APPENDIX B-10: Planning Aid Letter

ALISO CREEK MAINSTEM
ECOSYSTEM RESTORATION STUDY
Orange County, California

September 2017

US Army Corps
of Engineers

Orange County Public Works
Environmental Resources
Department

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Carlsbad Fish and Wildlife Office
2177 Salk Avenue, Suite 250
Carlsbad, California 92008

In Reply Refer To:
FWS-OR-08B0417-15CPA0315

AUG 28 2015

Colonel Kirk Gibbs
District Engineer
U.S. Army Corps of Engineers, Los Angeles District
915 Wilshire Boulevard, Suite 930
Los Angeles, California 90017-3409

Attention: Thomas Keeney

Subject: Planning Aid Letter for the Proposed Aliso Creek Mainstem Ecosystem Restoration Project, Orange County, California

Dear Colonel Gibbs:

The U.S. Fish and Wildlife Service (Service) has prepared this Planning Aid Letter (PAL) for the U.S. Army Corps of Engineers (Corps) on the proposed Aliso Creek Mainstem Ecosystem Restoration Project to describe issues and opportunities related to the conservation and enhancement of fish and wildlife resources. The project, as proposed, would involve construction of ecological restoration features, as well as stream grade control and flood damage reduction structures, along Aliso Creek in southern Orange County, California (County). The proposed project areas would involve about 6.5 miles of the mainstem of Aliso Creek, and about 1,000 feet of the downstream portion of Wood Canyon Creek, a tributary to Aliso Creek. A majority of project area is in Aliso and Wood Canyons Wilderness Park, a 3,900-acre natural open space public park under the jurisdiction of Orange County Parks. The project area is located southwest (downstream) of Interstate 5.

This PAL is provided in accordance with the Fish and Wildlife Coordination Act (FWCA) of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 *et seq.*), the Endangered Species Act (ESA) of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 *et seq.*), and the scope of work agreed upon by the Corps and the Service. This PAL does not constitute the report of the Secretary of the Interior as required by section 2(b) of the FWCA, nor does it constitute a biological opinion under section 7 of the ESA. The purpose of this PAL is to deliver recommendations for use by the Corps design team in developing alternatives for the project.

In the coastal watersheds of California, a variety of human interventions during the past 200 years have resulted in the loss of stream floodplain function and substantial degradation of

riparian and aquatic functions (Haltiner and Beeman 2003). These interventions have included the introduction of intensive cattle grazing, farming, urbanization, and channelization projects. A common result of this human intervention has been the effective loss of the channel-floodplain interaction with the stream, either via artificial separation of channel and floodplain (e.g., levees) or as a result of channel incision (resulting in less frequent floodplain flows) (Haltiner and Beeman 2003). Aliso Creek has been subject to almost all of these activities and effects.

The Aliso Creek watershed, which includes Aliso Creek (mainstem) and several tributaries, is located on the coastal slope and drains as a long, narrow watershed from the Cleveland National Forest to the Pacific Ocean. The terrain is generally hilly, and varies from being somewhat steep in the upper reaches, to being somewhat flat in the middle reaches. The lower portion has steep hillsides surrounding a narrow canyon. The 34.6-square-mile watershed includes portions of the cities of Lake Forest, Aliso Viejo, Mission Viejo, Laguna Niguel, Laguna Hills, and Laguna Beach. The creek ultimately discharges into the Pacific Ocean at Aliso Beach. The Aliso Creek watershed is mainly an urbanized area, with the exception of the Cleveland National Forest in the upper watershed and the Aliso and Wood Canyons Wilderness Park in the lower watershed. Aliso Creek is a heavily incised coastal stream that includes one of the last natural stream stretches left in southern Orange County; the portion of Aliso Creek in Aliso and Wood Canyons Wilderness Park is undammed and unchannelled, with substantial potential for lateral meander of the stream channel and other natural stream fluvial processes within undeveloped portions of the park.

The lands within and surrounding the Aliso and Wood Canyons Wilderness Park boundaries were historically part of the Rancho Niguel Mexican Land Grant, granted to Juan Avila in 1842. The lands of Rancho Niguel (including the park) were used for cattle, and later sheep, ranching from the early 1840s into the 1870s (County of Orange 2009). During this time, many of the large landholdings were subdivided, and agriculture centered on citrus fruits, grapes, and grains appeared. From the late 1880s until the 1950s, the ranch maintained an economy based on cattle ranching, agriculture (including dry farming), and tenant farming. Following World War II, rapid Orange County housing expansion occurred in nearby cities; Rancho Niguel was divided, and most of it developed into what eventually became Aliso Viejo, Laguna Woods, Laguna Hills, and Laguna Niguel (County of Orange 2009).

The park was created in 1979 (opened in 1990) and currently receives substantial recreational use, including hiking, running, mountain biking, equestrian use, nature viewing, painting, photography, and wilderness education (Orange County Parks 2014, County of Orange 2009). Aliso and Wood Canyons Wilderness Park is mostly undeveloped and is designated a regional preserve/wildlife sanctuary. The park is located in the San Joaquin Hills and is surrounded by the suburban communities of Laguna Niguel, Aliso Viejo, and Laguna Beach. Approximately 30 miles of unpaved trails exist throughout the park. The park encompasses open space that includes the hills, canyons, and floodplain of Aliso and Wood canyons and portions of the Laguna Canyon/El Toro Cliffs area. The park is located within the Central and Coastal Subregion

Natural Communities Conservation Plan (NCCP) reserve known as the Nature Reserve of Orange County.

A paved road utilized by the Aliso Water Management Authority (AWMA) closely parallels the northwest side Aliso Creek through the park to within about 1.2 miles of the creek's mouth. The AWMA road connects the main park entry to the Coastal Treatment Plant owned and operated by the South Coast Wastewater Authority (SOCWA) (County of Orange 2009). The paved AWMA road facilitates utility truck traffic though the park to the wastewater treatment plant located directly outside the southern boundary of the park. Currently the agreement between the County and SOCWA allows for public access Monday through Friday on the dirt trail that parallels the road up to the park entry gate at the park's northern edge (County of Orange 2009). On weekends the public is allowed to use the paved AWMA road up to the entry gate. Consistent with the County Regional Riding and Hiking Trail Master Plan, a planned Class 1 Bikeway would extend from the main park entry to the coast. Working with SOCWA, the bikeway is planned to be on the existing AWMA road with a parallel equestrian and hiking trail (County of Orange 2009).

Federally threatened California gnatcatchers (*Polioptila californica californica*) are reported to be residents in coastal sage scrub throughout the park. Federally endangered least Bell's vireos (*Vireo belli pusillus*) are reported to occur regularly during the breeding season in riparian zones of the park within Aliso Creek (County of Orange 2009).

Downstream of the park and wastewater treatment plant along Aliso Creek (to the south and out of the project area), the Aliso Creek Inn and Golf Course occurs along a channelized (soft-bottom and banks) 0.6-mile portion of the creek. After flowing out of the golf course, the creek enters an approximately 6-acre lagoon remnant, passes under the Pacific Coast Highway (and through related adjacent development), and then enters the Pacific Ocean. The Federally endangered tidewater goby (*Eucyclogobius newberryi*), a fish species, historically occurred in the lagoon of Aliso Creek (County of Orange 2009), but is considered unlikely to currently occupy the lagoon. Designated critical habitat for the tidewater goby occurs in the golf course and lagoon, outside of the project area.

Within Aliso and Wood Canyons Wilderness Park, almost all of Aliso Creek consists of natural channel, with large portions of the creek sided by channel banks that are very high and quite steep (both banks), caused by channel erosion and invert degradation (Tetra Tech 2012). Substantial infrastructure currently exists along the southeast side of Aliso Creek, consisting of sewer and water lines buried on contours parallel to the creek. A dirt access trail follows these lines, and in some areas the currently eroded southeast embankment of the creek is quite close to these lines. A utility road (AWMA road) and dirt trails occur along the northwest side of the creek within the park; the paved AWMA road is the only known infrastructure on the northwest side of the creek within the park. Various attempts at flood damage reduction and ecological restoration have occurred in the park over the years, including a large drop structure in the park known as the Aliso Creek Wetland Habitat Enhancement Project (ACHWEP). Wood Canyon Creek is a 2.8-mile long tributary to Aliso Creek, with most of its watershed area within the park.

The park segment of Aliso Creek is reportedly occupied by more than 137 bird species and supports one of Orange County's largest remaining populations of southwestern pond turtle (*Actinemys marmorata pallida*). Several sensitive plants are found throughout the Aliso Creek watershed (City of Aliso Viejo 2015). The park predominantly consists of coastal sage scrub, chaparral, and annual grassland natural communities. Oak woodland and riparian scrub communities occur along Wood Canyon Creek and Aliso Creek, with some limited areas of freshwater marsh and open water that occur sporadically along the creeks. Additional biological resources information is found within Enclosure 2.

Portions of Aliso Creek upstream of Aliso and Wood Canyons Wilderness Park occur in moderately to heavily urbanized settings with little potential for lateral meander (due to risk of flood damage to infrastructure) and varied amounts of adjacent contiguous natural upland areas. For example, the Chet Holifield Federal Building and parking lot lie near Aliso Creek in this area. Other existing land uses near the creek in this area consist of extensive commercial and residential development. Upstream of the park Aliso Creek has been somewhat straightened and channelized, but retains a soft-bottom and sides for most of its length. Large portions of the creek upstream of the park are subject to local vegetation control within the riparian and aquatic zones for flood damage reduction reasons, with some other areas having high or moderate function natural communities where vegetation control does not occur and invasive exotic plants have been controlled. Additional information on the project area is contained in Enclosures 2 & 3.

Several completed or ongoing restoration projects have occurred along Aliso Creek. At least four restoration projects are targeting giant reed grass (*Arundo donax*), an escaped exotic plant species that was invading Aliso Creek, particularly within disturbed areas. Giant reed grass had, until recently, reportedly taken over large portions of the stream ecosystem and outcompeted as much as 75 percent of the native species (by cover) in some areas (Laguna Canyon Foundation 2015). These four projects span the entire 19.7 mile length of Aliso Creek (Orange County Parks 2014) and are: County of Orange Invasives Removal, Conservation Corps Invasives Removal, Measure M Habitat Restoration, and Prop 50 Invasives Removal Project.

A project somewhat similar to currently proposed project has been in planning since at least 2002. In October 2002, the Los Angeles District of the Army Corps completed the Aliso Creek Watershed Management Study that resulted in one of the recommendations to pursue a more focused feasibility study effort on ecosystem restoration opportunities along the lower Aliso Creek mainstem (Corps 2009). The scope of the feasibility study was to include about a 7-mile reach of the Aliso Creek mainstem from the Pacific Ocean to just north of Pacific Park Drive (Corps 2009). The current proposal does not extend to the Pacific Ocean, but would end approximately 0.9 mile from the creek's outlet to the ocean.

Constraints and Opportunities

The degradation and incision of Aliso Creek within the project area stems from development of the watershed, with a host of resulting changes to the creek:

1. Increases in impervious surfaces through development of hard structures;

2. Increases in the flashiness of runoff from the watershed, with resultant increased flashiness of the storm surface flows in the creek for any given storm event; and

3. Decreases in sediment input to the creek from the watershed due to covering/capping of ground surfaces with hard structures.

These modifications have resulted in general alteration of the natural hydrologic regime and sediment/fluvial processes in the stream. Notably, the peak flows of the creek following any given storm event are now greater; the storm flow runoff reaches the creek and is conveyed more quickly than has occurred in the past before substantial development of the watershed. These storm flows now occur in the creek with a reduced relative sediment load. As a result, the creek's storm flows that now occur are out of what is termed "Lane's balance."[1] This loss of equilibrium usually results in erosion[2] of the creek channel and banks that is caused by "hungry water" conditions of the current storm flows in the stream.[3]

Aliso Creek and its floodplain have also been directly altered along most of its length outside of Aliso and Wood Canyons Wilderness Park:

1. Shortening of the creek length through elimination of some channel bends (channel straightening);

2. Construction of grade control structures;

3. Elimination of the potential for substantial channel movement and meanders in most locations through levee development and/or channelization; and

4. Channelization of the creek, with active deepening of the channel, steepening, increasing height, and/or armoring of the banks, and loss or severe reduction of overflow to the adjacent floodplain in certain locations for a given flood event.

Both inside and outside of Aliso and Wood Canyons Wilderness Park these watershed changes have resulted in channel destabilization and culminated in major down-cutting of the mainstem

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[1] Stream channels are naturally formed, maintained, and altered by two things: flows and sediment loads. Equilibrium is achieved through a balance of four factors: sediment discharge, sediment particle size, streamflow, and stream slope. Equilibrium of these factors is known as Lane's balance (Lane 1954).

[2] Equilibrium occurs when the streamflow power is constant over the length of the stream resulting in zero change in the shape. By changing any term on either side of the Lane's balance equation, the balance is shifted and one or more of the other variables must compensate for this. Reaching equilibrium usually involves erosion (Loucks 2005).

[3] An example of "hungry water" conditions is a stream below a dam - the effluent from the dam is typically sediment starved since the initial sediment discharge from the dam is quite low. The streamflow from the dam cannot typically be adjusted, so equilibrium is reached through changes in channel slope, the mean sediment particle size, and "hungry water" picking up sediment from the channel bed immediately below the dam.

creek and some tributaries where energy dissipaters/drop structures have not locally controlled erosion. This down-cutting/incision has caused substantial degradation of aquatic and riparian natural communities associated with the creek and its floodplain.

Geomorphic Assessment

The Aliso Creek Mainstem Geomorphic Baseline Assessment (Tetra Tech 2014) provided information that indicates that the currently incised stream elevations are quite close to equilibrium and are relatively stable. This information points to the potential for implementing an alternative that keeps the channel thalweg/invert[4] elevations close to where there are today, and performing a modest or reduced amount of ecological restoration activity at reduced costs, with smaller temporary biological impacts; our Alternative C below builds on this concept. Utilizing the current channel thalweg elevations within the Aliso and Wood Canyons Wilderness Park could leave some infrastructure (e.g., sewer and water lines) potentially vulnerable to flood damage and/or in need of enhanced protection as part of the project, as compared to some other alternatives where the creek thalweg would be raised. The Aliso Creek Mainstem Geomorphic Baseline Assessment (Tetra Tech 2014) stated the following (taken verbatim) regarding Aliso Creek in the project area:

1. Colluvial inputs to the valley bottom, particularly through landslides, have provided an ample supply of gravels and cobbles to the creek, and tributary/gulley confluences continue to be sources of coarse material. These coarse materials are being concentrated into natural grade controls throughout the study area.

2. Incipient motion analyses confirmed that existing hydraulic conditions are incapable of mobilizing cobbles, but that gravels may be susceptible to mobilization if tules and cattails in the channel do not persist.

3. A geomorphic model confirms that future vertical adjustments to the bed profile will be limited because (1) the widened channel and decreased channel slope have decreased unit discharge and bed material transport capacity, and (2) the formation of grade controls such as riffles and plugs (relatively immobile concentrations of coarse sediment in the bed of the channel) that cannot readily be mobilized by flood flows up to the peak of the 500-year event.

4. The gradations of bed and bank material samples collected since 1980 show that the valley fill into which Aliso Creek has incised contains up to 75 percent silt and clay (i.e., wash load), but that the remaining material includes enough coarse gravel and cobble, that due to sorting and concentration over time, to form relatively immobile natural grade controls.

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[4] The thalweg is a line connecting the lowest or deepest points along a streambed. Similarly, the invert is the part of a streambed represents the lowest point or channel floor in a cross section.

5. Where clay exposures are present in the bed, the channel is expected to continue vertically incising into the clay layer. Two locations in particular, one near river mile (RM) 2.75 (downstream of the Wood Canyon Creek confluence) and the other near RM 6.0 (downstream of the where the Joint Regional Water Supply System pipelines cross the creek) were investigated to calculate incision profiles for 25, 35, and 50 years under the no action plan. These calculations show that incision upstream of these sites could be 0.8 to 1.1 feet for a non-eroding slope of 0.45 percent or 3.0 to 4.1 feet for a non-eroding slope of 0.30 percent. The significance of these results is that the ultimate bed profile will closely resemble the existing profile and where localized changes are expected to occur, the magnitude and extent of the incision is expected to be relatively minor compared to degradation that has occurred since 1980.

6. Future systematic upper bank erosion is expected where banks are nearly vertical, are composed of alluvium, and contain tension cracks that extend the height of the upper bank thereby exceeding the critical bank height (the maximum geotechnically-stable height of a bank given the bank materials and bank angle) for geotechnical stability. Localized bank erosion is also expected where the active channel is located against the toe of the terrace. The presence of more erosion-resistant clay-rich sediments that form the toes of most of the banks provides stability and limits the potential for systematic widening of the inset floodplain (a hydrologically-connected depositional surface adjacent to the bed of the incised channel).

7. Both localized (colluvial) and more widespread (fluvial) deposition of sediment on the inset floodplain will reduce the effective heights of the banks to the point where they no longer exceed the critical height and this, combined with reduced bank angles, will ultimately lead to bank stabilization. Despite this natural progression towards stable banks, stabilization measures may be required for those locations where infrastructure is at risk from continued bank erosion. As deposition of sediment continues on the inset floodplain, a net reduction in sediment delivery from the watershed is expected.

Service Suggested Project Alternatives

While restoring the full historic channel thalweg/invert elevations (to pre-incision conditions that existed several decades ago) within Aliso and Wood Canyons Wilderness Park would otherwise be generally desirable, the biological impacts associated with reaching that goal may not be offset by the potential gains involved. Also, the economic costs would be high given the imported fill needed to raise the invert would be substantial. The resulting stream slope angles would likely be increased for each increase in invert elevation, which would normally increase the need for costly measures to reduce stream competency,[5] such as energy dissipators, or result in the need for substantially greater additions of coarse sediment to the stream to offset losses to fluvial processes. For example, we do not suggest that regaining or enhancing connectivity for aquatic

[5] Stream competency is a measure of the maximum size of the particles that the stream can transport under given conditions. It is proportional to the velocity of the flow, which is often related to stream slope and other factors.

species between Aliso Creek and Wood Canyon Creek is worth the potential ecological impacts involved. This is, in part, due to: the very meager stream low flows in Wood Canyon that will likely diminish in the future, the lack of freshwater native fish within both Aliso Creek and Wood Canyon Creek, the very few species that would benefit, and the mobile nature of the native aquatic reptiles and amphibians in the watershed. We expect that Aliso Creek is in the process of restoring itself as it continues to evolve or recover a new partial equilibrium following the recent substantial incision conditions, and we are suggesting alternatives that would likely enhance this existing recovery trajectory.

We suggest three alternatives for consideration by the Corps:

Alternative A (Figures 1-6, & 13):

1. In Alternative A, substantial fill in the form of rock and/or soil would be imported and placed in the incised portions of the channel within Aliso and Wood Canyons Wilderness Park. The creek invert elevations would be partially restored to historic conditions, likely to a total of 7 to 14 feet above existing invert grade (or as appropriate). Cut material from grading of nearby construction activities (e.g., road relocations within the Park, proposed herein) and steep embankment slope lay back activities would be also be placed within the channel. No export of graded soil material would occur. Most of this work would be performed linearly along the channel bottom, leaving relatively large riparian areas along the creek largely undisturbed. Existing channel embankments that are steeper than 1:1 would be laid back to a variable 1.5:1 to 3:1, as appropriate. Riparian areas of existing and expected future low function potentially would also be included in re-grading.

2. The ACHWEP structure would be modified as hydrologically necessary, including notching of the top if appropriate. Substantial large rock would likely need to be placed at the base of ACHWEP to prevent erosion during design storm events and to form a pool, with development of a glide-riffle made out of large river-rounded rock downstream of the pool, appropriate to the energy of design flows at this location. Large river-rounded rock and cobble would be placed in the channel in such a way as to provide natural channel geomorphology (Figure 1, 2, & 13). A matrix of sand, soil, and gravel (gravel augmentation) would be placed over this imported material at a depth of about 2 to 5 feet (or as appropriate) in the morphology of natural pool-glide-riffle-run sequences complementary to the large rock and cobble geomorphology noted above; these depths and quantities would be sufficient to bring the stream to Lane's Balance within the Park for about 25 years or more. A portion of this matrix would be expected to become eroded-transported-deposited within and through the park during most storm flow events (e.g., 1-year storm or greater), reducing or eliminating the "hungry water" conditions within the Park.

3. No channel weirs or drop structures would be constructed, but a large pool and two substantial riffles made of large rock would be constructed immediately below ACHWEP

to dissipate stream energy, as noted above. 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 ACHWEP 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.

4. Park roads on the north side of the Aliso Creek would have their pavement coverings removed and converted to dirt Park trails/Park staff roads, as appropriate. These dirt trails/roads would be realigned where the current alignments are close to the historic floodplain of Aliso Creek, as practicable. New paved road access would be constructed on the south side of Aliso Creek approximately along the alignment of the existing jeep trail that follows the existing utility lines on the south side of the creek, with the goal of consolidating wastewater treatment plant truck traffic, wastewater roads (all paved roads), and utility line infrastructure on one side of the creek. All non-emergency/non-park vehicle traffic (outside of bicycles) would be relegated to the south side of Aliso Creek on this paved road. Where the utility lines near Aliso Creek would remain vulnerable to damage, a minimum amount of sheetpile would be utilized along the utility ROW line (as far away from the creek floodplain, and buried, as practicable) for infrastructure protection, as necessary (Figures 2 & 3). The goal of all these activities is to consolidate infrastructure to one side of the creek to the extent possible, to minimize any future maintenance need of remaining infrastructure on the north side of Aliso Creek (the dirt trail/road should need minimal and simple maintenance), to gain additional room for natural creek lateral meander (e.g., through road re-alignment), and minimize channel slope protection (either exposed or buried) that would otherwise limit lateral channel meander and reduce riparian functions.

Alternative B (Figures 7-13):

1. Our proposed Alternative B is similar to Alternative A, but involves substantially less imported fill and gravel augmentation quantities and depths (Figures 7 & 8). Fill in the form of predominantly soil would be imported and placed within the incised portions of the channel within Aliso and Wood Canyons Wilderness Park, to a depth of about 2 to 5 feet; cobble, gravel, and sand matrix augmentation to a depth of about 2 to 3 feet would occur above that (Figure 7 & 8). The creek invert elevations would be partially restored to historic conditions, likely to a total of 4 to 8 feet above existing invert grade (or as appropriate). Cut material from grading of nearby construction activities (e.g., herein proposed road relocations within the Park) and steep channel embankment slope lay-back activities would also be placed within the channel at the same time as the soil fill noted above. 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.

2. The ACHWEP structure would be modified as necessary to provide appropriate hydrological characteristics (e.g., the channel area immediately upstream of ACHWEP may have too shallow of a stream slope for proper functioning), including notching of the top of the structure. Substantial large rock would likely need to be placed at the base of ACHWEP to prevent erosion during design storm events. This rock would be placed in a way to form the bottom of a substantial pool at the base of the structure (similar to the natural pools that form at the base of waterfalls), so as to accommodate and dissipate the substantial creek energy of the design flows coming off the ACHWEP structure (see Figure 11). Large river-rounded rock and cobble would be placed in the channel to provide natural channel riffle-run-pool-glide geomorphology (see Figures 7, 8, & 13). A series of riffles, comprised of large river-rounded rock, would be constructed within the channel, at hydrologically appropriate intervals, to both help create and maintain pool-glide-riffle-run morphology and reduce stream competency (Figures 9 - 13). These rock riffles would be ungrouted and a portion of the placed rock would be buried within the channel side slopes.

3. A matrix of sand, soil, and gravel (gravel augmentation) would be placed over this imported material to appropriate depths to match the weir elevations (likely 2 to 3 feet), in the morphology of natural pool-riffle-run sequences complementary to the imported rock and weirs; these depths and quantities would be sufficient to bring the stream to Lane's Balance within the Park for at least 25 years. A portion of this gravel matrix would be expected to become eroded-transported-deposited within/through the park during most storm flow events (e.g., 1-year storm or greater), reducing or eliminating the "hungry water" conditions within the Park. Substantial gravel augmentation matrix stockpiles would be placed along the channel for entrainment during large storm flow events, so as to protect the stream from future incision during design storm events. If necessary, additional gravel augmentation stockpiles would be placed along Aliso Creek upstream of the Park and at the ACHWEP structure (and possibly at other locations,) for ease of future augmentation by local entities on an as-needed basis.

4. Park road and utility-associated work would be performed as in Alternative A above.

Alternative C:

1. Alternative C would be similar to the Corps proposed Alternative 2, but it would involve the Park road and utility-associated work as noted above. Alternative C would reduce the laying back of channel embankment slopes (as compared to Alternative 2) to only those areas with existing slopes steeper than 1:1, and then only to a variable 1.5:1 to 3:1 slope, based on the current condition/functions of areas that would be disturbed by grading and to create natural slope variability. Similar to Alternative B above, the 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 in reduced quantities compared to Alternative B. The goal of this

alternative would be to largely enhance the recovery of the stream that has been occurring since the last large flood event, but at an accelerated rate, with moderately steep channel side slopes (i.e., less than 1:1) naturally laying back and hanging floodplain terraces eroding over time on their own. It is likely that as the stream "evolves" over time, it will regain new substantial floodplain area along the currently incised channel elevations, with some expanded aquatic zones and expanded/increased functional riparian zones. This alternative would leave much of the creek's existing riparian zones intact. Sheetpile utility infrastructure protection would be provided as shown in Figure 10.

We are supportive the Corps proposed project designs outside of Aliso and Wood Canyons Wilderness Park (Enclosure 1). These areas are generally degraded and have significantly reduced potential for ecological restoration gains due to surrounding development and heavy constraints in most areas. The proposed project would likely modestly improve connectivity and aquatic and riparian conditions in these areas. As discussed between the Service, Corps, and US Geological Survey staffs, we suggest that any of the proposed turtle ponds ("off-line turtle refugia"), if implemented, be temporary features (5 years maximum) and later filled above groundwater levels to eliminate ponded water, which would remove habitat within these ponds for invasive species such as bullfrogs (*Lithobates catesbeianus*) and reduce pest management needs.

As we have discussed in our numerous meetings on this project over the last couple years, we are suggesting a less intrusive approach to restoration of the Aliso Creek within Aliso and Wood Canyons Wilderness Park than your proposed alternatives (Alternatives 2, 3, and 4). Outside of a modified version of proposed Alternative 2, we are not supportive of any of the current proposed Corps project alternatives for the portions within Park for the following reasons:

1. None of the Corps' proposed alternatives would substantially preserve the existing riparian vegetation/natural communities within the Park. Large areas of riparian natural communities within the Park are of moderate to high ecological function, and they are valued greatly by many of the substantial numbers of local recreational users of the Park. Laying back channel slopes to 3:1, as proposed in proposed Alternatives 2, 3, and 4, would essentially eliminate (albeit temporarily) these existing riparian resources. We expect that many of these riparian areas can be conserved while practicably restoring fluvial functions to the stream. Admittedly, many aquatic and riparian areas in the Park are degraded, particularly where former floodplain terraces are now "hanging" above groundwater and surface stream flows, and some other areas are still recovering following the last large storm events in the stream. Additional areas that currently consist of very steep stream slopes (steeper than 1:1) likely should be laid back (to a variable slope of 1.5:1 to 3:1, depending on the resources affected). Nevertheless, the stream is currently slowly at least partially recovering itself as it comes closer to a new equilibrium. All of the proposed Corps alternatives would largely eliminate the existing riparian systems as a result of substantial channel and embankment grading and re-contouring. While restoration of riparian vegetation is proposed as part of the project, a substantial lag time

in habitat availability would result, with approximately 5 years to establish woody riparian vegetation, and 10 or more years for that vegetation to mature. We suggest that any alternative chosen retain substantial riparian systems within the Park through avoidance where practicable. We suggest that channel work (e.g., fill) be performed primarily from the center of the channel (invert), with steep (1:1 or steeper) channel slope embankments laid back where necessary; general grading of channel slopes be should be avoided. We also suggest variation in final channel slope grading along the creek.

2. Outside of Alternatives 1 and 2, all of the proposed Corps alternatives include substantial drop structures within the Park, with reduced channel slopes and substantially dissipated stream energy (by design, to reduce erosion) between these structures. We suggest more natural designs for runs, riffles, and pools than those afforded by these drop structures, including riffles that have natural cross sections and profiles and are constructed of rounded river rock. The proposed drop structures would greatly reduce natural fluvial processes within the Park, likely including causing areas of slow/slack water upstream of drop structures during low flows, with general fine-sediment siltation in these areas and associated reduced aquatic ecological functions (e.g., a reduced aquatic invertebrate fauna). These drop structures would likely eliminate most channel erosion (again, by design) and greatly reduce potential lateral stream meander. We consider the potential for lateral meander of the stream a highly important natural stream function. It also appears that each drop structure consists of an unnaturally flat/level surface when viewed in profile looking upstream. While the stream currently has excess (unnatural) stream competency during storm flows due to development-caused watershed changes upstream, we suggest working with both the unnatural excess stream competency and unnaturally reduced sediment input from upstream areas. If the channel invert is to be raised, we suggest that this should be done by restoring the Lane's Balance to the stream in the Park by combining reduction of the stream energy and elimination the sediment deficit, thus greatly reducing the need for substantial drop structures. Equilibrium in the stream within the Park should be attained by either restoring the stream in approximately its current incised invert elevation condition (our Alternative C), bringing the channel invert up partially (our Alternatives A and B), and adding coarse sediment (predominantly gravel and sand) in a matrix to attain Lane's Balance. Portions of this coarse sediment matrix would become mobile during storm flows for fluvial processes of erosion-transport-deposition within the Park, greatly reducing or eliminating the "hungry water" erosion conditions that would otherwise cause the need for drop-structures. While we understand that periodically adding coarse sediment mechanically to locations within the stream is undesirable to the Corps (versus a "ready to go" project following construction), we expect that stockpiles of gravel and sand can be pre-emptively placed during construction in channel areas for periodic augmentation by the stream itself during high storm flow events. Additional stockpiles can be placed along the stream for periodic point-location mechanical augmentation by local entities (e.g., with a front-end loader) on an as-needed basis (our estimate is this would occur approximately once every 25 years).

We suggest a meeting between our respective agencies that includes an expert on fluvial geomorphology to discuss these issues, similar to the discussions our agencies recently had with a consultant hydrologist in designing the Whelan mitigation site along the San Luis Rey River. To schedule such a meeting, or ask any questions you have regarding this letter, please contact Jon Avery, Federal Projects Coordinator, at 760-431-9440, extension 309.

Sincerely,

for Scott A. Sobiech
Deputy Field Supervisor

Enclosures

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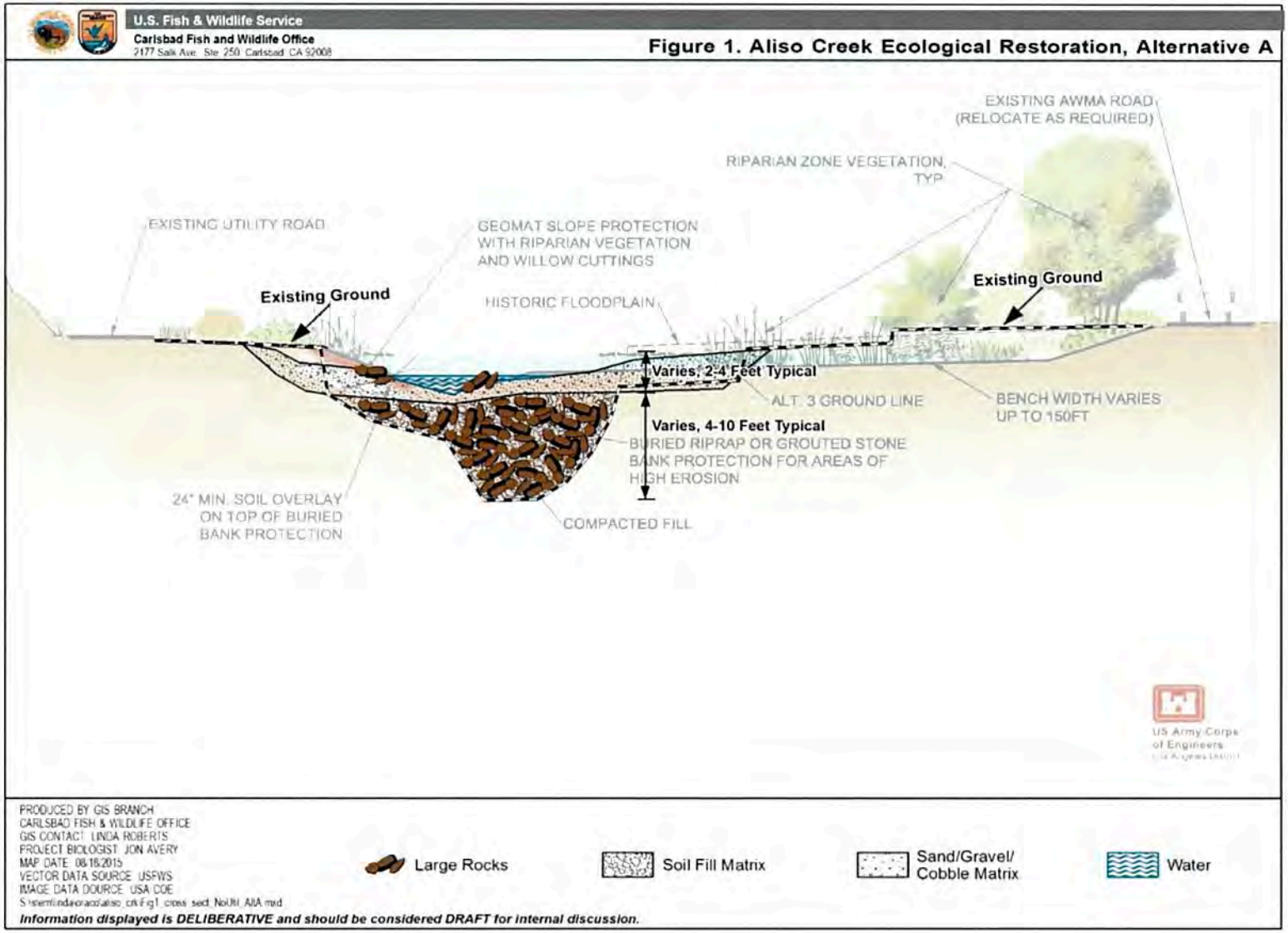
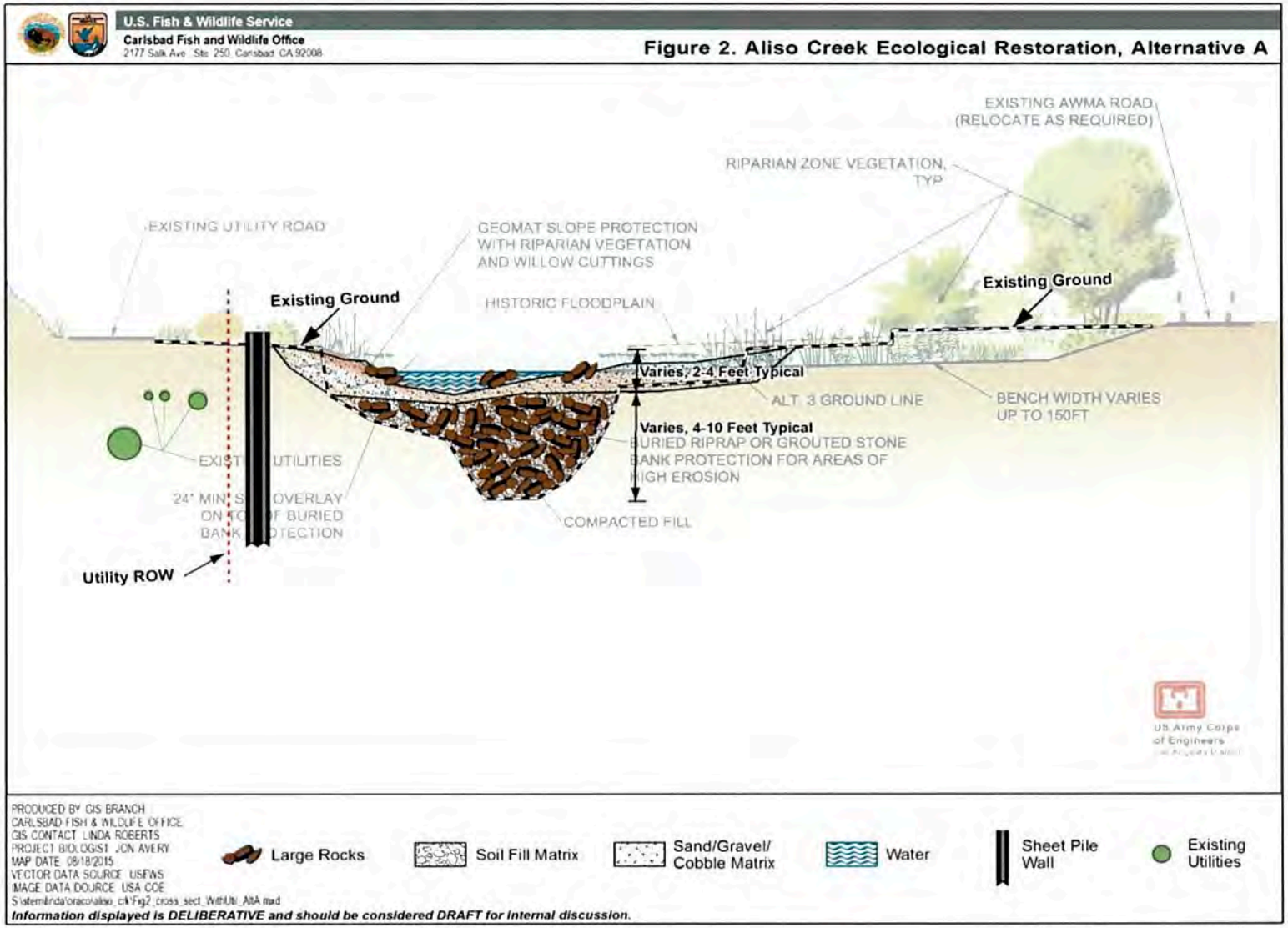


Figure 1. Aliso Creek Ecological Restoration – Alternative A



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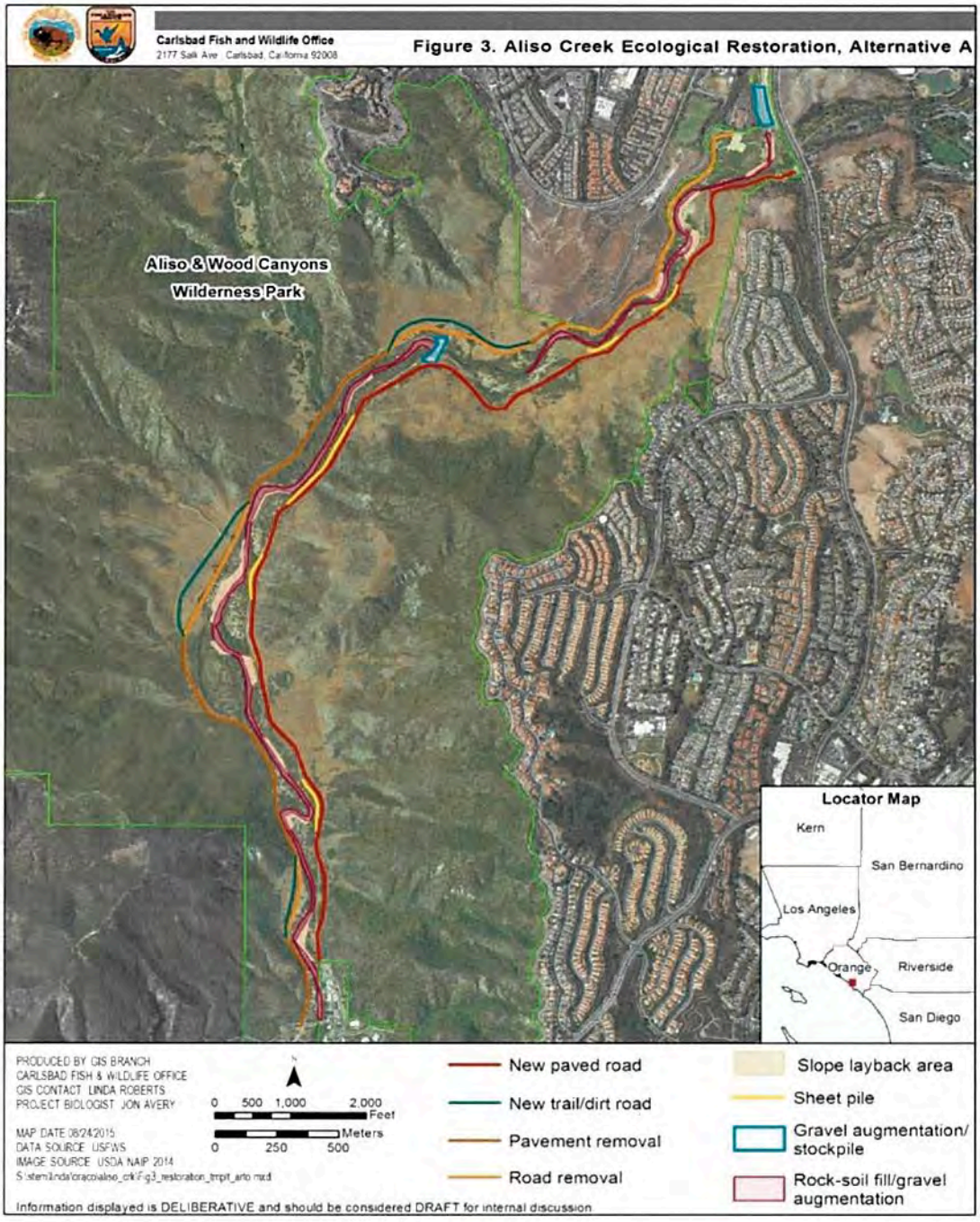


Figure 3. Aliso Creek Ecological Restoration – Alternative A

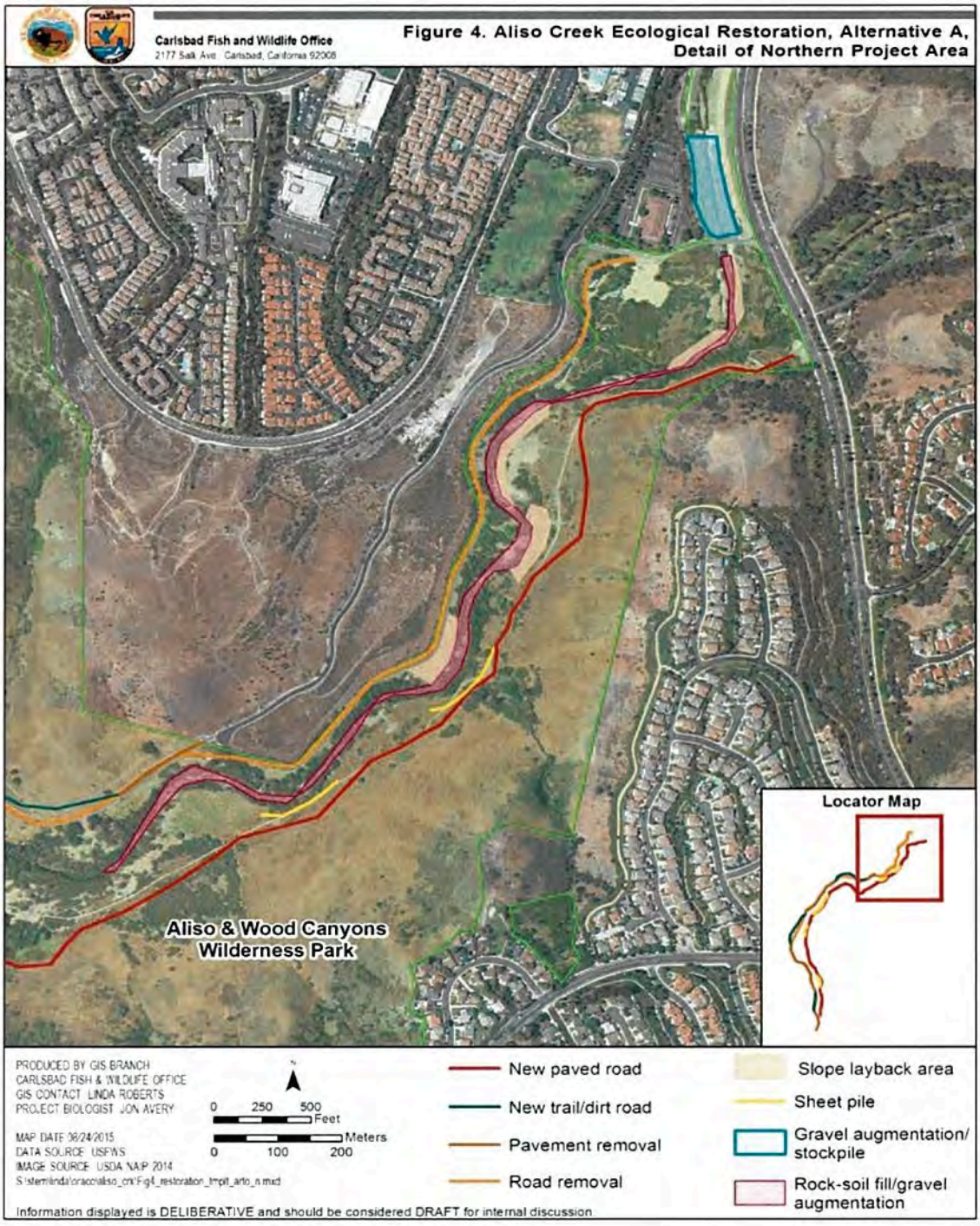
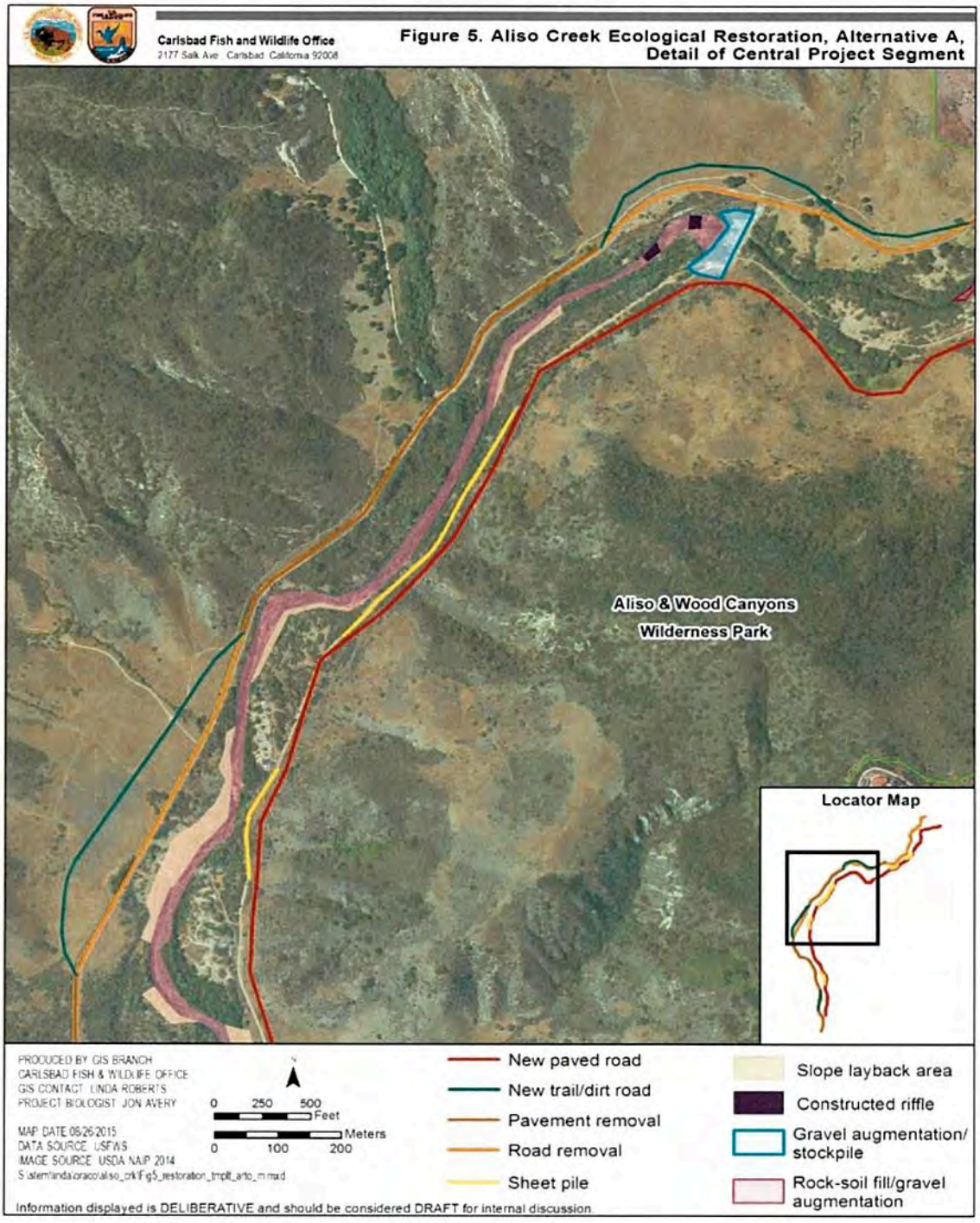


Figure 4. Aliso Creek Ecological Restoration – Alternative A



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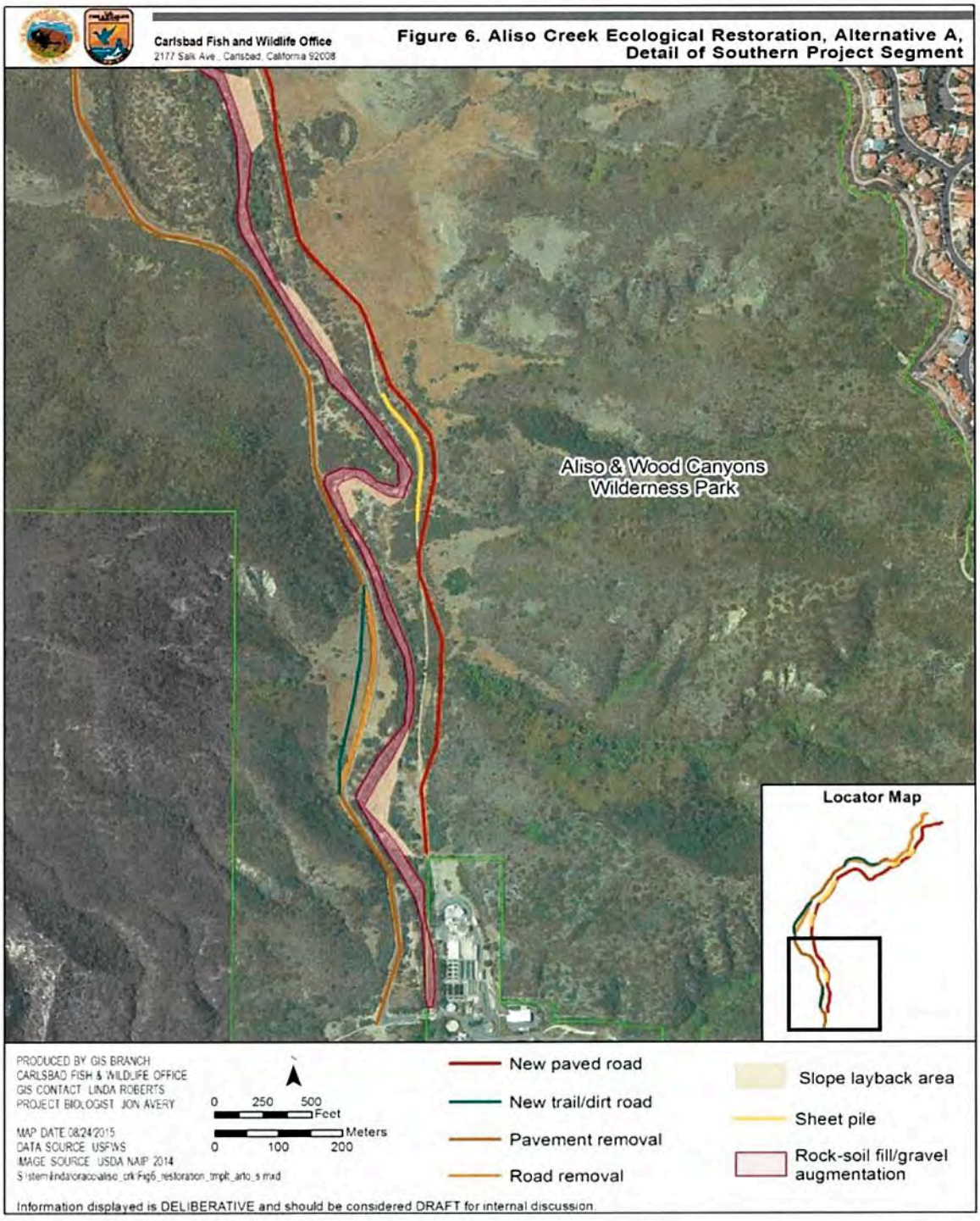


Figure 6. Aliso Creek Ecological Restoration – Alternative A

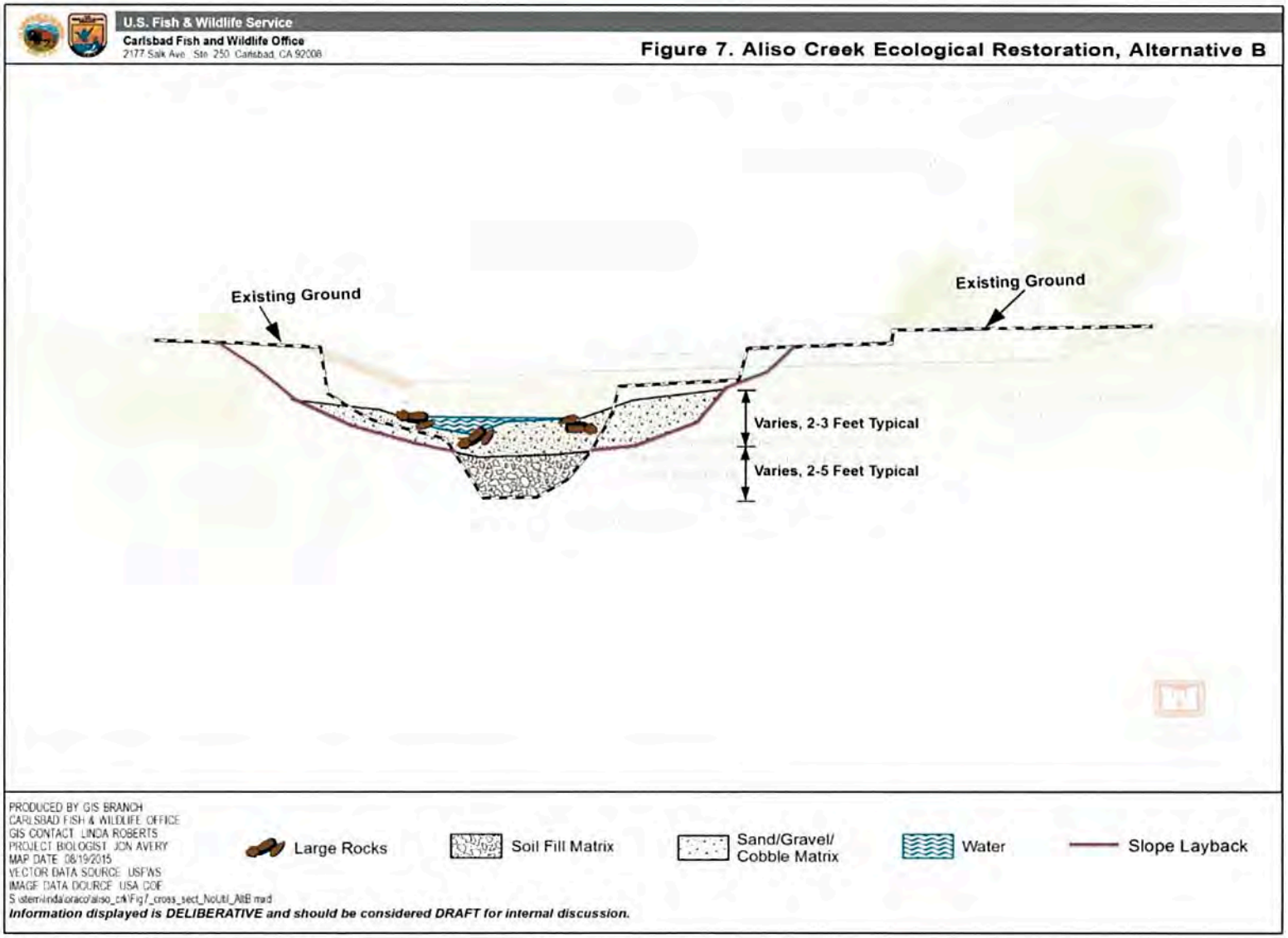


Figure 7. Aliso Creek Ecological Restoration – Alternative B

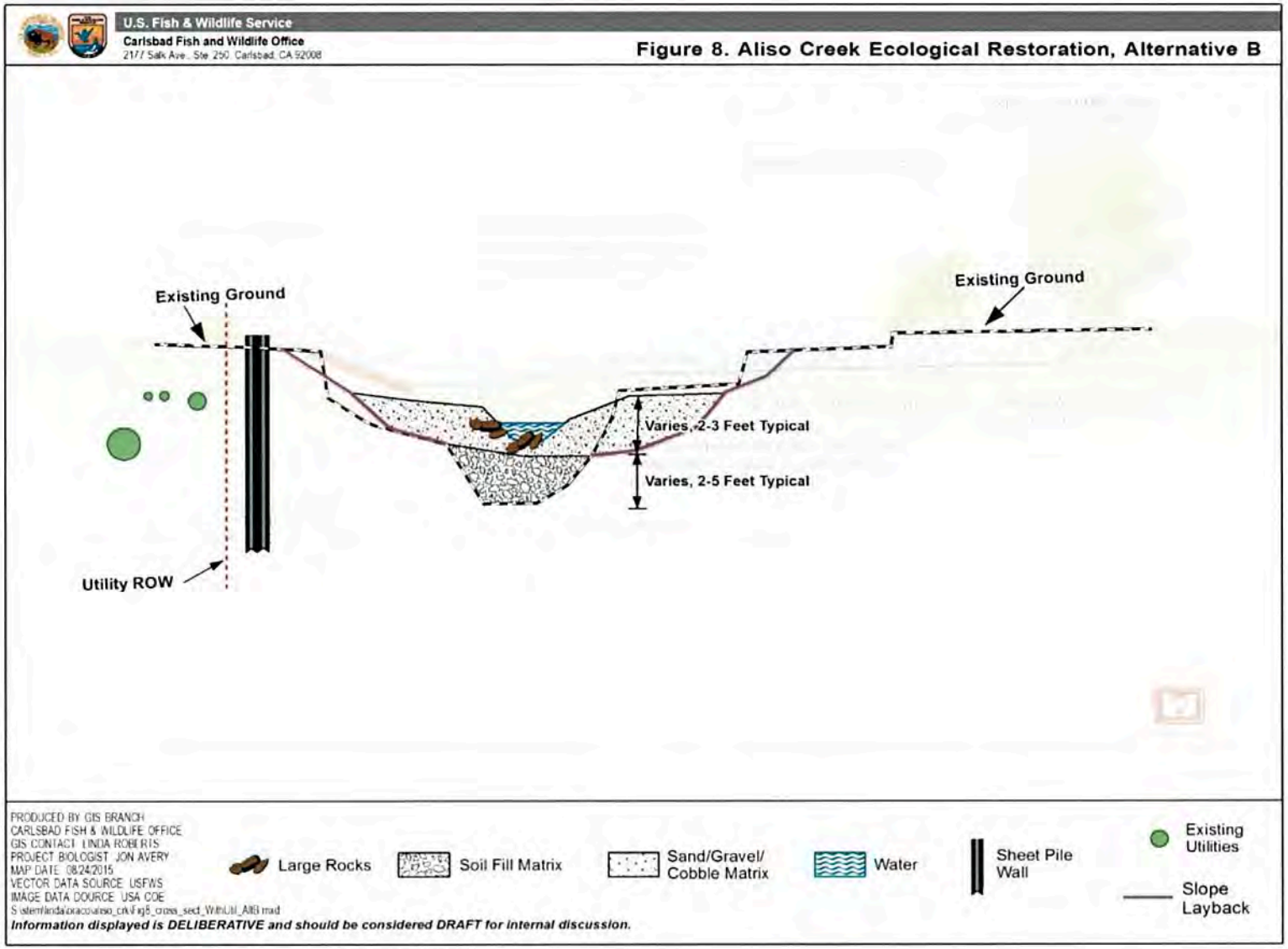


Figure 8. Aliso Creek Ecological Restoration – Alternative B

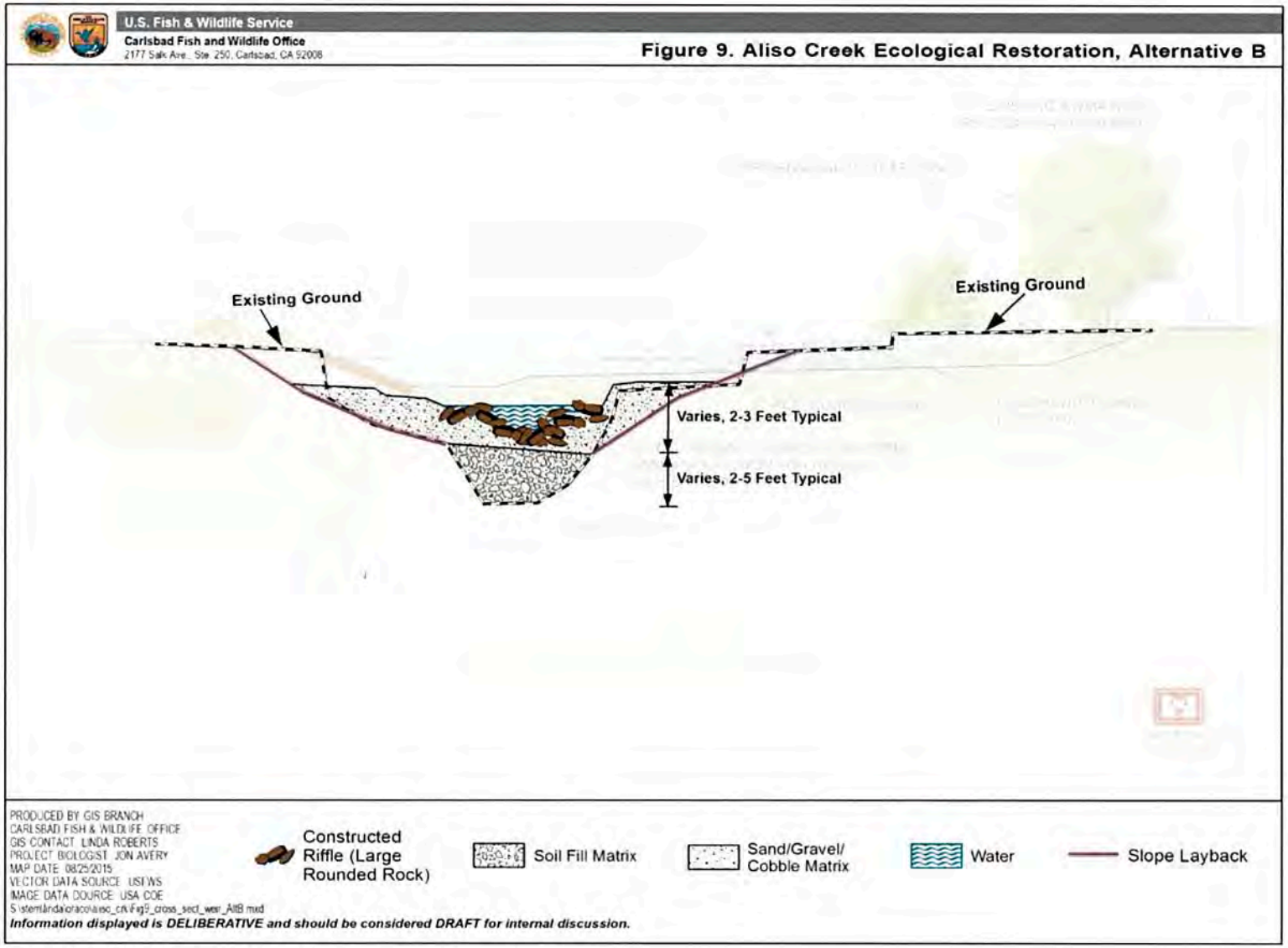


Figure 9. Aliso Creek Ecological Restoration – Alternative B

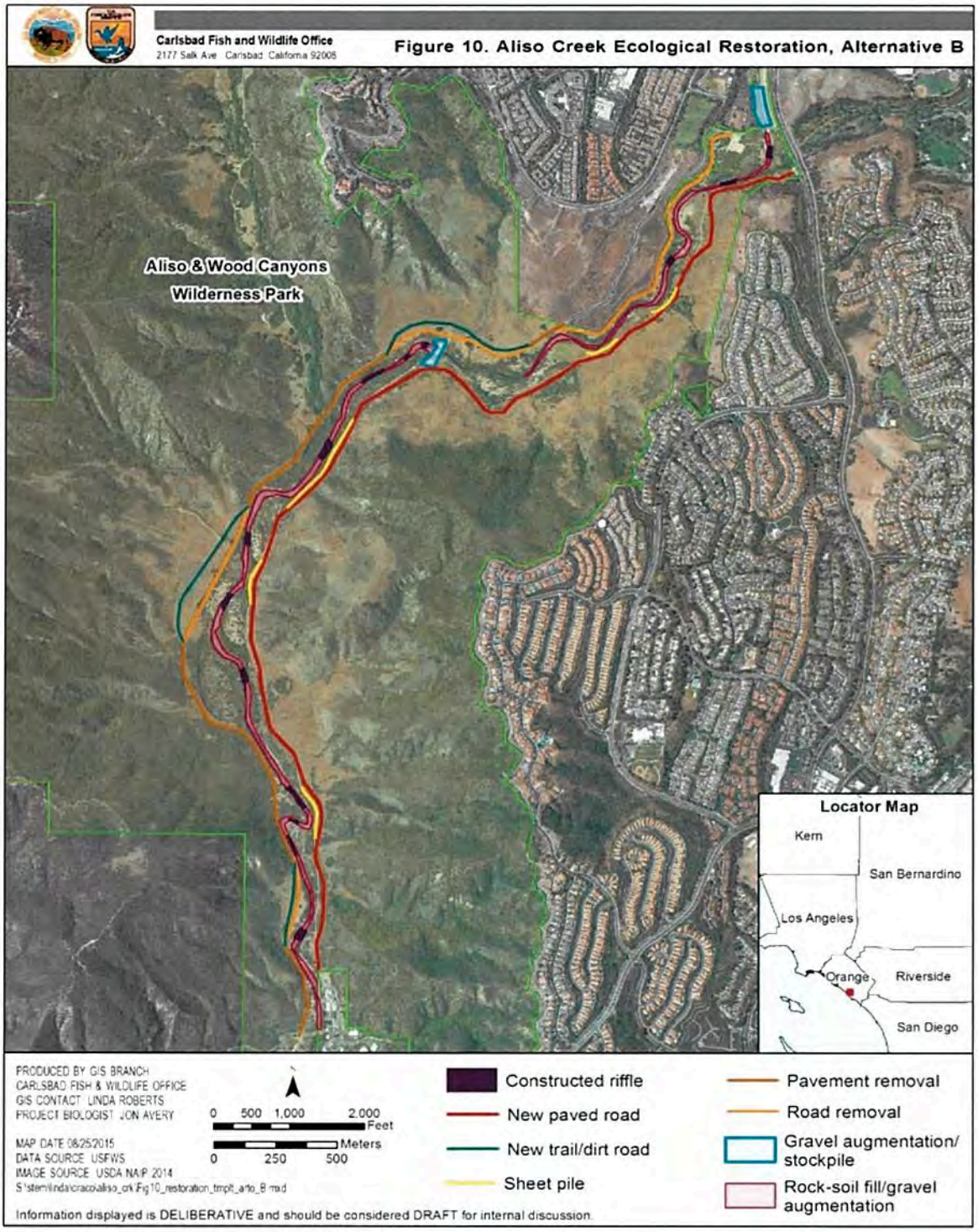


Figure 10. Aliso Creek Ecological Restoration – Alternative B

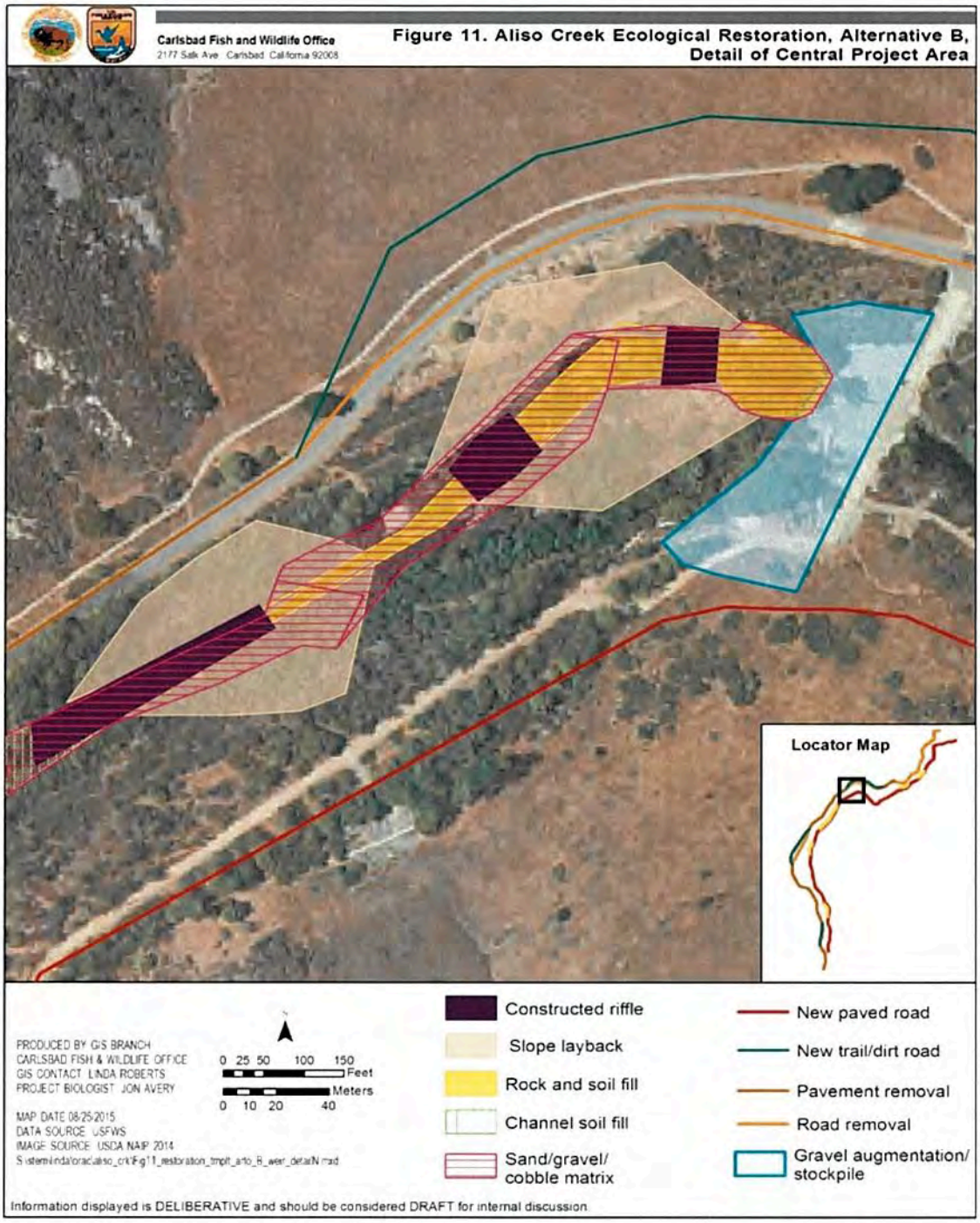


Figure 11. Aliso Creek Ecological Restoration – Alternative B

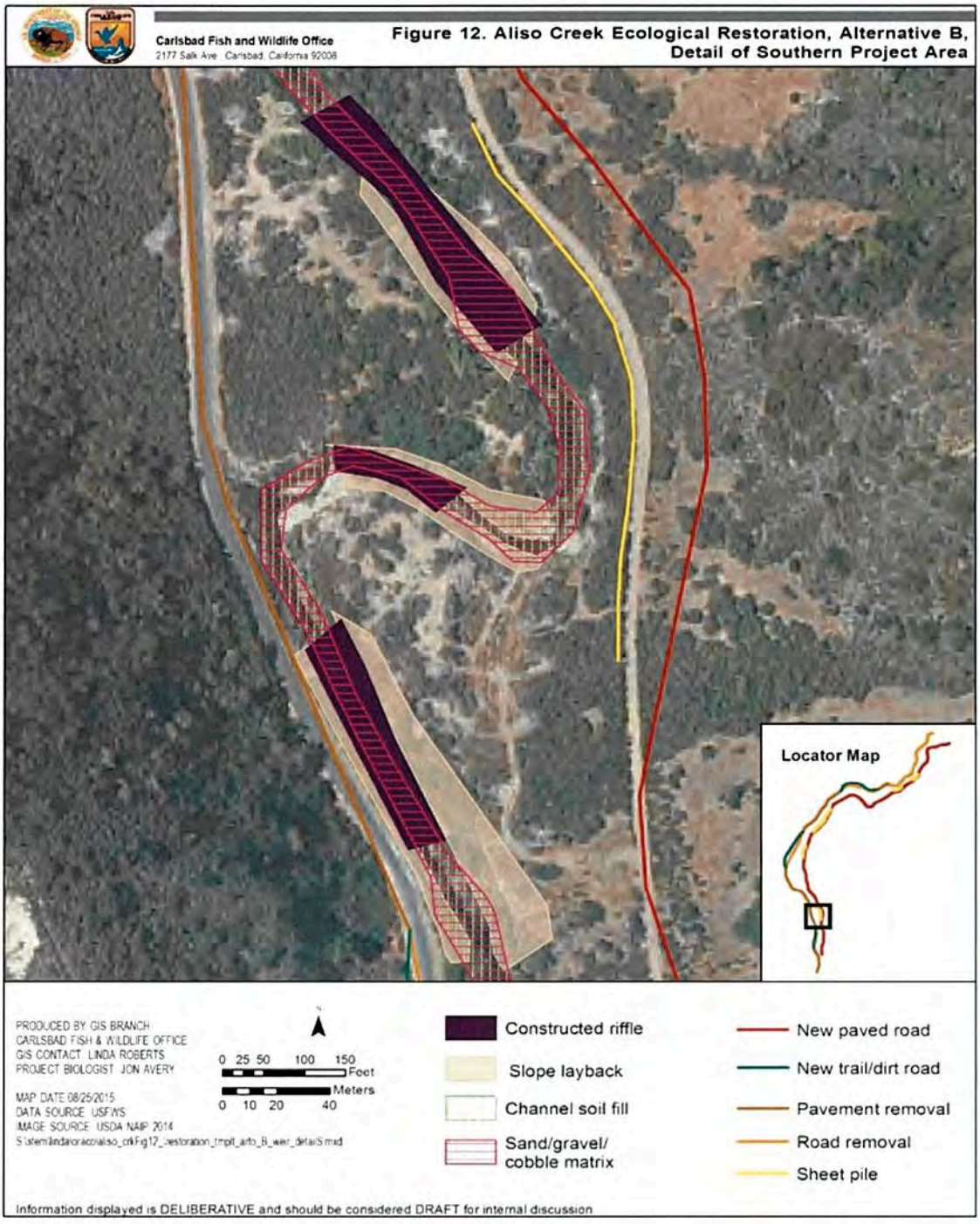


Figure 12. Aliso Creek Ecological Restoration – Alternative B

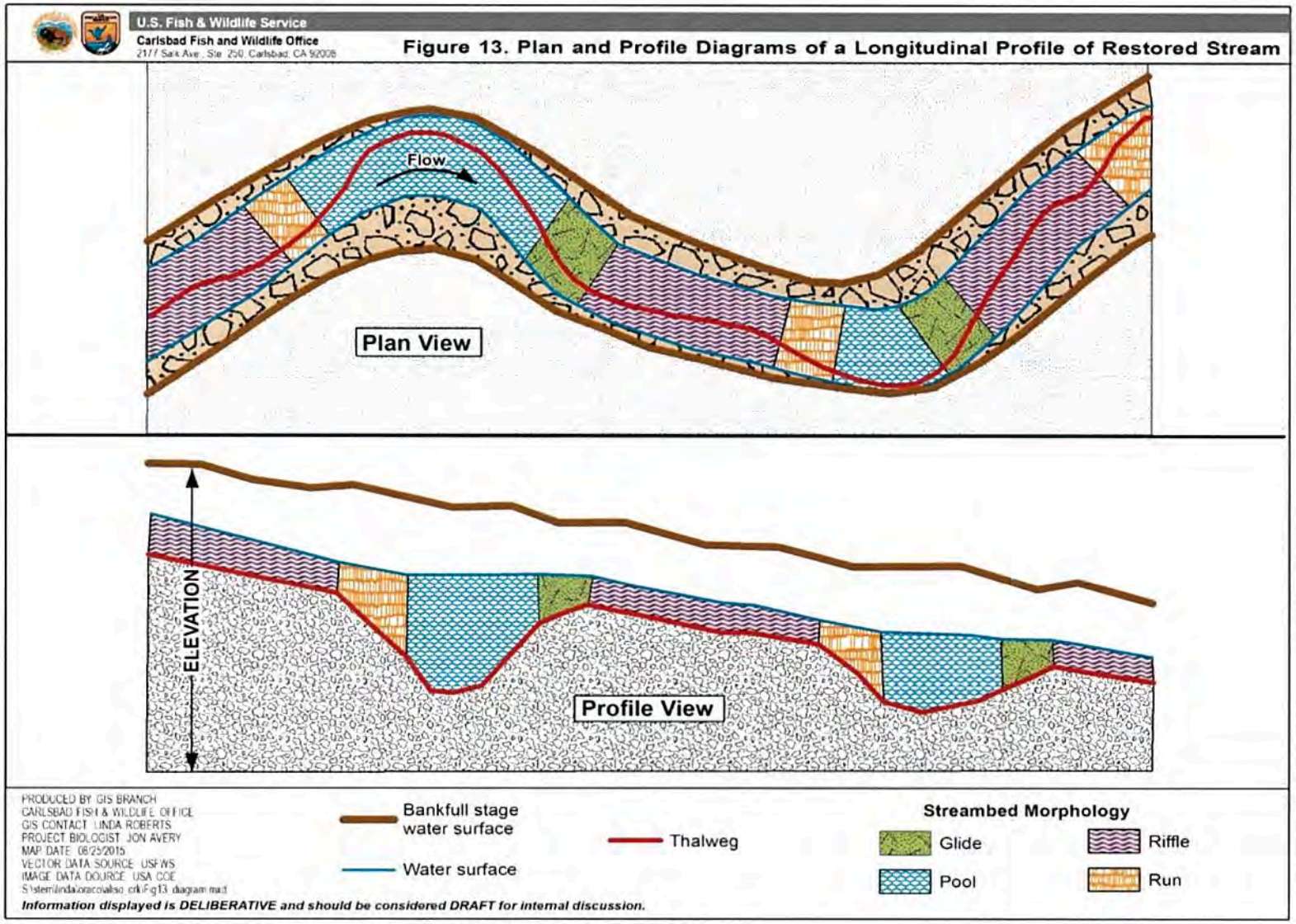


Figure 13. Plan and Profile Diagrams of a Longitudinal Profile of a Restored Stream

Enclosure 1

[Received by the U.S. Fish and Wildlife Service from the Army Corps on August 14, 2015]

Aliso Creek Mainstem Ecosystem Restoration Study

The purpose of this feasibility study is to evaluate opportunities for restoring degraded ecosystem function and stream channel stability along the lower Aliso Creek Mainstem in Orange County, California. The study in addition will also address reduction of flood risk damage threat to infrastructure and facilities. Channel degradation is the result of the effects of upstream urbanization over the last few decades.

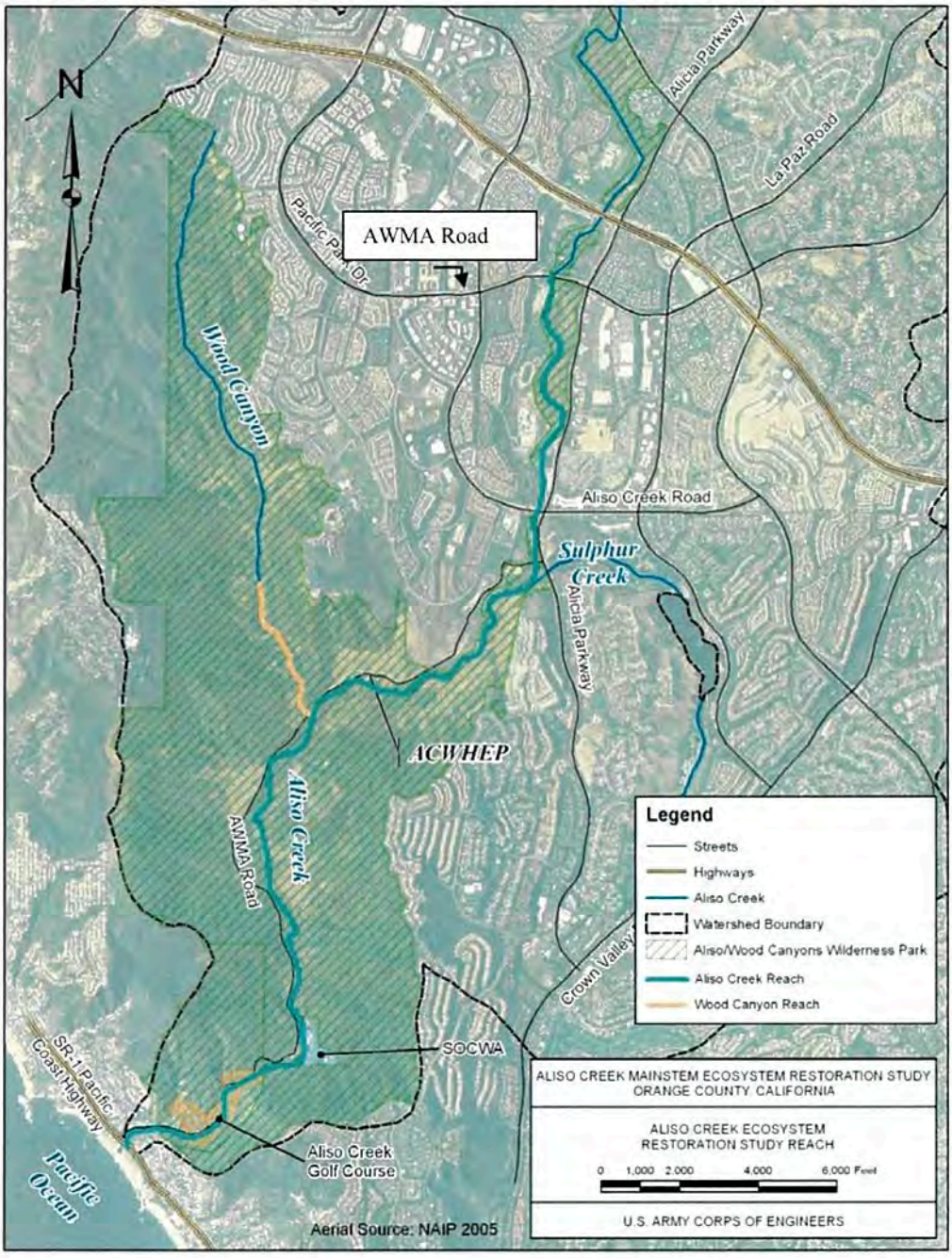
The majority of the project area lies within the Aliso and Wood Canyons Wilderness Park, which is owned, operated, and managed by the County of Orange. Aliso Creek is largely a natural stream. The project area focuses on 5.5 miles of the Aliso Creek Watershed from the Coastal Treatment Plant (CTP) Bridge to Pacific Park Drive; included also is consideration of the lower 1,000 feet of the Wood Canyon Creek tributary from its confluence with Aliso Creek (See Figure 1). The CTP is owned and operated by the South Orange County Wastewater Authority (SOCWA). The lower reach of the watershed is identified as having the most significant issues associated with ecosystem and stream degradation (channel incision and unstable side slopes), and infrastructure threat. The feasibility study will also evaluate the effects of a potential federal project to the reaches of Aliso Creek mainstem from downstream of the CTP bridge to the Pacific Ocean.

Within the Wilderness Park, an area associated with a former non-federal mitigation site referred to as the Aliso Creek Wildlife Habitat Enhancement Project (ACWHEP), is a key area for ecosystem restoration opportunities. The mitigation project was severely damaged in the winter of 1997-98. The ACWHEP no longer functions as intended and severe streambank and streambed erosion (current incision totaling 25 feet) continues downstream of the headworks structure, which now acts as a large drop structure. As of October 2012, the ACWHEP mitigation site agreement has been terminated. The ACWHEP headworks structure however still remains serving solely to preclude severe upstream headcutting. The structure is an armored earth fill embankment that straddles 450 feet across Aliso Creek, and is a barrier to aquatic wildlife migration.

Wood Canyon tributary also is highly eroded at its confluence with Aliso Creek. There is currently at least a 25-foot high drop in elevation just downstream of the AWMA Road crossing. The perched confluence acts as a barrier to aquatic wildlife migration.

A public utility, the SOCWA Coastal Treatment Plant, is situated in Aliso Canyon within an isolated parcel surrounded by the Wilderness Park. The wastewater treatment plant has a design capacity of 6.7 million gallons per day and serves the City of Laguna Beach, Emerald Bay Services District, South Coast Water District, and Moulton Niguel Water District. An easement for effluent and sludge conveyance pipelines runs along the east side of Aliso Creek. 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 bridge via an access road (AWMA Road) that parallels to 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.

The on-going erosion of the Aliso Creek channel poses a threat to the SOCWA infrastructure. Past storms have resulted in erosion that has caused failure of the Moulton Niguel Water District 18-inch sewer line within the Wilderness Park reach. SOCWA has spent millions of dollars repairing erosion damages along Aliso Creek. SOCWA considers all repairs along Aliso Creek temporary due to instability of the channel.



Enclosure 1 - Figure 1. Project Area

Alternatives:

Six alternatives are being evaluated, including the "No Action" alternative.

Alternative 1: No Action Alternative:
Under this alternative, the Federal government or other entities would take no action to restore ecosystem functions or values, or protect infrastructure within the Aliso Creek study area.

Alternative 2: Stabilize Existing Streambed Elevation and Construct Associated Floodplain:
This alternative will stabilize the existing incised streambed alignment starting from the SOCWA bridge to the ACWHEP structure. "Stabilizing" the channel involves recontouring it to an adequate width and equilibrium slope to allow it to carry its dominant (channel forming or bank full) discharge without significant aggradation or degradation. This would be the long-term condition to which the channel is adjusting. Existing bank slopes, many of which are oversteepened and unstable, will be graded to a stable 1v:3h slope. No grade control is necessary to address streambed stability issues. The riparian corridor along the creek banks will be restored with appropriate riverine vegetation types. The significant elevation discontinuity (currently about 25 feet) at the Wood Canyon Creek confluence and at the ACWHEP structure will remain unchanged. Buried riprap stone bank protection will be placed to protect infrastructure (AWMA Rd and SOCWA wastewater pipelines) at key locations where lateral erosion is considered a threat.

Other features considered for alternative 2 include: reconnection of the abandoned oxbow (active channel would be filled in); lowering the perched terrace at the abandoned oxbow to create a 10-year floodplain for the active channel with an associated adjacent backwater area; stream lengthening; and off-line turtle refugia.

Alternative 3: Raise Streambed Elevation to Reconnect to Historic Floodplain:
This alternative will raise the existing streambed to approach the pre-incised stream elevation to allow hydrologic reconnection with the historic floodplain. Raising of the streambed will be transitioned, starting from the SOCWA bridge and continuing upstream to AWMA Road Bridge. The channel will be widened (to its dominant discharge width) and will include in-channel benches (to act as a 2-yr event floodplain). Side slopes will be graded to 1v:3h. The ACWHEP structure would be demolished. Grade control stabilizers ("riffle structures"), consisting of large riprap boulders set at and below streambed grade, will be placed in a series transverse to the channel to provide stability to the raised streambed. A total of 34 riffle structures will be necessary. Spacing will be between 500 and 800-feet apart to promote the formation of pools. The riparian corridor along the creek banks will be restored with appropriate riverine vegetation types. Raising of the stream will reduce the significant elevation discontinuity (currently about 25 feet) at the Wood Canyon Creek confluence. Buried riprap stone bank protection will be placed to protect infrastructure (AWMA Rd and SOCWA wastewater pipelines) at key locations where lateral erosion is considered a threat.

Other features to be considered for Alternative 3 include: reconnection of the abandoned oxbow (active channel would be filled in); lowering the perched terrace at the abandoned oxbow to create a 10-year floodplain for the active channel with an associated adjacent backwater area;

stream lengthening; off-line turtle refugia; Sulphur Ck reconnection; channel widening/riparian corridor addition for 2,200 feet in vicinity of Aliso Creek bridge; removal of two 10-foot high concrete drop structures; removal of skate park; channel widening, including in-channel benches downstream of Pacific Park Drive; raising of the channel where necessary between AWMA Bridge and Pacific Park Drive; Pacific Park Drive bypass; repurposing of west road downstream of Wood Canyon confluence to a trail; and east bank paved SOCWA road construction.

Alternative 4: Raise Streambed Elevation and Establish Intermediate Floodplain Connection
Alternative 4 will 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 will be transitioned, starting from the SOCWA bridge and continuing upstream to AWMA Road Bridge. The channel will be widened (to its dominant discharge width) and will include in-channel benches (to act as a 2-yr event floodplain). Side slopes will be graded to 1v:3h. The ACWHEP structure would be demolished. Grade control stabilizers ("riffle structures"), consisting of large riprap boulders set at and below streambed grade, will be placed in a series transverse to the channel to provide stability to the raised streambed. A total of 37 riffle structures will be necessary. Spacing will be between 500 and 800-feet apart to promote the formation of pools. The riparian corridor along the creek banks will be restored with appropriate riverine vegetation types. Raising of the stream to an intermediate elevation will reduce the significant elevation discontinuity (currently about 25 feet) at the Wood Canyon Creek confluence.

Other features to be considered for Alternative 4 include: reconnection of the abandoned oxbow (active channel would be filled in); lowering the perched terrace at the abandoned oxbow to create a 10-year floodplain for the active channel with an associated adjacent backwater area; stream lengthening; off-line turtle refugia; Sulphur Ck reconnection; channel widening/riparian corridor addition for 2,200 feet in vicinity of Aliso Creek bridge; removal of two 10-foot high concrete drop structures; removal of skate park; channel widening, including in-channel benches downstream of Pacific Park Drive; raising of the channel where necessary between AWMA Bridge and Pacific Park Drive; Pacific Park Drive bypass; repurposing of west road downstream of Wood Canyon confluence to a trail; and east bank paved SOCWA road construction.

Alternative 5: USFWS Minimal Approach
Alternative 5 advocates moving existing infrastructure (i.e the west bank access road and the east bank treatment plant wastewater pipelines and associated access road) away from the floodplain, thereby allowing more natural meander potential for the creek. Only where infrastructure cannot be relocated would protection be provided. This protection would be placed as close as possible to the infrastructure alignment, ideally using sheetpile. Rock riffle structures would be provided as needed to dissipate excess stream energies. An energy dissipation boulder structure would be placed at the base of the ACWHEP structure. Notching the top of ACWHEP would be considered to reduce the extensive backwater upstream. A gravel augmentation program would be utilized on a periodic basis with the goal of restoring Lane's balance, to promote a reduction in streambed and streambank erosion from scouring. No raising of the streambed would be pursued. This alternative would include a scenario where excess stream velocities/energies that could not be adequately handled by rock riffles would be accommodated for by the inclusion of V-shaped boulder weirs (1-foot high maximum , or less if needed for aquatic species migration).

Other features upstream of AWMA Road Bridge similar to Alternative 3 or 4 will be considered.

Alternative 6: USFWS Partial Slope Layback Approach

Alternative 6 would include similar restoration measures as in Alternative 5. Additionally, at each boulder weir location (or other streambed feature), the adjacent streambank slopes would be recontoured to a less steeper slope for a distance limited to 75 feet immediately upstream and downstream of each weir. Impacts to high ecological areas would be avoided. The excavated materials would be placed upstream of each structure location. New cut slopes would be revegetated (including use of salvaged plant materials), as necessary. Channel slopes and streambed areas away from the riffle and weir areas would remain undisturbed by construction. Other features upstream of AWMA Road Bridge similar to Alternative 3 or 4 will be considered.

Enclosure 2

2.6 Biological Resources

(Army Corps' draft section from the Aliso Creek Mainstem Ecosystem Restoration Feasibility Study)

2.6 Biological Resources

This section describes biological resources and applicable laws and policies in the study area.

2.6.1 Affected Environment/Baseline Conditions

2.6.1.1 Introduction

Within the study area, Aliso Creek generally consists of a narrow riparian corridor through residential areas. Most of the study area is located within the Aliso and Wood Canyon Wilderness Park (AWCWP), which is part of the Central and Coastal Subregion Natural Communities Conservation Plan (NCCP)/Habitat Conservation Plan (HCP) Reserve known as the Nature Reserve of Orange County (NROC). Past history shows that most of the AWCWP was operated as a ranch, and thus, much of the study area shows influences from long-term grazing. Additionally, the existing urban setting may have contributed to the introduction of exotic plants. Erosion of the creek banks and lack of natural flushing of the creek to the ocean has resulted in sediment loading to the estuary. Even though it is tidal, habitat quality in the estuary is poor, no salt marsh estuary or lagoon characteristic left intact, with little in-stream vegetation or structure, and riparian habitat is highly altered by bank stabilization efforts and invasion by Arundo donax. Water quality in the estuary is impaired by bacteria and other potential pollutants (OC Parks 2009).

A grade control structure known as the Aliso Creek Wildlife Habitat Enhancement Project (ACWHEP) structure is located on Aliso Creek in the upstream locale of the AWCWP. The structure no longer functions as intended and severe erosion and incision of the stream is occurring downstream, which is contributing to a lack of connectivity between the creek and willow/cottonwood vegetation. In addition, the ACWHEP structure blocks access for aquatic, amphibious, and terrestrial wildlife through the riverine and aquatic corridor.

2.6.1.2 Methodology - HAB - A Habitat Accounting and Appraisal Method

At issue is how to determine a more ecologically based method that includes realistic depictions of a site, evaluates multiples species invasive taxa, as well as anthropogenic effects, and can link to management plans as well as to an existing evaluation currency of Habitat Units (HUs) that is used by U.S. Army Corps of Engineers (Corps) and others as a basis for habitat and economic analysis.

Biological resources in the study area were assessed by the Northwest Habitat Institute NHI) using a spatially based multi-purpose field inventory and assessment tool called HAB. HAB is an accounting tool and when applied to a site or area can generate an appraised habitat value for fish and wildlife. Unlike many other previous efforts to calculate the wildlife habitat value (HU) on a piece of land, the HAB approach does not rely on predictive models of species population or population response to derive intrinsic value. Rather, it is based first and foremost on standardized field inventory of existing conditions within a framework that allows visual presentation of the information. A habitat value is calculated using two sets of numbers; one that

shows how many fish and wildlife species might occur and how they might influence their environment, such as a downy woodpecker (a primary excavator) making a cavity in a tree. The other set of numbers evaluates how many habitat components can characterize functions like flowers representing pollination. Each set of numbers has two-parts a potential and observe value associated with it (see Figure 2.6-1).

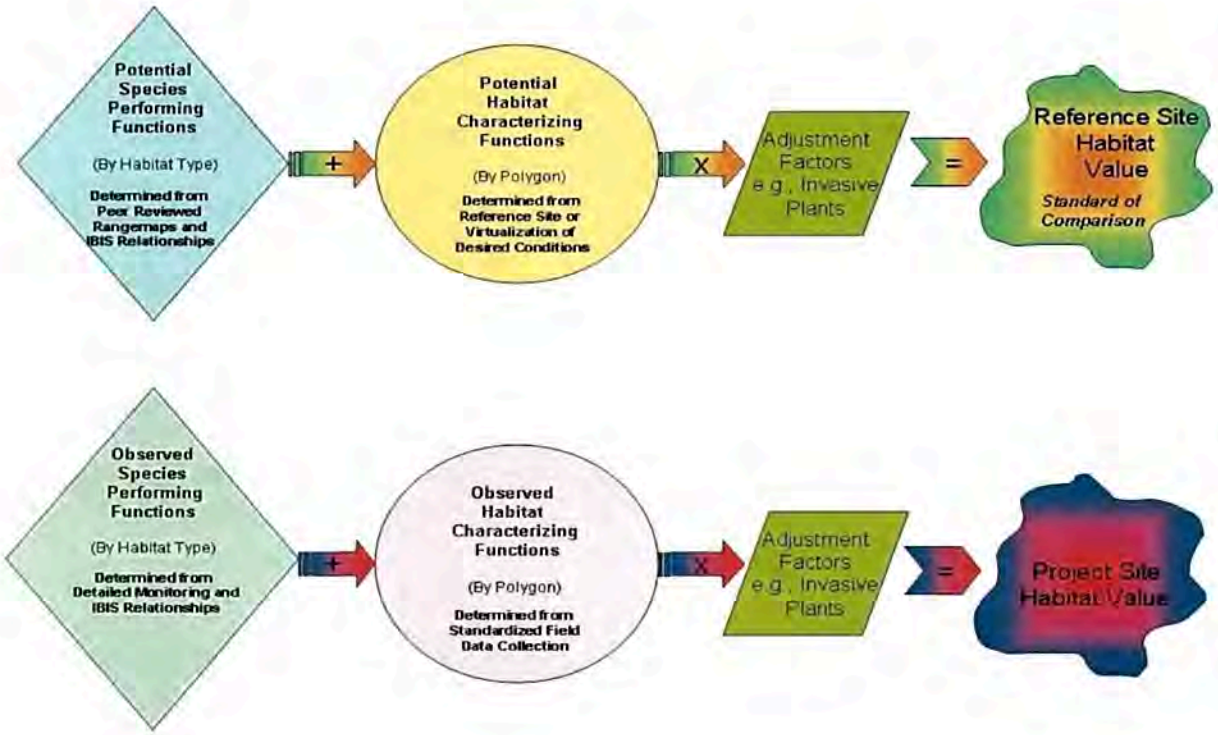


Figure 2.6-1. Habitat Accounting and Appraisal Method

A field inventory of habitat components in the study area was performed in May, 2009 by NHI. Elements of HAB and HEP were combined under Combined Habitat Assessment Procedure (CHAP) to determine HUs for the Aliso Creek study area. HAB methodology was used to first determine the habitat types within the study area. Wildlife species associated with these habitat types were then determined in order to identify key environmental correlates (KECs) representing the habitat elements (physical and biological) that are thought to most influence a species' distribution, abundance, fitness, and viability. Key ecological functions (KEFs) were then determined for each species, representing the principal set of ecological roles performed by each species in its ecosystem. HU's were then determined by comparing to a standard that represents the full ecological potential for a particular habitat type.

HAB methodology utilized to assess the Aliso Creek study area involved four components: 1) preliminary mapping, 2) field inventory and verification, 3) data compilation and analysis, and 4) GIS maps, spreadsheets and report, as follows:

1. Preliminary mapping. Vegetation type polygons with homogenous habitat types were identified and delineated based on visual interpretation of photography or imagery, including National Agriculture Imagery Program (NAIP) imagery and high-resolution aerial imagery supplied by Orange County Watershed Program.

2. Field inventory: An ocular survey was conducted of each polygon to a) confirm the polygon delineations; b) identify and record vegetation and habitat type, structural conditions, and KECs observed within each polygon;, and c) note the amount of non-native plant taxa. Next, verification transects were evaluated that are stratified random samples of the vegetation. The purpose of these transects was to measure and substantiate site variables, including percent cover/species of trees, shrubs, herbaceous and invasive vegetation, and to confirm ocular surveys. In addition, information was gathered from focused wildlife surveys, including California gnatcatcher surveys recently conducted in the study area, to verify species lists.

3. Data compilation and analysis: Field data were used to generate a quantitative assessment of habitat value for each polygon by summing the values for species-functions and habitat-functions and correcting for the amount of invasive species present. In this way, a per-acre baseline value was determined for each polygon. Next, a Habitat Quality Index value (HQI) was first computed as the ratio of the calculated baseline value per acre for a polygon and the potential per acre value for that given habitat type, which represents the value of a habitat type if all of the likely KEC's are observed and the levels of invasive plant species are brought to the 0-10% level. Habitat Units (HUs) were then calculated by multiplying the HQI for each polygon by its acreage.

4. GIS maps, spreadsheets, and report: GIS maps were generated to depict HUs of each polygon. Additional maps were created to illustrate: a) study area boundaries, b) polygon numbering c) corrected habitat value per acre d) habitat units and e) amounts of non-native plant species by polygon. Spreadsheets were developed to present calculations of HUs using species-functions and habitat-functions matrices along with an overall site habitat value.

A more detailed description of the HAB methodology and results are presented in *Aliso Creek Wildlife Habitat Assessment Baseline Condition Report*, prepared by NHI (Appendix B to this report).

2.6.1.3 Biological Resources in the Study Area

This section outlines the existing biological resources within the study area, including vegetation communities, wildlife, special-status species (plant and wildlife), wildlife corridors, and exotic vegetation. This information was obtained from the California Department of Fish and Game (CDFG)'s California Natural Diversity Database (CNDDB) for the San Juan Capistrano U.S. Geological Survey (USGS) 7.5-minute quadrangle. In addition, information on biological resources was obtained from:

1. *Aliso Creek Wildlife Habitat Assessment Baseline Condition Report*, prepared by Northwest Habitat Institute (NHI) based on a field inventory of habitat components

performed May 9-12, 2009 by NHI using CHAP, as described above. Vegetation types identified during the field inventory are described below according to *Preliminary Descriptions of the Terrestrial Natural Communities of California* (Holland 1986). Botanical information was obtained from *Jepson Manual of Higher Plants of California* (Hickman 1993) and *A Manual of California Vegetation* (Sawyer and Keeler-Wolf 1995).

2. *AWCWP Resource Management Plan (RMP), Appendix C.* In accordance with the NCCP, the County of Orange, Harbors Beaches and Parks, which owns and operates AWCWP, prepared the RMP to identify the biological resources within AWCWP and establish practices to manage, protect and enhance the natural resource values of the park while providing safe recreational and educational opportunities to the public (OC Parks 2009).

3. *Aliso Creek Area Redevelopment Plan, Habitat Management Plan.* This Plan was prepared for the proposed redevelopment of the Aliso Creek Inn and Golf Course, which includes measures to restore riparian habitat and stabilize the banks of Aliso Creek and extend the public trail system to link the AWCWP and other open space areas with the Pacific Ocean (PCR 2007).

Vegetation

The study area is located within the South Coast and Peninsular Range regions of the California Floristic Province (Holland 1986). NHI identified 137 vegetation polygons within the study area based on habitat type (Figure 2.6-2). Polygons were based on the occurrence of the following California Wildlife Habitat Types: Valley Foothill Riparian, Woodlands, Riverine (Open Water), Freshwater Marsh, Coastal Scrub, Annual Grassland, Barren (beach), and Urban, as described in California's Guide to Wildlife Habitats (Mayer and Laudenslayer, 1988). The habitat evaluation assessment area was broken into two sections, estuary (downstream of the golf course) and riverine (upstream of the golf course). The golf course was not considered in the habitat evaluation. Vegetation communities associated with these habitat types are discussed below.

Valley Foothill Riparian

Valley Foothill Riparian woodland in the study area occurs adjacent to riverine areas. Dominant species in the canopy layer include Fremont cottonwood (*Populus fremontii*) and California sycamore (*Platanus racemosa*). Subcanopy trees and shrubs include arroyo willow (*Salix lasiolepis*) and also contains Mexican elderberry (*Sambucus mexicana*), mulefat (*Baccharis salicifolia)*, poison oak (*Toxicondendron diversilobum*) and an understory of herbaceous water-dependant plants. Giant reed or *Arundo* (*Arundo donax*) dominates the riparian corridor throughout Aliso Creek, as described in Section 2.6.3.6.

Riparian communities account for the third largest vegetation type within AWCWP. 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 AWCWP, riparian habitats are associated with the perennial streams and floodplains of Aliso Creek and Wood Creek and range from herbaceous plants to multilayered tree species. Riparian communities are dominated by one or several species of anemophilous (wind-pollinated), winter-

deciduous trees adapted to periodic or continuous soil saturation during all or part of the growing season. Riparian vegetation is found along the length of Aliso Creek and in the lower portions of Wood and Mathis Canyons. The majority of this habitat is composed of mulefat, willow, and giant reed. A good portion of Aliso Creek is inundated with large patches of giant reed, a highly invasive nonnative plant. Arundo 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) includes giant reed on its "Exotic Pest Plants of Greatest Ecological Concern in California" list (Cal-IPC 1999).

The overall riparian community in AWCWP contains as many as eight associations: riparian herb, southern willow scrub, mulefat scrub, southern sycamore riparian woodland, southern coast live oak riparian forest, southern arroyo willow forest, southern black willow forest, and bramble thicket.

Woodlands

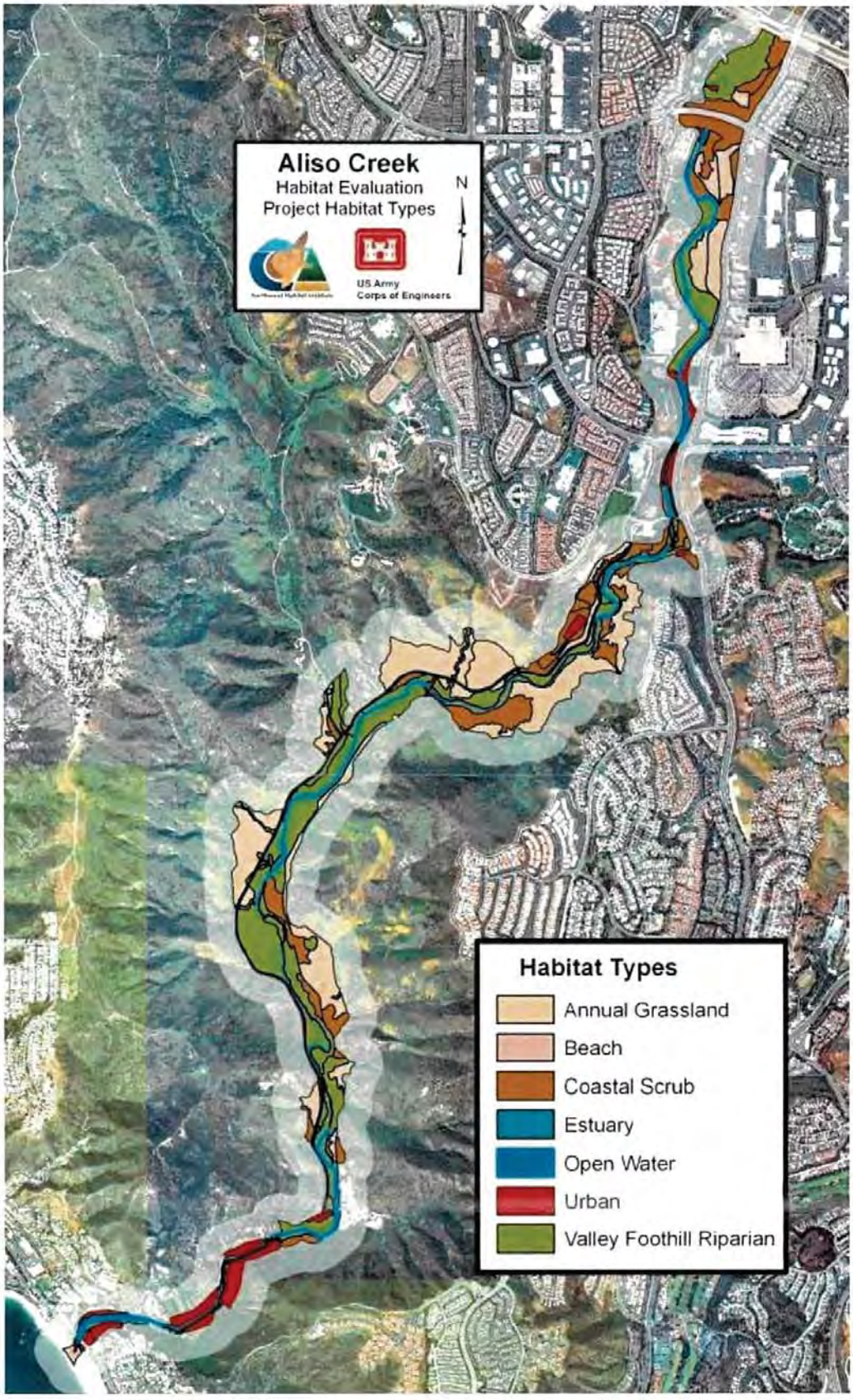
Woodland habitats comprise a considerable amount of the northwest portion of AWCWP. Coastal oak woodlands are extremely variable multilayered vegetation communities dominated by trees with an open, mosaic canopy. Woodlands typically occur on or near the base of north-facing slopes and in moist ravines. 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.

Riverine

This habitat type refers to open water within the creek channel. Aquatic vegetation occurring in this habitat type includes water moss, algae, and duckweed.

Freshwater Marsh

Freshwater marsh habitats are extremely limited and account for a remnant amount of AWCWP. Brackish and freshwater marshes are flooded for a majority of the year and are characterized by perennial, emergent species including: umbrella sedges (*Cyperus* sp.), Olney's bulrush *(S. americanus)*, California bulrush *(Scirpus californicus)*, alkali bulrush *(S. maritimus),* and narrow-leaved cat-tail *(Typha angustifolia)*. Marsh habitats are associated with Aliso Creek, El Toro Creek, and some portions of Wood Creek. Mallard Marsh has historically provided some open water habitat and still supports some emergent wetland species. However, currently no surface water is evident, and the plant species are dominated by coastal goldenbush and a variety of weedy forms. One association of marsh habitat is known to occur in AWCWP: coastal freshwater marsh (OC Parks 2009).


Aliso Creek
Habitat Evaluation
Project Habitat Types
N
US Army
Corps of Engineers
Habitat Types
Annual Grassland
Beach
Coastal Scrub
Estuary
Open Water
Urban
Valley Foothill Riparian

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. Dominant plant species include California sagebrush (*Artemisia californica*), California buckwheat (*Erigonum fasciculatum*), coastal goldenbush (*Isocoma menziesii*), island mallow (*Lavatera assurgentiflora*), deerweed (*Lotus scoparius*), mesa bushmallow (*Malacothamnus fasciculatus*), laurel sumac (*Malosma laurina*), lemonadeberry (*Rhus integrifolia*), white sage (*Salvia apiana*), and small-flowered needle grass (*Nassella lepida*) (Holland 1986).

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 study area consists primarily of nonnative annual grassland, a community consisting of European grasses that have largely replaced the perennial native grasslands in southern California (Holland 1986). Characteristic species within the study 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 study area include sweet fennel (*Foeniculum vulgare*), black mustard (*Brassica nigra*), and yellow star thistle (*Centaurea solstitialis*).

Barren (Beach)

This habitat type is defined by the absence of vegetation and occurs in the open sandy beach at the mouth of Aliso Creek.

Urban

The Urban habitat type in the study 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 water treatment plant and some park facilities.

Wildlife

Wildlife habitats within the study area support many common species (OC Parks, 2009). Raptors include northern harrier *(Circus cyaneus)*, Cooper's hawk *(Accipiter cooperii)*, red-tailed hawk *(Buteo jamaicensis)*, American kestrel *(Falco sparverius)*, barn owl *(Tyto alba)*, and great horned owl *(Bubo virginianus).* Some of the many bird species found in the study area include California quail *(Callipepla californica)*, mourning dove *(Zeniada macroura)*, white-throated swift *(Aeronautes saxatilis)*, Anna's hummingbird *(Calypte anna)*, downy woodpecker *(Picoides*

pubescens), northern flicker *(Colaptes auratus)*, black phoebe *(Sayornis nigricans),* ash-throated flycatcher *(Myiarchus cinerascens),* western kingbird *(Tyrannus verticalis)*, western scrub-jay *(Aphelocoma californica)*, common raven *(Corvus corax)*, bushtit *(Psaltriparus minimus)*, common yellowthroat *(Geothlypis trichas)*, Bewick's wren *(Thryomanes bewickii),* wrentit *(Chamaea fasciata)*, song sparrow *(Melospiza melodia)*, California towhee *(Pipilo crissalis),* and lesser goldfinch *(Carduelis psaltria).* Common water birds using the study area include mallard (*Anas platyrhynchos*), American coot *(Fulica americana)*, great blue heron *(Ardea herodias),* and belted kingfisher *(Ceryle alcyon)*. Reptiles include the southern Pacific rattlesnake (*Crotalus oreganus helleri*) and the western fence lizard (*Sceloporus occidentalis*). Mammals found within the study area include coyote (*Canis latrans*), grey fox (*Urocyon cinereoargenteus*), raccoon (*Procyon lotor*), mule deer (*Odocoileus hemionus*), and bobcat (*Lynx rufus*).

Coastal sage scrub habitat in the study area is considered a sensitive habitat by the CDFG, as it supports numerous threatened, endangered, or rare species, many of which are target species protected under the Orange County Central-Coastal NCCP/HCP (Orange County 1996). These species include the coastal cactus wren (*Campylorhynchus brunneicapillus sandiegensis*), San Diego horned lizard (*Phrynosoma coronatum blainvillei*), orange-throated whiptail (*Cnemidophorus hyperthyrus*), and the coastal California gnatcatcher (*Polioptila californica californica*).

California Species of Concern

A review of the CNDDB was conducted to identify California species of concern, including plant species listed by the California Native Plant Society (CNPS) that have the potential to occur in the study area due to the presence of suitable habitat. Based on the habitat present in the study area and recent observations, a list of California Species of Concern with the potential to occur in the study area is provided in Table 2.6-1 below and described in this section.

Cooper's Hawk

The Cooper's hawk (*Accipiter cooperii*) inhabits riverine forest and woodlands as well as urban areas with dense stands of trees. The species typically nests in deciduous riparian areas or second-growth conifer stands near streams (Zeiner et. al. 1990). Due to the presence of suitable habitat, this species is likely to occur in the study area (Hamilton and Willick 1996).

Northern Harrier

The northern harrier (*Circus cyaneus hudsonius*) frequents, meadows, grasslands, open rangelands, desert sinks, fresh and saltwater emergent wetlands (Zeiner et. al. 1990). Based on the amount of suitable grassland habitat, this species is likely to occur in the study area (Gallagher 1997).

Table 2.6-1 California Species of Concern with Potential to Occur in the Study Area			
Common name	**Scientific Name**	**Status**	**Occurrence/Comments**
Plants			
Intermediate mariposa-lily	*Calochortus weedii var. intermedius*	1B.2	Potential to occur on dry rocky slopes in chaparral and coastal scrub (Consortium of California Herbaria 2009)
Summer holly	*Comarostaphylis diversifolia ssp. diversifolia*	1B.2	Potential to occur in chaparral habitat (Consortium of California Herbaria 2009)
Many-stemmed dudleya	*Dudleya multicaulis*	1B.2	Potential to occur in coastal sage scrub, chaparral, and grasslands (Consortium of California Herbaria 2009)
Cliff spurge	*Euphorbia misera*	2.2	Potential to occur on rocky slopes and coastal bluffs (Consortium of California Herbaria 2009)
Allen's pentachaeta	*Pentachaeta aurea ssp. allenii*	1B.1	Potential to occur in grassland habitat (Consortium of California Herbaria 2009)
Nuttall's scrub oak	*Quercus dumosa*	1B.1	Potential to occur in open chaparral and coastal sage scrub habitats (Consortium of California Herbaria 2009)
Birds			
Cooper's hawk	*Accipiter cooperii*	SC	Present in study area, potential breeding (Keeney 2009). Observed during recent surveys conducted for the California gnatcatcher (RECON 2009).
Northern harrier	*Circus cyaneus hudsonius*)	SC	Observed foraging in study area (Keeney 2009). Observed during recent surveys conducted for the California gnatcatcher (RECON, 2009). Note- does not occur on CNDDB list for San Juan Capistrano quadrangle.
Yellow-breasted chat	*Icteria virens auricollis*	SC	Breeding pairs observed in study area (Keeney 2009). Observed during recent surveys conducted for the California gnatcatcher (RECON, 2009). Note- does not occur on CNDDB list for San Juan Capistrano quadrangle.
Yellow warbler	*Dendroica petechia*	SC	Breeding pairs observed in study area (Keeney 2009). Observed during recent surveys conducted for the California gnatcatcher (RECON 2009). *Note- does not occur on CNDDB list for San Juan Capistrano quadrangle.*

Birds Continued			
Southern California rufous-crowned sparrow	*Aimophila ruficeps canescens*	SC	Potential to occur due to presence of suitable habitat. Observed during recent surveys conducted for the California gnatcatcher (RECON 2009).
Grasshopper sparrow	*Ammodramus savannarum*	SC	Low potential to occur due to lack of suitable grassland habitat
Coastal cactus wren	*Campylorhynchus brunneicapillus sandiegensis*	SC	Present during surveys in 2006 and 2007. Suitable habitat exists within study area (NROC 2007, 2009).
Mammals			
Western mastiff bat	*Eumops perotis californicus*	C	Potential to occur in a variety of habitats including woodlands, coastal sage scrub and grasslands
Amphibians			
Western spadefoot	*Spea hammondii*	SC	Potential to occur in suitable habitat. Present in adjacent areas (USGS 2009)
Reptiles			
Southwestern pond turtle	*Actinemys marmorata pallida*	SC	Present. Aliso Creek has one of the largest known populations in coastal and central Orange County (USGS 2009)
Orange-throated Whiptail	*Aspidoscelis hyperythra*	C	Present. Captured during surveys from 2000-2005 (USGS 2009)
Coast (San Diego) Horned Lizard	*Phrynosoma coronatum (blainvillii population)*	SC	Potential to occur in coastal sage scrub and chaparral. Present in adjacent areas (USGS 2009)
Two-striped garter snake	*Thamnophis hammondii*	C	Present. Captured during surveys from 2000-2005 (USGS 2009)

SC = California Species of Concern (CNDDB)

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

Yellow-breasted Chat

The yellow-breasted chat (*Icteria virens auricollis*) is primarily found in dense, relatively wide riparian woodlands and thickets of willows, vine tangles, and dense brush with well-developed understories (Zeiner et. al., 1990). Some suitable habitat occurs within the study area for this species to occur (Dudek 2006, 2007).

Yellow Warbler

The yellow warbler (*Dendroica petechia)* occurs in riparian woodlands dominated by cottonwoods and willows. The species requires dense understory vegetation for nesting (Zeiner et. al. 1990). Due to the presence of suitable habitat, this species is likely to occur in the study area (Gallagher 1997).

Southern California Rufous-crowned Sparrow

The southern California rufous-crowned sparrow (*Aimophila ruficeps canescens)* inhabits coastal sage scrub and sparse mixed chaparral in southern California. Based on the presence of suitable habitat, this species is likely to occur in the study area (Gallagher 1997).

Grasshopper Sparrow

Grasshopper sparrows (*Ammodramus savannarum*) occur in dry, dense grasslands, especially those with a variety of grasses and tall forbs and scattered shrubs for singing perches (Zeiner et al. 1990). Based on the lack of suitable habitat present, this species has a low potential to occur in the study area (Gallagher 1997).

Coastal Cactus Wren

The coastal race of the cactus wren (*Campylorhynchus brunneicapillus couesi)* is found in arid parts of westward-draining slopes of southern California with thickets, patches, or tracts of larger, branching cacti, stiff-twigged, thorny shrubs, and small trees (Zeiner et al. 1990). Surveys in 2006 and 2007 confirmed the presence of cactus wren within cactus scrub habitat in the study area (NROC 2007, 2009).

Western Mastiff Bat

The western mastiff bat (*Eumops perotis californicus*) is the largest bat in California and inhabits arid and semiarid lowlands (CDFG, 2009a). This species roosts primarily in crevices in vertical cliffs, usually granite or consolidated sandstone, and in broken terrain with exposed rock faces, but may also be found occasionally in high buildings, trees and tunnels. Due to suitable habitat present, there is potential for this species to occur in the study area.

Arroyo Chub

The arroyo chub (*Gila orcutti)* is a small minnow found in slow moving mud or sand bottomed sections of streams (Moyle 1995). The species is absent from much of its native range and is now restricted to the streams of the Los Angeles Basin and other nearby coastal streams as far south as the San Luis Rey drainage. They require low gradient streams, spawning in slower moving sections of runs and pools (Moyle 1995). Based on lack of suitable habitat, this species is not expected to occur in the study area (PCR 2007).

Western Spadefoot

The western spadefoot toad (*Spea hammondii)* occurs primarily in lowlands, frequenting washes, floodplains of rivers, alluvial fans, playas, and alkali flats, but also ranges into the foothills and mountain valleys. The species prefers areas of open vegetation and short grasses where the soil is

sandy or gravelly (CDFG 2009b). The toads are nocturnal and almost entirely terrestrial, occupying underground burrows for most of the year. During spring rains, toads emerge to breed, requiring temporary rain pools that lack predators (fish, bullfrogs, crayfish). This species occurs in adjacent areas and has the potential to occur in the study area (USGS 2009).

Southwestern Pond Turtle

The southwestern pond turtle (*Clemmys marmorata pallid)* occurs in perennial ponds, lakes, rivers, and streams with suitable basking habitat (mud banks, mats of floating vegetation, partially submerged logs) and submerged shelter (Zeiner et al. 1990). The species requires some slack- or slow-water aquatic habitat. The study area supports one of the largest known populations of southwestern pond turtle in coastal and central Orange County (USGS 2009). The pond turtle occurs at several locations in Orange County including Aliso and Oso creeks (Harmsworth Associates 1999). Streambank alteration within a 400 m corridor of the waterline has a significant potential to affect pond turtle habitat, especially basking sites, nesting and hibernation sites. Furthermore, shaving of stream banks may alter soil characteristics for nest sites. Removal of vegetation and soil disturbance can affect soil and water temperatures, vegetation communities and invasion by non-native species. Lastly, activities related to extensive stream bank alterations may attract nest predators, increase public access to the riparian habitat and may increase the vulnerability of turtles to mortality (Kohlmann and O'Neill 2009).

Orange-throated Whiptail

The orange-throated whiptail (*Aspidoscelis hyperythra*) inhabits low-elevation coastal scrub, chamise-redshank chaparral, mixed chaparral, and valley-foothill hardwood habitats (Zeiner et al. 1990). The primary food source for this species is termites. The species prefers washes and other sandy areas with patches of brush and rocks and does not require permanent water. This species is present in the study area and was captured during surveys from 2000-2005 (USGS 2009).

Coast (San Diego) Horned Lizard

The coast (San Diego) horned lizard (*Phrynosoma coronatum* (*blainvillii* population)) inhabits a variety of habitats throughout the central and southern California coast (Zeiner et al., 1990). This species inhabits open country, especially sandy areas, washes, flood plains and wind-blown deposits in a wide variety of habitats. Coast horned lizards have high site fidelity and a specialized diet, feeding primarily on native harvester ants and not the non-native Argentine ants that have replaced native ants in much of southern California. Though once common to the entire San Diego area, this species is in decline (Fisher and Case 2003). The species is present in adjacent areas and there is potential for the species to occur in the study area (USGS 2009).

Two-striped Garter Snake

The two-striped garter snake (*Thamnophis hammondii*) is highly aquatic, foraging primarily in and along streams (Zeiner et al. 1990). The species is associated with permanent or semi-permanent bodies of water bordered by dense vegetation in a variety of habitats. The species is considered present in the study area and was captured during surveys from 2000-2005 (USGS 2009).

Threatened and Endangered Species

Federal and state-listed threatened and endangered species with the potential to occur in the study area were also identified by the CNDDB search. Based on habitat present in the study area and recent observations, Table 2.6-2 presents the threatened and endangered species with the potential to occur within the study area. These species are also described in this section.

Table 2.6-2
Federal and State Listed Species with Potential to Occur in the Study Area

Common Name	Scientific Name	Status	Occurrence/Comments
Plants			
Thread-leaved brodiaea	*Brodiaea filifolia*	FT, SE	Potential to occur in grassland and seasonal wetlands
Laguna Beach dudleya	*Dudleya stolonifera*	FT, ST	Potential to occur on weathered sandstone rock outcrops on cliffs within coastal sage scrub or chaparral
Big-leaved crownbeard	*Verbesina dissita*	FT, ST	Potential to occur in chaparral and coastal sage scrub habitats
Birds			
Coastal California gnatcatcher	*Polioptila californica californica*	FT	Present within coastal sage scrub habitats. Observed during recent focused surveys (RECON 2009).
Least Bell's vireo	*Vireo bellii pusillus*	FE, SE	Breeding pairs observed in study area (USACE 2009)
Fish			
Tidewater goby	*Eucyclogobius newberryi*	FE	Historical evidence of occurrence. Not present based on recent surveys at mouth of Aliso Creek. However, this location is considered for reintroduction of the species.
Steelhead Trout	*Oncorhynchus mykiss*	FE	No direct observation or published literature of occurrence, historical or otherwise. Not present. Note- does not occur on CNDDB list for San Juan Capistrano quadrangle.

Amphibians			
California Red-legged Frog	*Rana aurora draytonii*	FT	Not present. Note- does not occur on CNDDB list for San Juan Capistrano quadrangle.
Southwestern Arroyo Toad	*Bufo microscaphus californicus*	FE	Low potential to occur (USGS 2009). Note- does not occur on CNDDB list for San Juan Capistrano quadrangle.

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 Game)
ST = State Threatened (California Department of Fish and Game)

Coastal California Gnatcatcher

The coastal 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 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 coastal California gnatcatcher territories were detected (RECON 2009 [Appendix B to this report]). Three of the four pairs observed were accompanied by at least one juvenile. Figure 2.6-3 shows the locations within the study area where California gnatcatchers were observed during the focused surveys.

Least Bell's Vireo

The least Bell's vireo (*Vireo bellii pusillus*) was listed as endangered in 1986 and critical habitat was designated in 1994 (USFWS 1998). The species requires structurally diverse riparian woodlands, utilizing willow, cottonwood, and mulefat vegetation.

While the study area is not within critical habitat designated for the species, there is potential for it to occur there due to patches of suitable habitat. Figure 2.6-4 shows the results of recent surveys for the least Bell's vireo. The figure shows vireo observations in the northern portion of the study area. No vireo were observed south of ACWHEP. The Corps is in the process of preparing a survey report of the results.

Tidewater Goby

The tidewater goby (*Eucyclogobius newberryi*) occurred historically at the mouth of Aliso Creek, but has not been found there since 1976 (USFWS 2000). Critical habitat for this species was designated in 2000 and includes the associated lagoon and marsh at the mouth of Aliso Creek and upstream portions of the creek approximately 0.6 mile from the Pacific Ocean (USFWS 2000). Thus, the study area is located within critical habitat for this species.
Focused surveys for tidewater goby at Aliso Beach in July and August of 2005 did not find this species at this location (PCR 2007). However, reintroduction of tidewater goby to unoccupied habitat is one of four primary tasks recommended for recovery of the species in the South Coast Recovery Unit (USFWS 2005). Moreover, USFWS considers Aliso Creek lagoon to be one of the most promising locations for reintroduction of a goby population in southern California outside of Marine Corps Base Camp Pendleton (USFWS 2006).

Steelhead Trout

The Southern California ecological significant unit (ESU) of steelhead trout (*Oncorhynchus mykiss*) was listed by the National Marine Fisheries Service as endangered in 1997. Steelhead, which are anadramous, are native to Pacific Coast streams from Alaska south to northwestern Mexico. Wild steelhead populations in California have decreased significantly from their historic levels. Extensive habitat loss due to development, land use practices, and urbanization are largely responsible for the current population status. The endangered Southern California ESU extends from the Santa Maria River to Malibu Creek. This species does not occur in the study area.

California Red-legged Frog

The California red-legged frog (*Rana aurora draytonii)* requires habitat with specific aquatic and riparian components, including deep-water pools with dense stands of overhanging willows and an intermixed fringe of cattails (USFWS 2009b). During the dry season, the frogs enter a dormant state (estivation), during which they take refuge in small mammal burrows and moist leaf litter within 300 feet of a riparian area.

The range of the California red-legged frog formerly extended from coastal areas in California as far south as Baja California, Mexico, spanning 46 counties in California. To date, however, the range has been decreased to only 31 counties in California. The species is not known to occur in Orange County (USFWS, 2009b).

Southwestern Arroyo Toad

The Southwestern arroyo toad (*Bufo microscaphus californicus*) inhabits coastal and desert areas of nine counties along the central and southern coast of California (USFWS 1999). The species breeds in stream channels and utilizes stream terraces for foraging and wintering habitat.

Critical habitat has been designated in Orange County (USFWS 2005). The study area is not within designated critical habitat, and the nearest extant populations of record are populations found in Trabuco and San Juan Creeks (USGS 2009).

Wildlife Corridors

As described in the NCCP/HCP, the AWCWP 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.

Invasive Vegetation

The study area is significantly impacted by the presence of invasive riparian plant species which out-compete native riparian species, thereby limiting native species diversity and reducing habitat and food for native wildlife.

Giant reed is an aggressive species with remarkable reproductive abilities. This ability to reproduce quickly allows *Arundo* to out compete native species of plants for land and food resources, thus establishing thick, concentrated stands (Figure 2.6-5). In addition, mature giant reeds stand can withstand flooding and drought. All of this combined with giant reed's ability to spread over geographic locations quickly, via natural waterways, allows 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 reeds can catch on fire quickly and easily, and through their extensive placement, spread fires rapidly through entire riparian systems. Since giant reed suffocates native vegetation, it alters the food resources for local wildlife. *Arundo* can hardly be called an alternative food resource because of its lack of nutrients. Giant reed has only proved to benefit a very small number of species, most of which use giant reed for shelter (Figure 2.6-5), not as a food resource.

Figure 2.6-3. Sensitive Bird Species Observed in the Study Area (Source: RECON 2009)

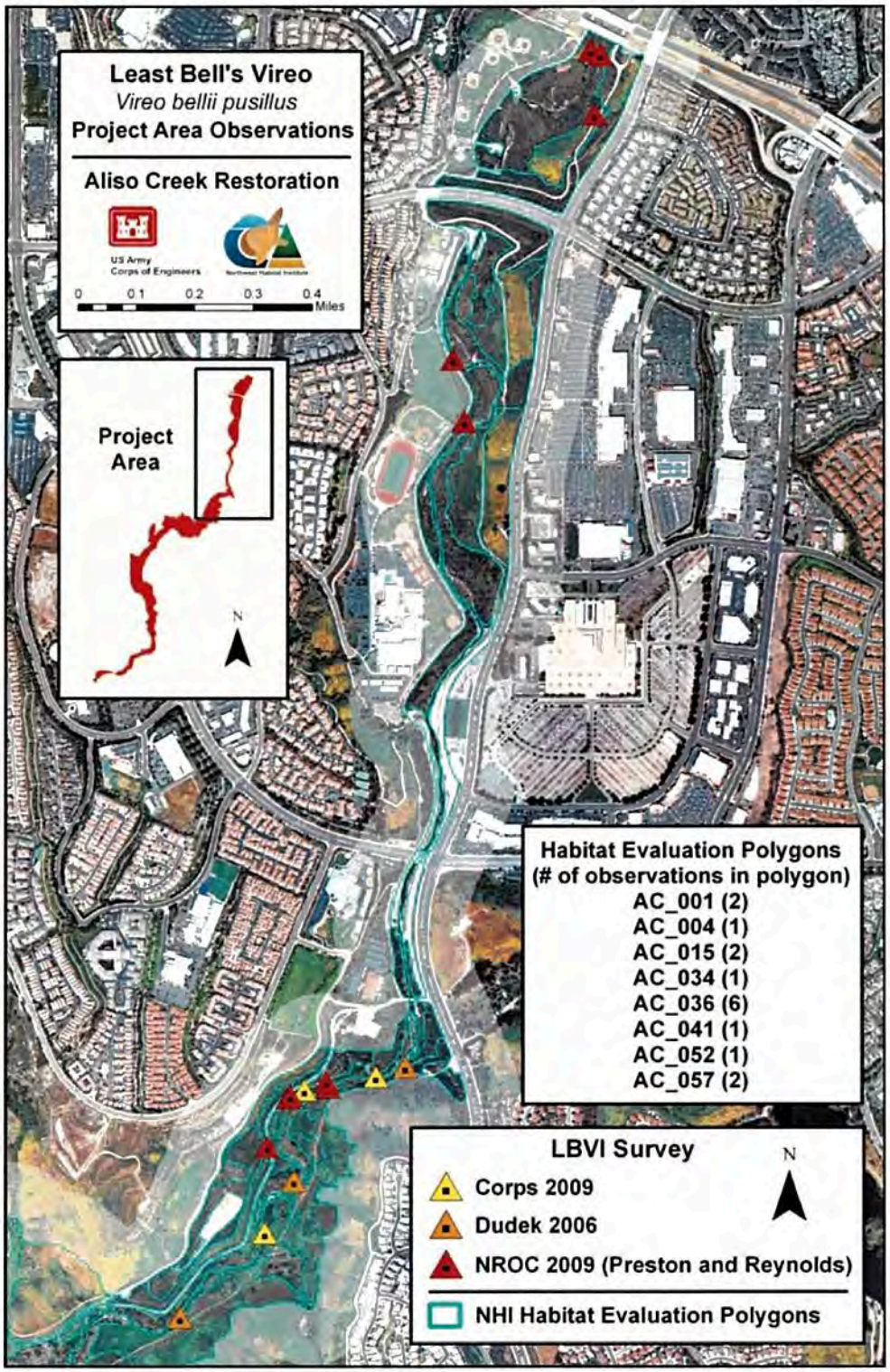


Figure 2.6-3. Least Bell's Vireo Observations in the Study Area [Source: Northwest Habitat Institute 2009 (based on data from USACE, Dudek 2006, and NROC 2009.)]

Figure 2.6-5. Giant Reed Forms Dense, Impenetrable, Monotypic Stands

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, on bridges, and in other flood control systems. The *Arundo* then quickly decides to reestablish itself in these new locations. This causes a costly cleanup, obstructed waterways, and quite possibly structural damage. This can put an economic strain on areas inundated with giant reeds. Arundo has caused the biggest problem in the southern California riparian watershed areas. (Santa Margarita and San Luis Rey Weed Management Area 2009).

The Aliso Watershed has been mapped for invasive riparian plant species (Orange County, 2008). Within the Aliso Watershed, there is a total of 116.7 acres of invasive plant species, with the most prevalent invasive species, *Arundo* occupying 57 acres. It was also mapped in 2009 by NHI for comparison (see the Habitat Assessment 50-year Future Without Project report, Appendix B to this report).

2.6.1.4 Habitat Units (HUs)

As described in Section 2.6.2, CHAP was utilized to provide an assessment of biological resources based on habitat, species, and functions determined to be present in polygons within the Aliso Creek study area. A standard of comparison based on the full ecological potential of the polygon was used to determine a habitat suitability index (HSI). The HSI was then multiplied by the polygon acreage to determine habitat units (HUs) for each polygon.

A total of 167.7 HUs were determined for the baseline condition of the study area. Figure 2.6-6 shows the distribution of HUs by habitat type. Figure 2.6-7 shows the corrected baseline habitat

value for the HU by habitat type at Aliso Creek. This figure is presented to illustrate that the amounts of HUs vary among habitat type (Figure 2.6-6) as well as they have various habitat values (Figure 2.6-7).

The average HSI was 0.35, which indicates that, on average, habitat value within the study area is only 35 percent of its full potential. This is likely due, in part, to the prevalence of invasive *Arundo* but more importantly due to the continued erosion, deep incision of Aliso Creek and the degradation of removal from the historical flood plain. Other ecological stressors affecting habitat value in the Aliso Creek study area include the lack of a natural fire regime, and poor water quality. For additional details on the determination of the HU value, see the Wildlife Habitat Assessment Baseline Condition Report, Appendix B to this report.

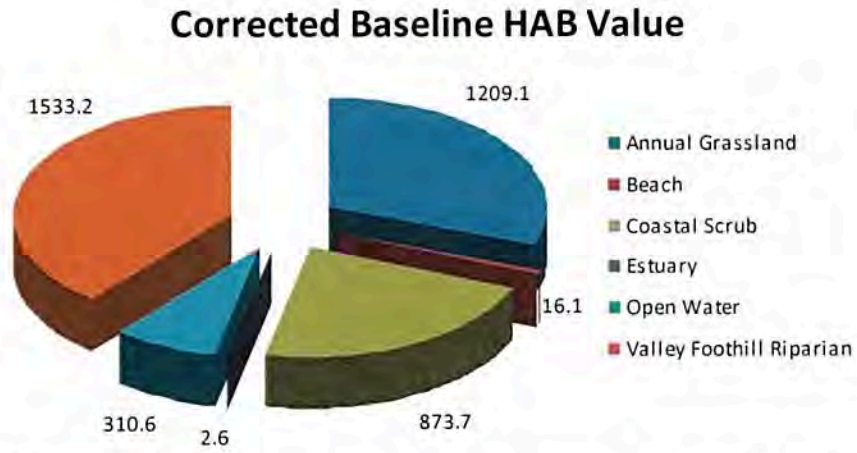


Figure 2.6-6. Breakout of HUs by Habitat Type (Source: Northwest Habitat Institute 2009)

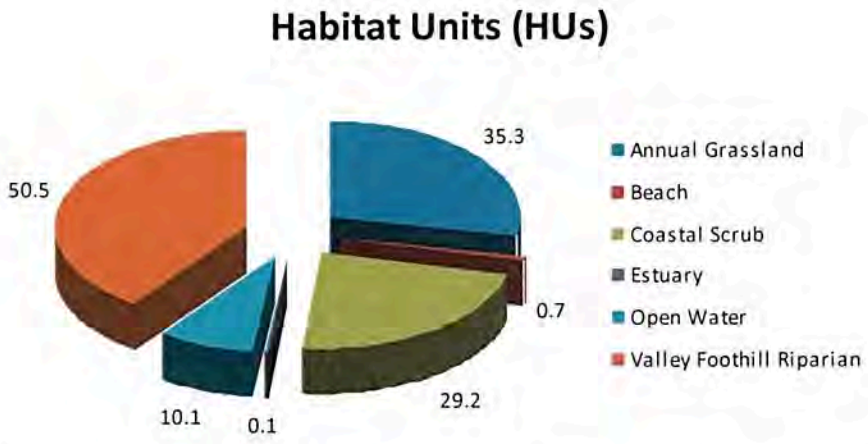


Figure 2.6-7. Breakout of the Corrected Baseline Habitat Value by Habitat Type as Determined by HUs Proportions (Source: Northwest Habitat Institute 2009)

2.6.2 Applicable Policies and Programs

Biological resources in the study area are protected by several Federal, State, and local laws and policies, as described in this section.

National Environmental Policy Act and California Environmental Quality Act

NEPA, as amended (42 USC 4321 *et seq.*) established the CEQ, responsible for administration of NEPA. NEPA requires Federal agencies to evaluate and consider the environmental impacts of their proposed actions, including impacts to biological resources, and reasonable alternatives to those actions. Under NEPA, Federal agencies may be required to take actions that protect, restore and enhance the environment as mitigation for project impacts.

CEQA, as amended (Public Resources Code 21000 *et seq.*), was established to inform both State and local governmental decision-makers and the public about potential significant environmental effects of proposed activities, to identify ways to avoid or reduce environmental impacts, and to disclose the reasons why a project is approved if significant environmental impacts would result.

Endangered Species Act

The Endangered Species Act (ESA) of 1973, as amended (16 U.S.C 1531 *et seq.*) provides for the conservation and recovery of endangered and threatened species and the ecosystems upon which they depend. Section 7 of the ESA requires Federal agencies to aid in the conservation and recovery of listed species, and ensure that the activities of Federal agencies will not jeopardize the continued existence of listed species or adversely modify designated critical habitat. At the Federal level, the USFWS and the National Oceanic and Atmospheric Administration (NOAA) are responsible for administration of the ESA. Under ESA there is no mitigation, only avoidance and minimization actions.

At the state level, the CDFG is responsible for administration of the California Endangered Species Act (CESA) of 1984, as amended (Fish and Game Code 2050 *et seq.*). Unlike the Federal ESA, there are no State agency consultation procedures under CESA. For projects that affect both a State and Federal listed species, compliance with the Federal ESA will satisfy CESA if CDFG determines that the Federal incidental take authorization is "consistent" with CESA. Projects that will result in a take of a State-only listed species require a take permit under CESA.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) of 1918, as amended (16 USC 703 *et seq*). decrees that all migratory birds and their parts (including eggs, nests and feathers) are fully protected. Migratory birds include geese, ducks, shorebirds, raptors, songbirds, wading birds, seabirds, and passerine birds (such as warblers, flycatchers, and swallows). Under the MBTA, taking, killing or possessing migratory birds is unlawful, and projects that are likely to result in take 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 destruction of migratory bird nesting habitat during the nesting season when eggs or young are likely to be present.

Clean Water Act

The Corps has primary jurisdiction over modifications to stream channels, river banks, lakes, and other wetland features through the CWA of 1977, as amended (33 USC 1251 *et seq.*). Section 404 of the CWA prohibits the discharge of dredged or fill material into "waters" of the United States without a permit.

CDFG has responsibility for protection of streams, water bodies, and riparian corridors through the Streambed Alteration Agreement process under §1601-1606 of the California Fish and Game Code. CDFG regulates activities that would alter the flow, bed, channel or bank of streams and lakes. Wetlands under jurisdiction of the Corps may or may not be included in the area covered by a Streambed Alteration Agreement obtained from CDFG.

Certification from the RWQCB is required when a proposed activity may result in discharge into navigable waters, pursuant to section 401 of the CWA. A project that would result in the discharge of any pollutant, including soil, into waters and wetlands requires coordination with the appropriate RWQCB to obtain Section 401 certification.

Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996, requires the National Marine Fisheries Service (NMFS) and regional fishery management councils to minimize, to the extent practicable, adverse effects to essential fish habitat (EFH) caused by fishing activities. The Act also requires federal agencies to consult with NMFS about actions that could damage EFH. Areas designated as EFH contain habitat essential to the long-term survival and health of fisheries.

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act of 1934, as amended (16 U.S.C. 661 et seq) requires consultation with USFWS and CDFG whenever the waters or channel of a body of water are modified by a department or agency of the U.S. The Act provides for wildlife conservation through planning, development, maintenance and coordination of wildlife conservation and rehabilitation.

California Coastal Act §30000 et seq.

The California Coastal Act contains policies to protect coastal resources and defines Environmentally Sensitive Habitat Areas (ESHA). An ESHA is "any area in which plant or

animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could be easily disturbed or degraded by human activities and developments". The Coastal Act, Section 30240, generally protects ESHAs where they exist, and also protects "against any significant disruption of habitat values".

Protection of Wetlands

Executive Order 11990, Protection of Wetlands (FR 26961) was issued May 24, 1977 and directed Federal agencies to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out their responsibilities.

Invasive Species

Executive Order 13112, Invasive Species and Landscaping (FR 99-3184), issued February 3, 1999, 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 of Executive Order 13112 are to prevent the introduction of invasive species; provide for their control; and take measures to minimize economic, ecological, and human health effects. In compliance with Executive Order 13112, restoration of disturbed vegetation should be conducted using native plants and efforts to prevent the introduction of invasive plant species must be demonstrated.

Orange County Central-Coastal Natural Community Conservation Plan and Habitat Conservation Plan

The NCCP/HCP was approved on May 31, 1996. The NCCP/HCP covers 208,000 acres and includes the central portion of Orange County from the coast inland to the Riverside Freeway (SR-91). Along the coast, the plan extends from the mouth of the Santa Ana River in Costa Mesa to the mouth of San Juan Creek in Dana Point.

The NCCP/HCP creates a preservation area consisting of two habitat reserves (the "coastal" and "central" subarea reserves), designation of "Linkage Areas" for protection of important habitat not within the reserves, and definition of some lands as "Existing Use Areas." In total, approximately 38,000 acres of natural habitat would receive protection under the NCCP/HCP as the NROC. Special-status species, including 6 federally listed species, are covered under the plan, as well as habitat types including coastal sage scrub, grasslands, and riparian habitat. Within NROC lands, compliance with NCCP/HCP policies and guidelines for conservation of habitat and species and guidelines is required.

County of Orange General Plan

Orange County's General Plan Resource Element contains official policies on the conservation and management of resources within the County. The Land Use Component of the Plan

recognizes the need to conserve natural resources and protect habitat consistent with the NCCP/HCP. In addition, the Natural Resources Component identifies the following policy that pertains to the study area:

Policy 1: To identify and preserve the significant wildlife and vegetation habitat of the County.

Aliso Viejo General Plan

The City of Aliso Viejo General Plan Conservation/Open Space Element identifies natural, cultural, and open space resources within Aliso Viejo and sets forth policies and programs for the conservation and preservation of these resources. The City supports implementation of the Central and Coastal NCCP/HCP and requires biological resource impacts be evaluated prior to new development. The following policies are relevant to the ecological and biological resources in the study area:

Policy COS-3.1 Support regional and sub-regional efforts to conserve ecological and biological resources.

Policy COS-3.2 Protect sensitive habitat areas and vegetation, particularly along Aliso Creek, within Aliso Woods, and within the Aliso and Wood Canyons Wilderness Park, by maintaining these resources as long term open space.

City of Laguna Niguel

The City of Laguna Niguel General Plan Open Space/Parks/Conservation Element sets forth goals and policies for the conservation of natural resources. Goals and policies relevant for the study area include:

Goal 5: Conservation of natural resource areas of community and regional significance.

Policy 5.2: Recognize Aliso Creek, Sulfur Creek, and Salt Creek as important open space resources and cooperate where feasible to enhance their conservation value.

Goal 8: Conservation and enhancement of Aliso Creek Corridor.

Cooperate with the County of Orange to maintain ecological balance by protecting infringement on those areas in and along Aliso Creek which have significant environmental value.

Cooperate with the County of Orange to conserve, and expand where possible, riparian areas in the Aliso Creek area as sources of shelter and water for wildlife.

Cooperate with the County of Orange to conserve a continuous open space corridor along the Aliso Creek corridor in order to maintain animal migration opportunities and conserve natural and recreational resource values.

Laguna Beach General Plan

The Laguna Beach General Plan Open Space and Conservation Element/Integrated Local Coastal Plan ("GP/LCP") contains policies for the preservation of natural resources, including policies for tide pools and marine habitats, water quality and conservation; vegetation and wildlife resources, and watersheds and watercourses. Policies relevant for the study area include:

8A: Preserve the canyon wilderness throughout the City for its multiple benefits to the community, protecting critical areas adjacent to canyon wilderness, particularly stream beds where loss would destroy valuable resources.

8C: Identify and maintain wildlife habitat area in their natural state as necessary for the preservation of species.

8O: Preserve and protect fish and/or wildlife species for future generations.

8P: Preserve a continuous open space corridor within the hillsides in order to maintain animal migration opportunities.

Along with the Land Use Element, the Open Space and Conservation Element of the General Plan serves as the City's Local Coastal Program under the California Coastal Act.

2.6.3 Future Without Project Conditions

Future without project conditions related to biological resources were assessed by NHI (Appendix B to this report). To undertake this assessment several projections were made to assess habitats over the 50-year time period. These projections are based on the following current condition trends:

There would be an increase in presence of invasive plant species.

There would be a reduction in the number of fish and wildlife taxa present within the study area over time.

The streambed would remain relatively stable upstream of the ACWHEP as well as below the South Orange County Wastewater Authority (SOCWA) treatment plant; however several of the reaches of creek will continue to incise.

There would be a greater potential for wildfire due to continued drought conditions, senescence of chaparral and coastal sage scrub vegetation, and increased prevalence of fire-prone invasive species such as giant reed (Arundo donax).

Land use in the study area will remain as a Wilderness Park, and future recreation will remain constant with its current level.

The Aliso Creek Inn and Golf Course in the lower reach of the study area will not expand but be maintained in its current state and size.

Additional assumptions were made with respect to changes caused by climate change, including:

Warmer temperatures year-round, accompanied by substantially wetter winters;

Sea level rise, causing wetlands to move inland with an overall decrease in wetland acreage due to the constraints of existing urban development and steeper slopes immediately inland of existing wetlands;

Increased flooding and erosion of tidal rivers, estuaries, and shoreline habitats due to higher sea levels combined with higher river runoff;

Adverse effects on coastal and aquatic species due to loss of habitat and increased temperatures.

To determine future conditions, the CHAP method was used to determine changes in species, habitat, and functions from the baseline condition. Predicted changes in habitat were applied to the fine scale habitat map, while the species and function changes were applied to their respective data sets to help visualize these changes over time. Using 2008 imagery, future conditions were estimated at 25 years (2034) and 50 years (2059).

NHI used several resources to determine changes in species, including published and unpublished literature, discussions with expert and knowledgeable ecologist/population biologists from the local scientific community (NROC,CNPS, Sea and Sage Audubon Society), federal and state fish and wildlife resource agencies (U.S. Fish and Wildlife Service [USFWS], USGS/Biological Resources Division, NMFS, CDFG) as well as local government entities (OC Watersheds and OC Parks).

Species more prone to changes were identified as those that are currently federal- or state-listed as threatened, endangered species or species of special concern and/or species covered by the NCCP/HCP. In addition, some large mammal species having a large home range were expected to be extirpated due to continued urban growth. Along with this, landscape connectivity between the study area and other large tracts of undeveloped land was an important consideration during development of the future without project conditions.

Based on this evaluation, future without project conditions in the study area are projected to include:

1. An increase in the potential for wildfires to occur, with at least one occurrence of fire within the study area in the next 50-years, which could cover an area of approximately 1,750 acres (708 hectares) depending on weather factors and fire behavior, and source and site of ignition. Existing riparian habitat would decrease substantially while non-native annual grassland habitat would increase. Coastal sage scrub habitat would initially decrease, but would be restored by 2059. Species that depend on riparian or coastal sage scrub habitat would be extirpated from the study area for up to 10 years. Species diversity of birds, reptiles, and small mammals would decrease significantly for at least 50-100 years, and large mammals (mule deer, mountain lion, bobcat, and others) could be extirpated within 50-100 years due to loss of landscape connectivity to the Santa Ana Mountains.

2. Based on GIS analysis of 2006 and 2009 imagery, and an estimated rate of increase of 7.4 percent per year, the prevalence of *Arundo donax* and other invasive plant species would increase to the next abundance category in all locations within the study area where it currently exists. That is, if the current invasive species value was 11-35 percent, it was assumed to increase to 36-65 percent in the first 25 years. If the initial value was greater than 11-35 percent, by 50-years the abundance of invasive species would increase to > 90 percent.

3. Based on predictions of future streambed profiles, there would be continued loss of cottonwood/willow riparian habitat due to lack of necessary water within native plant root zones.

4. By 2034, existing populations of three (3) species would be extirpated within the study area. These species include the red-shouldered hawk, golden eagle, and burrowing owl. In addition, the populations of the following three (3) species would decrease within the study area by 2034: southwestern pond turtle, northern harrier, and gray fox. By 2059, populations of three (3) additional species would be extirpated. These species include the coast range newt, coast horned lizard, and white-tailed kite. Populations of the following seven (7) species would decrease: sharp-shinned hawk, Cooper's hawk, least Bell's vireo, yellow warbler, yellow-breasted chat, bobcat, and mule deer.

5. Overall wildlife habitat value of the study area would steadily decline from 2009 to 2054. HUs and per acre habitat values would decrease for all habitat types. Due to an increase in acreage of annual grassland habitat, habitat units would initially increase for this habitat type at 2034, but would subsequently decrease to 2009 levels by 2059. Total HUs would decrease from 164,2 in 2009 to 145.2 in 2034 to 121.0 in 2059.

2.6.4 References

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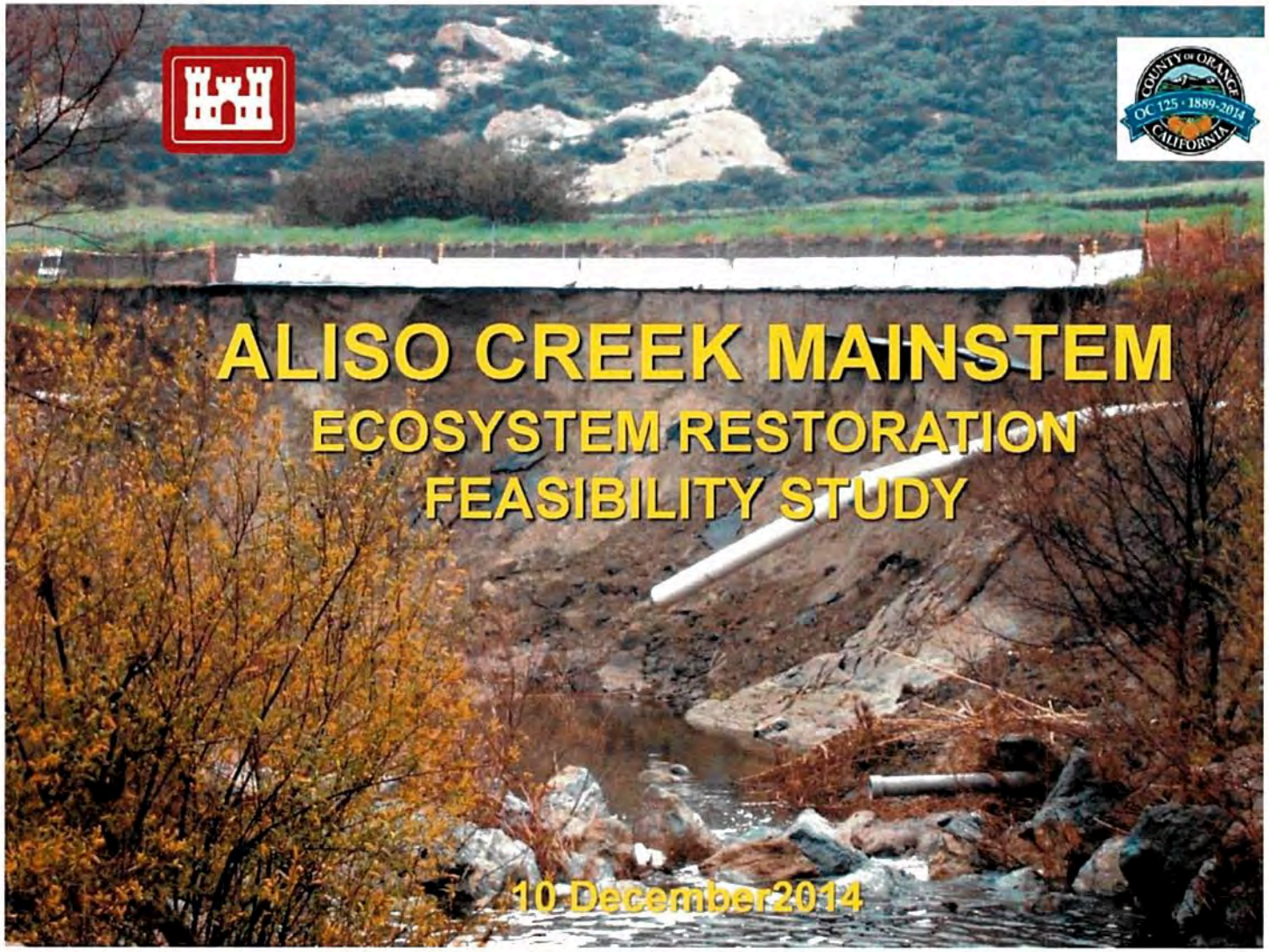
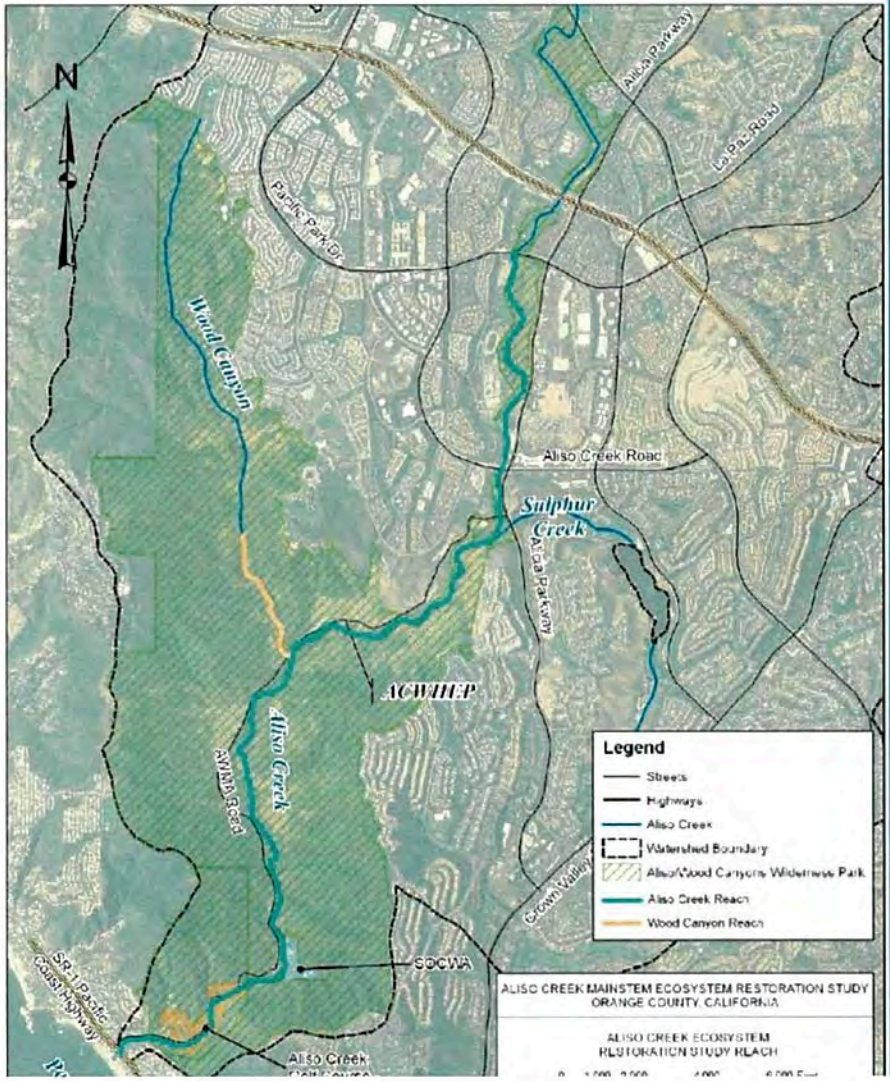
Enclosure 3

Aliso Creek Mainstem Ecosystem Restoration Feasibility Study

(Army Corps powerpoint presentation October 2014)

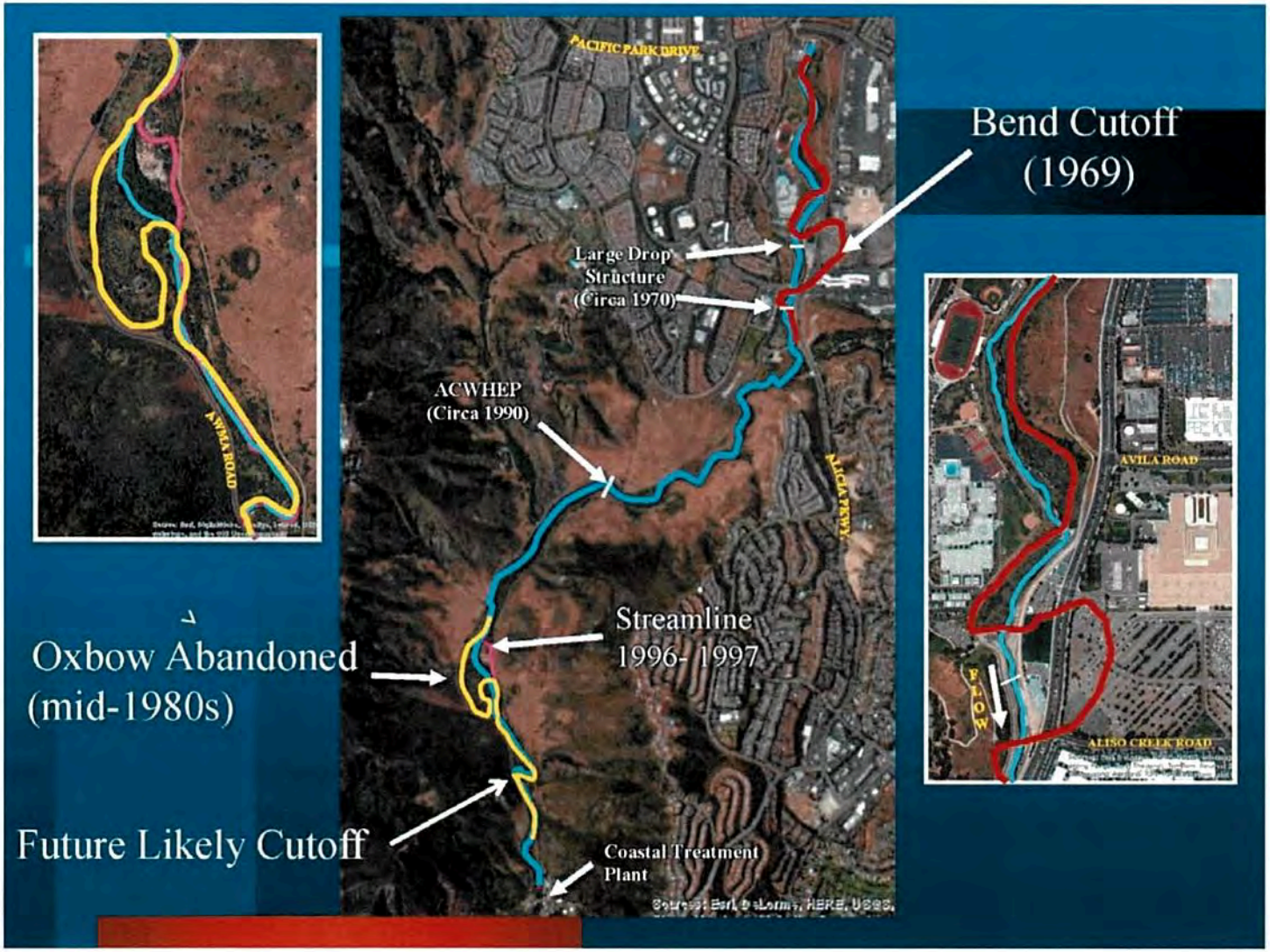

ALISO CREEK MAINSTEM
ECOSYSTEM RESTORATION
FEASIBILITY STUDY
10 December2014



Project Area

- 6.5 Miles Mainstem
- 1,000 ft. Wood Canyon Ck
- Majority of Study Area in Aliso/Woods Canyons Wilderness Park

ACWHEP Structure


PACIFIC PARK DRIVE
Bend Cutoff
(1969)
Large Drop
Structure
(Circa 1970)
ACWHEP
(Circa 1990)
AVILA ROAD
Streamline
1996- 1997
Oxbow Abandoned
(mid-1980s)
FLOW
ALISO CREEK ROAD
Future Likely Cutoff
Coastal Treatment
Plant

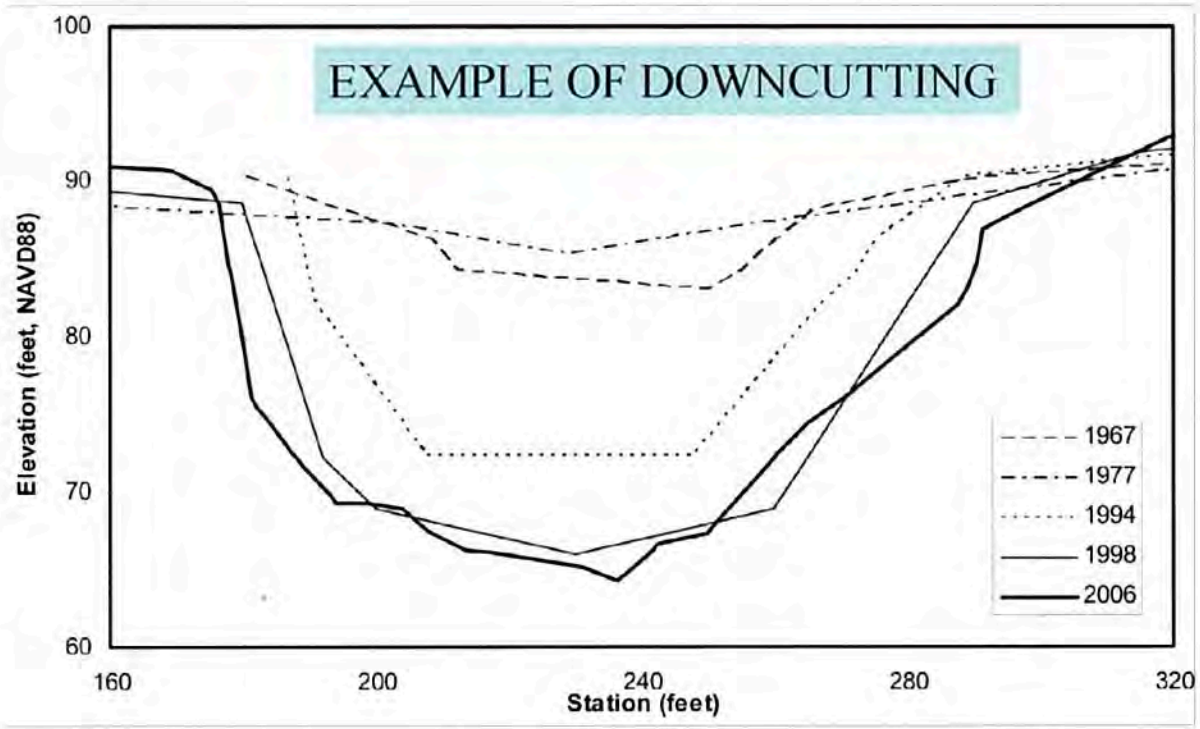


Figure 6-1. Aliso Creek channel geometry 300 feet upstream of the Wood Canyon Creek confluence

FORMULATION OF ALTERNATIVE PLANS

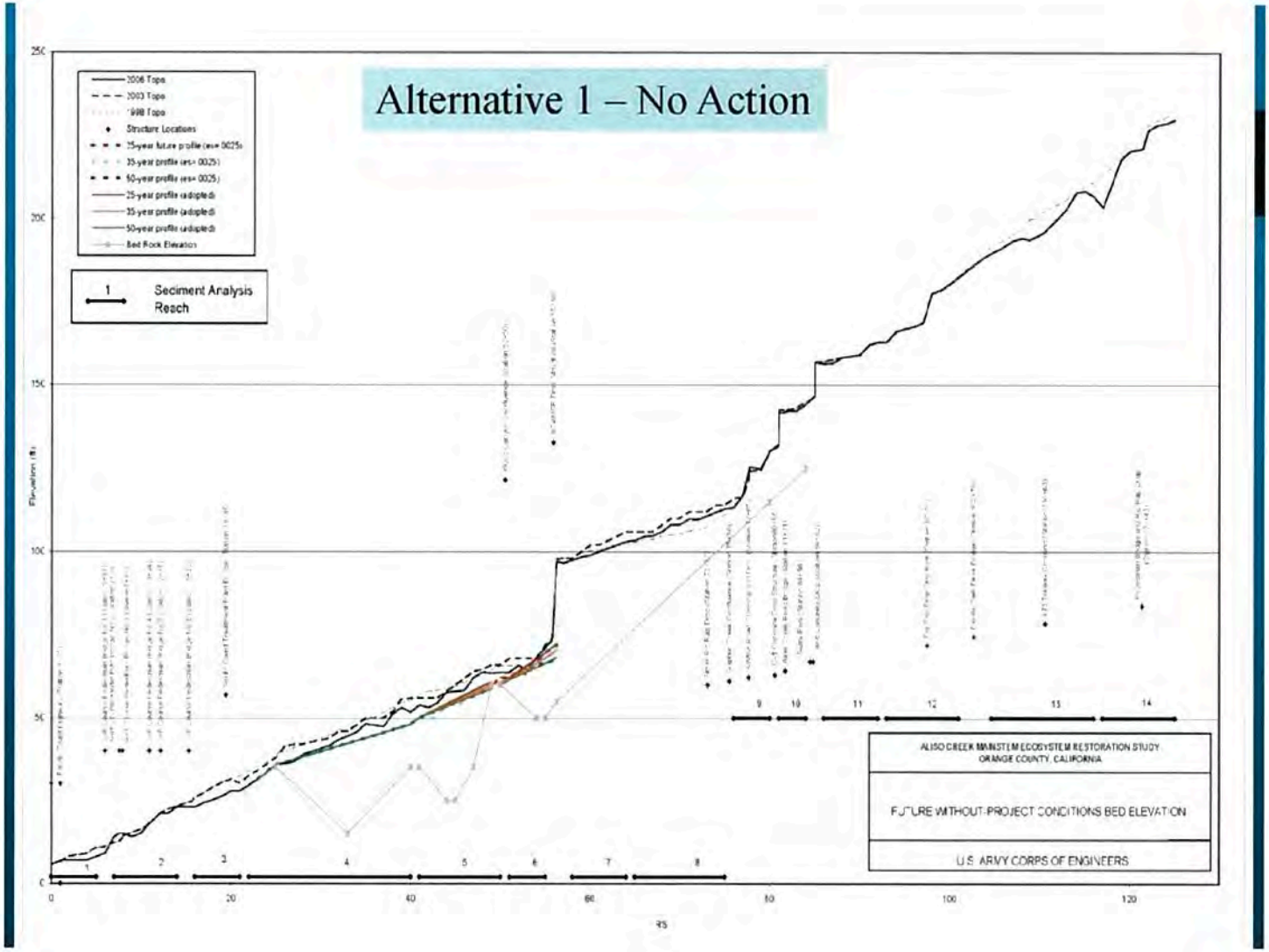
ALTERNATIVES

1. No Action

2. Stabilize existing streambed elevation
   - ACWHEP remains in place

3. Raise streambed to approach historic pre-incised streambed elevation
   - ACWHEP removed
   - Wood Canyon reconnected

4. Raise streambed to intermediate elevation between the current streambed and the historic pre-incised streambed elevation
   - ACWHEP modified
   - Wood Canyon not reconnected


Alternative 1 – No Action
2006 Topo
2003 Topo
1998 Topo
Structure Locations
25-year profile (adopted)
35-year profile (adopted)
50-year profile (adopted)
Bed Rock Elevation
1
Seciment Analysis Reach
ALISO CREEK MAINSTEM ECOSYSTEM RESTORATION STUDY
ORANGE COUNTY, CALIFORNIA
FUTURE WITHOUT-PROJECT CONDITIONS BED ELEVATION
U.S. ARMY CORPS OF ENGINEERS

ALTERNATIVES

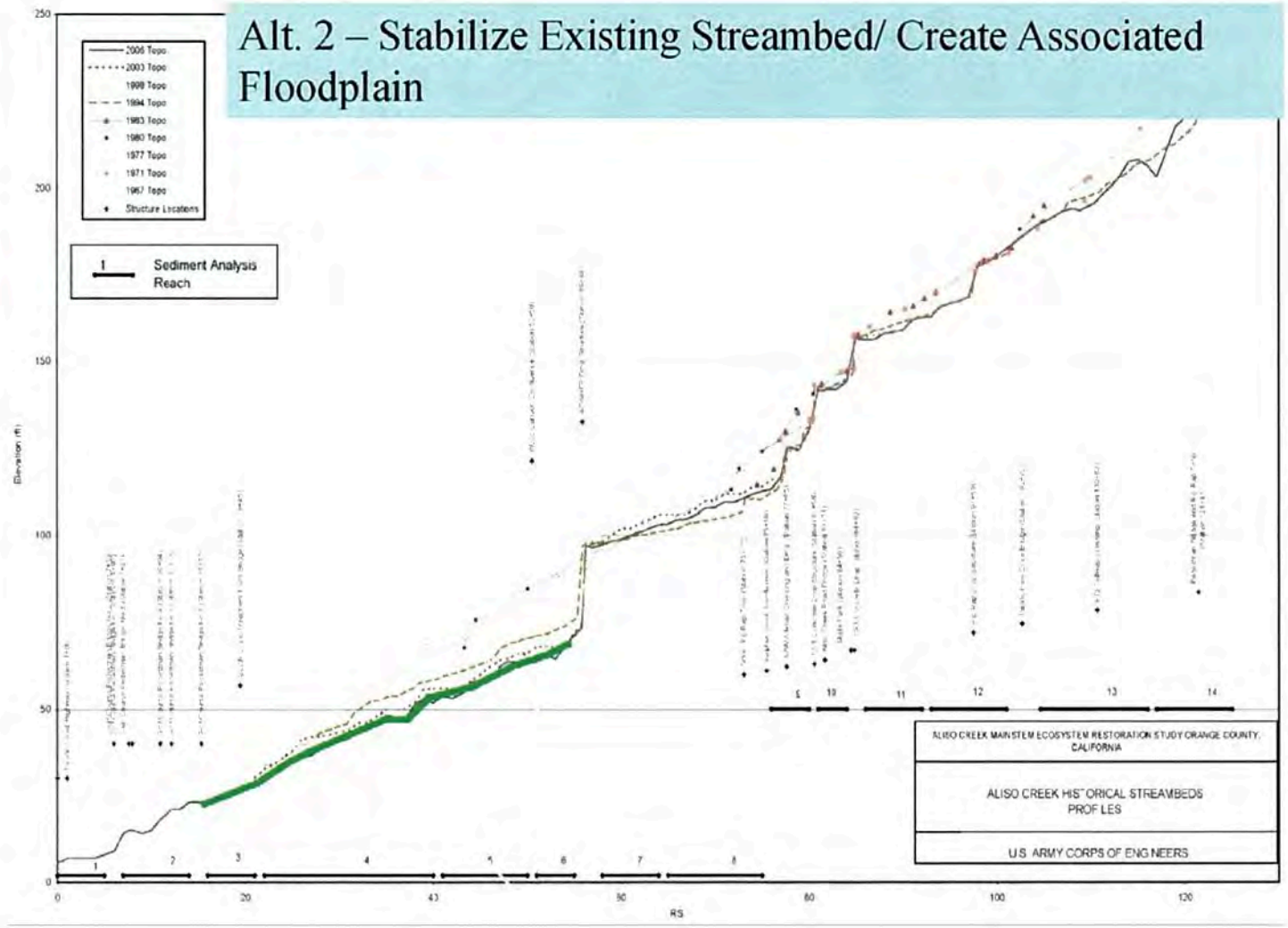
1. No Action

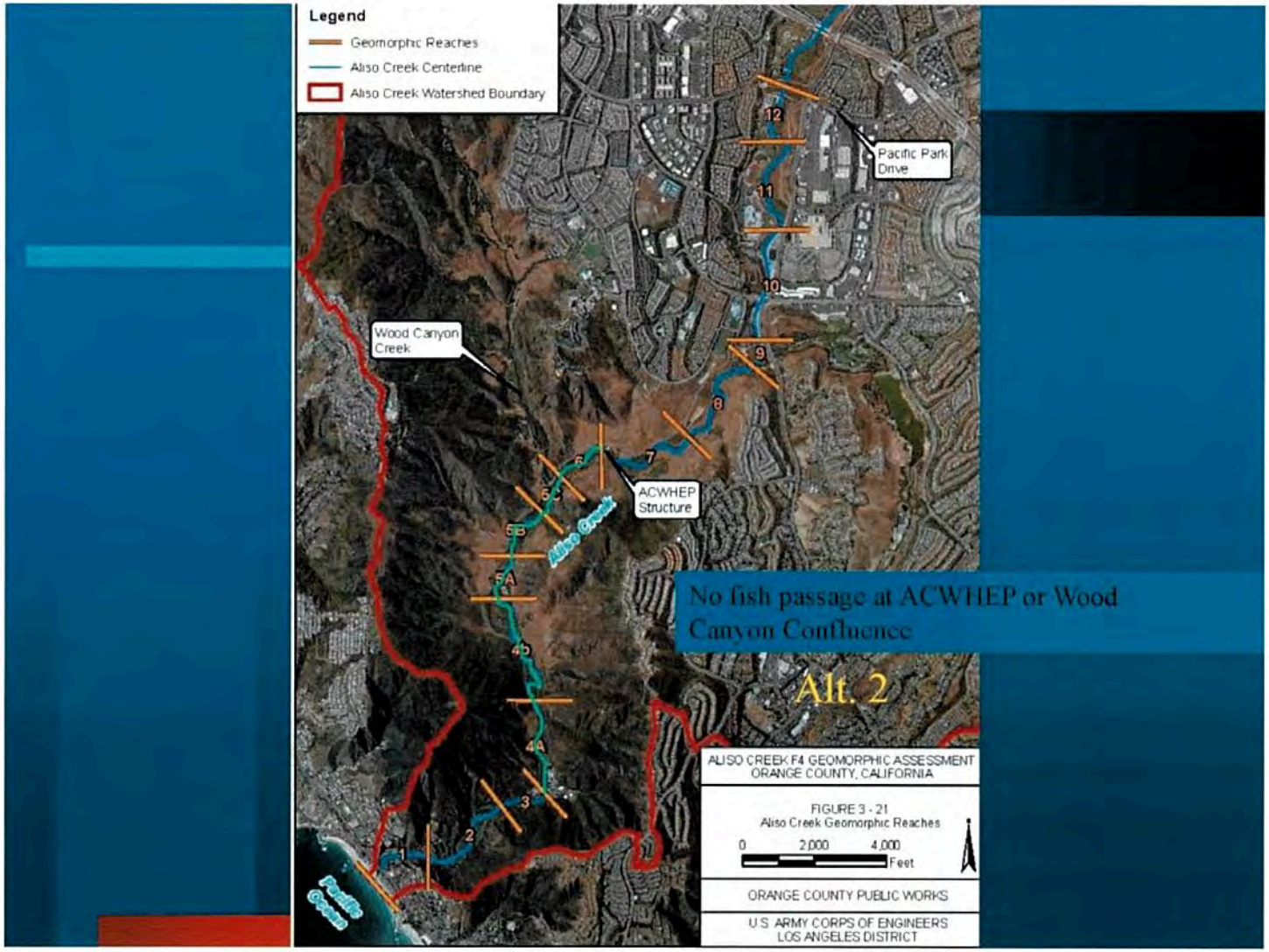
2. Stabilize existing streambed elevation
   - ACWHEP remains in place

3. Raise streambed to approach historic pre-incised streambed elevation
   - ACWHEP removed
   - Wood Canyon reconnected

4. Raise streambed to intermediate elevation between the current streambed and the historic pre-incised streambed elevation
   - ACWHEP modified
   - Wood Canyon not reconnected

Alt. 2 – Stabilize Existing Streambed/ Create Associated Floodplain




Legend
Geomorphic Reaches
Aliso Creek Centerline
Aliso Creek Watershed Boundary
Pacific Park Drive
Wood Canyon Creek
ACWHEP Structure
Aliso Creek
Pacific Ocean
12
11
10
9
8
7
6
5C
5B
5A
4B
4A
3
2
1
No fish passage at ACWHEP or Wood Canyon Confluence
Alt. 2
ALISO CREEK F4 GEOMORPHIC ASSESSMENT
ORANGE COUNTY, CALIFORNIA
FIGURE 3 - 21
Aliso Creek Geomorphic Reaches
0
2,000
4,000
Feet
ORANGE COUNTY PUBLIC WORKS
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

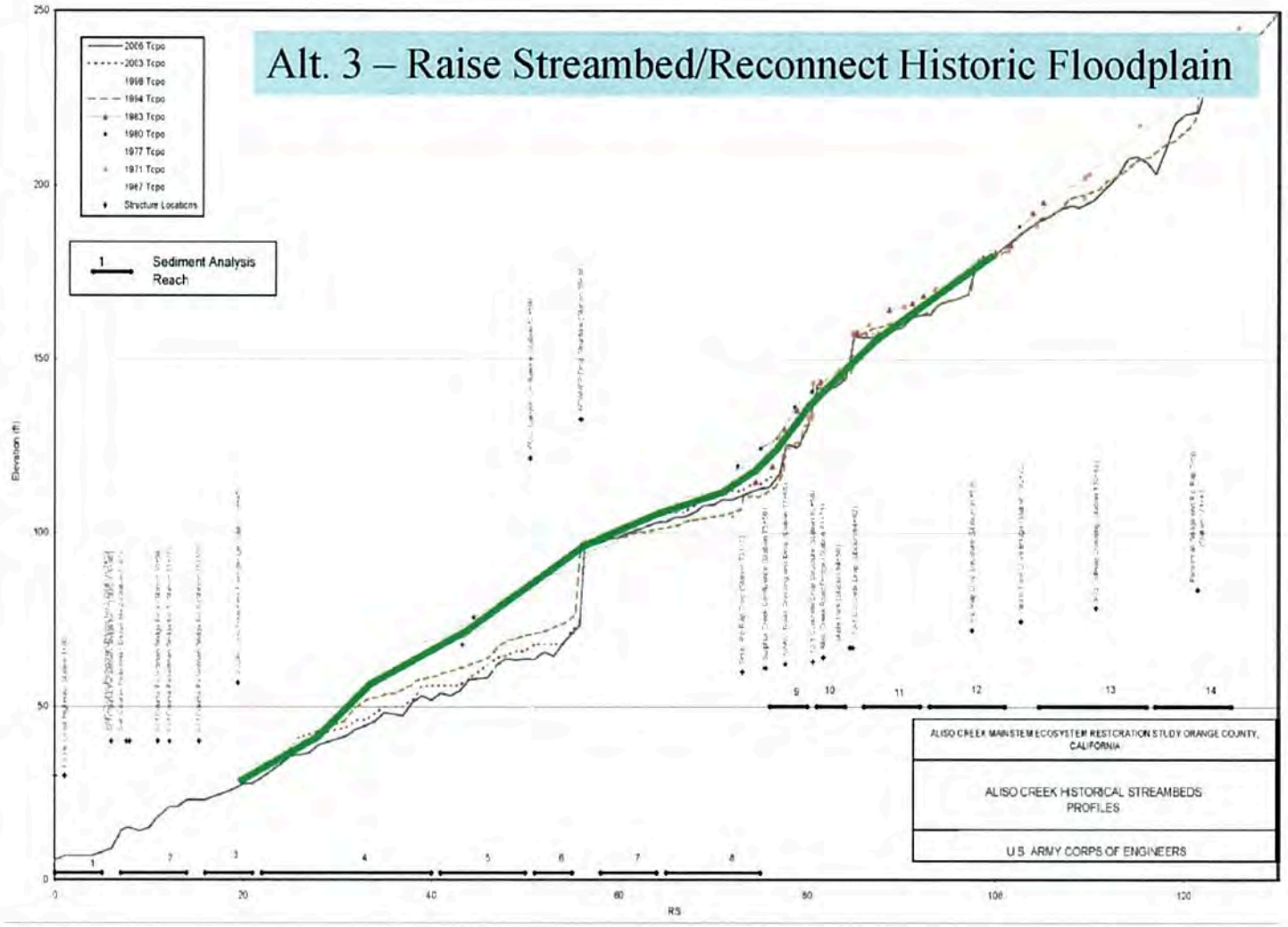
ALTERNATIVES

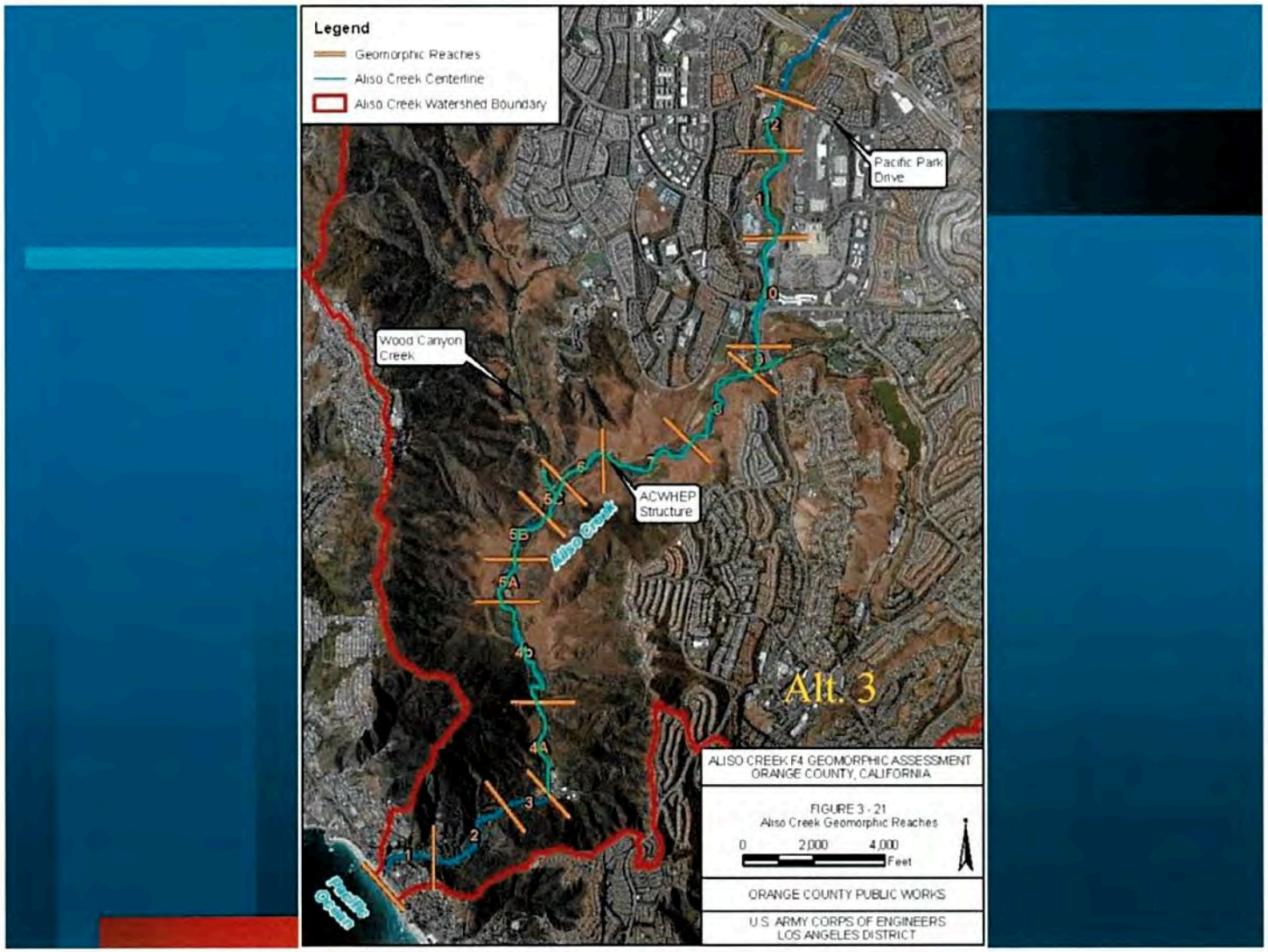
1. No Action

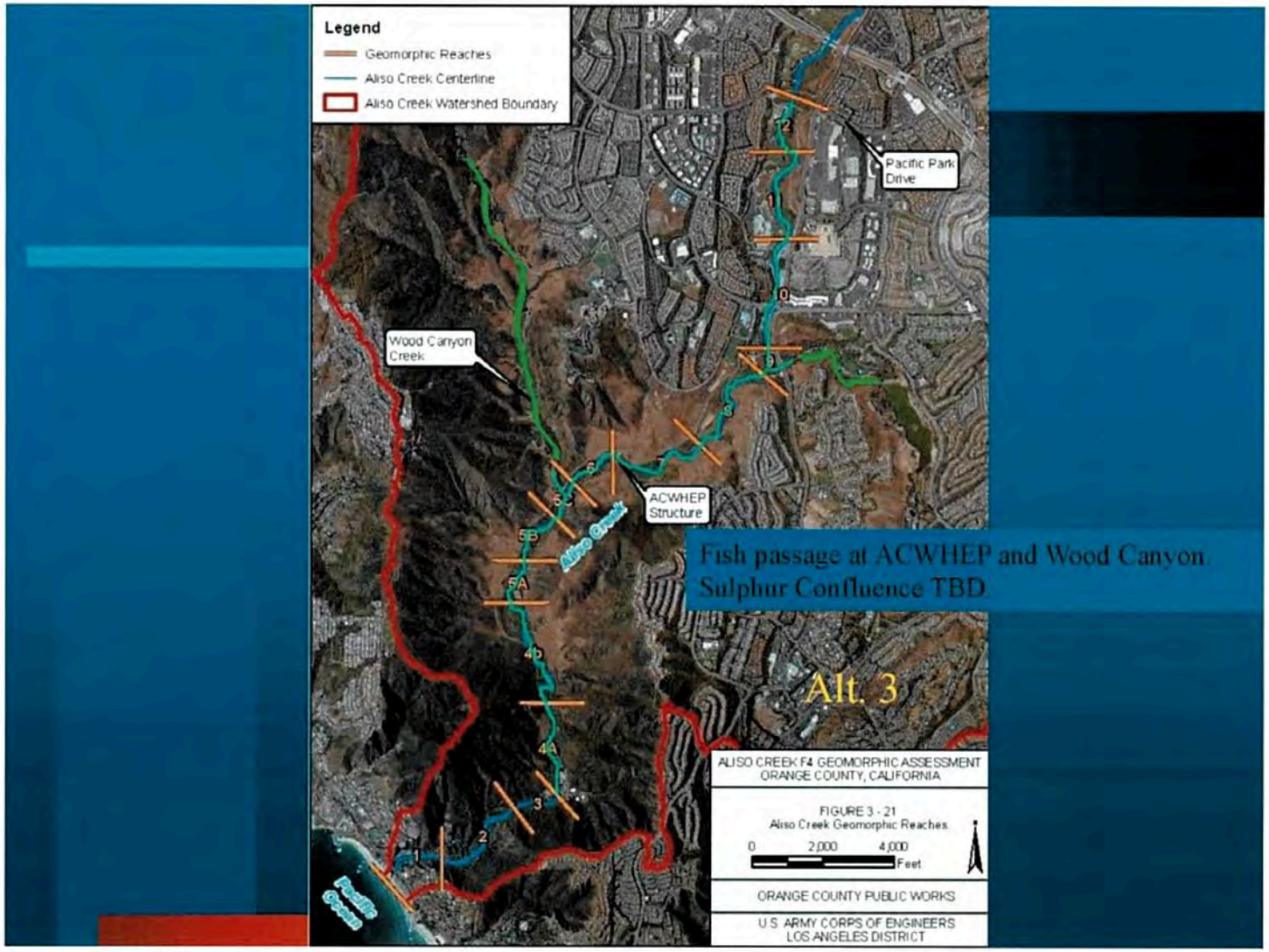
2. Stabilize existing streambed elevation
   - ACWHEP remains in place

3. Raise streambed to approach historic pre-incised streambed elevation
   - ACWHEP removed
   - Wood Canyon reconnected

4. Raise streambed to intermediate elevation between the current streambed and the historic pre-incised streambed elevation
   - ACWHEP modified
   - Wood Canyon not reconnected


Alt. 3 – Raise Streambed/Reconnect Historic Floodplain
2006 Topo
2003 Topo
1998 Topo
1994 Topo
1983 Topo
1980 Topo
1977 Topo
1971 Topo
1967 Topo
Structure Locations
1 Sediment Analysis Reach
Elevation (ft)
RS
ALISO CREEK MAINSTEM ECOSYSTEM RESTORATION STUDY ORANGE COUNTY, CALIFORNIA
ALISO CREEK HISTORICAL STREAMBEDS PROFILES
U.S. ARMY CORPS OF ENGINEERS


Legend
Geomorphic Reaches
Aliso Creek Centerline
Aliso Creek Watershed Boundary
Pacific Park Drive
Wood Canyon Creek
ACWHEP Structure
Aliso Creek
Alt. 3
ALISO CREEK F4 GEOMORPHIC ASSESSMENT
ORANGE COUNTY, CALIFORNIA
FIGURE 3 - 21
Aliso Creek Geomorphic Reaches
0 2,000 4,000
Feet
ORANGE COUNTY PUBLIC WORKS
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT


Legend
Geomorphic Reaches
Aliso Creek Centerline
Aliso Creek Watershed Boundary
Pacific Park Drive
Wood Canyon Creek
ACWHEP Structure
Aliso Creek
Fish passage at ACWHEP and Wood Canyon. Sulphur Confluence TBD.
Alt. 3
ALISO CREEK F4 GEOMORPHIC ASSESSMENT
ORANGE COUNTY, CALIFORNIA
FIGURE 3 - 21
Aliso Creek Geomorphic Reaches
0 2,000 4,000
Feet
ORANGE COUNTY PUBLIC WORKS
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

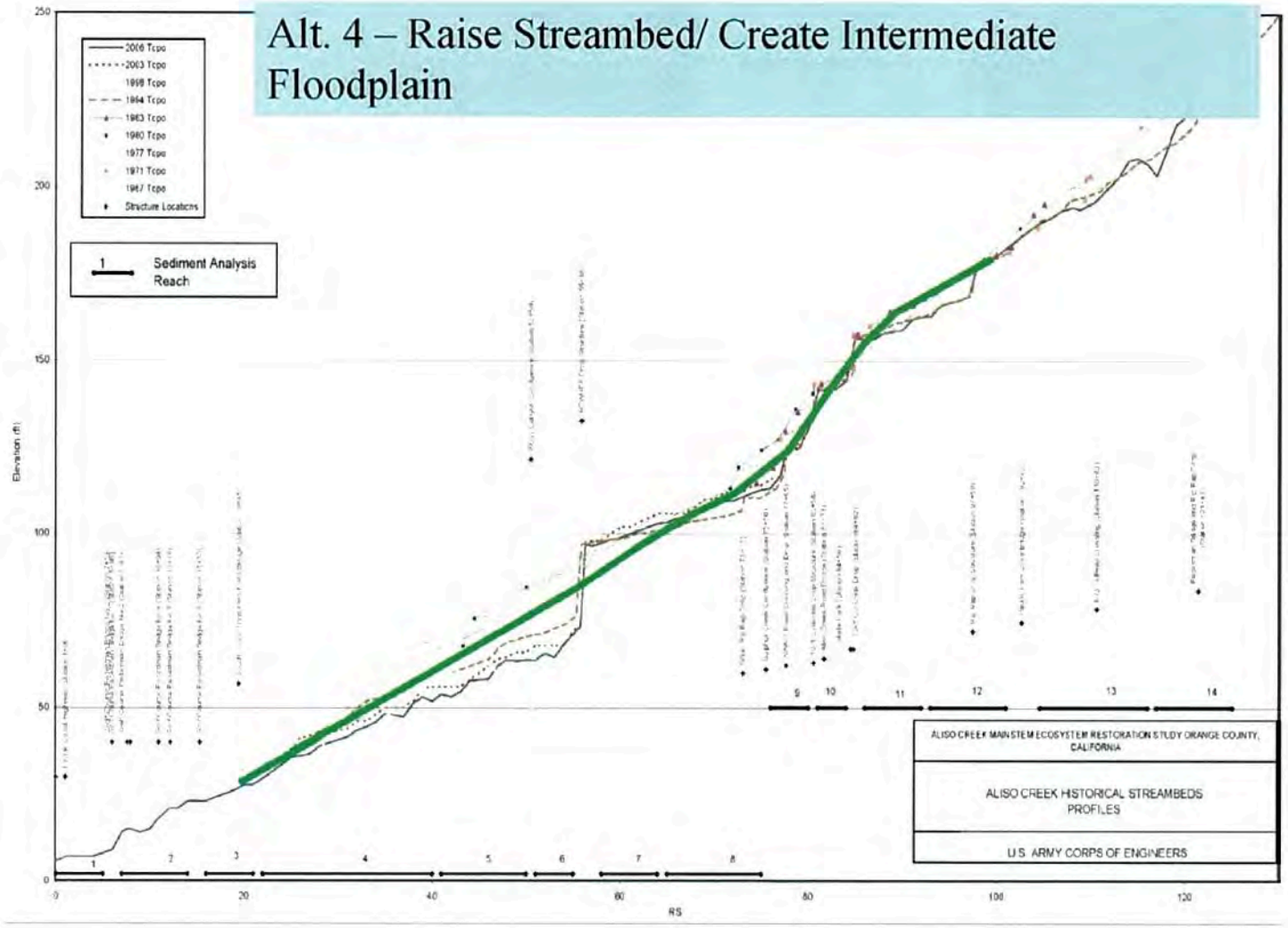
ALTERNATIVES

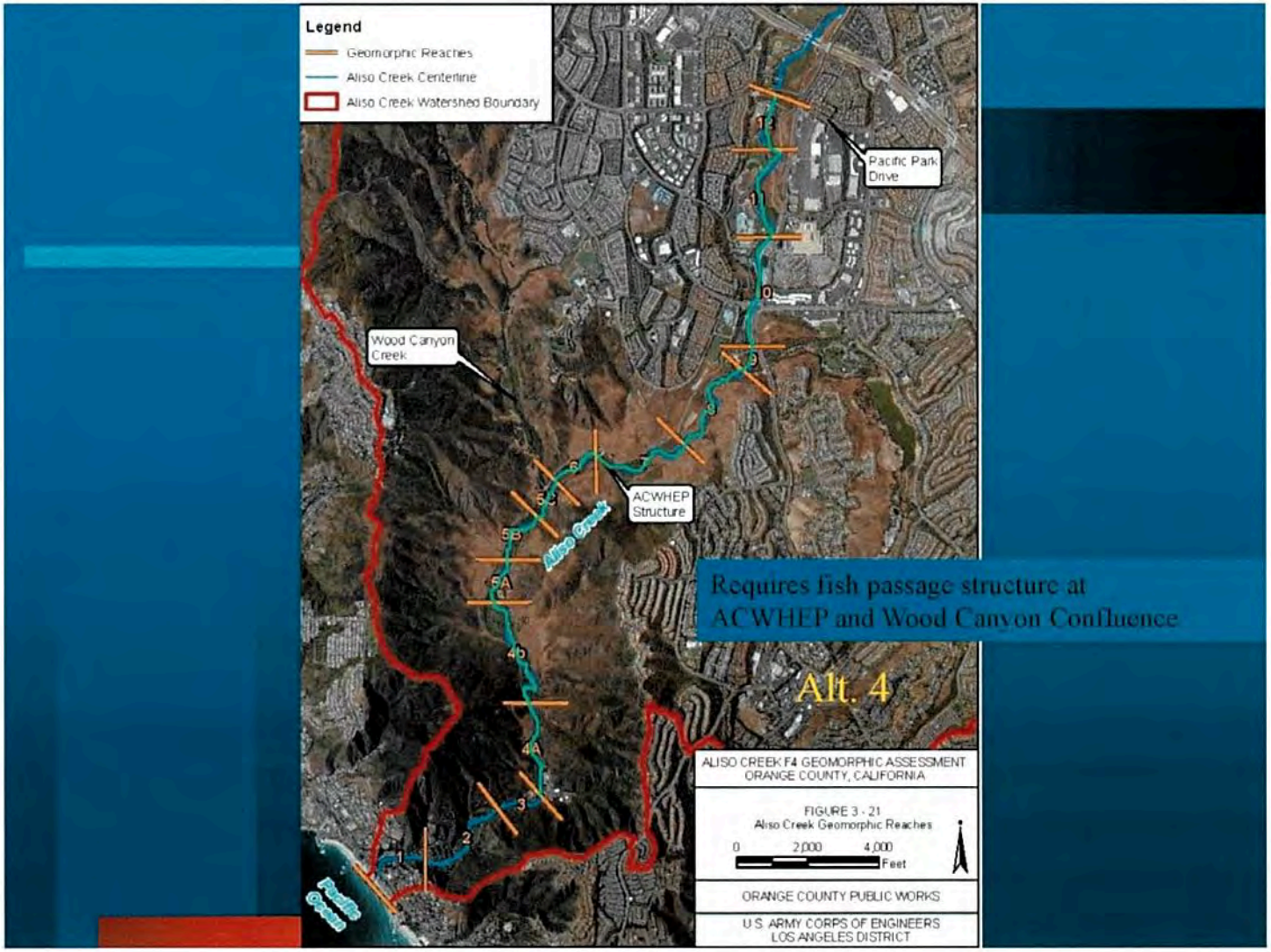
1. No Action

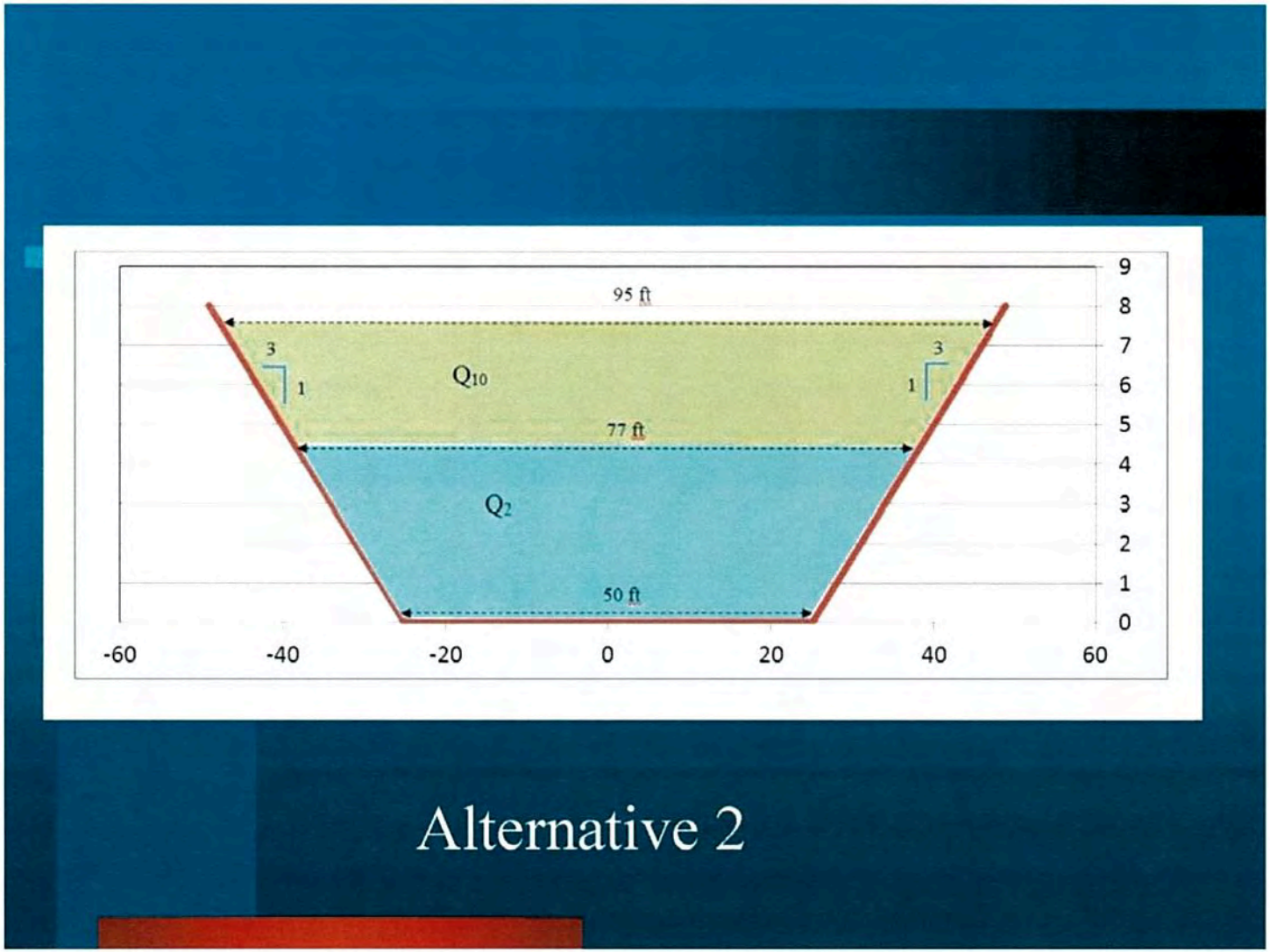
2. Stabilize existing streambed elevation
   - ACWHEP remains in place

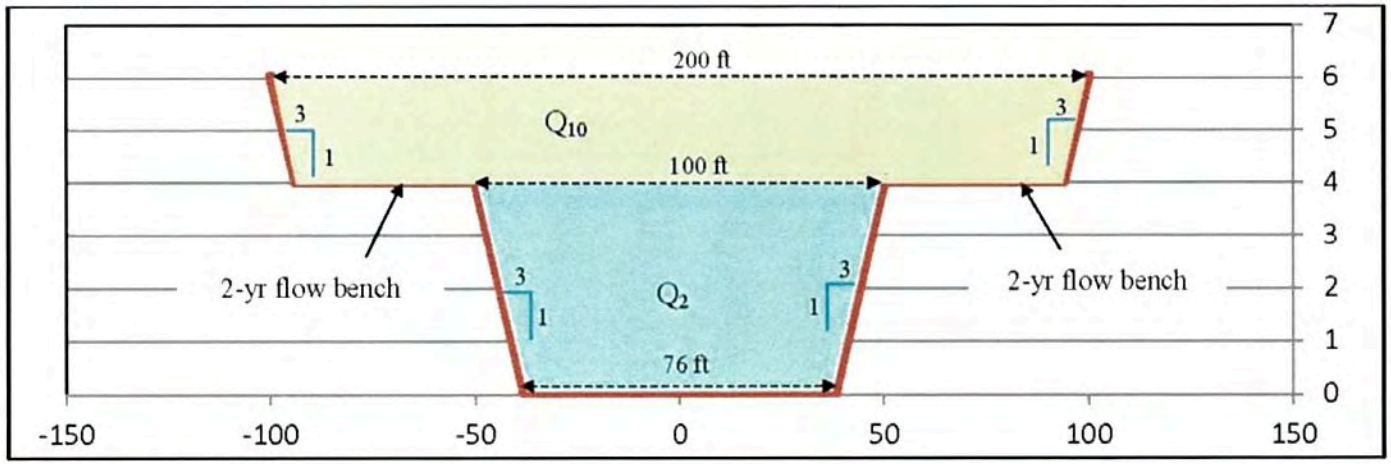
3. Raise streambed to approach historic pre-incised streambed elevation
   - ACWHEP removed
   - Wood Canyon reconnected

4. Raise streambed to intermediate elevation between the current streambed and the historic pre-incised streambed elevation
   - ACWHEP modified
   - Wood Canyon not reconnected


Alt. 4 – Raise Streambed/ Create Intermediate Floodplain
2006 Topo
2003 Topo
1998 Topo
1984 Topo
1983 Topo
1980 Topo
1977 Topo
1971 Topo
1967 Topo
Structure Locations
1
Sediment Analysis Reach
Elevation (ft)
RS
ALISO CREEK MAINSTEM ECOSYSTEM RESTORATION STUDY ORANGE COUNTY, CALIFORNIA
ALISO CREEK HISTORICAL STREAMBEDS PROFILES
U.S. ARMY CORPS OF ENGINEERS

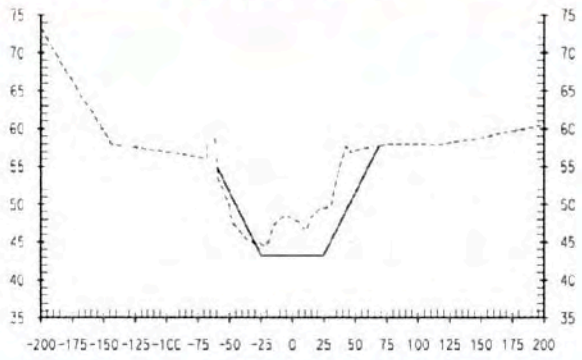

Legend
Geomorphic Reaches
Aliso Creek Centerline
Aliso Creek Watershed Boundary
Pacific Park Drive
Wood Canyon Creek
ACWHEP Structure
Aliso Creek
Requires fish passage structure at ACWHEP and Wood Canyon Confluence
Alt. 4
ALISO CREEK F4 GEOMORPHIC ASSESSMENT
ORANGE COUNTY, CALIFORNIA
FIGURE 3 - 21
Aliso Creek Geomorphic Reaches
0 2,000 4,000
Feet
ORANGE COUNTY PUBLIC WORKS
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT


95 ft
3
1
Q_{10}
3
1
77 ft
Q_2
50 ft
9
8
7
6
5
4
3
2
1
0
-60
-40
-20
0
20
40
60
Alternative 2

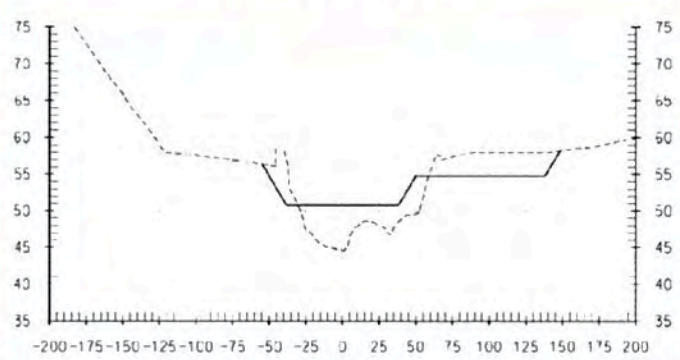


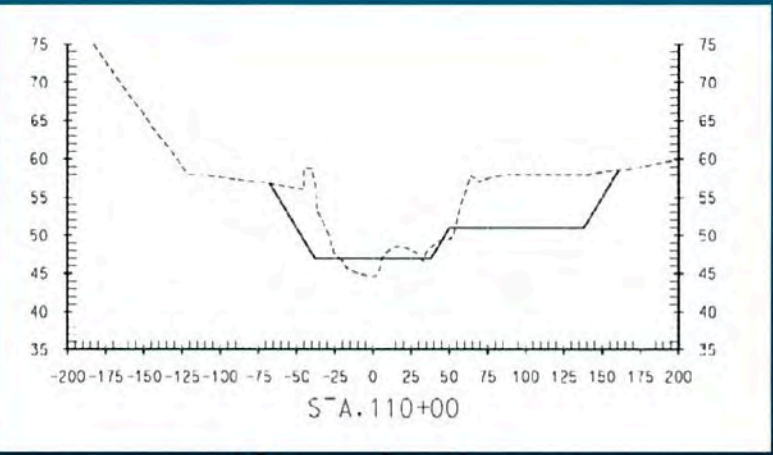
Alternative 3 and 4

Alternative 2

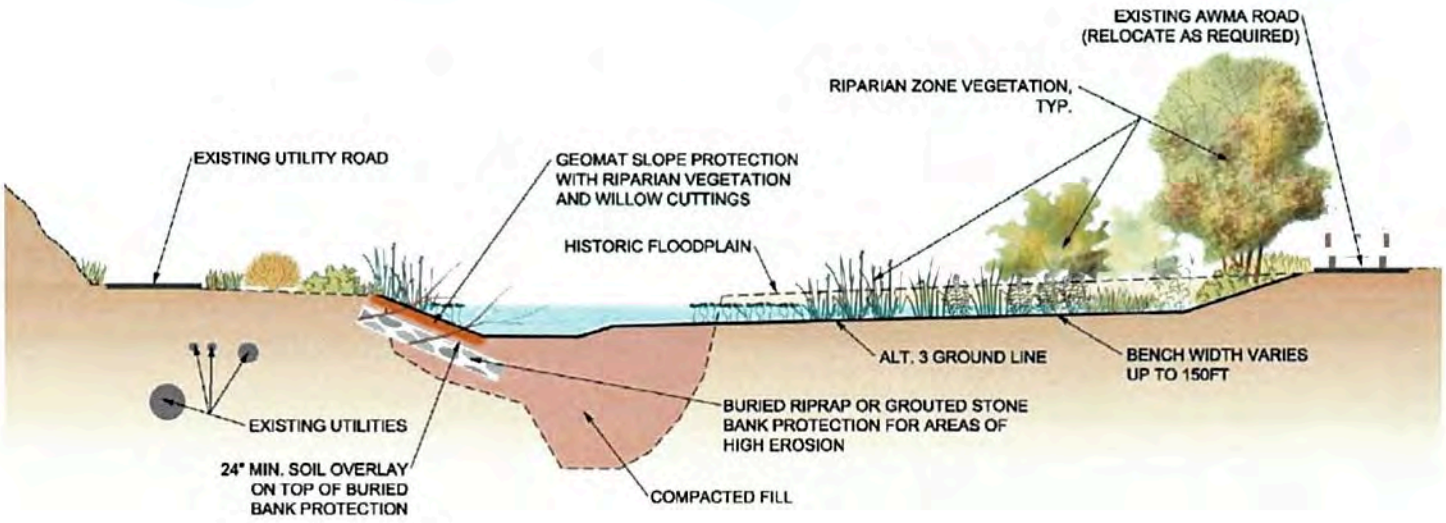


Alternative 3



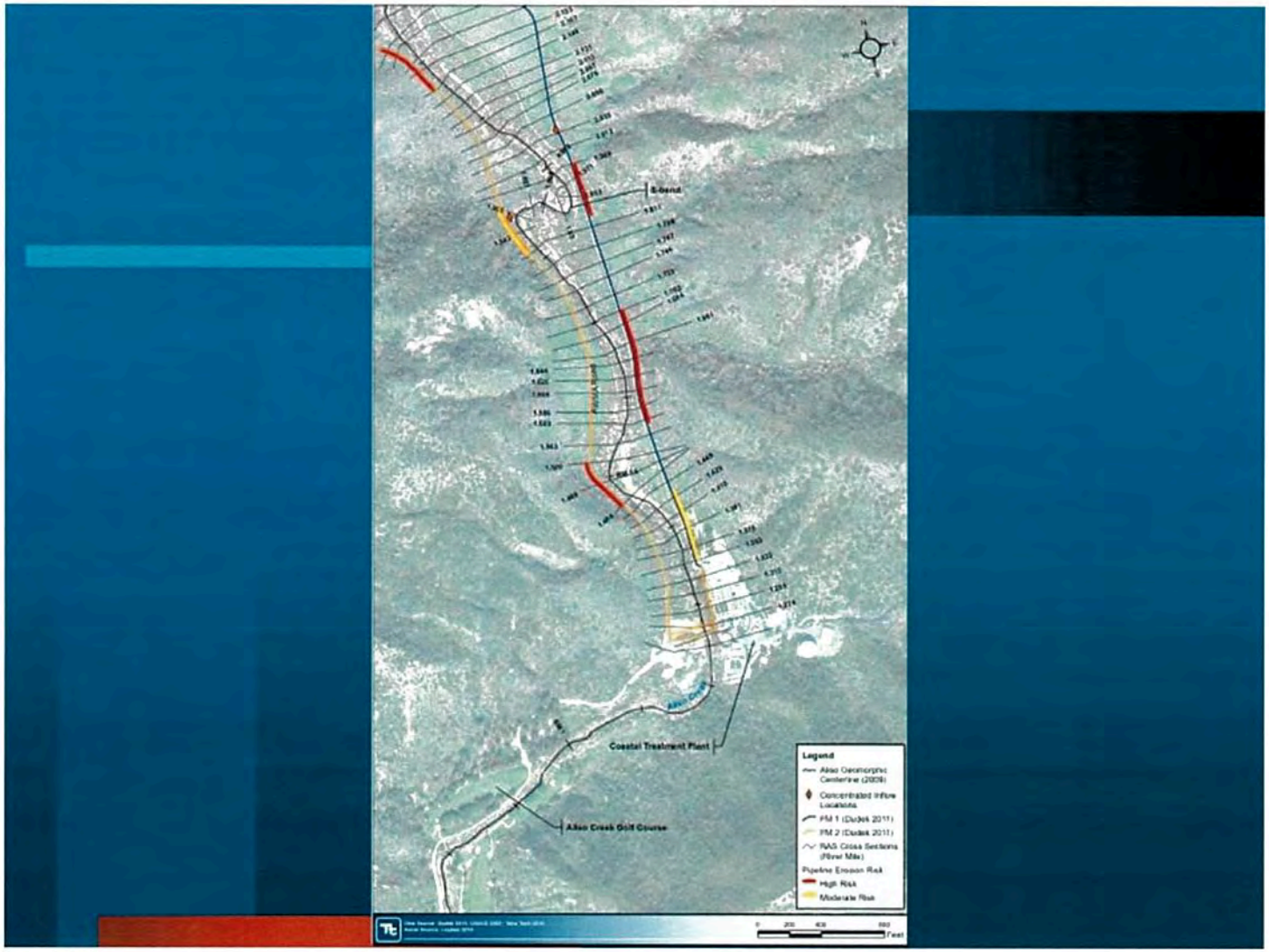


Alternative 4



ALTERNATIVE 3: CONCEPTUAL SECTION

US Army Corps
of Engineers
Los Angeles District


S-bend
Coastal Treatment Plant
Aliso Creek Golf Course
Legend
Concentrated Inflow Locations
High Risk
Moderate Risk
Feet

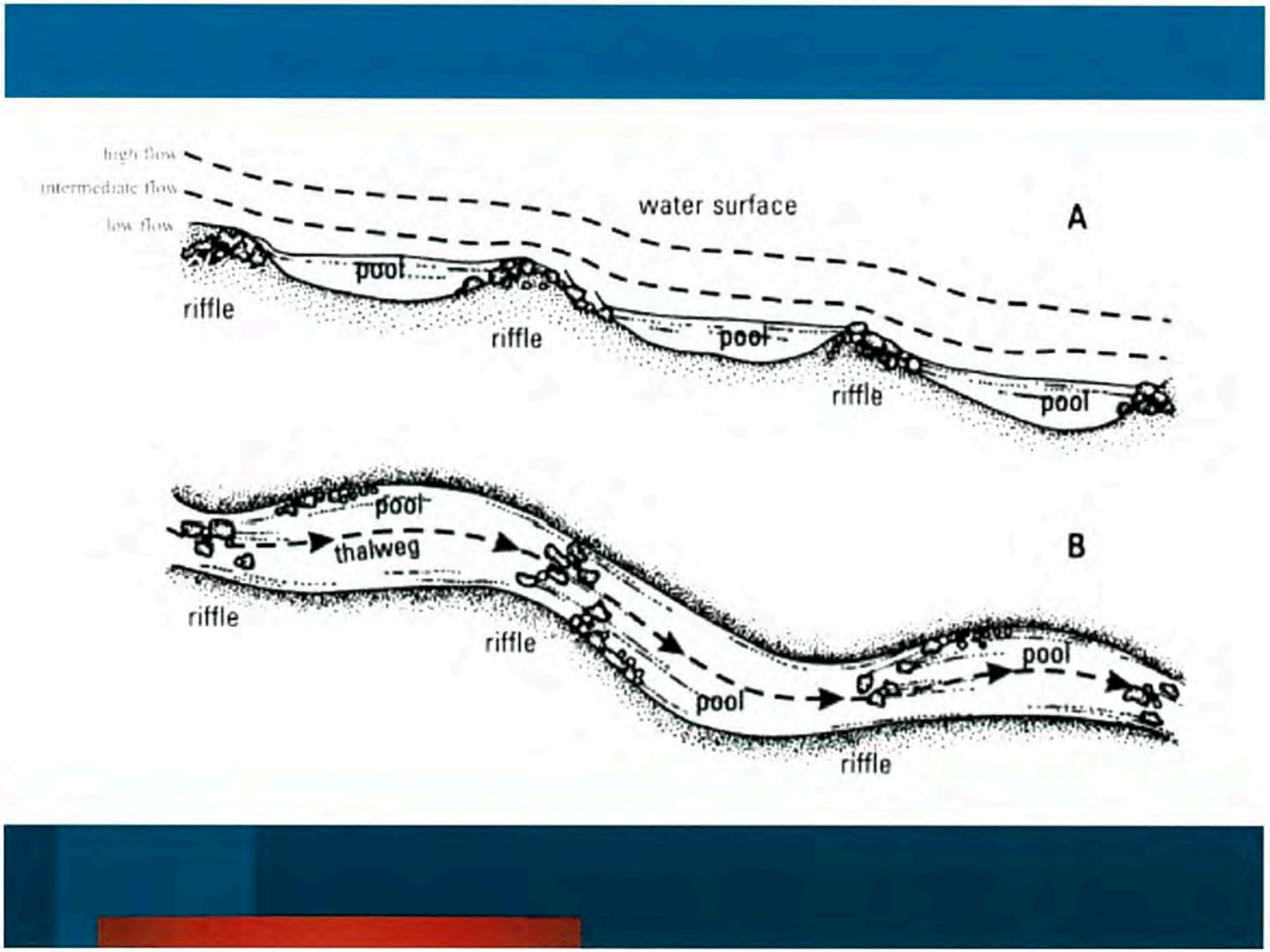
MEASURES

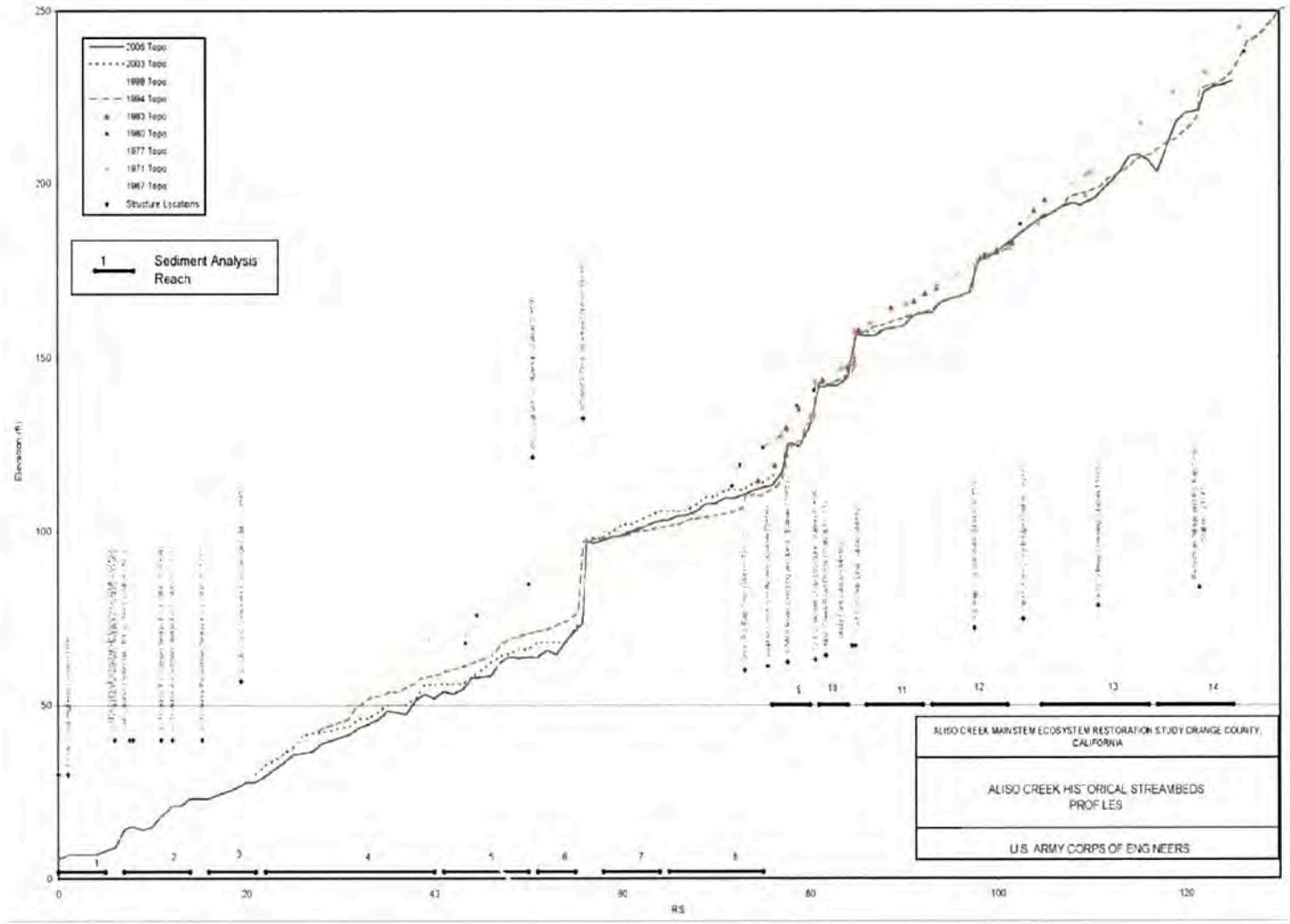
Channel/Habitat Improvements

- Bank slope recontouring
- grade control stabilizers (fish friendly)
- Raising streambed
- Utility /infrastructure protection
- stream lengthening (sinuosity)
- Remove/modify barriers
- Reconnect abandoned oxbow
- Widen riparian corridor
- Exotic vegetation removal
- Introduce So. Cal. native fisheries (speckled dace, arroyo chub)

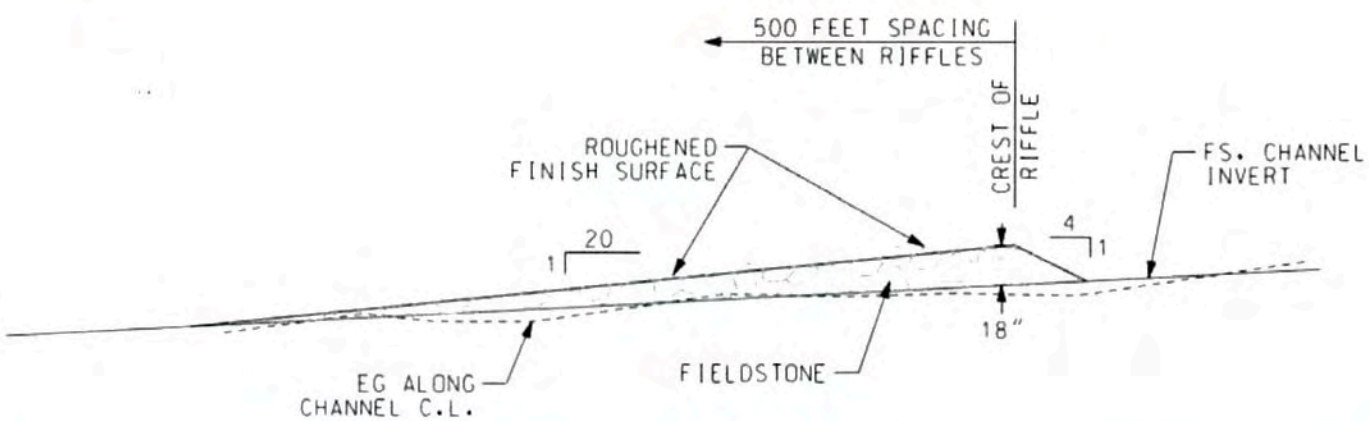
Access Road Alignments

- Relocate AWMA road where possible (to allow channel sinuosity)
- Remove/relocate abandoned section of AWMA road
- Establish east road as permanent SOCWA road
- Repurpose AWMA road: downstream of Wood Canyon as pedestrian / bike trail

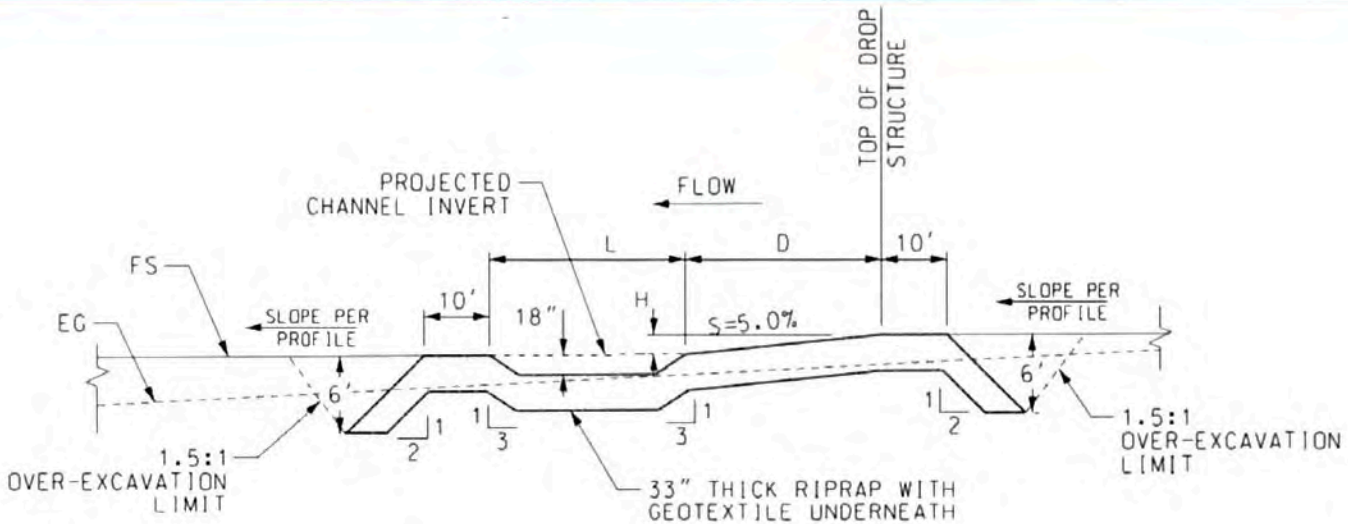

high flow
intermediate flow
low flow
water surface
A
pool
riffle
riffle
pool
riffle
pool
pool
thalweg
B
riffle
riffle
pool
pool
riffle


2006 Topo
2003 Topo
1998 Topo
1994 Topo
1983 Topo
1960 Topo
1877 Topo
1871 Topo
1967 Topo
Structure Locations
1 Sediment Analysis Reach
Elevation (ft)
RS
ALISO CREEK MAINSTEM ECOSYSTEM RESTORATION STUDY ORANGE COUNTY, CALIFORNIA
ALISO CREEK HISTORICAL STREAMBEDS PROFILES
U.S. ARMY CORPS OF ENGINEERS

NEWBURY RIFFLE

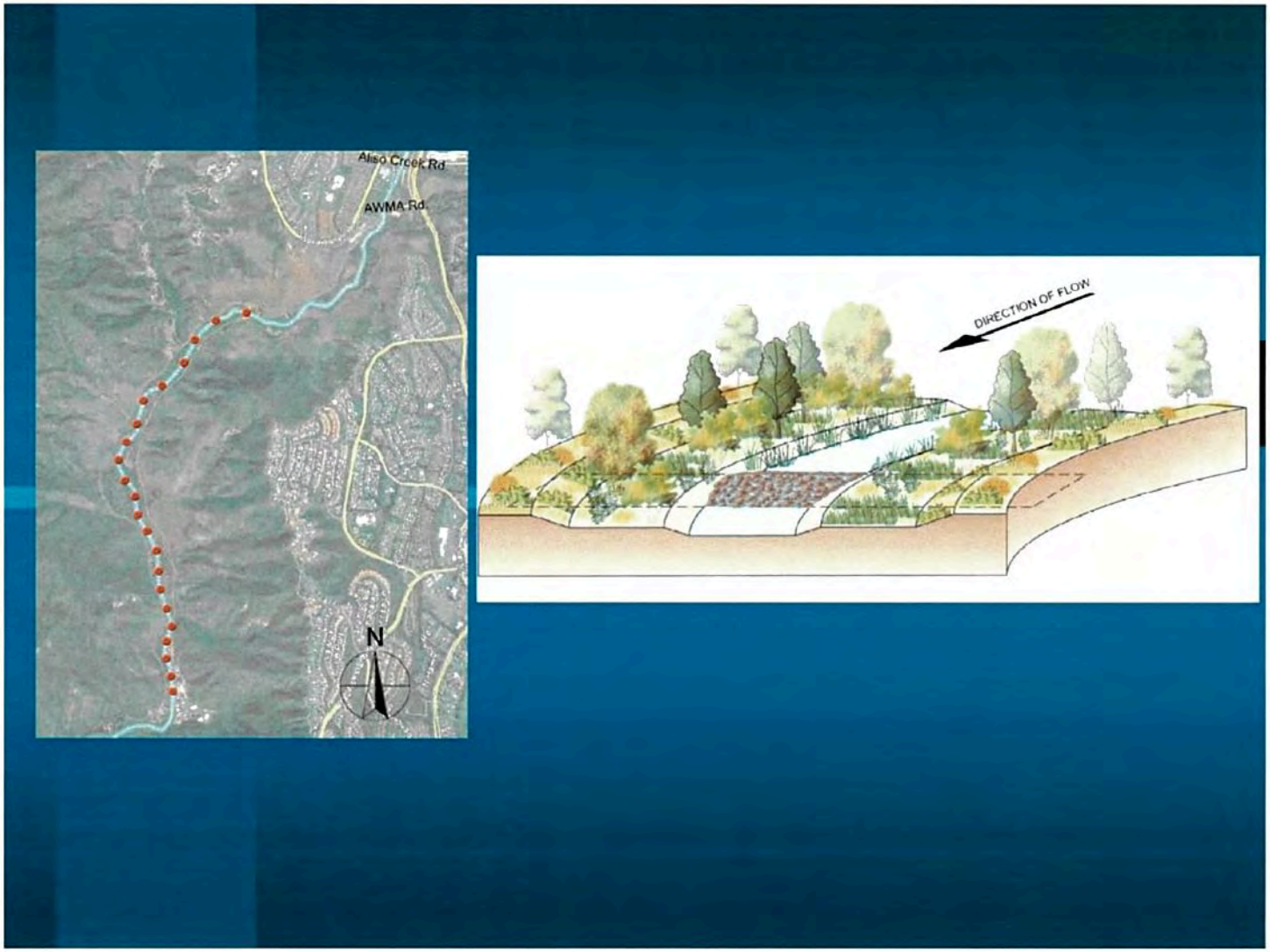


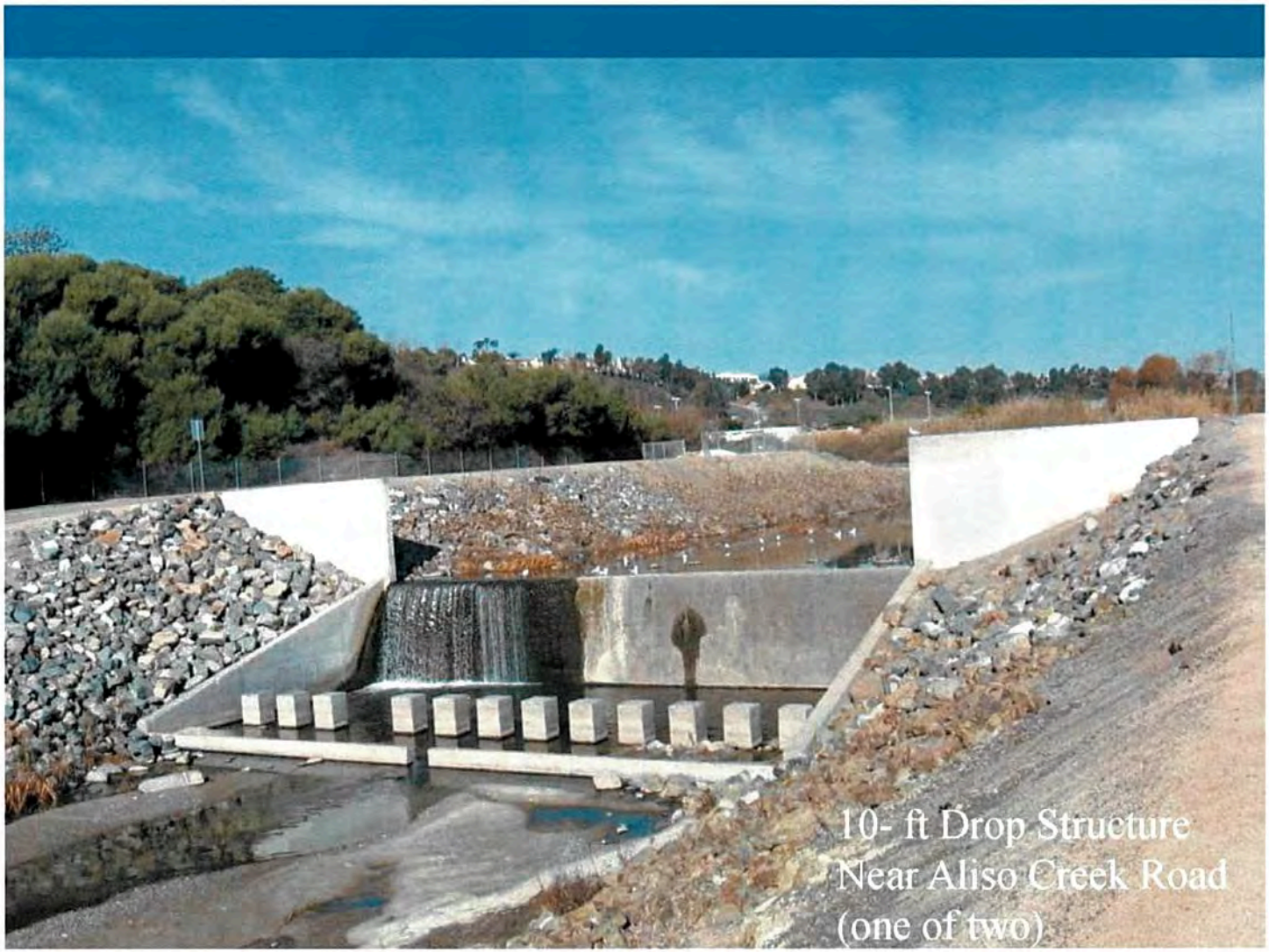
ROCK RIFFLE



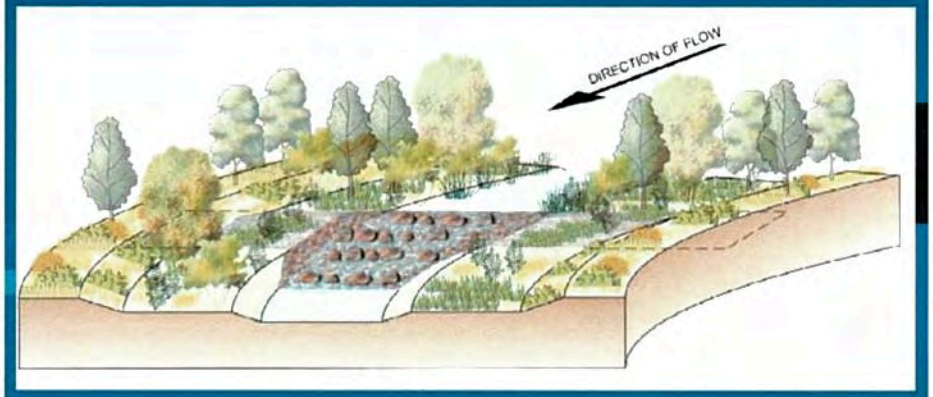
RIFFLE STRUCTURE DIMENSIONS

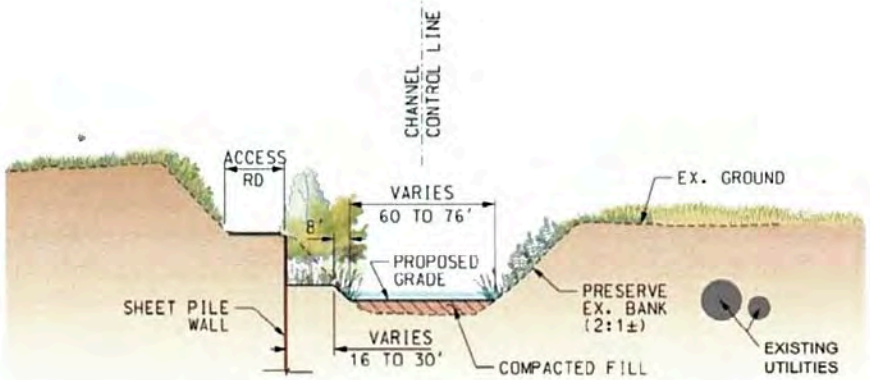
DROP HEIGHT, H	DROP LENGTH, D	POOL LENGTH, L	ROCK TYPE
9"	15'	20'	UNGROUTED
18"	30'	20'	UNGROUTED
6'	120'	30'	GROUTED


Aliso Creek Rd
AWMA Rd
N
DIRECTION OF FLOW


10- ft Drop Structure
Near Aliso Creek Road
(one of two)


Aliso Creek Rd.
AWMA Rd.
N


DIRECTION OF FLOW

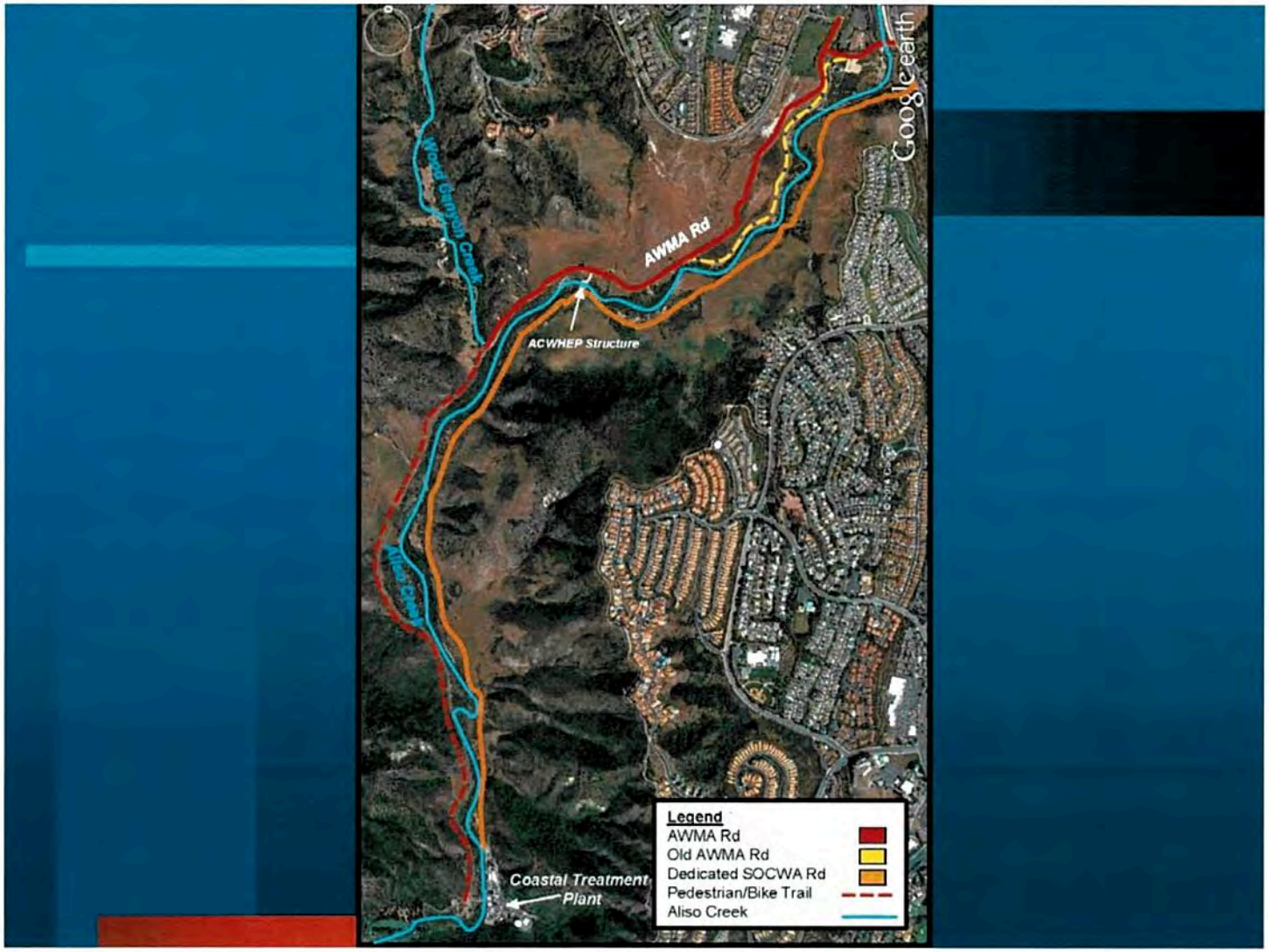


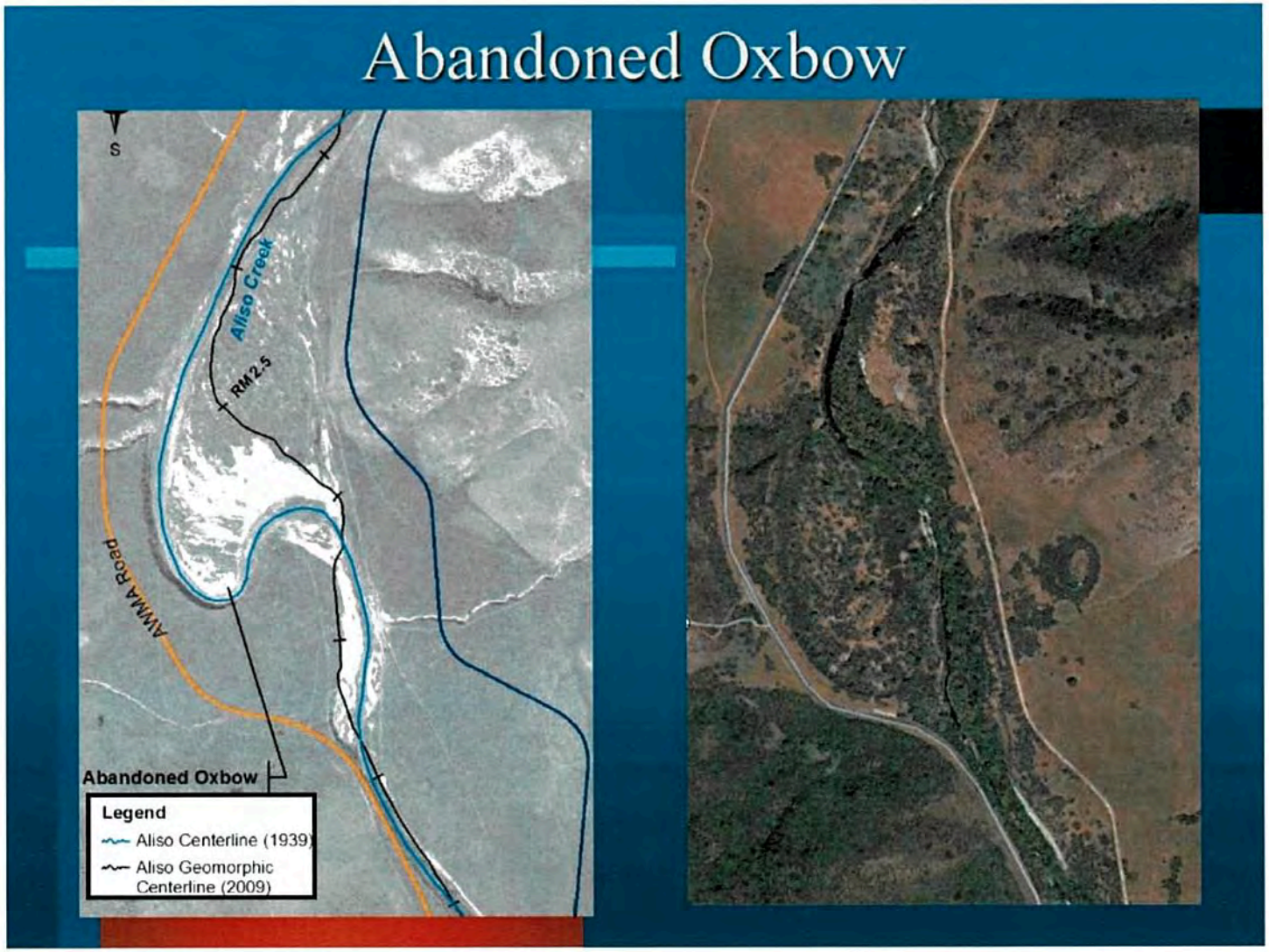
TYPICAL SECTION C - ALONG PREVIOUSLY IMPROVED REACH

N.T.S.

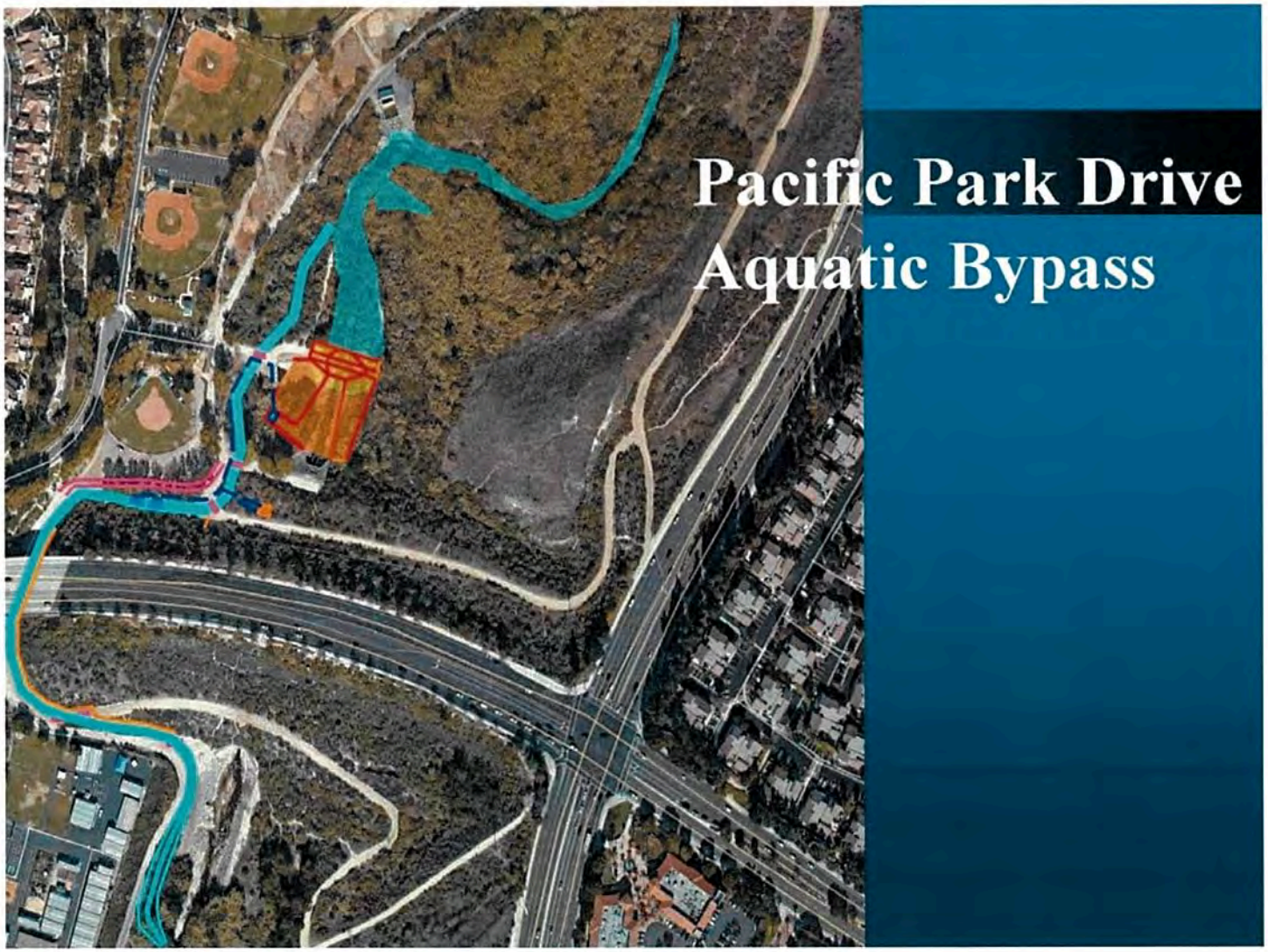
Channel Widening at Aliso Creek Road

(for Channel Length = 2,000 ft)


Google earth
AWMA Rd
ACWHEP Structure
Wood Canyon Creek
Aliso Creek
Coastal Treatment Plant
Legend
AWMA Rd
Old AWMA Rd
Dedicated SOCWA Rd
Pedestrian/Bike Trail
Aliso Creek


Abandoned Oxbow
S
Aliso Creek
RM2.5
AWMA Road
Abandoned Oxbow
Legend
Aliso Centerline (1939)
Aliso Geomorphic Centerline (2009)


Skate Park Relocation
Aliso Creek
Skate Park Area: 5 acres
Google earth



Pacific Park Drive Aquatic Bypass


Google earth
Wood Canyon Creek
AWMA Rd
ACWHEP Structure
Aliso Creek
Coastal Treatment Plant
Legend
AWMA Rd
Old AWMA Rd
Dedicated SOCWA Rd
Pedestrian/Bike Trail
Aliso Creek

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