would support the future construction of housing.

5.24.4 Public Services

The Wilderness Park is within a Local Responsibility Area, where fire protection is the responsibility of the OCFA, which provides regional fire protection, emergency medical services, rescue services and forest services, such as fighting wildfires and hazardous materials response to unincorporated Orange County. Orange County Park Rangers provide additional fire protection services within the Wilderness Park.

Increases in the demand for public services (such as fire protection, police protection, schools, parks, and libraries) typically are related to an increase in population. As described above under Population and Housing, none of the alternatives would result in short- or long-term population growth. Therefore, none of the alternatives would cause an increase in the requirements of any public service provider to respond to an increased resident population.

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CHAPTER 6 COORDINATION, CONSULTATION, AND COMPLIANCE*

6.1 PUBLIC INVOLVEMENT PROGRAM

Public involvement is a process by which interested parties and affected individuals, organizations, and government agencies are consulted and included in the decision-making process of a planning effort. In providing public service, the Federal role in water resources planning is to respond to what the public perceives as problems and opportunities and to formulate and select alternative plans that reflect public preferences. The Administrative Procedures Act and the NEPA, among other Federal laws and regulations, mandate public involvement. Federal planning policies and Corps' regulations and practices have consistently required and encouraged this practice. All this must occur, however, with the awareness that the Corps cannot relinquish its legislated decision-making responsibility.

The purpose of public involvement is to ensure that the Corps' and County's programs are responsive to the needs and concerns of the public. The objectives of public involvement are to provide information about proposed Corps and County activities to the public; to make the public's desires, needs, and concerns known to the decision makers; to provide for consultation with the public before decisions are reached; and to take into account the public's views in reaching decisions.

6.1.1 Public Scoping Meeting

A notice of intent (NOI) to prepare an EIS was published in the Federal Register on April 9, 2009, and a notice of preparation (NOP) of an EIR was issued on April 8, 2009, by the non-Federal sponsor, OCPW. A public scoping meeting was conducted for the purpose of seeking public input in the scope of the EIS/EIR document on May 7, 2009, in the City of Mission Viejo, several miles from the proposed project area. The general public, organizations with interest in the subject matter, local municipalities, state government agencies, Federal agencies, and Tribal Governments were invited to attend. The meeting was held at the Mission Viejo City Council Chambers, 200 Civic Center in Mission Viejo, California 92692.

The primary concerns identified in public comments at the scoping meeting and by written comments during the public comment period on the NOI and NOP include:

- Need for improved water quality of the creek, specifically as related to dry weather flows from development upstream of the Proposed Project area.
- Need for the installation of water retention and detention facilities to control dry weather flows, including cisterns and wetlands.
- Need to consider alternatives to engineered structures and use of manmade structures/materials, particularly within the Wilderness Park.
- Protect existing and/or promote the reestablishment of sensitive biological species (including southwestern pond turtle, tidewater goby, and steelhead).

- Protect archeological and historical resources within the Proposed Project area.

In addition to the issues listed above, many of the public scoping comments presented views and concerns that were outside of the Corps' or OCPW's authority, or otherwise did not directly influence the scope or content of the Proposed Project. Examples of these comments include statements in general support for or general opposition to the Proposed Project, criticism of the overall OCPW and Corps' watershed efforts within the Aliso Creek watershed, addressing the need for greater control of dry weather flows into the creek by upstream communities, and expressing the desire for a holistic multiagency and jurisdictional approach to address the watershed as a whole. The Corps considered and documented these concerns, but analysis of these issues is not discussed further. A list of attendees at the public scoping meeting and written comments provided in response to the NOI and NOP are provided in Appendix B-1.

6.1.2 Public Stakeholders Workshop

An all-day public workshop on stream restoration techniques and opportunities within the Proposed Project area was held on May 13, 2009. A Corps' stream restoration expert gave a presentation at the Laguna Niguel City Hall Council Chambers (27841 La Paz Road in Laguna Niguel, California 92677). Questions from the public on stream restoration in general and Aliso Creek specifically were addressed throughout the presentation. Following the presentation, the Corps and OCPW led a tour of the Proposed Project area. The presentation and tour were open to interested members of the public. A second workshop, Stream Restoration Techniques and Opportunities was held on the February 9 and 10, 2011. Additional stakeholder meetings were held on August 26, 2010, October 24, 2013, and December 10, 2014.

6.1.3 Agency and Public Review of Draft Report

The Draft IFR has been made available for agency and public review for 45 days. The Notice of Availability was published in the Federal Register on September 25, 2017. The list of recipients receiving notification is provided in Appendix B-1. The Public Review Meeting will be held within the 45-day review period, but no earlier than 10 days after distribution/circulation. Comments and responses are being solicited and will be included in the Final IFR.

6.1.4 Agency Review of Final Report

Following agency and public review of the Draft IFR, the Corps will review and respond to comments and revise the Draft IFR as necessary to address comments provided. The Final IFR will be prepared for state and agency review for a period of 30 days prior to the Record of Decision being finalized and signed by the Assistant Secretary for Civil Works (ASA (CW)).

6.2 AGENCY PARTICIPATION

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

During the Draft IFR process, coordination with the USFWS was conducted in accordance with the Fish and Wildlife Coordination Act. The Corps met with the USFWS and the CDFW on May 7, 2009, for an informal meeting to discuss the Proposed Project and survey methodologies and tour the Proposed Project area. Additional informal meetings have been held to discuss the biological reports prepared for this study (Appendix B-2 and B-3).

The Corps received a Planning Aid Letter (PAL) from the USFWS dated August 28, 2015 (Appendix B-10). The USFWS has acknowledged the value of restoring the streambed to pre-incision conditions, but is concerned that the Corps' alternatives would largely eliminate the existing riparian systems as a result of substantial channel and embankment grading, with too long of a lag time for habitat reestablishment. In addition to the Corps' formulated ecosystem plans, the USFWS suggested three alternatives for consideration in the PAL. The alternatives would leave the discontinuity at the ACWHEP structure and at Wood Canyon Creek confluence in place. Measures considered by the Corps upstream of AWMA Road Bridge are supported, but the USFWS advocates the implementation of long-term use of gravel augmentation practices to address balances in the sediment regime and reduction of the erosive effects of "hungry" water. The alternatives provided are conceptual, with no accompanying analysis. As a result, habitat evaluation or costs have not been developed. These alternatives were evaluated as part of the plan formulation process in a qualitative manner.

A field meeting with the USFWS was held on August 2, 2016. ESA Section 7(a)(2) consultation commenced informally February 2017. Discussion continues with the USFWS Carlsbad Ecological Field Office on the "may affect, but not likely to adversely affect" determination. Chapter 5 discusses the Corps effects determination on Federal listed taxa.

6.2.2 California Coastal Commission

Initial contact was made in early December 2016 for determination if the Proposed Project is in the coastal zone as identified by the California Coastal Commission (CCC). Initial response from the CCC indicated the coastal zone boundary crosses Aliso Creek slightly upstream of its intersection with Sulphur Creek. Upon review of a preliminary project description, the CCC determined a consistency determination will need to be prepared by the Corps and submitted to the CCC. The Coastal Act, Chapter 3 policies, that will need to be addressed include environmentally sensitive habitat and species, biological productivity and water quality, flood control, sediment transport, archaeological/paleontological/cultural resources, visual resources, and public access and recreation. After the CCC staff is able to review the Draft IFR for the Proposed Project, they will be able to provide more detailed comments on the Proposed Project and provide guidance in the preparation of the consistency determination. Further coordination will continue through the Draft IFR process.

6.2.3 California State Historic Preservation Office (SHPO)

The Corps has initiated consultation with the California SHPO via letter dated August 1, 2017, regarding project compliance with Section 106 of the National Historic Preservation Act (pursuant to 54 U.S.C. § 306108 and 36 C.F.R. Part 800). This letter is found in Appendix B-3. The SHPO is being provided the Draft IFR during the public review period and may provide comments.

6.2.4 California Department of Fish and Wildlife (CDFW, formerly the California Department of Fish and Game)

The Corps and OCPW will continue to coordinate with CDFW throughout the planning and CEQA process and construction activities. Also, the Corps will coordinate with CDFW relative to California listed species and Species of Special Concern. The CDFW may participate in a Federal Section 7 consultation, once initiated, and has the option to adopt the Federal Biological Opinion (BO) or to prepare its own BO. Depending on the results of the BO, a Section 2081 take permit may be required for the Proposed Project. The non-Federal sponsor would be responsible for applying for a Section 2081 take permit, as well as a 1601 Streambed Alternation Agreement, if required.

6.2.5 Habitat Evaluation Team

Habitat Evaluation Team (HET) meetings were held from late 2009 through 2015. HET members include the Corps, OCPW, USFWS, CDFW, U.S. Geological Survey (USGS), and NHI. Meetings were held on:

- November 19, 2009, meeting at Fairchild Library (Whittier College) with agencies to review historic aerial photos.
- August 10, 2014 at CDFW.
- December 11, 2014, site visit with USFWS.
- December 18, 2014, site visit with USGS.
- December 29, 2014, site visit with CDFW.

6.2.6 ACWHEP Agreement

Pursuant to an extensive period (2010 through 2012) of negotiations between the signatories of the ACWHEP Agreement, consisting of OCPW, Shea Properties (successor to Mission Viejo Company), USFWS, and CDFW, the parties agreed to terminate the ACWHEP agreement in its entirety, with no right of survivorship or other obligations. The termination agreement was signed October 2, 2012. OCPW will retain the existing restrictive covenant for the ACWHEP parcels in place, limiting the ACWHEP site to Aliso and Wood Canyons Wilderness Park (Wilderness Park) purposes. With the termination of the agreement, the ACWHEP was no longer precluded from consideration as part of the prospective Federal ecosystem restoration project.

6.3 ENVIRONMENTAL LAWS AND EXECUTIVE ORDERS

The status of the Proposed Project's compliance with applicable Federal, state, and local environmental requirements is summarized below. Prior to initiation of construction, the Proposed Project would be in full compliance with all applicable laws, regulations, and Executive Orders.

6.3.1 National Environmental Policy Act (NEPA) (42 U.S.C. § 4321, et seq.)

NEPA is the nation's primary charter for protection of the environment. It establishes national environmental policy, which provides a framework for Federal agencies to minimize environmental damage and requires Federal agencies to evaluate the potential environmental impacts of their proposed actions.

CEQ regulations for implementing NEPA, found at 40 C.F.R. Parts 1500-1508, establish the requirements and procedures by which Federal agencies fulfill their obligations under NEPA. The regulations also define such key terms as "cumulative impact," "mitigation," and "significant" (as it relates to impacts) to ensure consistent application of the terms in environmental documents.

Corps' guidance for implementing NEPA is provided in *Procedures for Implementing NEPA*, Engineer Regulation (ER) 200-2-2, March 1988, and at 33 C.F.R. Part 230. This regulation provides guidance for implementation of the procedural provisions of the NEPA for the Civil Works Program of the Corps. It supplements the CEQ regulations, in accordance with the CEQ regulations.

This document has been prepared to comply with the requirements of NEPA of 1969, the CEQ Regulations for Implementing the Procedural Provisions of NEPA, and the Corps' regulations. As specified in NEPA, reasonable alternatives were identified and evaluated, as presented in Chapters 3 and 4. Potential environmental effects were identified and environmental commitments were proposed to reduce any potentially significant impacts to a less-than-significant level where feasible. After the 45-day public review period, a Final IFR will be prepared in accordance with both NEPA and CEQA requirements. Full compliance with NEPA is achieved with the filing of the final EIS with USEPA and with the Corps' issuance of a Record of Decision.

6.3.2 Water Resources Development Act (WRDA), 2007

With the passing of the WRDA in 2007, Congress directed the Corps (and other Federal agencies) to put environmental protection and restoration first when planning water resources projects. This emphasis complements the sustainability approach taken by the Corps in developing and implementing water resources and ecosystem restoration projects. The WRDA encourages the conservation, development, and utilization of water and related land resources in conjunction with *the Environmental and Economic Guidelines for Water and Related Land Resources Implementation Studies.* The Proposed Project would be in compliance with WRDA.

6.3.3 Clean Water Act (CWA) (33 U.S.C. § 1251, et seq.)

Section 401 of the CWA requires every applicant for a Federal license or permit that may result in a discharge into navigable waters to obtain a State Water Quality Certification (Certification) or waiver that the proposed activity will comply with state water quality standards (i.e. beneficial uses, water quality objectives, and anti-degradation policy). The Santa Ana RWQCB issues section 401 Water Quality Certifications for activities within Orange County. Section 401 requires compliance with water quality standards. The Corps will continue to coordinate with the RWQCB throughout the remaining study, design, and construction phases of this Proposed Project. This Draft IFR contains sufficient information regarding water quality effects, including consideration of the Section 404(b)(1) Guidelines. Pending the issuance of the 401 certification by the RWQCB, the Proposed Project would be in compliance with section 401 of the CWA.

To comply with Section 402 of the CWA, coverage under the NPDES General Permit for Storm Water Discharges Associated with Construction and Land Use Disturbance Activities (Order No. 2010-0014-DWQ, as amended) would be obtained prior to construction. A SWPPP, which would establish best management practices for stormwater and non-stormwater source control and pollutant control, would be prepared and implemented by the construction contractor.

Section 404 of the CWA authorizes the Secretary of the Army acting through the Corps to issue permits for the discharge of dredged or fill materials into the waters of the United States, including wetlands at specified disposal sites. The selection and use of disposal sites must be in accordance with guidelines developed by the Administrator of the USEPA in conjunction with the Secretary of the Army and published in 40 C.F.R. Part 230 (known as the 404(b)(1) guidelines). The Corps does not issue permits to itself, but generally demonstrates compliance with Section 404 through a Section 404(b)(1) Water Quality Evaluation. Under the Section 404(b)(1) guidelines, the Corps shall examine practicable alternatives to the proposed discharge and permit only the Least Environmentally Damaging Practicable Alternative (LEDPA). In addition, the requirements and conditions of nationwide permits and regional permits may be applied to Corps projects and thus considered when addressing compliance under Section 404. A Section 404(b)(1) evaluation has been prepared and located in Appendix B-7. With implementation of the avoidance and minimization measures the proposed discharges of fill would be in compliance with Section 404 of the CWA.

6.3.4 Clean Air Act (42 U.S.C. § 7401, et seq.)

The 1977 Amendments to the Clean Air Act (CAA) enacted legislation to control seven toxic air pollutants. The EPA adopted National Emission Standards for Hazardous Air

Pollutants, which have been designed to control Hazardous Air Pollutants and emissions to prevent adverse health effects in humans.

1990 Amendments to the CAA determine the attainment and maintenance of NAAQS (Title I), motor vehicles and reformulation (Title II), hazardous air pollutant (Title III), acid deposition (Title IV), operating permits (Titles V), stratospheric ozone protection (Title VI), and enforcement (Title VII).

General Conformity. Under Section 176(c) of the CAAA of 1990, the Lead Agency is required to make a determination of whether a Proposed Federal action "conforms" to the SIP. Conformity is defined in Section 176(c) of the CAAA as compliance with the SIP's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of such standards. If the relevant air basin is in attainment for all NAAQS, it is presumed that the action conforms to the SIP. The Proposed Action would be exempt from performing a comprehensive Air Quality Conformity Analysis, and would be considered to be in conformity with the SIP, for air basins, which are not in attainment status (i.e., in maintenance or non-attainment status), if the total direct and indirect emissions from the Proposed Action are below the General Conformity Rule *de minimis* emission thresholds of a criteria pollutant or precursor as defined in 40 C.F.R. Part 93.153,

Potential air quality impacts have been assessed in Section 5.4. The section discusses the issues relative to the project's compliance with the EPA's adopted *de minimis* thresholds in its general conformity rule. The general conformity applicability analysis in Section 5.4 determined that project-related emissions under the NER/TSP are under the *de minimis* threshold for all pollutants. Therefore, a general conformity determination is not required.

For the Proposed Project, environmental commitments would be implemented to further minimize air quality impacts. The Proposed Project would have no long-term impacts on local or regional air quality. Full analysis is proved in Section 5.4. The Proposed Project would be in compliance with this Act.

6.3.5 Noise Control Act (42 U.S.C. § 4901, et seq.)

The Noise Control Act of 1972 establishes a national policy to promote an environment free from noise that jeopardizes their health and welfare. Noise generated by any activity, which may affect human health or welfare on Federal, state, county, local, or private lands must comply with noise limits specified in the Noise Control Act of 1972. There are no Federal noise standards that directly regulate environmental noise related to the construction or operational activities associated with the Proposed Project. Primary responsibility for control of noise rests with state and local governments, although the USEPA is directed by Congress to coordinate the programs of all Federal agencies relating to noise research and noise control.

The Proposed Project would result in temporary construction-related noise emissions. The Corps would further reduce noise impacts through implementation of environmental commitments. Operation and maintenance of the Proposed Project would not alter the existing noise environment, as typical operation and maintenance activities would remain unchanged. The Proposed Project would be in compliance with this Act.

6.3.6 U.S. Fish and Wildlife Coordination Act (16 U.S.C. § 661, et seq.)

This Act requires Federal agencies to consult with the USFWS and the fish and wildlife agencies of states where the "waters of any stream or other body of water are proposed or authorized, permitted or licensed to be impounded, diverted or otherwise controlled or modified" by any agency under a Federal permit or license. Consultation is to be undertaken for the purpose of "…preventing loss of and damage to wildlife resources." The intent is to give fish and wildlife conservation equal consideration with other purposes of water resources development projects. The Corps received a PAL from the USFWS on August 2015 (Appendix B-10). The Proposed Project would be in compliance with this Act.

6.3.7 Endangered Species Act (ESA) (16 U.S.C. § 1531, et seq.)

The ESA protects threatened and endangered species, as listed by the USFWS, from unauthorized take, and directs Federal agencies to ensure that their actions do not jeopardize the continued existence of such species. Section 7 of the Act defines Federal agency responsibilities for consultation with the USFWS. The Act requires preparation of a Biological Assessment to address the effects on listed and proposed species of a project.

ESA, Section 7 Consultation. Section 7 of the Endangered Species Act (Act) [16 U.S.C. 1531 et seq.] outlines the procedures for Federal interagency cooperation to conserve Federally listed species and designated critical habitats. Section 7(a)(1) directs all Federal agencies to utilize their authorities in furtherance of the purposes of the Act by carrying out programs for the conservation of species listed pursuant to the Act. This section of the Act makes it clear that all Federal agencies should participate in the conservation and recovery of listed threatened and endangered species.

Section 7(a) (2) states that each Federal agency shall ensure, in consultation that any action they authorize, fund, or carry out is not likely to jeopardize existence of a listed species or result in the destruction or adverse critical habitat. In fulfilling these requirements, each agency is to use the best scientific and commercial data available. This section of the Act defines the consultation further developed in regulations promulgated at 50 C.F.R. §402. Although it is the responsibility of the USFWS to make the determination of jeopardy or destruction/adverse modification in the biological opinion, action agencies and applicants should be fully informed and involved in the development of Reasonable and Prudent Alternatives, Reasonable and Prudent Measures, and Terms and Conditions to minimize the impacts of incidental take. Biologists should be creative in problem solving and look for ways to conserve listed species while still accommodating project goals. By law, Section 7 consultation is a cooperative effort involving affected parties engaged in analyzing effects posed by proposed actions on listed species or critical habitat(s). Latitude exists within Section 7 to work with applicants and agencies during this analytical process.

ESA, Section 9. Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or to attempt to engage in any such conduct. Harm is further defined by the USFWS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering. Harass is defined by the USFWS as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The USFWS will not refer the incidental take of any migratory bird or bald eagle for prosecution under the Migratory Bird Treaty Act (MBTA) of 1918, as amended (16 U.S.C. §§ 668- 668d), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein. The Corps has a continuing duty to regulate the activity that is covered by an incidental take statement. If the Corps fails to require the local sponsor and/or their contractors to adhere to the terms and conditions of the incidental take statement through enforceable terms, and/or fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

ESA Section 7(a)(2) consultation commenced informally February 2017. Discussion continues with the USFWS Carlsbad Ecological Field Office on the “may affect, but not likely to adversely affect” determination. Chapter 5 discusses the Corps’ effects determination on Federal listed taxa.

6.3.8 Migratory Bird Treaty Act (16 U.S.C. § 715, et seq.)

The MBTA decrees that all migratory birds and their parts (including eggs, nests and feathers) are fully protected. Almost all native birds are covered by this Act and any bird listed in wildlife treaties between the United States and several countries, including Great Britain, Mexican States, Japan, and countries once part of the former Soviet Socialist Republics. Under the MBTA, taking, killing, or possessing migratory birds is unlawful. Projects that are likely to result in the taking of birds protected under the MBTA will require the issuance of take permits from the USFWS. Activities that would require such a permit would include, but not be limited to, the destruction of migratory bird nesting habitat during the nesting season when eggs or young are likely to be present. To comply with the MBTA, vegetation clearing would be completed outside of the nesting season for migratory birds (February 1 through August 15). The Proposed Project would be in compliance with this Act.

6.3.9 Neotropical Migratory Bird Conservation Act

The purpose of the Act is to perpetuate and conserve healthy populations of neotropical migratory birds including maintenance, protection, and restoration of their habitats. The Proposed Project would be in compliance with this Act. The least Bell's vireo is a neotropical species, therefore restoration of riverine habitat would comply with the Act.

6.3.10 North American Wetlands Conservation Act

Section 9 of the Act directs Federal agencies to cooperate with USFWS to restore, protect, and enhance wetland ecosystems and other habitats for migratory birds, fish and wildlife to the extent consistent with its mission. With the restoration of the historic floodplain and restoration of riverine habitat, the Proposed Project would be in compliance with this Act.

6.3.11 Coastal Zone Management Act (CZMA) (16 U.S.C. § 1451, et seq.)

The purpose of the Act is to preserve, protect, develop where possible, and restore and enhance the Nation's coastal zone resources. Section 307 of the Act states that Federal actions must be consistent with the enforcement policies of approved state coastal management programs to the maximum extent practicable. It additionally encourages and assists states in their responsibilities in the coastal zone through development and implementation of management programs. The California Coastal Act of 1976, as amended, protects and enhances coastal resources within the California Coastal Zone, including, but not limited to public coastal access, recreation, the marine environment, land resources and development. California's coastal management program was implemented by the California Coastal Act of 1976. This Act is the state's approved coastal management program applicable to the Proposed Project. To document the degree of consistency with the state program, CZMA requires the preparation of a Coastal Consistency Determination (CCD) whenever a project may directly affect the coastal zone. A CCD will be submitted for review to the CCC in order to comply with the requirements of these acts. The Proposed Project would be in compliance with this Act.

6.3.12 National Historic Preservation Act (54 U.S.C. § 300101, et seq.)

The impacts of Federal undertakings on cultural resources are formally assessed through a separate process mandated by the NHPA of 1966 as amended (54 U.S.C. Section 300101) and its implementing regulations, Protection of Historic Properties (36 CFR 800). Section 106 of the NHPA and the Part 800 regulations describe the process for identifying and evaluating historic properties, for assessing the effects of Federal actions on historic properties, and for consulting to avoid, minimize, or mitigate for adverse effects.

Historic properties are cultural resources that are either "included in" or are eligible for inclusion in the NRHP. The Section 106 process does not require historic properties to be preserved, but ensures that the decisions of Federal agencies concerning treatment of these places result from meaningful consideration of cultural and historic values and the options available to protect the properties.

The Corps has initiated consultation with the SHPO via letter on August 1, 2017, regarding the Corps' APE and has requested that the SHPO work with the Corps to develop a Programmatic Agreement (PA) that lays out how the Corps would satisfy its requirements under Section 106. The Corps has also concurrently notified the Juaneño Band of Mission Indians, the Juaneño Band of Mission Indians Acjachemen Nation, and the Pauma Band of Luiseño Indians Tribes about the project and requested their participation in the development of the PA. The Proposed Project would be in compliance with this Act.

6.3.13 Native American Graves Protection and Repatriation Act (25 U.S.C. § 3001, et seq.)

The Act establishes rights of Indian tribes and Native Hawaiian organizations to claim ownership of certain cultural items, including human remains, funerary objects, sacred objects, and objects of cultural patrimony. Permits for the excavation or removal of cultural items protected by the act require Native American consultation, as do discoveries of cultural items found on, or taken from Federal or tribal lands, and requires repatriation of cultural items controlled by Federal agencies or museums receiving Federal funds. This Proposed Project would be in compliance with this Act.

6.3.14 Farmland Protection Policy Act (7 U.S.C. § 4201, et seq.)

There are no designated prime or unique farmlands within the study area; therefore, there would be no adverse effects to farmland and the Proposed Project would be in compliance with this Act.

6.3.15 Federal Water Project Recreation Act (16 U.S.C. § 460l-12, et seq.)

The Federal Water Project Recreation Act requires that any Federal water project must give full consideration to opportunities afforded by the Proposed Project for outdoor recreation and fish and wildlife enhancement. Implementation of the Proposed Project includes resurfacing existing trails and educational kiosks as part of the recreation element of all Action Alternatives. Therefore the Proposed Project would be in compliance with this Act.

6.3.16 National Trails System Act (16 U.S.C. § 1241, et seq.)

The Act authorized creation of a national trail system comprised of National Recreation Trails, National Scenic Trails, and National Historic Trails. National Recreation Trails may be designated by the Secretary of Interior or the Secretary of Agriculture to recognize exemplary trails of local and regional significance in response to an application from the trail's managing agency or organization. The Act acknowledges the increasing popularity of outdoor recreation and the need to promote access to and enjoyment of outdoor areas, both urban and more remote areas. In 2012 the Secretary of the Interior granted National Recreation Trail status to the Aliso Creek Regional Bikeway, Riding and Hiking Trail. With the resurfacing of the main existing trail, the Proposed Project would be in compliance with this Act.

6.3.17 Occupational Safety and Health Act (29 U.S.C. § 651, et seq.)

The Occupational Safety and Health Act was enacted to ensure safe and healthful conditions for working men and women. The Act created the Occupational Safety and Health Administration (OSHA) at the Federal level and provided that states could run their own safety and health programs as long as those programs were at least as effective as the Federal program. Under the Act, OSHA has adopted regulations designed to protect workers against the effects of occupational noise exposure. These regulations list permissible noise level exposure as a function of the amount of time during which the worker is exposed. The regulations further specify a hearing conservation program that involves monitoring the noise to which workers are exposed, ensuring that workers are made aware of overexposure to noise, and periodically testing the workers' hearing to detect any degradation. In addition, the Act specifies requirements for a workplace free from serious recognized hazards, including employee training, availability of safety equipment, accident prevention programs, and hazardous substance exposure warnings. Implementation of the Proposed Project would be in compliance with the Act, and these regulations, as all applicable working condition requirements, would be followed.

6.3.18 Resource Conservation and Recovery Act (42 U.S.C. § 6901, et seq.)

The Resource Conservation and Recovery Act directs the EPA to administer a regulatory program that extends from the manufacture of hazardous materials to their disposal, thus regulating the generation, transportation, treatment, storage, and disposal of hazardous waste at all facilities and sites in the nation. No materials classified as hazardous are proposed to be used for construction of the Proposed Project. The Proposed Project would be in compliance with the Act.

6.3.19 Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. § 9601, et seq.)

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) provided the USEPA with the authority to identify and clean-up contaminated hazardous waste sites. In 1986, the act was amended by the Superfund Amendment and Reauthorization Act Title III (community right-to-know laws). Title III states that past and present owners of land contaminated with hazardous substances can be held liable for the entire cost of the cleanup, even if the material was dumped illegally when the property was under different ownership (also known as Superfund).

Individual states may implement hazardous waste programs under the Resource Conservation and Recovery Act (RCRA) with approval of the EPA. California has not yet received this approval; instead, the California Hazardous Waste Control Law (HWCL) is administered by the CALEPA to regulate hazardous wastes. While the HWCL is generally more stringent than RCRA, until the USEPA approves the California program, both the state and Federal laws apply in California. CERCLA also contains enforcement provisions for the identification of liable or responsible parties. It details the legal claims that arise under the statute, and provides guidance on settlements with the USEPA. Section 120 of CERCLA addresses hazardous waste cleanups at Federal facilities, and requires the creation of a Federal Agency Hazardous Waste Compliance Docket, which lists facilities that have the potential for hazardous waste problems.

During implementation (construction and operation/maintenance) of the Proposed Project conformance with CERCLA would only be engaged if unforeseen waste is found or abandoned onsite in the future. The Proposed Project is in compliance with this Act.

6.3.20 Energy Policy and Conservation Act (42 U.S.C. § 6201, et seq.)

The Energy Policy Act of 1975 was established in response to the oil crisis of 1973, which increased oil prices due to a shortage of reserves. The Act required that all vehicles sold in the United States meet certain fuel economy goals. Since 1990, the fuel economy standard for new passenger cars has been 27.5 miles per gallon. Since 1996, the fuel economy standard for new light trucks (gross vehicle weight of 8,500 pounds or less) has been 20.7 miles per gallon. Heavy-duty vehicles (i.e. vehicles and trucks over 8,500 pounds gross vehicle weight) are not subject to fuel economy standards. The Act applies to the Proposed Project due to its requirements for increased fuel economy standards, particularly for the construction equipment to be used to cut and fill the incised creek, move excess soil for disposal, bring material to the site including native plants for restoration of habitat, and grade and restore existing road and trails. During construction and operations/maintenance activities, the requirements of the Act would be followed. The Proposed Project would be in compliance with this Act.

6.3.21 Energy Insurance and Security Act

Section 438 of the Act establishes strict stormwater requirements for Federal projects with a footprint greater than 5,000 square feet shall use planning, design, construction, and maintenance strategies for the property to maintain or restore to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to temperature, rate, volume, and duration of flow. The Proposed Project would restore the pre-incised creek, therefore there would be no increase in creek hydrology.

6.3.22 Magnuson-Stevens Fishery Management and Conservation Act, as amended

The purpose of the Act is to conserve and protect the fisheries resources of the coasts of the United States, the anadromous species, and Continental Shelf species of the U.S. The

Project is not located within an area designated as essential fish habitat, therefore the Act is not applicable.

6.3.23 Executive Order (EO) 11514, Protection and Enhancement of Environmental Quality, amended by Executive Order 11991, Relating to Protection and Enhancement of Environmental Quality

This EO mandates that the Federal government provide leadership in protecting and enhancing the quality of the nation's environment to sustain and enrich human life. Federal agencies must initiate measures needed to direct their policies, plans, and programs so as to meet national environmental goals. Corps regulations advocate early NEPA preparation and require impact statements to be concise, clear, and supported by evidence that the Corps has made the necessary analyses. This Draft IFR has been prepared to comply with the EO, and the Proposed Project would be consistent with the EO.

6.3.24 Executive Order No. 11593, Protection and Enhancement of the Cultural Environment

This EO directs Federal agencies to inventory cultural properties under their jurisdiction, to nominate to the National Register all Federally-owned properties that meet the criteria, to use due caution until the inventory and nomination processes are completed, and to ensure that Federal plans and programs contribute to preservation and enhancement of non-Federal properties. The Proposed Project would be consistent with the EO.

6.3.25 Executive Order 11988, Floodplain Management

EO 11988, Floodplain Management, signed 24 May 1977, revoked and replaced Executive Order 11296 issued 10 August 1966. EO 11988 requires Federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of natural floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. In accomplishing this objective, "each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by flood plains in carrying out its responsibilities." To comply with EO 11988, projects are formulated and recommended that, to the extent possible, avoid, minimize and/or mitigate adverse effects associated with use of the floodplain, and avoid inducing incompatible development in the floodplain unless there is no practicable alternative. Under the EO, the Corps is required to provide leadership and take action to:

a. Avoid development in the base floodplain unless it is the only practicable alternative.
b. Reduce the hazard and risk associated with floods.
c. Minimize the impact of floods on human safety, health and welfare.
d. Restore and preserve the natural and beneficial values of the base floodplain.

The Water Resources Council Floodplain Management Guidelines for implementation of EO 11988 as referenced in the Engineer Regulation 1165-2-26, 30 March 1984, identify an eight-step process to determine how projects would have potential impacts to or within the floodplain. Each of the eight steps are discussed below. As described in this guidance, if a proposed action is located within the base floodplain (Step 1), where the "base floodplain" is the area which has a one percent or greater chance of flooding in any given year (also referred to as the "100-year Flood Zone," "Flood Hazard Area," or "0.1 Exceedance Area"), agencies should conduct early public review (Step 2), identify and evaluate practicable alternatives to locating in the base floodplain (Step 3), identify impacts of the proposed action (Step 4), develop measures to minimize the impacts and restore and preserve the floodplain, as appropriate (Step 5), reevaluate alternatives (Step 6), and present the findings and a public explanation (Step 7), with the final step being to implement the action (Step 8) (FEMA 2012).

1. *Determine if the proposed action would be in the base (1 percent ACE or 100-year) floodplain.*

The Proposed Project is located within the defined base floodplain.

2. *If the proposed action would be in the base floodplain, identify and evaluate practicable alternatives to the action or to locating the action in the base floodplain.*

The floodplain for the Proposed Project area is established by the existing incised channel and surrounding area of the Wilderness Park that is inundated during a one percent exceedance. As described in ER 1165-2-26, it is the policy of the Corps to formulate projects, which to the extent possible, avoid or minimize adverse impacts associated with use of the base floodplain and avoid inducing development in the base floodplain unless there is no practicable alternative. The Proposed Project is the restoration of the historic floodplain by raising the creek invert and restoring aquatic and riparian habitat. There are no other practicable alternatives the meet the purpose and need of the Proposed Project.

3. *If the action must be in the floodplain, advise the general public in the affected area and obtain their views and comments.*

Federal, state, and local agencies and the general public were informed of the Proposed Project including its location in the base floodplain. A NOI was published in Federal Register on April 9, 2009, and a NOP of an EIR was issued on April 8, 2009, by the non-Federal sponsor, OCPW. A public scoping meeting was conducted on May 7, 2009, in the City of Mission Viejo, several miles from the Proposed Project area. The general public, local municipalities, state government agencies, Federal agencies, and Tribal Governments were invited to attend. The meeting was held at the Mission Viejo City Council Chambers (200 Civic Center in Mission Viejo, California 92692). In addition, this Draft IFR is being circulated for public review and comment.

4. *Identify beneficial and adverse impacts due to the action and any expected losses of natural and beneficial floodplain values. Where actions proposed to be located outside the base floodplain will affect the base floodplain, impacts resulting from these actions should also be identified.*

While construction of project features would result in mostly minor and temporary impacts to the natural environment, as fully described in Chapter 5, the proposed restoration would result in a substantial and long-term increase in habitat values, including an increase in the quantity and quality of riparian and aquatic habitat. The Proposed Project would also restore natural and beneficial floodplain functions which had been lost to creek incision.

5. *If the action is likely to induce development in the base floodplain, determine if a practicable non-floodplain alternative for the development exists.*

The Proposed Project does not include construction of any new, permanent housing or commercial activities, and is not expected to induce any new residential or commercial growth. The Central and Coastal Subregion of the NCCP/HCP also limits development within the Wilderness Park. A deed restriction placed on it in 2001 limits it to county park uses in perpetuity.

6. *As part of the planning process under the Principles and Guidelines, determine viable methods to minimize any adverse impacts of the action including any likely induced development for which there is no practicable alternative and methods to restore and preserve the natural and beneficial flood plain values. This should include reevaluation of the "no action" alternative.*

During the environmental analysis of the Proposed Project, wherever there were potential adverse impacts by the Proposed Project, appropriate environmental commitments were identified. The Proposed Project would not induce development in the floodplain. The Proposed Project is site-specific and would not aggravate current hazards of the floodplain and would not disrupt the natural and beneficial floodplain values. The "no action" alternative was carried through the entire assessment and selection process.

7. *If the final determination is made that no practicable alternative exists to locating the action in the floodplain, advise the general public in the affected area of the findings.*

The Draft IFR is being released for public review, the release posted by EPA in the Federal Register, and a public meeting will be held to receive comments on the Draft IFR. Comments received will be responded to and included in the Final IFR.

8. *Recommend the plan most responsive to the planning objectives established by the study and consistent with the requirements of the Executive Order 11988.*

Based on the above decision-making process, it has been determined that the Proposed Project would be in compliance with Executive Order 11988. The Proposed Project would have no adverse effects on floodplain function or values, and the Tentatively Selected Plan (Alternative 3.6) is recommended as the most responsive option to planning objectives and requirements established by EO 11988, as amended.

6.3.26 Executive Order 11990, Protection of Wetlands

Under EO 11990, Federal agencies shall take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agencies' responsibilities. Wetland vegetation within the Proposed Project area would be cleared prior to raising the creek bed to its historic elevation and restoring natural stream process that would provide beneficial impacts to sensitive wildlife; therefore, the Proposed Project would be in compliance with the EO.

6.3.27 Executive Order 12088, Federal Compliance with Pollution Control Standards

Under EO 12088, Federal agencies are required to ensure compliance of agency decisions with all applicable pollution control standards, laws, and regulations, including but not limited to the following: Toxic Substances Control Act; Federal Water Pollution Control Act; Public Health Service Act; Clean Air Act; Noise Control Act of 1972; Solid Waste Disposal Act; Radiation guidance pursuant to Section 274(h) of the Atomic Energy Act of 1954; Marine Protection, Research, and Sanctuaries Act of 1972; and Federal Insecticide, Fungicide, and Rodenticide Act. The head of each Executive agency is responsible for ensuring that all necessary actions are taken for the prevention, control, and abatement of environmental pollution with respect to Federal facilities and activities under control of the agency. Implementation of the Proposed Project would be in compliance with this EO as the Proposed Project would be in compliance with the laws listed above.

6.3.28 Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

This EO states that Federal agencies are responsible for conducting their programs, policies, and activities that substantially affect human health of the environment in a manner that ensures such programs, policies, and activities do not have the effect of excluding persons from participation, denying persons' benefits, or subjecting persons to discrimination because of their race, color, or national origin. The objectives of this EO include identifying and addressing disproportionately high and/or adverse impacts of Federal programs, policies, or activities on minority and/or low-income populations. The required analysis has been conducted, and no disproportionately high and/or adverse impacts to minority and/or low-income populations have been identified. Additional information is provided in Section 0. The Proposed Project would be in compliance with this EO.

6.3.29 Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks

EO 13045 requires Federal agencies to the extent permitted by law and within its mission to make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children and shall ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks. These risks arise because children's neurological, immunological, digestive, and other bodily systems are still developing; children eat more food, drink more fluids, and breathe more air in proportion to their body weight than adults; children's size and weight may diminish their protection from standard safety features; and children's behavior patterns may make them more susceptible to accidents because they are less able to protect themselves. The Proposed Project would not disproportionately impact children. Potential impacts were identified with regard to biology, air quality, esthetics, noise, transportation, and recreational uses. Environmental commitments were identified to reduce these potential impacts. While there was no specific study conducted to assess impacts to children, there is no indication that any impacts would disproportionately affect children. The Proposed Project would be in compliance with the EO.

6.3.30 Executive Order 13112, Invasive Species and Landscaping

The EO directs Federal agencies to expand and coordinate their efforts to combat the introduction and spread of plants and animals not native to the United States. Requirements are to prevent the introduction of invasive species; provide for their control; and take measures to minimize economic, ecological, and human health effects. This Proposed Project includes removal of invasive species and habitat restoration with native plants and efforts to prevent the reestablishment of invasive plant species. The Proposed Project would be in compliance with the EO.

6.3.31 Executive Order 13175, Consultation and Coordination with Indian Tribal Governments

The EO further defines and clarifies the government-to-government relationship with Federally-recognized tribes and consultation requirements for Federal actions. The Corps has initiated consultation with local Tribes as described in Section 6.3.13. The Proposed Project would be consistent with the EO.

6.3.32 Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds

The EO directs Federal agencies to take action to implement the MBTA within the provisions of its mission. Restoration of riverine habitat during implementation of the Proposed Project and the creation of additional habitat suitable for migratory birds would be consistent with the EO.

6.3.33 Executive Order 13195, Trails for America in the 21st Century

The EO directs Federal agencies to the extent permitted by law and where practicable to protect, connect, promote, and assist trails of all types. The existing trail within the Wilderness Park would be resurfaced as an element of the Proposed Project. The Proposed Project would be consistent with the EO.

6.4 CORPS' REGULATIONS AND POLICIES

6.4.1 Engineer Regulation 200-1-5, Policy for Implementation and Integrated Application of the USACE Environmental Operating Principles (EOP) and Doctrine

The Corps has reaffirmed its commitment to environmental stewardship by formalizing a set of "Environmental Operating Principles" applicable to all its decision-making and programs. By implementing these principles, the Corps will continue its efforts to develop the scientific, economic, and sociological measures to judge the effects of its projects on the environment and to seek better ways of achieving environmentally sustainable solutions. The Engineer Regulation (ER) 200-1-5 highlights the Corps' role and responsibilities for sustainability, preservation, stewardship, and restoration of our Nation's natural resources a based on the premise that through the restoration and maintenance of environmental health and productivity, both economic development and social equity can be achieved.

Engineer Manual 1110-2-38, *Environmental Quality in Design of Civil Works Projects*, directs the avoidance, destruction, or degradation of natural habitats while preserving and enhancing the natural environment in a manner that fosters and promotes the general welfare of man and nature to exist in harmony. The objective is to fulfill social, economic, and other requirements of present and future generations of Americans. Full description of the Corps' compliance with the EOPs is found in Section 4.6.

6.4.2 Engineer Regulation 200-2-2, Procedures for Implementing NEPA

This regulation provides guidance for implementation of the procedural provisions of NEPA for the Civil Works Program of the Corps. It supplements CEQ regulations 40 C.F.R. Parts 1500-1508, in accordance with the CEQ regulations. Wherever the guidance in this regulation is unclear or not specific, the reader is referred to the CEQ regulations. This regulation is applicable to all Corps responsibility for preparing and processing environmental documents in support of civil works functions. Full compliance with NEPA is achieved with the filing of the final EIS with USEPA and with the Corps' issuance of a Record of Decision. The Proposed Project would be consistent with the ER.

6.4.3 Engineer Regulation 1105-2-100, *Planning Guidance Notebook,* as amended

ER 1105-2-100 provides guidance for conducting Civil Works planning studies and related programs by the Corps. Guidance provided in this regulation has been followed in the preparation of this Draft IFR. The Proposed Project would be consistent with the ER.

6.4.4 Engineer Manual 1110-2-38, Environmental Quality in Design of Civil Works Projects

This Engineer Manual (EM) directs the avoidance, destruction, or degradation of natural habitats while preserving and enhancing the natural environment in a manner that fosters and promotes the general welfare of man and nature to exist in harmony. The objective is to fulfill social, economic, and other requirements of present and future generations of Americans. The Proposed Project is consistent with the EM.

6.5 STATE

6.5.1 California Environmental Quality Act (CEQA)

CEQA establishes requirements and procedures for state and local agency review of the environmental effects of projects proposed within their jurisdictions. It further requires that agencies, when feasible, avoid or reduce the significant environmental impacts of their decisions. CEQA requires the preparation of an Initial Study (IS) to determine if a project may result in significant effects on the environment. If there is substantial evidence in record that support a fair argument that significant effects may occur, an EIR will be prepared. A Negative Declaration or Mitigated Negative Declaration shall be prepared if there is no substantial evidence that the project may have a significant effect on the environment, or if revision in the project would avoid or mitigate the effects that would result in no significant effects In some cases, a joint EIS/EIR is prepared to comply with both NEPA and CEQA for projects that are cost-shared by Federal and non-Federal agencies.

6.5.2 Guidelines for the Implementation of the California Environmental Quality Act (Section 15000 et seq. of the California Public Resources Code)

The CEQA Guidelines stipulate that a public agency shall prepare or have prepared a proposed negative declaration or mitigated negative declaration for a project subject to CEQA when: (a) The initial study shows that there is no substantial evidence, in light of the whole record before the agency, that the project may have a significant effect on the environment, or (b) the initial study identifies potentially significant effects, but: (1) Revisions in the project plans or proposals made by, or agreed to by the applicant before a proposed mitigated negative declaration and initial study are released for public review would avoid the effects or mitigate the effects to a point where clearly no significant effects would occur, and (2) there is no substantial evidence, in light of the whole record before the agency, that the project as revised may have a significant effect on the environment.

EIRs are required to discuss potential energy impacts of proposed actions, with emphasis on avoiding or reducing inefficient, wasteful, or unnecessary energy consumption. NEPA directs that an EIS should include energy requirements and potential mitigation measures (40 C.F.R. § 1502.16(e)). Energy requirements of the project primary includes fuel for transport and construction vehicles. To reduce inefficient, wasteful, or unnecessary energy consumption, the use of low-emission vehicles, as described in the Air Quality environmental commitments, is required, as listed in Section 5.4.5.

In accordance with the provisions of CEQA, reasonable alternatives to implement the Proposed Project have been considered during the planning process and potential environmental effects have been included in the evaluation of this project.

CEQA requires state and local agencies to disclose and consider the environmental impacts of their actions. It further requires that agencies, when feasible, avoid or reduce the significant environmental impacts of the implementation of their action. Therefore, this document meets the goal, policies, and requirements of CEQA.

6.5.3 California Clean Air Act (CCAA)

The CCAA, signed into law in 1988, provides the framework for air quality planning regulation and denotes the state's air quality goals, planning mechanisms, regulatory strategies, and standards of progress. Prior to the CCAA, Federal law contained only comprehensive planning framework.

The CCAA establishes requirements for various California air districts to attain state ambient air quality standards within a practicable date and develop attainment plans for meeting state standards to ozone, carbon monoxide, sulfur dioxide, and nitrogen dioxide. Attainment plans for the listed chemicals were required by July 1991.

The CARB is the California lead agency for air quality and is responsible for upholding and attainment of air quality standards, climate change programs, and the enforcement of motor vehicle pollution control programs, greenhouse gas (GHG) statewide emission estimates and goals, and development and enforcement of GHG emission reduction. As detailed in Section 5.4, the Proposed Project would comply with this Act.

6.5.4 California Seismic Hazards Mapping Act (SHMA)

The 1990 SHMA (Section 2690-2699.6 of the Public Resource Code) provides the Department of Conservation direction in identifying and mapping areas that may be prone to liquefaction, earthquake-induced landslides, and amplified ground shaking. The purpose of the SHMA is to minimize the loss of life and property by identifying, evaluating, and mitigating seismic hazards, including withholding development permits until geologic or soils investigations are conducted within specified areas and are provided with measures to reduce such hazards. Known faults within Orange County include the Newport-Inglewood and San Joaquin Hills faults. The main fault line that would potentially affect cities within Orange County is the Newport-Inglewood Fault with an estimate magnitude of 6.0 to 7.4 on the Richter scale. Its last major rupture was in 1933 with a magnitude of 6.4 with no surface rupture. Based on the proposed improvements to stability of the creek, including improvements to address erosion and landslides, the Proposed Project would minimize loss of life and property due to seismic hazards and would be consistent with this Act.

6.5.5 Executive Order S-3-05

Governor's EO S-3-05, signed in 2005, established targets to achieve GHG emissions reduction, established the Climate Action Team, and directs the CALEPA Secretary to coordinate the efforts in reduction of GHG emissions, report progresses, impacts, and mitigation plans to the Governor and Legislature. The EO proposed to reduce GHG emissions to 2000 levels by 2010, 1990 levels by 2020, and 80 percent below 1990 by 2050.

Assembly Bill (AB) 32 was signed into law in 2006 that provided authority to implement a cap and trade system to meet the 2020 goals. An intermediate target was signed under EO B-30-15 by reduction of GHG emissions below 1990 levels by 2030. As detailed in Section 5.5, the Proposed Project would be consistent with this EO.

6.5.6 Williamson Act and Farmland Security Zone Act

Williamson Act, also known as the California Land Conservation Act, was enacted in 1965 to preserve agricultural and open land space by allowing landowners to privately contract with counties and cities to restrict the conversion of their land to uses that are not compatible to agricultural and open space purposes. A benefit under the contract allows landowners to receive property tax assessments that are lower due to their farming and open space uses, as opposed to full market value.

The Farmland Security Zones (FSZ), established by the Williamson Act, is an agricultural preserve area developed by a board of supervisors at the request of the landowner(s). The area defines the boundary within which a city or county will enter a Williamson Act contract agreement with the landowners. FSZ landowners receive property tax reductions as benefits and restricts the preserved land to agricultural or open space uses for a minimum of 20 years, while contracts under the Act are at a 10-year minimum term. All counties offer Williamson Act contracts except Del Norte, San Francisco, Inyo, and Yuba as of 2013. The County of Orange has predominantly urban and built-up lands with dispersed areas that are designated as prime farmland, unique farmland, and farmland of statewide importance. There are no designated prime or unique farmlands within the study area; therefore, there would be no adverse effects to farmland and the Proposed Project would be in compliance with this Act.

6.5.7 California Water Code/Porter Cologne Act

California's primary statute governing water quality and water pollution issues is the Porter-Cologne Water Quality Control Act. With numerous amendments and additions since initial adoption, it established comprehensive programs to ensure protection of water quality and the beneficial uses of water such as surface waters, wetlands, and groundwater. The Act grants the California SWRCB and nine RWQCBs broad powers to protect water quality and is the primary vehicle for implementation of California's responsibilities under the Federal CWA. The Act requires the adoption of water quality control plans for water pollution management in California. Statewide water quality control plans, or regional water quality control plans (basin plans) are required to be updated as necessary. The Act provides protection of water quality within the state of California, of which SWRCB has jurisdiction on nine regions. The Santa Ana RWQCB Region 8 and San Diego RWQCB Region 9 cover various cities within Orange County. The Act grants the SWRCB and the RWQCBs authority and responsibility to adopt plans and policies, to regulate discharges to surface and groundwater, to regulate waste disposal sites and to require cleanup of discharges of hazardous materials and other pollutants. The Act also establishes reporting requirements for unintended discharges of any hazardous substance, sewage, or oil and petroleum product. The potential effects of the Proposed Project on water quality are discussed in Section 5.3. This project expects to achieve full compliance with the Water Quality Control Act by achieving compliance with RWQCB certification mandates for Section 401.

The California Water Code, under Article 3. Regional Water Quality Control Plans, states that each regional board must devise and adopt a water quality control plan specified for that region and be periodically reviewed and revised to conform to state policies. The California Water Code is supported by the Federal CWA, amended in 1972, which established the structure of regulating pollutant discharges into waters of the United States and oversees restoring and maintaining the physical, chemical, and biological integrity of the waters. Basin plans managed by RWQCB and SWRCB contain water quality standards to be enforced and implemented. Section 13241 of the California Water Code states that the regional board must establish water quality objectives to ensure protection of beneficial uses and prevention of nuisance. Establishment of water quality objectives shall include past and future beneficial uses of water, water quality characteristics, reasonably achievable water quality conditions, and economic considerations including the need for development of housing and use of recycled water. Because beneficial uses, together with their corresponding water quality objectives, can be defined per Federal regulations as water quality standards, the Basin Plans are regulatory references for meeting the state and Federal requirements for water quality control (40 CFR 131.20). As described in Section 5.3, the Proposed Project would follow the existing alignment and the proposed Environmental Commitments (Section 5.3.5) would reduce impacts to creek waters as best practicable during the construction, restoration, and monitoring phases; the Proposed Project would be consistent with this Act.

6.5.8 California Coastal Act and Local Coastal Programs

The California Coastal Act of 1976 (Public Resources Code Section 30100 et seq.) was enacted to protect California's coastal resources. Implementation of the Coastal Act is primarily accomplished through the preparation of local coastal programs (LCPs) that must be completed by each county and city located in whole or in part in the coastal zone. The coastal zone can extend from about 1,000 yards inland in urban areas up to five miles inland from the mean high tide line in particularly important and generally undeveloped areas. Objectives of an LCP include protecting coastal resources, providing public access and recreational opportunities while allowing for balanced urban development and coastal-dependent and coastal-related industry. Development within the designated coastal zone requires a coastal development permit issued by either the CCC or a local government that has a commission-certified LCP.

Within the study area is part of the Aliso Viejo Segment of the Aliso Creek Planning Unit (ACPU) LCP under the jurisdiction of the County. The City of Laguna Beach adopted an LCP in 1992. An LCP for the unincorporated Orange County was certified in 1986 for the segment of Aliso Creek from the Laguna Beach city limits to Aliso Creek Road. At certification, the county's Aliso Creek LCP included the segments of the creek within unincorporated Aliso Viejo and Laguna Niguel. However, the county's LCP did not automatically become certified for the cities at incorporation. The City of Laguna Niguel has subsequently adopted a certified LCP; however, Aliso Viejo has not.

The Aliso Viejo Segment comprises 2,690 acres and generally encompasses Aliso and Wood Canyons. This LCP was approved by the Orange County Board of Supervisors on July 30, 1980, amended on November 5, 1980, and certified by the CCC on November 18, 1980. The LCP includes a discussion of relevant planning programs, a land use plan, an implementation plan, and a public participation record. A CCD will be submitted for review to the CCC to comply with the Federal requirements for the coastal zone, which also would be applicable to this act. The Proposed Project would be consistent with this Act.

6.5.9 California Endangered Species Act of 1984

The California Endangered Species Act (CESA) provides for the protection of rare, threatened, and endangered plants and animals, as recognized by the CDFW and prohibits the unauthorized taking of such species. As a responsible agency, CDFW has regulatory authority over state-listed endangered and threatened species. State agencies are required to consult with CDFW on actions that may affect listed or candidate species. The state legislature encourages cooperative and simultaneous findings between state and Federal agencies. Further, the General Counsel for CDFW has issued a memorandum to CDFW regional managers and division chiefs clarifying the CESA consultation process wherein, if a Federal BO has been prepared for a species, the CDFW must use this BO in lieu of its own findings unless it is inconsistent with CESA. CDFW Code Section 2095 authorizes participation in Federal consultation and adoption of a Federal BO. By adopting the Federal BO, the CDFW need not issue a taking permit per Section 2081 of the state Code.

If the BO is consistent with CESA, CDFW will complete a 2095 Form in finalizing the adoption of the BO. If the Federal BO is found to be inconsistent with CESA, CDFW may separately issue a 2081 take permit with conditions of approval. As discussed in Sections 6.2.4, 6.3.6, and 6.3.7, the CDFW has participated in project discussions and will identify any additional required permits; the Proposed Project would be consistent with this Act.

6.5.10 California Fish and Game Code (Streambed Alteration Agreement)

Under Chapter 6 of the California Fish and Game Code, CDFW is responsible for protecting and conserving the state's fish and wildlife resources. Sections 1600 et seq. of the Code define the responsibilities of CDFW and the requirement for public and private applicants to obtain an agreement to:

"… divert, obstruct, or change the natural flow or bed, channel, or bank of any river, stream, or lake designated by CDFW in which there is at any time an existing fish or wildlife resource or from which those resources derive benefit, or will use material from the streambeds designated by the department."

CDFW, under California Fish and Game Code Sections 1600 through 1607, regulates work that would substantially divert, obstruct, or change the natural flow of a river, stream, or lake; that would substantially change the bed, channel, or bank of a river, stream, or lake; or that would use material from a streambed. Federal agencies are exempt from Section 1601, but the local sponsor is a participant in the project; therefore, the local sponsor would file a Section 1601 application for a streambed alteration agreement. Under Section 1602, prior to construction, the OCPW will enter into a Streambed Alteration Agreement (SAA) with CDFW that will include conditions to ensure impacts on fish and wildlife or habitat are avoided and/or minimized. As this is an ecosystem restoration project, it is anticipated that no mitigation will be required. The Proposed Project would be consistent with this Act.

6.5.11 Native Plant Protection Act

The Native Plant Protection Act, administered by the CDFW, establishes a state policy to preserve, protect, and enhance endangered or rare native plants in the state of California and preserve vegetative biodiversity supporting sensitive ecosystems. Many species and subspecies of native plants are endangered due to habitat destruction, modification, severe curtailment, disease, or commercial exploitation or by other means. Early consultation is recommended to avoid potential impacts to native plant species and to develop appropriate mitigation planning to offset impacts to listed species populations and their essential habitats (California Fish and Game Code, Section 1900 et seq.). As described in Section 0, the Proposed Project would reestablish native plant communities; the Proposed Project would be consistent with this Act.

6.5.12 Public Resources Code 5024-5097

California Public Resources Codes (PRC) 5020-5097 include a compilation of state statutes and regulations that govern the identification, designation and protection of the California's significant historical resources Section 5020.6 identifies the SHPO implements preservation laws regarding historic resources and is responsible for the California Historic Resource Information System (CHRIS), which uses the National Criteria for listing resources significant at the national, state, and local level.

Section 5097.9 et seq. of the PRC and Section 7050 et seq. of the Health and Safety Code empower the NAHC to regulate Native American concerns toward the excavation and disposition of Native American cultural resources. Among its duties, the NAHC is authorized to resolve disputes relating to the treatment and disposition of Native American human remains and items associated with burials. Upon notification of the discovery of human remains by a county coroner, the NAHC notifies the Native American group or individual most likely descended from the deceased. A NAHC list for the Proposed Project is found in Appendix B-5. As identified in Section 5.8, the Proposed Project would be consistent with these PRC statutes and regulations.

6.5.13 Native American Heritage Commission

Section 5097.9 et seq. of the California PRC and Section 7050 et seq. of the Health and Safety Code empower the NAHC to regulate Native American concerns toward the excavation and disposition of Native American cultural resources. Among its duties, the NAHC is authorized to resolve disputes relating to the treatment and disposition of Native American human remains and items associated with burials. Upon notification of the discovery of human remains by a county coroner, the NAHC notifies the Native American group or individual most likely descended from the deceased. A NAHC list for the Proposed Project is found in Appendix B-5.

6.5.14 California Toxics Rule

The California Toxics Rule is within the Code of Federal Regulations (40 CFR 131.38) and was issued by the EPA in May 2000 to provide water quality criteria for potentially toxic constituents in receiving waters with human health or aquatic life designated uses in California. It includes criteria for five of the seven constituents based on human health, and 23 constituents based on the health of aquatic life. With implementation of the measures identified in Section 5.3.5 and 5.10.5, the Proposed Project would be consistent with this Rule.

6.5.15 California Hazardous Waste Control Law (HWCL)

Health and Safety Code, Division 20, Chapter 6.5 (HSC § 25100 et seq.) HWCL of 1972 is California's statute regulating the management of hazardous waste. This law provides for the minimization, management, storage, transport, treatment, and disposal of hazardous wastes. RCRA and HWCL are similar, however, not all the requirements for various permitting activities are the same. The Department of Toxic Substances Control policy is to follow the most stringent or comprehensive requirements.

The HWCL lists approximately 790 chemicals and about 300 common materials that may be hazardous; establishes criteria for identifying, packaging and labeling hazardous wastes; prescribes applicable management controls; establishes permit requirements for treatment, storage, disposal and transportation; and identifies selected wastes that cannot be disposed of in landfills. With implementation of the environmental commitments in Section 5.10.4, the Proposed Project would be consistent with this Law.

6.5.16 Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to address the hazards of surface faulting to buildings. This state law was a direct result of the 1971 San Fernando Earthquake. The purpose of the Act is to prevent the construction of buildings used for human occupancy on the surface trace of active faults. This Act only addresses the hazard of surface fault rupture. Other earthquake hazards are addressed by the Seismic Hazards Mapping Act passed in 1990, which addresses non-surface fault rupture earthquake hazards, including liquefaction and seismically induced landslides. Based on the proposed improvements to stability of the creek, including improvements to the surface structures within and immediately adjacent to the Project footprint that have been subject to erosion and landslides, the Proposed Project would minimize loss of life and property to seismic hazards and would be consistent with this Act.

6.5.17 California Noise Act of 1973 (Health and Safety Code §§46000-46002)

The California OSHA is the primary agency responsible for worker safety in the handling and use of chemicals in the workplace. The regulations specify requirements for employee training, availability of safety equipment, accident-prevention programs, and hazardous substance exposure warnings.

Occupational noise exposure is regulated by CalOSHA, which has promulgated Occupational Noise Exposure Regulations (8 CCR §§5095-5099). These regulations set employee noise exposure limits that are equivalent to the Federal OSHA standards. All requirements of this Act and Code would be followed, thus the Proposed Project would be consistent with this Act.

6.5.18 Title 14 California Code of Regulations, Section 15131

Socioeconomics encompasses several related areas of interest and concern. A typical socioeconomic impact analysis evaluates the effects of project-related population changes on local schools, medical and protective services, public utilities and other public services, the fiscal and physical capability of local governmental agencies to meet the needs of project-related population changes. Further details on how the Proposed Project is consistent with these regulations is found in Section 0.

6.5.19 Surface Mining and Reclamation Act of 1975 (SMARA)

The SMARA requires the state geologist to classify, solely on the basis of geologic factors and without regard to existing land use and ownership, the areas identified by the Office of Planning and Research, and other specified areas, as one of the following: areas containing little or no mineral deposits; areas containing significant mineral deposits; and, areas containing mineral deposits, the significance of which requires further evaluation. The California Department of Conservation, Division of Mines and Geology (CDMG) subsequently divided the above categories into Mineral Resource Zones. The project would not significantly impact mineral deposits. The Proposed Project purpose is environmental restoration, is not a mining activity, and is not subject to SMARA.

6.5.20 California Code of Regulations Title 8

The California Occupational Safety and Health Administration (CalOSHA) is the primary agency responsible for worker safety in the handling and use of chemicals in the workplace. The regulations specify requirements for employee training, availability of safety equipment, accident-prevention programs, and hazardous substance exposure warnings. Implementation of the Proposed Project would be in compliance with these regulations.

6.5.21 California Global Warming Solutions Act (Assembly Bill [AB] 32)

AB 32 codified the state's GHG emissions target by requiring that the state's global warming emissions be reduced to 1990 levels by 2020. Since being adopted, ARB, CEC, CPUC, and the State Building Standards Commission have been developing regulations that will help meet the goals of AB 32 and EO S-03-05. Pursuant to AB 32, the ARB adopted a Climate Change Scoping Plan in December 2008 (ARB 2008) outlining measures to meet the 2020 GHG reduction goal. To meet this goal, California must reduce its GHG emissions by 30 percent below projected 2020 business-as-usual emissions levels. The 2008 Scoping Plan recommends measures that California may implement such as new fuel regulations, to reduce statewide GHG emissions. It estimates that a reduction of 174 million metric tons (MMT) of CO2e from the transportation, energy, agriculture, forestry, and other sources could be achieved if California implements all of the measures. The Proposed Project would be consistent with this Act as further detailed in Section 5.5.

6.5.22 California Scenic Highway Program

The California Department of Transportation (Caltrans) administers the state Scenic Highway Program to preserve and protect scenic highway corridors from change that would diminish the aesthetic value of lands adjacent to highways (California Streets and Highways Code, Section 260 et seq.). The state Scenic Highway Program includes a list of highways that are either eligible for designation as scenic highways or have been so designated. These highways are identified in the California Streets and Highways Code, Section 263. The program entails the regulation of land use and density of development;

attention to the design of sites and structures; attention to and control of signage, landscaping, and grading; and other restrictions. The local jurisdiction is responsible for adopting and implementing such regulations. If a highway is listed as eligible for official designation, it is also part of the Scenic Highway Program and care must be taken to preserve its eligibility status. South Coast Highway (Also known as Pacific Coast Highway [Highway 101]) is listed as an eligible scenic highway and is located approximately one mile south of the Proposed Project. No changes to Highway 101 are anticipated. Thus, the Proposed Project is consistent with this Program.

6.6 REGIONAL

The following regional districts and plans were taken into consideration throughout the planning process.

6.6.1 Air Quality Management Plan

California air districts comprise of 35 districts divided into 23 Air Pollution Control Districts (APCD) and 12 AQMDs. The air districts are responsible for the control of air pollution from stationary sources. Adopted in 1947, the California Air Pollution Control District Act authorized the creation of an air district for each county within the state.

The SCAQMD is responsible for controlling stationary emissions within portions of Los Angeles, Riverside, and San Bernardino counties, as well as all of Orange County. Stationary emission sources vary from large power plants to commercial gas stations. SCAQMD developed an Air Quality Management Plan (AQMP) that provided a comprehensive analysis of the region’s emission, growth projections, atmospheric chemistry, and impacts of existing control measures. In addition, the AQMP provided measures to meet National Ambient Air Quality Standards established by the EPA for criteria air pollutants. As described in Section 5.4, including the environmental commitments in Section 5.4.5, the Proposed Project would be consistent with this Plan.

6.6.2 Local General Plan

California General Code 65300 require that, “Each planning agency shall prepare and the legislative body of each county and city shall adopt a comprehensive, long-term general plan for the physical development of the county or city, and of any land outside its boundaries which in the planning agency's judgment bears relation to its planning.” The seven mandatory elements shall include discussion of land use, circulation, housing, conservation, open space, noise, and safety, however, additional elements may be included in the general plan. The County of Orange General Plan 2005, with updated land use components in 2015, provides discussion of eleven elements: Land Use, Flood Hazard, Transportation, Public Service and Facilities (which includes flood control and water management), Resources, Recreation, Noise, Safety, Housing, and Growth Management. The Proposed Project has taken these elements into consideration and based on the environmental commitments identified for the project, the Proposed Project would be consistent with the County’s General Plan.

6.6.3 Southern California Association of Governments (SCAG) Regional Comprehensive Plan

Orange County is located at the western edge of a six-county metropolitan region composed of Orange, Los Angeles, Ventura, Riverside, San Bernardino, and Imperial Counties. The SCAG serves as the Federally-recognized Metropolitan Planning Organization for this southern California region. Orange County and its jurisdictions constitute the Orange County Subregion within the SCAG region. The Orange County Subregion is governed by the Orange County Council of Governments (OCCOG). SCAG has developed plans to achieve specific regional objectives, including the Regional Comprehensive Plan (RCP).

The RCP is an advisory plan for local agencies for use in handling local issue of regional significance that addresses regional issues such as housing, traffic/transportation, water, and air quality. SCAG has developed the RCP to help coordinate transportation and infrastructure, open space, and environmental planning with population, housing, and employment growth within the multi-county region. It presents a vision of how southern California can balance resource conservation, economic vitality, and quality of life; and it serves as a guide in approaching growth and infrastructure challenges in an integrated and comprehensive way. This EIS/EIR provides the analysis for environmental planning with consideration to transportation, infrastructure, open space, population and housing, growth, water, and air quality; the Proposed Project is consistent with this Plan.

6.6.4 County of Orange Natural Community Conservation Plan/Habitat Conservation Plan (NCCP/HCP)

The Nature Reserve of Orange County (NROC) is a reserve system established by the Orange County NCCP/HCP. The NCCP/HCP program is the result of the Natural Community Conservation Planning Act enacted by the California Legislature in 1991. The Central-Coastal Subregion NCCP/HCP, approved by the participating agencies in July 1996, addresses a range of species issues, in particular, subregional habitat needs of the California gnatcatcher (*Polioptila californica*).

The Central-Coastal Subregion NCCP/HCP provides take authorization or conditional take authorization for certain species and habitats to participants in the Central-Coastal Subregion NCCP/HCP program. The program is a habitat-based, multiple-species management and conservation strategy that focuses on conserving natural vegetation communities, such as coastal sage scrub, cliff and rock, coastal chaparral, and oak woodlands. In addition to habitat types, the program focuses on a few identified or target plant and animal species that are indicators of ecosystem health. In compliance with the provisions of the NCCP agreement, a RMP was prepared for the Wilderness Park to implement NCCP/HCP policies and adaptive management plans for fire, restoration/enhancement, and recreation.

The Proposed Project study area is located in the coastal subarea of the Central-Coastal Subregion NCCP/HCP and is one of the County's existing public open space areas which contributes to the subregional habitat reserve. Aliso Creek is one of the dominant physiographic features in the coastal subarea and is specifically called out in discussions regarding reserve design, and special linkages and management areas. Lands within the Proposed Project area are designated by the Central-Coastal Subregion NCCP/HCP as "Reserve Lands." These lands include Wood Canyon and Lower Aliso Canyon. Within the Reserve Lands, take of coastal sage scrub habitat and/or the Federally listed as threatened coastal California gnatcatcher are allowed only in relation to specified planned activities (i.e. allowable uses) regarding the amount of take and other parameters specified in the Central-Coastal Subregion NCCP/HCP Implementation Agreement (IA). As described in Section 0, impacts to sensitive species have been avoided or minimized and the environmental commitments in Section 0 further avoid or minimize any potential impacts based on coordination with the resources agencies. The Proposed Project is consistent with these Plans.

6.6.5 Orange County Drainage Area Management Plan (DAMP)

The DAMP (2003) is the county's primary policy, planning, and implementation document for municipal NPDES Stormwater Permit compliance. The DAMP includes specific water pollutant controls, including BMPs for erosion control, sediment control, wind erosion control, tracking control, non-stormwater control, and waste management and materials pollution control. The Proposed Project will comply with the requirements of the NPDES stormwater permit and, therefore, will be consistent with this plan.

6.6.6 Orange County Zoning Code

The Wilderness Park is identified in the County Zoning Code as Open Space (OS). The OS District is established to provide relatively large open space areas for the preservation of natural resources, for the protection of valuable environmental features, for outdoor recreation and education, and for the public health and welfare. Public/private utility buildings and structures are permitted within the OS District subject to a site development permit. The Proposed Project will maintain the general footprint of the existing creek while improving, repairing, or removing existing infrastructure and natural resources; it does not propose new development. The Proposed Project would be consistent with this code.

6.6.7 Aliso Creek Watershed Management Plan (WMP)

The Aliso Creek WMP was prepared in 2006 through coordination by the Corps and Orange County, with participation from local agencies within the watershed, and the community. The Watershed Management Plan presents a set of recommendations for various focus groups (i.e. individual, neighborhood groups, local, state, and Federal government) to help ensure the long-term protection of the watershed's natural resources. It addresses water and land related problems in the Aliso Creek watershed, which are grouped into the four general categories of creek instability, water quality, loss of fish and wildlife habitat, and flood damage. The WMP's objectives include: (1) promote stream stabilization; (2) reduce soil erosion; (3) increase biological diversity, (4) encourage land stewardship; (5) improve aquatic and riparian habitat; (6) reduce invasive species; and (7) improve water quality. The Proposed Project design has been developed to be consistent with this Plan.

6.6.8 Aliso and Wood Canyons Wilderness Park Resource Management Plan (RMP)

Orange County Parks finalized a draft RMP for the Wilderness Park in June 2009 for the comprehensive, long-term management of the Wilderness Park. The RMP states that the fundamental objective is to identify the best framework for managing, protecting, and enhancing the natural resource values of Wilderness Park, while at the same time providing the public with safe recreational and educational opportunities. Specific goals and policies include protecting the biological resources of the park, improving the quality of stream water flowing through the park, achieving a balance of protecting natural and cultural resources while providing for passive recreational use, and providing effective stewardship of the Wilderness Park. The Proposed Project design has been developed to be consistent with this Plan.

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CHAPTER 7 RECOMMENDATIONS

At this phase of the study, prior to concurrent review of the Draft IFR, the Corps has identified Alternative 3.6 as the NER Plan and the TSP for future recommendation for authorization as a Federal project, with such modifications thereof as in the discretion of the Corps, Headquarters Commander, may be advisable. The TSP also includes a passive recreation component compatible with the NER Plan.

Concurrent review of this Draft IFR includes public, technical, legal, and policy reviews, and an Independent External Peer Review (IEPR). The Corps, Los Angeles District management, and Corps vertical team representatives throughout the agency will consider comments provided during the review period prior to providing feedback to a Corps Headquarters Senior Leaders Panel. This panel will consider the evaluation of the significant public, technical, legal, policy and IEPR comments on the TSP, and other alternatives to determine the corporate endorsement of a recommended plan and proposed way forward to complete feasibility-level design and the Final IFR.

The Final IFR will include recommendations from the Corps, Los Angeles District Commander, reflecting information gathered from concurrent reviews and the current Departmental policies governing formulation of individual projects. Recommendations will not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to Congress as proposals for authorization and implementation funding. However, prior to transmittal to the Congress, the non-Federal sponsor, the state, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

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CHAPTER 8 LIST OF PREPARERS*

Table 6.7-1 List of Preparers

Preparers	Education (Degrees, Field)	Years of Experience	Role/Area of Expertise
U.S. Army Corps of Engineers			
Hsu, Se-Yao	BS, MS, Ph.D. Structural Engineering	35+	Project Manager
Vivanti, Jon	BS Geology, BS Civil Engineering, MS Civil Engineering	30+	Lead Planner/Feasibility Study Manager
Lamb, Deborah RLA, #3115	BA, Certificate in Gardening and Horticulture; Certificate in Landscape Architecture, Registered Landscape Architect	25	Environmental Coordinator—Land Use, Aesthetics, Recreation, Public Health and Safety, Public Services, Climate Change, Noise and Vibration, Socioeconomics and Environmental Justice, Earth Resources
Keeney, Thomas	BS Biology, MA	35	Senior Biologist, Agency Coordination, Restoration Ecologist
Brus, Kirk	BS Chemistry, MS Environmental Planning	28	Air Quality
Storey, Danielle	MA, Anthropology	15+	Archaeologist
Lamb, Joe	BS Economics	20+	Economist
Pillars, Miles	BS Real Estate and Urban Development	25	Real Estate Specialist
Davis, Matthew	BS Sociology, MS Geographic Information Science & Technology (GIST)	10+	GIS/Analyst/Cartography
Harirchi, Hassan	BS Civil Engineering	20+	Hydraulic Engineer/Hydrologist
Mallette, Frank	BS Civil Engineering	30	Civil Engineer/Civil Design
Masuda, Rod	BS Geology	35+	Engineering Geologist
Yang, Julia	BS, MS Civil Engineering	20	Geotechnical Engineer
Non-Federal Sponsor			
Mesa, Ann	BS, MS Civil Engineering	18	OCPW, Engineering Oversight
Peng, Jian	PhD Marine Chemistry	15	OCPW, Water Quality
Shao, Stella	MS Environmental Engineering	3	OCPW, Water Quality
Thoms, Marilyn	BS Industrial Technology	40+	OCPW, Project Advisor
Voss, Jenna	BS Environmental/ Ecology	10+	OCPW, Stakeholder Outreach

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CHAPTER 9 REFERENCES

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CHAPTER 10 ACRONYMS AND GLOSSARY*

10.1 ACRONYMS

AAC	Average annual cost
AAHU	Average Annual Habitat Unit
ACE	Annual Chance of Exceedance
ACHP	Advisory Council on Historic Preservation
ACPU	Aliso Creek Planning Unit
ACWHEP	Aliso Creek Wildlife Habitat Enhancement Project
AHPA	Archaeological and Historic Preservation Act
APE	Area of Potential Effect
AQMD	Air Quality Management District
AQMP	Air Quality Management Plan
ASA[CW]	Assistant Secretary for the Army [Civil Works]
ASTM	American Society for Testing and Materials
AWMA	Aliso Water Management Agency (now SOCWA)
BMP	Best Management Practice
CAA	[Federal] Clean Air Act
CAAA	Clean Air Act Amendments
CAAQS	California Ambient Air Quality Standards
CALEPA	California Environmental Protection Agency
Cal/OSHA	California Occupational Safety and Health Administration
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CCC	California Coastal Commission
CCCC	California Climate Change Center
CD	Consistency Determination
CDFG	California Department of Fish and Game (now CDFW)
CDFW	California Department of Fish and Wildlife
CE/ICA	Cost Effectiveness / Incremental Cost Analysis
CEQ	Council for Environmental Quality
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CESA	California Endangered Species Act
CFCs	Chlorofluorocarbons
CFR	Code of Federal Regulation
cfs	Cubic feet per second
CH4	Methane
CHAP	Combined Habitat Assessment Protocol
CHRIS	California Historical Resources Information System
CNDDB	California Natural Diversity Database
CNEL	Community Noise Equivalent Level
CNPS	California Native Plant Society
CO	Carbon monoxide

CO2	Carbon dioxide
CO2e	Carbon dioxide equivalent
Corps	United States Army Corps of Engineers
CRHR	California Register of Historical Resources
CTP	[SOCWA] Costal Treatment Plant
CTR	California Toxic Rule
CWA	Clean Water Act
cy	Cubic yard
CZMA	Coastal Zone Management Act
DAMP	Drainage Area Management Plan
dB	Decibel
dBA	A-weighted decibel
DTSC	[California] Department of Toxic Substances Control
DWR	[California] Department of Water Resources
EA	Environmental Assessment
EGM	Economic Guidance Memorandum
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EO	Executive Order
EOP	Environmental Operating Principles
ESA	Endangered Species Act
ER	Engineering Regulation
FIB	
FRM	Flood Risk Management
GHGs	Greenhouse gases
HCP	Habitat Conservation Plan
HET	Habitat Evaluation Team
HFCs	Hydrofluorocarbons
HMTA	Hazardous Material Transportation Act
HSI	Habitat Suitability Indices
HQI	Habitat Quality Index
HTRW	Hazardous, Toxic, and Radioactive Waste
HU	Habitat Unit
HWCL	[California] Hazardous Waste Control Law
I-405	Interstate 405
I-5	Interstate 5
IEPR	Independent External Peer Review
IFR	Integrated Feasibility Report
IPCC	Intergovernmental Panel on Climate Change
IRWM	Integrated Regional Water Management
IS	Initial Study
JRWSS	Joint Regional Water Supply System
JTM	Joint Transmission Line
LARC	Los Angeles Regional Collaborative for Climate Action and Sustainability
LCP	Local Costal Program
LEDPA	Least Environmentally Damaging Practicable Alternative

LERRD	Lands, easements, right-of-way, and disposal sites
Leq	Equivalent noise level
LPP	Locally Preferred Plan
MBTA	Migratory Bird Treaty Act
MMT	Million metric tons
MTCO2e	Metric tons carbon dioxide equivalent
MVC	Mission Viejo Company
MWDOC	Municipal Water District of Orange County
N2O	Nitrous oxide
NAAQS	National Ambient Air Quality Standards
NAHC	Native American Heritage Commission
NCCP/HCP	Natural Community Conservation Plan / Habitat Conservation Plan
NED	National Economic Development
NEPA	National Environmental Policy Act
NER	National Ecosystem Restoration
NHI	Northwest Habitat Institute
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
NOP	Notice of Preparation
NOx	Nitrous oxide
NPDES	National Pollutant Discharge Elimination System
NRC	National Research Council
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NROC	Nature Reserve of Orange County
OC	Orange County California
OCCOG	Orange County Council of Governments
OCFCD	Orange County Flood Control District
OCSD	Orange County Sheriff-Coroner Department
OCTA	Orange County Transportation Authority
OCVCD	Orange County Vector Control District
OCW	Orange County Watersheds
OFEE	Office of the Federal Environmental Executive
OHP	Office of Historic Preservation
OPC	Ocean Protection Council
OS	Open Space (zoning code)
OSE	Other Social Effects
OSH	Occupational Safety and Health [Act]
OSHA	Occupational Safety and Health Administration
P&G	Principles and Guidelines
PAL	Planning Aid Letter
PDT	Project Delivery Team
PFCs	Perfluorocarbons
PPD	Pacific Park Drive
PPDBC	Pacific Park Drive Bypass Channel

PRC	[California] Public Resources Code
RCRA	Resource Conservation and Recovery Act
RCP	Regional Comprehensive Plan
RDMD	Orange County Resources and Development Management Department
RED	Regional Economic Development
RMP	Resource Management Plan
ROD	Record of Decision
RWQCB	Regional Water Quality Control Board
SAA	Streambed Alteration Agreement
SAM	Corps' SAM Hydraulics Design Package for Channels
SCAG	Southern California Association of Governments
SCAQMD	South Coast Air Quality Management District
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SMARA	Surface Mining and Reclamation Act
SOCWA	South Orange County Wastewater Authority
SR	State Route
SSF6	Sulfur hexafluoride
SSMP	Standard Stormwater Mitigation Plan
SUPER	Stabilization, Utility Protection, and Environmental Restoration
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
Tg	Teragrams
TMDL	Total Maximum Daily Load
TSP	Tentatively Selected Plan
UDV	Unit Day Value
USACE	U.S. Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geologic Survey
VOC	Volatile organic compounds
WRDA	Water Resources Development Act

10.2 GLOSSARY

abatement	Reduction or decrease in amount, degree, intensity or worth.
acre-foot (AF)	The volume of water that would cover 1 acre to a depth of 1 foot, or 325,851 gallons of water. On average, 1 acre-foot could supply one to two households with water for a year. A flow of 1 cubic foot per second for a day is approximately 2 acre-feet.
(a)esthetic	A term that denotes those properties of an entity that appeal to the senses.
air district	A political body responsible for managing air quality on a regional or county basis. California is divided into 35 air districts.
alluvial soils	Soils deposited through the action of moving water. These soils lack horizons and are usually highly fertile.
alternative	A collection of actions or action categories assembled to provide a comprehensive solution to problems.
ambient	1) The existing or background air, soil, water, or plant quality in a given community. 2) The allowable amount of materials, as a concentration of pollutants, in air, soil, water, or plants.
anadromous fish	Fish that spend a part of their life cycle in the sea and return to freshwater streams to spawn.
annual grassland	Annual grassland is a heterogeneous mix of non-native grasses, annual forbs and wildflowers.
aquifer	Underground layer of porous rock, sand, etc. that contains water.
armored	A facing layer or protective cover of concrete structural features placed to prevent erosion or the sloughing off of an embankment. Also, a layer of large stones, broken rocks or boulders, or precast blocks placed in specific random fashion on a river to protect against flowing water.

artifact	Any object manufactured, used or modified by humans. Common examples include tools, utensils, art, food remains, and other products of human activity.
attainment area	Areas that do meet the ambient air quality standards.
avian	Of, relating to, or derived from birds.
baseflow	The portion of the stream that originates in the groundwater aquifer.
bedrock	The solid rock that underlies all soil, sand, clay, gravel, and other loose materials on the earth's surface.
beneficial use	Uses of the waters of the state that may be protected against quality degradation include domestic, municipal, agricultural and industrial supply; recreation and navigation; and the preservation of fish and wildlife.
best management practices	Best Management Practices (BMPs) are effective, practical, structural or nonstructural methods which prevent or reduce the movement of sediment, nutrients, pesticides and other pollutants from the land to surface or ground water, or which otherwise protect water quality from potential adverse effects of activities.
California Endangered Species Act (CESA)	California legislation that prohibits the “take” of plant and animal species designated by the CDFG as either endangered or threatened. Take includes hunting, pursuing, catching, capturing, killing, or attempting such activity. CESA provides the CDFG with administrative responsibilities over the plant and wildlife species listed under the State act as threatened or endangered. CESA also provides CDFG with the authority to permit the take of State-listed species under certain circumstances.
California Environmental Quality Act (CEQA)	California legislation that requires State, regional, and local agencies to prepare environmental impact assessments for proposed projects that will have significant environmental effects and to circulate these documents to other agencies and the public for comment before making decisions. CEQA requires that the lead agency make findings for all significant impacts identified in the environmental impact report. The lead agency must propose mitigation to reduce

environmental impacts to a less-than-significant level unless the mitigation is infeasible or unavailable and there are overriding considerations that require the project to be approved. See Public Res. Code Sections 21001.1, 21002, 21080; Guidelines 15002(c).

candidate species	Plant and animal taxa considered for possible addition to the List of Endangered and Threatened Species. These are taxa for which the Fish and Wildlife Service has on file sufficient information on biological vulnerability and threat(s) to support issuance of a proposal to list, but issuance of a proposed rule is currently precluded by higher priority listing actions. [61 FR 7596-7613 (February 28, 1996)].
carbon dioxide equivalent (CO2e)	An internationally recognized methodology for comparing greenhouse (GHG) emissions that normalizes various emissions associated with each greenhouse gas to a consistent metric. Each GHG has a different capacity to trap heat in the atmosphere, which is referred to as their global warming potential (GWP). The reference gas for GWP is CO2, which is designated as a GWP of 1. Other GHGs have a GWP greater than 1, which means they have a greater global warming effect on a molecule-per-molecule basis than CO2. CO2 is not as potent a greenhouse gas compared to the others, however, it is produced in much larger quantities than the other greenhouse gasses combined.
carbon monoxide (CO)	A colorless, odorless, poisonous gas, produced by incomplete burning of carbon based fuels, including gasoline, oil, and wood. Carbon monoxide is also produced from incomplete combustion of many natural and synthetic products.
chaparral	Habitat that consists of a dense cover of perennial, drought-resistant, mostly evergreen shrubs, generally 1 to 3 meters in height.
channelization	Straightening of a river or stream for flood control purposes. Often accompanied by the use of concrete to stabilize channel banks.
coliform bacteria	Organisms common to the intestinal tract of humans and animals; the organisms' presence in waste water is an

	indicator of pollution. Generally reported as colonies per 100 milliliters of sample.
conjunctive use	The operation of a groundwater basin in combination with a surface water storage and conveyance system. Water is stored in the ground water basin for later use in place of or to supplement surface supplies. Water is stored by intentionally recharging the basin during years of above-average surface water supply.
conservation measures	Actions to benefit or promote the recovery of listed species that are included by the Federal agency as an integral part of the proposed action. These actions will be taken by the Federal agency or applicant, and serve to minimize or compensate for, project effects on the species under review. These may include actions taken prior to the initiation of consultation, or actions which the Federal agency or applicant have committed to complete in a biological assessment or similar document.
constituent	Member, part, component, or element of a larger group. With regard to water quality, a constituent is a chemical compound or parameter that can be measured.
criteria pollutant	Any pollutant for which USEPA has established a National Ambient Air Quality Standard (NAAQS), specifically carbon monoxide, lead, nitrogen oxides, ozone, particulate matter, and sulfur oxides.
critical habitat	Designation for federally listed species. Consists of: 1) the specific areas within the geographical area occupied by the species at the time it is listed in accordance with the provisions of Section 4 of the Federal ESA (16 USCA 1533), on which are found those physical or biological features (constituent elements) that are: a) essential to the conservation of the species & b) may require special management considerations or protection; and 2) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of Section 4 of ESA (16 USCA 1533), upon a determination by the Secretary that such areas are essential for the conservation of the species. (16 USCA 1532(5)(A). Designated critical habitats are described in 50 CFR 17 and 50 CFR 226.
cubic feet per second (cfs)	Rate of water release representing a volume of 1 cubic foot passing a given point during 1 second, equivalent to

	approximately 7.48 gallons per second or 448.8 gallons per minute. In a stream channel, a release of 1 cubic foot per second is equal to the release at a rectangular cross section, 1 foot wide and 1 foot deep, flowing at an average velocity of 1 foot per second.
cultural resource	A wide-ranging category that describes an extensive variety of resources, regardless of significance. These resources may include archaeological sites, isolated artifacts, features, records, manuscripts, historical sites, traditional cultural properties, historical resources, and historic properties.
cumulative impact	The incremental impact or effect of the action together with impacts of past, present, and reasonable foreseeable future actions (regardless of the source of these other actions).
dBA	A unit of measurement/sound level for noise based on the A-weighted scale that simulates the frequency response of the human ear by giving more weight to the middle frequency sounds and less to the low and high frequency sounds. The range of human hearing extends from approximately 3 to 140 dBA.
decibel (dB)	A unit used to express the intensity of a sound wave. In sound, decibels generally measure a scale from 0 (the threshold of hearing) to 120-140 dB (the threshold of pain).
de minimis	A legal term for an amount that is small enough to be ignored, too small to be taken seriously.
dewatering	Removing water by pumping, drainage, or evaporation.
diesel particulate matter (DPM)	Small particles in diesel exhaust considered a toxic air contaminant and a human carcinogen.
direct (economic) effect	Change in final demand in an industry.
dissolved oxygen (DO)	Amount of free oxygen found in water; perhaps the most commonly employed measurement of water quality. Low DO levels adversely affect fish and other aquatic life. The ideal dissolved oxygen for fish life is between 7 and 9 mg/L. Most fish cannot survive when the DO level falls below 3 mg/L.

diversion	The action of taking water out of a river system or changing the flow of water in a system for use in another location.
dredge	To dig under water. A machine that digs under water.
drop structure	A manmade structure, typically small and built on minor streams, to pass water to a lower elevation while controlling the energy and velocity of the water as it passes over.
easement	The right to use land owned by another for some specific purpose.
ecosystem	A recognizable, relatively homogeneous unit that includes organisms, their environment, and all the interactions among them.
embankment	An earth structure the top of which is higher than the adjoining surface. A shaped earth or rockfill dam. Fill material, usually earth or rock, placed with sloping sides and with a length greater than its height. An embankment is generally higher than a dike.
emergent	A plant rooted in shallow water that has most of its vegetative growth above water.
endangered species (CESA)	Any species listed as endangered under the California Endangered Species Act (CESA). Endangered species are native California species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant that has been determined by the CDFG to be in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, exploitation, predation, competition, or disease. See California Fish and Game Code Section 2062.
endangered species (ESA)	Any species listed as endangered under the Federal endangered species act (ESA). Endangered species are any species (including subspecies or a qualifying distinct population segment) that is in danger of extinction throughout all or a significant portion of its range. See 16 USCA 1532(6).

environmental impact report (EIR)
A detailed written report, required by the CEQA, analyzing the environmental impacts of a proposed action, adverse effects that cannot be avoided, alternative courses of action, and cumulative impacts.

environmental impact statement (EIS)
A detailed written statement, required by Section 102(2)(c) of the National Environmental Policy Act (NEPA), analyzing the environmental impacts of a proposed action, adverse effects that cannot be avoided, alternative courses of action, short-term uses of the environment versus the maintenance of long-term productivity, and any irreversible and irretrievable commitment of resources.

environmental justice
Refers to the concept that people of all races, cultures, and incomes deserve fair treatment with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies.

ephemeral stream
An ephemeral stream has flowing water only during, and for a short duration after, precipitation events in a typical year. Ephemeral stream beds are located above the water table year-round. Groundwater is not a source of water for the stream.

equivalent noise level
The equivalent noise level (Leq) is the constant sound level that in a given period has the same sound energy level as the actual time-varying sound pressure level. Leq provides a methodology for combining noise from individual events and steady state sources into a measure of cumulative noise exposure. It is used by local jurisdictions and the Federal Highway Administration (FHWA) to evaluate noise impacts.

erosion
A gradual wearing away of soil or rock by running water, waves, or wind. Surface displacement of soil caused by weathering, dissolution, abrasion, or other transporting.

essential fish habitat
Waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.

estuarine
Pertaining to an estuary; a water passage where ocean water mixes with river water.

exotic species	A species that did not originally occur in the areas in which it is now found, but that arrived as a direct or indirect result of human activity.
Federal Endangered Species Act (ESA)	Federal legislation that requires Federal agencies, in consultation with the USFWS and NOAA Fisheries, to ensure that their actions do not jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of these species. The ESA recognizes the value to the nation of species in danger of, or threatened with, extinction. The act requires Federal agencies to conserve these species and their habitats and ranges to the extent practicable. Section 4 of the ESA (16 USCA 1533) provides a listing process for species considered "endangered" (in danger of becoming extinct) or "threatened" (threatened to become endangered). The Secretary of Commerce, acting through NOAA Fisheries, is involved for projects that may affect marine or anadromous fish species listed under the ESA. All other species listed in the ESA are under USFWS jurisdiction. Section 7 of the ESA (16 USCA 1536(a)(2)) requires that all Federal agencies, in consultation with the Secretaries of the Interior and Commerce (acting through USFWS and NOAA Fisheries, respectively), ensure that their actions do not jeopardize the continued existence of species listed as endangered or threatened and protected or result in the destruction or adverse modification of the critical habitat of these species. Section 9 of the ESA (16 USCA 1538) prohibits take of a listed species. Section 9 (16 USCA 1538) compliance is applicable if the proposed action would result in the take of any listed threatened (if not subject to special rule) or endangered fish or wildlife species and such take is not authorized in a biological opinion issued by USFWS or NOAA Fisheries. Section 10 of the ESA (16 USCA 1539) authorizes the conditions for the USFWS or NOAA Fisheries to issue a permit for incidental take of a listed species when there is no other Federal agency involved. See 16 USC 153 1 et seq. federally covered species.
fill	Manmade deposits of natural soils or rock products and waste materials designed and installed in such a manner as to provide drainage, yet prevent the movement of soil particles due to flowing water.

fine particulate matter	Particulate matter less than 2.5 microns in diameter (PM2.5).
fluvial	Processes associated with rivers and streams and the deposits and landforms created by them.
forb	A broadleaf plant that has little or no woody material in it.
freeboard	Generally defined as the difference in elevation from the top edge of a flood control facility (channel, dam, basin) to the design WSE. Freeboard provides a factor of safety and protects against unknown factors such as wave action. Freeboard varies based on the type of project and velocities of flows, but is generally between 1-3 feet.
freshwater marsh	Freshwater marsh communities within the Project area are wetland communities fed by seeps or springs and are permanently to semi-permanently flooded.
fugitive dust	Particles lifted into the ambient air caused by man-made and natural activities such as the movement of soil, vehicles, equipment, blasting, and wind. This excludes particulate matter emitted directly from the exhaust of motor vehicles and other internal combustion engines, from portable brazing, soldering, or welding equipment, and from pile drivers.
gauging station	A location used to monitor and test terrestrial bodies of water. Typical data collected at gauging stations include flow rate and water quality.
greenhouse gases (GHG)	A collection of atmospheric gases - water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), ozone, chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6) – that act as global insulators reflecting visible light and infrared radiation back to earth.
habitat enhancement	To improve degraded habitat. Management actions that enhance habitat do not result in increasing the extent of habitat area.
habitat protection, protect habitat	To maintain the existing extent and quality of habitat.

habitat restoration, restore habitat
To create habitat. Management actions that restore habitat.

hazardous waste
Any solid, liquid, or gaseous substance which, because of its source or measurable characteristics, is classified under state or federal law as hazardous and is subject to special handling, shipping, storage, and disposal requirements.

historic property
Any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places. This includes artifacts, records, and remains that are related to and located within such properties. As a general guideline, a cultural resource should be at least 50 years old to be considered as a historic property.

historical resource
Per CEQA guidelines, a resource listed or eligible for listing on the California Register of Historical Resources. It must be significant based on one or more of four criteria to be considered a historical resource on a local, state, or national level.

Holocene
The geological time period (epoch) that began approximately 10,000 years ago and continues to the present.

hydrophytic vegetation
Plants that grow partially or completely in water.

hydromodification
Changes in the quantity and timing of stormwater runoff brought about by changes in land uses, most notably urbanization. Urbanization (land development) creates impervious surfaces which reduces rainfall infiltration and sediment delivery to waterways, which alters stream stability. Hydromodification impacts include increases in erosion, unstable stream banks, property and infrastructure damage, loss of habitat, and degradation of water quality.

igneous rock
Igneous rocks are formed from magma (melted rock) that has cooled and solidified, either within the Earth's crust or on the Earth's surface.

impervious
Surface that prevents or significantly reduces the entry of water into the underlying soil, resulting in runoff from the surface in greater quantities and/or at an increased rate when compared to natural conditions prior to development.

indirect (economic) effect	Changes in industry sectors within the region that supply goods and services to industries directly affected by the changes in final demand.
induced (economic) effect	Changes in economic activity resulting from household spending of the income earned from changes in final demand.
inhalable particulate matter	Particulate matter less than 10 microns in diameter (PM10). input-output (I-O) analysis Describes commodity flow from producers to intermediate and final consumers.
instream flows	Year-round flows in rivers and streams.
intermittent stream	A stream that flows part of the time because of a connection with groundwater or because of season snow melt and, therefore, is dry most of the year.
invasive species	Non-native species of plants or animals that out-compete native species in a specific habitat.
invertebrate	An animal that lacks a backbone or spinal column.
jurisdiction	The territory or geographic area within which power can be exercised, or the power or authority of a court to hear and try a case.
kilowatt (kW)	The basic unit of electric demand, equal to 1,000 watts. Average household demand is 10 to 20 kilowatts.
landslide	An abrupt movement of soil and bedrock downhill in response to gravity. Landslides can be triggered by an earthquake or other natural causes.
levee	An elevated berm that is used to protect adjacent low lying ground from floodwaters. The levee is usually lined with a structural material such as concrete or rip-rap to ensure that it does not fail from erosion. This lining usually extends many feet below ground to ensure that scour caused by high water velocities cannot undermine the levee.
level of service (LOS)	A qualitative measure describing operational conditions within a traffic stream, based on service measures such as speed and travel time, freedom to maneuver, traffic interruptions, comfort, and convenience.

liquefaction	Process where water-saturated sediment (sandy material) temporarily looses strength, usually because of an earthquake, and behaves like a fluid. Soil or sand changes from solid ground and behaves like a liquid, which can cause the ground above the liquefied sediment to break into small blocks.
listed species (state)	(CESA) Species or subspecies declared as threatened or endangered by the CDFG in 14 CCR Section 670.5.
listed species (Federal)	(ESA) Species, including subspecies, of fish, wildlife, or plants federally listed at 50 CFR 17.11 and 50 CFR 17.12 as either endangered or threatened, or listed at 14 CCR Section 670.2 and 14 CCR Section 670.5 as threatened or endangered.
littoral zone	Area on or near the shore of a body of water.
low-income population	That portion of the population that falls within the low-income bracket as defined based on federal poverty thresholds. The low-income index is determined annually by the US Department of Health and Human Services.
maximum contaminant level (MCL)	The highest level of a contaminant that is allowed in drinking water. MCL's are set as close to the Maximum Contaminant Level Goal as feasible using the best available treatment technology.
mesic site	Characterized by having a medium moisture supply e.g., a type of habitat or soil.
minority population	Any individual or racial/ethnic group that is not categorized as White, not Hispanic or Latino.
Miocene	The geological time period (epoch) that extended from approximately 5 to 23 million years ago.
mitigation	To moderate, reduce, or alleviate the impacts of a proposed activity; including: (a) avoiding the impact by not taking a certain action or parts of an action; (b) minimizing impacts by limiting the degree or magnitude of the action and its implementation; (c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and (e) compensating for the impact by

	replacing or providing substitute resources or environments.
multiplier	A ratio of total economic effects to direct economic effects that captures the size of indirect and induced effects to the region's economy.
National Environmental Policy Act (NEPA)	Federal legislation establishing the national policy that environmental impacts will be evaluated as an integral part of any major federal action. Requires the preparation of an environmental impact statement (EIS) for all major federal actions significantly affecting the quality of the human environment.
National Pollutant Discharge Elimination System (NPDES)	A permitting program under section 402 of the Clean Water Act required for all point sources discharging pollutants into waters of the United States. The purpose of the NPDES program is to protect human health and the environment.
native vegetation	Stands of blocks of naturally occurring plant communities. These include a range of vegetation associations such as woodlands, grasslands, forests, wetlands, mangroves etc Scattered native trees and shrubs in cleared paddocks or urban areas are more usually considered separately as scattered or isolated plants.
navigable waters	Waters of the United States including: (a) All waters that are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters that are subject to the ebb and flow of the tide; (b) Interstate waters, including interstate wetlands; (c) All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats and wetlands, the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce, including waters used or which could be used for industries in interstate commerce; (d) All impoundments of waters otherwise defined as navigable waters; (e) Tributaries of waters identified in (a) through (d); (f) Wetlands adjacent to waters identified in (a) through (d).

nephelometric turbidity unit (NTU)
: NTU is an indication of the clarity of water, or the amount of suspended particles in water. Low NTU values indicate high quality water. NTU is obtained by measuring the amount of scattering of light in water.

negative declaration
: A document that states upon completion of an initial study, that there is no substantial evidence that a project may have a significant effect on the environment.

nitrogen dioxide
: A pollutant that causes smog and acid rain, as well as eye, throat, and lung irritation. Nitrogen dioxide is mainly produced by burning fossil fuels (e.g., emissions from burning gasoline in a car).

nitrogen oxide (NOx)
: The chemical transformation caused by sunlight. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.

non-attainment area
: Areas that do not meet the ambient air quality standards.

non-criteria pollutant
: Any recognized and otherwise regulated air pollutants that are not listed as criteria pollutants.

non-native species
: Also called introduced species or exotic species; refers to plants and animals that originate elsewhere and are brought into a new area, where they may dominate the local species or in some way negatively impact the native species environment.

nonpoint source
: A contributing factor to water pollution that cannot be traced to a specific spot. Manmade or man-induced alteration of the chemical, physical, biological, or radiological integrity of water, originating from any source other than a point source.

overland flow
: Flow of water across the land surface in a down-gradient direction.

ozone
: Ozone gas is a molecule that consists of three oxygen molecules. It is naturally occurring in the earth's atmosphere at all levels and is responsible for filtering out much of the sun's ultraviolet radiation.

perennial plant
: A plant that grows for more than one season; it over-winters in a dormant condition and resumes growth the following season.

permeability	A measure of the ability of a material (such as rocks) to transmit fluids.
petrographic	The description and classification of rocks.
pH	A relative scale, from 0 to 14, of how acidic or basic (alkaline) a material is, where a pH of 7 is neutral, smaller readings are increasingly acid.
Pliocene	The geological time period (epoch) that extended from approximately 2.5 to 5 million years ago.
point source	Any discernible, confined, or discrete conveyance from which pollutants are or may be discharged, including, but not limited to, any pipe, ditch, channel, tunnel, conduit, well, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft.
potable water	Water suitable for drinking.
probable maximum flood (PMF)	The largest flood that may reasonably be expected to occur at a given point on a stream from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible on a particular watershed.
promulgated	Documents that are formally made public.
Quaternary	The geological time period that extends from approximately 2.5 million years ago to the present.
regional capture rate	Percentage of spending that accrues to the region's economy as direct sales or final demand.
riffle	A section of stream that has shallow, fast-flowing water followed by deep, slow-flowing water.
riparian	The strip of land adjacent to a natural watercourse such as a river or stream. Often supports vegetation that provides important wildlife habitat values when a complex forest structure is present and important fish habitat values when vegetation grows large enough to overhang the bank.

riprap	A layer of large uncoursed stones, broken rock, or precast blocks placed in random fashion on the upstream slope of an embankment dam, on a reservoir shore, or on the sides of a channel as protection against wave and ice action.
sedimentary rock	Rocks formed from material, including debris of organic origin, deposited as sediment by water, wind, or ice and then compressed and cemented together by pressure.
seepage	Percolation of water through the soil from unlined canals, ditches, laterals, watercourses, or water storage facilities.
seismic	Of or related to movement in the earth's crust caused by natural relief of rock stresses.
sensitive receptors	Segments of the population most susceptible to poor air quality (i.e. children, elderly and the sick). Also refers to the susceptibility of certain land uses such as schools, hospitals, convalescent homes, parks, or residential communities to noise, pollution, and other disturbances.
sensitive species	Listed species, species that are candidates for listing, and other species that have been designated as species of special concern by Federal or State agencies or scientific organizations (see "special-status species").
siltation/sedimentation	Deposition of waterborne sediments due to a decrease in velocity and corresponding reduction in the size and amount of sediment which can be carried.
special status species	Species in any of the following categories: plants listed, proposed for listing, or candidates for possible future for listing under the federal Endangered Species Act, plants listed or proposed for listing under the California Endangered Species Act, plants listed as rare or endangered under the California Native Plant Protection Act, plants that meet the definitions of rare or endangered under the State CEQA Guidelines, plants considered by the CNPS to be "rare, threatened, or endangered in California" (Lists 1B and 2), plants considered by CNPS as plants about which more information is needed to determine their status, and plants of limited distribution (Lists 3 and 4), which may be included as special-status species on the basis of local significance.

species	Species of fish, wildlife, or plants, any subspecies of fish, wildlife, or plants, and any distinct population segment of vertebrate fish or wildlife that interbreeds when mature.
species of concern	Species that could be affected by actions and are not listed as threatened or endangered under the Federal ESA; proposed for listing under ESA; candidates under ESA; listed as threatened or endangered under the CESA; candidates under CESA; plants listed as rare under the California Native Plant Protection Act; California fully protected species or specified birds under various sections of the California Fish and Game Codes; California species of special concern; or California Native Plant Society List lA, lB, 2, or 3 species.
sulfur dioxide (SO2)	Sulfur dioxide is a gas produced by burning coal, most notably in power plants. Some industrial processes, such as production of paper and smelting of metals, produce sulfur dioxide. Sulfur dioxide is closely related to sulfuric acid, a strong acid. Sulfur dioxide plays an important role in the production of acid rain.
suspended particulate matter (SPM)	Particles suspended in the air of less than 10 micrometer in size which can accumulate in the lungs and bronchi bringing about breathing problems for those affected. SPM is caused by human activities (cars and industry) but also by natural phenomena.
swale	A low place in a tract of land. A wide, shallow ditch, usually grassed or paved. A wide open drain with a low center line.
take	Under the ESA, "To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" in regard to federally listed, endangered species of wildlife (16 USCA 1532[19]). "Harm" is further defined as an act "which actually kills or take threatened species injures". Harm may include "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter" (50 CFR 17.3). Under the California Fish and Game Code, take is defined as "to hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill" (California Fish and Game Code Section 86).

terrestrial species	Types of species of animals and plants that live on or grow from the land.
threatened species (CESA)	Threatened species are native California species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant that have been determined by the CDFG, although not presently threatened with extinction, to be likely to become an endangered species in the foreseeable future in the absence of special protection and management efforts. See California Fish and Game Code Section 2067.
total dissolved solids (TDS)	A water quality parameter defining the concentration of dissolved organic and inorganic chemicals in water, usually expressed in milligrams per liter (mg/L).
total maximum daily load (TMDL)	The maximum amount of a pollutant that can be discharged into a water body from all sources (point and non-point) and still maintain water quality standards. Under Clean Water Act Section 303(d), TMDLs must be developed for all water bodies that do not meet water quality standards after application of technology-based controls.
total organic carbon (TOC)	A measure of the concentration of organic carbon in water, determined by oxidation of the organic matter into carbon dioxide.
toxic air contaminant (TAC)	As defined by California Health and Safety Code, Section 39655 (a): an air pollutant which may cause or contribute to an increase in mortality or in serious illness, or which may pose a present or potential hazard to human health.
toxicity, toxic waste	The degree to which a substance is able to produce injury if inhaled, swallowed, or absorbed through the skin.
tributary	River or stream flowing into a larger river or stream.
turbidity	A cloudy appearance that results when excessive silt or other substances are in the water.
underground storage tank (UST)	A tank located at least partially underground and designed to hold gasoline or other petroleum products or chemicals.

understory	The layer formed by the leaves and branches of the smaller trees under the forest canopy.
unincorporated land	A region of land is unincorporated if it is not a part of any municipality. To "incorporate" in this context means to form a municipal corporation, i.e., a city or similar. Unincorporated, in turn, implies no city and hence no city, town, village, or other municipal government.
value added	Economic measurement of wages and salaries, proprietor's income, dividends and interest, and indirect business taxes.
value of output	Total value of an industry's production.
vista	A view or the visual percept of a region.
volatile organic compound (VOC)	Reactive gases released during combustion or evaporation of fuel and regulated by USEPA. VOCs react with NOx in the presence of sunlight and form ozone.
watershed	An area that drains to a particular channel or river, usually bounded peripherally by a natural divide of some kind such as a hill, ridge, or mountain.
water table	The surface of underground, gravity controlled water, or the level of ground water.
wetlands	Lands including swamps, marshes, bogs, and similar areas such as wet meadows, river overflows, mudflats, and natural ponds. An area characterized by periodic inundation or saturation, hydric soils, and vegetation adapted for life in saturated soil conditions. Any number of tidal and nontidal areas characterized by saturated or nearly saturated soils most of the year that form an interface between terrestrial and aquatic environments; including freshwater marshes around ponds and channels, and brackish and salt marshes. A jurisdictional wetland is subject to regulation under the Clean Water Act. A non-jurisdictional wetland is subject to consideration under the Fish and Wildlife Coordination Act.
wildlife corridor	An area of habitat connecting wildlife populations separated by human activities (such as roads, development, or logging).

zoning	Land use regulations enacted to manage use of land and control the character of an area.

CHAPTER 11 INDEX*

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