You omitted posting the attachment to add to my comments of 8.11.2014, which are important in understanding the significance of Griffith Park to the LA River Ecosystem Restoration. We are resending them in part and ask that the Arts, Parks, Health River and Aging clerk post them in their entirety.

You must take responsibility for the proper use of Federal Water Resources Reform and Development Act WRDDA funding that affects taxpayers across the country. Ecosystem restoration is part of flood control issues and watershed functionality.
You must NOT treat it as a backdrop to hotel development and the tourism industry.

Development in such an open space that is considered a Significant Ecological Area is costly though it may not be obvious.

Daylighting of the riverbed will also affect those jurisdictions (cities) downstream with increased bacteria levels and pollution (TMDL) mitigation issues. Those citizens outside the City of Los Angeles did not vote for you, but you are responsible for your decisions and the financial and ecological effects on them.

This Council needs to engage in the water issues-all aspects-and accept that your decisions affect taxpayers in your districts, in neighboring districts that you do not represent and in the states across this country that have no elected representation in the City of Los Angeles.

Use of local funding such as Prop K and Quimby is deceptive to the entire intention of these two projects to Griffith Park. The Crystal Springs project is under the agency of the Bureau of Engineering, subject to the Board of Public Works approval, not the Board of Recreation and Park Commissioners. City of Los Angeles is listed as the Lead Agency.

Joyce Dillard
P.O. Box 31377
Los Angeles, CA 90031

Attachments
AppGHabitat (USACE)
8_Griffith_Park_SEA_Spring_2012_GP (LA County SEA)
Criteria_Table_8 (LA County SEA)

US Army Corps
of Engineers®
Los Angeles District

Los Angeles River Ecosystem Restoration Feasibility Study

DRAFT – APPENDIX G
HABITAT EVALUATION (CHAP)

September 2013

Los Angeles River near Downtown, circa 1900
from Blake Gumprecht's "The Los Angeles River"

CHAP Habitat Evaluation Appendix
Los Angeles River Ecosystem Restoration Study

U.S. Army Corp of Engineers
Los Angeles District

and

Northwest Habitat Institute

August 2013

Table of Contents

1.0 INTRODUCTION 4
2.0 STUDY BACKGROUND 4
3.0 SITE DESCRIPTION 6
4.0 STUDY AND METHODOLOGY ASSUMPTIONS AND CONSTRAINTS 9
5.0 HABITAT EVALUATION: COMBINED HABITAT ASSESSMENT PROTOCOL (CHAP) 10
5.1 Corps Restoration Policy 10
5.2 Habitat Assessments 11
5.3 CHAP Background 12
5.4 Corps Planning Process 13
6.0 CHAP ANALYSIS 13
6.1 Baseline: Existing Conditions 14
6.1.1 Baseline: Existing Conditions Methods 14
6.1.2 Per-Acre Adjustment Value for Habitat Stressors 16
6.1.3 Baseline: Existing Conditions Results 17
6.2 Baseline: Fifty Year Future Without Project 27
6.2.1 Baseline: Future Without Project Methods 35
6.2.2 Baseline: Future Without Project Results 42
6.2.3 Annualizing HUs 42
6.3 Alternatives Analysis 42
6.3.1 Alternatives Methods 45
6.3.2 Alternatives Results 51
6.3.3 Economic Analysis 55
7.0 OTHER BENEFITS NOT CAPTURED IN CHAP 58
7.1 Connectivity 58
7.1.1 Hydrologic and Hydraulic Connectivity - Reconnection of River to Floodplain 58
7.1.2 Wildlife Connectivity 59
7.2 Economic 60
8.0 CHAP HABITAT EVALUATION TEAM 60
8.1 Participants 60
8.2 Meetings 60
9.0 CONCLUSION 60
10.0 REFERENCES 62

Table of Figures

Figure 1-1. ARBOR Study Area 5
Figure 3-1. Key River Adjacent Areas 7
Figure 3-2. Geomorphic Reaches 8
Figure 6.1.1-1. Sample Maps – Baseline Existing Conditions – Polygon Identification Numbers 18
Figure 6.1.2-1. Sample Maps – Baseline Existing Conditions – Percentage of Non-native Plant Species – Herbaceous Species 19
Figure 6.1.3-1. Sample Maps – Baseline Existing Conditions – Wildlife Habitat Types 25
Figure 6.1.3-2. Sample Maps – Baseline Existing Conditions – Structural Conditions 26
Figure 6.1.3-3. Verification Transect Locations 28
Figure 6.1.3-4. Baseline Existing Conditions – Acres by Habitat Type 31
Figure 6.1.3-5. Baseline Existing Conditions – Per Acre Habitat Value by Habitat Type 32
Figure 6.1.3-6. Sample Maps – Baseline Existing Conditions – Per-Acre Value 33
Figure 6.1.3-7. Sample Maps – Baseline Existing Conditions – Baseline HUs by Polygon Number 34
Figure 6.2.1-1. 500-year Flood Event – Overflow Area 37
Figure 6.2.1-2. LA County Fire History 38
Figure 6.2.1-3. Santa Ana Winds 40
Figure 6.2.1-4: Earthquakes in Southern California 41
Figure 6.2.1-5. Proximity to other Natural Areas 43
Figure 6.2.2-1. Without Project HUs 44
Figure 6.3.1-1. Sample Alternative Mapping – Alternative 1 – Reach 3 48
Figure 6.3.1-2. Sample Alternative Mapping – Alternative 1 – Reach 6 49
Figure 6.3.1-3. Sample Alternative Mapping – Alternative 1 Gross HUs 52
Figure 6.3.2-1. Gross Benefits (HUs) for With Project Alternatives at Base Year, 25 Years With Project, and 50 Years With Project and the Baseline Condition 54
Figure 6.3.2-2. Net Benefits (HUs) for With Project Alternatives at Base Year, 25 Years With Project, and 50 Years With Project - Showing Increase in HUs over Without Project Conditions 56

Table of Tables

Table 6.1.3-1. Acreage of Habitat Type by Reach 24
Table 6.1.3-2. List of Plant Species Encountered on or Near Verification Transects 29
Table 6.1.3-3. Proportion of Acreage and Habitat Value by Wildlife Habitat Type 30
Table 6.3.1-1. Habitat Design Assumptions Related to Management Measures 47
Table 6.3.2-1. Gross and Net Benefits for With Project Alternatives 53
Table 6.3.2-2. Percent Increase in HUs for With Project Alternatives 57

Appendices

A. Master List Key Ecological Correlates (KECs)
B. Master List Key Ecological Functions (KEFs)
C. Potential Species List for the Study Area
D. Relationship Matrix Descriptions & HU Calculation Overview
E. Verification Transect Report
F. Alternative Measures Matrix
G. Preliminary Design - Channel Cross Sections
H. Gross & Net HUs by Reach by Alternative
I. HUs by Reach for Final Array of Alternatives

1.0 INTRODUCTION

This Appendix provides a habitat assessment analysis of alternatives proposed for the Los Angeles (LA) River Ecosystem Restoration (ER) Feasibility Study (the "Study"), Los Angeles, California. The Study examines restoration opportunities within an 11-mile segment of the LA River, referred to as the ARBOR (Alternative with Restoration Benefits and Opportunities for Revitalization) reach (hereafter referred to as Study area) (Figure 1-1). The Study alternatives evaluate restoration of the area to a condition characteristic of the historic, natural riparian river channel, as limited by the surrounding highly urbanized City of LA and the channel's purpose for flood risk management. Development of restoration alternatives was based on the following study objectives:

- Restore Valley Foothill Riparian Strand and Freshwater Marsh Habitat.
- Increase Habitat Connectivity.

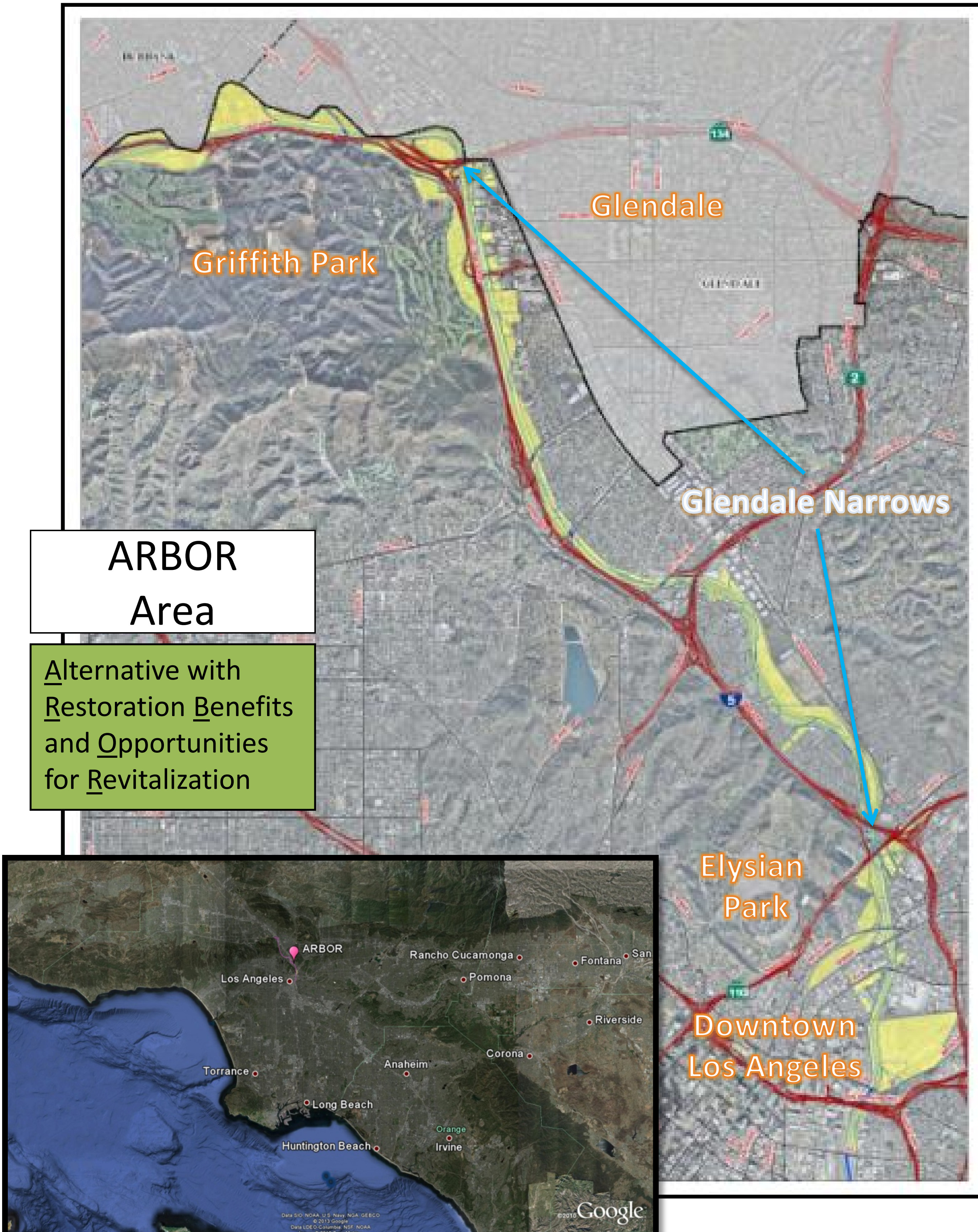
2.0 STUDY BACKGROUND

The U.S. Army Corps of Engineers' (Corps') involvement with the LA River began in the 1930s after devastating floods destroyed homes, businesses, and infrastructure in the early 20th Century. The City of Los Angeles and Los Angeles County initiated the flood control program that channelized the river after these floods. Congress authorized the Corps to undertake, with the County as partner, a modified version of the County's comprehensive plan. The Corps then joined the efforts, which led to the further channelization of the River in the 1930s and 1940s and the current concrete configuration. This configuration drastically altered the remaining riparian and freshwater marsh habitats as well as ecosystem functions in the once natural River system. The flood risk management project also allowed for increased urbanization and development in the floodplain, further reducing the marsh and riparian habitats that had naturally occurred on the river and its tributaries. The Corps' involvement on the LA River continues today in sharing operation and maintenance responsibilities with the LA County Flood Control District. The Corps has operation and maintenance responsibility for the portion of the river within the Study Area.

The U.S. Congress directed the Corps to undertake the LA River Ecosystem Restoration Study in 2006. The Study initially focused on the first 32 miles of river, and was subsequently narrowed to focus on the 11.5-mile Study area (aka ARBOR reach), which exhibits the greatest potential for ecosystem restoration. This reach includes the "soft-bottomed" Glendale Narrows that connects Griffith Park to Downtown LA and that currently supports degraded riparian habitat. The soft-bottomed reaches currently support a natural bed with concrete banks due to a high groundwater table that did not allow the bed to be constructed with concrete.

In 2007, the City of LA adopted the long-range LA River Revitalization Master Plan that calls for the creation of a 64-mile network of trails, parks, and recreation along both sides of the first 32 miles of the LA River, from the San Fernando Valley to the City of LA's border with the City of Vernon, an area home to more than one million people. The entire Study area is within the Master Plan's focus area.

Figure 1-1. ARBOR Study Area



The Feasibility Scoping Meeting milestone[1] for the LA River ER Study occurred in November 2007. The Study is currently in the Plan Formulation and Evaluation Phase with the City of LA as the non-Federal local sponsor. Planning workshops were held in December 2009, and the Corps used the information from these workshops to develop 19 preliminary alternatives defined by combinations of more than 200 measures. Elements from these preliminary 19 alternatives were later recombined and eventually reduced to four final alternatives for detailed consideration based on preliminary design and cost-benefit analyses. A final recommended plan will be chosen from this group of four alternatives.

3.0 SITE DESCRIPTION

The 11-mile Study area encompasses the soft bottom Glendale Narrows as well as portions of the concrete channel from Griffith Park to northern downtown LA. The Study area includes the LA River channel and select adjacent areas, beginning upstream at Pollywog Park, across from the Forest Lawn Cemetery. Further downstream, Verdugo Wash enters the LA River from the east, and the River then flows south through the Glendale Narrows. Just downstream of the Glendale Narrows, the Arroyo Seco enters the River from the east, and the River continues to flow south into downtown. The project area ends in downtown at First Street.

Large (i.e. in acreage) River-adjacent areas considered in the Study area include Pollywog Park, Burbank-Western Channel confluence, Bette Davis Park, Ferarro Fields, Verdugo Wash confluence, Griffith Park Golf Course (a.k.a. Harding Municipal Golf Course), Los Feliz Golf Course, Bowtie Parcel, Taylor Yard (a.k.a. G-2 Parcel), Arroyo Seco confluence, Cornfields (a.k.a. Los Angeles State Historic Park), and Piggyback Yard (Figure 3-1). The Study area encompasses approximately 842 acres.

The Study area is split into eight geomorphic reaches (Figure 3-2) generally defined by Study landmarks as follows:

1) Pollywog Park to Bette Davis Park (concrete bottom)
2) Bette Davis Park to Ferraro Fields (soft bottom)
3) Ferraro Fields to upstream Glendale Narrows (concrete bottom)
4) Upstream Glendale Narrows to Los Feliz Boulevard (soft bottom)
5) Los Feliz Boulevard to Bowtie Parcel (soft bottom)
6) Bowtie Parcel to downstream Glendale Narrows/Arroyo Seco (soft bottom)
7) Downstream Glendale Narrows/Arroyo Seco to Main Street (concrete bottom)
8) Main Street to First Street (concrete bottom)
*Note that all reaches have concrete banks

1 Feasibility Scoping Meeting (FSM) = The purpose of the FSM is to bring the Corps vertical management team, the non-Federal sponsor, and resource agencies together to agree on the problems and solutions to be investigated by a Study, and the scope of analyses required. An FSM will address the problems, opportunities, and needs; refine study constraints; identify the key alternatives; and further define the scope, depth, and methods of analyses required.

Figure 3-1. Key River Adjacent Areas

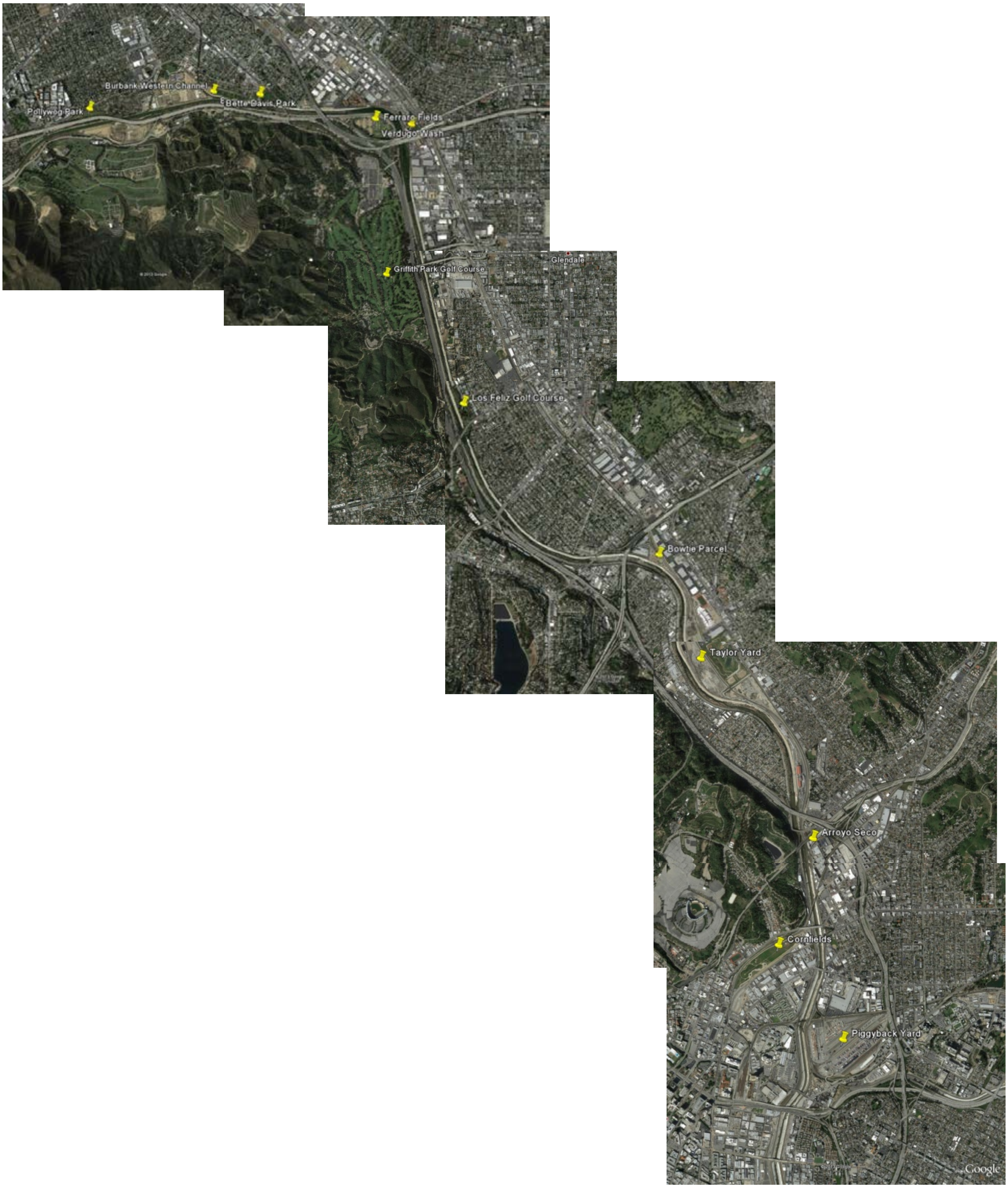
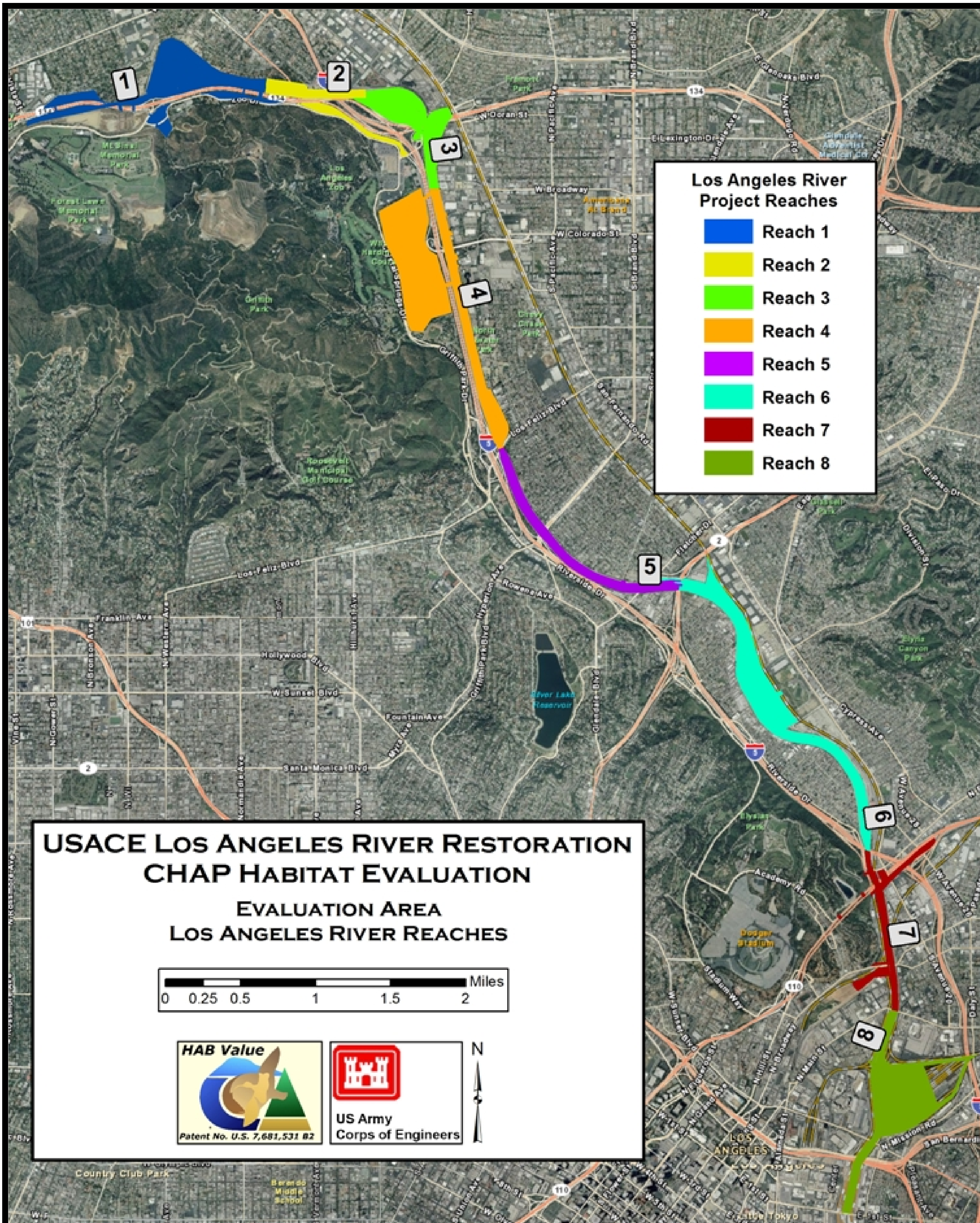


Figure 3-2. Geomorphic Reaches



The reaches of the River with a concrete bottom have three configurations in the Study area, including box and trapezoidal, or a combination of the two. The “soft” bottom areas have predominantly rock and cobble substrate that support riparian and wetland vegetation within trapezoidal concrete slopes.

4.0 STUDY AND METHODOLOGY ASSUMPTIONS AND CONSTRAINTS

Due to its highly urbanized setting and the hydrologic alterations that the River has undergone prior to and since its channelization, there are several constraints that were considered in defining alternatives and assessing how these alternatives can achieve the Study objectives.

Historic hydrologic conditions that are extremely important to riverine, riparian, and marsh ecosystems have been irreversibly altered along most of the LA River. Complete restoration of historic conditions is not feasible; therefore, to the greatest extent possible, the Study aims to restore riparian and wetland vegetation communities and habitats that were known to occur historically.

Residential, commercial, and industrial land uses border the River, thereby limiting the area adjacent to the River available for restoration. This is an important determinant in the potential acreage of each community type in the habitat analysis. More importantly, it influences the spatial and structural diversity that can be attained, as well as the quality of riparian habitat in terms of characteristics such as availability of water to River adjacent restoration areas and the relationship between interior versus edge space. Presently, the Study area (i.e., width of the restoration corridor) has been predominantly defined by existing easements and rights of way, existing structures, availability of adjacent lands for acquisition, local topography, and the historic floodplain. Furthermore, several of the River-adjacent areas that would provide substantial lands for restoration, if acquired, require cleanup of hazardous and toxic wastes from previous uses, such as rail yards.

Overall, water availability in the project area during the non-flood season, is predominated by upstream releases from the Tillman Water Reclamation Plant, as well as local surface runoff. Ongoing water conservation efforts include holding more water at upstream reservoirs with the intent of percolating in spreading basins. The City also has plans to remove dry weather flows from the River as part of its Integrated Regional Plan, specifically the Department of Water and Power’s Recycled Water Master Plan. Lack of a more significant, reliable water source for the Study area poses constraints on the ability to sustain important functions of stream, riparian, and wetland habitats that currently exist, as well as proposed habitats in the alternative plans. However, the City is committed to maintaining flows necessary for the restoration plan to be implemented as a result of this study.

Several other ecosystem restoration studies and projects are on-going on LA River tributaries, including the Headworks, Sun Valley, and Arroyo Seco Ecosystem Restoration Continuing Authority Program Studies, and the Tujunga Wash project was recently completed. These Studies and projects will positively affect the LA River riverine system by restoring upstream habitat and functions, and by increasing ecosystem value. However, the implementation of these projects will also require a portion of the scarce water resources to support the restoration efforts.

The California High Speed Train (HST) project is also a factor in the extent to which the riparian ecosystem can be restored and the success of the restoration project in achieving its goals. Certain proposed alignment alternatives near the Study area may impact the restoration project. While HST project implementation is considered long-term and not precisely defined at this point, the alignments that abut and cross the Study area would have a negative impact on the value of wildlife habitat. Other development, transportation, and infrastructure projects occurring within or adjacent to the Study area would generally have a negative effect on restoration.

Ultimately the LA River in its current state is a flood risk management structure. The purpose of flood risk management must be maintained and there can be no increase in flood risk, thereby limiting the amount vegetation that can be sustained in the channel. Acquisition of river adjacent areas that would allow for widening of the River would allow for more vegetation in the channel; however these opportunities are limited.

Despite these constraints and limitations, the ARBOR reach retains the potential for substantial improvements to habitat quality in highly degraded areas, providing or enhancing wildlife movement corridors, and increasing nesting opportunities for native resident and migratory species.

5.0 HABITAT EVALUATION: COMBINED HABITAT ASSESSMENT PROTOCOL (CHAP)

5.1 CORPS RESTORATION POLICY

Under Corps authority, restoration opportunities that are associated with wetlands, riparian and other floodplain and aquatic systems are most appropriate for Corps involvement. The objective of Corps ecosystem restoration projects is to restore degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition. Even partial restoration may provide significant and valuable improvements to degraded ecological resources (USACE 2000).

Restored ecosystems should mimic, as closely as possible, conditions that would occur in the area in the absence of human changes to the landscape and hydrology. Indicators of successful restoration would include the presence of a large variety of native plants and wildlife, the ability of the area to sustain larger numbers of key indicator species[2] or more biologically desirable species, and the ability of the restored area to continue to function and produce the desired habitat benefits with a minimum of continuing human intervention (USACE 2000).

Additional guidance for ecosystem restoration in the Civil Works Program assures that civil work investments in ecosystem restoration have the intended beneficial effects and would be conducted in the most cost effective manner (USACE 2000).

Corps guidance requires that the ecosystem related benefits of proposed alternatives be subjected

2 An indicator species is an organism whose presence, absence or abundance reflects a specific environmental condition. Indicator species can signal a change in the biological condition of a particular ecosystem, and thus may be used as a proxy to diagnose the health of an ecosystem.

to detailed economic analysis, allowing an explicit comparison of the costs and benefits associated with the alternatives. Consequently, it is necessary that the environmental benefits of the alternatives be based on some quantifiable unit of value. Since restoration value is difficult to monetize, instead of calculating benefits in monetary terms, the Corps ecosystem restoration projects calculate the value and benefits of restored habitat using established habitat assessment methodologies. Comparing the alternatives in this manner facilitates the determination of the most cost-effective restoration alternative that meets restoration goals (USACE 2000).

5.2 HABITAT ASSESSMENTS

Evaluating habitat quality is the approach most often taken to compare ecosystem restoration alternatives because habitat is thought of as a surrogate for ecosystems; it is the setting where plants and animals live, interact, and reproduce. Habitat is frequently viewed in conjunction with species information to gain insight to various uses, structures, and functions existing within a landscape or site.

Few methods for habitat assessment exist; however, most are focused only on aquatic habitats, wetland habitats, or habitat for a single species. One such habitat assessment methodology used by the Corps is the U.S. Fish and Wildlife Service's (USFWS) single species model known as the Habitat Evaluation Procedure/Habitat Suitability Index Models (HEP/HSI) (1980). HEP evaluates single species, a species guild, or a species assemblage using models comprised of measureable habitat variables and associated mathematical aggregations to estimate habitat suitability/quality (NHI 2007). The preliminary output of the HEP model is a habitat suitability index (HSI), which ranges from 0 (poor habitat quality) to 1.0 (optimum habitat quality). Habitat value is finally calculated in terms of Habitat Units (HUs) by multiplying the HSI by site acreage.

HUs are then used to rate and compare the value of one ecosystem restoration alternative to another. While HUs are a simple and useful form for presenting habitat quality as a numerical value, HEP assumes a linear relationship between habitat suitability and species response. In other words, HEP assumes that as HSI increases the wildlife population should also increase. This implies that the model has the ability to predict population response without errors (NHI 2007).

Furthermore, the single species method assumes that an entire community is represented by that species, which may result in a narrow representation of habitat quality (NHI 2007). The single species method does not account for substantial benefits that are afforded by the ecosystem as a whole, which includes multiple species and multiple habitats. Furthermore, it does not account for all functions or habitat components potentially present at a site.

Throughout the U.S. there is a shift towards assessing restoration and other conservation activities at the ecosystem level (Perkins 2002). Determining habitat structure and functional integrity of an area for all species potentially using it is more supportive of an ecosystem management approach. A habitat assessment methodology that measures functionality, which is critical to the success of many restoration projects, should incorporate multiple components such as vegetation, structure, surrounding landscape, and habitat size and shape (Breaux et al. 2005, Store and Jokimaki 2003).

5.3 CHAP BACKGROUND

Recently, an ecosystem-based habitat evaluation framework known as HAB (or the Habitat Accounting and Appraisal methodology) was developed by the Northwest Habitat Institute (NHI). This approach involves a triad assessment of species, habitat, and functions (O'Neil et al. 2005), and includes an inventory of habitat components and their relationship to ecological functions performed by species. The Combined Habitat Assessment Protocols (CHAP) method, which incorporates the HAB methodology, generates HUs based on an assessment of multiple species, habitat features, and functions by habitat type.

In the HAB approach, fish and wildlife with the potential to occur at a given site are identified. Potential species are determined using range maps in conjunction with information on vegetation types and habitat types, structural conditions, and habitat elements, also known as Key Ecological Correlates (KECs). KECs represent habitat elements (physical and biological) that are known to most influence a species distribution, abundance, fitness, and viability. KECs include habitat elements such as down wood, snags, litter layer, shrub layer, flowers, burrows, boulders, or riffles and pools. For the Master list of CHAP KECs, see Appendix A.

Habitat is defined as "the place, including physical and biotic conditions, where a plant or animal usually occurs" (Johnson and O'Neil 2001). Habitat types are often characterized by a dominant plant form or physical characteristic. Structural conditions of the habitat are also considered.

Function refers to the principal way organisms influence the environment, also known as Key Ecological Functions (KEF) (NHI 2007). KEFs refer to the principal set of ecological roles performed by each species in its ecosystem (NHI 2007). More specifically, KEFs refer to the main ways organisms use, influence, and alter their biotic and abiotic environments. KEFs include functions that organisms perform in the environment, such as a grazer, sap feeder, carrion feeder, seed disperser, nest parasite, primary cavity excavator, or impounds water by creating dams. For the Master list of CHAP KEFs see Appendix B.

While other methods consider habitat components, the HAB approach considers over 350 different KECs and over 100 KEFs as seen in Appendices A and B. KECs and KEFs are key components in determining the wildlife habitat unit values.

The HAB approach can be combined with elements of HEP to address habitat value at evaluation sites, with HUs as the output. Such a combined approach is referred to as CHAP (Combined Habitat Assessment Protocol) (NHI 2007).

The CHAP evaluation described herein utilizes the ecosystem-based approach to quantitatively characterize the ecological value of wildlife habitat associated with the restoration alternatives proposed for the LA River ER Study. Habitats for the following groups of animals were evaluated as part of the CHAP analysis and would be benefited by implementation of the alternatives:

- Resident and Migratory Birds, including raptors
- Reptiles
- Amphibians

- Small mammals
- Fish

5.4 CORPS PLANNING PROCESS

In order to solve water resources and ecosystem restoration issues, the Corps Planning process identifies problems and opportunities, inventories and forecasts conditions, and formulates, evaluates, and compares alternative plans in order to select the best, most cost effective project alternative for implementation and construction.

In identifying problems and opportunities, project objectives and constraints are also developed that guide the formulation of alternatives. When inventorying and forecasting, the historic, existing, and future conditions are examined to establish a baseline for alternative comparison. Alternative formulation develops a suite of management measures[3] that are combined together in various ways to create a set of project alternative plans. The alternative plans are evaluated by forecasting conditions "with project" implementation and comparing them to the forecasted "without project" condition. The plans are then compared to one another based on how they meet project objectives, and on cost effectiveness and cost-benefit analyses, policy compliance, and acceptability by the public and stakeholders. The best plan, based on these factors, becomes the recommended plan for implementation.

The habitat assessment serves to quantify restoration benefits that inform the cost effectiveness and cost-benefit analyses and that contribute to the comparison of alternative plans.

6.0 CHAP ANALYSIS

The HAB approach, which is largely spatially based, uses Geographic Information Systems (GIS) to delineate habitat polygons[4] and map habitat types (cross-walked with associated vegetation types) within the Study area. These habitat type classifications are based on the California Wildlife Habitat Relationships (CWHR) habitat classification scheme, derived from the CDFG publication titled "A Guide to Wildlife Habitats of California" (Mayer and Laudenslayer 1988). For each habitat polygon, wildlife species associated with these CWHR habitat types are linked to key environmental correlates (KECs) (i.e. habitat elements) and key ecological functions (KEFs)(i.e. functions performed by species), which are derived from NHI's Interactive Habitat and Biodiversity Information System (IBIS) database[5] (Johnson and O'Neil, 2001).

The detailed steps of compiling KECs and KEFs are outlined in Section 6.1.1.

---

3 A management measure is a feature or activity that can be implemented at a specific geographic site to address one or more planning objectives. It may be a "structural" feature that requires construction or assembly on-site, or it may be a "non-structural" action that requires no construction (USACE 1996).
4 In GIS, a polygon is a map feature that bounds an area at a given scale, such as a county on a world map or a district on a city map. In habitat mapping, the polygon bounds a specific habitat type.
5 The datasets for KECs and KEFs have been developed through a multiple expert panel process. IBIS is an extensively peer reviewed system that contains current ecological information on more than 1,000 fish and wildlife species, organized in searchable databases.

The subsequent analysis of these habitats, species, and functions results in a quantitative value for existing and forecasted with and without project habitats in the Study area.

6.1 BASELINE: EXISTING CONDITIONS

6.1.1 Baseline: Existing Conditions Methods

A fine level scale approach was used to calculate habitat value for the LA River ER study. The baseline CHAP approach, incorporating the HAB methodology, involves: 1) preliminary mapping, 2) field inventory, 3) species list, 4) data compilation and analysis, 5) conversion to HUs, and 6) Annualizing HUs.

1. <u>Preliminary Mapping</u>
   Using GIS and geo-referenced aerial imagery, the LA River ER study site was mapped by delineating potential habitat types or structural conditions within the site. Habitat types were identified using visual differences in land formations, vegetation, and structural condition, as detected and interpreted in the imagery. Preliminarily, the National Agriculture Imagery Program (NAIP) imagery was used, and later high-resolution imagery supplied by the Corps was used.

2. <u>Field Inventory</u>
   The field inventory included an ocular survey that verified the polygon delineations. Habitat type, structural conditions, and key environmental correlates within each polygon were identified and recorded. Invasive plant species and the presence of stressors within each polygon were also recorded.

   Stratified random verification transects were then employed to measure in detail the site's vegetation characteristics. These transects substantiate site variables including percent cover and species of trees, shrubs, herbaceous and invasive vegetation and serve as a double sampling technique to confirm the ocular field inventory.

3. <u>Species List</u>
   The CWHR was used to produce a site-specific species list by considering ecological and geographical connections between species and the habitat types within the Study area. Factors used to generate the species list are potential species linked to each of the habitat types and potential species linked to the Study area based on species range maps and known existing conditions.

   References from local experts including the Griffith Park Draft Wildlife Management Plan (Cooper and Mathewson 2008), The Biota of the Los Angeles River (Garrett 1993), and The State of the River – the Fish Study (FoLAR 2008), were also employed to develop an initial species list.

   The species list was reviewed and refined by a habitat evaluation team (See Section 8.0) comprised of Corps and City of LA staff and local resource agency experts including the U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Game (CDFG), Regional Water Quality Control Board (RWQCB), and a local fish expert from the University of California Cooperative Extension, Los Angeles County. The team decided that seasonal migrants and infrequent visitors would be included on the species list, as creating an arbitrary limit for including a species as "occurring" would not account for all species that are known to use the project area. Additional review and input was requested from local experts including Dan Cooper (Cooper Ecological Monitoring, Inc.) and Drew Stokes (San Diego Natural Museum of History) to verify the presence or absence of certain species of interest. The resulting species list is included in Appendix C.

4. Data Compilation and Analysis
   Data from the mapping and field inventory was used to generate two relationship matrices including 1) a potential species by function (KEFs) matrix and 2) a habitat (KECs) by function (KEFs) matrix (for definitions of KEC and KEF See Section 5.3; for further details on the matrices see Appendix D).

   To create these matrices, the species list was sorted by its association with the CWHR habitat types and the list of taxa was linked to the associated habitat elements (KECs) and functions (KEFs).

   The first matrix determines the mean functional redundancy index (MFRI), which is based on the number of species performing functions in a habitat type (KEFs). More specifically, it is the number of species that are associated with the habitat type and performing each function divided by the number of potential functions associated with the habitat type. The result of the first matrix is the number of potential functions characterized by species specific to that polygon.

   The second matrix is based on the results of the field inventory of the Study area and the list of habitat elements (KECs) observed. The result of the second matrix is the number of functions characterized by habitat elements (KECs) specific to that polygon.

   Per-acre values were then computed for each polygon by adding the species-function matrix (MFRI) value and the habitat-function matrix value (for further details on calculations see Appendix D). In sum, for each polygon MFRI + KEC matrix = Per Acre Value.

   The per-acre value represents the intrinsic worth of an area to fish and wildlife, determined by accounting for species, habitats, and functions. Additional factors that may negatively impact this habitat value are accounted for as described in Section 6.1.2.

5. Conversion to HUs
   To determine HUs for site conditions, in order to compare Study alternatives and inform alternative cost-benefit analyses, each polygon's per-acre value was multiplied by its acreage. These values were then summed across all polygons to calculate the

total HUs for a particular condition or alternative scenario. In sum, for each polygon Per Acre Value x Acres = HUs.

Unlike HEP, where the preliminary output (HSI) ranges from 0 to 1 (as described in Section 5.2), CHAP's per-acre values are not limited to this range. In this way, where the HUs in HEP are dependent on acreage (HSI x acreage = HU; IE more acreage = more HUs), the HUs generated by CHAP are not dependent on acreage and reflect the intrinsic value of a particular habitat type based on species, functions, and habitat.

Results of the baseline CHAP analysis are provided in the form of GIS maps and Microsoft excel spreadsheets. GIS maps generated depict the habitat values (HUs) of each of the 172 polygons. Supporting maps illustrate: a) study area boundaries; b) polygon numbering; c) percentage of non-native plant species by polygon (See Section 6.1.2); d) wildlife habitat types by polygon (See Section 6.1.3); e) structural conditions by polygon (See Section 6.1.3); f) per-acre habitat value (See Section 6.1.3); and g) HUs (See Section 6.1.3).

Spreadsheets were developed that contain the calculations of the species-function and habitat-function matrices, along with calculations of Study area habitat values. Due to the large volume of data, maps, and spreadsheets, the complete set of files is available upon request from the Corps, Los Angeles District. Sample figures are provided in Figures 6.1.1-1, 6.1.2-1, and 6.1.3-1 to 6.1.3-8. Summary tables are included in Tables 6.1.3-1 and 6.1.3-3, and discussed in the following Sections 6.1.2 and 6.1.3.

6.1.2 Per-Acre Adjustment Value for Habitat Stressors

Since the LA River ER project area is located within a highly urbanized setting, there are several ecosystem drivers and stressors that affect the Study area and how it is currently managed. There are four noteworthy influences including: 1) invasive plant species, 2) potential use of the area for encampments by people who are homeless, 3) horseback riding in the river, and 4) excessive refuse/trash in the river.

Prior to conversion to HUs, the per-acre baseline value of each polygon was adjusted based on the presence of these stressors, in order to capture the value lost due to these factors within the Study area. The HAB method allows for these modifications when the habitat evaluation team deems them to be appropriate.

Invasive Plant Species

Each polygon was assigned an invasive plant value for each of three structural layers (grass/herbaceous, shrub, and tree) based on the presence and abundance of invasive species in that layer, as documented in the field inventory. Because invasive species generally negatively influence ecosystem function, the per-acre values were then discounted for the presence of invasives, to begin to arrive at a corrected per-acre value for each polygon. The value of discount applied based on presence of invasive species is described in Table 6.1.2-1. The deduction factor was multiplied by the per-acre value to reach the adjusted value. In sum, per-acre value x deduction factor = adjusted per-acre value.

The percent abundance of invasive species by polygon can also be spatially displayed in a map to show their influence on the habitat value. Sample maps are included in Figure 6.1.2-1.

Table 6.1.2-1. Invasive plant species deduction factors[6]

Invasive species cover	*X*
0-10%	1.0
11-35%	0.9
36-65%	0.7
66-90%	0.5
>90%	0.3

Homeless, Horseback Riding, Excessive Refuse
During the habitat evaluation team meetings, the subject of homeless encampments, horseback riding, and excessive refuse/trash and their influence on wildlife habitat was raised. The team members were reluctant to assign an arbitrary value of influence to weight the polygons based on these stressors, so to address these concerns a literature review was conducted. Activities noted as potential effects to wildlife habitat from these stressors include trampling, camping, sewage, erosion, and covering. KECs that are influenced by these activities are found in Table 6.1.2-2. Since the CHAP identifies KECs as absent or present within each polygon, the stressor influenced KECs are adjusted by changing their status from present to absent. For example, the presence of homeless encampments would result in camping/trampling, which would damage vegetation. KECs such as flowers, forbs, shrubs, and saplings would, therefore, be identified as absent for those polygons. In applying this to the Study Area, these local stressors influenced the site’s overall habitat value approximately 7%.

6.1.3 Baseline: Existing Conditions Results

Habitat Types and Vegetation Communities
The 172 polygons in the LA River ER Study area were determined by delineating the California Wildlife Habitat types that occur within the Study area. The mapping performed by NHI within the Study area in 2011 documented several habitat types, each of which are an aggregation of several vegetation communities. Habitat types as described by the CWHR System included Coastal Scrub, Eucalyptus, Open Water/Riverine, Pasture, Perennial Grassland, Valley Foothill Riparian, Tree Farm, and Urban (High Density, Golf Course, and Low Density). Structural conditions included: grass-forb, shrub, and tree layers along with constrained river channel and urban with various levels of impervious surfaces.

6 Deduction factors for invasive plant species were developed by NHI in a team environment during the Oregon Bridge Replacement Program, where agencies wanted to receive credit for controlling invasive species at a site. The team was comprised of representatives from: U.S. Army Corps of Engineers, Bureau of Land Management, NOAA Fisheries Service, Environmental Protection Agency, U.S. Forest Service, U.S. Fish and Wildlife Service, Federal Highway Administration, Oregon Department of Transportation, Oregon Department of Environmental Quality, Oregon Department of Fish and Wildlife, Oregon Department of State Lands, and the State Historic Preservation Office.

Figure 6.1.1-1. Sample Maps – Baseline Existing Conditions – Polygon Identification Numbers

Figure 6.1.1-1. Sample Maps – Baseline Existing Conditions – Polygon Identification Numbers

Figure 6.1.1-1. Sample Maps – Baseline Existing Conditions – Polygon Identification Numbers

Figure 6.1.1-1. Sample Maps – Baseline Existing Conditions – Polygon Identification Numbers

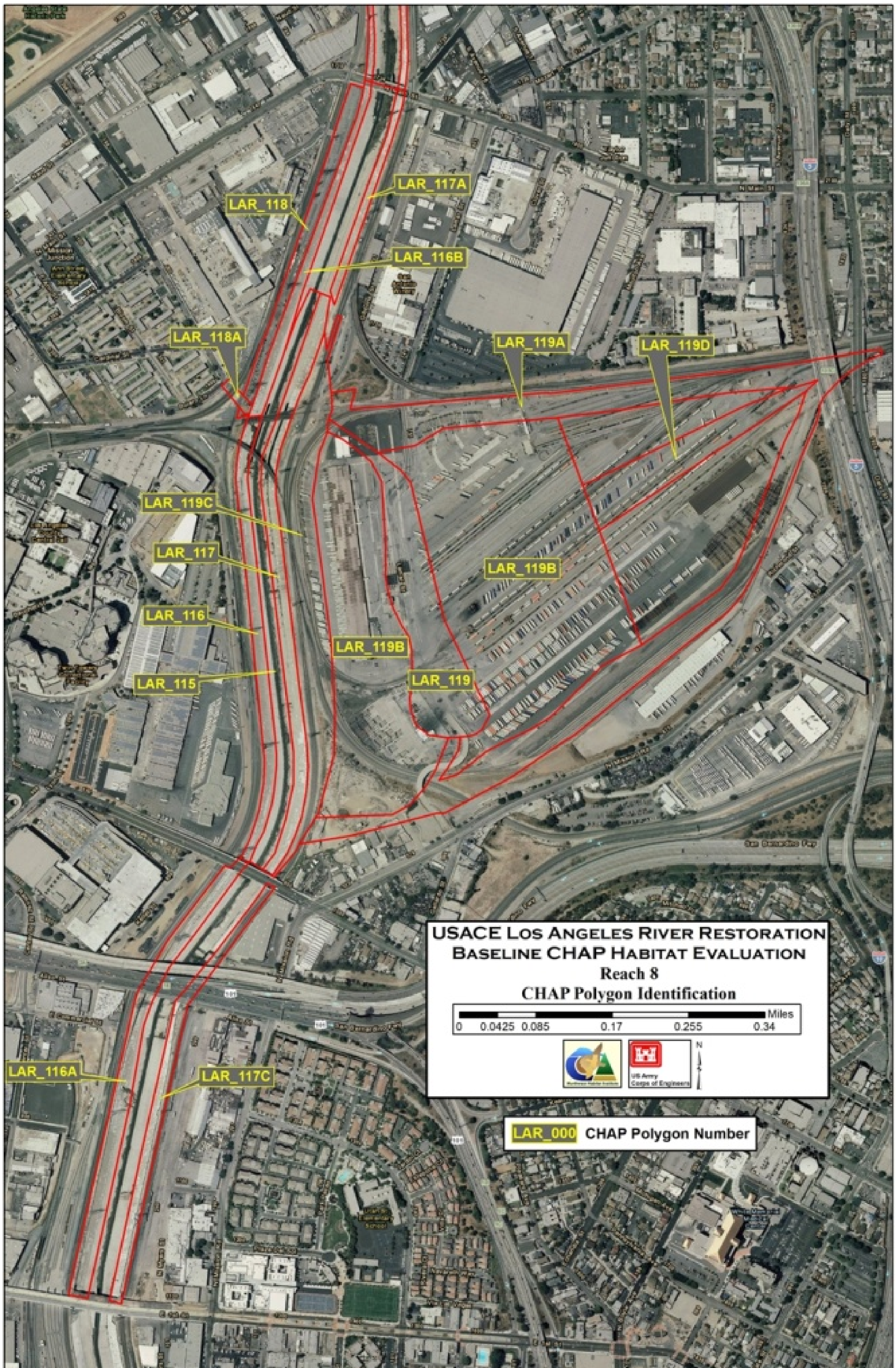


Figure 6.1.2-1. Sample Maps – Baseline Existing Conditions – Percentage of Non-native Plant Species – Herbaceous Species

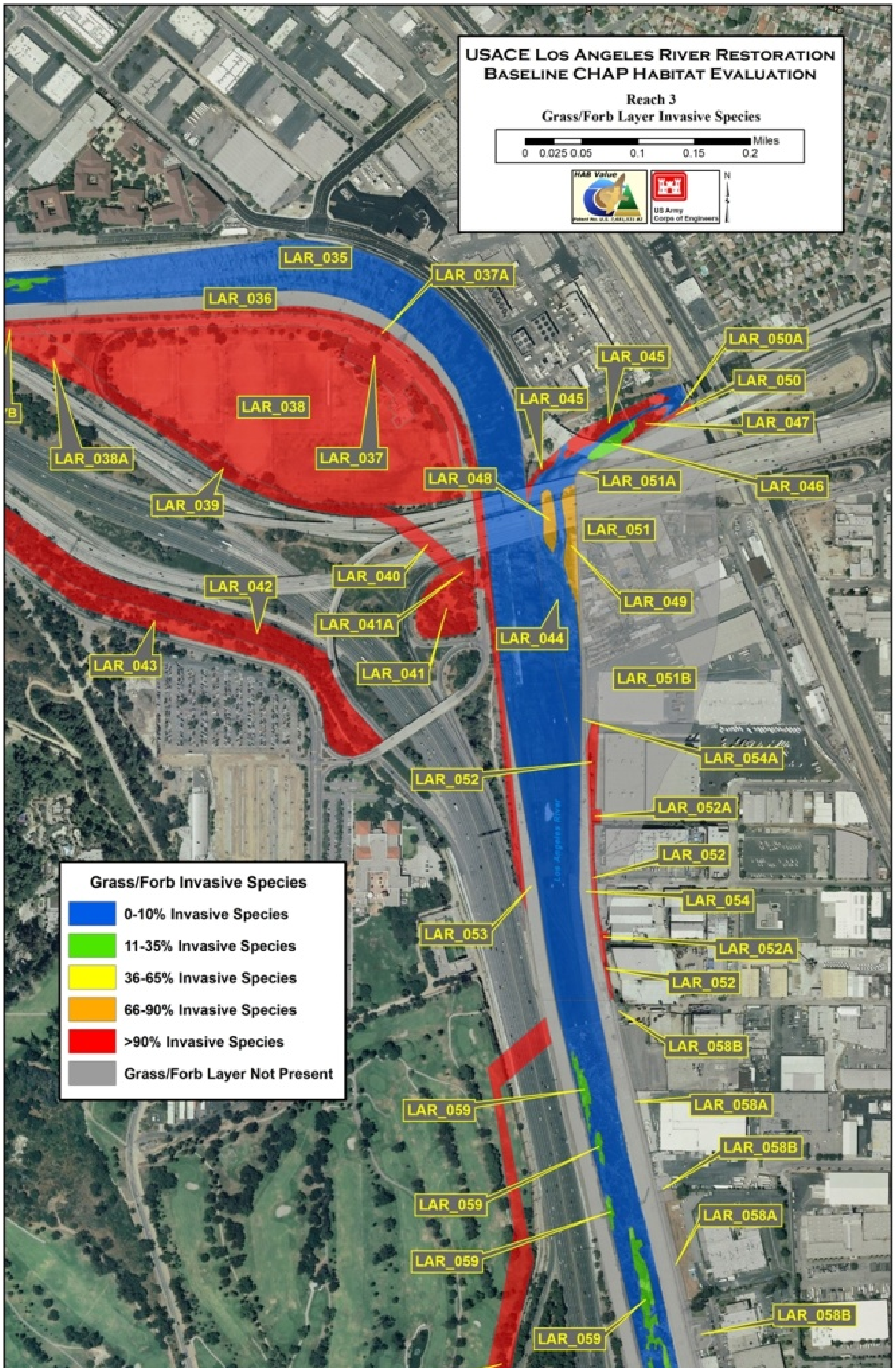


Figure 6.1.2-1. Sample Maps – Baseline Existing Conditions – Percentage of Non-native Plant Species – Herbaceous Species

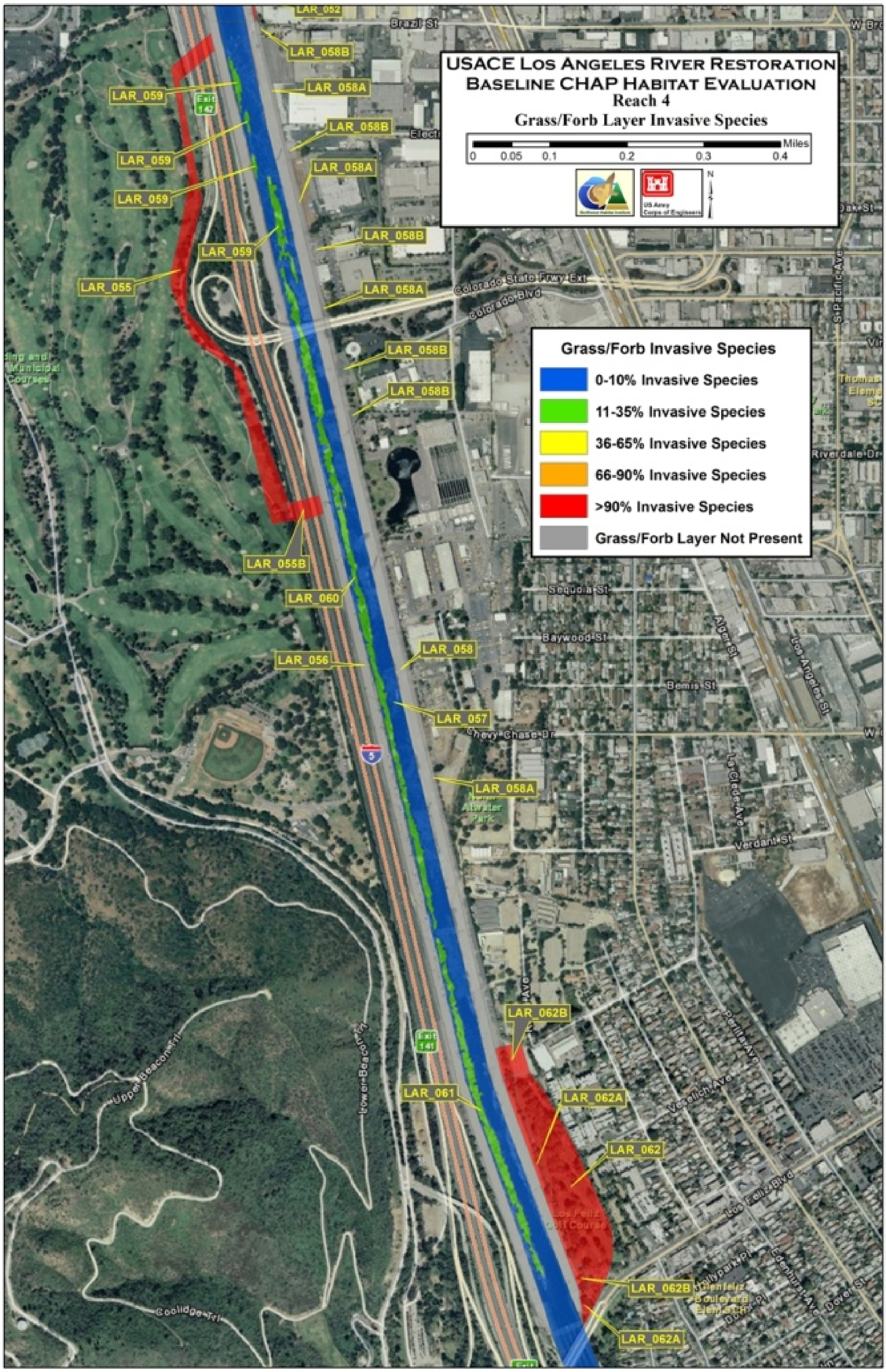


Figure 6.1.2-1. Sample Maps – Baseline Existing Conditions – Percentage of Non-native Plant Species – Herbaceous Species

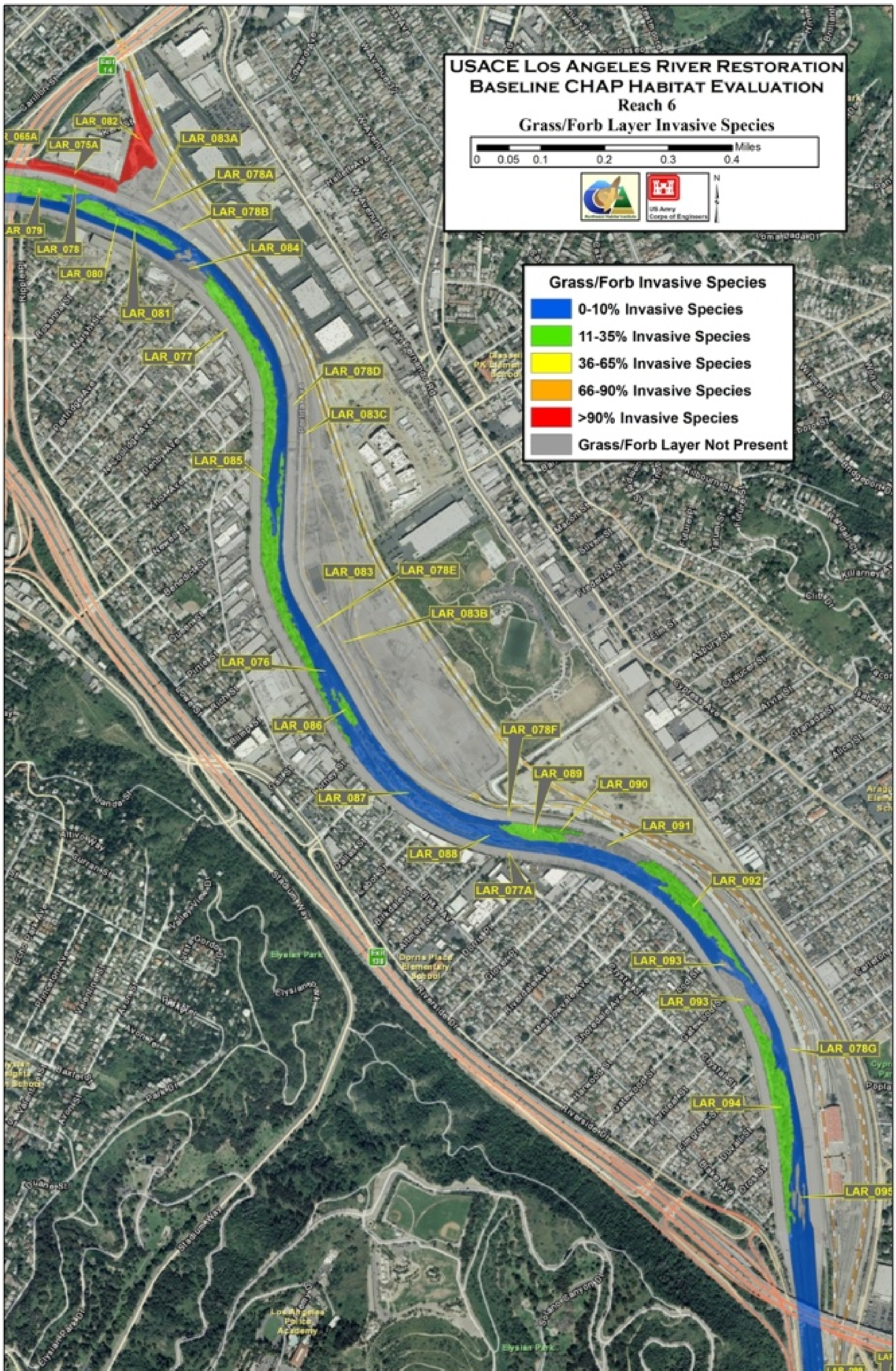


Figure 6.1.2-1. Sample Maps – Baseline Existing Conditions – Percentage of Non-native Plant Species – Herbaceous Species

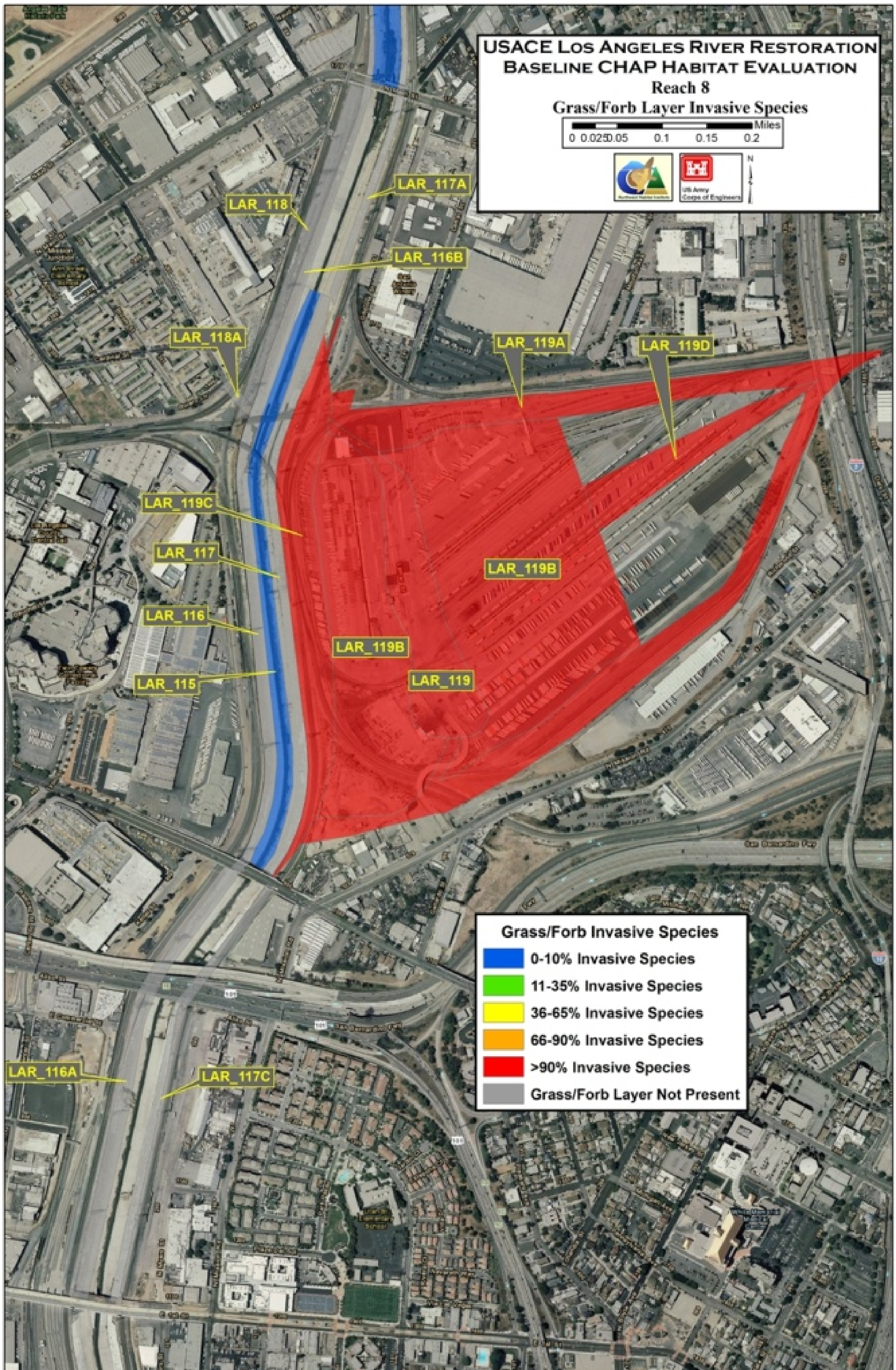


Table 6.1.2-2. KECs influenced by Stressors (homeless encampments, horseback riding, excessive refuse/trash)

Human Impact	KEC Code	KEC	Action
Homeless Encampments	1.2.1	herbaceous layer	camping/tramping
Homeless Encampments	1.2.5	flowers	camping/tramping
Homeless Encampments	1.2.8	forbs	camping/tramping
Homeless Encampments	1.2.6.1.1	shrubs small	camping/tramping
Homeless Encampments	1.2.6.1.2	shrubs medium	camping/tramping
Homeless Encampments	1.2.6.1.3	shrubs large	camping/tramping
Homeless Encampments	1.1.14.3.1	live tree seedling	camping/tramping
Homeless Encampments	1.1.14.3.2	live tree sapling	camping/tramping
Homeless Encampments	1.1.14.3.3	live tree small	camping/tramping
Homeless Encampments	1.1.14.3.4	live tree medium	camping/tramping
Homeless Encampments	1.1.14.3.5	live tree large	camping/tramping
Homeless Encampments	1.1.14.2.3	snag, small	camping/tramping
Homeless Encampments	4.1.12	aquatic nutrient enrichment	sewage
Human Impact	**KEC Code**	**KEC**	**Action**
Horse riding	1.1.3	duff	trampling
Horse riding	1.2.1	herbaceous layer	trampling
Horse riding	1.1.1.4.1	shrubs, small	trampling
Horse riding	1.1.1.4.2	shrubs, medium	trampling
Horse riding	1.1.5	moss	trampling
Horse riding	4.7.4	marshes	trampling/erosion
Horse riding	1.1.14.3.1	live tree, small	trampling/erosion
Horse riding	1.2.8	forbs	trampling/erosion
Horse riding	1.2.10	grasses	trampling/erosion
Horse riding	4.1.3	dissolved solids, aquatic	defecation/erosion
Horse riding	4.1.7	water tubidity	trampling/erosion
Horse riding	4.2.3.3	shorelines	trampling/erosion
Horse riding	4.1.12	aquatic nutrient enrichment	defecation/erosion
Horse riding	4.2.4.5	aquatic bentic structure	trampling/erosion
Horse riding	5.9	water clarity	trampling/erosion
Human Impact	**KEC Code**	**KEC**	**Action**
Refuse/Trash	1.2.1	herbaceous layer	covering
Refuse/Trash	1.2.8	forbs	covering
Refuse/Trash	1.1.1.2	down wood in riparian	covering
Refuse/Trash	1.1.4.1.1	small tree	covering
Refuse/Trash	1.1.4.1.2	medium tree	covering
Refuse/Trash	1.1.4.1.3	large tree	covering
Refuse/Trash	1.1.14.3.1	tree seedling	covering
Refuse/Trash	1.1.14.3.2	tree sapling	covering
Refuse/Trash	1.1.14.2.3	small snag	covering
Refuse/Trash	1.1.14.2.4	medium snag	covering
Refuse/Trash	1.1.14.2.5	large snag	covering
Refuse/Trash	4.2.4.5	aquatic bentic structure	covering
Human Impact	**KEC Code**	**KEC**	**Action**
Refuse/Trash	4.7.4	marshes	covering
Refuse/Trash	4.7.5	wet meadows	covering
Refuse/Trash	1.2.1	herbaceous layer	covering
Refuse/Trash	1.2.8	forbs	covering
Refuse/Trash	4.1.11	metals in water	depending on type
Refuse/Trash	8.19.3	pollution in water	depending on type
Refuse/Trash	5.9	water clarity	covering/depending on type

Vegetation communities associated with each habitat type are described below, as applicable, as documented in both "A Manual of California Vegetation" (2^{nd} Edition) (Sawyer and Keeler-Wolf 2009) and "Preliminary Descriptions of the Terrestrial Communities of California" (Holland 1986).

1. Coastal Scrub

Vegetation Communities

Holland 1986
- Riversidean Sage Scrub 32700

Sawyer and Keeler-Wolf 2009
- *Artemisia californica* Shrubland Alliance (California sagebrush scrub)

Dominant species include California sagebrush (*Artemisia californica*) and California buckwheat (*Eriogonum fasciculatum*). This community is typically found on xeric sites such as steep slopes or well drained soils. Co-dominant species include brittlebush (*Encelia farinosa*), deerweed (*Lotus scoparius*), chaparral mallow (*Malacothamnus fasciculatus*), and white and black sage (*Salvia apiana* and *S. mellifera*).

2. Eucalyptus

Vegetation Communities

Sawyer and Keeler-Wolf 2009
- *Eucalyptus* (*globules*, *camaldulensis*) Alliance (Eucalyptus groves) (semi-natural woodland stands)

Several species of eucalyptus including blue gum, red gum, and silver gum are established in dense, pure stands and are typically adjacent to urban areas and non-native grasses.

3. Open Water - Riverine

Vegetation Communities

Holland 1986
- Freshwater Marsh 52400

Sawyer and Keeler-Wolf 2009
- *Arundo donax* Semi-Natural Herbaceous Stands (Giant reed breaks)
- *Typha* (*angustifolia*, *domingensis*, *latifolia*) Herbaceous Alliance (Cattail marshes)
- *Schoenoplectus californicus* Herbaceous Alliance

Dominant species include cattails (*Typha* sp.), sedges, and rushes, as well as non-native invasive arundo (*Arundo donax*), in areas permanently saturated or flooded by freshwater.

Intermittent or continually running water distinguishes river and stream communities. Streams originate at an elevated source, such as a spring or lake, and flow velocity generally declines at progressively lower altitudes (Mayer and Laudenslayer 1988). These areas are considered to have a minimum of vegetation components, except along the edges, which may be mapped (in this case) as types such as freshwater marsh.

In the higher velocity stretches of natural streams, riffle/pool complexes are dominant and vegetation includes water moss and filamentous algae that are attached to rocks. In slower moving waters, with increasing temperatures, decreasing velocities and accumulating bottom sediment, emergent freshwater marsh vegetation, such as rushes, sedges, and cattails, establishes along river banks (Mayer and Laudenslayer 1988).

4. Pasture

Vegetation Communities

Holland 1986

- Non-native grassland 42200

Sawyer and Keeler-Wolf 2009

- *Conium maculatum – Foeniculum vulgare* Semi-Natural Herbaceous Stands (Poison hemlock or fennel patches)

Dominant species include non-natives such as fennel (*Foeniculum vulgare*), bromes (*Bromus sp.*), wild oat (*Avena sp.*), red-stem filaree (*Erodium cicutarium*), fescues (*Vulpia sp.*), and mustard (*Brassica sp.*). Scattered trees may also be present.

5. Perennial Grassland (Invasive)

Vegetation Communities

Holland 1986

- Non-native grassland 42200

Sawyer and Keeler-Wolf 2009

- *Conium maculatum – Foeniculum vulgare* Semi-Natural Herbaceous Stands (Poison hemlock or fennel patches)

Invasive Perennial Grassland is similar in composition to Pasture, where relic perennial grassland occurs in habitats now dominated by annual grasses and forbs (Mayer and Laudenslayer 1988).

6. Valley Foothill Riparian

Vegetation Communities

Holland 1986
- Southern Cottonwood-Willow Riparian Forest 61330
- Southern Willow Scrub 63320

Sawyer and Keeler-Wolf 2009
- *Salix gooddingii* Woodland Alliance (black willow thickets)
- *Salix laevigata* Woodland Alliance (red willow thickets)
- *Populous fremontii* Forest Alliance (Fremont cottonwood forest)

Dominant species include cottonwood (*Populus fremontii*), western sycamore (*Platanus racemosa*), and willows (*Salix* sp.). Forest understory may consist of shrubby willows and mule fat (*Baccharis salicifolia*) with herbaceous species including sedges, rushes, and mugwort (*Artemisia douglasiana*). Scrub habitat has less vertical structure, with shorter willows dominant.

7. Tree Farm

Ornamental or non-native hardwood species dominate this community, although other non-native conifers, shrubs, and grasses may be present. These communties are usually in developed areas, including urban and residential landscapes, parks, recreational areas, highways, and cemeteries, etc. and may include potted landscaping trees (USFS 2009).

8. Urban

This category includes landscapes dominated by urban structures, residential units, industrial areas, highways, parks, and other such structures (USFS 2009). Park areas may include alternately categorized vegetation such as non-native or ornamental. Urban areas are categorized as:

- High density
- Low density
- Golf course

The acreage of each habitat type by reach is shown in Table 6.1.3-1. To demonstrate the habitat mapping results, sample maps depicting habitat type and structural conditions are included in Figures 6.1.3-1 and 6.1.3-2.

Table 6.1.3-1. Acreage of Habitat Type by Reach

	Habitat Type (acres)										
Reach	**Coastal Scrub**	**Eucalyptus**	**Open Water (Channel)**	**Pasture**	**Perennial Grassland**	**Riparian**	**Tree Farm**	**Urban**	**Urban (Golf Course)**	**Urban (Low Density)**	**TOTAL**
1			22.80	11.75	2.19	2.97		108.12		7.98	155.81
2		12.37	9.02			4.01		12.78		9.82	48.00
3			30.84			7.07		38.62		24.61	101.14
4			29.00			7.94		35.90	20.33		93.16
5			28.02			8.97		30.72			67.71
6			32.42			28.90		103.01			164.33
7	0.29		23.14			2.55	6.30	21.48		5.15	58.90
8			6.97					146.35			153.32
TOTAL	0.29	12.37	182.21	11.75	2.19	62.42	6.30	496.97	20.33	47.55	842.37

Figure 6.1.3-1. Sample Maps – Baseline Existing Conditions – Wildlife Habitat Types

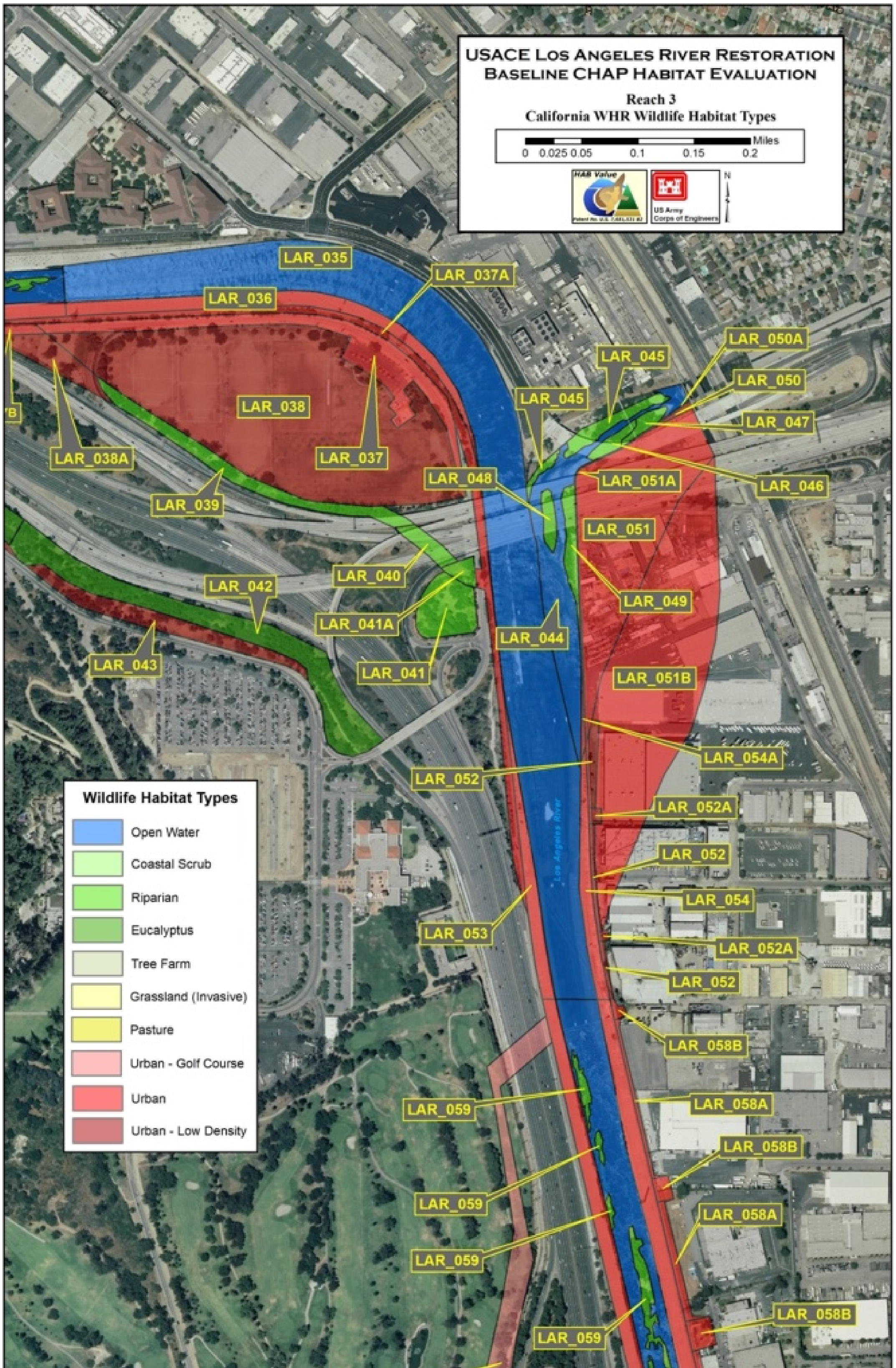


Figure 6.1.3-1. Sample Maps – Baseline Existing Conditions – Wildlife Habitat Types

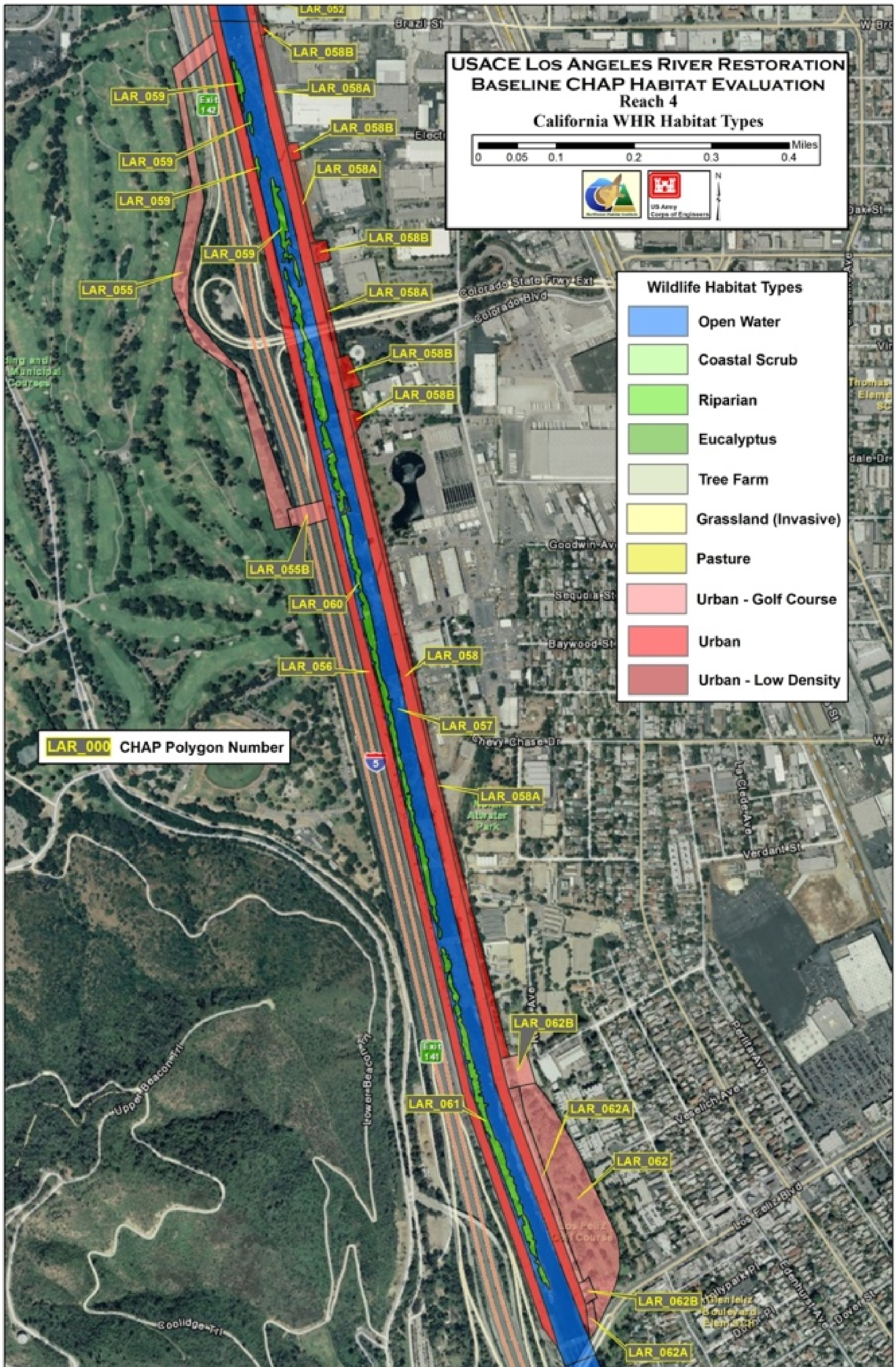


Figure 6.1.3-1. Sample Maps – Baseline Existing Conditions – Wildlife Habitat Types

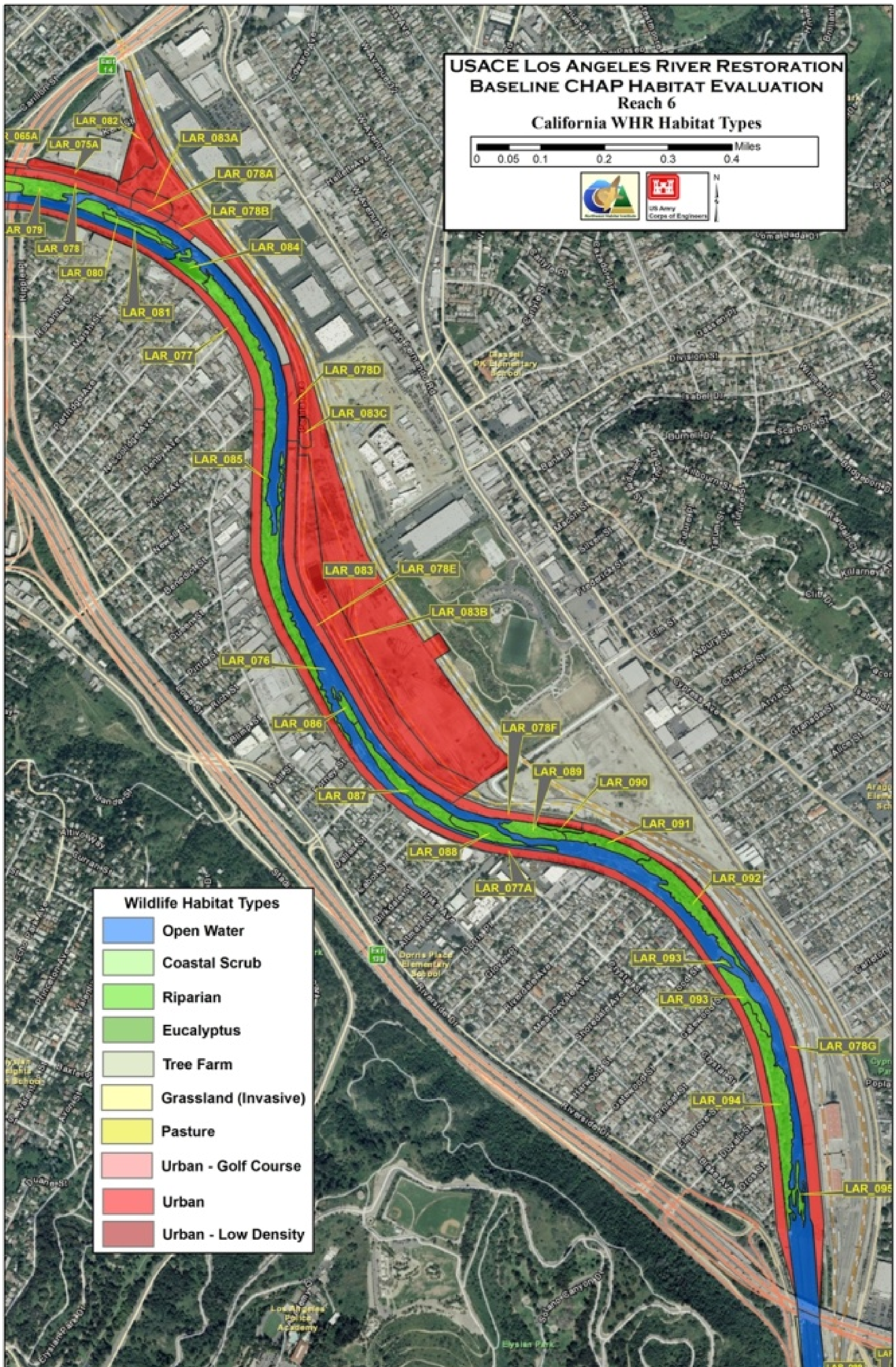


Figure 6.1.3-1. Sample Maps – Baseline Existing Conditions – Wildlife Habitat Types

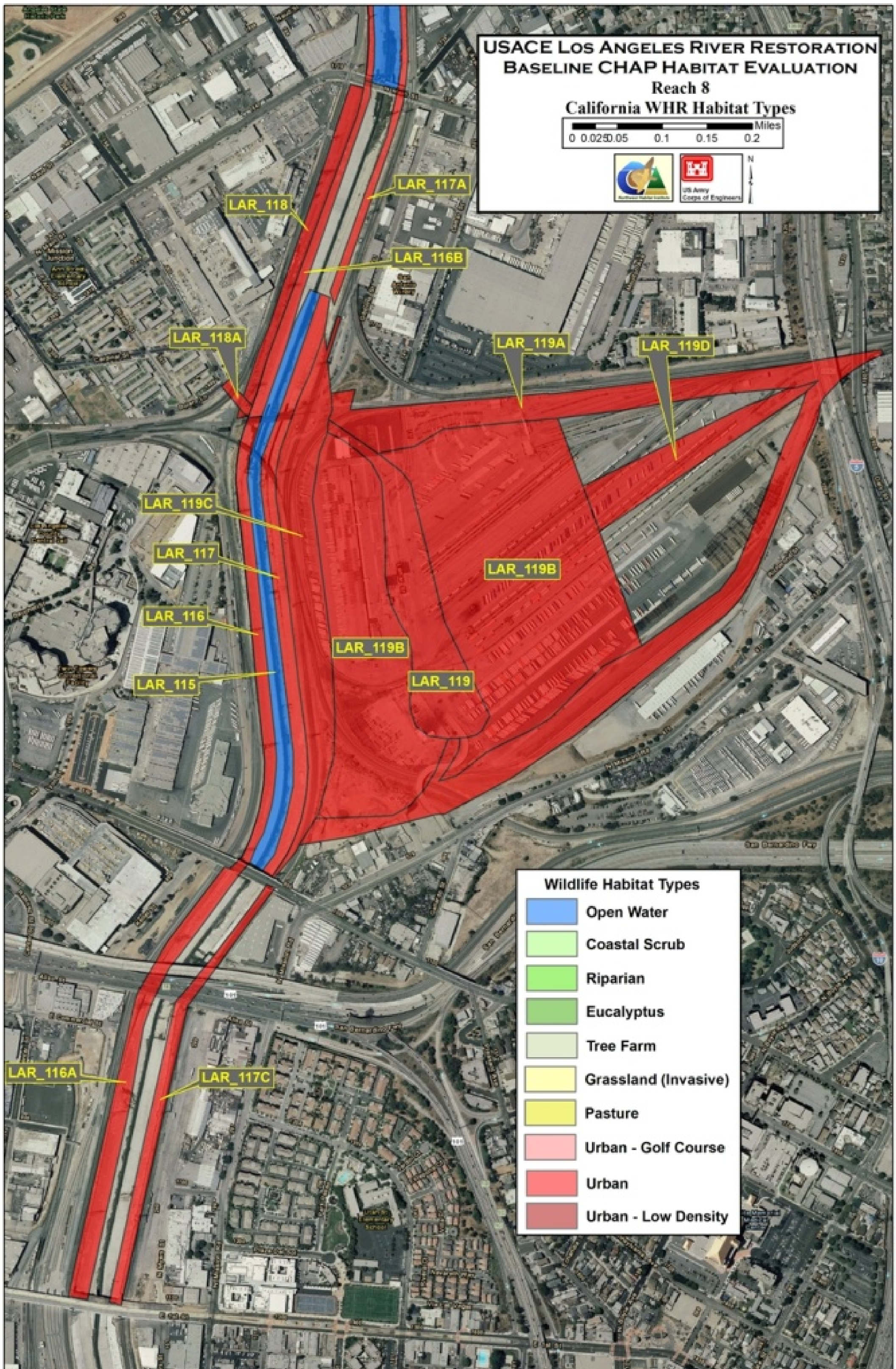


Figure 6.1.3-2. Sample Maps – Baseline Existing Conditions – Structural Conditions

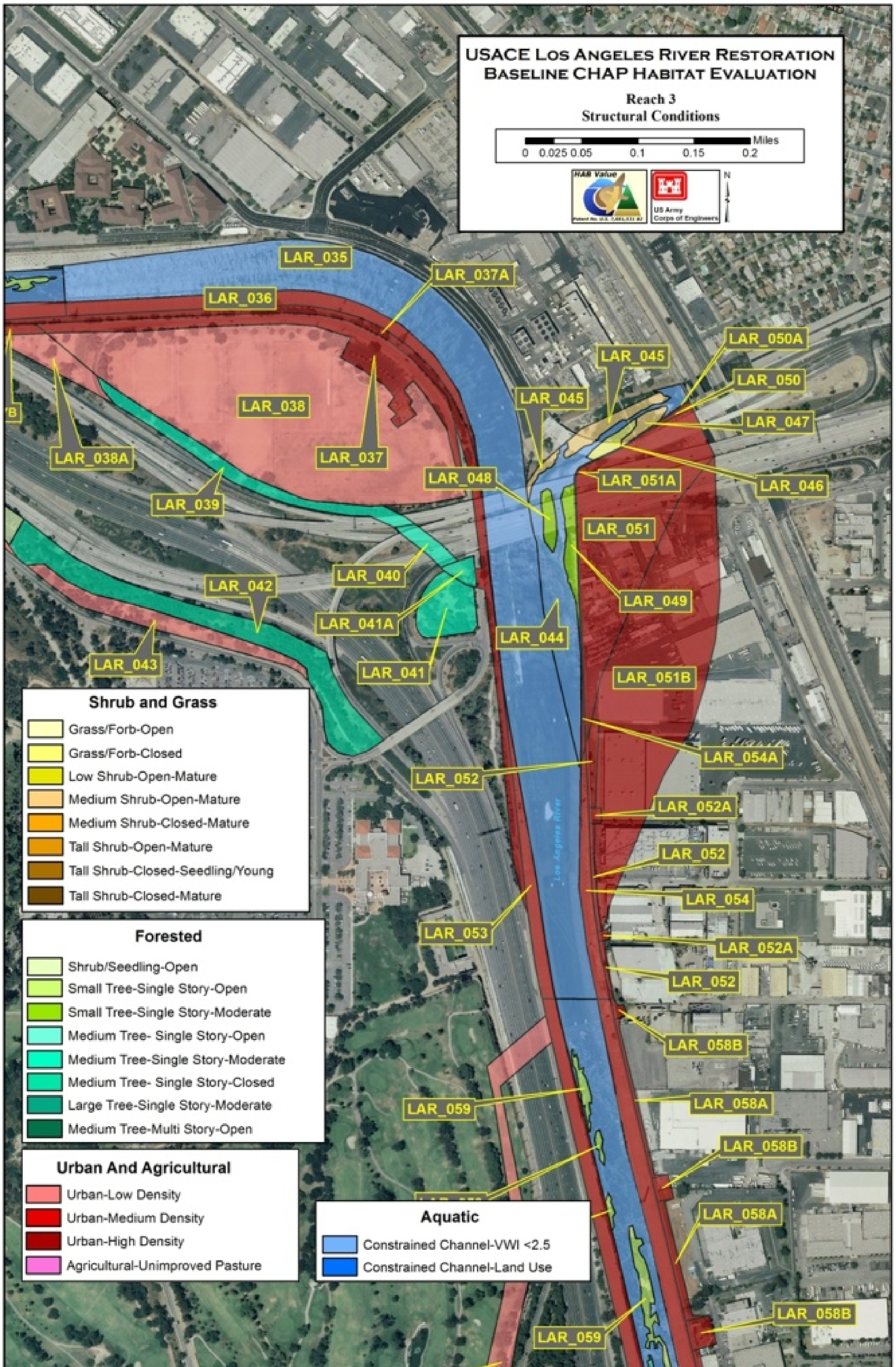


Figure 6.1.3-2. Sample Maps – Baseline Existing Conditions – Structural Conditions

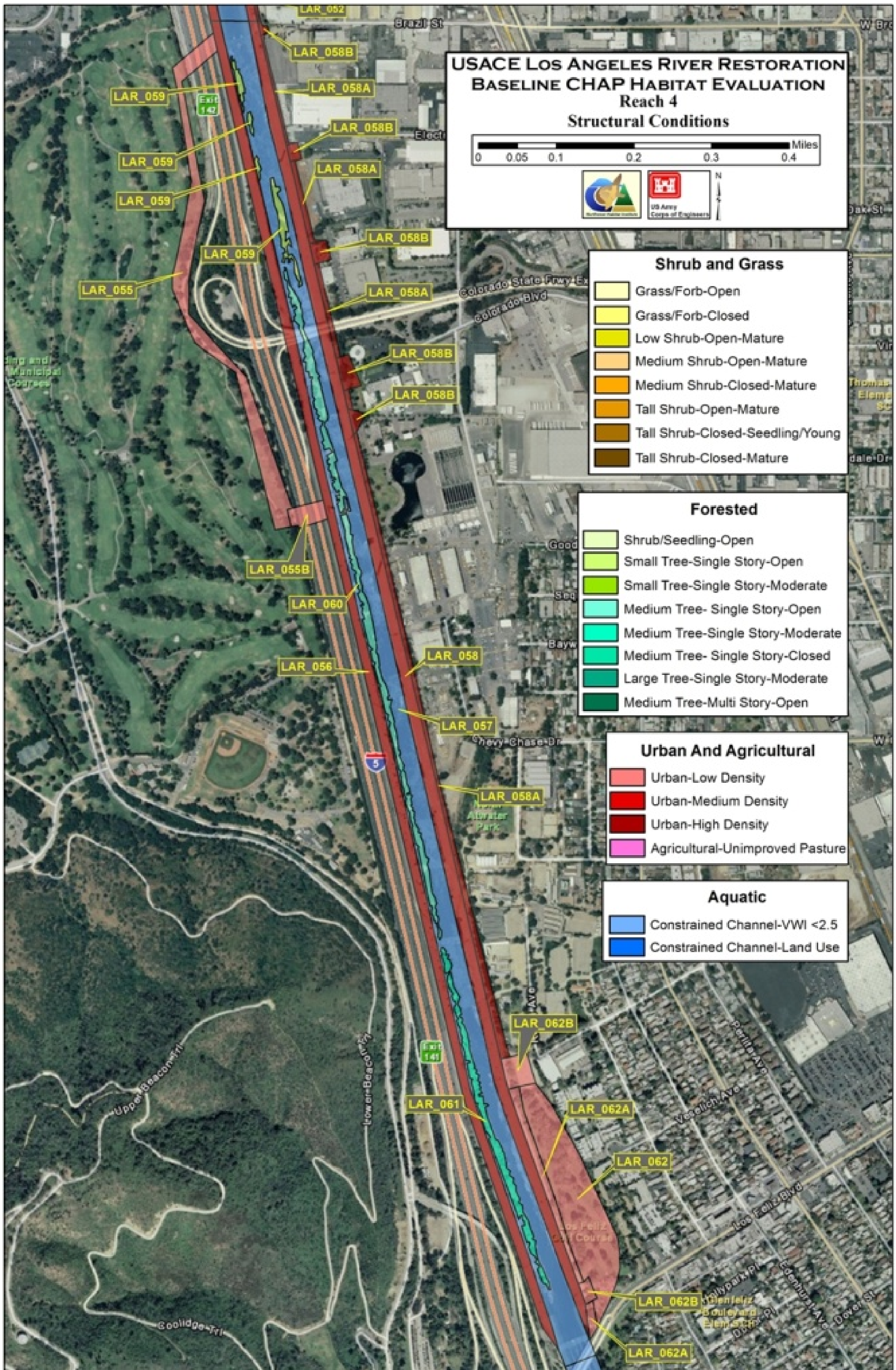


Figure 6.1.3-2. Sample Maps – Baseline Existing Conditions – Structural Conditions

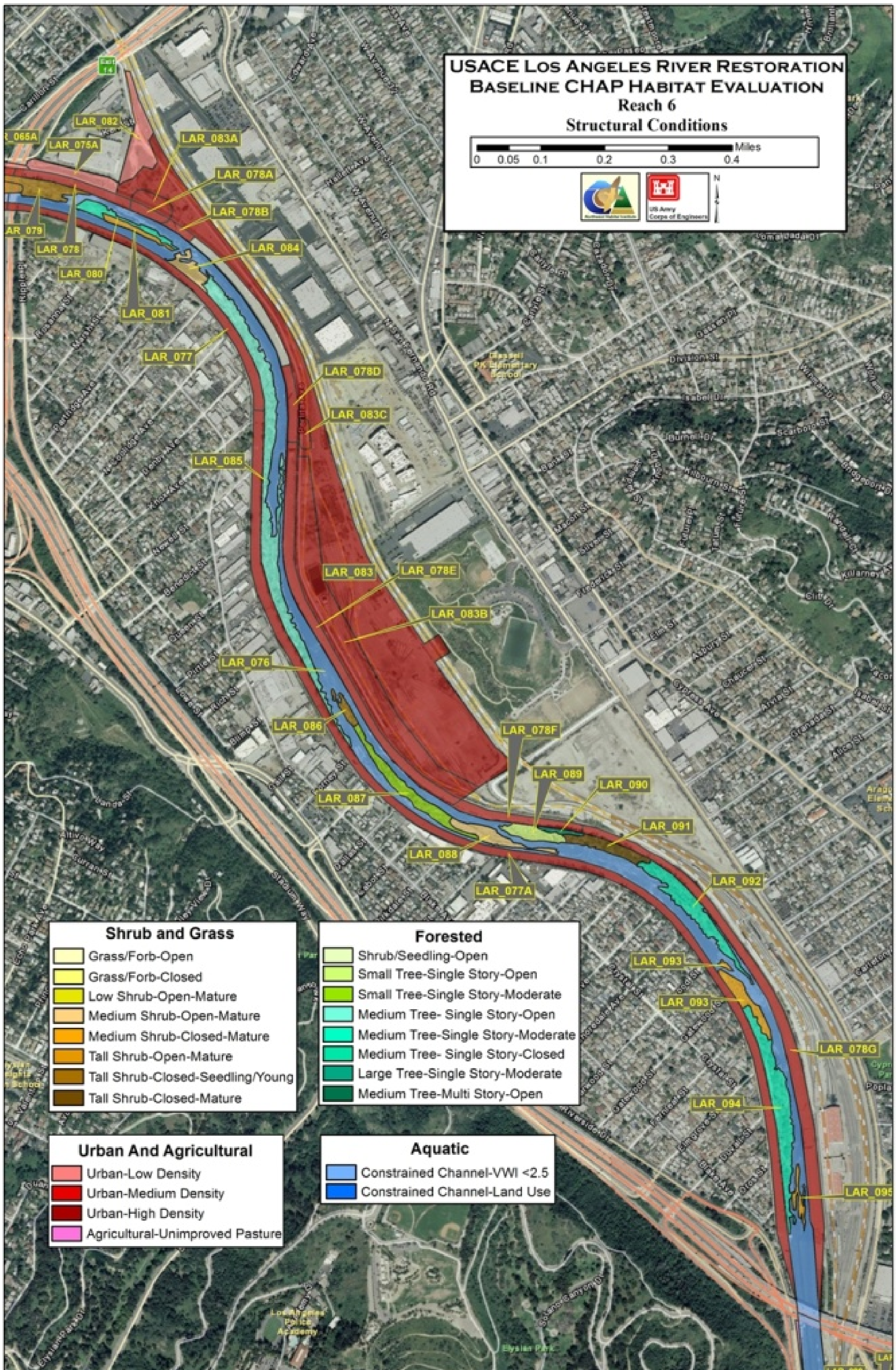
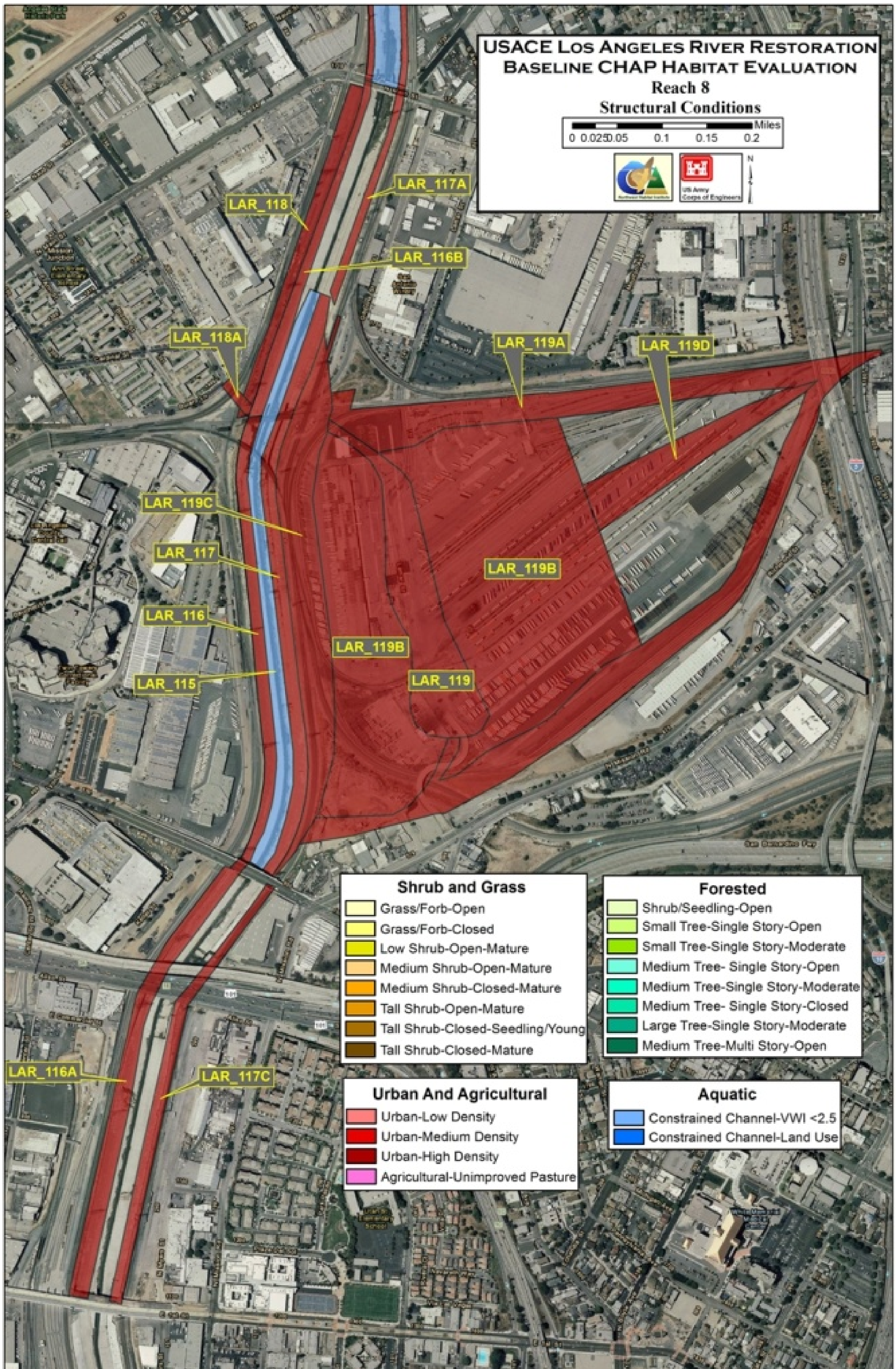


Figure 6.1.3-2. Sample Maps – Baseline Existing Conditions – Structural Conditions



Habitat Findings
Vegetation transects were employed to verify the results of the habitat inventory that occurred at the LA River ER Study site. Results of these verification transects are included in the LA River CHAP Verification Transect Report (Ashley 2010) (Appendix E). Figure 6.1.3-3 shows the location of the verification transects. Table 6.1.3-2 outlines a list of plant species encountered either along or near the verification line transects.

Habitat Units
The habitat assessment shows ten habitat types currently existing within the Study area, totaling approximately 842 acres. The acreage of each of the habitat types and their proportion of the total study area are depicted in Table 6.1.3-3. The baseline existing condition assessment calculated that these acres have a total value of 6,119 HUs. Graphs depicting acreage by habitat type and per-acre habitat value by habitat type follow in Figures 6.1.3-4 and 6.1.3-5. Sample figures depicting per-acre value and HUs are included in Figures 6.1.3-6 and 6.1.3-7.

Mapping of habitat types for baseline existing conditions shows that approximately 67% of the Study area (564.85 acres) is urban (including low density and golf course), providing an average 4.64 HUs per acre. Existing riparian habitat accounts for only 7% of the Study area (62.42 acres), however it provides 16.84 HUs per acre. These riparian areas occupy 9 times fewer acres than the urban areas, yet provide almost four times more HUs per acre than the urban areas. The open water areas also provide substantial HUs per acre, totaling 22% of the Study area (182.21 acres) and providing 11.89 HUs per acre. Other habitat types account for less than 4% of the Study area.

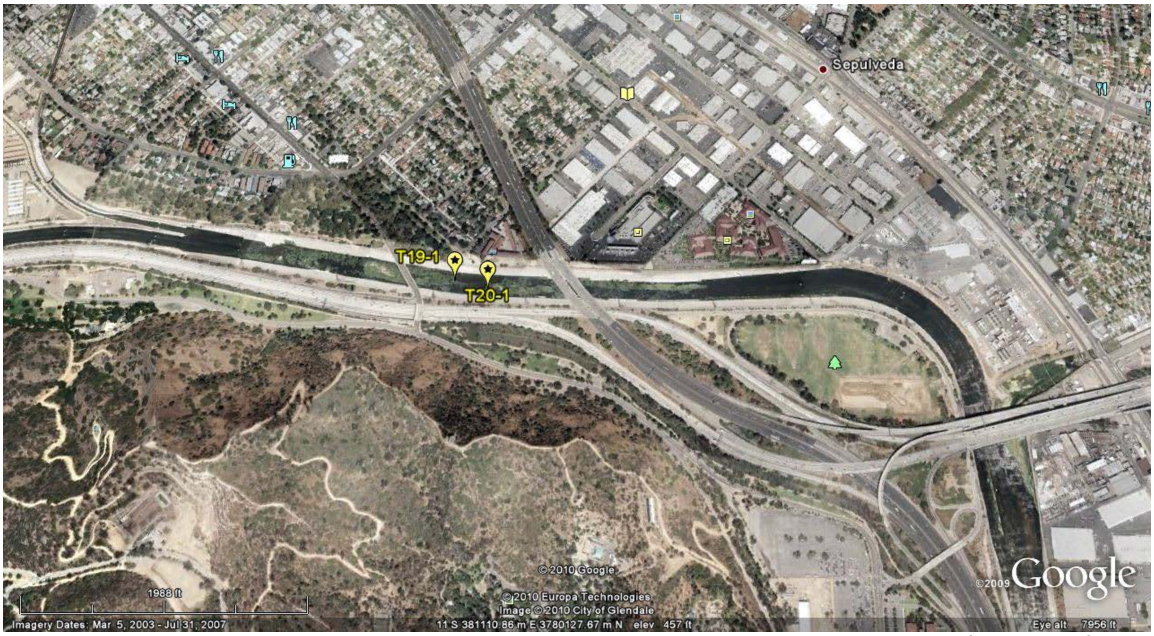
These conditions show that riparian and riverine restoration has the potential to provide substantial restored habitat function and value in the highly urban setting of Los Angeles, and that maximizing acreage of these habitats would benefit ecosystem functioning and species diversity in the area.

6.2 BASELINE: FIFTY YEAR FUTURE WITHOUT PROJECT
The future without project analysis forecasts the conditions in the Study area 50 years into the future assuming that no project is implemented (i.e. No Action alternative). The 50-year future without project analysis assesses two future time periods, 25 years and 50 years.

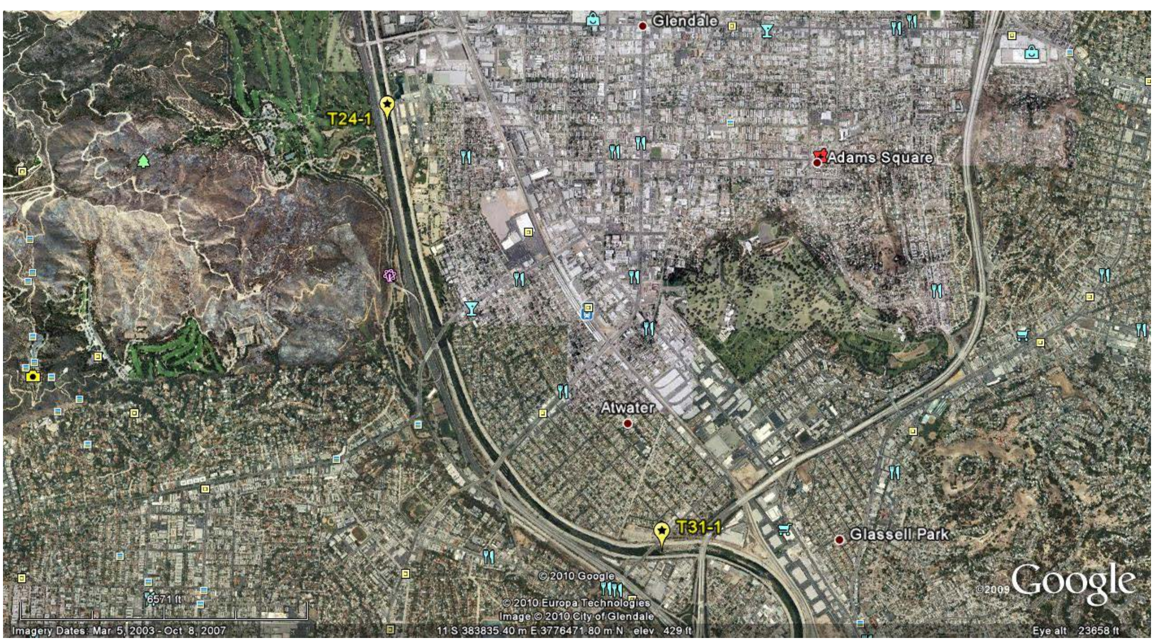
To undertake this assessment, several projections were made to assess habitats over the 50-year time period. These projections are based on past and current trends in habitat condition in the area. Specifically, reasonable predictions include: 1) an increase in presence of invasive plant species throughout the LA River ER Study area, 2) a large flood event (i.e. 500-year event) is likely to occur, and 3) fires threatening the project area will be suppressed.

The habitat evaluation team discussed a reduction in the number of fish and wildlife taxa present within the project area over time. However, in this case, it was the consensus of the habitat evaluation team that the current highly urban landscape conditions would prevail over time. Despite intense development pressure along certain areas of the river corridor, large swaths of existing open space (especially at Griffith Park) were expected to be conserved, consistent with long-established land use policies. Furthermore, it was assumed that native species are already

Figure 6.1.3-3. Verification Transect Locations (Ashley 2010)



LA River riparian transect start point locations (north)



LA River riparian transect start point locations (south)

Table 6.1.3-2. List of Plant Species Encountered on or Near Verification Transects

Common Name	***Scientific Name***	**Native**	**Transect #**			
			Los Angeles River			
Arroyo	*Salix lasiolepis*	Yes	19 -1	20 -1	24-1	31-1
Sage	*Salvia columbariae*	Yes	19 -1			
Castor Bean	*Ricinus communis*	No			24-1	
Eucalyptis	*Eucalyptis sp.*	No				31-1
Mexican Fan Palm	*Washingtonia robusta*	No			24-1	31-1
Mulefat	*Baccharis salicifolia*	Yes		20 -1	24-1	31-1
Red	*Salix laevigata*	Yes	19 -1		24-1	31-1
Shamel Ash	*Fraxinus uhdei*	No	19 -1	20-1	24-1	
Sycamore	*Platanus racemosa*	No		20 -1		
White Mulberry	*Morus alba*	No	19 -1	20 -1		

Common Name	***Scientific Name***	**Native**
Alkali bulrush	*Schoenoplectus maritimus*	Yes
Ash	*Fraxinus velutina*	Yes
Arundo	*Arundo donax*	No
Black mustard	*Brassica nigra*	No
bulrush	*Schoenoplectus californicus*	Yes
Sedge	*Carex spp.*	Yes
Cheatgrass	*Bromus tectorum*	No
Chickweed	*Cerastium sp.*	No
Dock	*Rumex salicifolius*	Yes
Datura	*Datura wrightii*	Yes
Fennel	*Foeniculum vulgare*	No
Foxtail chess brome	*Bromus madritensis*	No
Lemonade berry	*Rhus integrifolia*	Yes
Mustard	*Brassica sp.*	No
Narrow Leaved Cat tail	*Typha angustifolia*	Yes
Pepper tree	*Schinus molle*	No
Plantain	*Plantago major*	No
Poa spp.	*Poa spp.*	**
Prickly lettuce	*Lactuca serriola*	No
Rattail Fescue	*Vulpia myuros*	No
Redstem fillaree	*Erodium cicutarium*	No
Ripgut brome	*Bromus diandrus*	No
Slender oats	*Avena barbata*	No
Tabacco Tree	*Nicotiana glauca*	No
Bull Thistle	*Cirsium vulgare*	No
Fescue	*Vulpia sp.*	**
White sage	*Salvia apiana*	Yes
Wild cucumber	*Marah macrocarpus*	Yes
Wild radish	*Raphanus raphanistrum*	No
Yellow sweet clover	*Melilotus officinalis*	No

Table 6.1.3-3. Proportion of Acreage and Habitat Value by Wildlife Habitat Type

	Coastal Scrub	Eucalyptus	Open Water (Channel)	Pasture	Perennial Grassland	Riparian	Tree Farm	Urban	Urban (Golf Course)	Urban (Low Density)	TOTAL
Acres	0.29	12.37	182.21	11.75	2.19	62.42	6.30	496.97	20.33	47.55	842.37
Proportion of Acreage	0.00	0.01	0.22	0.01	0.00	0.07	0.01	0.59	0.02	0.06	1
Habitat Units (HUs)	2.38	129.51	2166.22	54.95	14.77	1051.38	42.18	2361.82	104.74	191.49	6119.44
Proportion of Habitat Value	0.00	0.02	0.35	0.01	0.00	0.17	0.01	0.39	0.02	0.03	1
Habitat Units (HUs) per Acre	8.29	10.47	11.89	4.68	6.74	16.84	6.69	4.75	5.15	4.03	

Figure 6.1.3-4. Baseline Existing Conditions – Acres by Habitat Type

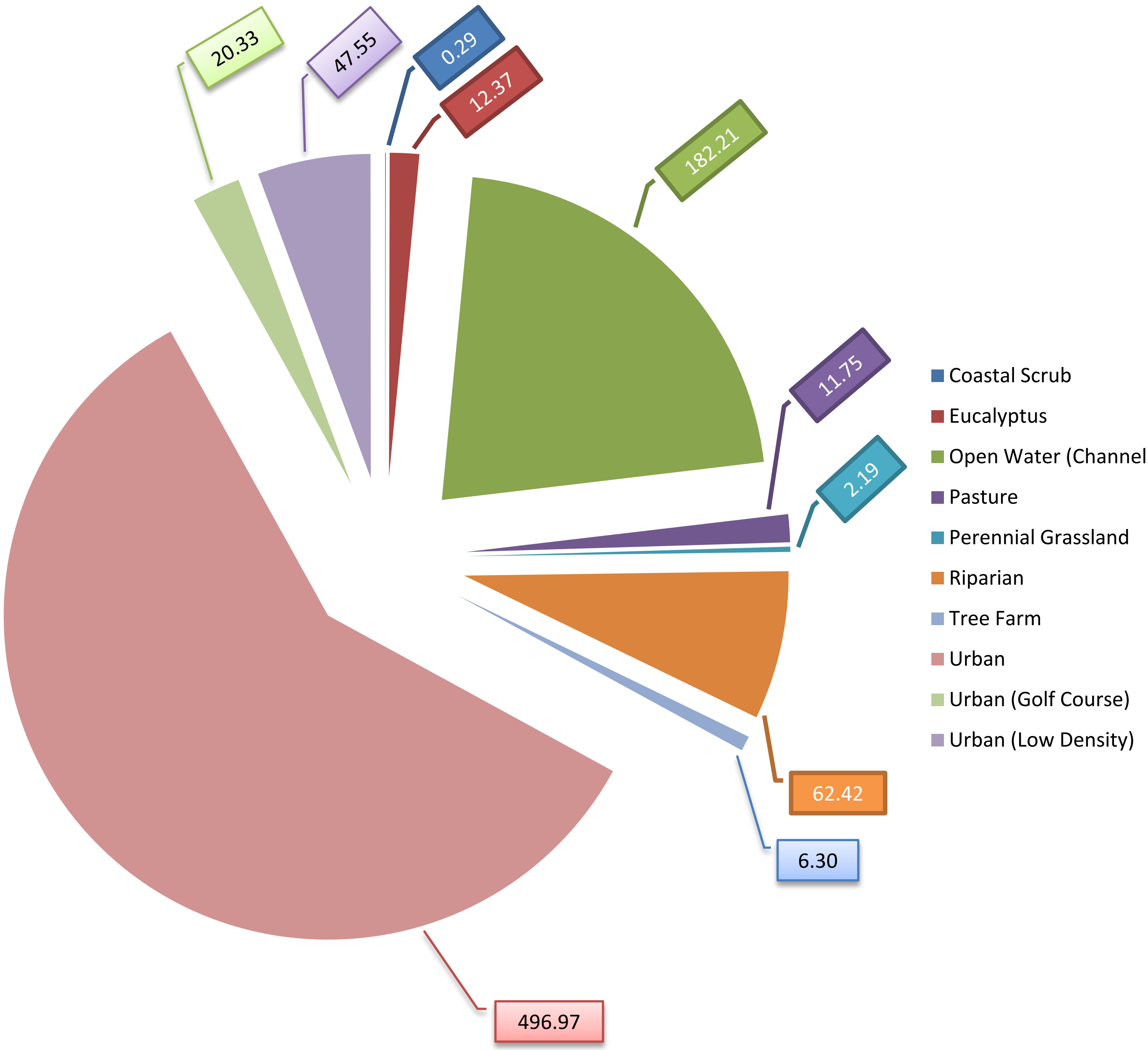


Figure 6.1.3-5. Baseline Existing Conditions – Per Acre Habitat Value by Habitat Type

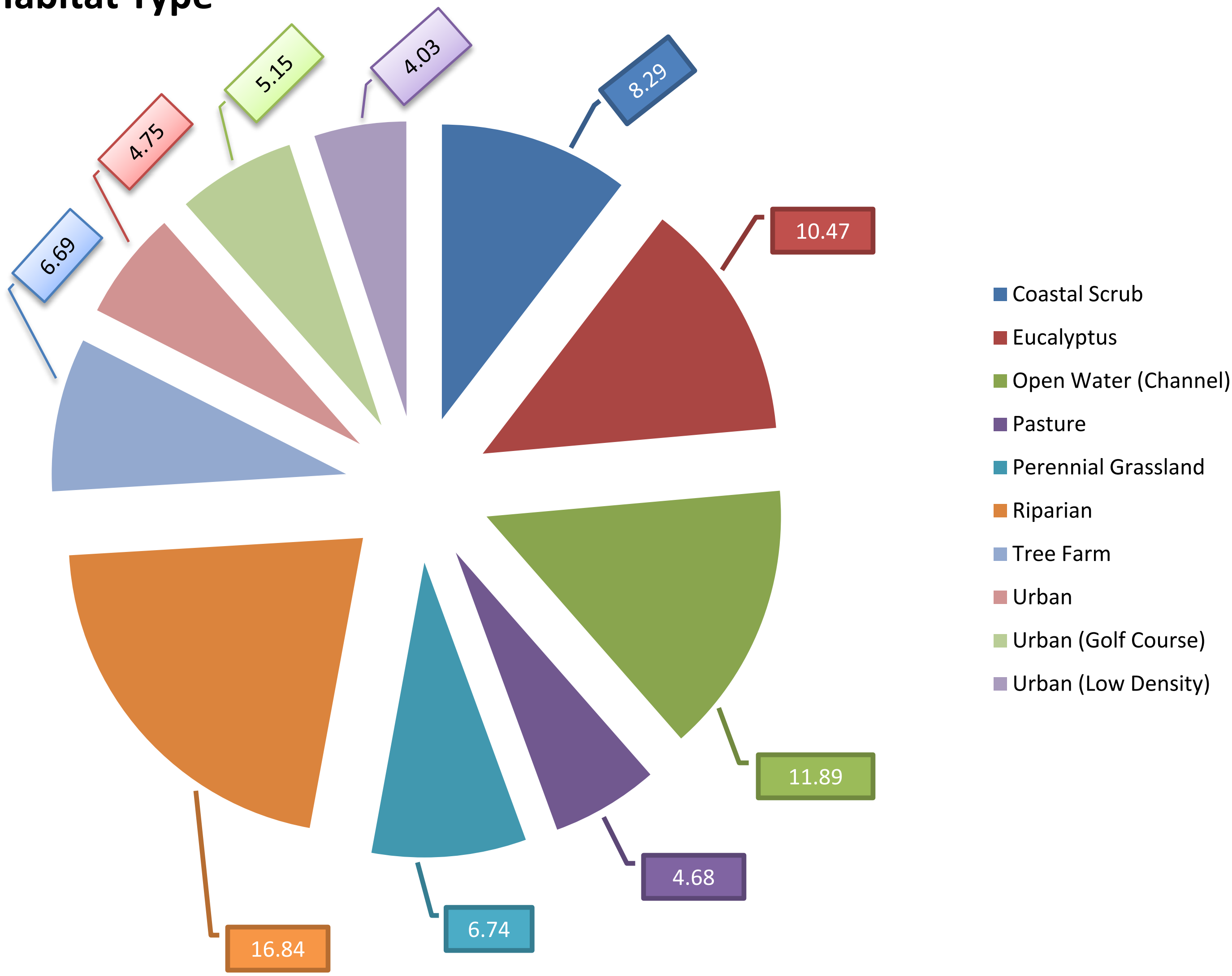


Figure 6.1.3-6. Sample Maps – Baseline Existing Conditions – Per-Acre Value

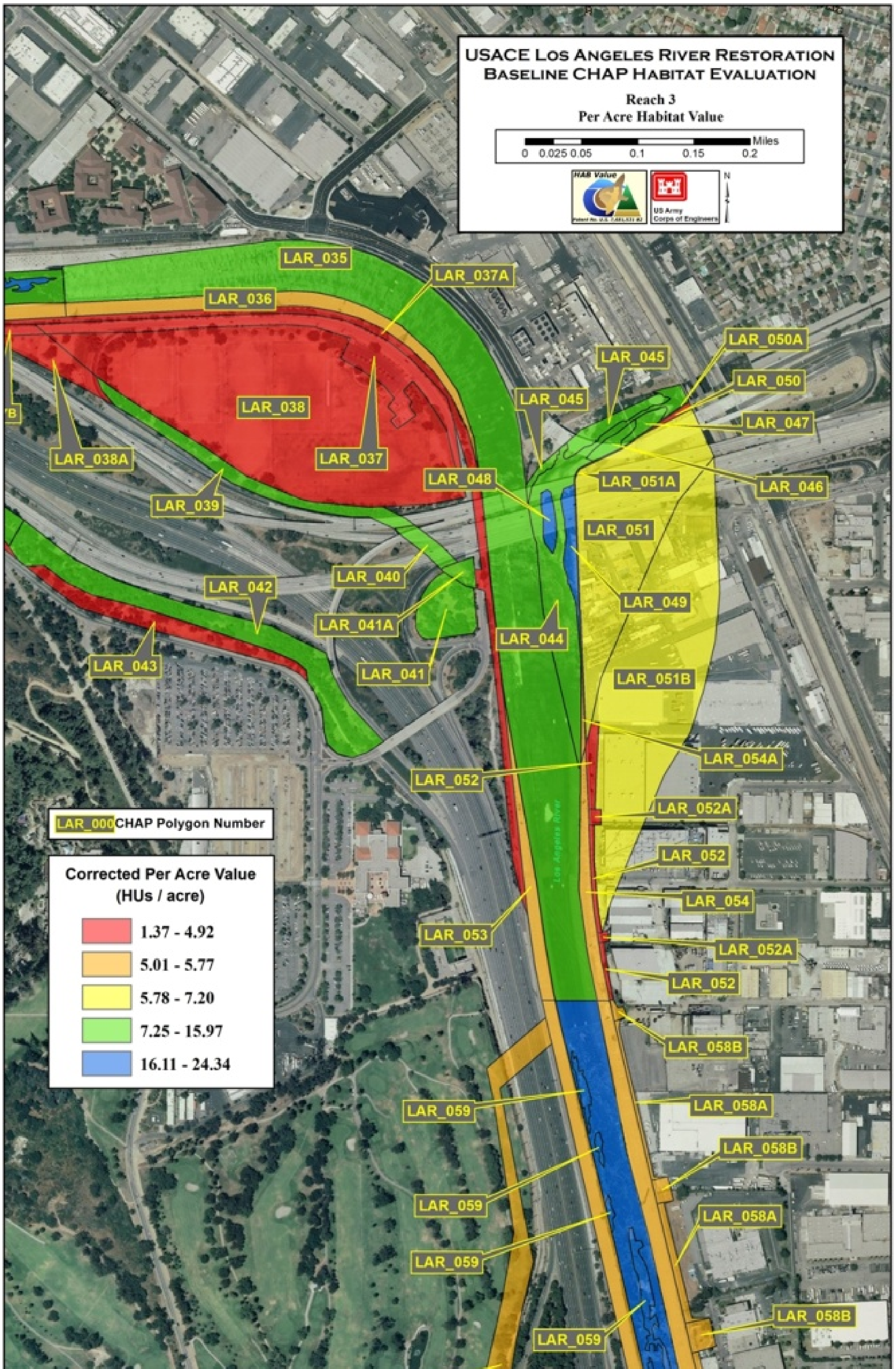


Figure 6.1.3-6. Sample Maps – Baseline Existing Conditions – Per-Acre Value

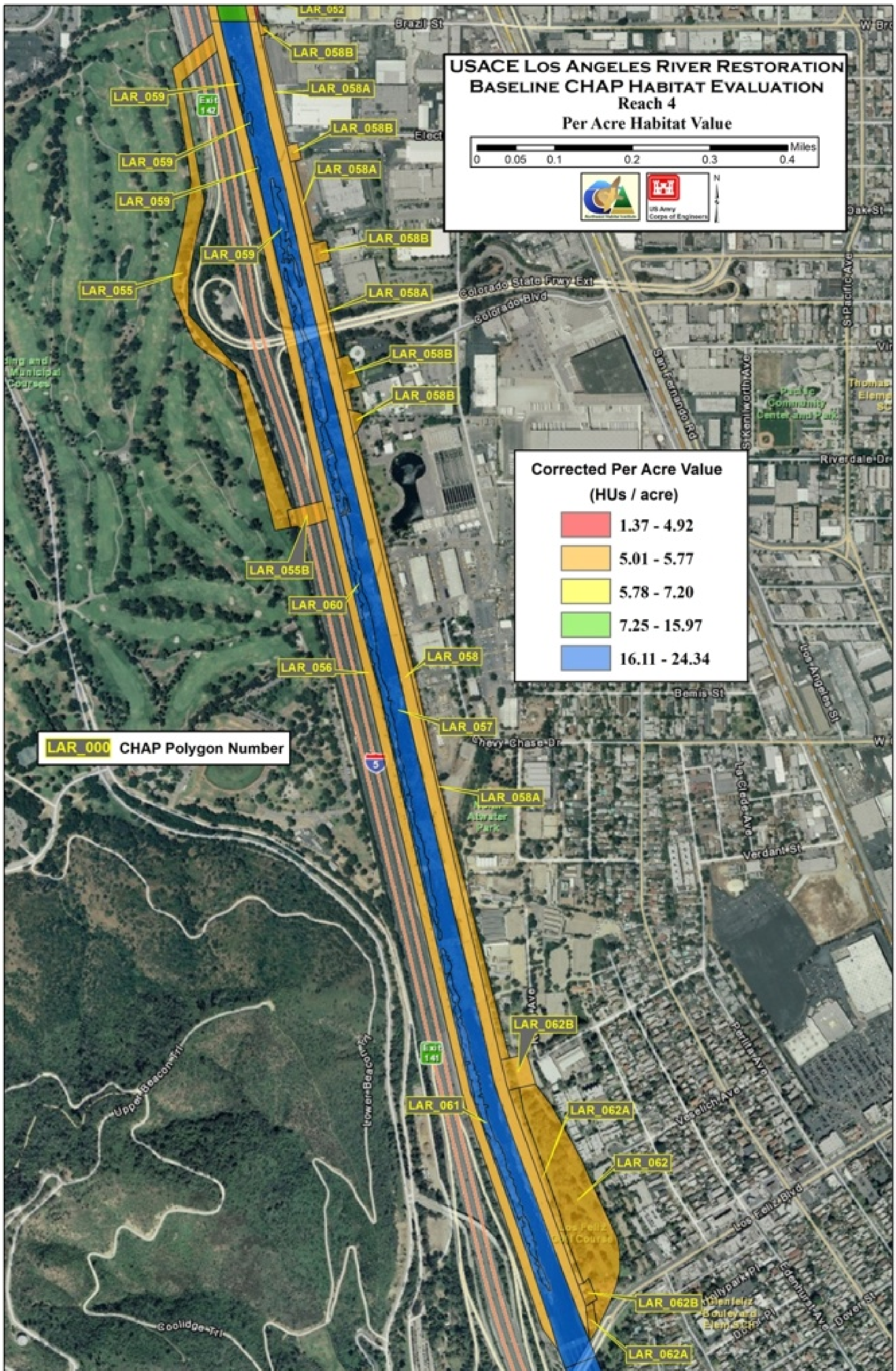


Figure 6.1.3-6. Sample Maps – Baseline Existing Conditions – Per-Acre Value

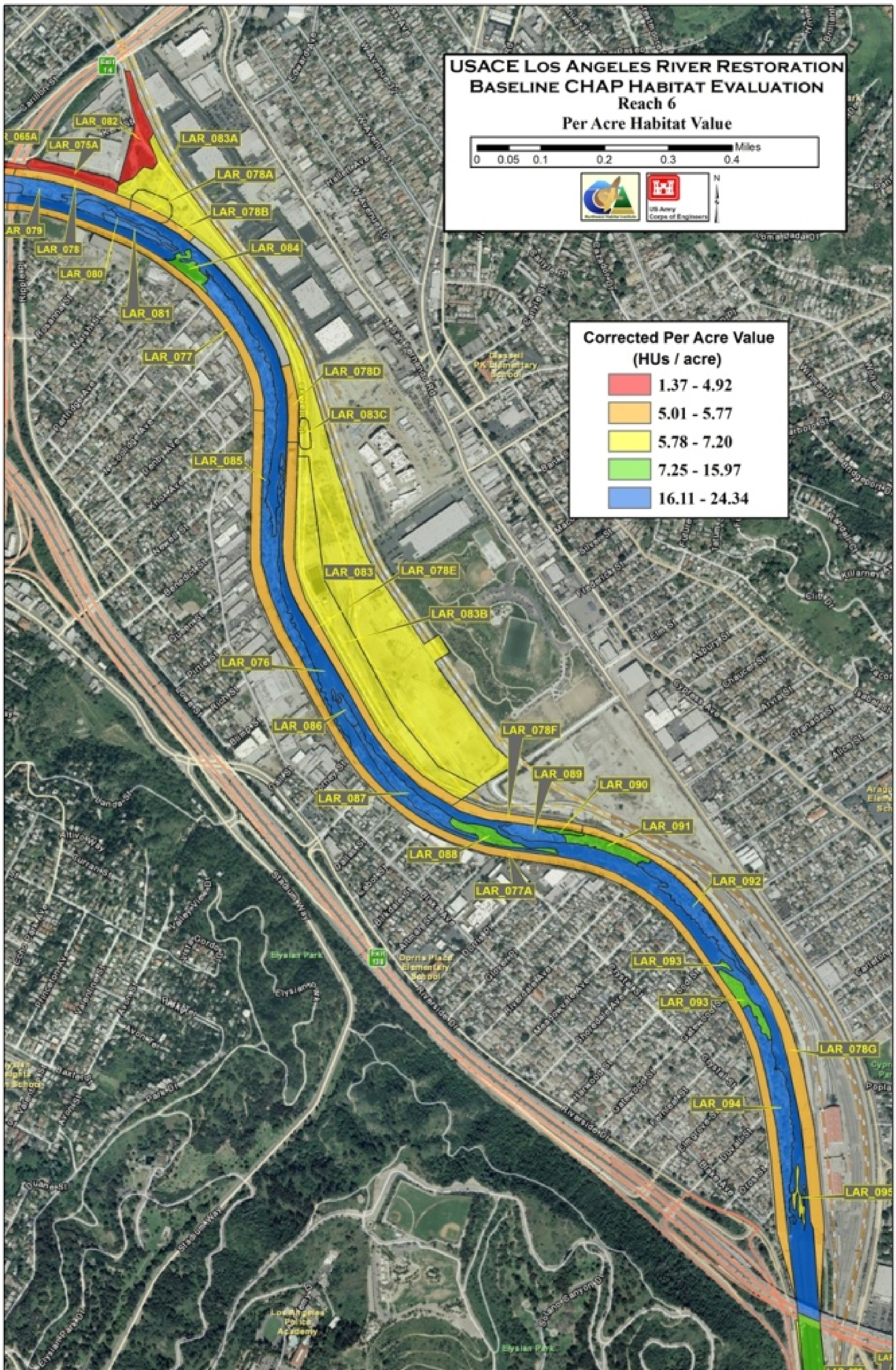


Figure 6.1.3-6. Sample Maps – Baseline Existing Conditions – Per-Acre Value

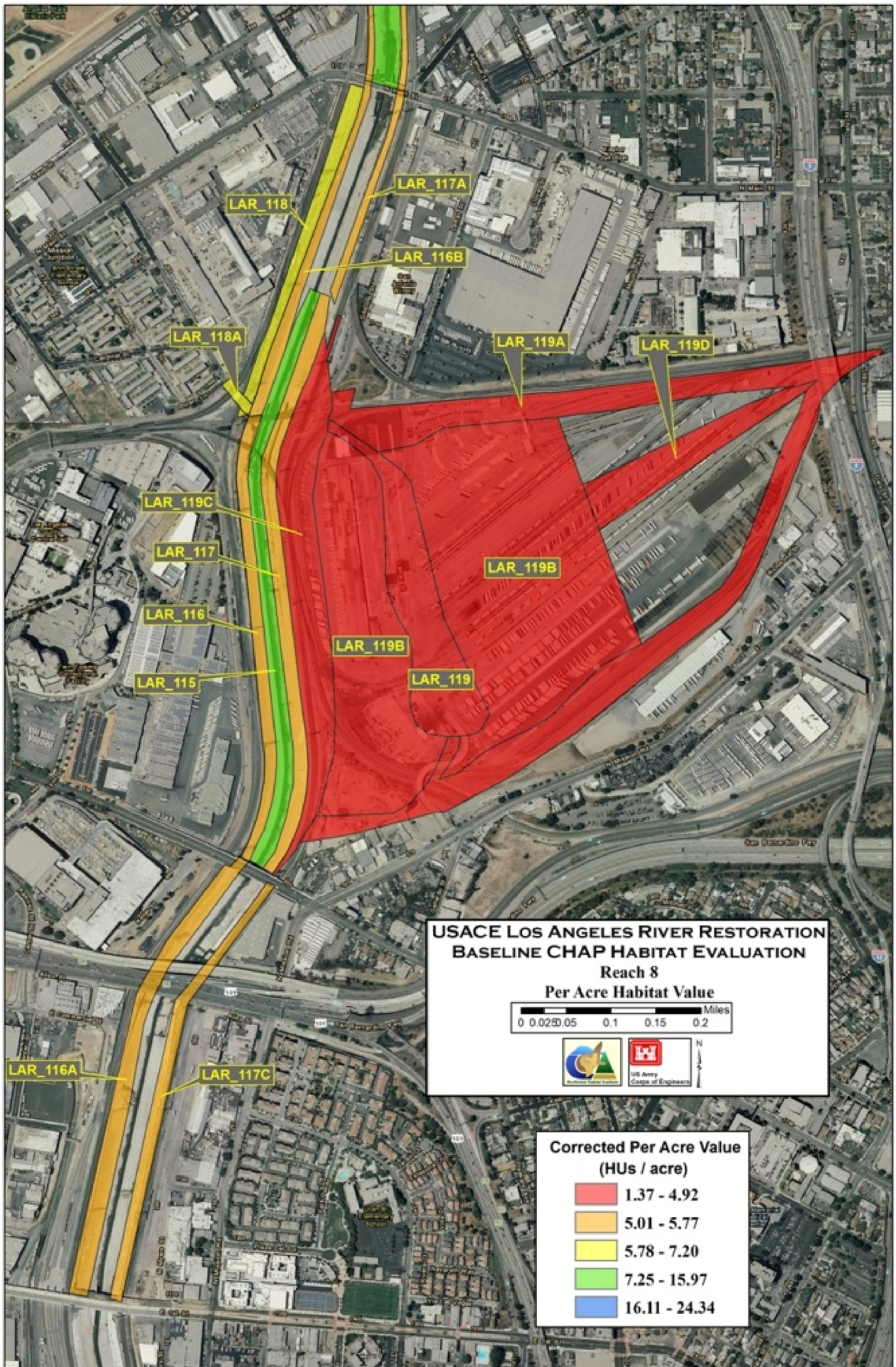


Figure 6.1.3-7. Sample Maps – Baseline Existing Conditions – Baseline HUs by Polygon Number

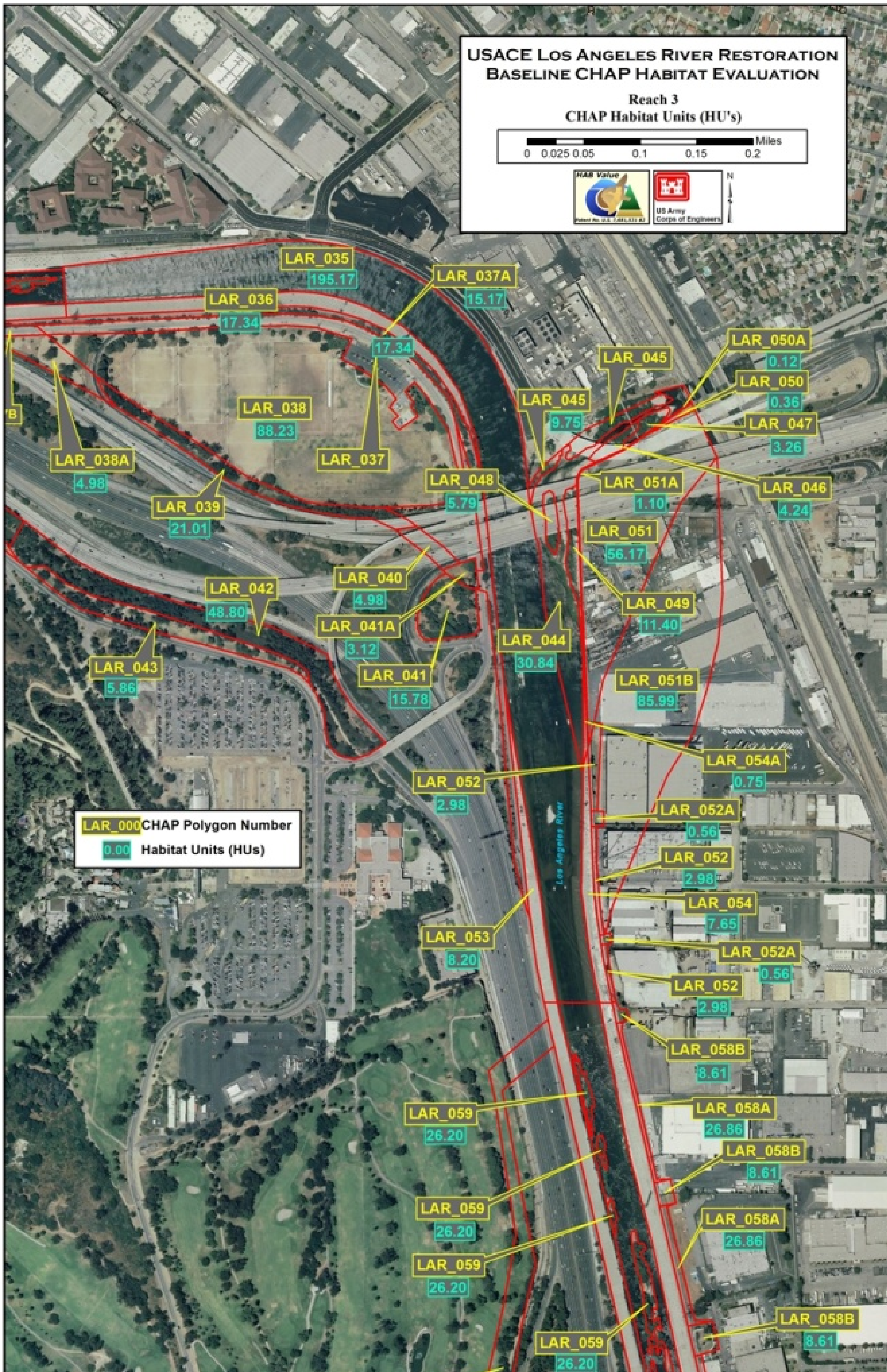
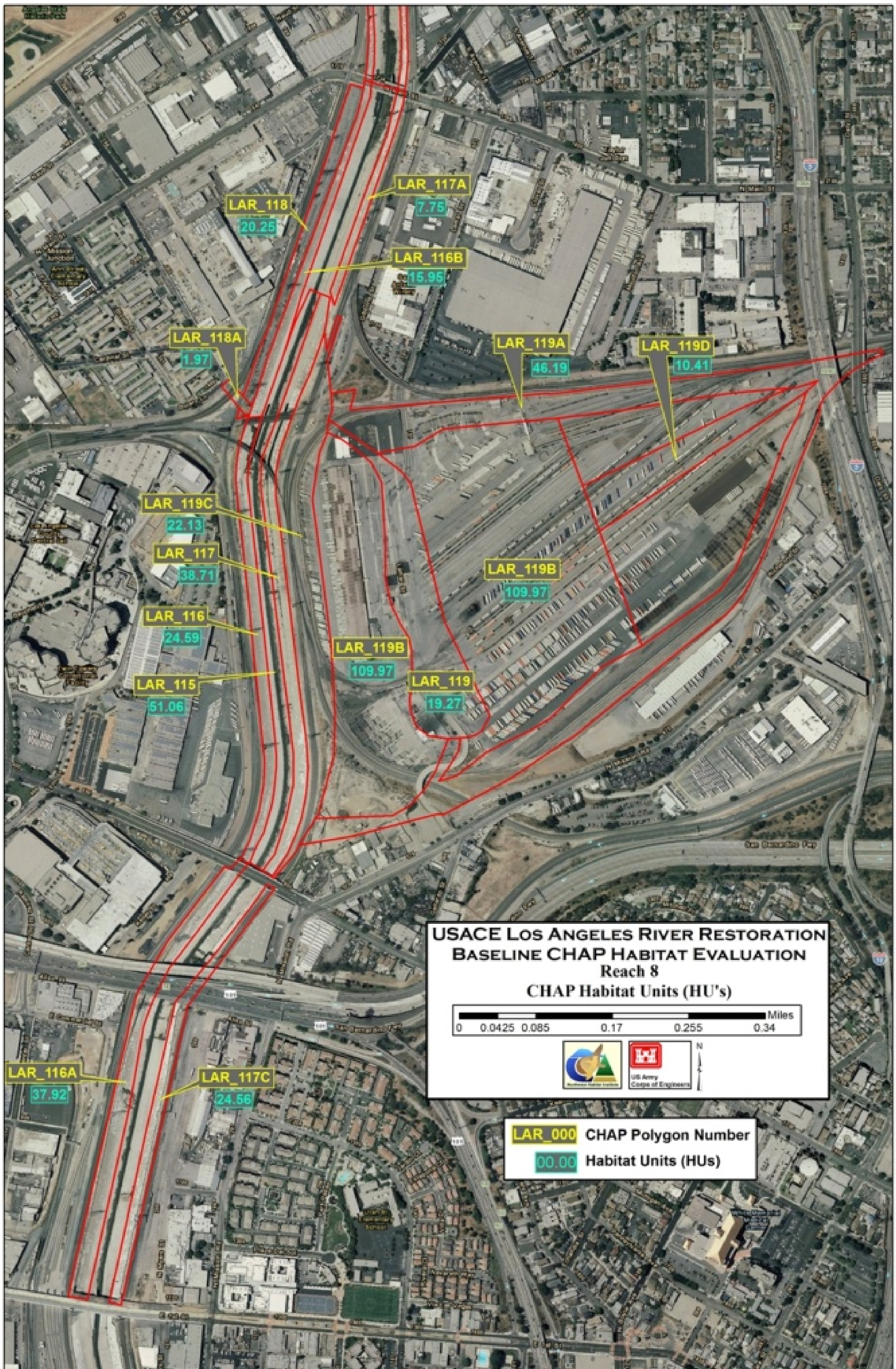


Figure 6.1.3-7. Sample Maps – Baseline Existing Conditions – Baseline HUs by Polygon Number

Figure 6.1.3-7. Sample Maps – Baseline Existing Conditions – Baseline HUs by Polygon Number

Figure 6.1.3-7. Sample Maps – Baseline Existing Conditions – Baseline HUs by Polygon Number



severely depressed, to nearly the maximum extent, given the impacts from urbanization. Therefore, it is assumed that the fish and wildlife species currently identified in the Study area, even under continued pressure from such stressors as invasive species, homeless encampments, horseback riding, and other urban uses, would likely prevail in the future. Thus, there were no adjustments made to the species list over the 50-year period.

Similarly, only minor adjustments to structural conditions were expected to occur from a simulated flood event. Due to the heavily urbanized environment surrounding the river and the engineered structure of the channel, conversion of wildlife habitat type and use by additional wildlife species would be unlikely. The riparian vegetation in the channel through the Glendale Narrows area has the potential to wash out during high flows, but would quickly recover, and has persisted through recent storm events.

6.2.1 Baseline: Future Without Project Methods

To determine a change in habitat values over time from the existing conditions, projections are needed to estimate changes to the species, habitat, and/or function parameters in the future. Applying these changes over several time periods requires some forecasting and theorizing to estimate the amount of alteration that might be expected during each time period. To display the future without project conditions and visualize these changes in value over time, changes to the habitat are applied to the fine scale habitat mapping, while changes to the species and functions, if any, are applied to their respective data sets.

The 25- and 50-year future without project analyses were built upon the baseline existing conditions analysis that illustrates the California wildlife habitat types within the Study area by GIS polygon (Figure 6.1.3-1). By modifying the species-habitat-function input information, which is based on the future projections for the area, a comparative time series evaluation over the 50-year period was generated.

<u>Adjusting Species, Habitat or Functions</u>

The habitat evaluation team met to generate projections for the 50-year future without project conditions. The rationale used by the habitat evaluation team, including logic and decision points, is included as follows.

1. <u>Potential non-viable wildlife populations</u> – The habitat evaluation team discussed the possibility of reducing or modifying the species list, however the team concluded that the current taxa, which are adapted to the highly urban environment surrounding the River, would most likely persist. It was assumed at the time of discussion that despite development pressure on the River, large open space areas, such as Griffith Park, were expected to be conserved due to high demand by the residents and established land use policies.

2. <u>Invasive species would expand in area and abundance</u> – Invasive plant species occurrence for baseline existing conditions was originally collected for three structural levels (the grass/forb layer, the shrub layer, and the tree layer) in each polygon. A discount factor

was applied based on the percentage of invasive species cover present, as shown in Table 6.1.2-1.

To determine the influence of invasive species for the future without project conditions, the habitat evaluation team forecasted that the presence and abundance of the invasive species would increase over time without implementation of a restoration project. Although occasional non-native and trash removal efforts are conducted by the Corps (and others) in certain reaches of the river, these efforts are not frequent or consistent, and are dependent on limited and unpredictable funding. They are also not conducted watershed-wide, so areas cleared of non-natives one year may be subject to re-infestation in later years. Therefore, it was estimated that the percentage of invasive species for each polygon at the baseline condition would advance to the next highest percentage level for the first 25 years, and to the subsequent level beyond that for the last 25 years. For example, if the baseline existing condition of a polygon exhibits 36-65% invasive cover in the grass/forb layer, then the condition at Year 25 would be assessed at 66-90% invasive cover, and the condition at Year 50 would be assessed at >90% invasive cover.

3. <u>Flooding</u> – A simulated 500-year flood event would likely have little influence on how the current wildlife population interacts with the landscape. It is possible that the riparian vegetation in the River within the soft-bottomed portions of the channel could be partially or even completely washed out by a 500-year event; however, historic photos indicate that current structural conditions are likely to persist in the soft-bottomed sections of the project area if no action is taken for the next 50 years. Riparian vegetation rapidly re-establishes after flood events, and this would be expected in the LA River channel. The project area outside the channel is extremely urbanized and any semi-natural areas would likely return to invasive shrub and grass conditions post-flood.

   While a 500-year storm event may wash larger amounts of urban trash and detritus into the river, in its current state the River already contains substantial levels of trash in the Study area. The impacts of trash in the River were, therefore, expected to persist in the event of major flooding without project implementation. Overall, it was not expected that the number of species present or how those species interact with the landscape (habitat function) would be altered by flooding in the absence of a restoration project. Figure 6.2.1-1 depicts the overflow area for a 500-year flood event.

4. <u>Fire</u> – Griffith Park may be threatened by wildfire, however extreme effort is placed on suppressing the spread of wildfire near the Study area due to the threat to human life and property (infrastructure). The 2007 Griffith Park fire burned 817 acres, and a similar fire in 1961 burned 814 acres. Neither fire impacted the habitat within the Study area. There may be a greater concern over time for a potential increase in wildfire due to increased drought conditions associated with climate change. Maturing vegetation types and senescence would increase fuel loading and the potential for wildfire to spread to the Study area.

   Therefore, the likelihood for at least one occurrence of a wildfire within the 50-year period has been projected based on the County's past fire history (Figure 6.2.1-2).

Figure 6.2.1-1. 500-year Flood Event – Overflow Area

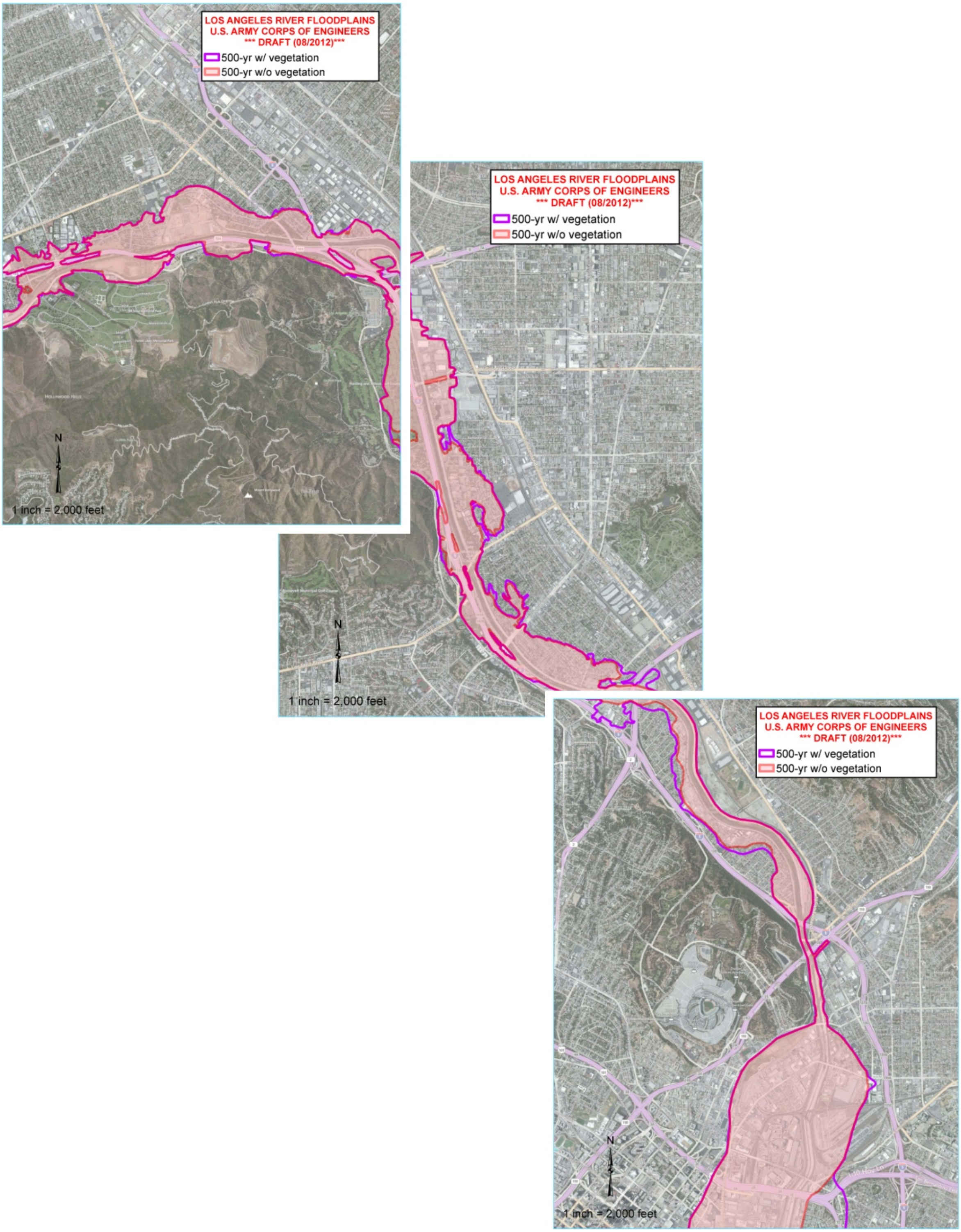
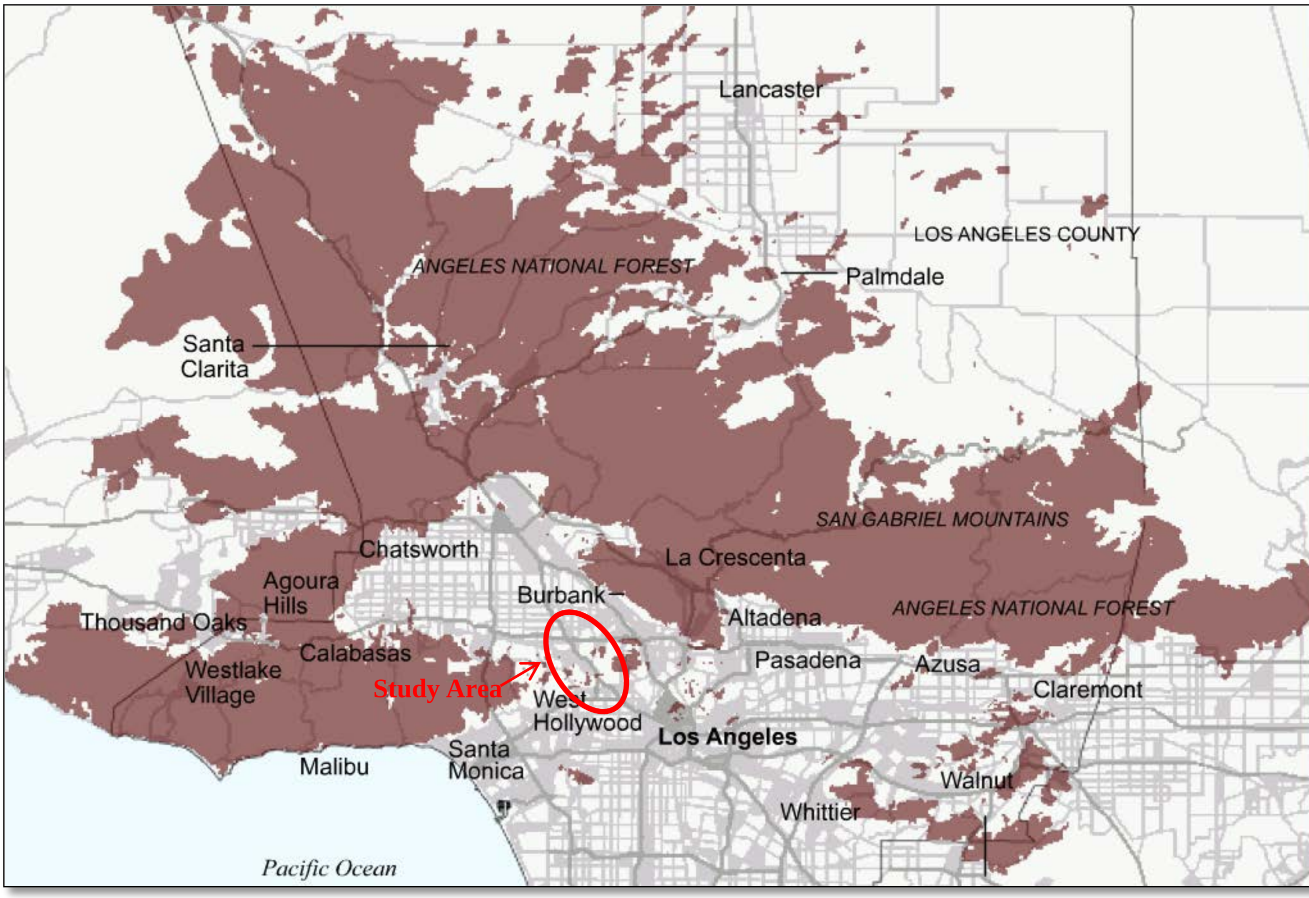


Figure 6.2.1-2. LA County Fire History



Fire History from the Los Angeles County Fire Department illustrating the fires that have occurred from 1870s to 2005 [as reported in LA Times 08-05-2007].

Depending on the severity of a fire in the Study area, burned trees that do not suffer mortality may re-sprout from remnant vegetation and weedy species would likely return as ground cover. Over time some riparian vegetation in the Study area may re-establish from upstream seed sources, however weedy species would be expected to colonize quickly in the absence of established native vegetation. Without maintenance of non-native weeds, these species would be expected to further degrade existing riparian areas over time.

Some wildlife may benefit immediately after a fire, such as insectivorous birds that feed from post-fire insect outbreaks and cavity nesting birds and perching birds that find shelter and snags in the standing dead and damaged trees. Species that prefer structural diversity are generally expected to be negatively affected by a large stand-replacing fire in the Study area. A severe fire may change the water chemistry, leading to mortality of fish and other aquatic organisms. Loss of vegetation and the associated increase in sedimentation would also affect water quality for these species.

The Santa Ana winds, which can fan a wildfire into a major fire storm, were not considered a contributor to fire as the winds do not blow uniformly across Southern California and some areas, including the Study area, are relatively sheltered from the winds (Figure 6.2.1-3).

5. <u>Planned Development</u> – Currently, several development projects are anticipated to occur near the Study area. At the Headworks site, LA County Department of Water and Power is actively installing water tanks at the west end of the site. The Headworks site currently consists of a pile of fill dirt and hole for the future water tanks; therefore, KECs were altered for the area under the future without project condition to account for grass and shrub components that would be planted if no other action is taken at the site.

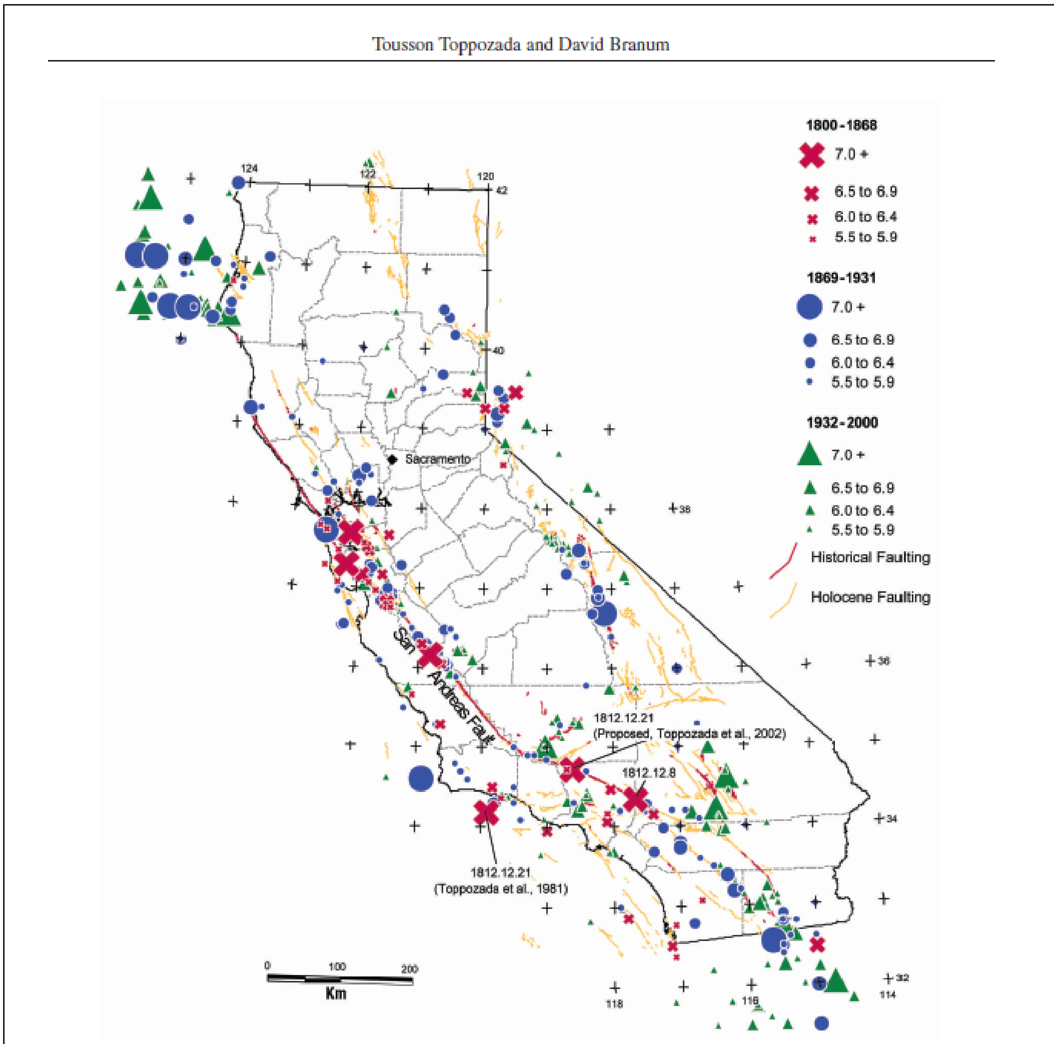
   The California High Speed Train project is currently developing alternative alignments near the Study area. While the final alignment has not been determined, the alignment alternatives that abut and cross the Study area (if chosen) would have an impact on the value of wildlife habitat in the Study area under the future-without project scenario.

   In the absence of an ecosystem restoration project on the River, urbanization will continue near the Study area, particularly in Downtown LA. Other development, transportation and infrastructure projects occurring within or adjacent to the Study area would generally have a negative effect on habitat value.

6. <u>Earthquakes</u> – Earthquakes and tremors occur frequently in the Southern California area. Figure 6.2.1-4 depicts the seismic activity that occurred in and around the Los Angeles area from 1800 thru 2000. In the event of an earthquake, the primary impact would be to infrastructure along the corridor. It is expected that the design and engineering of the channel, including pipelines and tanks, would withstand predictive earthquakes for the area. If this infrastructure failed, flooding may occur, although surface water would eventually flow back in the Los Angeles River.

Figure 6.2.1-3. Santa Ana Winds

Figure 6.2.1-4: Earthquakes in Southern California



Magnitude greater or equal to 5.5 California earthquakes, 1800-2000 (modified from Toppozada and Branum, 2002).

7. Proximity to Other Natural Areas – The Study area is in close proximity to other natural areas, most notably Griffith Park, which is the eastern terminus of the Santa Monica Mountains (Figure 6.2.1-5). It was expected that these substantial nearby open space areas and habitat connections would persist in the future.

6.2.2 Baseline: Future Without Project Results

After adjusting the percent of cover of invasive species and adjusting the KECs of each polygon based on planned development, flood and fire events, and climate change, habitat values were generated for the 25 and 50-year time periods.

As expected, habitat value is projected to substantially decline within the Study area assuming no restoration activity is implemented over the next 50 years. Open water areas and urban areas mostly comprised of impervious surfaces (including the concrete channel banks) showed no change from the current habitat value. The remainder of the Study area is projected to decline steadily in habitat value, with an overall decline of 7% after 25 years and 14% after 50 years (Figure 6.2.2-1). In the absence of restoration in the Study area, the existing riparian areas that currently provide the most habitat value per acre will continue to degrade. Ecosystem functions in the Study area will also continue to diminish.

The future without project CHAP calculations are included in Microsoft excel spreadsheets and displayed in a GIS geodatabase. Due to the large volume of these spreadsheets and data, the complete set of files is available upon request from the Corps, Los Angeles District.

6.2.3 Annualizing HUs

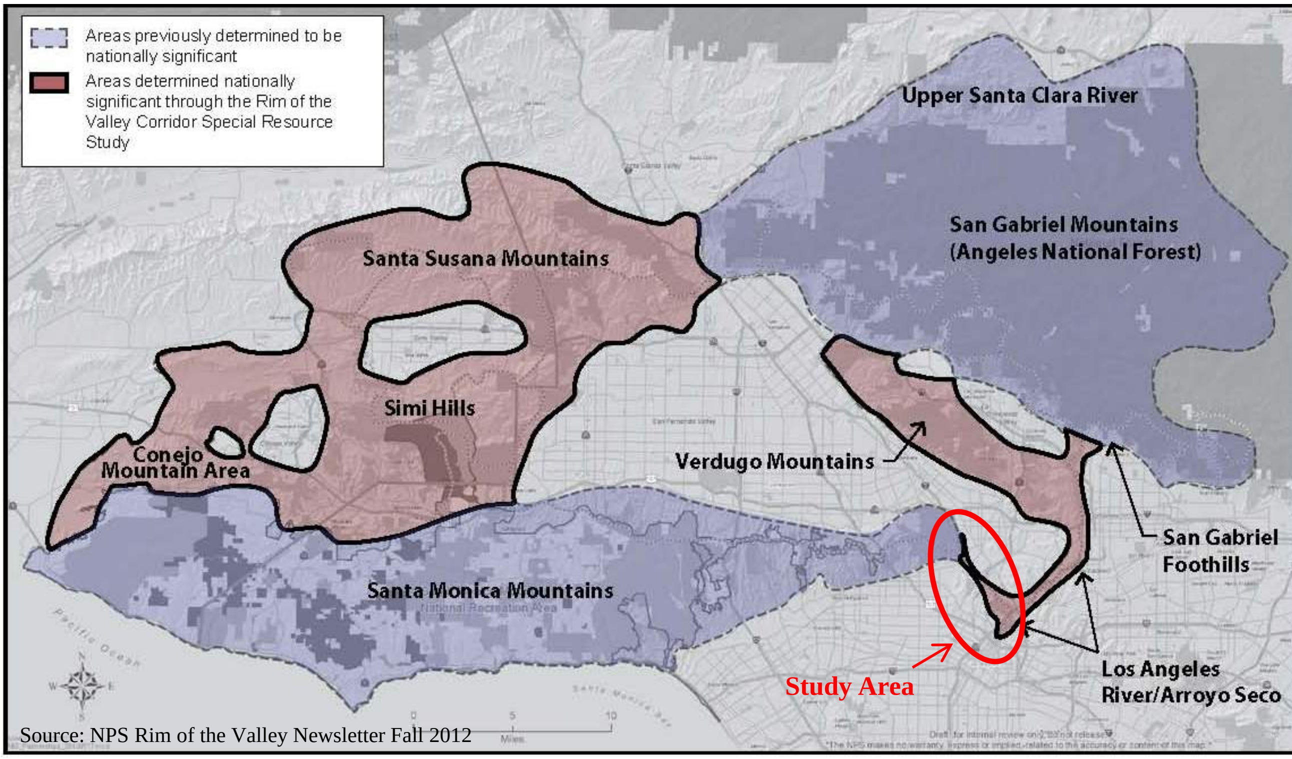
Since the amount and value of habitat found within the Study area is likely to vary over time, to account for time dependent variation habitat units were forecasted over the 50 year period of analysis. These 50 annualized values were then averaged to produce an average annual habitat unit value.

Annualized habitat unit values were generated by forecasting the amount and value of habitat expected to exist within the study area at discrete points of time during the period of analysis (i.e. the number of habitat units expected to exist in the 1st, 25th and 50th year of the period of analysis). The habitat values expected to exist in years between the forecast points were created by interpolating (linearly) between these forecast values. The resulting 50 habitat unit values (one for each year in the period of analysis) were then averaged to produce a single average annual habitat unit value. This annualized habitat value was compared to annualized costs in the economic cost effectiveness and incremental cost analyses (CE/ICA)(See Appendix B of the Main Feasibility Report).

6.3 ALTERNATIVES ANALYSIS

Through the Corps' Plan Formulation process, 19 preliminary ecosystem restoration alternatives were developed based on input from local stakeholders and resource agency groups provided at workshops throughout the planning process.

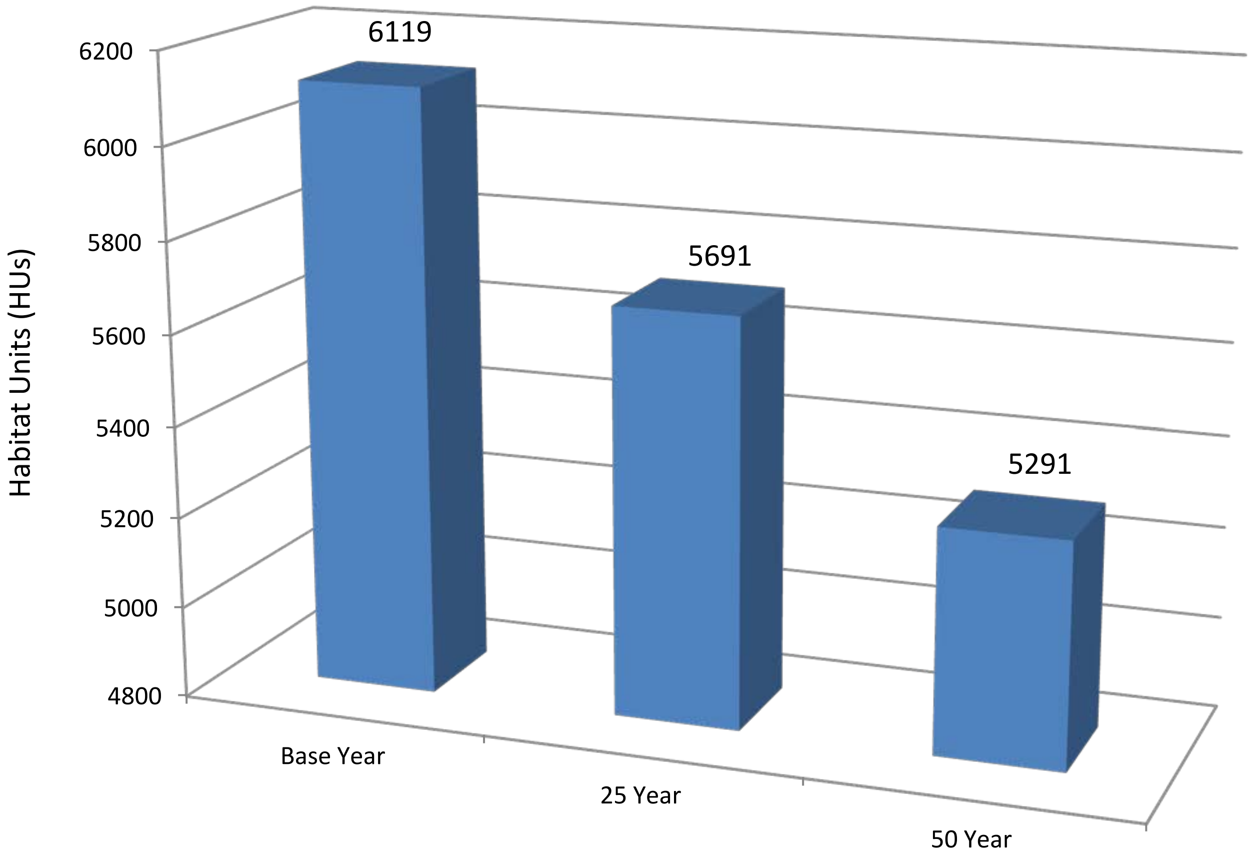
Figure 6.2.1-5. Proximity to other Natural Areas



Regional Connectivity to Local Mountain Ranges and Nationally Significant Areas

Opportunities for Connections to Griffith Park

Figure 6.2.2-1. Without Project HUs



HUs were calculated for each restoration alternative by evaluating specific habitat creation, improvement, and management actions within the Study area, where preliminary design specifications and future with project assumptions were clearly, spatially defined. Informed predictions of habitat value for each of the 19 preliminary restoration alternatives were made by altering the inputs to the CHAP to match the anticipated outcomes of the different restoration alternatives. Habitat value results were then tabulated for each alternative by reach.

6.3.1 Alternatives Methods

To calculate habitat value for each alternative, the species by function matrix values are adjusted when the species list changes or there is a conversion of habitat type. The habitat by function values are adjusted when KECs (i.e. habitat elements) are added or removed. Restoration activities can increase the values of either or both matrices within the CHAP accounting system.

By converting dense, urban uses to functioning riparian, open water, and marsh habitats, which are all aquatic ecosystems, the number of potential species linked to those habitats greatly increases in that area. The number of species performing functions and the number of functions provided by the habitat type also increases for that area. These adjustments in species, habitat, and functions lead to increased species by function matrix value for a given polygon. Adding KECs, such as by planting vegetation and creating geomorphology, or enhancing structures for wildlife use and connectivity, increases the habitat by function matrix values for a given polygon.

To calculate initial and future with project habitat values, representing the benefit of each alternative's proposed restoration activities, each of the total 172 CHAP polygons must be analyzed in terms of habitat type, structural conditions, and KECs expected to be present after restoration. For the purposes of the Study, habitat values were forecasted at initial HUs, after 25 years with project, and after 50 years with project. This provides a direct comparison to the baseline future without project conditions, at 25 and 50 years into the future.

The baseline CHAP polygons were delineated based on differences in habitat type or structural condition. During the alternatives analysis, some of the polygons established during baseline had to be split because different restoration actions were proposed in multiple areas within a given baseline polygon. In these cases the original CHAP baseline polygon number was retained, and any additional polygons resulting from split were labeled with a letter (e.g. polygon LAR_007 was split to LAR_007, LAR_007A and LAR_007B). Maintaining this continuity allowed for simplified spatial tracking.

After the polygons were split where necessary, and the new polygon acreages were calculated, each restoration measure was evaluated as to the habitat type it would create, and the structural condition and KECs expected to be present. The Corps' alternative matrix, describing alternative measures for each alternative per reach (Appendix F), was used to identify the sub-measures that occurred in each river reach for each alternative. Application of these sub-measures in certain areas dictated where habitat conversions would occur within the Study area for each alternative. Evaluations were also based on the proposed preliminary design cross sections (Appendix G), habitat assumptions made by the design team related to management measures[7] (Table 6.3.1-1), discussions with the CHAP habitat evaluation team, as well as projections of what current features would persist in a given polygon. To further assist in evaluating which sub-measures were to be implemented in each polygon, the design team's alternative GIS mapping (Tetra Tech 2012) was used as a spatial reference (Figure 6.3.1-1 and 6.3.1-2).

The following descriptions document the adjustments made to CHAP inputs (i.e. habitat type, KECs, percent invasives) to reflect the forecasted changes that would occur in each polygon with implementation of sub-measures from the restoration alternatives. Trash removal and invasives removal for the life of the project was included as a measure in any reach where restoration activities are proposed. For the complete list of measures, sub-measures, and their detailed descriptions, refer to Section 4.4 of the Main Feasibility Report. The master list of KECs and their numerical codes are included in Appendix A.

These descriptions are generalized for each sub-measure, and do not include polygon specific KECs such as roads, fences, bridges, buildings, and other anthropogenic features that were evaluated additionally for a given polygon.

For example, in polygons where the following sub-measures are implemented,

- Restore riparian and marsh by day lighting streams
- Creation of attenuation basin with wetlands

the following KECs were altered:

- Convert habitat type to Freshwater Emergent Wetland
- Restore all invasive species levels to 0-10%
- Remove trash and pollution KECs if applicable: 8.19.1 Chemical, 8.19.2 Sewage, 8.19.3 Water, 8.9 Refuse
- Add KECs: 4.1.2 Water Depth, 4.6.3.2 Emergent Vegetation, 4.7.1 Wetlands, 4.7.2.2 Non-Forest, 4.7.3 Size <2 ha, 4.7.4 Marsh Characteristics, 4.9 Seasonal Flooding, 8.16 Culverts, 8.24 Water Diversion

In other words, in polygons where a particular alternative designates that streams currently in storm drains be day lighted and the outlets/confluences be naturalized with created wetlands , it is expected that freshwater marsh would be restored and that invasives management would be implemented. Therefore, those KECs (habitat elements) should be accounted for in that polygon for the future with project condition. Trash management would also be implemented, which would remove certain existing habitat elements including chemical, sewage, and water pollution, and refuse. The restoration of wetlands would add KECs associated with that habitat such as emergent vegetation, seasonal flooding, and water diversions.

7 For the complete list of measures, sub-measures, and their detailed descriptions, refer to Section 4.4 of the Main Feasibility Report.

Table 6.3.1-1: Habitat Design Assumptions Related to Management Measures

<table>
<tr><th>Sub-Measure</th><th>Assumption</th></tr>
<tr><td>Restore riparian and marsh by day lighting streams</td><td>Average 1 acre wetland per site (confluence).</td></tr>
<tr><td>Create geomorphology and plant for freshwater marsh in adjacent side channel/in main LA River Channel. Create geomorphology for open water adjacent to the channel/in main LA River Channel.</td><td>Assume same percentage of wetland/riparian/open water as in existing soft bottom reaches.</td></tr>
<tr><td>Rebuild geomorphology for historic wash</td><td>Riparian.</td></tr>
<tr><td>Creation of attenuation basin with wetlands</td><td>Wetland.</td></tr>
<tr><td>Divert tributary & river flow into side channels</td><td>25% riparian/75% wetland.</td></tr>
<tr><td>Restructure/vegetate LA River concrete channel walls</td><td>This is applied to most of the channel banks but it is assumed that the banks will not be fully covered by vegetation. Assume 50% herbaceous riparian/50% concrete.</td></tr>
<tr><td>Habitat corridors/Riparian planting on over banks of the main channel or tributaries</td><td>50% riparian/50% shrub.</td></tr>
<tr><td>Terrace concrete banks/Planting built into modified channel walls</td><td>50% riparian/50% concrete*</td></tr>
<tr><td>Establish/improve open water habitat on concrete bottom areas within the main channel of the LA River</td><td>This measure is only in Reach 3. Assume 25% wetland (toe of the banks). Remaining stays as existing conditions.</td></tr>
<tr><td>Lower channel banks</td><td>One polygon adjacent to Verdugo Wash. Assume riparian.</td></tr>
<tr><td>Widen channel banks</td><td>Riparian.</td></tr>
<tr><td>Major tributary channels/widen channel</td><td>One polygon at Verdugo Wash. Assume same wetland/riparian percentage as existing conditions.</td></tr>
<tr><td>Terraces with earthen banks</td><td>Riparian.</td></tr>
<tr><td colspan="2">In Soft Bottom Reaches 2, 4, 5, 6:
Assume that the existing configuration of habitat in the channel bottom not modified.
Assume trash cleanup and invasives management will be conducted for the life of the project in reaches where measures are implemented. Assume only occasional non-native/trash removal without the project.</td></tr>
<tr><td colspan="2">*Habitat composed of 50% riparian and 50% concrete would provide half of the benefits attained by the fully restored riparian habitat. While it does not provide as much benefit as the comprehensive riparian restoration, this habitat is an important component for wildlife movement and connectivity within the project area for small animals (mammals, birds, reptiles) in more restricted reaches, providing opportunities for foraging and cover.

While concrete surfaces are not natural or a restored habitat, they do provide value to certain species, even if minimal value, in such a highly urbanized environment. Shorebirds benefit in areas of perennial flow where algae accumulates on the surface of the concrete. This provides them roosting and foraging habitat. This also serves as a linear open space corridor that wildlife can traverse without contending with traffic or other human intrusion. While persistence of concrete is not a restoration measure, it will continue to be a usable element for wildlife that will exist within the study area.

The main purpose of the habitat evaluation is to ensure that with-project values are significantly better than without project for the overall study area. Concrete is an existing condition, and while the value may be low it is not zero in this particular case. If concrete surfaces are assigned zero value then the overall value of the entire study area (for both existing and future conditions) would be undervalued. With the project, there will be less concrete and less non-native vegetation.</td></tr>
</table>

For the complete list of measures, sub-measures, and their detailed descriptions, refer to Section 4.4 of the Main Feasibility Report.

Figure 6.3.1-1. Sample Alternative Mapping – Alternative 1 – Reach 3

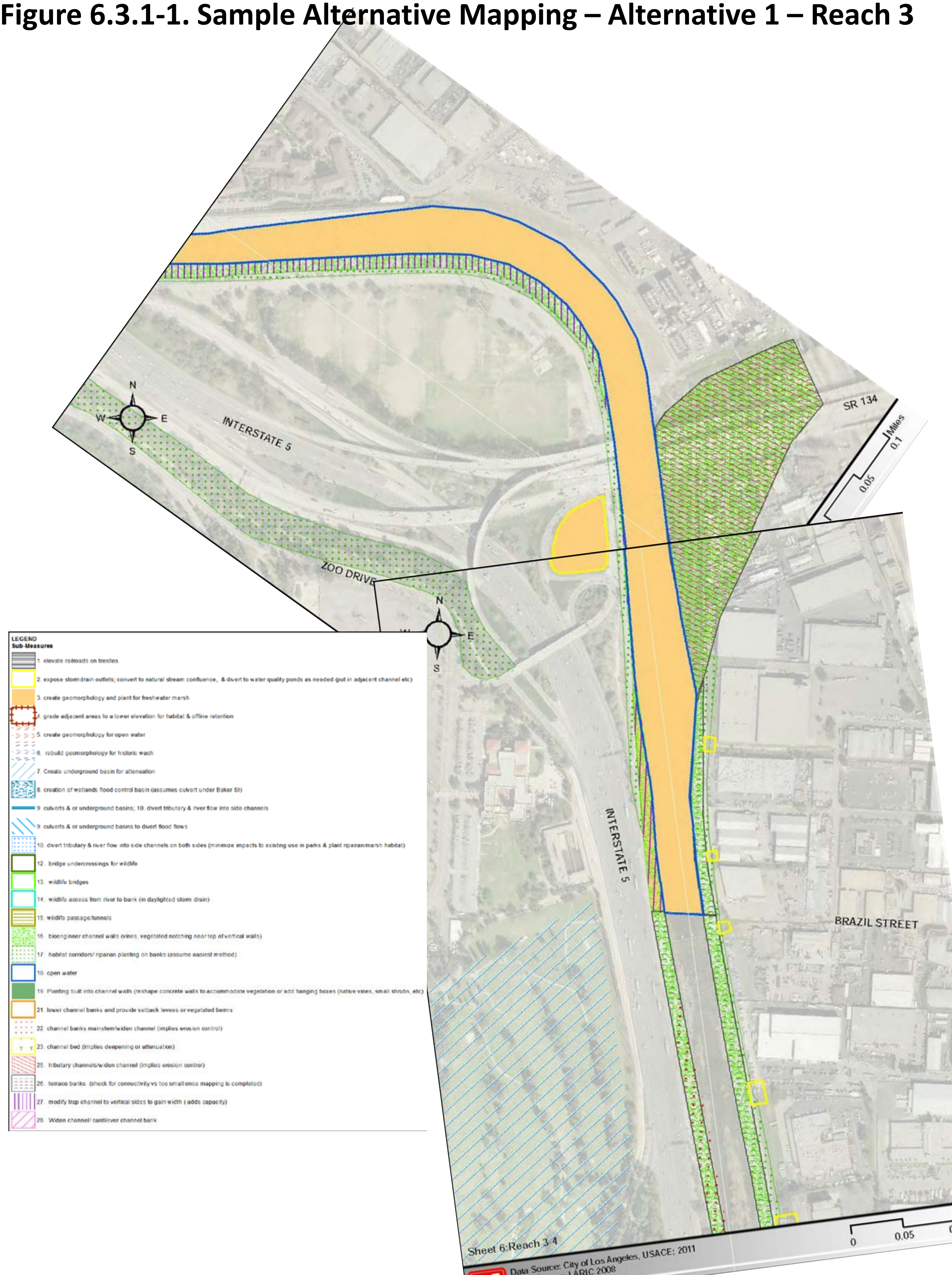
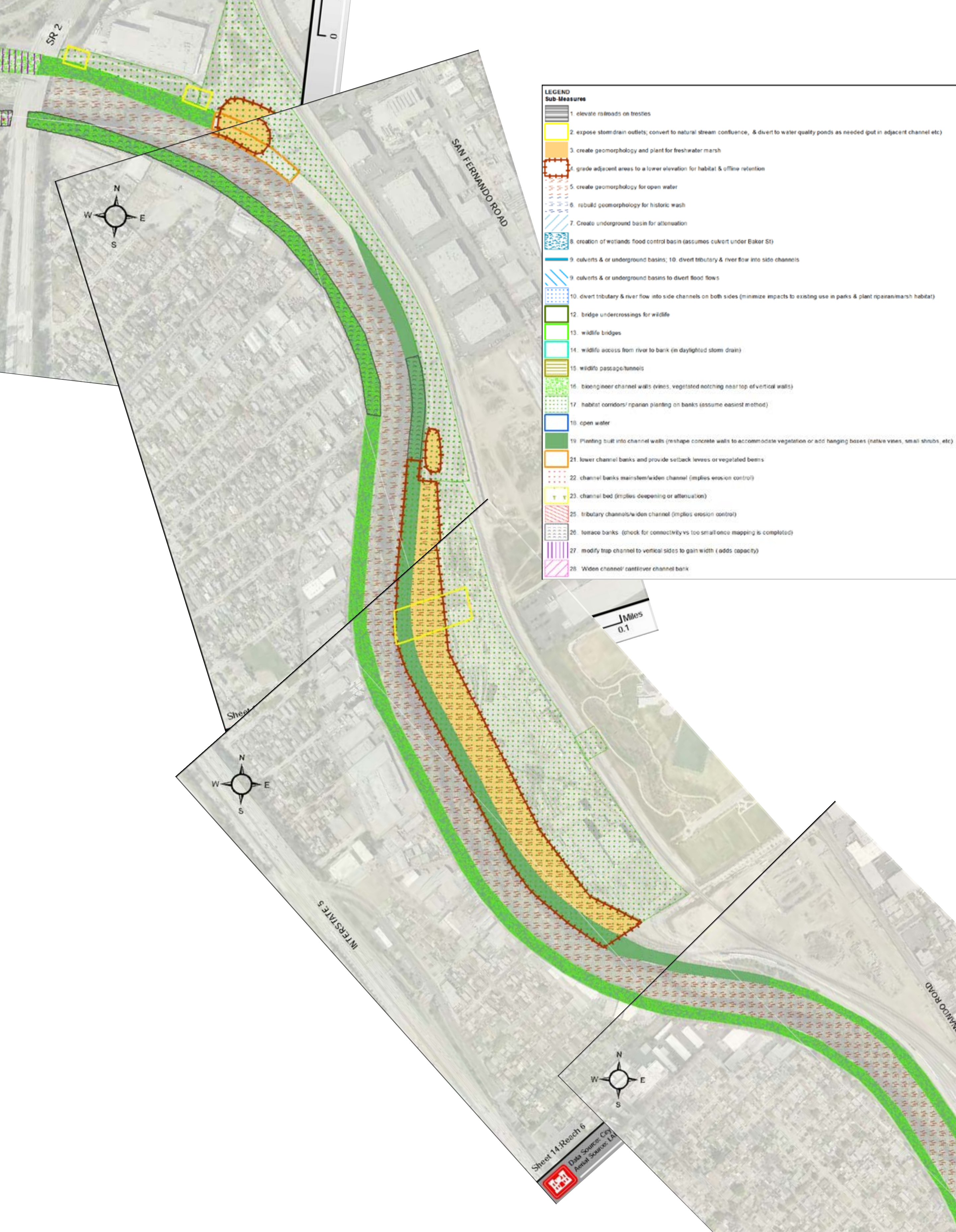


Figure 6.3.1-2. Sample Alternative Mapping – Alternative 1 – Reach 6



Similarly, the other sub-measures (below) would add or remove KECs to applicable polygons under the alternative future with project condition, based on the activities expected to occur for a particular alternative. The adjustments for each sub-measure are outlined as follows:

Create geomorphology and plant for freshwater marsh in adjacent side channel/in main LA River Channel
Create geomorphology for open water adjacent to the channel/in main LA River Channel

- Convert habitat type to Freshwater Emergent Wetland
- Restore all invasive species levels to 0-10%
- Remove trash and pollution KECs if applicable: 8.19.1 Chemical, 8.19.2 Sewage, 8.19.3 Water, 8.9 Refuse
- Add KECs: 4.1.2 Water Depth, 4.7.1 Riverine Wetland Characteristics, 4.6.3.2 Emergent Vegetation, 4.7.2.2 Non-Forest, 4.7.4 Marsh, 4.9 Seasonal Flooding, 8.16 Culverts, 8.24 Water Diversion Structures

Rebuild geomorphology for historic wash
Habitat corridors/Riparian planting on over banks of the main channel or tributaries
Widen channel banks
Terraces with earthen banks

- Convert habitat type to Valley Foothill Riparian
- Restore all invasive species levels to 0-10%
- Remove trash and pollution KECs if applicable: 8.19.1 Chemical, 8.19.2 Sewage, 8.19.3 Water, 8.9 Refuse
- Add KECs: 1.1.14.3.1 Seedling, 1.1.14.3.2 Sapling/Pole, 1.1.5 Moss, 1.1.6 Flowers, 1.1.7 Lichens, 1.1.8 Forbs, 1.1.13 Herbaceous Layer, 1.2.6.1.1 Small Shrub, 1.2.6.1.2 Medium Shrub, 3.2.3 Soil Moisture, 3.2.4 Soil Organic Matter

Divert tributary and river flow into side channels

- Convert habitat type to Freshwater Emergent Wetland
- Restore all invasive species levels to 0-10%
- Remove trash and pollution KECs if applicable: 8.19.1 Chemical, 8.19.2 Sewage, 8.19.3 Water, 8.9 Refuse
- Add KECs: 1.1.14.3.1 Seedling, 1.1.14.3.2 Sapling/Pole, 1.1.5 Moss, 1.1.6 Flowers, 1.1.7 Lichens, 1.1.8 Forbs, 1.1.13 Herbaceous Layer, 1.2.6.1.1 Small Shrub, 1.2.6.1.2 Medium Shrub, 3.2.3 Soil Moisture, 3.2.4 Soil Organic Matter, 8.24 Water Diversion, 4.7.1 Riverine Wetlands, 8.29 Regulated Hydrologic Regime

Restructure/vegetate LA River concrete channel walls
Terrace concrete banks/Planting built into modified channel walls

- Convert habitat type to Valley Foothill Riparian
- Restore all invasive species levels to 0-10%

- Remove trash and pollution KECs if applicable: 8.19.1 Chemical, 8.19.2 Sewage, 8.19.3 Water, 8.9 Refuse
- Add KECs: 1.1.5 Moss, 1.1.6 Flowers, 1.1.7 Lichens, 1.1.8 Forbs, 1.1.13 Herbaceous Layer, 1.2.6.1.1 Small Shrub, 1.2.6.1.2 Medium Shrub, 3.2.3 Soil Moisture, 3.2.4 Soil Organic Matter
- Apply restoration benefits to half of area (other half to remain concrete/baseline)

Establish/improve open water habitat on concrete bottom areas within the main channel of the LA River

- Convert habitat type to Open Water
- Remove trash and pollution KECs if applicable: 8.19.1 Chemical, 8.19.2 Sewage, 8.19.3 Water, 8.9 Refuse
- Add KECs: 4.1.2 Water Depth, 4.1.6 Water Velocity, 4.2.3.1 Open Water, 4.2.12 Banks

By adjusting the CHAP inputs based on the proposed restoration sub-measures, adjusting the individually unique inputs to each polygon, and calculating the CHAP matrices, per-acre HU values were generated for each polygon in each restoration alternative. KECs representing maturation of forecasted habitats (i.e. additional tree and shrub size classes, formation of downed wood and snags) were added to each polygon to predict the anticipated increased benefits of the restoration alternative at 25 and 50 years into the future. The per-acre value was then multiplied by the polygon acreage to obtain the total HUs for each polygon in each alternative.

The future with project CHAP calculations of habitat value are included in Microsoft excel spreadsheets and displayed in a GIS geodatabase. The design team's alternative mapping is also included in GIS. Due to the large volume of these spreadsheets and GIS data, the complete set of files is available upon request from the Corps, Los Angeles District. Sample figures depicting the alternative mapping and with project HUs are included in Figures 6.3.1-1 to 6.3.1-3. Summary tables are included in Table 6.3.2-1 and Appendix H, as discussed in the following Section 6.3.2.

6.3.2 Alternatives Results

By comparing the total with-project habitat value for each alternative to the baseline and without-project value, it is possible to isolate the benefits of the ecosystem restoration alternatives to fish and wildlife habitat. Table 6.3.2-1 outlines the gross and net benefits in HUs for the base year[8], 25 years with project, and 50 years with project for each of the 19 preliminary alternatives. Gross benefits are the total benefits afforded by the alternative. Net benefits are the difference in benefits between the with- and without-project value; in other words the with project value minus the without project value. Here, the net benefits describe the increase in benefits afforded by the alternative over the without-project condition. Results are also presented in terms of Gross and Net Benefits by reach for each alternative in tables in Appendix H. Figure 6.3.2-1 depicts the gross benefits for each of the 19 alternatives at the base year, 25 years with project, and 50 years with project. Note that the names associated with each

8 Base year: the year when the proposed project is expected to be operational (USACE 2000)

Figure 6.3.1-3. Sample Alternative Mapping – Alternative 1 Gross HUs

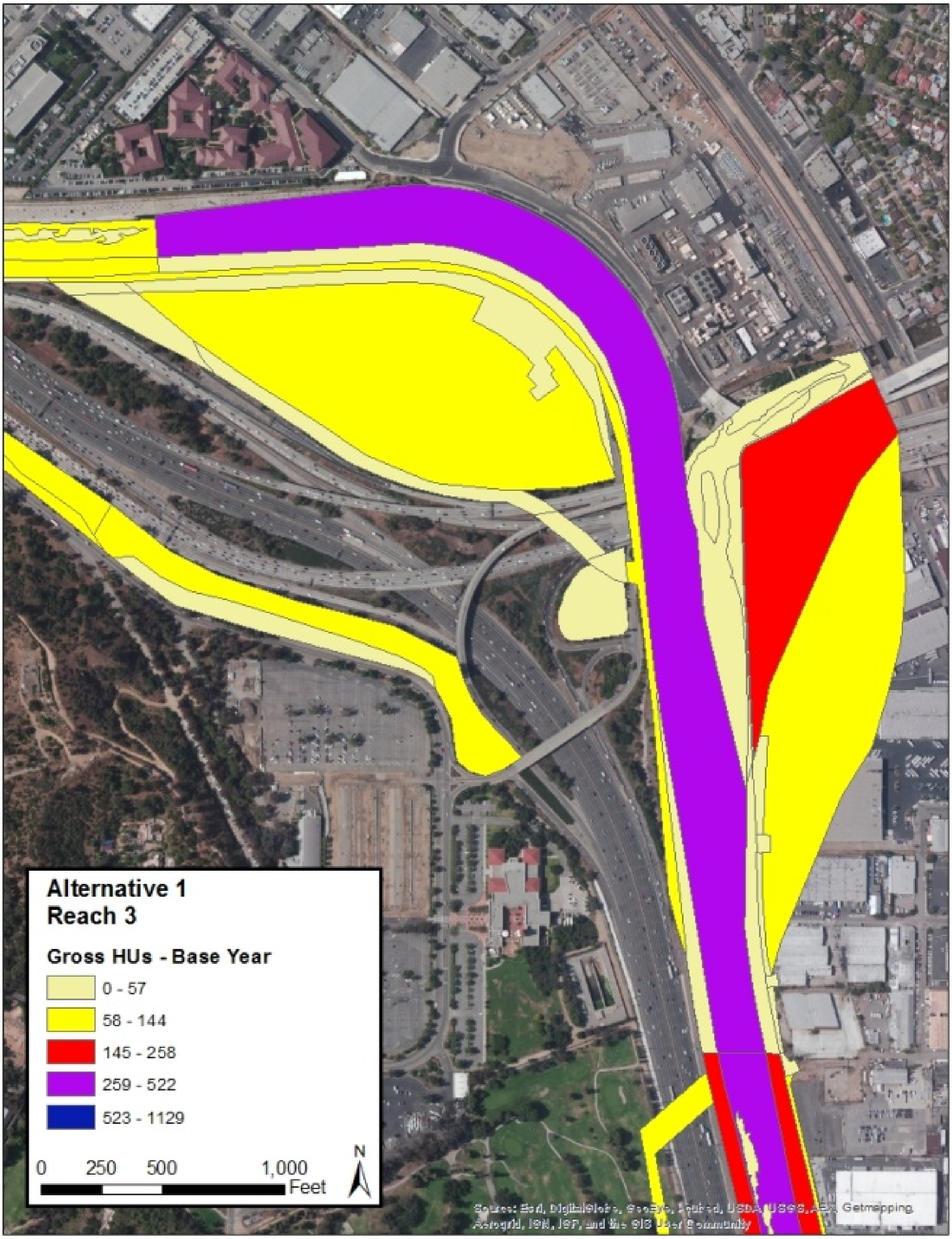


Figure 6.3.1-3. Sample Alternative Mapping – Alternative 1 Gross HUs

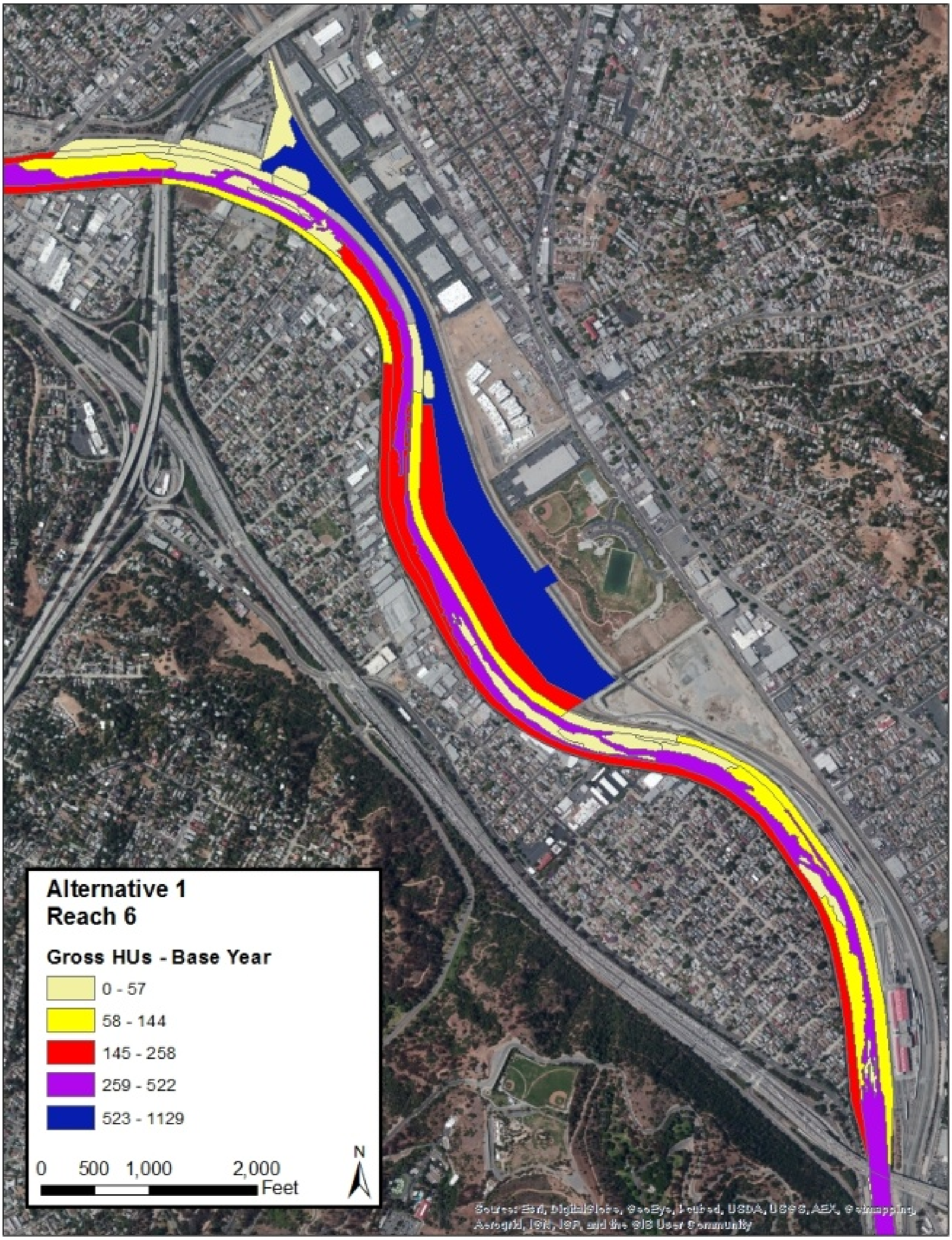


Figure 6.3.1-3. Sample Alternative Mapping – Alternative 1 Gross HUs

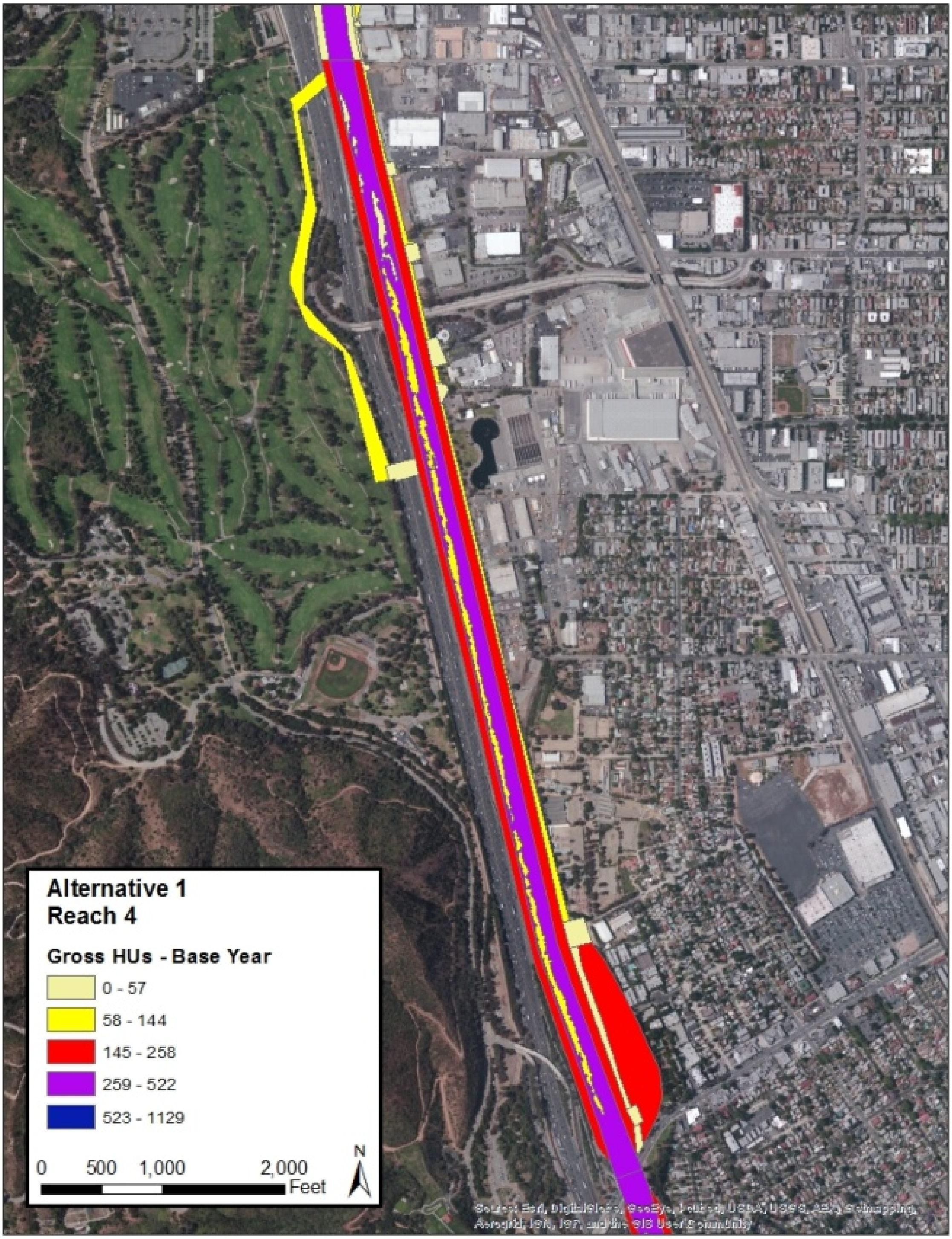


Figure 6.3.1-3. Sample Alternative Mapping – Alternative 1 Gross HUs

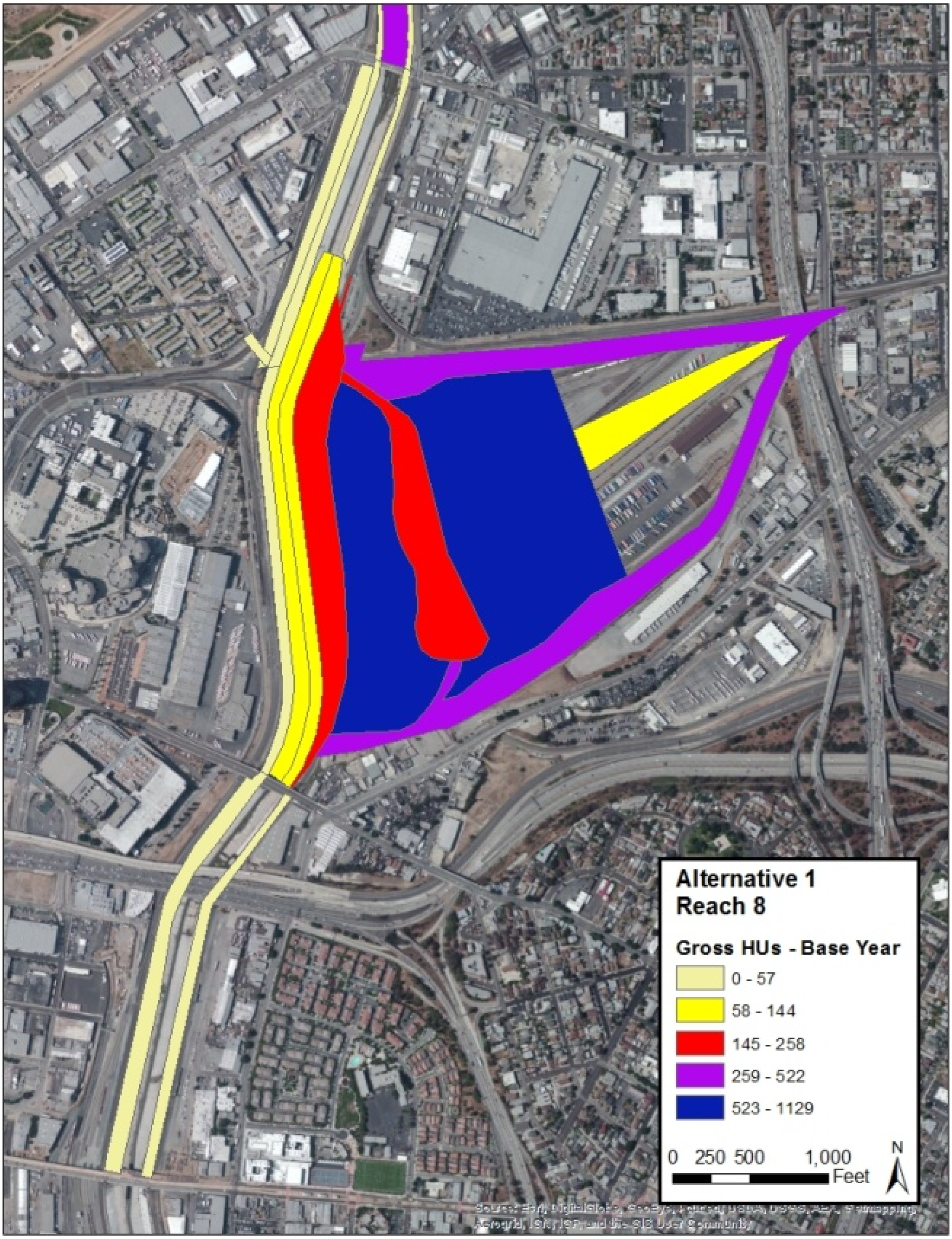


Table 6.3.2-1. Gross and Net Benefits for With Project Alternatives

	Without Project			
		Base Year	25 Year	50 Year
	Acres	Habitat Units (HUs)	Habitat Units (HUs)	Habitat Units (HUs)
Baseline	842.37	6,119.38	5,690.71	5,291.32

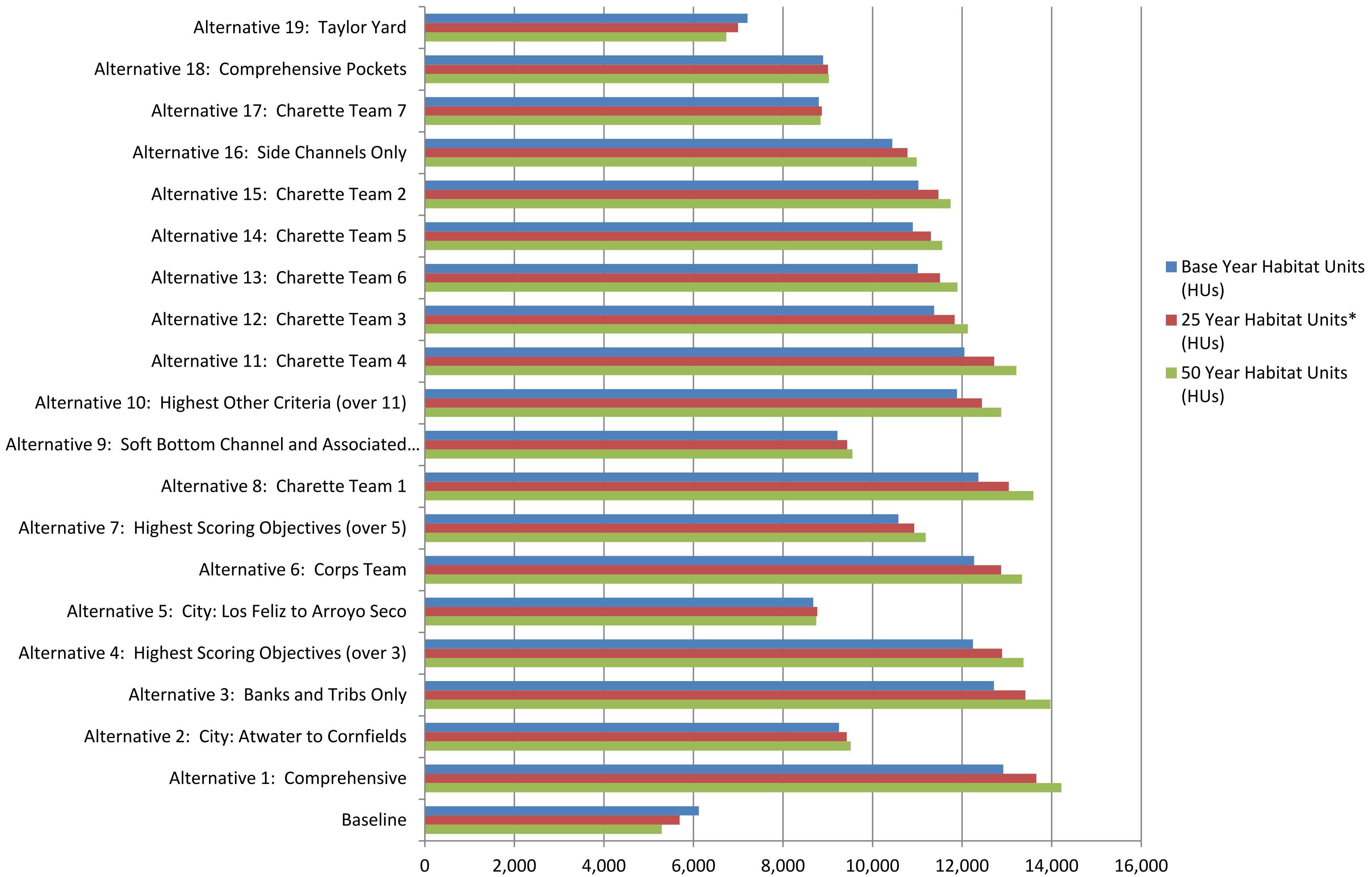
	With Project – Gross*				With Project – Net*		
		Base Year	25 Year	50 Year	Base Year	25 Year	50 Year
	Acres**	Habitat Units (HUs)***	Habitat Units (HUs)***	Habitat Units (HUs)***	Habitat Units (HUs)***	Habitat Units (HUs)***	Habitat Units (HUs)***
Alternative 1: Comprehensive	621.26	12,920.89	13,657.14	14,216.86	6,801.51	7,966.43	8,925.55
Alternative 2: City: Atwater to Cornfields	350.39	9,250.21	9,423.75	9,510.22	3,130.83	3,733.04	4,218.90
Alternative 3: Banks and Tribs Only	592.39	12,711.76	13,411.89	13,973.13	6,592.38	7,721.18	8,681.81
Alternative 4: Highest Scoring Objectives (over 3)	531.18	12,241.40	12,891.42	13,369.81	6,122.02	7,200.71	8,078.49
Alternative 5: City: Los Feliz to Arroyo Seco	285.75	8,674.95	8,766.52	8,743.87	2,555.57	3,075.81	3,452.55
Alternative 6: Corps Team	548.22	12,268.67	12,872.59	13,338.28	6,149.29	7,181.88	8,046.97
Alternative 7: Highest Scoring Objectives (over 5)	417.69	10,577.63	10,928.89	11,187.12	4,458.25	5,238.18	5,895.80
Alternative 8: Charette Team 1	596.19	12,365.07	13,042.78	13,591.57	6,245.69	7,352.07	8,300.25
Alternative 9: Soft Bottom Channel and Associated Banks	299.94	9,216.04	9,434.10	9,550.47	3,096.66	3,743.39	4,259.15
Alternative 10: Highest Other Criteria (over 11)	520.75	11,884.26	12,441.81	12,872.80	5,764.88	6,751.10	7,581.48
Alternative 11: Charette Team 4	529.43	12,050.11	12,716.92	13,210.78	5,930.73	7,026.21	7,919.46
Alternative 12: Charette Team 3	465.47	11,374.23	11,833.42	12,128.88	5,254.85	6,142.71	6,837.56
Alternative 13: Charette Team 6	520.22	11,009.62	11,504.09	11,896.13	4,890.24	5,813.38	6,604.81
Alternative 14: Charette Team 5	404.66	10,897.76	11,302.94	11,555.62	4,778.38	5,612.23	6,264.30
Alternative 15: Charette Team 2	407.04	11,022.81	11,470.26	11,742.84	4,903.43	5,779.55	6,451.52
Alternative 16: Side Channels Only	339.45	10,441.76	10,779.91	10,983.74	4,322.38	5,089.19	5,692.42
Alternative 17: Charette Team 7	236.88	8,799.73	8,865.86	8,837.49	2,680.35	3,175.15	3,546.17
Alternative 18: Comprehensive Pockets	285.38	8,895.97	9,005.18	9,023.68	2,776.59	3,314.47	3,732.36
Alternative 19: Taylor Yard	101.76	7,208.52	6,995.24	6,734.65	1,089.14	1,304.53	1,443.34

*Gross Benefits = Total Benefits afforded by an alternative; Net Benefits = With Project Value – Without Project Value

** acreage values represent acres experiencing a change in habitat value, and are not necessarily consistent with total project acreage

*** total Habitat Units (HUs) for entire 842 acre Study area

Figure 6.3.2-1. Gross Benefits (HUs) for With Project Alternatives at Base Year, 25 Years With Project, and 50 Years With Project and the Baseline Condition



of the 19 alternatives in Table 6.3.2-1 were used by the project team to more simply distinguish between alternatives. Generally, for each alternative, there is an increase in habitat value over the without project conditions.

Alternatives 5 and 17 show a decrease in gross benefit from the 25 years future with project to 50 years future with project condition. Alternative 19 shows a decrease in gross benefits from the base year to 25 years future with project to 50 years future with project. This decrease in gross benefits over time is due to the degradation of other reaches in the Study area where no restoration activity would occur. For example, in Alternative 19, restoration activity would only occur in Reach 6. The remaining 7 of the 8 reaches in the project area would have no restoration activity implemented; therefore, over time the degradation of those remaining 7 reaches would depress the HUs for the entire Study area. While gross benefits decrease over time from the base year in those cases, net benefits remain positive for all alternatives. This means that all 19 alternatives have increased benefits over the without project condition.

Figure 6.3.2-2 further depicts the net benefits as HUs per reach per alternative at the base year, 25 years with project, and 50 years with project.

As expected, the Comprehensive Alternative 1, which includes all measures implemented in all reaches, provides the greatest increase in habitat value from without project conditions (i.e. net benefit), with a 111% increase in HUs at the base year over without project conditions and a 169% increase in HUs at year 50 over without project conditions. However, even the most minimal alternative 19, which includes measures in only one reach (Reach 6/Taylor Yard), still provides an 18% increase in HUs at the base year over the without project conditions and a 27% increase in HUs after 50 years over the without project conditions. The range of increase in net benefits among all 19 alternatives can be seen in Table 6.3.2-2.

6.3.3 Economic Analysis

The results of the CHAP analysis were annualized, as described in Section 6.2.3, to inform the Corps' economic analyses, which includes a Cost Effectiveness Analysis and an Incremental Cost Analysis (CE/ICA). These analyses are used to determine which alternative plans are the most cost effective, or produce a given amount of habitat value at the lowest possible cost, and which alternative plans are the best buys, or produce the most additional habitat value for the lowest additional cost.

In performing the CE/ICA analysis, the alternatives are broken down by reach, and alternative reaches are recombined to produce the most cost effective, best buy plans. In other words, different measures are implemented in each of the 8 reaches for each of the 19 alternative plans, resulting in a total of 8 x 19 (152) alternative reaches. These 152 alternative reaches are recombined, based on the CHAP benefits (HUs) and the restoration costs, into new cost effective/best buy alternative plans, such that (for example) the measures from Reach 1 in Alternative 11 are combined with the measures from Reach 2 in Alternative 16, and the measures from Reach 3 in Alternative 1, and so on.

The original 19 alternatives are not cost effective in themselves in that the best (i.e. most cost effective) ideas for each reach could not be expected to be produced in a single alternative plan

Figure 6.3.2-2. Net Benefits (HUs) for With Project Alternatives at Base Year, 25 Years With Project, and 50 Years With Project - Showing Increase in HUs over Without Project Conditions

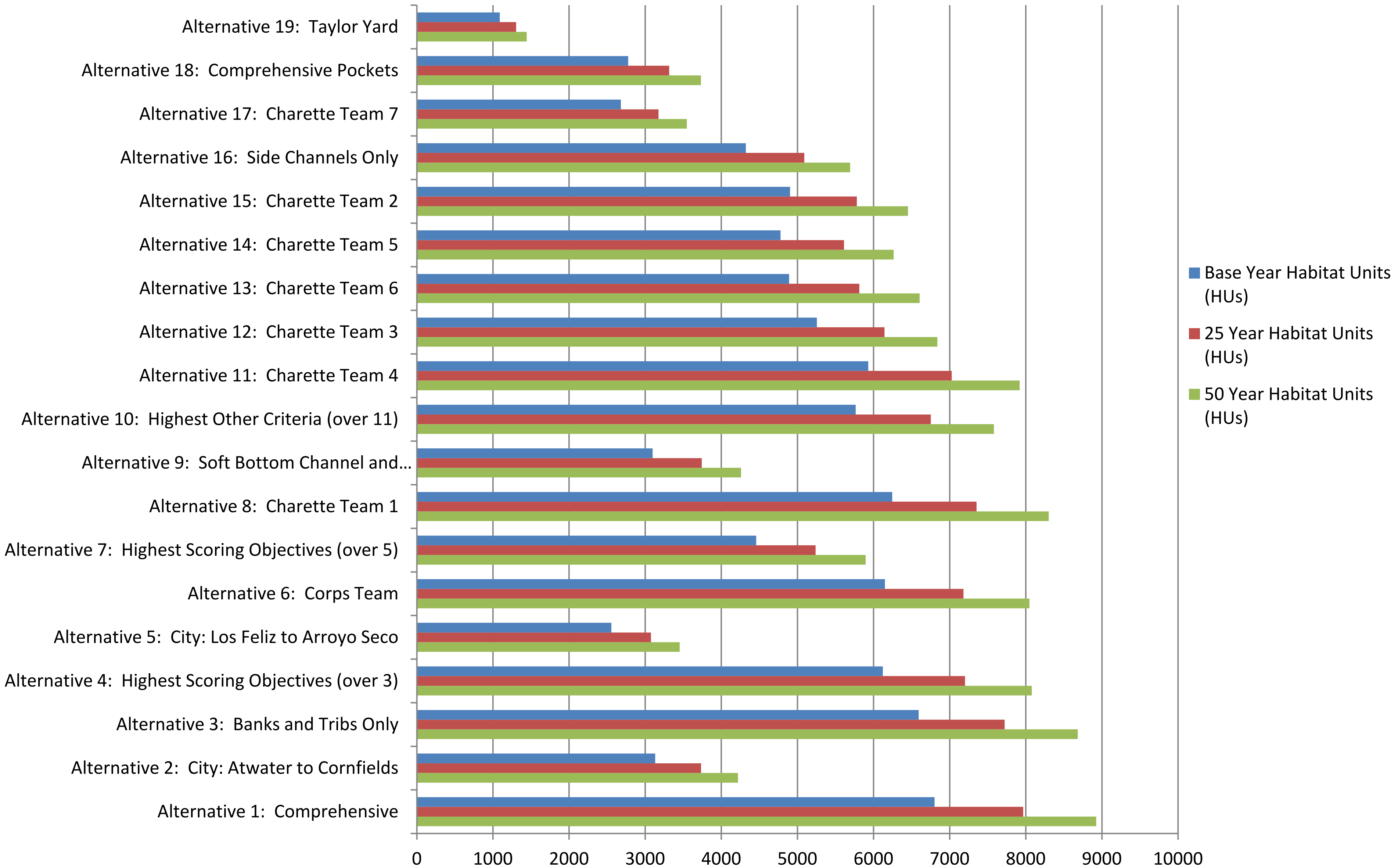


Table 6.3.2-2. Percent Increase in HUs for With Project Alternatives

	Without Project			
		Base Year	25 Year	50 Year
	Acres	Habitat Units (HUs)	Habitat Units (HUs)	Habitat Units (HUs)
Baseline	842.37	6,119.38	5,690.71	5,291.32

	With Project – Net*						
		Base Year		25 Year		50 Year	
	Acres**	Habitat Units (HUs)	% increase in HUs***	Habitat Units (HUs)	% increase in HUs***	Habitat Units (HUs)	% increase in HUs***
Alternative 1: Comprehensive	621.26	6,801.51	111%	7,966.43	140%	8,925.55	169%
Alternative 2: City: Atwater to Cornfields	350.39	3,130.83	51%	3,733.04	66%	4,218.90	80%
Alternative 3: Banks and Tribs Only	592.39	6,592.38	108%	7,721.18	136%	8,681.81	164%
Alternative 4: Highest Scoring Objectives (over 3)	531.18	6,122.02	100%	7,200.71	127%	8,078.49	153%
Alternative 5: City: Los Feliz to Arroyo Seco	285.75	2,555.57	42%	3,075.81	54%	3,452.55	65%
Alternative 6: Corps Team	548.22	6,149.29	100%	7,181.88	126%	8,046.97	152%
Alternative 7: Highest Scoring Objectives (over 5)	417.69	4,458.25	73%	5,238.18	92%	5,895.80	111%
Alternative 8: Charette Team 1	596.19	6,245.69	102%	7,352.07	129%	8,300.25	157%
Alternative 9: Soft Bottom Channel and Associated Banks	299.94	3,096.66	51%	3,743.39	66%	4,259.15	80%
Alternative 10: Highest Other Criteria (over 11)	520.75	5,764.88	94%	6,751.10	119%	7,581.48	143%
Alternative 11: Charette Team 4	529.43	5,930.73	97%	7,026.21	123%	7,919.46	150%
Alternative 12: Charette Team 3	465.47	5,254.85	86%	6,142.71	108%	6,837.56	129%
Alternative 13: Charette Team 6	520.22	4,890.24	80%	5,813.38	102%	6,604.81	125%
Alternative 14: Charette Team 5	404.66	4,778.38	78%	5,612.23	99%	6,264.30	118%
Alternative 15: Charette Team 2	407.04	4,903.43	80%	5,779.55	102%	6,451.52	122%
Alternative 16: Side Channels Only	339.45	4,322.38	71%	5,089.19	89%	5,692.42	108%
Alternative 17: Charette Team 7	236.88	2,680.35	44%	3,175.15	56%	3,546.17	67%
Alternative 18: Comprehensive Pockets	285.38	2,776.59	45%	3,314.47	58%	3,732.36	71%
Alternative 19: Taylor Yard	101.76	1,089.14	18%	1,304.53	23%	1,443.34	27%

*Net Benefits = With Project Value – Without Project Value

** acreage values represent acres experiencing a change in habitat value, and are not necessarily consistent with total project acreage

*** % increase in HUs over the without project condition during formulation. The determination of cost effectiveness is only made with detailed economic analysis. With the recombinations, therefore, the most cost effective ideas from each of the original 19 alternatives are combined into various new cost effective alternative plans. The final array of 4 of these new plans were chosen to be carried forward for further analysis in the Feasibility Study. The final array of 4 alternatives is described in detail in Section 4.14 of the Main Feasibility Report.

For additional detail on the CE/ICA analysis and the recombined cost effective alternative plans, see the Economic Appendix B in the Main Feasibility Report. For additional detail on the choice of alternative plans for the Final Array, see Section 4. of the Main Feasibility Report.

7.0 OTHER BENEFITS NOT CAPTURED IN CHAP

7.1 CONNECTIVITY

The CHAP analysis accounts for benefits provided by restored ecosystem functions, habitats, and species. There are, however, other types of benefits afforded by the restoration alternatives, including restoration of natural hydrology, that influences and supports restoration of biological systems. Restoration of movement corridors for wildlife is another benefit of restoration. Both hydrologic and wildlife connectivity has been lost since urbanization of the Study area and the channelization of the LA River in the early 20th century.

These benefits were considered in addition to the CHAP benefits to evaluate and compare the final array of alternatives, as described in Section 6.6 of the Main Feasibility Report.

7.1.1 Hydrologic and Hydraulic Connectivity - Reconnection of River to Floodplain

Hydrologic connections may be made naturally, by widening the river channel, removing artificial barriers, and allowing the river to naturally meander and reshape the adjacent floodplain area. Natural connections also support natural ecological processes such as exchange of sediment, nutrients, and energy between the river and floodplain. Connections may also be made artificially to support habitat, using river water to feed overbank sites via pipes, culverts, or pumps. Artificial connections are valuable to establish habitat, but are less capable of supporting other ecosystem processes and exchanges.

Maintaining ecological and evolutionary processes includes natural disturbance regimes, hydrologic processes, nutrient recycling and biotic interactions (EPA 1999). This benefit can only be achieved with reconnection of the river to its floodplain. This will protect the integrity of the ecosystem and increase sustainability. Biogeochemical interactions between the river and terrestrial sources are not as vital to riparian systems as overbank flow from floodplain connections (Hein 2003).

Floodplain connectivity also benefits restoration of fish habitat. Floodplain habitats provide critical spawning and rearing habitats for many large-river fishes. The standard that floodplains are essential habitats is often a key reason for restoring altered rivers to natural flow regimes (Burgess 2012).

Removal of concrete and widening restores ecosystem processes such as natural disturbance, hydrology, nutrient cycling, biotic interactions, population dynamics, and evolution, which determine the species composition, habitat structure, and ecological health of an ecosystem (EPA 1999). Channel widening would allow the river to connect to the overbank, which restores a dynamic floodplain and supports diverse riparian and in stream habitat for plants and wildlife.

7.1.2 Wildlife Connectivity

River channels in arid and semi-arid regions provide important wildlife movement corridors because they support continuous chains of vegetation that wildlife can use for cover and food (which may not be supported in drier upland habitats). These river corridors naturally guide wildlife movement, both daily and generationally, which is essential to species survival (Levick et al. 2008).

The remaining fragments of habitat in the urban landscape (or habitat “nodes”) benefit the integrity of the larger ecosystem by supporting metapopulations (assemblages of local populations connected by migration) (Hanski & Gilpin 1991). By increasing patches and reducing the distances between them, colonization among populations improves (Hanski & Thomas 1994). Metapopulations depend on seed dispersal and wildlife movements to persist, and such dispersal is in turn dependent on the connectivity of the landscape (Schippers et al 1996).

Nodes may be larger or smaller. Large habitat nodes support colonization of wildlife in the smaller nodes, while smaller nodes act as peripheral refuge habitat (Rudd et al. 2002). Large nodes tend to have high biodiversity and provide important breeding and seeding habitat for interior species, as well as edge species and transients. Smaller nodes are partly or entirely dependent on individuals immigrating from the larger nodes as they have a higher rate of extinction and therefore need to be repopulated constantly (Hansson 1991; van Apeldoorn et al. 1992). Smaller nodes (those under 250 acres) may not be able to support large numbers of species on their own but are able to provide important peripheral habitat to species in the larger nodes (Hansson 1991).

Generally, nodes have a greater overall interaction when they are larger and closer together (Linehan et al 1995). Well connected systems prevent inbreeding depression and disease, and have a lower extinction rate as populations can more easily colonize if they are highly connected (Noss 1983; Schippers et al 1996). Without connections between habitat areas, isolation and loss of genetic diversity is imminent (Hobbs & Saunders 1990).

In order to benefit the biological integrity of a landscape, corridors should be restored to allow for dispersal between habitat areas. More corridors equal more routes to suitable habitat, creating more opportunities for dispersal. A complex network of nodes and corridors is therefore critical to restoration in an urban environment, as suitable habitat often remains unused if isolated (Hanski & Thomas 1994).

Restoring connectivity for wildlife and movement between patches of habitat provides several benefits including reconnecting genetically isolated populations of species and preventing inbreeding depression, providing necessary interactions between predators and prey to control population size and providing a healthy ecosystem balance, and connecting individual wildlife to required resources that may not be present within one isolated area.

7.2 ECONOMIC

Other benefits include installation of recreational features and regional economic development (RED) benefits. RED benefits may include increases in employment and regional income/gross regional product (GRP) resulting from the project. Benefits may also include other social effects that have value that were not explicitly valued in monetary terms, such as increases in "community cohesion" or carbon offsets from the installation of carbon sequestering vegetation.

These benefits are accounted for in the narrative of the Main Feasibility Report in Section 6.6.

8.0 CHAP HABITAT EVALUATION TEAM

8.1 PARTICIPANTS

The CHAP Habitat Evaluation Team consisted of the following representatives from the USACE environmental and plan formulation branches, City of Los Angeles Bureau of Engineering (BOE), Northwest Habitat Institute (NHI), U.S. Fish and Wildlife Service (USFWS), Regional Water Quality Control Board (RWQCB), California Department of Fish and Game (CDFG), and U.C. Cooperative Extension. The CHAP analysis team members based their evaluation on expertise in local ecology, plants and wildlife, study objectives, and field visits to the project site. The team members are listed below:

- Erin Jones, Biologist, U.S. Army Corps of Engineers, Planning Division
- Kathleen Bergmann, Study Manager, U.S. Army Corps of Engineers, Planning Division
- Larry Hsu, City of Los Angeles, formerly Bureau of Engineering
- Tom O'Neil, Northwest Habitat Institute
- Andy Hackethorn, Northwest Habitat Institute
- Scott Estergard, Tetra Tech
- Peter Beck, U.S. Fish and Wildlife Service
- Shirley Birosik, Regional Water Quality Control Board, Los Angeles Region
- Scott Harris, California Department of Fish and Game
- Sabrina Drill, U.C. Cooperative Extension, Los Angeles County

8.2 MEETINGS

Habitat evaluation team meetings were held at the Corps' Los Angeles District Office to discuss baseline existing conditions, baseline future without project conditions, and future with project conditions. Meetings were held on January 7, 2010; April 21, 2010; and November 3, 2011.

9.0 CONCLUSION

The CHAP analysis is a habitat assessment tool that evaluates habitats, functions, and species to quantify habitat value. For the LA River ER Feasibility Study, CHAP was used to quantify the value, or benefits, of various restoration alternatives in terms of Habitat Units (HUs) in order to compare alternative plans. Habitat value was calculated for baseline conditions including the future without project conditions at 25 and 50 years into the future. Habitat value was also calculated for the 19 restoration alternatives developed during the plan formulation process.

The benefits of each restoration alternative were used with project costs to inform the economic cost effectiveness and incremental cost analysis. This analysis recombined the 8 reaches among the 19 alternatives, resulting in an array of new cost effective alternative plans. The final array of 4 of these new plans was chosen to be carried forward for further analysis in the Feasibility Study.

Additional benefits not captured in CHAP were used to evaluate and compare the final array of alternatives. These benefits include hydrologic connectivity to support biotic and abiotic functions, and nodal connectivity to support wildlife movement and dispersal. An assessment of these benefits is applied outside of the CHAP analysis as part of the environmental impact analysis.

10.0 REFERENCES

Ashley, P. 2010. *LA River CHAP Verification Transect Report*. April 11, 15 pp.

Becker, S. and Sweet, A. *Crosswalk Between WHR and California Vegetation Classifications*. Available as PDF at http://www.dfg.ca.gov/biogeodata/cwhr/wildlife_habitats.asp

Breaux, A., S. Cochrane, J. Evens, M. Martindale, B. Pavlik, L. Suer, and D. Benner. 2005. *Wetland ecological and compliance assessments in the San Francisco Bay Region, California, USA*. Journal of Environmental Management, 74:217-237.

Burgess, O.T, W.E. Pine III, S.J. Walsh. 2012. *Importance of Floodplain Connectivity to Fish Populations in the Apalachicola River, Florida*. Article first published online: 9 MAR 2012, DOI: 10.1002/rra.2567, John Wiley & Sons, Ltd.

City of Los Angeles, Department of Public Works, Bureau of Engineering. 2007. *Los Angeles River Revitalization Master Plan*.

Cooper, D. and P. Mathewson. 2008. *Griffith Park Wildlife Management Plan –Draft. For City of Los Angeles*. Cooper Ecological Monitoring, Inc. Los Angeles, CA pp.88

Dwire, Kathleen A., and J. Boone Kauffman, 2003. *Fire and riparian ecosystems in landscapes of the western USA*. In: Young, Michael K.; Gresswell, Robert E.; Luce, Charles H., guest eds. Selected papers from an international symposium on effects of wildland fire on aquatic ecosystems in the western USA; 2002 April 22-24; Boise, ID. In: Forest Ecology and Management. Special Issue: The effects of wildland fire on aquatic ecosystems in the western USA. New York: Elsevier Science B. V; 178(1-2): 61-74. [44923]

Friends of the Los Angeles River. 2008. *State of the River – The Fish Study*. Los Angeles, CA. pp. 38.

Garrett, K. 1993. *The biota of the Los Angeles River ~ an overview of the historical and present plant and animal life of the Los Angeles River drainage*. Natural History Museum of Los Angeles County Foundation. For California Dept. of Fish and Game, contract no. FG 0541. March. pp. 352.

Gumprecht, B. 2001. *The Los Angeles River: Its Life, Death, and Possible Rebirth*. Johns Hopkins University Press. 369 pp.

Hanski, I., and M. Gilpin. 1991. *Metapopulation dynamics: brief history and conceptual domain*. Biological Journal of the Linnean Society 42: 3–16.

Hanski, I., and C. D. Thomas. 1994. *Metapopulation dynamics and conservation: a spatially explicit model applied to butterflies*. Biological Conservation 68: 167–180.

Hansson, L. 1991. *Dispersal and connectivity in metapopulations*. Biological Journal of the Linnean Society 42: 89–103.

Hein, T., Baranyi, C., Herndl, G. J., Wanek, W., & Schiemer, F. 2003. *Allochthonous and autochthonous particulate organic matter in floodplains of the River Danube: the importance of hydrological connectivity*. Freshwater Biology, 48(2), 220-232.

Hobbs, R. J., and D. A. Saunders. 1990. *Nature conservation: the role of corridors*. Ambio 19: 94–95.

Holland, R.F. 1986. *Preliminary Descriptions of the Terrestrial Natural Communities of California*. California Department of Fish and Game. October.

Johnson, D. H., and T.A. O'Neil, (managing directors). 2001. *Wildlife-Habitat Relationships in Oregon and Washington*. Oregon State University Press, Corvallis, OR. pp. 736

Levick, L., J. Fonseca, D. Goodrich, M. Hernandez, D. Semmens, J. Stromberg, R. Leidy, M. Scianni, D. P. Guertin, M. Tluczek, and W. Kepner. 2008. *The Ecological and Hydrological Significance of Ephemeral and Intermittent Streams in the Arid and Semi-arid American Southwest*. U.S. Environmental Protection Agency and USDA/ARS Southwest Watershed Research Center, EPA/600/R-08/134, ARS/233046, 116 pp.

Linehan, J., M. Gross, and J. Finn. 1995. *Greenway planning: developing a landscape ecological network approach*. Landscape and Urban Planning 33: 179–193

Mayer, K.E. and Laudenslayer, W.F. 1988. *A Guide to Wildlife Habitats of California*. State of California, Resources Agency, Department of Fish and Game. Sacramento, CA. 166 pp.

Northwest Habitat Institute (NHI). 2007. *HAB Primer: An Introduction to the Habitat Appraisal and barter (HAB) Method for Fish & Wildlife Habitat Assessment*. March 21.

Noss, R. F. 1983. *A regional landscape approach to maintain diversity*. BioScience 33: 700–706.

O'Neil, T., 2005. *A multi-value habitat evaluation procedure for fish and wildlife*. Northwestern Naturalist, 86(2): 111.

O'Neil, T., B.G. Marcot, and P. Paquet. 2005. *The habitat-species-function triad: a planning framework for ecoprovinces and subbasins*. Northwestern Naturalist, 86(2): 111.

Perkins, J.P. 2002. *Like a cool drink of water*. Conservation Biology, 16(3):852-853. June.

Rudd, H., J. Vala, and V. Schaefer. 2002. *Importance of Backyard Habitat in a Comprehensive Biodiversity Conservation Strategy: A Connectivity Analysis of Urban Green Spaces*. Restoration Ecology, 10(2): 368-375.

Sawyer, J.O., Keeler-Wolf, T., Evens, J.M. 2009. *A Manual of California Vegetation, 2nd Edition*. California Native Plant Society Press. Sacramento, California.

Schippers, P., J. Verboom, J. P. Knaapen, and R. C. van Apeldoorn. 1996. *Dispersal and habitat connectivity in complex heterogeneous landscapes: an analysis with a GIS-based random walk model*. Ecography 19: 97–106.

Store, R., and J. Jokimäki. 2003. *A GIS-based multi-scale approach to habitat suitability modeling*. Ecological Modelling, 169:1-15.

Toppozada, T.R. and D. Branum. 2002. *California M ≥ 5.5 earthquakes, history and areas damaged*. in International Handbook of Earthquake and Engineering Seismology, edited by W.H. LEE, H. KANAMORI and P. JENNINGS (International Association of Seismology and Physics of the Earth's Interior). February 1, 2012

U.S. Army Corps of Engineers (USACE). 1996. *Planning Manual*. Water Resources Support Center, Institute for Water Resources. IWR Report 96-R-21. Charles E. Yoe, Ph.D. and Kenneth D. Orth. November.

USACE. 1999. *Pamphlet No. 1165-2-502 30 September 1999, Water Resources Policies and Authorities Ecosystem Restoration Supporting Policy Information*.

USACE. 2000. *Planning Guidance Notebook Engineering Regulation (ER) 1105-2-100*. April 22.

USACE. 2007. *Draft Integrated Future Without Project Conditions and Baseline Environmental Conditions Report, Los Angeles River - ER Feasibility Study*. November, pp.154.

U.S. Environmental Protection Agency (EPA). 1999. Considering Ecological Processes in Environmental Impact Assessments. Office of Federal Activities. July.

U.S. Forest Service (USFS). 2009. *Vegetation Descriptions: South Coast and Montane Ecological Province, CALVEG Zone 7*. March 30. Available at: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_045405.pdf

van Apeldoorn, R. C., W. T. Oostenbrink, A. van Winden, and F. F. van der Zee. 1992. *Effects of habitat fragmentation on the bank vole, Clethrionomys glareolus, in an agricultural landscape*. Oikos 65: 265–274.

CHAP Appendix
Appendix A
Master List Key Ecological Correlates (KECs)

KEC #	KEC Name	KEC Definition
1.1.1	down wood	Includes downed logs, branches, and rootwads, in a forested context.
1.1.1.1	decay class	System by which down wood is classified based on its deterioration.
1.1.1.1.1	hard [class 1,2]	Little wood decay evident; bark and branches present; log resting on branches, not fully in contact with ground; includes classes 1 and 2 as described in Thomas (1979).
1.1.1.1.2	moderate [class 3]	Moderate decay present; some branches and bark missing or loose; most of log in contact with ground; includes class 3 as describedin Thomas (1979).
1.1.1.1.3	soft [class 4, 5]	Well decayed logs; bark and branches missing; fully in contact with ground; includes classes 4 and 5 as described in Thomas (1979).
1.1.1.2	down wood in riparian areas	Includes down wood in the terrestrial portion of riparion zones in forest habitats. Does not refer to in-stream woody debris.
1.1.1.3	down wood in upland areas	Includes downed wood in upland areas of forest habitats.
1.1.1.4	size of down wood	Count all down wood >/= 6 feet long.
1.1.1.4.1	small	</= 5 inches large end diameter
1.1.1.4.2	medium	>5 to <20 inches large end diameter
1.1.1.4.3	large	>/= 20 inches large end diameter
1.1.2	litter	The upper layer of loose, oreganic (primarily vegetative) debris on the forest floor. Decomposition may have begun, but components still recognizable.
1.1.3	duff	The matted layer of organic debris beneath the litter layer. Decomposition more advanced than in litter layer; intergrades with uppermost humus layer of soil.
1.1.4	shrub layer	Refers to the shrub strata within forest stands.
1.1.4.1	shrub size	Refers to shrub height. Select all categories present within the map unit.
1.1.4.1.1	small shrubs	< 20 inches
1.1.4.1.2	medium shrubs	20 inches - 6.5 feet
1.1.4.1.3	large shrubs	6.6 feet - 16.5 feet
1.1.4.2	percent shrub canopy cover	Percent of ground covered by vertical projection of shrub crown diamter.
1.1.4.3	shrub canopy layers	Within a shrub community, differences in shrub height and growth-form produce multi-layered shrub canopies in the forest understory.
1.1.5	moss	Large group of nonvascular green plants without flowers but with small leafy stems growing in clumps.
1.1.6	flowers	A modified plant branch for the production of seeds and bearing leaves specialized into floral organs.
1.1.7	lichens	Any of a various complex of lower plants made up of an alga and a fungus growing as a unit on a solid surface.
1.1.8	forbs	Borad-leaved herbaceous plants. Does not include: grasses, sedges or rushes.
1.1.9	cactus	Any of a large group of drought-resistant plants with fleshy, ususally jointed stems and leaves replaced by scales or prickles.
1.1.10	fungi	Mushrooms, molds, yeasts, rusts, etc.
1.1.11	roots, tubers, underground plant parts	Any underground part of a plant that functions in nutrient absorbtion, aeration, storage, reproduction and/or anchorage.
1.1.12	ferns	Any of a group of flowerless, seedless vascular green plants.
1.1.13	herbaceous layer	Understory non-woody vegetation layer beneath shrub layer (forest context). May include forbs, grasses, and ferns.
1.1.14	trees	Includes both coniferous and hardwood species.
1.1.14.1	snags	Standing dead trees.
1.1.14.1.1	decay class	System by which snags are classified based on their deterioration.
1.1.14.1.1.1	hard [class 1, 2]	Little wood decay evident; bark, branches, top, present; recently dead; includes class 1 as described in Brown
1.1.14.1.1.2	moderate [class 3]	Moderately decayed wood; some branches and bark missing and/or loose; top broken; includes classes 2 and 3 as describe din Brown (1985).
1.1.14.1.1.3	soft [class 4, 5]	Well-decayed wood; bark and branches generally absent; top broken; includes classes 4 and 5 as described in Brown (1985).
1.1.14.2	snag size (dbh)	Measured in diameter at breast height (dbh), the standard measurement for standing trees taken at 4.5 feet above the ground.
1.1.14.2.1	seedling	< 1 inch
1.1.14.2.2	sapling/pole	1 - 9 inches
1.1.14.2.3	small tree	10 - 14 inches
1.1.14.2.4	medium tree	15 - 19 inches
1.1.14.2.5	large tree	20 - 29 inches
1.1.14.2.6	giant tree	>= 30 inches
1.1.14.3	tree size (dbh)	Measured in diameter at breast height (dbh), the standard measurement for standing trees taken at 4.5 feet above the ground.
1.1.14.3.1	seedling	< 1 inch
1.1.14.3.2	sapling/pole	1 - 9 inches
1.1.14.3.3	small tree	10 - 14 inches
1.1.14.3.4	medium tree	15 - 19 inches
1.1.14.3.5	large tree	20 - 29 inches
1.1.14.3.6	giant tree	>= 30 inches
1.1.14.4	mistletoe brooms/witches brooms	Dense masses of deformed branches caused by any type of broom-forming parasite (fungal or plant).
1.1.14.5	dead parts of live tree	Portions of live trees with rot; can include broken tops; branches with decay; tree base with rot.
1.1.14.6	hollow living trees (chimney trees)	Tree bole with large hollow chambers.
1.1.14.7	tree cavities	Smaller chamber in a tree; can be in bole, limbs, or forks of live or dead trees. May be excavated or result from decay or damage.
1.1.14.8	bark	Includes crevices/fissures, loose or exfoliating bark.
1.1.14.9	live remnant/legacy trees	A live mature or old-growth tree remaining from the previous stand. Context is remnant trees in recently harvested or burned stands up through young forested stands. See dead parts of live trees, hollow living trees, tree cavities, an bark to see which species benefit from remnant trees with these attributes.
1.1.14.10	large live tree branches	Large branches often growing horizontally out from the tree bole.
1.1.14.11	tree canopy layer	Referes to the strata occupied by tree crowns.
1.1.14.11.1	sub-canopy	The space below the predominant tree crowns.
1.1.14.11.2	above canopy	The space above the predominant tree crowns.
1.1.14.11.3	tree bole	The tree trunk.
1.1.14.11.4	canopy	The more or less continuous cover of branches and foliage formed collectively by the crowns of adjacent trees and other woodly growth.
1.1.15	fruits/seeds/nuts	Plant reproductive bodies that are used by animals.
1.1.16	edges	The place where plant communities meet or where successive stages or vegetative conditions within plant communitites come together; an edge between 2 different habitat types; only record this one time (i.e. don't record for both of the habitat types).

1.2	Shrubland/Grassland Vegetative Elements or Substrates	Biotic components found within a shrubland or grassland context. Positive influences only.
1.2.1	herbaceous layer	Zone of understory non-woody vegetation beneath shrub layer (non-forest context). May include forbs, grasses.
1.2.2	fruits/seeds/nuts	Plant reproductive bodies that are used by animals.
1.2.3	moss	Large group of nonvascular green plants without flowers but with small leafy stems growing in clumps; record moss found in trees, shrubs, etc.; do NOT record moss found on soil surface (this is recorded in KEC 1.2.11).
1.2.4	cactus	Any of a large group of drought-resistant plants with fleshy, usually jointed stems and leaves replaced by scales or prickles.
1.2.5	flowers	A modified plant branch for the production of seeds and bearing leaves specialized into floral organs.
1.2.6	shrubs	Plant with persistent woody stems and less than 16 feet tall; usually produces several basal shoots as opposed to a single bole.
1.2.6.1	shrub size	Refers to height.
1.2.6.1.1	small	< 20 inches
1.2.6.1.2	medium	20 inches - 6.5 feet
1.2.6.1.3	large	6.6 feet - 16.5 feet
1.2.6.2	percent shrub canopy cover	Percent of ground covered by vertical projection of shrub crown diameter.
1.2.6.2.1	<5%	
1.2.6.2.2	21-35%	
1.2.6.2.3	36-50%	
1.2.6.2.4	>50%	
1.2.6.3	shrub canopy layer	Within a shrub community, differences in shrub height and growth form produce multi-layered shrub canopies.
1.2.6.3.1	sub-canopy	The space below the predominant shrub crowns.
1.2.6.3.2	above canopy	The space above the predominant shrub crowns.
1.2.7	fungi	Mushrooms, molds, yeasts, rusts, etc.
1.2.8	forbs	Broad-leaved herbaceous plants. Does not include: grasses, sedges or rushes.
1.2.9	bulbs/tubers	Any underground part of a plant that functions in nutrient absorbtion, aeration, storage, reproduction and/or
1.2.10	grasses	Members of the Poaceae (Graminae) family.
1.2.11	cryptogamic crusts	Non-vascular plants that grow on the soil surface. Primarily lichens, mosses and algae. Often found in arid or semi-arid regions. May form soil surface "pinnacles".
1.2.12	trees (located in a shrubland/grassland context)	Small groups of trees or isolated individuals.
1.2.12.1	snags	Standing dead trees.
1.2.12.1.1	decay class	System by which snags are classified based on their deterioration.
1.2.12.1.1.1	hard	Little wood decay evident; bark, branches, top, present; recently dead; includes class 1 as described in Brown
1.2.12.1.1.2	moderate	Moderately decayed wood; some branches and bark missing and/or loose; top broken; includes classes 2 and 3 as describe din Brown (1985).
1.2.12.1.1.3	soft	Well-decayed wood; bark and branches generally absent; top broken; includes classes 4 and 5 as described in Brown (1985).
1.2.12.2	snag size (dbh)	Measured in diameter at breast height (dbh), the standard measurement for standing trees taken at 4.5 feet above the ground.
1.2.12.2.1	seedling	< 1 inch
1.2.12.2.2	sapling/pole	1 - 9 inches
1.2.12.2.3	small tree	10 - 14 inches
1.2.12.2.4	medium tree	15 - 19 inches
1.2.12.2.5	large tree	20 - 29 inches
1.2.12.2.6	giant tree	>= 30 inches
1.2.12.3	tree size (dbh)	Measured in diameter at breast height (dbh), the standard measurement for standing trees taken at 4.5 feet above the ground.
1.2.12.3.1	seedling	< 1 inch
1.2.12.3.2	sapling/pole	1 - 9 inches
1.2.12.3.3	small tree	10 - 14 inches
1.2.12.3.4	medium tree	15 - 19 inches
1.2.12.3.5	large tree	20 - 29 inches
1.2.12.3.6	giant tree	>= 30 inches
1.2.13	edges	The place where plant communities meet or where successive stages or vegetative conditions within plant communitites come together.
2.0	Influences by Other Organisms	Selected interspecies relationships within the biotic community. Both positive and negative influences.
2.1	exotic species	When checked, these KECs refer to the relationship between an exotic species and the species queried by the user. This relationship may be positive or negative, and the user should refer to the comments section for further information. Exotic species are defined as any non-native plant or animal, including cats, dogs, and cattle.
2.1.1	exotic plants	This field refers to the relationship between an exotic plant species and the animal species queried by the user. This relationship may be positive or negative, and the user should refer to the comments section for further information. If no specific species of interest is known, only check if exotic plant presence is obvious and list the
2.1.2	exotic animals	This field refers to the relationship between an exotic animal species and the animal species queried by the user. This relationship may be positive or negative, and the user should refer to the comments section for further information. If applicable, the user will also find clarification of how the species queried is affected by the exotic species in HE subcategories 2.1.2.1 - 2.1.2.3. If no specific species of interest is known, only check if exotic animal presence is obvious and list the species.
2.1.2.1	predation	The species queried is preyed upon by or preys upon an exotic species. If no specific species of interest is known, only check if exotic animal predation is obvious and list the species.
2.1.2.2	direct displacement	The species queried is physically displaced by an exotic species, either by competition or actual disturbance. If no specific species of interest is known, only check if direct displacement by an exotic animal is obvious and list the species.
2.1.2.3	habitat structure change	The species queried is affected by habitat structural changes caused by an exotic species, for example, cattle grazing. If no specific species of interest is known, only check if habitat structure changes by exotic animals are obvious and list the species.
2.1.2.4	other	Any other effects of an exotic species on a native species (not used by panelists).
2.2	insect population irruptions	The queried species directly benefits from insect population eruptions (i.e., benefits from the insects themselves, not the resulting tree mortality or loss of foliage).
2.2.1	mountain pine beetle	The queried species directly benefits from Mountain Pine Beetle eruptions.
2.2.2	spruce budworm	The queried species directly benefits from Spruce Budworm eruptions.
2.2.3	douglas-fir tussock moth	The queried species directly benefits from Douglas-fir Tussock Moth eruptions (not used by panelists).
2.2.4	other	

2.3	beaver/muskrat activity (dams, lodges, ponds)	The results of beaver activity including dams, lodges, and ponds, that are beneficial to other species.
2.4	burrows (aquatic or terrestrial)	Aquatic or terrestrial cavities produced by burrowing animals that are beneficial to other species.
2.5	pathogens	Fish pathogens
3.0	Non-Vegetative, Abiotic Habitat Elements	Non-living components found within any ecosystem. Primarily positive influences with a few exceptions as indicated.
3.1	rocks	Solid mineral deposits.
3.1.1	gravel	Particle size from 0.1-3.0-inches diameter; gravel bars associated with streams and rivers are a separate category.
3.1.2	talus	Accumulations of rocks at the base of cliffs or steep slopes; rock/boulder sizes varied and determine what species can inhabit the spaces between them.
3.1.3	talus-like habitats	Refers to areas that contain many rocks and boulders but are not associated with cliffs or steep slopes.
3.2	soils	Various soil characteristics.
3.2.1	soil depth	Enter the distance from the top layer of the soil to the bedrock or hardpan below, measured in feet. Note, only complete this field if you are actually sampling soil depth.
3.2.2	soil temperature	Enter the measure of soil temperature or range of temperatures that are key to the queried species, measured in degrees F. Note, only complete this field if you are actually sampling soil temperature.
3.2.3	soil moisture	Enter the amount of water contained within the soil as a percentage. Note, only complete this field if you are actually sampling soil moisture.
3.2.4	soil organic matter	The accumulation of decomposing plant and animal materials found within the soil.
3.2.5	soil texture	Refers to size distribution and amount of mineral particles (sand, silt, and clay) in the soil; examples are sandy clay, sandy loam, silty clay etc.
3.2.6	no correlation	
3.3	rock substrates	Various rock formations.
3.3.1	avalanche chute	An area where periodic snow or rockslides prevent the establishment of forest conditions; typically shrub and herb dominated (Sitka alder and/or vine maple).
3.3.2	cliffs	A high, steep formation, usually of rock. Coastal cliffs are a separate category under Marine Habitat Elements.
3.3.3	caves	An underground chamber open to the surface with varied opening diameters and depths; includes cliff-face caves, intact lava tubes, coastal caves, and mine shafts.
3.3.4	rocky outcrops and ridges	Areas of exposed rock.
3.3.5	rock crevices	Refers to the joint spaces in cliffs, and fissures and openings between slab rock; crevices among rocks and boulders in talus fields are a separate category (talus).
3.3.6	barren ground	Bare exposed soil with >40% of area not vegetated; includes mineral licks and bare agricultural fields; natural bare exposed rock is under the rocky outcrop category.
3.3.7	playa (alkaline, saline)	Shallow desert basins without natural drainage-ways where water accumulates and evaporates seasonally.
3.3.8	no correlation	
3.4	snow	Selected features of snow. Can be negative or positive.
3.4.1	snow depth	Any measure of the distance between the top layer of snow and the ground below.
3.4.2	glaciers, snow field	Areas of permanent snow and ice.
3.5	insect fall	The accumulation of dead insects in an aquatic environment. Note: complete this field only for aquatic map units.
3.6	litter fall	The accumulation of dead plant material in an aquatic water environment. Note: complete this field only for aquatic map units.
3.7	precipitation	Accumulation of rainfall and/or snowfall in an aquatic environment. Note: complete this field only for aquatic map
3.8	wind stress	Effects of wind on the turbidity and movement of hydrologic forces. Can influence fish through upwelling of nutrients and mortality of young in turbulent waters. Note: complete this field only for aquatic map units.
4.0	Freshwater Riparian & Aquatic Bodies Habitat Elements	Includes selected forms and characteristics of any body of freshwater.
4.1	Water Characteristics	Various freshwater attributes. Ranges of continuous attributes that are key to the queried species, if known, will be in the comments.
4.1.1	dissolved oxygen	The amount of oxygen passed into solution. Note, only complete this field if you are actually sampling for DO.
4.1.2	water depth	Enter the distance from the surface of the water to the bottom substrate.
4.1.3	dissolved solids	A measure of dissolved minerals in water. Note, only complete this field if you are actually sampling for dissolved
4.1.4	water pH	A measure of water acidity or alkalinity. Note, only complete this field if you are actually sampling for pH.
4.1.5	water temperature	Water temperature range that is key to the queried species, if known, is in the comments field. Note, only complete this field if you are actually sampling water temperature.
4.1.6	water velocity	The speed or momentum of water flow. Note, only complete this field if you are actually sampling water velocity.
4.1.7	water turbidity	Refers to the amount of roiled sediment within the water and the resulting clarity of the water. Note, only complete this field if you are actually sampling for turbidity.
4.1.8	free water (derived from any source)	Water derived from any source
4.1.9	salinity and alkalinity	The presence of salts.
4.1.10	icing in inland rivers and streams (scouring action)	Freezing of water columns and benthic substrate; especially important to fish and invertebrates in small and headwater stream and rivers that may freeze solid. Substrate scouring comes during spring runoff.
4.1.11	metals in water column	A measure of metals present in water.
4.1.12	nutrient enrichment	Enrichment of the water column with nutrients (i.e., decaying salmon carcasses)
4.2	Rivers & Streams	Various characteristics of streams and rivers.
4.2.1	oxbows	A pond or wetland created when a river bend is cut off from the main channel of the river.
4.2.2	order and class	Systems of stream classification.
4.2.2.1	intermittent	Streams/rivers, which contain non-tidal flowing water for only part of the year, water may remain in isolated pools.
4.2.2.2	upper perennial	Streams/rivers with a high gradient, fast water velocity, no tidal influence, some water flowing throughout the year, substrate consists of rock, cobbles, or gravel with occasional patches of sand, little floodplain development.
4.2.2.3	lower perennial	Streams/rivers with a low gradient, slow water velocity, no tidal influence, some water flowing throughout the year, substrate consists mainly of sand and mud, floodplain is well developed.
4.2.3	zone	System of water body classification based on the horizontal strata of the water column.
4.2.3.1	open water	Open water areas not closely associated with the shoreline or bottom.
4.2.3.2	submerged/benthic	Relating to the bottom of a body of water, includes the substrate and the overlaying body of water within one meter of the substrate.
4.2.3.3	shoreline	Continually exposed substrate that is subject to splash, waves, and/or periodic flooding. Includes gravel bars, islands, and immediate nearshore areas.
4.2.4	in-stream substrate	The bottom materials in a body of water.
4.2.4.1	boulders	Rocks (Boulders) > 256 mm (10") in diameter.
4.2.4.2	cobble/gravel	Rocks or pebbles, 4-256 mm in diameter (10"), substrata may consist of cobbles, gravel, shell, and sand with no one substratum type exceeding 70 percent cover.
4.2.4.3	sand/mud	Fine substrata < 4 mm in diameter, little gravel present, may be mixed with organics.
4.2.4.4	bedrock	Reflects bedrock as a substrate in aquatic environs (e.g., stream, river, lake).
4.2.4.5	aquatic bentic structure	Embeddedness, interstitial space

4.2.5	vegetation	Herbaceous plants
4.2.5.1	submergent vegetation	Rooted aquatic plants that do not emerge above the water surface.
4.2.5.2	emergent vegetation	Rooted aquatic plants that emerge above the water surface.
4.2.5.3	floating mats	Unrooted plants that form vegetative masses on the surface of the water.
4.2.6	coarse woody debris in streams and rivers	Any piece of woody material (debris piles, stumps, root wads, fallen trees) that intrudes into or lies within a river or stream.
4.2.6.1	rootwads	Lower stem and root fan of a dead tree.
4.2.6.2	large woody debris (tree stems)	“Large” is considered stems that are 10 cm (4 in) in diameter or larger, and 2 m (6 ft) in length or longer.
4.2.6.3	small woody debris (branches, twigs,etc.)	“Small” is considered stems that are less than 10 cm (4 in) in diameter.
4.2.7	pools	Portions of the stream with reduced current velocity, often with water deeper than surrounding areas.
4.2.7.1	secondary channel pools	formed by merging-flow scour from secondary channels
4.2.7.2	backwater pools	eddy or slack water along the channel margin separated from the main current by a gravel bar or small channel obstruction.
4.2.7.3	trench pools	long, usually deep slot in a stable substrate (often bedrock).
4.2.7.4	plunge pools	basin scoured by a vertical drop over a channel obstruction.
4.2.7.5	lateral scour pools	scoured basin near the channel margin caused by flow being directed to one side of the stream by a partial channel obstruction.
4.2.7.6	dammed pools	Dammed pools: pool impounded upstream from a complete or nearly complete channel blockage (including beaver ponds).
4.2.8	riffles	Shallow rapids where the water flows swiftly over completely or partially submerged obstructions to produce surface agitation, but where standing waves are absent.
4.2.8.1	low gradient riffles	shallow reach of gradient <4% with moderate current velocity and moderate turbulence.
4.2.8.2	rapids	shallow reach of gradient >4% with high current velocity and considerable turbulence.
4.2.8.3	cascades	series of small steps of alternating small waterfalls and small pools.
4.2.9	runs/glides	Areas of swiftly flowing water, without surface agitation or waves, which approximates uniform flow and in which the slope of the water surface is roughly parallel to the overall gradient of the stream reach.
4.2.10	overhanging vegetation	Herbaceous plants that cascade over stream and riverbanks and are < 1 meter above the water surface.
4.2.11	waterfalls	Steep decent of water within a stream or river.
4.2.12	banks	Rising ground that borders a body of water.
4.2.12.1	undercut banks	Stream or river banks that have been undercut by hydrologic forces resulting in the bank overhanging the water. This feature is critical to many fish species for cover from predation.
4.2.13	seeps or springs	A concentrated flow of ground water issuing from openings in the ground.
4.2.14	channel morphology	the general shape of a channel
4.2.14.1	Channel length	a measure of the length of a reach of stream channel
4.2.14.2	Channel width	a measure of the width of a reach of stream channel
4.2.15	flow	Rate of water flow, typically given in cubic feet per second (ft3/sec)
4.2.15.1	high flow	Change in interannual variability in high flows.
4.2.15.2	low flow	Change in interannual variablility in low flows.
4.2.15.3	diel flow	Intra-daily variation in flow level (regulated rivers influenced by sotrm water runoff).
4.2.15.4	intra-annual flow	The average extent of intra-annual flow variation during a month (stream "flashiness").
4.3	ephemeral pools	Pools that contain water for only brief periods of time usually associated with periods of high precipitation.
4.4	sand bars	Exposed areas of sand or mud substrate.
4.5	gravel bars	Exposed areas of gravel substrate.
4.6	Lakes/Ponds/Reservoirs	Various characteristics of lakes, ponds, and reservoirs.
4.6.1	zone	System of water body classification based on the horizontal strata of the water column.
4.6.1.1	open water	Open water areas not closely associated with the shoreline or bottom substrates.
4.6.1.2	submerged/benthic	Relating to the bottom of a body of water, includes the substrate and the overlaying body of water within one meter of the substrate.
4.6.1.3	shoreline	Continually exposed substrate that is subject to splash, waves, and/or periodic flooding. Includes gravel bars, islands, and immediate nearshore areas.
4.6.2	in-water substrate	The bottom materials in a body of water.
4.6.2.1	boulders	Rocks (Boulders) > 256 mm (10 inches) in diameter.
4.6.2.2	cobble/gravel	Rocks or pebbles, 4-256 mm in diameter (10"), substrata may consist of cobbles, gravel, shell, and sand with no one substratum type exceeding 70 percent cover.
4.6.2.3	sand/mud	Fine substrata < 4 mm in diameter, little gravel present, may be mixed with organics.
4.6.3	vegetation	Herbaceous plants.
4.6.3.1	submergent vegetation	Rooted aquatic plants that do not emerge above the water surface.
4.6.3.2	emergent vegetation	Rooted aquatic plants that emerge above the water surface.
4.6.3.2.1	Sedges and rushes	Emergent vegetation characterized by a predominance of sedges and rushes.
4.6.3.3	floating mats	Unrooted plants that form vegetative masses on the surface of the water.
4.6.3.4	Riparian (including woody vegetation)	Emergent vegetation characterized by a predominance of woody vegetation.
4.6.4	size	Refers to whether or not the species is differentially associated with water bodies based on their size.
4.6.4.1	ponds	< 2 ha
4.6.4.2	lakes	>= 2 ha
4.7	Wetlands/Marshes/Wet Meadows/Bogs and Swamps	Various components and characteristics related to any of these systems.
4.7.1	riverine wetlands	Wetlands found in association with rivers.
4.7.2	context	When checked, indicates that the setting of the wetland, marsh, wet meadow, bog or swamp is key to the queried species.
4.7.2.1	forest	Wetlands within a forest.
4.7.2.2	non-forest	Wetlands that are not surrounded by forest.
4.7.3	size	When checked, indicates that the queried species is differentially associated with a wetland, marsh, wet meadow, bog or swamp based on the size of the water body.
4.7.4	marshes	Frequently or continually inundated wetlands characterized by emergent herbaceous vegetation (grasses, sedges, reeds) adapted to saturated soil conditions.
4.7.5	wet meadows	Grasslands with waterlogged soil near the surface but without standing water for most of the year.
4.8	islands	A piece of land made up of either rock and/or unconsolidated material that projects above and is completely surrounded by water.
4.9	seasonal flooding	Flooding that occurs periodically due to precipitation patterns.
4.10	Littoral zone	Area of shallow water where some fish migrate, find protection and find key food resources. Typically regarded as the shoreline (<5m depth) of lakes, reservoirs, and large rivers.
5.0	Marine Habitat Elements	Selected biotic and abiotic components and characteristics of marine systems.
5.1	zone	System of marine classification based on water depth, and relationship to substrate.

5.1.1	supratidal	The zone that extends landward from the higher high water line up to either the top of a coastal cliff or the landward limit of marine process (i.e., storm surge limit).
5.1.2	intertidal	The zone between the higher high water line and the lower low water line.
5.1.3	nearshore subtidal	The zone that extends from the lower low water line seaward to the 20 meter isobath, typically within 1 kilometer of shore i.e.
5.1.4	shelf	The area between the 20 and 200-meter isobath, typically within 60 kilometers of shore.
5.1.5	oceanic	The zone that extends seaward from the 200-meter isobath.
5.2	substrates	The bottom materials in a body of water.
5.2.1	bedrock	The solid rock underlying surface materials.
5.2.2	boulders	Large, worn, rocks > 256 mm (10 inches) in diameter.
5.2.3	hardpan	Consolidated clays forming a substratum firm enough to support an epibenthos and too firm to support a normal infauna (clams, worms, etc.), but with an unstable surface which sloughs frequently.
5.2.4	cobble	Rocks or pebbles, 64-256 mm in diameter, may be a mix of cobbles, gravel, shells, and sand, with no one type exceeding 70 percent cover.
5.2.5	mixed-coarse	Substrata consisting of cobbles, gravel, shell, and sand with no one substratum type exceeding 70 percent cover.
5.2.6	gravel	Small rocks or pebbles, 4-64 mm in diameter.
5.2.7	sand	Fine substrata < 4 mm in diameter, little gravel present, may be mixed with organics.
5.2.8	mixed-fine	Mixture of sand and mud particles < 4 mm in diameter, little gravel present.
5.2.9	mud	Fine substrata < 0.06 mm in diameter, little gravel present, usually mixed with organics.
5.2.10	organic	Substrata composed primarily of organic matter such as wood chips, leaf litter, or other detritus.
5.2.11	clay	Substrata composed primarily of clayey materials.
5.2.12	shell	Substrata composed of mainly marine organism shells.
5.2.13	Artificial substrata (riprap)	Substrata consisting of artificial (man-made) material including riprap.
5.3	energy	Degree of exposure to oceanic swell, currents, and wind waves.
5.3.1	degree of exposure	Measure of how exposed a shoreline is to the hydrologic forces of a large body of water.
5.3.1.1	Protected	No sea swells, little or no current, and restricted wind fetch.
5.3.1.2	Semi protected	Shorelines protected from sea swell, but may receive waves generated by moderate wind fetch, and/or moderate to weak tidal currents.
5.3.1.3	Partially exposed	Oceanic swell attenuated by offshore reefs, islands, or headlands, but shoreline substantially exposed to wind waves, and/or strong to moderated tidal currents.
5.3.1.4	Exposed	Highly exposed to oceanic swell, wind waves, and/or very strong currents.
5.3.2	Sources of energy	Hydrodynamic forces in a marine environment.
5.3.2.1	Upwelling	A process in which cold, often nutrient-rich waters from the ocean depths rise to the surface.
5.3.2.2	Local jets and eddies	strong currents moving in different directions from the main current, often in a circular motion in eddies.
5.3.2.3	Outflow plume	pattern of circulation of one body of water flowing into another.
5.3.2.4	Fresh water inflow	area of flow where a freshwater source meets marine waters.
5.4	vegetation	Includes herbaceous plants and plants lacking vascular systems.
5.4.1	species dominated communities	Species dominated communities
5.4.1.1	mixed macro algae	Includes brown, green, and red algae.
5.4.1.1.1	algal blooms	Quickly growing concentrations of algae that may be harmful to the environment, plants, or animals.
5.4.1.1.2	toxic blooms	High concentrations of cyanobacteria that are highly toxic to plants and animals.
5.4.1.2	kelp	Subaquatic rooted vegetation found in the nearshore marine environment.
5.4.1.3	eelgrass	Subaquatic rooted vegetation found in an estuarine environment
5.4.1.4	pickleweed	A salt loving plant (Salicornia europeae) found in estuarine environments.
5.4.2	vegetation zone	Tidally influenced vegetation zones
5.4.2.1	Low sandy marshes	Occur on sandy substrate with a gradual slope, typically on the low-energy side of bay mouth sand spits or as fringing marshes on islands with coarse-textured sediments. They are flooded by nearly all high tides and drain diffusely (i.e., there are not tidal creeks) over the marsh surface. Near the tidal flat edge, the vegetation is scattered, but becomes continuous up the slope.
5.4.2.2	Low silty marshes	Develop on fine-textured sediments, silt, or mud substrates in low energy parts of esturaries and are relatively flat. These marshes develop in areas of rapid sedimentation and are flooded by nearly all high tides; have diffuse drainage patterns with some defined channels around clumps of plants.
5.4.2.3	Sedge marshes	Form on silt and have a nearly level surface. They are oftenfound on islands or delta edges with elevations somewhat above the first two marsh types. They are flooded by most high tides and drain via creeks in the higher sedge marshes and diffusely in the lower ones.
5.4.2.4	Immature high marshes	Relatively level with some bare depressions and are located on silty substrates. Organic matter accumulation is abundant here as it is in sedge wetlands. Immature high marshes occur above sedge and low sandy marshes, ususally at least 40 cm above the tidal flat; often the transition is an abrupt rise. Many of the high tides (especially the higher highs) cover the soil surface. A well-defined system of channels drain and flood these marshes.
5.4.2.5	Mature high marshes	They are level and have developed extensive peaty soils. A dendritic network of steep-sided stream channels circulates water to the soil surface on higher high tides. Shallow saline pools produce openings in the otherwise continuous sward of vegetation. Salinities fluctuate widely and depend on rainfall, tidal input, and evaporation.
5.4.2.6	Bulrush and sedge marshes	Low marshes in brackish parts of the estuary. The substrate is silt or sand, and inundation occurs with most high tides. Drainage is diffuse; vegetation is continuous and its composition is dependent on the salinity.
5.4.2.7	Intertidal gravel marshes	Rare forms; develop on sand and gravel bars near the mouths of relatively high-energy estuaries with large volumes of freshwater. Vegetation is discontinous and of a type which indicates low salinities. The salt from the tidal water is probably leached by rainwater and freshwater runoff through the coarse substrates.
5.4.2.8	Diked salt marshes	Manmade habitats that develop when the tides are excluded from immature and mature high marshes. Althouugh non-salt marsh plants may invade, the area retains some wetland characteristics due to seepage, high water tables, and perhaps residual salinity. Vegetation is continuous over the marsh surface and the old dendritic stream channels system has collapsed.
5.4.2.9	Riparian zone (freshwater influenced)	Reflects the terrestrial vegetation community immediately alongside marine, estuarine, lagoon, and inlet water environs. This area contributes nutrients, insects (i.e., “insect rains”), minerals, vegetation, soil, and woody stems directly to marine/estuarine systems.
5.4.2.9.1	coniferous	Riparian vegetation community dominated by coniferous forests.
5.4.2.9.2	deciduous	Riparian vegetation community dominated by deciduous forests.
5.4.2.9.3	mixed coniferous/deciduous	Riparian vegetation community dominated by a mixture of coniferous and deciduous forests.
5.4.2.9.4	sedges	Riparian vegetation community dominated by sedges.
5.4.2.9.5	forbs	Riparian vegetation community dominated by forbs.
5.5	water depth	Refers to the vertical layering of the water column.
5.5.1	surface layer	The uppermost part of the water column.
5.5.1.1	fronts (e.g. tide rips, and confluence zones)	A current of water disturbed by an opposing current, especially in tidal water or by passage over an irregular bottom.
5.5.1.2	surface microlayer (neuston)	The thin uppermost layer of the water's surface.

5.5.2	euphotic	Upper layer of a water body that receives sufficient sunlight for the photosynthesis of plants.
5.5.3	disphotic	Area below the euphotic zone where photosynthesis ceases.
5.5.4	demersal/benthic	Submerged lands including vegetated and unvegetated areas.
5.6	water temperature	Measure of ocean water temperature.
5.7	salinity zone	The presence and concentration of salts; salinity range that is key to the species, if it is known, will be in the comments field. Positive or negative influences.
5.7.1	tidal fresh	Tidal freshwater
5.7.2	mixing	Area with recurrent mixing of freshwater and seawater; brackish waters.
5.7.3	seawter	Highly saline water from marine waters.
5.8	forms	Morphological elements within marine areas.
5.8.1	beach	An accumulation of unconsolidated material (sand, gravel, angular fragments) formed by waves and wave-induced currents in the intertidal and subtidal zones.
5.8.2	off-shore islands/rocks/sea stacks/off-shore cliffs	A piece of land made up of either rock and/or unconsolidated material that projects above and is completely surrounded by water at higher high water for large (spring) tide. Includes off-shore marine cliffs.
5.8.3	marine cliffs (mainland)	A sloping face steeper than 20 degrees usually formed by erosional processes and composed of either bedrock and/or unconsolidated materials.
5.8.4	delta	Accumulations of sand, silt, and gravel deposited at the mouth of a stream where it discharges into the sea.
5.8.5	dune	In a marine context; a mound or ridge formed by the transportation and deposition of wind-blown material (sand and occasionally silt).
5.8.6	lagoon	Shallow depression within the shore zone continuously occupied by salt or brackish water lying roughly parallel to the shoreline and separated from the open sea by a barrier.
5.8.7	salt marsh	A coastal wetland area which is periodically inundated by tidal brackish or salt water and which supports significant (15% cover) non-woody vascular vegetation (e.g., grasses, rushes, sedges) for at least part of the year.
5.8.8	reef	A rock outcrop, detached from the shore, with maximum elevations below the high-water line.
5.8.9	tidal flat	A level or gently sloping (less than 5 degrees) constructional surface exposed at low tide, usually consisting primarily of sand or mud with or without detritus, and resulting from tidal processes.
5.8.10	tide pools	Pools of water left behind after tides recede.
5.8.11	high tide current channels	Channels formed by the moment of water at high tides.
5.8.12	complex dendritic channel morphology	Dendritic channel complexity reflects the extensive dissection of the inter-tidal environment; the many naturally-deepened aquatic channels offer important structures providing food and refuge environs (even short-term) for estuarine and marine fishes
5.8.13	spit berms	Berms of sand that are formed on spits due to wave action.
5.8.14	underwater channels	Channels formed by the movement of water, such as at a river or stream mouth on a larger body of water, that are permanently underwater.
5.9	water clarity	As influenced by sediment load.
6.0	No Data	
7.0	Fire as a Habitat Element	Fire can influence species in a positive or negative way.
8.0	Anthropogenic Disturbances and Elements	Anthropogenic - Related Habitat Elements: This section contains selected examples of human-related Habitat Elements that may be a key part of the environment for many species. These HE's may have either a negative or positive influence on the queried species.
8.1	campgrounds/picnic areas	Sites developed and maintained for camping and picnicking.
8.2	roads	Roads that are either paved or unpaved.
8.2.1	paved	Roads that are paved with asphalt or concrete.
8.2.2	un-paved	Roads or trails that are not paved (i.e., gravel or dirt roads).
8.3	buildings	Permanent structures.
8.4	bridges	Permanent structures typically over water or ravines.
8.5	diseases transmitted by domestic animals	Some domestic animal diseases may be a source of mortality or reduced vigor for wild species.
8.6	harvest/persecution (of animals)	Includes illegal harvest/poaching, incidental take (resulting from fishing net by-catch, or by hay mowing, for example), and targeted removal for pest control.
8.7	fences/corrals	Wood, barbed wire, or electric fences.
8.8	supplemental food	Food deliberately provided for wildlife (e.g. bird feeders, ungulate feeding programs, etc.) as well as spilled or waste grain along railroads and cattle feedlots.
8.9	refuse (includes landfills)	Any source of human-derived garbage (includes landfills).
8.10	supplemental boxes, structures and platforms	Includes birdhouses, bat boxes, raptor and waterfowl nesting platforms.
8.11	guzzlers and waterholes	Water sources typically built for domestic animal use.
8.12	toxic chemical use	Proper use of regulated chemicals; documented effects only.
8.12.1	herbicides/fungicides	Chemicals used to kill vegetation and fungi.
8.12.2	insecticides	Chemicals used to kill insects.
8.12.3	pesticides	Chemicals used to kill vertebrate species.
8.12.4	fertilizers	Chemicals used to enhance vegetative growth.
8.12.5	fire fighting chemicals	Chemicals used to suppress fire.
8.13	hedgerows/windbreaks	Woody and/or shrubby vegetation either planted or that develops naturally along fence lines and field borders.
8.14	sewage treatment plant	Settling ponds associated with sewage treatment plants.
8.15	repellents	Various methods purposely used against wildlife species that damage crops or property (excluding pesticides and insecticides)..
8.15.1	chemical (taste or smell)	Chemical substances that repel wildlife.
8.15.2	noise or visual disturbance	Non-chemical methods to deter wildlife.
8.16	culverts	Drain crossings under roads or railroads.
8.17	irrigation ditches/canals	Ditches built to transport water to agricultural crops or to handle runoff.
8.18	powerlines/corridors	Utility lines, poles, and rights-of-way associated with transmission, telephone, and gas lines.
8.19	pollution	Human-caused environmental contamination.
8.19.1	chemical	Contamination caused by chemicals.
8.19.2	sewage	Contamination caused by human waste.
8.19.3	water	Aquatic contamination from any source.
8.20	piers	A structure built out over water.
8.21	mooring piles, dolphins, buoys	Floating objects anchored out in the water for nautical purposes.
8.22	bulkheads, seawalls, revetment	Retaining structures built to protect the shoreline from wave action.
8.23	jetties, groins, breakwaters	Structures built to influence the current or protect harbors.
8.24	water diversion structures	Structures built to funnel or direct water, including dams, dikes and levies.
8.25	log boom	A raft of logs lashed together either to transport the logs or as barriers to boat traffic near marinas or dams.
8.26	boats/ships	Watercraft, either motorized or non-motorized.
8.27	dredge spoil islands	Sediment deposited from dredging operations.

8.28	hatchery facilities and fish	Fish that are hatched in captivity and later released into the wild. For simplicity this refers to freshwater areas, though marine birds and mammals likely feed on hatchery-released fish too.
8.29	hydrologic regime - regulated (river)	Rivers that are altered and controlled by human activities.
8.30	obstructions (to fish passage)	Obstructions or blockages to fish passage (e.g., poorly situated culverts; fences; piers; warm thermal pulses).
8.31	weirs	A fence or wattle placed in a stream to catch or retain fish.
8.32	other	Any other anthropogenic-related habitat elements not described by KECs 8.1-8.31)

CHAP Appendix
Appendix B
Master List Key Ecological Functions (KEFs)

SHP-KEF	KEFDescription
~	added by fish review
1	Trophic relationships
1.1	heterotrophic consumer
1.1.1	primary consumer (herbivore) (also see below under Herbivory)
1.1.1.1	foliovore (leaf-eater)
1.1.1.2	spermivore (seed-eater)
1.1.1.3	browser (leaf, stem eater)
1.1.1.4	grazer (grass, forb eater)
1.1.1.5	frugivore (fruit-eater)
1.1.1.6	sap feeder
1.1.1.7	root feeders
1.1.1.8	nectivore (nectar feeder)
1.1.1.9	fungivore (fungus feeder)
1.1.1.10	flower/bud/catkin feeder
1.1.1.11	aquatic herbivore
1.1.1.12	feeds in water on decomposing benthic substrate
1.1.1.13	bark/cambium/bole feeder
1.1.1.14	periphyton eater (including algae) ~
1.1.1.15	phytoplankton eater (including algae) ~
1.1.2	secondary consumer (primary predator or primary carnivore)
1.1.2.1	invertebrate eater
1.1.2.1.1	terrestrial invertebrates
1.1.2.1.2	aquatic macroinvertebrates
1.1.2.1.3	freshwater or marine zooplankton
1.1.2.2	vertebrate eater (consumer or predator of herbivorous vertebrates)
1.1.2.2.1	piscivorous (fish eater)
1.1.2.3	ovivorous (egg eater)
1.1.2.4	prey (fish) for secondary consumers ~
1.1.3	tertiary consumer (secondary predator or secondary carnivore)
1.1.4	carrion feeder
1.1.5	cannibalistic
1.1.6	coprophagous (feeds on fecal material)
1.1.7.1	aquatic (e.g. offal and bycatch of fishing boats)
1.1.7.2	terrestrial (e.g. landfills)
1.1.7	feeds on human garbage/refuse
1.2	prey relationships
1.2.1	prey for secondary or tertiary consumer (primary or secondary predator)
1.2.2	fish prey for secondary or tertiary consumer (primary or secondary predator)
2	aids in physical transfer of substances for nutrient cycling (C,N,P, etc.)
2.1	significant carrier of nutrients ~
2.1.1	within aquatic system ~
2.1.2	within terrestrial systems (including wetlands) ~
2.2	significant carrier of heavy metals ~
2.2.1	within aquatic systems ~
2.2.2	within terrestrial systems (including wetlands) ~
3	organismal relationships
3.1	controls or depresses insect population peaks
3.1.1	influences aquatic invertebrate population peaks ~
3.1.2	influences zooplankton population peaks ~
3.2	controls terrestrial vertebrate populations (through predation or displacement)
3.3	pollination vector
3.4	transportation of viable seeds, spores, plants or animals ^
3.4.1	disperses fungi

3.4.2	disperses lichens
3.4.3	disperses bryophtes, including mosses
3.4.4	disperses insects and other invertebrates
3.4.4.1	disperse aquatic invertebrates ~
3.4.5	disperses seeds/fruits (through ingestion or caching)
3.4.6	disperses vascular plants
3.5.1	creates feeding opportunities (other than direct prey relations)
3.5.1.1	creates sapwells in trees
3.5.2	creates roosting, denning, or nesting opportunities
3.5	creates feeding, roosting, denning, or nesting opportunities for other organisms
3.6.1	aerial structures
3.6.2	ground structures
3.6.3	aquatic structures
3.6	primary creation of structures (possibly used by other organisms)
3.7.1	aerial structures
3.7.2	ground structures
3.7.3	aquatic structures
3.7	user of structures created by other species
3.8.1	interspecies parasite
3.8.2	common interspecific host
3.8	nest parasite
3.9	primary cavity excavator (in aquatic and/or terrestrial systems)
3.10	secondary cavity user
3.11.1	creates large burrows (rabbit-sized or larger)
3.11.2	creates small burrows (less than rabbit-sized)
3.11	primary burrow excavator (fossorial or underground burrows)
3.12	uses burrows dug by other species (secondary burrow user)
3.13	creates runways (possibly used by other species)
3.14	uses runways created by other species)
3.15	pirates food from other species
3.16	interspecific hybridization
3.16.1	interspecific hybridization with native species
3.16.2	interspecific hybridization with exotic species
4	carrier, transmitter, or reservoir of vertebrate diseases
4.1	diseases that affect humans
4.2	diseases that affect domestic animals
4.3	diseases that affect other wildlife species
4.4	diseases that affect other fish species ~
5	soil relationships
5.1	physically affects (improves) soil structure, aeration (typically by digging)
5.2	physically affects (degrades) soil structure, aeration (typically by trampling)
5.3	physically affects aquatic soils and bed materials (typically by digging or spawning actions)
6	wood structure relationships (either living or dead wood)
6.1	physically fragments down wood
6.2	physically fragments standing wood
7	water relationships
7.1	impounds water by creating diversions or dams
7.2	creates ponds or wetlands through wallowing
8	vegetation structure and composition relationships
8.1	creates standing dead trees (snags)
8.2	herbivory on trees or shrubs that may alter vegetation structure and composition (browsers)
8.3	herbivory on grasses or forbs that may alter vegetation structure and composition (grazers)

CHAP Appendix
Appendix C
Study Area - Species - Potential List

Largemouth bass	*Micropterus salmoides*
Black bullhead	*Ictalarus (Ameiurus) melas*
Carp	*Cyprinus carpio*
Mosquitofish	*Gambusia affinis*
Green sunfish	*Lepomis cyanellus*
Tilapia	*Oreochromis spp.*
Western toad	*Bufo boreas*
California Treefrog	*Pseudacris regilla*
Bullfrog	*Rana catesbeiana*
Red-eared Slider	*Trachemys scripta elegans*
Southern Alligator Lizard	*Elgaria multicarinata*
Western Fence Lizard	*Sceloporus occidentalis*
Side-blotched lizard	*Uta stansburiana*
Two-Striped Garter Snake	*Thamnophis hammondii*
Pied-billed Grebe	*Podilymbus podiceps*
Eared Grebe	*Podiceps nigricollis*
Double-crested Cormorant	*Phalacrocorax auritus*
Great blue heron	*Ardea herodias*
Great Egret	*Ardea alba*
Snowy Egret	*Egretta thula*
Green Heron	*Butorides virescens*
Black-crowned Night-Heron	*Nycticorax nycticorax*
Turkey Vulture	*Cathartes aura*
Canada Goose	*Branta canadensis*
Gadwall	*Anas strepera*
American Wigeon	*Anas americana*
Mallard	*Anas platyrhynchos*
Blue-winged Teal	*Anas discors*
Cinnamon teal	*Anas cyanoptera*
Northern Shoveler	*Anas clypeata*
Northern Pintail	*Anas acuta*
Green-winged Teal	*Anas crecca*
Bufflehead	*Bucephala albeola*
Hooded Merganser	*Lophodytes cucullatus*
Ruddy Duck	*Oxyura jamaicensis*
Muscovy Duck	*Cairina moschata*
Osprey	*Pandion haliaetus*
White-tailed Kite	*Elanus leucurus*
Sharp-shinned Hawk	*Accipiter striatus*
Cooper's Hawk	*Accipiter cooperii*
Red-shouldered Hawk	*Buteo lineatus*
Red-tailed Hawk	*Buteo jamaicensis*
American Kestrel	*Falco sparverius*
Merlin	*Falco columbarius*
Peregrine Falcon	*Falco peregrinus*
Sora	*Porzana carolina*
Common Moorhen	*Gallinula chloropus*
American Coot	*Fulica americana*
Killdeer	*Charadrius vociferus*

Black-necked Stilt	*Himantopus mexicanus*
Greater Yellowlegs	*Tringa melanoleuca*
Lesser Yellowlegs	*Tringa flavipes*
Spotted Sandpiper	*Actitis macularia*
Western sandpiper	*Calidris mauri*
Least Sandpiper	*Calidris minutilla*
Wilson's Snipe	*Gallinago delicata*
Ring-billed Gull	*Larus delawarensis*
California Gull	*Larus californicus*
Western Gull	*Larus occidentalis*
Caspian Tern	*Sterna caspia*
Rock Pigeon	*Columba livia*
Mourning Dove	*Zenaida macroura*
Barn Owl	*Tyto alba*
Great Horned Owl	*Bubo virginianus*
Vaux's Swift	*Chaetura vauxi*
White-throated Swift	*Aeronautes saxatalis*
Black-chinned Hummingbird	*Archilochus alexandri*
Anna's Hummingbird	*Calypte anna*
Rufous Hummingbird	*Selasphorus rufus*
Allen's Hummingbird	*Selasphorus sasin*
Belted Kingfisher	*Ceryle alcyon*
Acorn Woodpecker	*Melanerpes formicivorus*
Red-breasted Sapsucker	*Sphyrapicus ruber*
Nuttall's Woodpecker	*Picoides nuttallii*
Downy Woodpecker	*Picoides pubescens*
Northern Flicker	*Colaptes auratus*
Western Wood-pewee	*Contopus sordidulus*
Willow Flycatcher	*Empidonax traillii*
Pacific-slope Flycatcher	*Empidonax difficilis*
Black Phoebe	*Sayornis nigricans*
Say's Phoebe	*Sayornis saya*
Ash-throated Flycatcher	*Myiarchus cinerascens*
Cassin's Kingbird	*Tyrannus vociferans*
Western Kingbird	*Tyrannus verticalis*
Loggerhead Shrike	*Lanius ludovicianus*
Bell's Vireo	*Vireo bellii*
Cassin's Vireo	*Vireo cassinii*
Hutton's Vireo	*Vireo huttoni*
Warbling Vireo	*Vireo gilvus*
Western Scrub Jay	*Aphelocoma californica*
American Crow	*Corvus brachyrhynchos*
Common Raven	*Corvus corax*
Tree Swallow	*Tachycineta bicolor*
Violet-green Swallow	*Tachycineta thalassina*
Northern rough winged swallow	*Stelgidopteryx serripennis*
Cliff Swallow	*Petrochelidon pyrrhonota*
Barn Swallow	*Hirundo rustica*
Oak Titmouse	*Baeolophus inornatus*
Bushtit	*Psaltriparus minimus*

Bewick's Wren	*Thryomanes bewickii*
House Wren	*Troglodytes aedon*
Ruby-crowned Kinglet	*Regulus calendula*
Blue-gray Gnatcatcher	*Polioptila caerulea*
Western Bluebird	*Sialia mexicana*
Swainson's Thrush	*Catharus ustulatus*
Hermit Thrush	*Catharus guttatus*
American Robin	*Turdus migratorius*
Wrentit	*Chamaea fasciata*
Northern mockingbird	*Mimus polyglottos*
California Thrasher	*Toxostoma redivivum*
European Starling	*Sturnus vulgaris*
American Pipit	*Anthus rubescens*
Cedar Waxwing	*Bombycilla cedrorum*
Phainopepla	*Phainopepla nitens*
Orange-crowned Warbler	*Vermivora celata*
Nashville Warbler	*Vermivora ruficapilla*
Yellow Warbler	*Dendroica petechia*
Yellow-rumped Warbler	*Dendroica coronata*
Black-throated Gray Warbler	*Dendroica nigrescens*
Townsend's Warbler	*Dendroica townsendi*
Hermit Warbler	*Dendroica occidentalis*
MacGillivray's Warbler	*Oporornis tolmiei*
Common Yellowthroat	*Geothlypis trichas*
Wilson's Warbler	*Wilsonia pusilla*
Yellow-breasted Chat	*Icteria virens*
Western Tanager	*Piranga ludoviciana*
Spotted Towhee	*Pipilo maculatus*
California Towhee	*Pipilo crissalis*
Chipping Sparrow	*Spizella passerina*
Lark Sparrow	*Chondestes grammacus*
Savannah Sparrow	*Passerculus sandwichensis*
Song sparrow	*Melospiza melodia*
Lincoln's Sparrow	*Melospiza lincolnii*
White-crowned Sparrow	*Zonotrichia leucophrys*
Golden-crowned Sparrow	*Zonotrichia atricapilla*
Dark-eyed Junco	*Junco hyemalis*
Black-headed Grosbeak	*Pheucticus melanocephalus*
Blue Grosbeak	*Guiraca caerulea*
Lazuli Bunting	*Passerina amoena*
Red-winged blackbird	*Agelaius phoeniceus*
Western Meadowlark	*Sturnella neglecta*
Brewer's Blackbird	*Euphagus cyanocephalus*
Great tailed Grackle	*Quiscalus mexicanus*
Brown-headed Cowbird	*Molothrus ater*
Hooded Oriole	*Icterus cucullatus*
Bullock's Oriole	*Icterus bullockii*
Purple Finch	*Carpodacus purpureus*
House Finch	*Carpodacus mexicanus*
Lesser Goldfinch	*Carduelis psaltria*

Lawrence's Goldfinch	*Carduelis lawrencei*
American Goldfinch	*Carduelis tristis*
House Sparrow	*Passer domesticus*
Virginia opossum	*Didelphis virginiana*
California Myotis	*Myotis californicus*
Yuma Myotis	*Myotis yumanensis*
Silver-haired Bat	*Lasionycteris noctivagans*
Western Pipistrelle	*Pipistrellus hesperus*
Big Brown Bat	*Eptesicus fuscus*
Western Red Bat	*Lasiurus blossevillii*
Hoary Bat	*Lasiurus cinereus*
Townsend's Big-eared Bat	*Corynorhinus townsendii*
Brazilian Free-tailed Bat	*Tadarida brasiliensis*
Desert Cottontail	*Sylvilagus audubonii*
California ground squirrel	*Spermophilus beecheyi*
Eastern Fox Squirrel	*Sciurus niger*
Little Pocket Mouse	*Perognathus longimembris*
Western Harvest Mouse	*Reithrodontomys megalotis*
Deer Mouse	*Peromyscus maniculatus*
Dusky-footed Wood Rat	*Neotoma fuscipes*
Black Rat	*Rattus rattus*
Norway Rat	*Rattus norvegicus*
House Mouse	*Mus musculus*
Coyote	*Canis latrans*
Raccoon	*Procyon lotor*
Striped skunk	*Mephitis mephitis*
Bobcat	*Lynx rufus*
Amazon sailfin catfish	*Pterygoplichthys pardalis*
African clawed frog	*Xenopus laevis*
Gopher snake	*Pituophis catenifer*
Southern Pacific Rattlesnake	*Crotalus helleri*
Ring-Necked Duck	Aythya collaris
Domestic Dog	Canis familiaris
Domestic Cat	Felis catus

CHAP Appendix
Appendix D
Relationship Matrix Descriptions
HU Calculation Overview

Relationship Matrix Descriptions

MATRIX 1: Potential Species by Function (KEF) Matrix

The potential species list generated by IBIS is aligned with Key Ecological Functions (KEFs) that could potentially be performed in the habitat type and structural condition represented by the polygon. For example, if the polygon represents a "shrub-steppe" habitat type, the KEFs thought to be performed in that habitat type by the potential species are included in the relationship matrix. This information is acquired from IBIS. The result of this matrix is the number of potential species performing key functions in that habitat type. Example follows:

Lowland Mixed Conifer <u>Habitat Type</u> (Potential)	Function 1 Transportation of Viable Seeds, Spores or Plants	Function 2 Breaks up Down Wood	Function 3 Primary Excavator	Function 4 Eats Terrestrial Invertebrates
American Beaver	1			
Pileated Woodpecker		1	1	1
Black Bear	1	1	1	1
Black-tailed Deer	1	1		
Steelhead Salmon	1			1

Relationship Matrix Descriptions

MATRIX 2: Habitat (Actual KEC) by Function (KEF) Matrix

In this matrix, the functions, or KEFs, are again related to Key Environmental Correlates (KECs), but this time the KECs are those actually present at the site (based on field data inventory). Because this is an actual account, those KEFs not correlated to an actual KEC are then removed. The result of this matrix is the number of KEFs characterized by KECs specific to that polygon. Example follows:

Lowland Mixed Conifer Habitat Type (Actual)	Function 1 Creates Snags	Function 2 Breaks up Down Wood	Function 3 Pollination Vector	Function 4 Primary Excavator	Function 5 Filtering Water	Function 6 Eats Terrestrial Insects
Down Wood		1				1
Snags	1			1		1
Tree Cavities	1	1		1		1
Hollow Living Trees		1				1
Flowers			1			
Emergent Vegetation					1	

Calculations

For Each Matrix

Divide:

$$\frac{\textbf{total number of 1s in matrix}}{\textbf{total number of non-zero functions*}}$$

1

Total # of 1s = 12

Total # non-zero fxns = 4

2

Total # of 1s = 13

Total # non-zero fxns = 6

$$\frac{\text{Number of species performing functions}}{\text{Total number of potential functions}} = \frac{12}{4} = 3.0 + \frac{\text{Number of KECs at site}}{\text{Total number of functions characterized}} = \frac{13}{6} = 2.17$$

= **Per-Acre Habitat Value 5.17**

*non-zero functions refer to function columns in the matrix that have at least one "1" in that column

CHAP Appendix
Appendix E
Verification Transect Report

Lone Pine Butte Consulting

LA River CHAP Verification Transect Report

Combined Habitat Assessment Protocols (CHAP)

Paul R Ashley

4/11/2010

Table of Contents

Introduction.......... 1

Study Area.......... 1

Verification Transect Locations.......... 2

Methods.......... 6

Results.......... 6

LA River.......... 6

Head Works.......... 7

References.......... 9

Appendix A – Transect Photographs.......... 10

Transect 14-1.......... 10

Transect 14B-1.......... 11

Transect 14D-1.......... 11

Transect 14F-1.......... 12

Transect 14G-1.......... 12

Transect 15-1.......... 13

Transect 19-1.......... 13

Transect 20-1.......... 14

Transect 24 -1.......... 14

Transect 63-1.......... 15

List of Tables

Table 1 LA River project transect UTM coordinates, azimuths, and lengths 5
Table 2 Summarized LA River verification transect results and data links 7
Table 3 Head Works site shrub verification transect results 7
Table 4 Head Works site herbaceous stratum verification transect results 8

Table of Figures

Figure 1 General location of LA River CHAP study 1
Figure 2 Head Works transect start point locations 2
Figure 3 LA River riparian transect start point locations (north) 3
Figure 4 LA River riparian transect start point locations (south) 3
Figure 5 Verification transect start point overview map (all transect start locations) 4

Introduction

Northwest Habitat Institute (NHI) staff evaluated habitat quality on and along selected portions of the Los Angeles River (LAR) within the city limits of Los Angeles, California in late March and early April 2010. NHI staff used Combined Habitat Assessment Protocols (CHAP) to assess habitat quality.

CHAP methodology includes delineating and displayed habitat types, structural conditions, and attributes as Geographic Information System (GIS) data, which is verified in the field with ocular observations and measured verification transects. Ocular observations and verification transect data is then used to modify initial habitat quality/attribute estimates.

Funding for the LAR habitat assessment project and assistance with data collection was provided by the US Army Corps of Engineers (USACOE). This report includes only the results of the verification transects.

Study Area

The study area is located on the south side of Burbank, California just east of Universal City and includes the Los Angeles River channel and adjacent uplands. The general project area is shown in Figure 1. CHAP verification transects were limited to “soft bottom” areas in the LA River channel and the “Head Works” area.

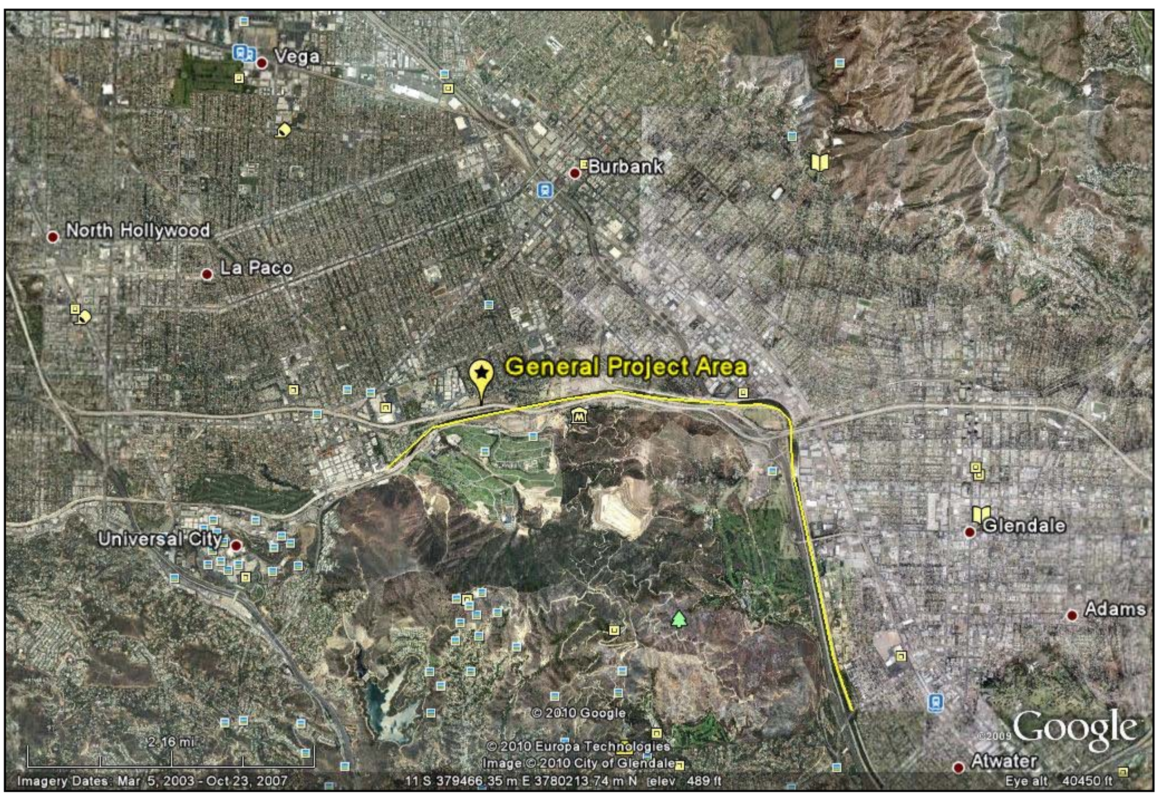


Figure 1 General location of LA River CHAP study

Verification Transect Locations

Habitat variable data was collected on 11 transects to verify and support GIS map layers and associated ocular habitat attribute estimates. Seven verification transects were established at the Head Works location (Figure 2) while four transects were disbursed in "soft bottom" areas of the LA River (Figure 3 and Figure 4). A transect overview map is shown in Figure 5.

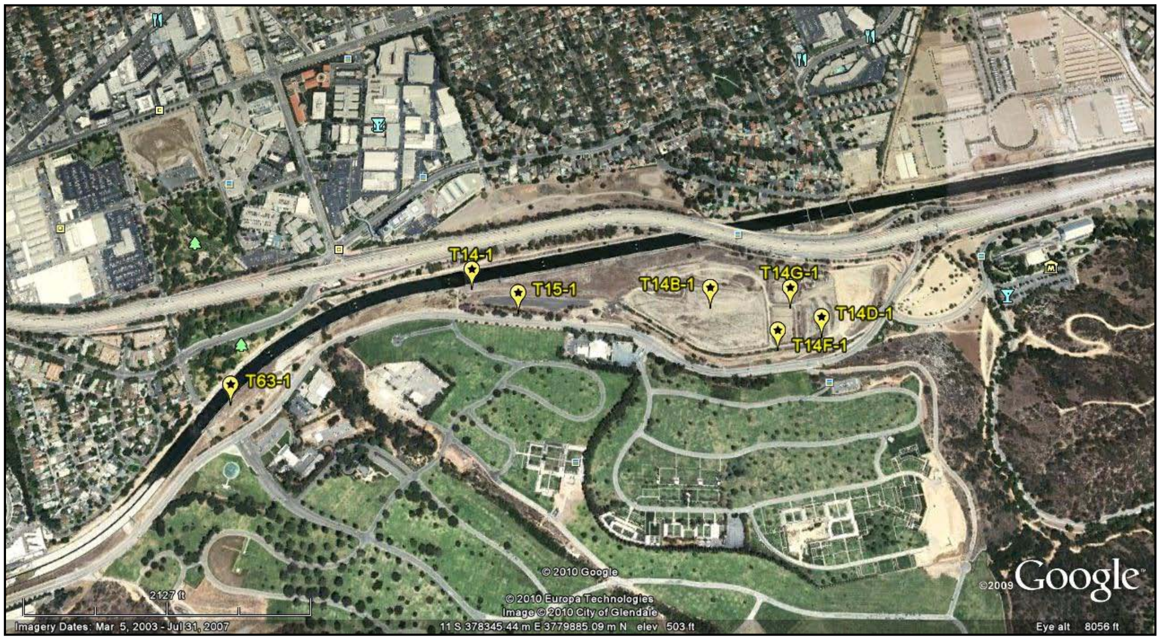


Figure 2 Head Works transect start point locations

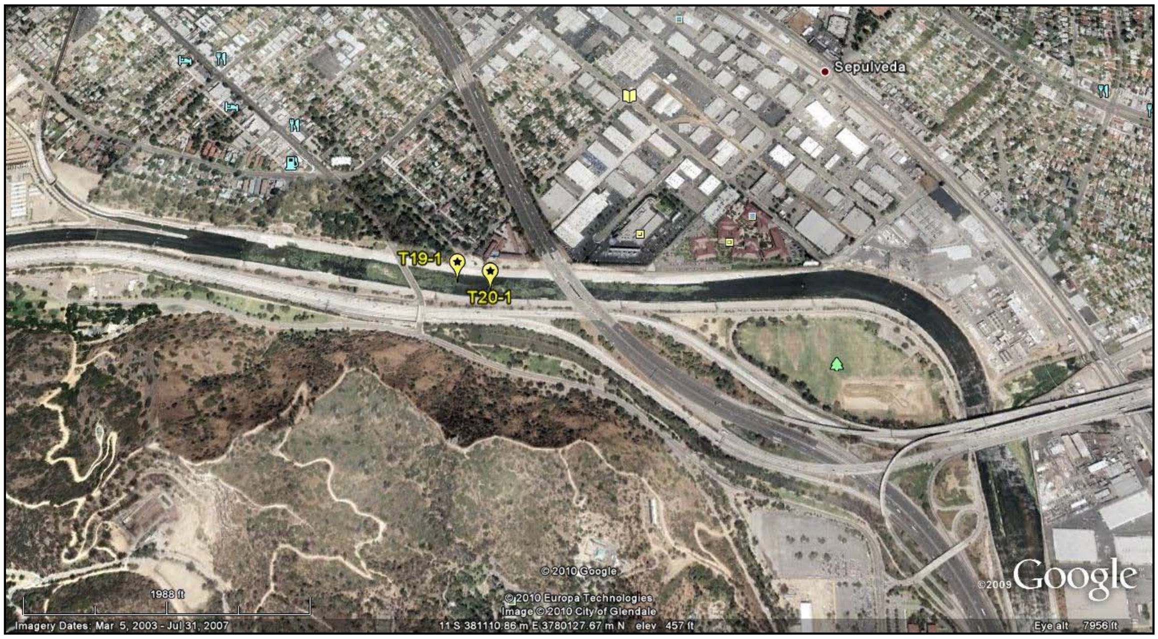


Figure 3 LA River riparian transect start point locations (north)

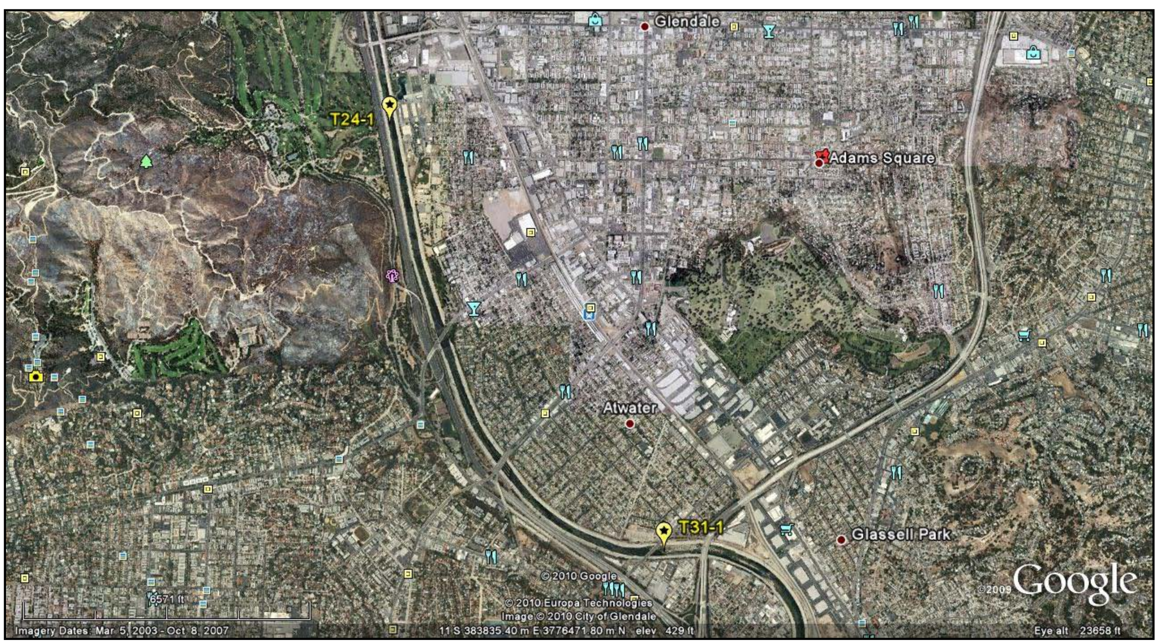


Figure 4 LA River riparian transect start point locations (south)

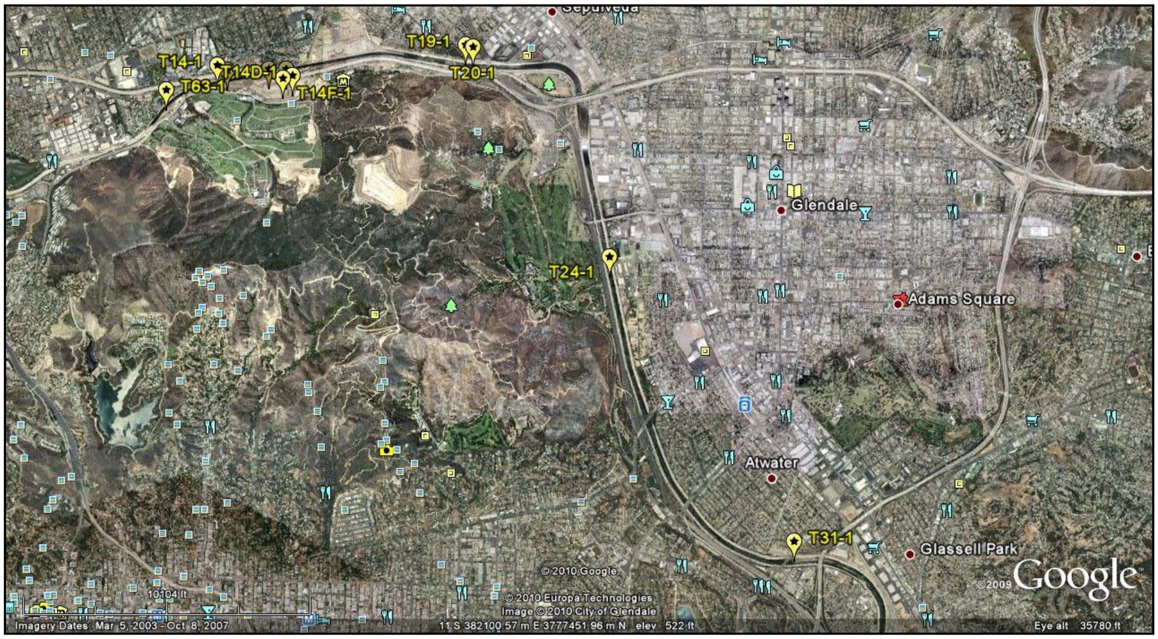


Figure 5 Verification transect start point overview map (all transect start locations)

Transect start points were established at random locations. Transect azimuths were selected from a random numbers table whenever possible (the narrow, linear nature of riparian habitats/transects precluded use of random azimuths). Once an azimuth was determined, a 300' measuring tape was used as the transect line from which habitat variable measurements were taken.

Transect start and end UTM coordinates were recorded on a Garmin 60CSx® global positioning system (GPS) and are displayed Table 1. The end point for transect 24-1 was unavailable due to limited GPS satellite coverage.

Transect length was 300 feet wherever possible. Transect 19-1, however, was only 250 feet in length because of the limited amount of riparian forest habitat available. Similarly, transect 63-1 extended only 150 feet.

Table 1 LA River project transect UTM coordinates, azimuths, and lengths

Site	Transect Number	Point	UTM Coordinates (NAD 83) E	UTM Coordinates (NAD 83) N	Magnetic Azimuth	Transect Length (FT)
LA River	19-1	Start	0380805	3780223	275	250
		End	0380735	3780227		
	20-1	Start	0380891	3780198	080	300
		End	0380976	3780196		
	24-1	Start	0382423	3777918	156	300
		End	Unknown	Unknown		
	31-1	Start	0384453	3774886	075	300
		End	0384540	3774889		
	63-1	Start	0377536	3779670	052	150
		End	0377575	3779686		
Head Works	14-1	Start	0378089	3779962	097	300
		End	0378174	3779949		
	14B-1	Start	0378654	3779919	230	300
		End	0378585	3779865		
	14D-1	Start	0378915	3779852	245	300
		End	0378904	3779941		
	14F-1	Start	0378811	3779819	245	300
		End	0378719	3779805		
	14G-1	Start	0378843	3779920	178	300
		End	0378812	3779844		
	15-1	Start	0378198	3779907	265	300
		End	0378110	3779918		

Methods

Verification transects (n = 11) were established in riparian forest, floodplain riparian shrub, grassland, and shrubland cover types located on LA River "soft bottom" sites and/or the Head Works area. Ashley (2010) describes the specific methods used to measure habitat attributes in Habitat Measurement Techniques.

Habitat attributes measured in this study included:

1. Tree and shrub species
2. Tree and shrub canopy cover
3. Tree and shrub height
4. Diameter breast height (DBH)
5. Snag density, size, and class (only one snag was detected)
6. Percent herbaceous plant cover
7. Herbaceous cover height
8. Percent grass cover
9. Percent cover forbs
10. Percent cover exotic/invasive herbaceous vegetation

Tree and shrub data was collected using the point intercept method. Tree canopy point cover was collected at five foot intervals while shrub point intercept data was collected at either five foot or two intervals foot intervals predicated on initial shrub cover estimates (two foot intervals are applied when estimated shrub cover is < 30%).

A rectangular 0.10m^2 quadrat was used to estimate total herbaceous cover, grass cover, forbs cover, and percent cover of invasive herbaceous species (percent cover = aerial cover). Quadrats were placed adjacent to the transect line at 25 foot intervals. Herbaceous vegetation height measurements were taken within the quadrats with a "pocket rod" and recorded in 10ths of feet (Ashley 2010).

Results

Verification transect results for the LA River and Head Works sites are summarized below. Percent cover estimates are rounded to the nearest whole number. Actual data sets, including species information, can be viewed at the data link locations included in the summary tables. Transect photographs are shown in Appendix A.

LA River

Three verification transects were established in the riparian forest cover type, one transect in shrub-scrub floodplain, and one transect in disturbed grassland. Snag, shrub, and tree data was collected on the riparian forest and shrub-scrub transects (only one snag was detected which had an 8.5 inch dbh). Only herbaceous habitat attribute data was recorded on Transect 63-1 (shrubs were not present).

Tree canopy cover ranged from 17% to 77%. The average minimum tree height was just over 17 feet while the maximum tree height was slightly more than 49 feet. Tree species detected included eucalyptus (*Eucalyptus* globules), shamel ash (*Fraxinus* uhdei), white mulberry (*Morus alba*), sycamore (*Paltanus* sp.), and red willow (*Salix* laevigata).

Shrub cover ranged from 48% to 64% while mean shrub height varied little extending from approximately 3.5 feet to just over 4 feet. Shrub species (included trees < 16 feet in height) detected included castor bean (*Ricinus* spp.), Mexican fan palm (*Washingtonia robusta*), arroya willow (Salix lasiolepis), shamel ash, white mulberry, mule fat (*Baccharis salicifolia*), red willow, and California sagebrush (*Artemisia californica*).

Total herbaceous cover on transect 63-1 was 81%, which was comprised entirely of invasive plant species. Summarized LA River transect results and data spreadsheet links are provided in Table 2.

Table 2 Summarized LA River verification transect results and data links

Cover Type	Transect Number	Habitat Stratum	Percent Cover	Mean Height (Feet)		DBH Class Range (Inches)		Data Link
Riparian Forest	19-1	Trees	58%	49.20		<4 to >20		19
		Shrubs	64%	3.53		N/A		
Riparian Forest	20-1	Trees	72%	37.50		4 to 20		20
		Shrubs	50%	3.77		N/A		
Riparian Forest	24-1	Trees	77%	38.00		4 to >20		24
		Shrubs	53%	4.22		N/A		
Shrub-scrub Floodplain	31-1	Trees	17%	17.30		<4 to 20		31
		Shrubs	48%	4.00		N/A		
Cover Type	**Transect Number**	**Habitat Stratum**	**Percent Herb. Cover**	**Mean Height**	**Percent Grass**	**Percent Forbs**	**Percent Exotics**	**Data Link**
Disturbed Grassland	63-1	Herbaceous Stratum	81%	6”	71.50	23.50	80.50	63

Head Works

Four shrubland and two grassland verification transects were established at the Head Works site. Both shrub and herbaceous habitat attribute data was collected on most transects.

Percent shrub cover ranged from 11% to 92% while shrub height was between 5 feet and 6 feet on three transects and just over 10 feet on the fourth transect. Shrub species detected included Spanish broom (*Spartium* junceum), poison oak (*Toxicodendron diversilobum*), mule fat, Mexican elderberry (*Sambucus mexicana*), laurel sumac (*Malosma laurina*), coyote brush (*Baccharis pilularis*), deerweed (*Lotus scoparius*) (half shrub), and California sagebrush (Table 3).

Table 3 Head Works site shrub verification transect results

Cover Type	Transect Number	Habitat Stratum	Percent Cover	Mean Height (Feet)	Data Link
Shrubland	14B-1	Shrubs	11%	5.82	14B-1
Shrubland	14D-1	Shrubs	35%	5.04	14D-1
Riparian Shrub	14F-1	Shrubs	53%	5.75	14F-1
Shrubland	15-1	Shrubs	92%	10.22	15-1

Percent cover of herbaceous vegetation ranged from 67% to 88% with only a trace amount (<1%) comprised of native species while the average height ranged from four to 15 inches. Herbaceous transect results are summarized in Table 4.

Table 4 Head Works site herbaceous stratum verification transect results

Cover Type	Transect Number	Habitat Stratum	Percent Herb. Cover	Mean Height	Percent Grass	Percent Forbs	Percent Exotics	Data Link
Shrubland	14B-1	Herbaceous	67%	4”	31%	50%	67%	14B-1
Grassland	14-1	Herbaceous	84%	13”	82%	5%	83%	14-1
Shrubland	14D-1	Herbaceous	88%	7”	79%	36%	88%	14D-1
Grassland	14G-1	Herbaceous	70%	15”	35%	60%	70%	14G-1

References

Ashley, P. R. 2010. Habitat Measurement Techniques. Regional HEP Team. Columbia Basin Fish and Wildlife Authority. Portland, OR.

Appendix A – Transect Photographs

Transect 14-1

Transect 14B-1

Transect 14D-1

Transect 14F-1

Transect 14G-1

Transect 15-1

Transect 19-1

Transect 20-1

Transect 24 -1

Transect 63-1

CHAP Appendix
Appendix F
Alternative Measures Matrix

Alternatives Submeasure Matrix by River Reach

Reach	Submeasure	Comprehensive 1	City: Atwater to Cornfields 2	Banks & Tribs Only 3	Highest Scoring Objectives (over 3) 4	City: Los Feliz to Arroyo Seco 5	Corps Team 6	highest objectives (over 5) 7	Charette Team 1 8	associated banks &Soft Bottom Chanml 9	Highest Other Criteria (over 11) 10	Charette Team 4 11	Charette Team 3 12	Charette Team 6 13	Charette Team 5 14	Charette Team 2 15	Side Channels Only 16	Charette Team 7 17	nsive PocketsComprehe 18	Taylor Yard 19
1. Pollywog Park/Headworks to Midpoint of Betty Davis Park	3/5. create geomorphology and plant for freshwater marsh, open water Ie pool/riffle system	X		X	X					X	X				X	X	X	X		
	2. expose stormdrain outlets; convert to natural stream confluence, & divert to water quality ponds as needed (put in adjacent channel etc)	X		X			X			X	X				X		X			
	10. divert tributary & river flow into side channels on both sides (minimize impacts to existing use in parks & plant ripairan/marsh habitat)	X		X			X		X	X	X						X			
	7. Create underground basin for attenuation at equestrian center - continue current use	X		X			X			X					X		X		X	
	9. culverts & or underground basins to divert flood flows	X		X	X		X	X	X	X						X		X		
	16. bioengineer channel walls (vines, vegetated notching near top of vertical walls)	X							X					X						
	17. habitat corridors/ riparian planting on banks (assume easiest method)	X		X	X		X		X	X	X	X	X	X	X	X	X	X	X	
	23. channel bed (implies deepening or attenuation)	X			X		X		X	X	X		X		X					
	25. tributary channels/widen channel (implies erosion control)	X		X			X			X										
	26. terrace banks (check for connectivity vs too small once mapping is completed)	X		X			X		X	X	X		X	X	X			X		
	27. modify trap channel to vertical sides to gain width (adds capacity)	X			X			X						X						

Reach	Submeasure	Comprehensive 1	City: Atwater to Cornfields 2	Banks & Tribs Only 3	Highest Scoring Objectives (over 3) 4	City: Los Feliz to Arroyo Seco 5	Corps Team 6	highest objectives (over 5) 7	Charette Team 1 8	associated banks &Soft Bottom Channl 9	Highest Other Criteria (over 11) 10	Charette Team 4 11	Charette Team 3 12	Charette Team 6 13	Charette Team 5 14	Charette Team 2 15	Side Channels Only 16	Charette Team 7 17	Comprehensive Pockets 18	Taylor Yard 19
2. Midpoint Betty Davis Park to upstream end of Ferraro Fields	3/5. create geomorphology and plant for freshwater marsh, open water Ie pool/riffle system	X		X	X					X	X				X	X	X	X		
	2. expose stormdrain outlets; convert to natural stream confluence, & divert to water quality ponds as needed (put in adjacent channel etc)	X		X			X			X	X						X			
	10. divert tributary & river flow into side channels on both sides (minimize impacts to existing use in parks & plant ripairan/marsh habitat)	X		X			X		X	X	X						X			
	9. culverts & or underground basins to divert flood flows	X		X	X		X	X	X	X						X		X		
	16. bioengineer channel walls (vines, vegetated notching near top of vertical walls)	X							X					X						
	17. habitat corridors/ riparian planting on banks (assume easiest method)	X		X	X		X	X	X	X	X	X	X	X	X	X	X			
	23. channel bed (implies deepening or attenuation)				X			X												
	26. terrace banks (check for connectivity vs too small once mapping is completed)	X					X		X	X	X		X							
	27. modify trap channel to vertical sides to gain width (adds capacity)	X			X			X						X						

Reach	Submeasure	Comprehensive 1	City: Atwater to Cornfields 2	Banks & Tribs Only 3	Highest Scoring Objectives (over 3) 4	City: Los Feliz to Arroyo Seco 5	Corps Team 6	highest objectives (over 5) 7	Charette Team 1 8	associated banks &Soft Bottom Channl 9	Highest Other Criteria (over 11) 10	Charette Team 4 11	Charette Team 3 12	Charette Team 6 13	Charette Team 5 14	Charette Team 2 15	Side Channels Only 16	Charette Team 7 17	Comprehensive Pockets 18	Taylor Yard 19
3. Ferraro Fields to Brazil St	3/5. create geomorphology and plant for freshwater marsh, open water Ie pool/riffle system	X		X	X					X	X			X	X		X		X	
	2. expose stormdrain outlets; convert to natural stream confluence, & divert to water quality ponds as needed (put in adjacent channel etc)	X	X	X			X		X	X							X	X		
	10. divert tributary & river flow into side channels on both sides (minimize impacts to existing use in parks & plant ripairan/marsh habitat) ro recreate channel braiding	X		X	X				X	X	X	X	X				X		X	
	9. culverts & or underground basins to divert flood flows	X	X	X	X		X	X	X	X				X		X		X		
	16. bioengineer channel walls (vines, vegetated notching near top of vertical walls)	X	X						X					X						
	17. habitat corridors/ riparian planting on banks (assume easiest method)	X	X	X	X		X	X	X	X	X	X	X	X	X		X		X	
	18. open water	X								X								X		
	21/22 widenchannel, provide erosion control may lower channel banks and provide setback levees or vegetated berms			X						X		X		X					X	
	23. channel bed (implies deepening or attenuation)		X		X			X												
	25. tributary channels/widen channel (implies erosion control)	X					X		X	X		X	X	X	X	X			X	
	26. terrace banks (check for connectivity vs too small once mapping is completed)	X		X			X			X		X		X						
	27. modify trap channel to vertical sides to gain width (adds capacity)	X	X		X			X					X	X						

Reach	Submeasure	Comprehensive 1	City: Atwater to Cornfields 2	Banks & Tribs Only 3	Highest Scoring Objectives (over 3) 4	City: Los Feliz to Arroyo Seco 5	Corps Team 6	highest objectives (over 5) 7	Charette Team 1 8	associated banks &Soft Bottom Channl 9	Highest Other Criteria (over 11) 10	Charette Team 4 11	Charette Team 3 12	Charette Team 6 13	Charette Team 5 14	Charette Team 2 15	Side Channels Only 16	Charette Team 7 17	Comprehensive Pockets 18	Taylor Yard 19
4. Brazil to Los Feliz Blvd	3/5. create geomorphology and plant for freshwater marsh, open water Ie pool/riffle system	X	X	X	X			X	X		X						X	X		
	2. expose stormdrain outlets; convert to natural stream confluence, & divert to water quality ponds as needed (put in adjacent channel etc)	X	X	X	X	X	X	X	X	X	X		X			X	X	X		
	10. divert tributary & river flow into side channels on both sides (minimize impacts to existing use in parks & plant ripairan/marsh habitat)	X	X	X	X	X	X	X	X		X			X			X			
	7. Create underground basins for attenuation - continue current use	X		X					X				X	X			X			
	9. culverts & or underground basins to divert flood flows	X	X	X	X	X	X	X	X	X						X		X		
	12. bridge undercrossings for wildlife	X	X													X				
	15. wildlife passage/tunnels	X	X	X			X							X		X				
	16. bioengineer channel walls (vines, vegetated notching near top of vertical walls)	X	X			X			X					X						
	17. habitat corridors/ riparian planting on banks (assume easiest method)	X	X		X	X	X	X	X			X	X	X			X			
	21/22 widenchannel, provide erosion control may lower channel banks and provide setback levees or vegetated berms	X	X		X		X	X					X		X					
	26. terrace banks (check for connectivity vs too small once mapping is completed)	X	X	X	X		X	X	X	X	X	X		X	X					
	27. modify trap channel to vertical sides to gain width (adds capacity)	X	X		X	X		X						X						

Reach	Submeasure	Comprehensive 1	City: Atwater to Cornfields 2	Banks & Tribs Only 3	Highest Scoring Objectives (over 3) 4	City: Los Feliz to Arroyo Seco 5	Corps Team 6	highest objectives (over 5) 7	Charette Team 1 8	associated banks &Soft Bottom Channl 9	Highest Other Criteria (over 11) 10	Charette Team 4 11	Charette Team 3 12	Charette Team 6 13	Charette Team 5 14	Charette Team 2 15	Side Channels Only 16	Charette Team 7 17	Comprehensive Pockets 18	Taylor Yard 19
5. Los Feliz to Glendale Fwy (2)	3/5. create geomorphology and plant for freshwater marsh, open water Ie pool/riffle system	X	X	X		X			X		X	X		X						
	2. expose stormdrain outlets; convert to natural stream confluence, & divert to water quality ponds as needed (put in adjacent channel etc)	X	X			X	X			X							X			
	9. culverts & or underground basins to divert flood flows	X	X	X	X	X	X	X	X	X						X		X		
	14. wildlife access from river to bank (in daylighted storm drain)	X	X			X	X		X		X					X				
	16. bioengineer channel walls (vines, vegetated notching near top of vertical walls)	X	X			X			X					X						
	17. habitat corridors/ riparian planting on banks (assume easiest method)	X	X		X	X	X	X	X			X	X	X			X			
	23. channel bed (implies deepening or attenuation)		X		X	X		X												
	26. terrace banks (check for connectivity vs too small once mapping is completed)	X	X	X		X						X								
	27. modify trap channel to vertical sides to gain width (adds capacity)	X	X		X	X		X						X						

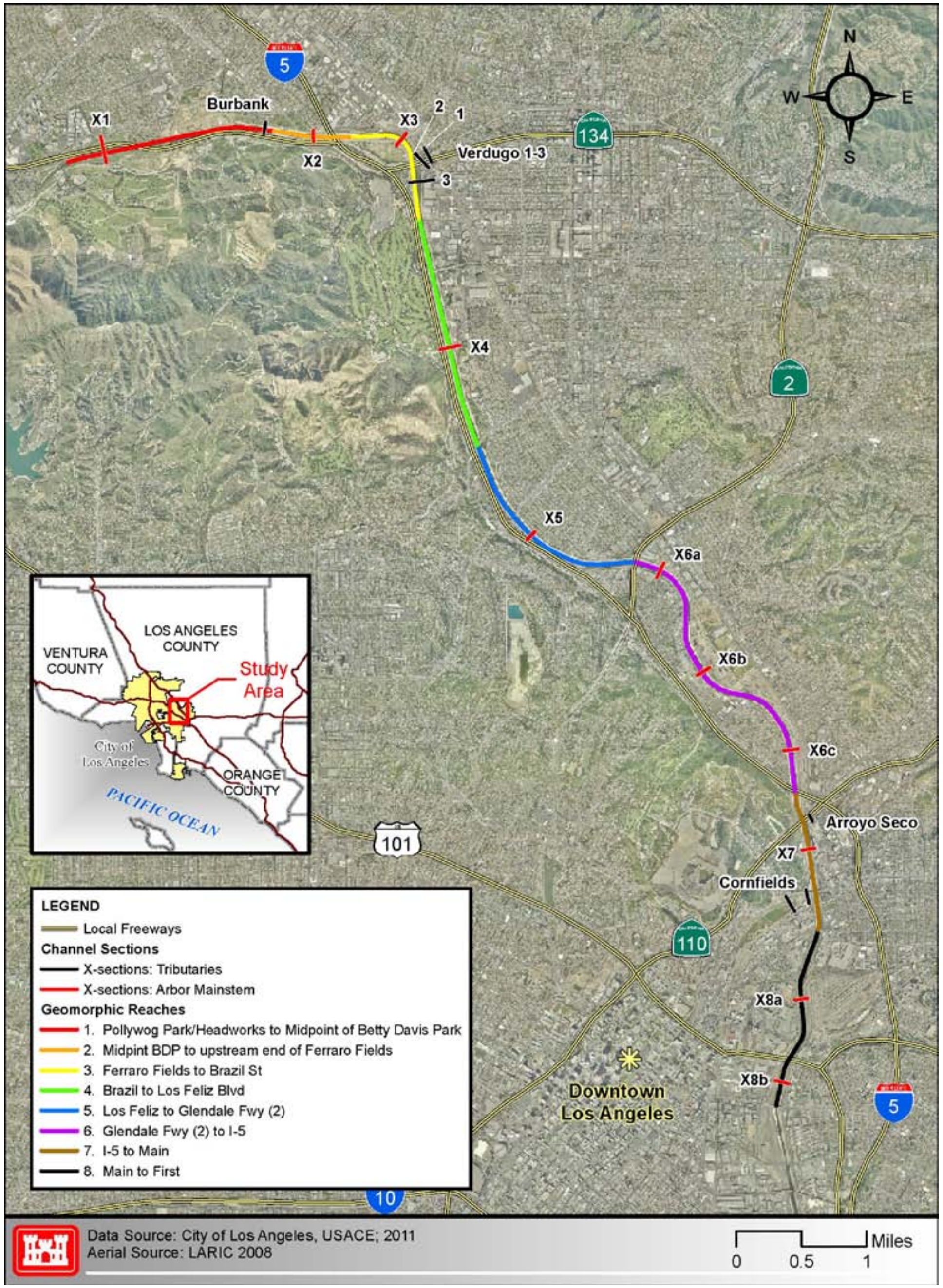
Reach	Submeasure	Comprehensive 1	City: Atwater to Cornfields 2	Banks & Tribs Only 3	Highest Scoring Objectives (over 3) 4	City: Los Feliz to Arroyo Seco 5	Corps Team 6	highest objectives (over 5) 7	Charette Team 1 8	associated banks &Soft Bottom Channl 9	Highest Other Criteria (over 11) 10	Charette Team 4 11	Charette Team 3 12	Charette Team 6 13	Charette Team 5 14	Charette Team 2 15	Side Channels Only 16	Charette Team 7 17	Comprehensive Pockets 18	Taylor Yard 19
6. Glendale Fwy (2) to I-5	3/5. create geomorphology and plant for freshwater marsh, open water Ie pool/riffle system	X	X	X	X	X	X			X	X		X	X	X	X	X	X	X	X
	2. expose stormdrain outlets; convert to natural stream confluence, & divert to water quality ponds as needed (put in adjacent channel etc)	X	X	X	X	X	X			X							X		X	X
	9. culverts & or underground basins to divert flood flows	X	X	X	X	X	X	X	X	X						X		X		
	16. bioengineer channel walls (vines, vegetated notching near top of vertical walls)	X	X			X			X					X						
	17. habitat corridors/ riparian planting on banks (assume easiest method)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X
	19. Planting built into channel walls (reshape concrete walls to accommodate vegetation or add hanging boxes (native vines, small shrubs, etc)	X	X	X		X					X	X	X	X					X	
	20. bring concrete down to channel level; reconfigure as soft bottom channel	X	X	X	X	X	X			X				X	X	X			X	X
	21/22 widenchannel, provide erosion control may lower channel banks and provide setback levees or vegetated berms	X	X	X	X	X	X	X		X		X	X	X	X	X		X	X	X
	26. terrace banks (check for connectivity vs too small once mapping is completed)	X	X	X		X	X		X	X	X	X	X			X		X	X	X
	27. modify trap channel to vertical sides to gain width (adds capacity)	X	X		X	X		X						X						

Reach	Submeasure	1 Comprehensive	2 City: Atwater to Cornfields	3 Banks & Tribs Only	4 Highest Scoring Objectives (over 3)	5 City: Los Feliz to Arroyo Seco	6 Corps Team	7 highest objectives (over 5)	8 Charette Team 1	9 associated banks &Soft Bottom Channl	10 Highest Other Criteria (over 11)	11 Charette Team 4	12 Charette Team 3	13 Charette Team 6	14 Charette Team 5	15 Charette Team 2	16 Side Channels Only	17 Charette Team 7	18 Comprehensive Pockets	19 Taylor Yard
	2. expose existing storm drains & gravity flow through DWP to LAR with terracing into the river	X	X	X			X		X		X	X				X			X	
	3/5. create geomorphology and plant for freshwater marsh, open water Ie pool/riffle system	X	X	X	X	X	X		X		X	X		X		X	X	X	X	
	3. expose stormdrain outlets; convert to natural stream confluence, & divert to water quality ponds as needed (put in adjacent channel etc)	X	X			X	X			X							X			
	10. divert tributary & river flow into side channels on both sides (minimize impacts to existing use in parks & plant ripairan/marsh habitat)	X	X	X										X			X		X	
	8. creation of wetlands flood control basin (assumes culvert under Baker St)	X	X	X			X					X							X	
	9. culverts & or underground basins to divert flood flows	X	X	X	X	X	X	X	X	X						X		X		
	16. bioengineer channel walls (vines, vegetated notching near top of vertical walls)	X	X			X			X					X						
	17. habitat corridors/ riparian planting on banks (assume easiest method)	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X		X	
	19. Planting built into channel walls (reshape concrete walls to accommodate vegetation or add hanging boxes (native vines, small shrubs, etc)	X	X	X		X					X	X	X	X					X	
	26. terrace banks (check for connectivity vs too small once mapping is completed)	X	X	X		X	X		X		X	X		X						
	27. modify trap channel to vertical sides to gain width (adds capacity)	X	X		X	X		X						X						

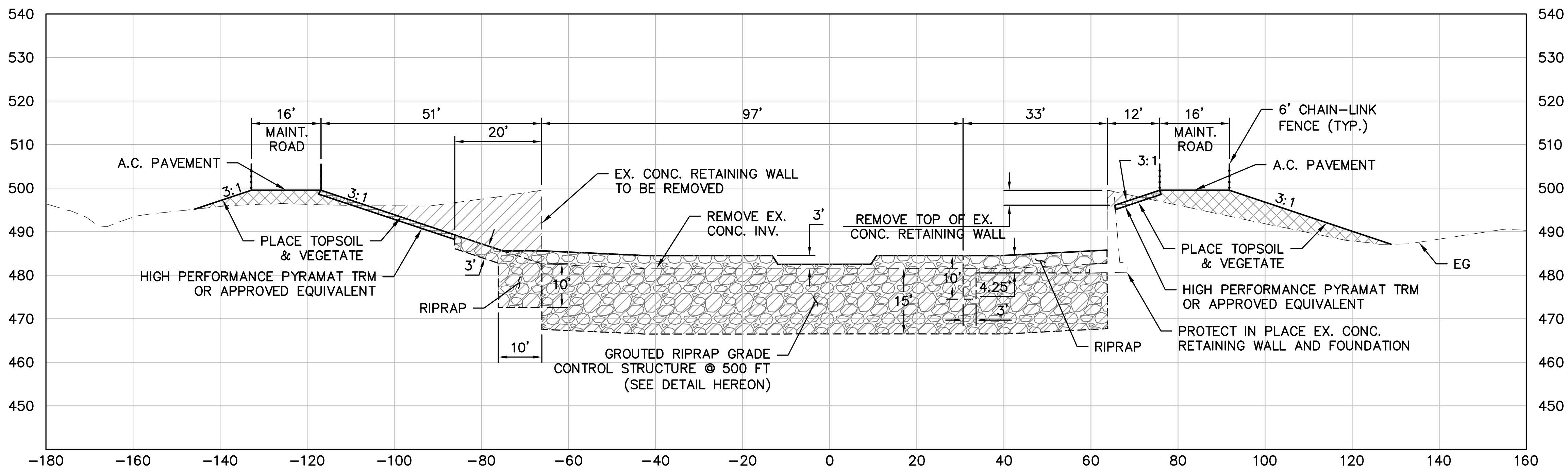
Reach	Submeasure	Comprehensive 1	City: Atwater to Cornfields 2	Banks & Tribs Only 3	Highest Scoring Objectives (over 3) 4	City: Los Feliz to Arroyo Seco 5	Corps Team 6	highest objectives (over 5) 7	Charette Team 1 8	associated banks &Soft Bottom Channl 9	Highest Other Criteria (over 11) 10	Charette Team 4 11	Charette Team 3 12	Charette Team 6 13	Charette Team 5 14	Charette Team 2 15	Side Channels Only 16	Charette Team 7 17	Comprehensive Pockets 18	Taylor Yard 19
8. Main to First	1. elevate railroads on trestles (consider other locations when necessary - is this an "all alts" measure?)	X		X					X				X					X		
	3/5. create geomorphology and plant for freshwater marsh, open water Ie pool/riffle system	X		X	X		X		X		X				X		X			
	2. expose stormdrain outlets; convert to natural stream confluence, & divert to water quality ponds as needed (put in adjacent channel etc)	X					X			X							X			
	6. rebuild geomorphology for historic wash	X		X	X				X			X				X				
	10. divert tributary & river flow into side channels on both sides (minimize impacts to existing use in parks & plant ripairan/marsh habitat) to recreate channel braiding	X		X	X		X							X			X	X		
	9. culverts & or underground basins to divert flood flows	X		X	X		X	X	X	X						X		X		
	15. wildlife passage/tunnels	X		X			X					X				X				
	16. bioengineer channel walls (vines, vegetated notching near top of vertical walls)	X							X					X						
	17. habitat corridors/ riparian planting on banks (assume easiest method)	X		X	X		X	X	X		X	X	X	X	X	X	X			
	26. terrace banks (check for connectivity vs too small once mapping is completed)			X			X					X								
	27. modify trap channel to vertical sides to gain width (adds capacity)	X			X			X						X						

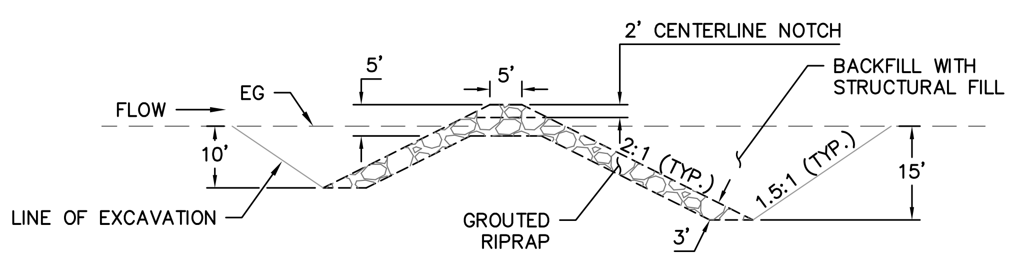
CHAP Appendix
Appendix G
Preliminary Design - Channel Cross Sections

Key to Cross Section Locations

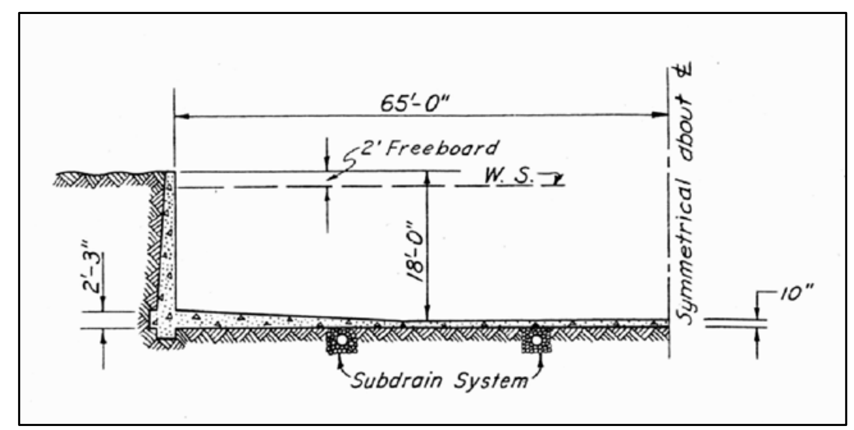


THIS IS A PRELIMINARY, PLANNING-LEVEL, CONCEPTUAL IMAGE USED FOR COST ESTIMATING PURPOSES ONLY.





GRADE CONTROL STRUCTURE DETAIL
NTS



EXISTING TYPICAL SECTION
NTS

0 15 30 60

LEGEND

— — — — —	EX. GROUND		RIPRAP
———	PROPOSED CHANNEL		REINFORCED CONCRETE
	EXCAVATION		HIGH PERFORMANCE PYRAMAT TURF REINFORCEMENT MAT (TRM) OR APPROVED EQUIVALENT
	COMPACTED FILL		

REVISIONS

MARK	DATE	DESCRIPTION	BY

TETRA TECH, INC.
17885 Von Karman Avenue, Suite 500
Irvine, CA 92614
Phone (949) 809-5103, FAX (949) 809-5003

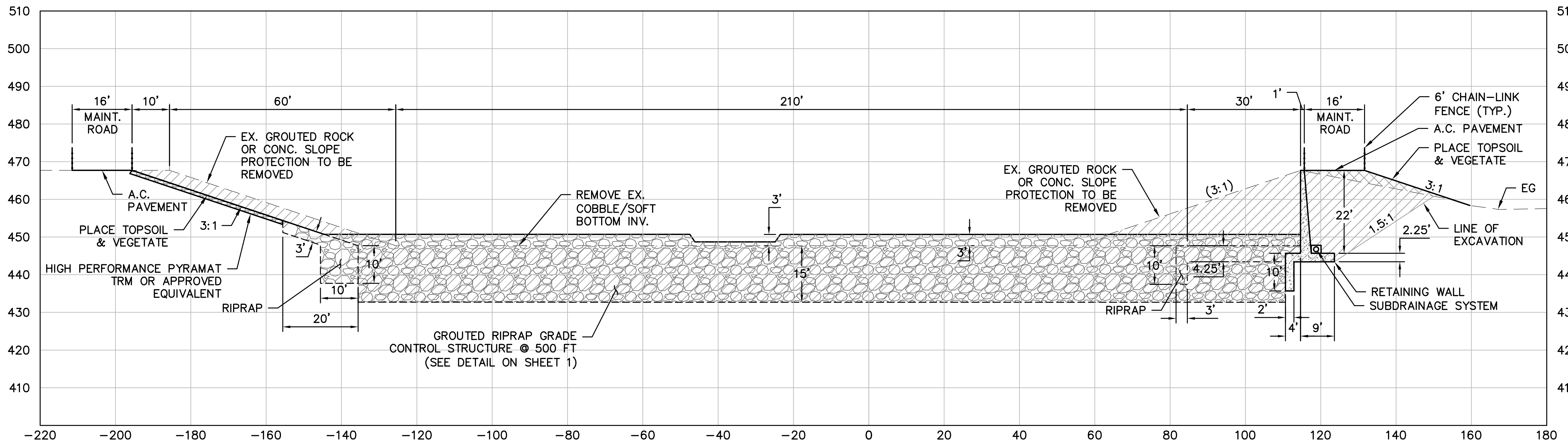
LOS ANGELES RIVER FEASIBILITY STUDY
PRELIMINARY DESIGN

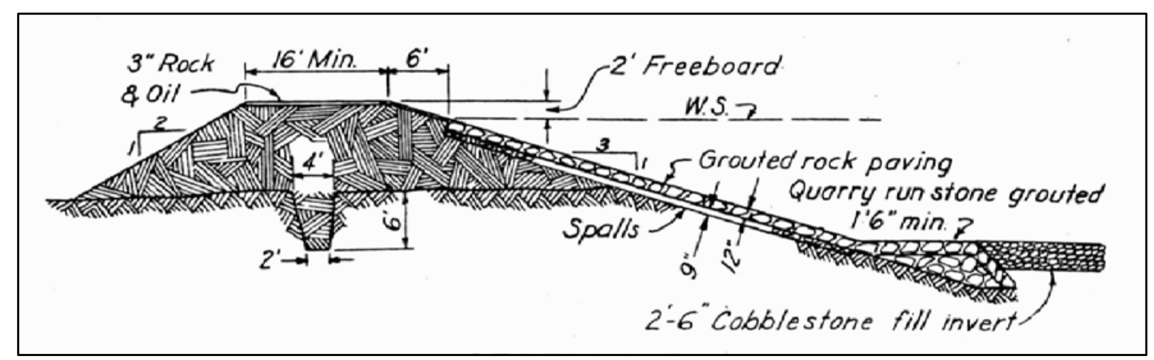
ARBOR REACH
CROSS SECTION 1

DATE
10/25/11

SHT NO.
1 OF 19

THIS IS A PRELIMINARY, PLANNING-LEVEL, CONCEPTUAL IMAGE USED FOR COST ESTIMATING PURPOSES ONLY.





EXISTING TYPICAL SECTION

NTS

0 15 30 60

LEGEND

EX. GROUND	RIPRAP
PROPOSED CHANNEL	REINFORCED CONCRETE
EXCAVATION	HIGH PERFORMANCE PYRAMAT TURF REINFORCEMENT MAT (TRM) OR APPROVED EQUIVALENT
COMPACTED FILL	

REVISIONS

MARK	DATE	DESCRIPTION	BY

TETRA TECH, INC.
17885 Von Karman Avenue, Suite 500
Irvine, CA 92614
Phone (949) 809-5103, FAX (949) 809-5003

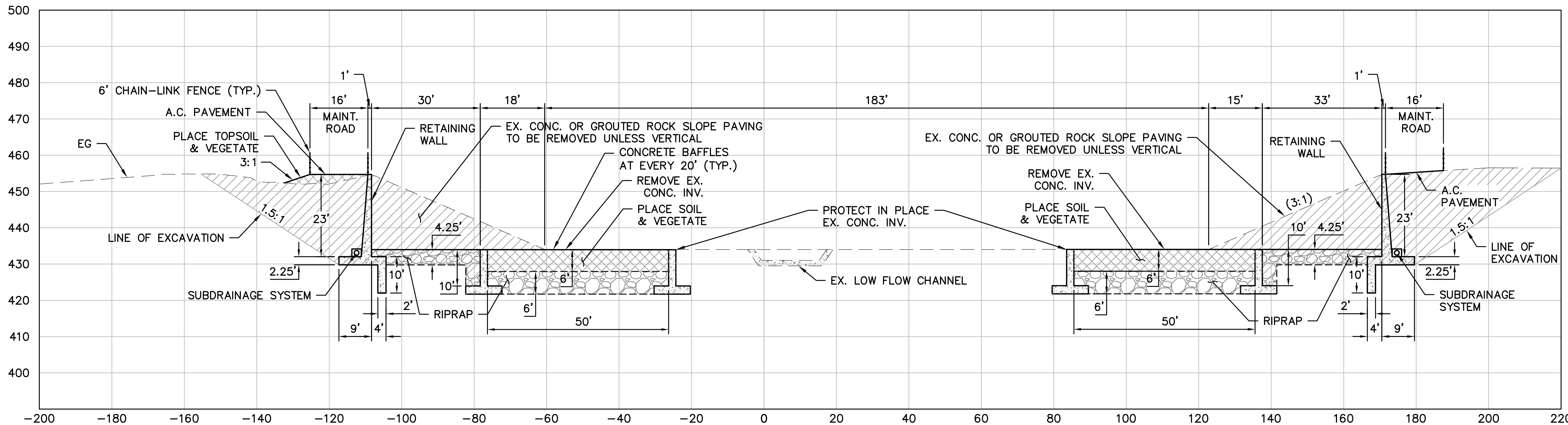
LOS ANGELES RIVER FEASIBILITY STUDY
PRELIMINARY DESIGN

ARBOR REACH
CROSS SECTION 2

DATE
10/25/11

SHT NO.
2 OF 19

THIS IS A PRELIMINARY, PLANNING-LEVEL, CONCEPTUAL IMAGE USED FOR COST ESTIMATING PURPOSES ONLY.



LEGEND

EX. GROUND		RIPRAP	
PROPOSED CHANNEL		REINFORCED CONCRETE	
EXCAVATION		HIGH PERFORMANCE PYRAMAT TURF REINFORCEMENT MAT (TRM) OR APPROVED EQUIVALENT	
COMPACTED FILL			

REVISIONS			
MARK	DATE	DESCRIPTION	BY

TETRA TECH, INC.
17885 Von Karman Avenue, Suite 500
Irvine, CA 92614
Phone (949) 809-5103, FAX (949) 809-5003

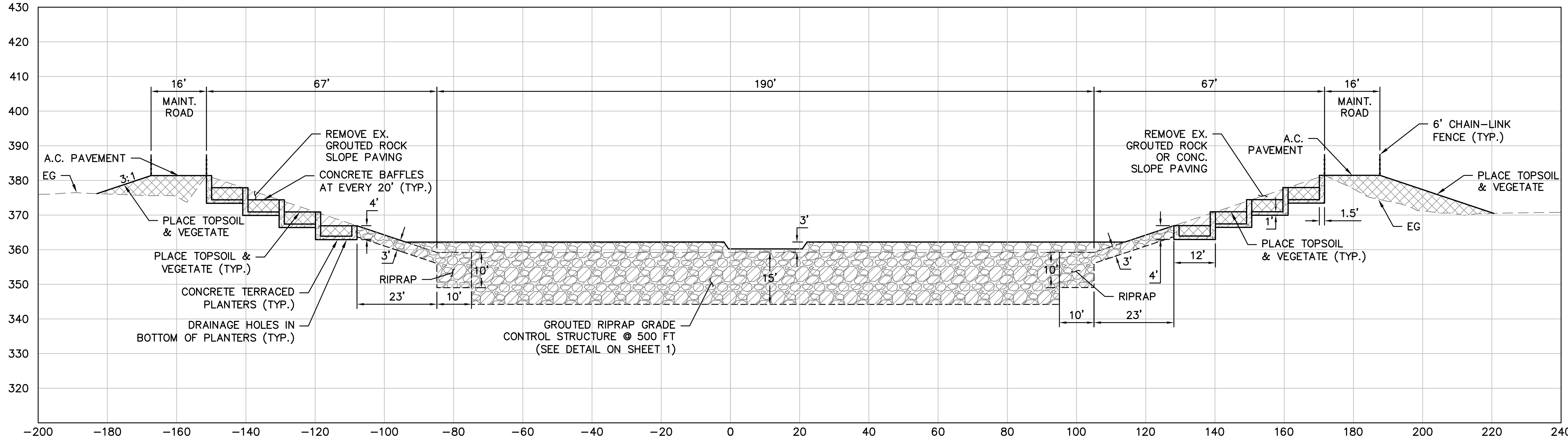
LOS ANGELES RIVER FEASIBILITY STUDY
PRELIMINARY DESIGN

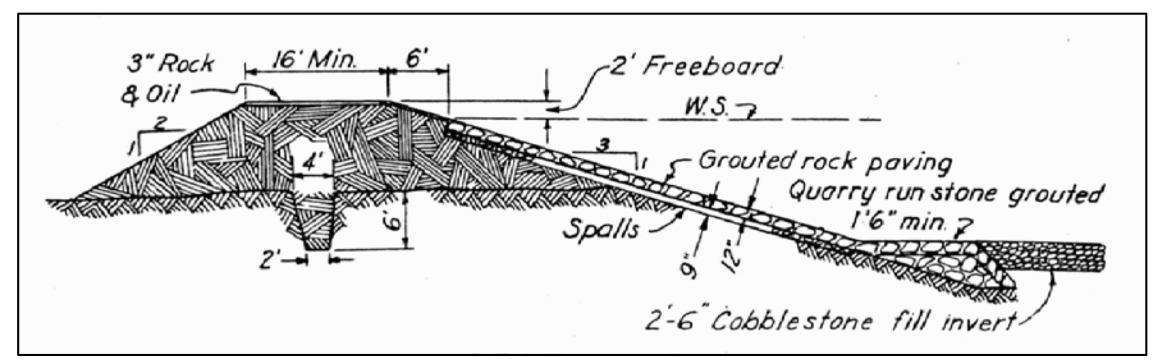
ARBOR REACH
CROSS SECTION 3

DATE 10/25/11

SHT NO. 3 OF 19

THIS IS A PRELIMINARY, PLANNING–LEVEL, CONCEPTUAL IMAGE USED FOR COST ESTIMATING PURPOSES ONLY.





EXISTING TYPICAL SECTION
NTS

0 15 30 60

LEGEND

EX. GROUND	RIPRAP
PROPOSED CHANNEL	REINFORCED CONCRETE
EXCAVATION	HIGH PERFORMANCE PYRAMAT TURF REINFORCEMENT MAT (TRM) OR APPROVED EQUIVALENT
COMPACTED FILL	

REVISIONS

MARK	DATE	DESCRIPTION	BY

TETRA TECH, INC.
17885 Von Karman Avenue, Suite 500
Irvine, CA 92614
Phone (949) 809–5103, FAX (949) 809–5003

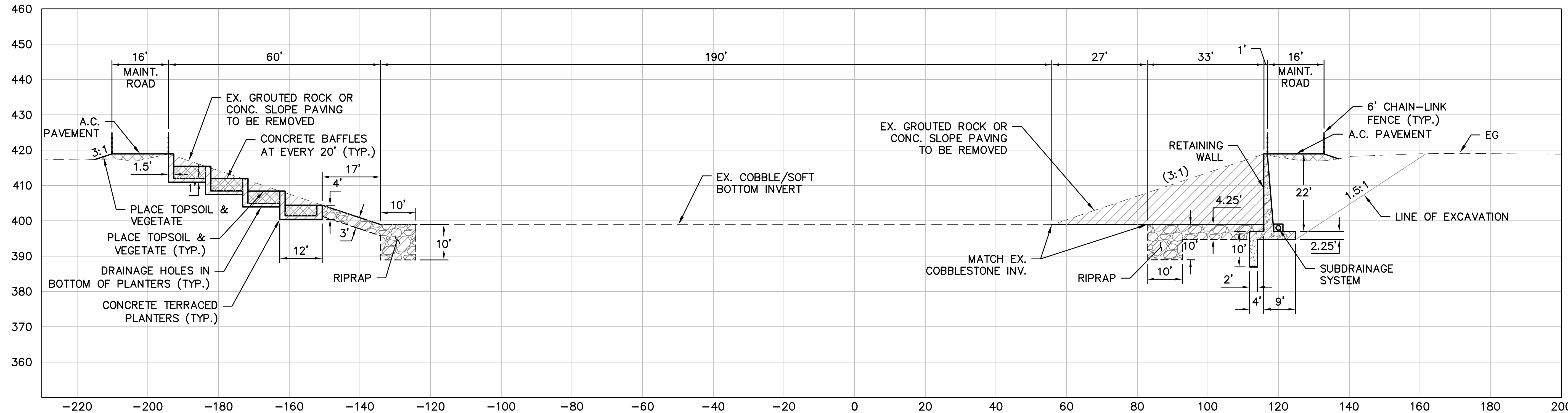
LOS ANGELES RIVER FEASIBILITY STUDY
PRELIMINARY DESIGN

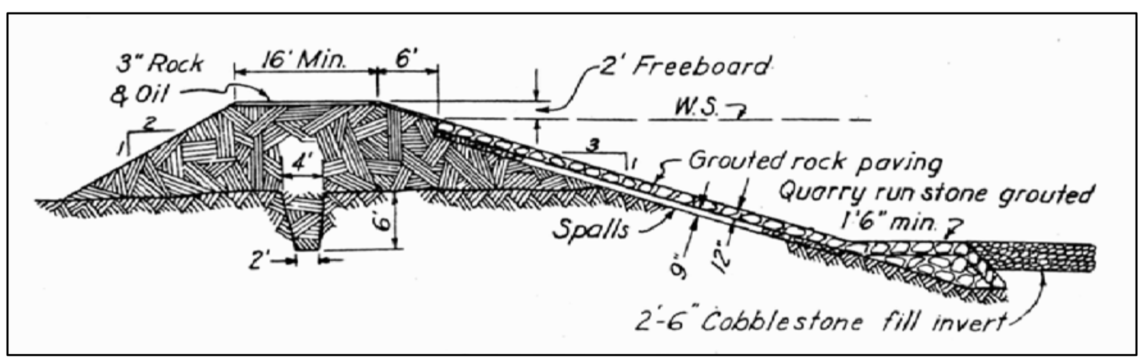
ARBOR REACH
CROSS SECTION 4

DATE
10/25/11

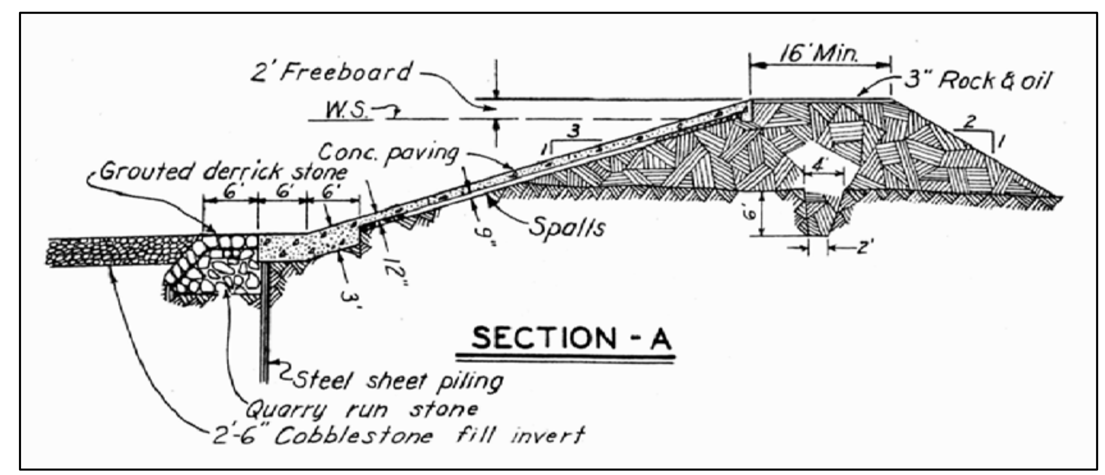
SHT NO.
4 OF 19

THIS IS A PRELIMINARY, PLANNING–LEVEL, CONCEPTUAL IMAGE USED FOR COST ESTIMATING PURPOSES ONLY.





EXISTING TYPICAL SECTION
NTS



EXISTING TYPICAL SECTION
NTS

0 15 30 60

LEGEND

— — — —	EX. GROUND		RIPRAP
———	PROPOSED CHANNEL		REINFORCED CONCRETE
	EXCAVATION		HIGH PERFORMANCE PYRAMAT TURF REINFORCEMENT MAT (TRM) OR APPROVED EQUIVALENT
	COMPACTED FILL		

REVISIONS			
MARK	DATE	DESCRIPTION	BY

TETRA TECH, INC.
17885 Von Karman Avenue, Suite 500
Irvine, CA 92614
Phone (949) 809–5103, FAX (949) 809–5003

LOS ANGELES RIVER FEASIBILITY STUDY
PRELIMINARY DESIGN

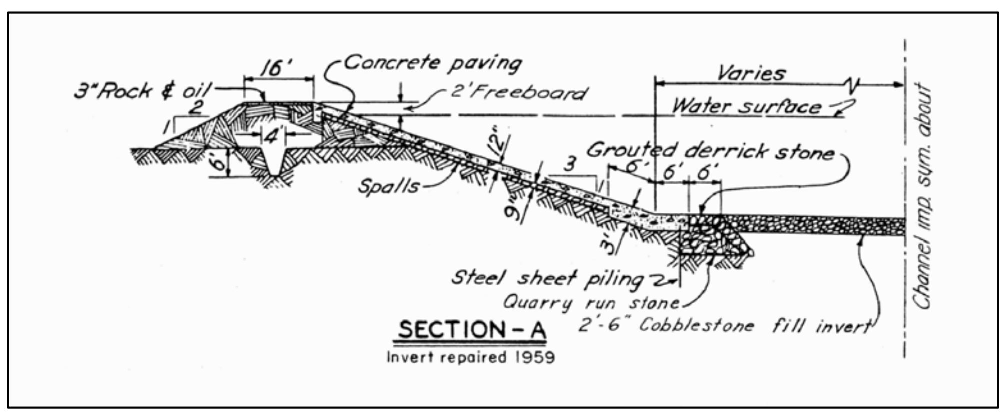
ARBOR REACH
CROSS SECTION 5

DATE
10/25/11

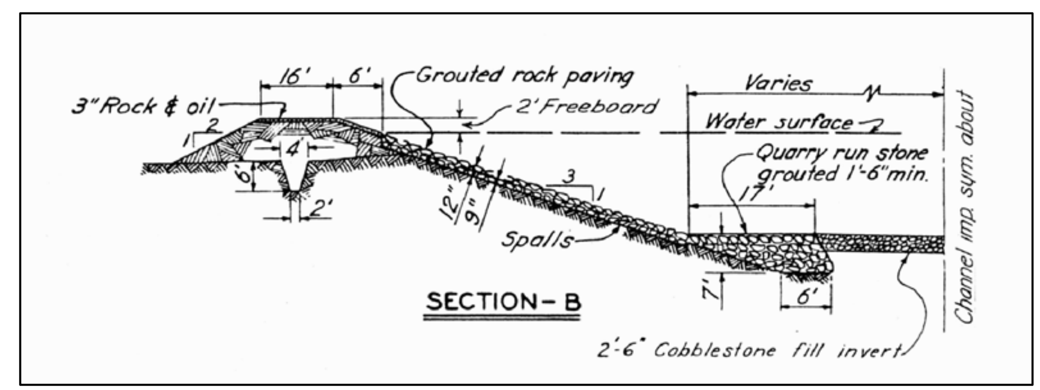
SHT NO.
5 OF 19

P:\Watr\T26313 LA River Feasibility F4\05_Design\CAD\T26313C–XS5.DWG 10/25/2011 13:08

THIS IS A PRELIMINARY, PLANNING-LEVEL, CONCEPTUAL IMAGE USED FOR COST ESTIMATING PURPOSES ONLY.



EXISTING TYPICAL SECTION
NTS



EXISTING TYPICAL SECTION
NTS

0 15 30 60

LEGEND

— — — —	EX. GROUND		RIPRAP
———	PROPOSED CHANNEL		REINFORCED CONCRETE
	EXCAVATION		HIGH PERFORMANCE PYRAMAT TURF REINFORCEMENT MAT (TRM) OR APPROVED EQUIVALENT
	COMPACTED FILL		

REVISIONS

MARK	DATE	DESCRIPTION	BY

TETRA TECH, INC.
17885 Von Karman Avenue, Suite 500
Irvine, CA 92614
Phone (949) 809-5103, FAX (949) 809-5003

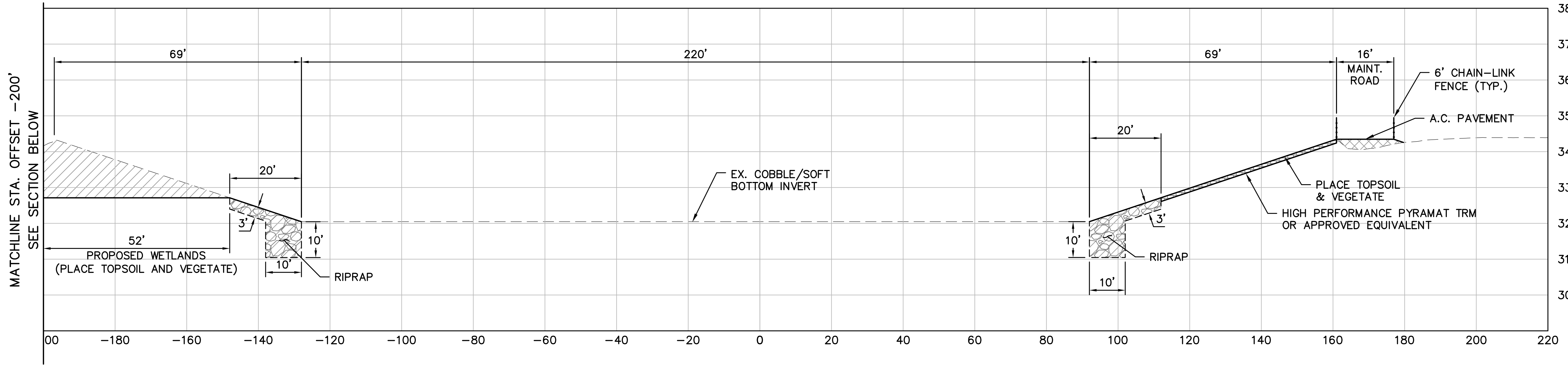
LOS ANGELES RIVER FEASIBILITY STUDY
PRELIMINARY DESIGN

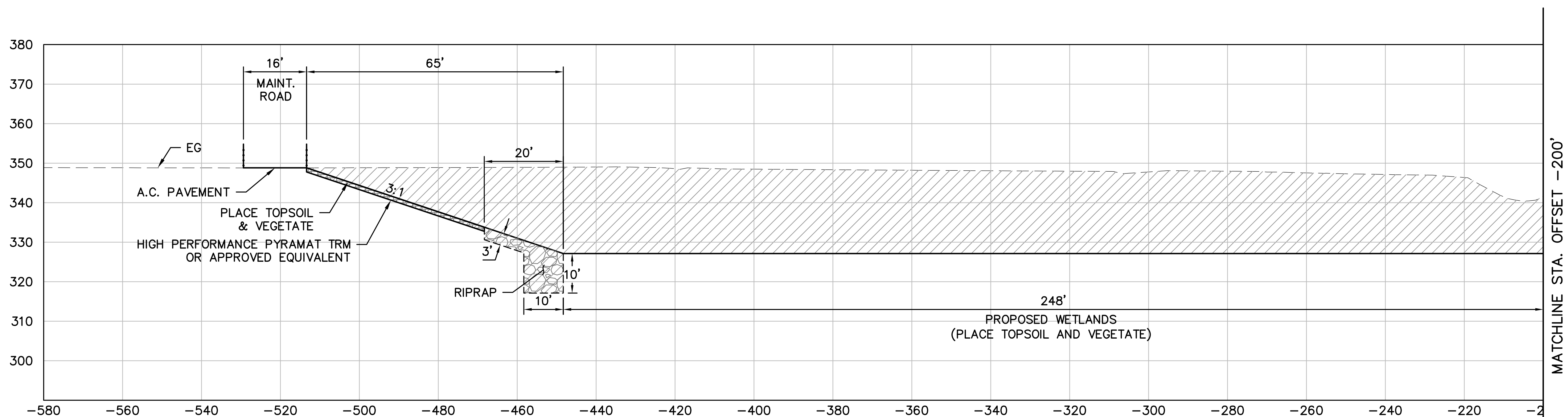
ARBOR REACH
CROSS SECTION 6a

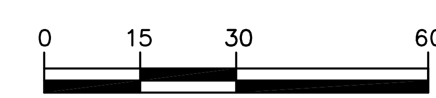
DATE
10/25/11

SHT NO.
6 OF 19

THIS IS A PRELIMINARY, PLANNING–LEVEL, CONCEPTUAL IMAGE USED FOR COST ESTIMATING PURPOSES ONLY.







LEGEND

— — — —	EX. GROUND		RIPRAP
———	PROPOSED CHANNEL		REINFORCED CONCRETE
	EXCAVATION		HIGH PERFORMANCE PYRAMAT TURF REINFORCEMENT MAT (TRM) OR APPROVED EQUIVALENT
	COMPACTED FILL		

NOTE: EXISTING TYPICAL SECTIONS PER SHEET 6

REVISIONS			
MARK	DATE	DESCRIPTION	BY

TETRA TECH, INC.
17885 Von Karman Avenue, Suite 500
Irvine, CA 92614
Phone (949) 809–5103, FAX (949) 809–5003

LOS ANGELES RIVER FEASIBILITY STUDY
PRELIMINARY DESIGN

ARBOR REACH
CROSS SECTION 6b

DATE
10/25/11

SHT NO.
7 OF 19

THIS IS A PRELIMINARY, PLANNING–LEVEL, CONCEPTUAL IMAGE USED FOR COST ESTIMATING PURPOSES ONLY.

LEGEND

EX. GROUND

PROPOSED CHANNEL

EXCAVATION

COMPACTED FILL

RIPRAP

REINFORCED CONCRETE

HIGH PERFORMANCE PYRAMAT TURF REINFORCEMENT MAT (TRM) OR APPROVED EQUIVALENT

NOTE: EXISTING TYPICAL SECTIONS PER SHEET 6

0 15 30 60

REVISIONS			
MARK	DATE	DESCRIPTION	BY

TETRA TECH, INC.
17885 Von Karman Avenue, Suite 500
Irvine, CA 92614
Phone (949) 809–5103, FAX (949) 809–5003

LOS ANGELES RIVER FEASIBILITY STUDY
PRELIMINARY DESIGN

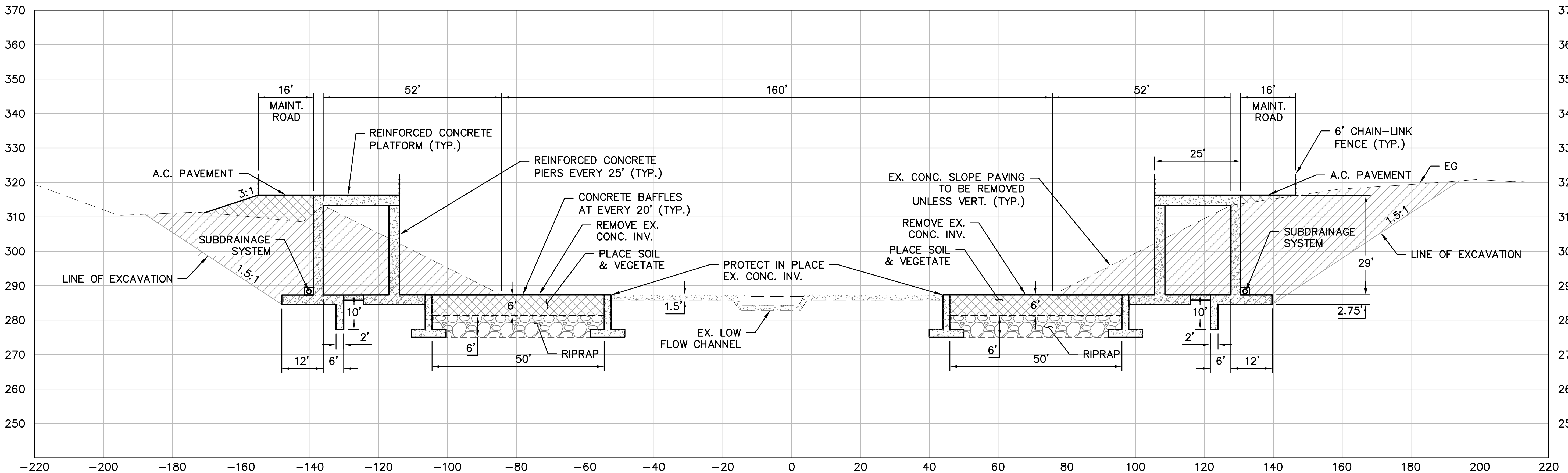
ARBOR REACH
CROSS SECTION 6c

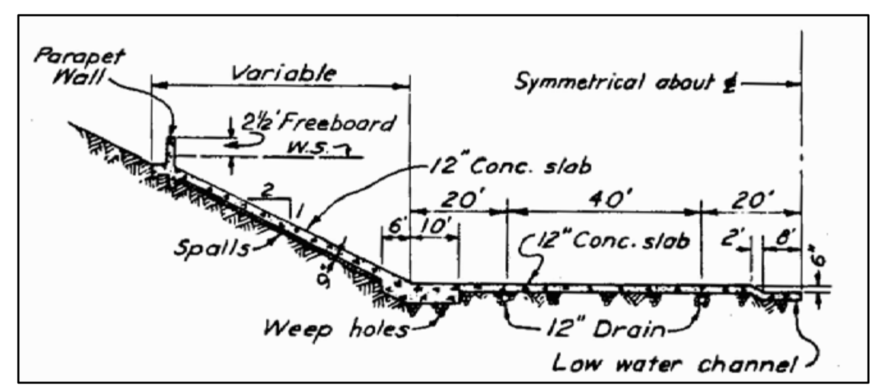
DATE
10/25/11

SHT NO.
8 OF 19

P:\Watr\T26313 LA River Feasibility F4\05_Design\CAD\T26313C–XS8.DWG 10/25/2011 13:11

THIS IS A PRELIMINARY, PLANNING-LEVEL, CONCEPTUAL IMAGE USED FOR COST ESTIMATING PURPOSES ONLY.





EXISTING TYPICAL SECTION
NTS

0 15 30 60

LEGEND

— — — —	EX. GROUND		RIPRAP
———	PROPOSED CHANNEL		REINFORCED CONCRETE
	EXCAVATION		HIGH PERFORMANCE PYRAMAT TURF REINFORCEMENT MAT (TRM) OR APPROVED EQUIVALENT
	COMPACTED FILL		

REVISIONS			
MARK	DATE	DESCRIPTION	BY

TETRA TECH, INC.
17885 Von Karman Avenue, Suite 500
Irvine, CA 92614
Phone (949) 809-5103, FAX (949) 809-5003

LOS ANGELES RIVER FEASIBILITY STUDY
PRELIMINARY DESIGN

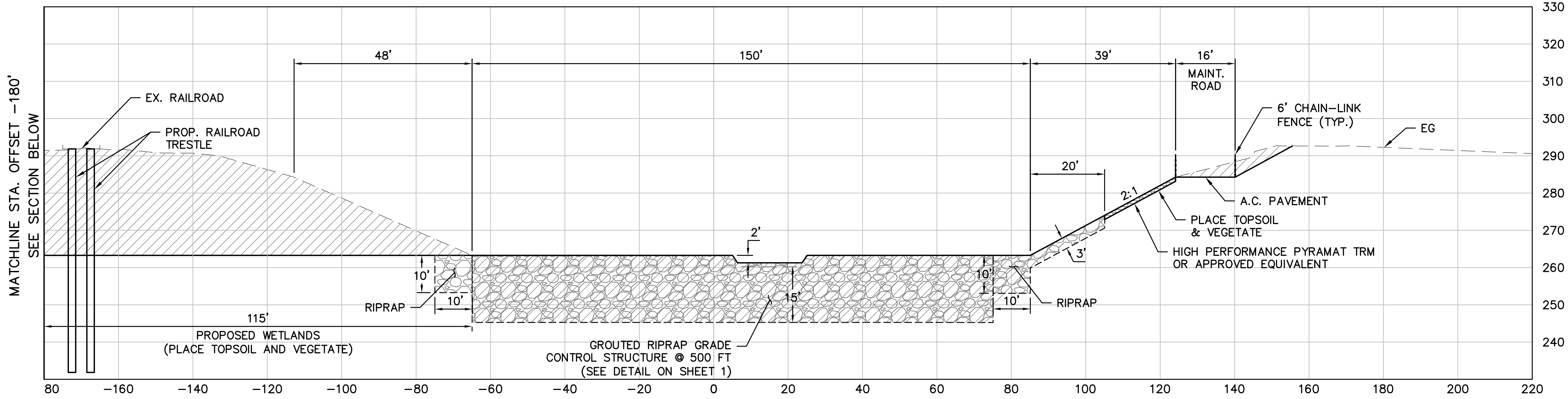
ARBOR REACH
CROSS SECTION 7

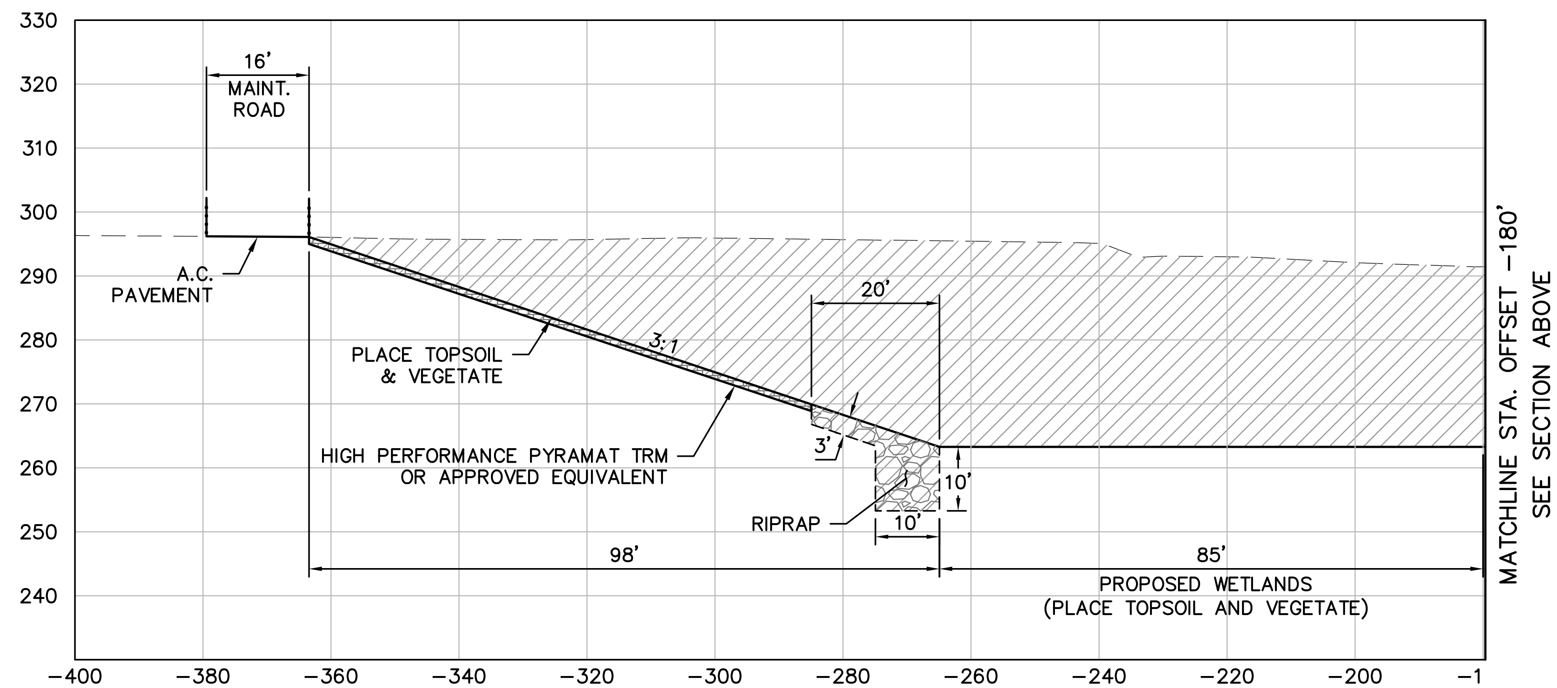
DATE 10/25/11

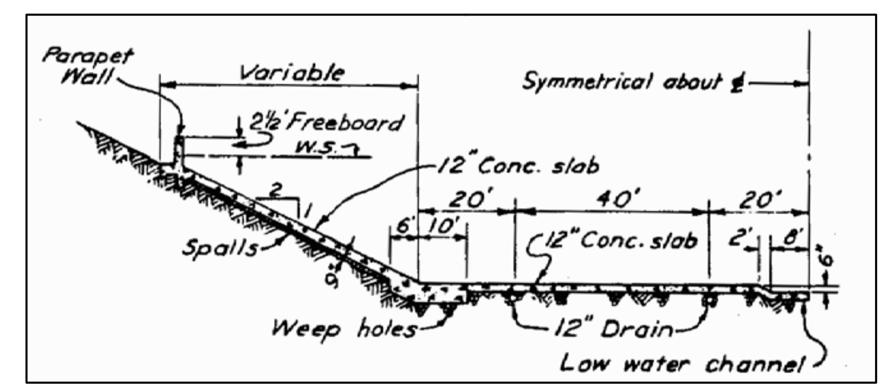
SHT NO. 9 OF 19

P:\Watr\T26313 LA River Feasibility F4\05_Design\CAD\T26313C-XS9.DWG 10/25/2011 13:13

THIS IS A PRELIMINARY, PLANNING-LEVEL, CONCEPTUAL IMAGE USED FOR COST ESTIMATING PURPOSES ONLY.







EXISTING TYPICAL SECTION
NTS

0 15 30 60

LEGEND

EX. GROUND	RIPRAP
PROPOSED CHANNEL	REINFORCED CONCRETE
EXCAVATION	HIGH PERFORMANCE PYRAMAT TURF REINFORCEMENT MAT (TRM) OR APPROVED EQUIVALENT
COMPACTED FILL	

REVISIONS

MARK	DATE	DESCRIPTION	BY

TETRA TECH, INC.
17885 Von Karman Avenue, Suite 500
Irvine, CA 92614
Phone (949) 809-5103, FAX (949) 809-5003

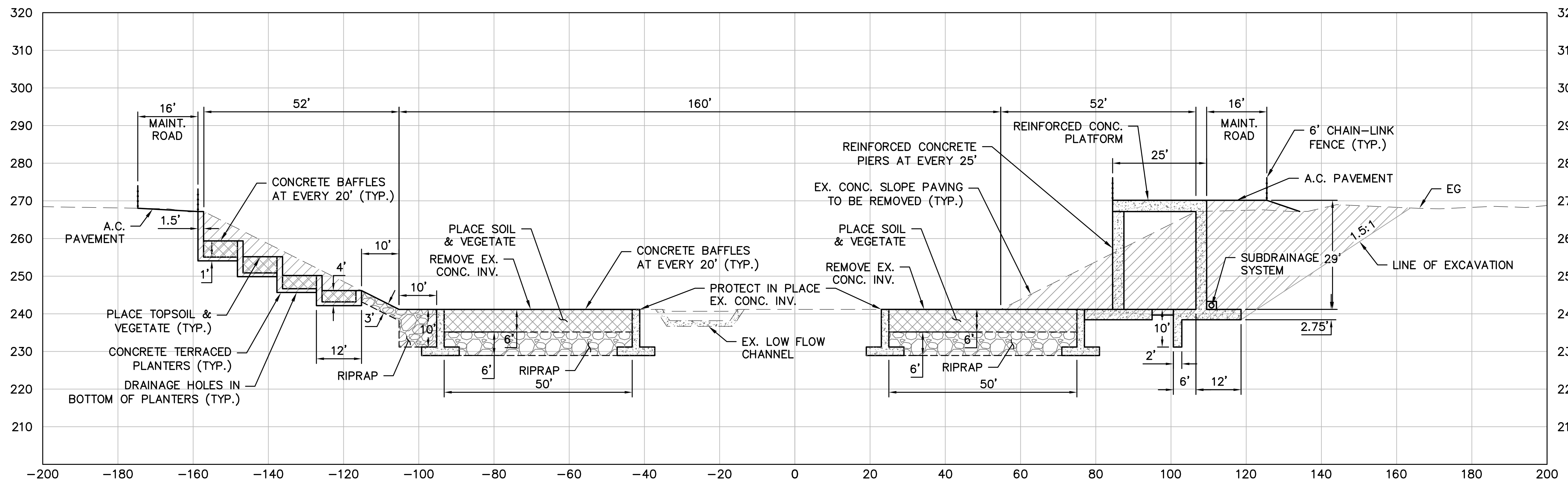
LOS ANGELES RIVER FEASIBILITY STUDY
PRELIMINARY DESIGN

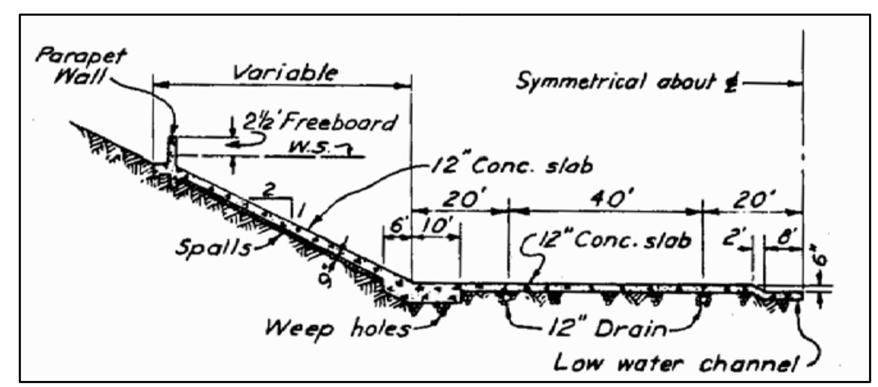
ARBOR REACH
CROSS SECTION 8a

DATE
10/25/11

SHT NO.
10 OF 19

THIS IS A PRELIMINARY, PLANNING–LEVEL, CONCEPTUAL IMAGE USED FOR COST ESTIMATING PURPOSES ONLY.





EXISTING TYPICAL SECTION
NTS

0 15 30 60

LEGEND

— — — — —	EX. GROUND
———	PROPOSED CHANNEL
(hatched)	EXCAVATION
(cross-hatched)	COMPACTED FILL
(pattern)	RIPRAP
(pattern)	REINFORCED CONCRETE
(pattern)	HIGH PERFORMANCE PYRAMAT TURF REINFORCEMENT MAT (TRM) OR APPROVED EQUIVALENT

REVISIONS			
MARK	DATE	DESCRIPTION	BY

TETRA TECH, INC.
17885 Von Karman Avenue, Suite 500
Irvine, CA 92614
Phone (949) 809–5103, FAX (949) 809–5003

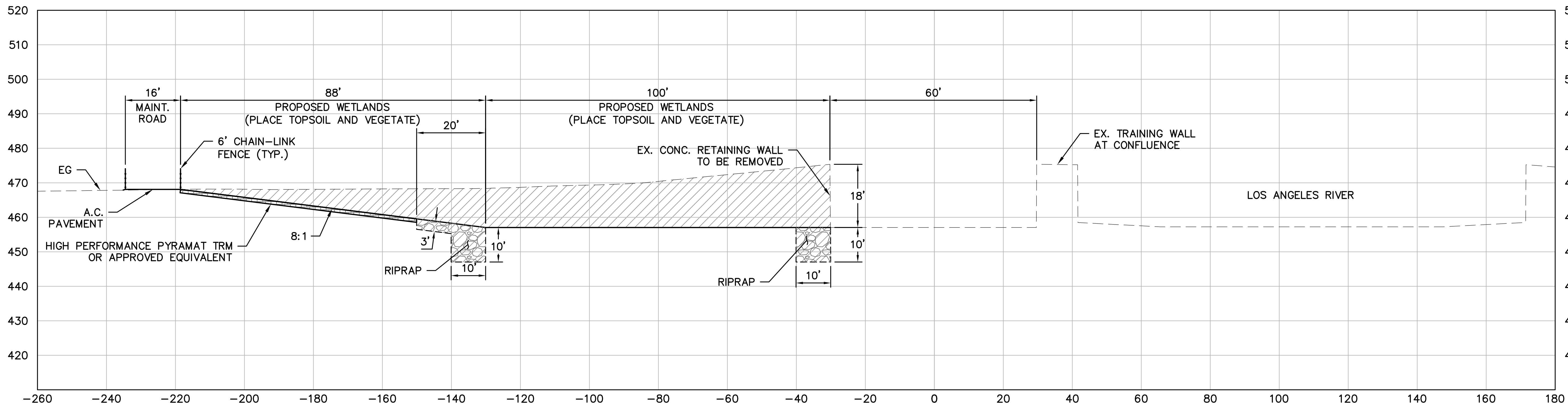
LOS ANGELES RIVER FEASIBILITY STUDY
PRELIMINARY DESIGN

ARBOR REACH
CROSS SECTION 8b

DATE
10/25/11

SHT NO.
11 OF 19

THIS IS A PRELIMINARY, PLANNING-LEVEL, CONCEPTUAL IMAGE USED FOR COST ESTIMATING PURPOSES ONLY.



0 15 30 60

LEGEND

EX. GROUND	RIPRAP
PROPOSED CHANNEL	REINFORCED CONCRETE
EXCAVATION	HIGH PERFORMANCE PYRAMAT TURF REINFORCEMENT MAT (TRM) OR APPROVED EQUIVALENT
COMPACTED FILL	

REVISIONS

MARK	DATE	DESCRIPTION	BY

TETRA TECH, INC.
17885 Von Karman Avenue, Suite 500
Irvine, CA 92614
Phone (949) 809-5103, FAX (949) 809-5003

LOS ANGELES RIVER FEASIBILITY STUDY
PRELIMINARY DESIGN

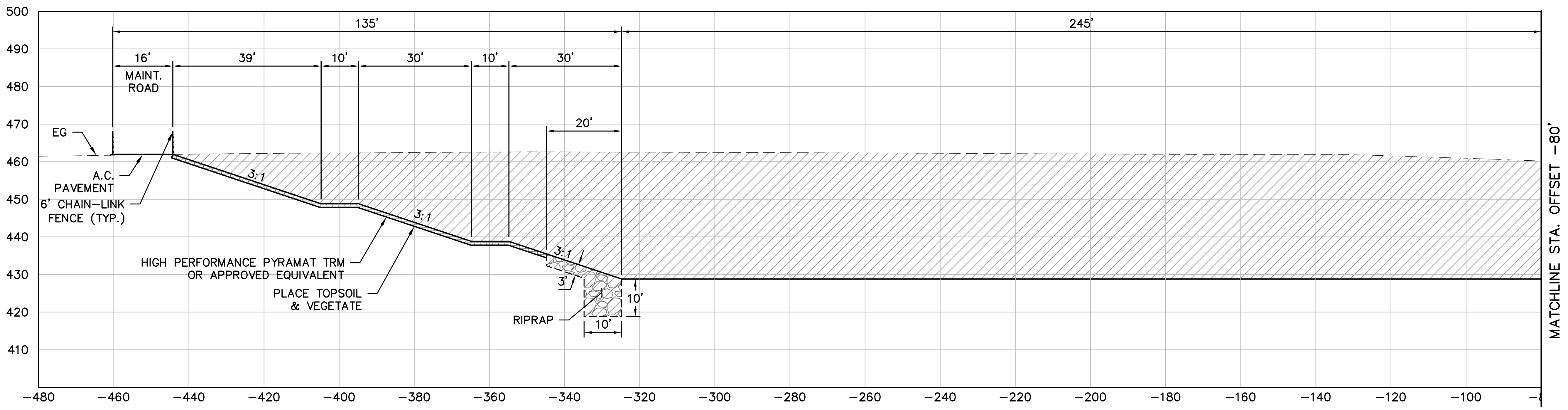
BURBANK CHANNEL
CROSS SECTION

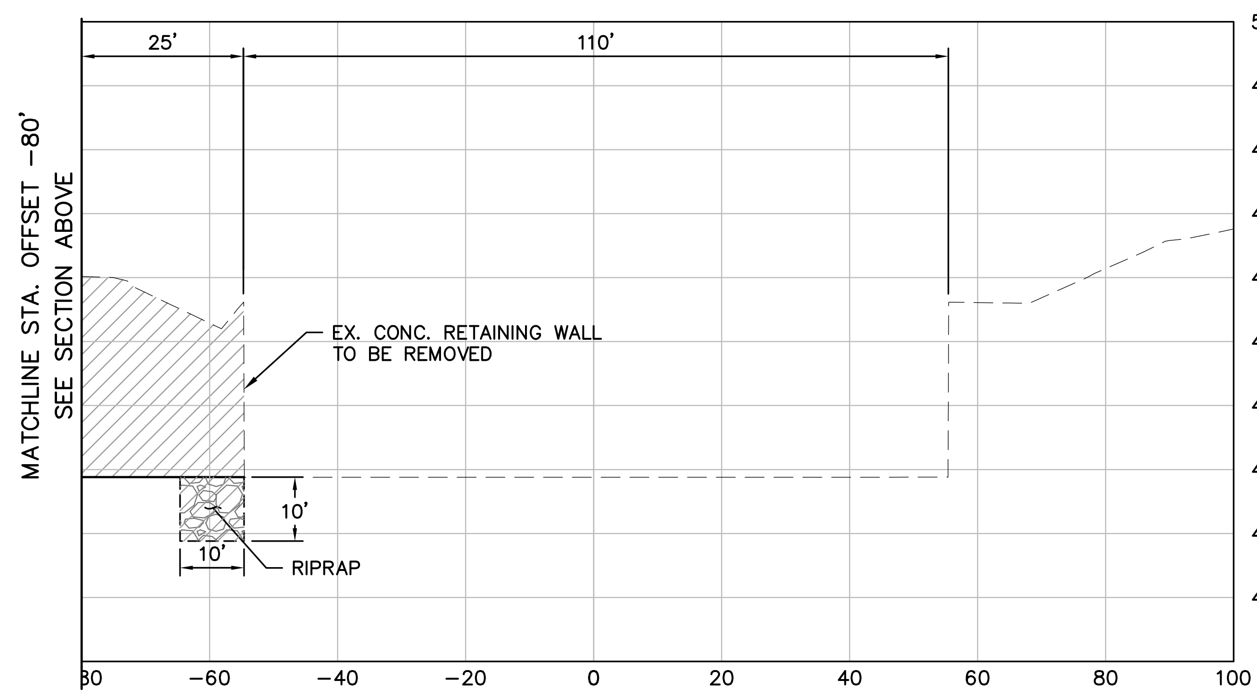
DATE
10/25/11

SHT NO.
12 OF 19

P:\Watr\T26313 LA River Feasibility F4\05_Design\CAD\T26313C-XS12.DWG 10/25/2011 13:17

THIS IS A PRELIMINARY, PLANNING-LEVEL, CONCEPTUAL IMAGE USED FOR COST ESTIMATING PURPOSES ONLY.





NOTE: FREEWAY PIER DEPTH/
AS-BUILT DRAWING INFORMATION BEING AQUIRED.

0 15 30 60

LEGEND

EX. GROUND	RIPRAP
PROPOSED CHANNEL	REINFORCED CONCRETE
EXCAVATION	HIGH PERFORMANCE PYRAMAT TURF REINFORCEMENT MAT (TRM) OR APPROVED EQUIVALENT
COMPACTED FILL	

REVISIONS

MARK	DATE	DESCRIPTION	BY

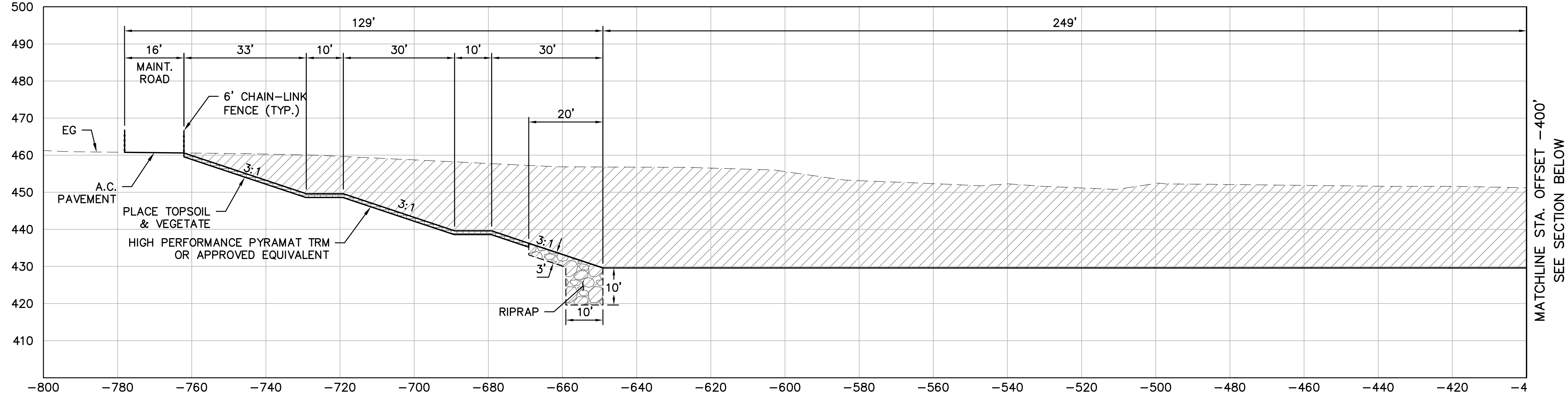
TETRA TECH, INC.
17885 Von Karman Avenue, Suite 500
Irvine, CA 92614
Phone (949) 809-5103, FAX (949) 809-5003

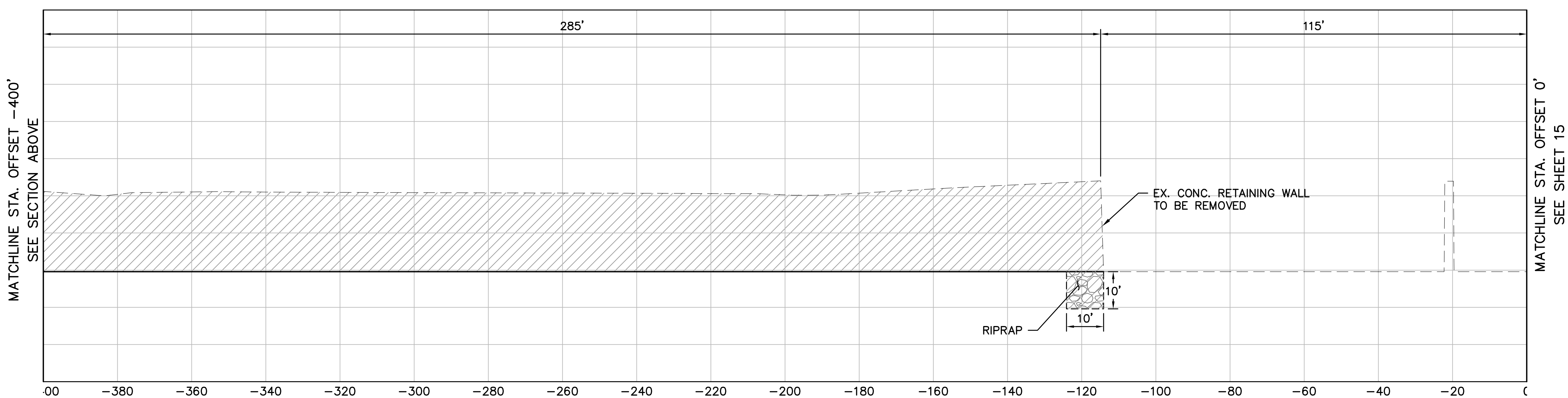
LOS ANGELES RIVER FEASIBILITY STUDY
PRELIMINARY DESIGN

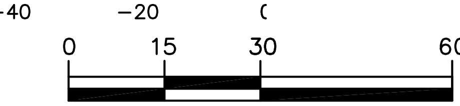
VERDUGO WASH
CROSS SECTION 1

DATE
10/25/11

THIS IS A PRELIMINARY, PLANNING–LEVEL, CONCEPTUAL IMAGE USED FOR COST ESTIMATING PURPOSES ONLY.







LEGEND

— — — —	EX. GROUND		RIPRAP
———	PROPOSED CHANNEL		REINFORCED CONCRETE
	EXCAVATION		HIGH PERFORMANCE PYRAMAT TURF REINFORCEMENT MAT (TRM) OR APPROVED EQUIVALENT
	COMPACTED FILL		

REVISIONS

MARK	DATE	DESCRIPTION	BY

TETRA TECH, INC.
17885 Von Karman Avenue, Suite 500
Irvine, CA 92614
Phone (949) 809–5103, FAX (949) 809–5003

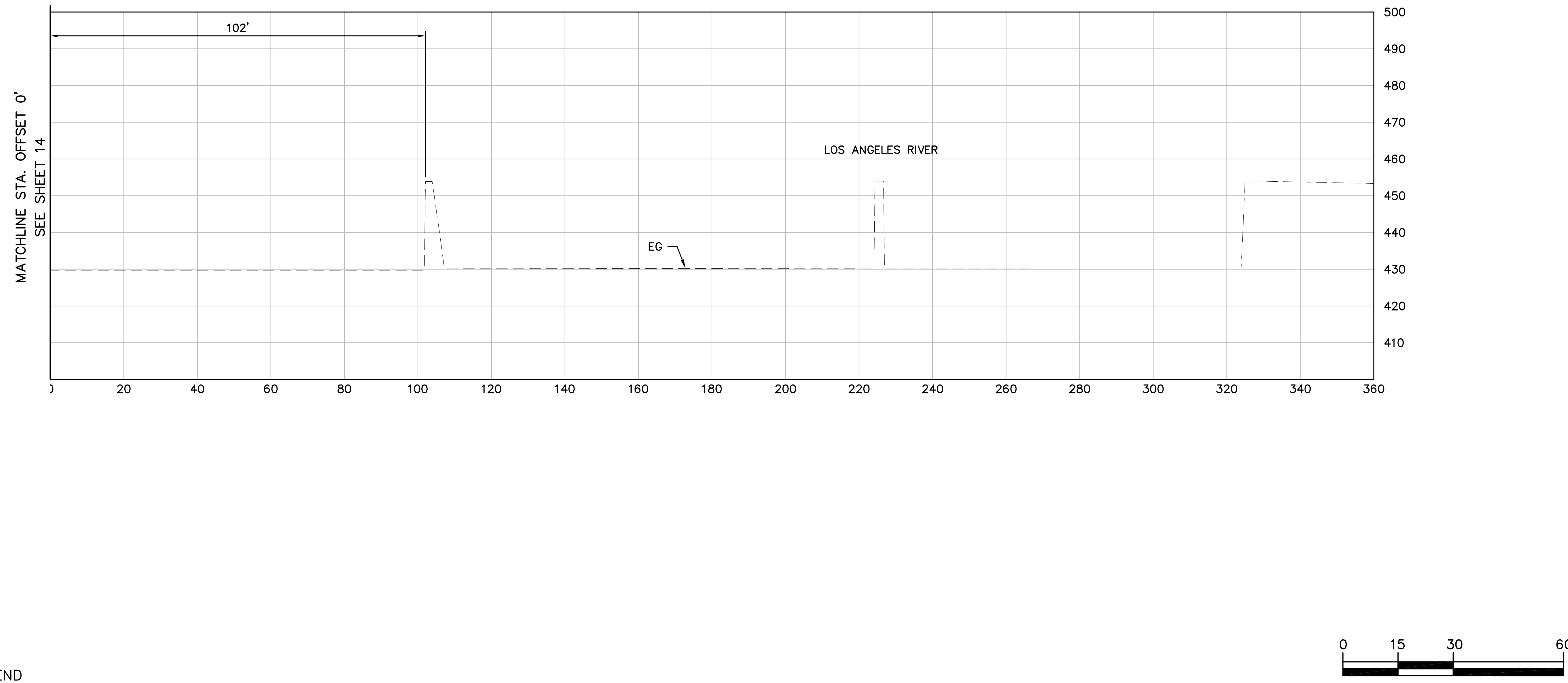
LOS ANGELES RIVER FEASIBILITY STUDY
PRELIMINARY DESIGN

VERDUGO WASH
CROSS SECTION 2

DATE
10/25/11

SHT NO.
14 OF 19

THIS IS A PRELIMINARY, PLANNING-LEVEL, CONCEPTUAL IMAGE USED FOR COST ESTIMATING PURPOSES ONLY.



LEGEND

(dashed line)	EX. GROUND	(pattern)	RIPRAP
(solid line)	PROPOSED CHANNEL	(pattern)	REINFORCED CONCRETE
(pattern)	EXCAVATION	(pattern)	HIGH PERFORMANCE PYRAMAT TURF REINFORCEMENT MAT (TRM) OR APPROVED EQUIVALENT
(pattern)	COMPACTED FILL		

REVISIONS

MARK	DATE	DESCRIPTION	BY

TETRA TECH, INC.
17885 Von Karman Avenue, Suite 500
Irvine, CA 92614
Phone (949) 809-5103, FAX (949) 809-5003

LOS ANGELES RIVER FEASIBILITY STUDY
PRELIMINARY DESIGN

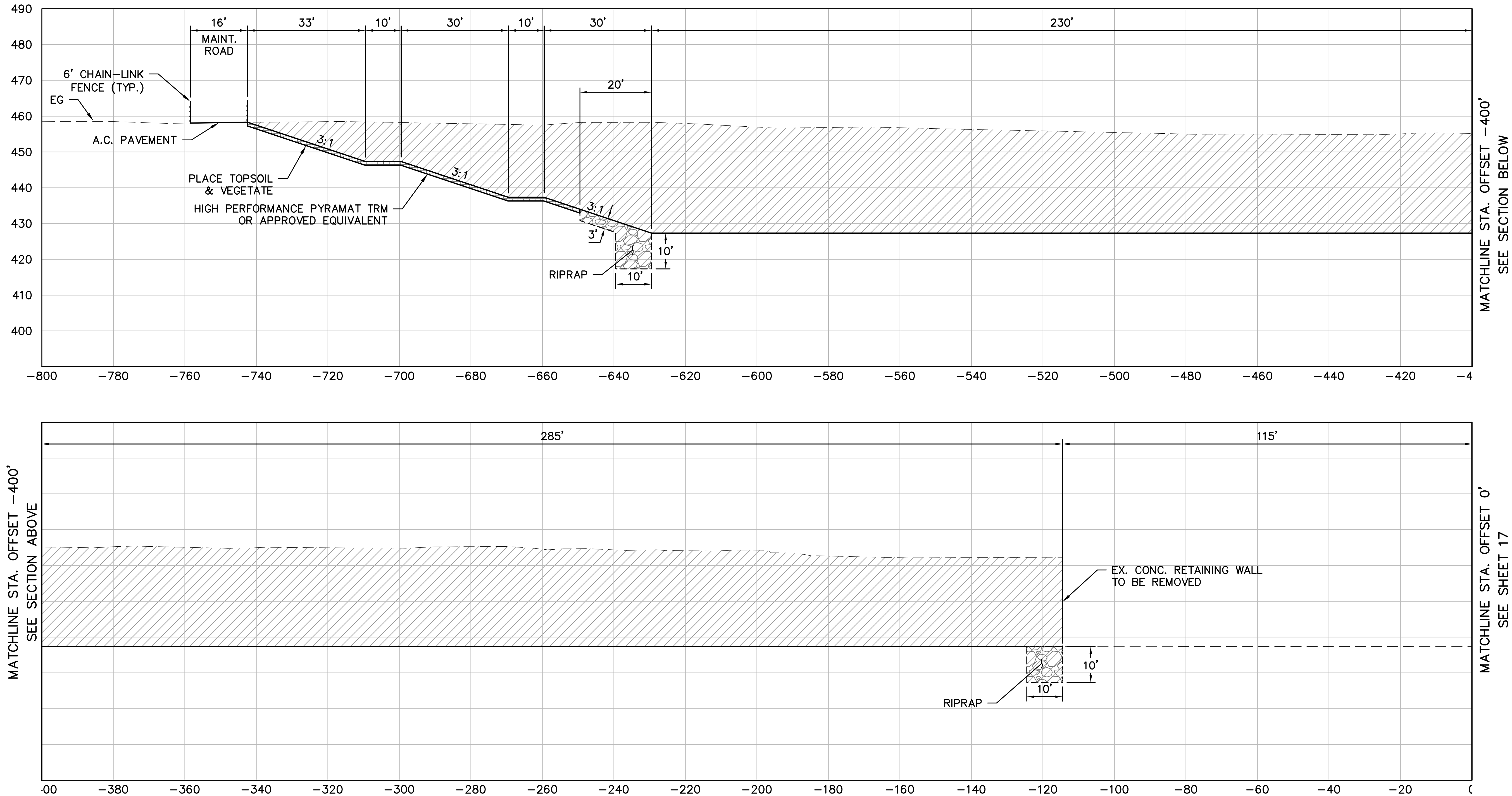
VERDUGO WASH
CROSS SECTION 2 CONT.

DATE
10/25/11

SHT NO.
15 OF 19

P:\Watr\T26313 LA River Feasibility F4\05_Design\CAD\T26313C-XS15.DWG 10/25/2011 13:20

THIS IS A PRELIMINARY, PLANNING—LEVEL, CONCEPTUAL IMAGE USED FOR COST ESTIMATING PURPOSES ONLY.



LEGEND

— — — —	EX. GROUND		RIPRAP
———	PROPOSED CHANNEL		REINFORCED CONCRETE
	EXCAVATION		HIGH PERFORMANCE PYRAMAT TURF REINFORCEMENT MAT (TRM) OR APPROVED EQUIVALENT
	COMPACTED FILL		

REVISIONS			
MARK	DATE	DESCRIPTION	BY

TETRA TECH, INC.
17885 Von Karman Avenue, Suite 500
Irvine, CA 92614
Phone (949) 809—5103, FAX (949) 809—5003

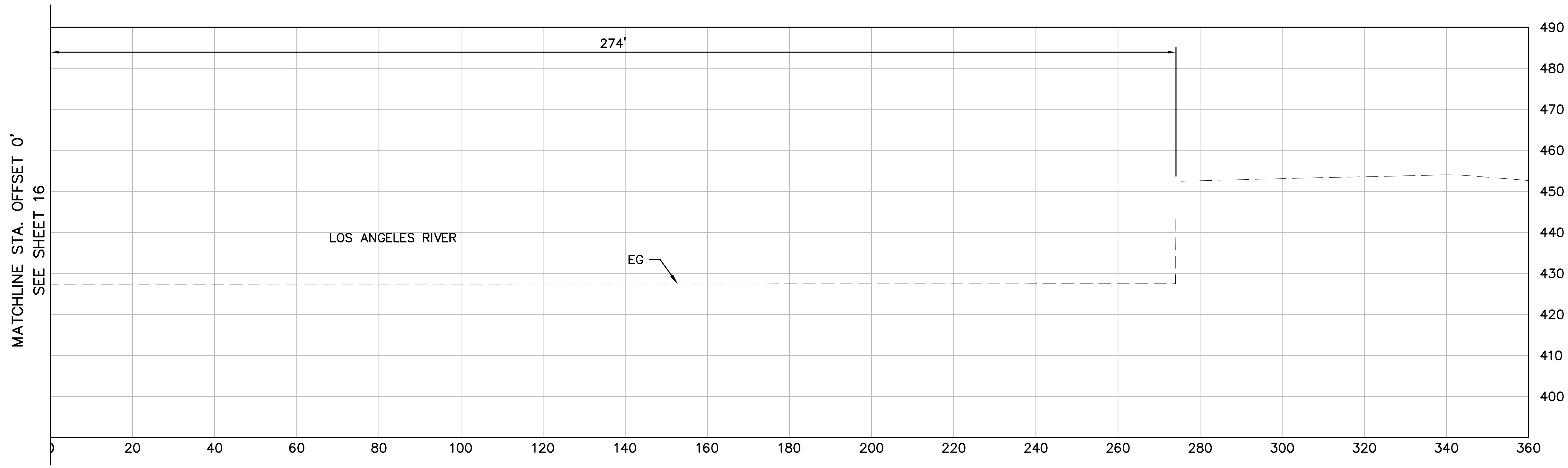
LOS ANGELES RIVER FEASIBILITY STUDY
PRELIMINARY DESIGN

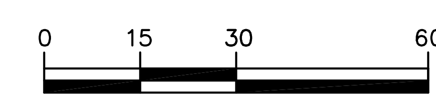
VERDUGO WASH
CROSS SECTION 3

DATE
10/25/11

SHT NO.
16 OF 19

THIS IS A PRELIMINARY, PLANNING-LEVEL, CONCEPTUAL IMAGE USED FOR COST ESTIMATING PURPOSES ONLY.





LEGEND

— — — — —	EX. GROUND		RIPRAP
———————	PROPOSED CHANNEL		REINFORCED CONCRETE
	EXCAVATION		HIGH PERFORMANCE PYRAMAT TURF REINFORCEMENT MAT (TRM) OR APPROVED EQUIVALENT
	COMPACTED FILL		

REVISIONS

MARK	DATE	DESCRIPTION	BY

TETRA TECH, INC.
17885 Von Karman Avenue, Suite 500
Irvine, CA 92614
Phone (949) 809-5103, FAX (949) 809-5003

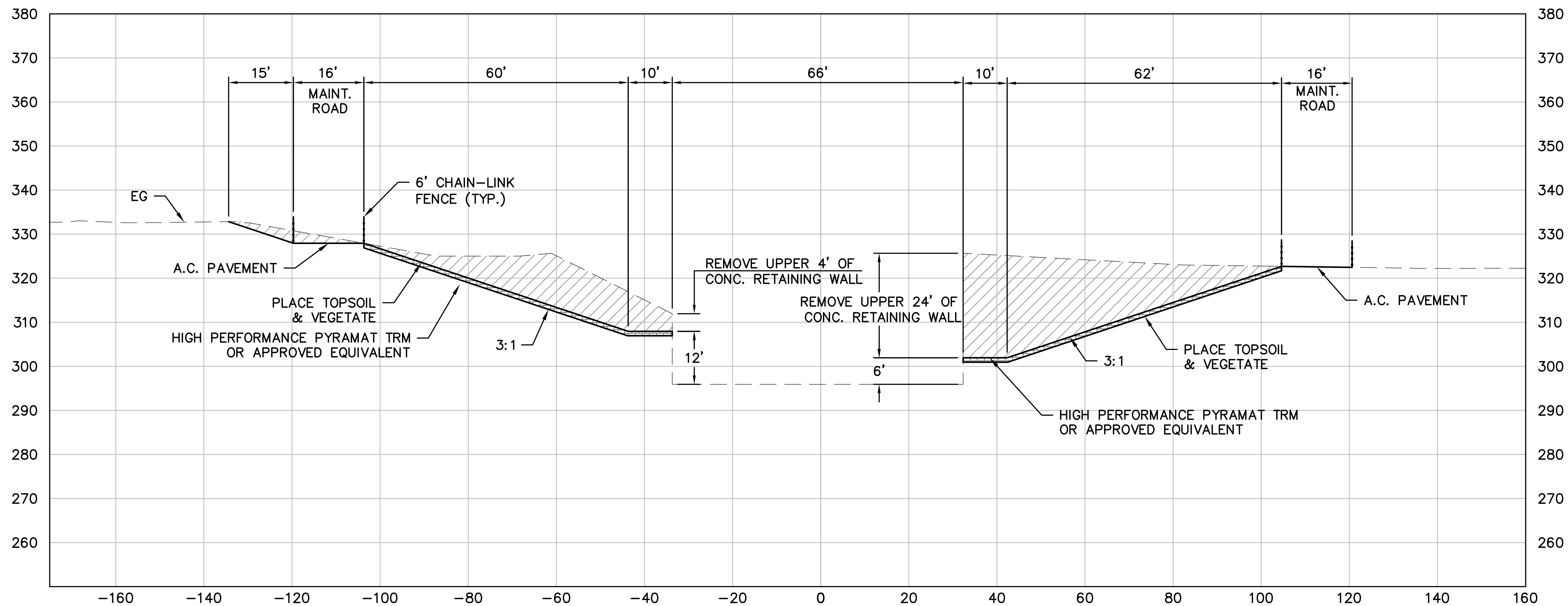
LOS ANGELES RIVER FEASIBILITY STUDY
PRELIMINARY DESIGN

VERDUGO WASH
CROSS SECTION 3 CONTINUED

DATE
10/25/11

SHT NO.
17 OF 19

THIS IS A PRELIMINARY, PLANNING–LEVEL, CONCEPTUAL IMAGE USED FOR COST ESTIMATING PURPOSES ONLY.



0 15 30 60

LEGEND

— — — — —	EX. GROUND
———	PROPOSED CHANNEL
	EXCAVATION
	COMPACTED FILL
	RIPRAP
	REINFORCED CONCRETE
	HIGH PERFORMANCE PYRAMAT TURF REINFORCEMENT MAT (TRM) OR APPROVED EQUIVALENT

REVISIONS			
MARK	DATE	DESCRIPTION	BY

LOS ANGELES RIVER FEASIBILITY STUDY
PRELIMINARY DESIGN

TETRA TECH, INC.
17885 Von Karman Avenue, Suite 500
Irvine, CA 92614
Phone (949) 809–5103, FAX (949) 809–5003

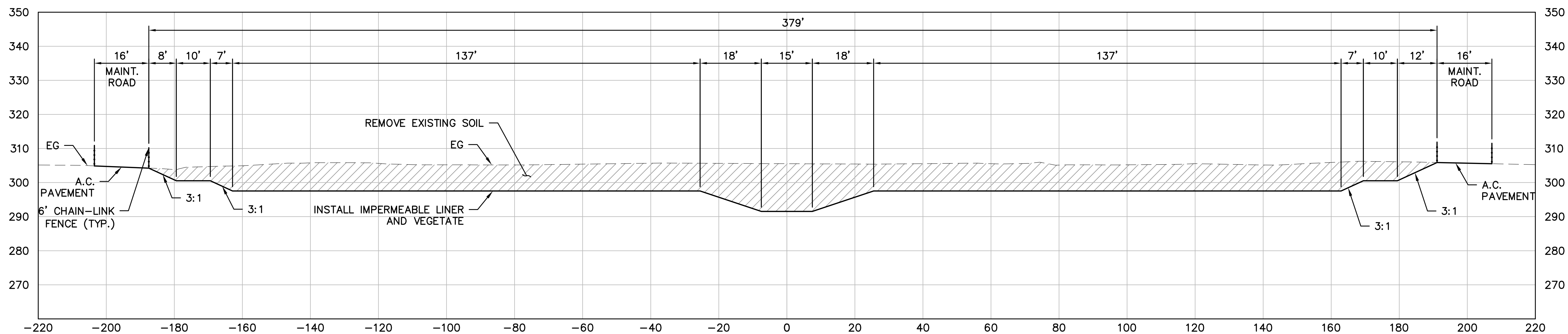
ARROYO SECO
CROSS SECTION

DATE
10/25/11

SHT NO.
18 OF 19

P:\Watr\T26313 LA River Feasibility F4\05_Design\CAD\T26313C–XS18.DWG 10/25/2011 13:22

THIS IS A PRELIMINARY, PLANNING-LEVEL, CONCEPTUAL IMAGE USED FOR COST ESTIMATING PURPOSES ONLY.



0 15 30 60

LEGEND

— — — —	EX. GROUND		RIPRAP
———	PROPOSED CHANNEL		REINFORCED CONCRETE
	EXCAVATION		HIGH PERFORMANCE PYRAMAT TURF REINFORCEMENT MAT (TRM) OR APPROVED EQUIVALENT
	COMPACTED FILL		

REVISIONS

MARK	DATE	DESCRIPTION	BY

TETRA TECH, INC.
17885 Von Karman Avenue, Suite 500
Irvine, CA 92614
Phone (949) 809-5103, FAX (949) 809-5003

LOS ANGELES RIVER FEASIBILITY STUDY
PRELIMINARY DESIGN

CORN FIELD
CROSS SECTION

DATE
10/25/11

SHT NO.
19 OF 19

CHAP Appendix
Appendix H
Gross & Net HUs
by Reach by Alternative

Gross Benefits by Reach		Baseline	Alternative 1: Comprehensive	Alternative 2: City: Atwater to Cornfields	Alternative 3: Banks and Tribs Only	Alternative 4: Highest Scoring Objectives (over 3)	Alternative 5: City: Los Feliz to Arroyo Seco	Alternative 6: Corps Team	Alternative 7: Highest Scoring Objectives (over 5)	Alternative 8: Charette Team 1	Alternative 9: Soft Bottom Channel and Associated Banks	Alternative 10: Highest Other Criteria (over 11)	Alternative 11: Charette Team 4	Alternative 12: Charette Team 3	Alternative 13: Charette Team 6	Alternative 14: Charette Team 5	Alternative 15: Charette Team 2	Alternative 16: Side Channels Only	Alternative 17: Charette Team 7	Alternative 18: Comprehensive Pockets	Alternative 19: Taylor Yard
Reach 1	Initial (HUs)	901.86	1,939.13	901.86	1,904.93	1,817.34	901.86	1,820.24	907.33	1,845.32	1,711.96	1,904.93	1,615.61	1,786.86	1,821.07	1,871.93	1,808.59	1,648.99	1,871.55	1,615.61	901.86
155.81	25 year (HUs)	761.22	1,974.53	761.22	1,936.04	1,858.72	761.22	1,827.05	766.69	1,855.08	1,716.79	1,936.04	1,629.78	1,812.45	1,850.94	1,922.21	1,849.03	1,644.39	1,921.43	1,629.78	761.22
Acres	50 year (HUs)	618.23	1,980.58	618.23	1,938.46	1,857.86	618.23	1,825.17	623.70	1,856.66	1,714.91	1,938.46	1,624.45	1,815.74	1,857.87	1,929.81	1,848.00	1,633.87	1,929.03	1,624.45	618.23
Reach 2	Initial (HUs)	432.76	798.41	432.76	742.37	774.55	432.76	767.35	774.55	798.42	767.35	767.35	735.55	760.52	779.11	735.55	735.55	742.38	519.69	432.76	432.76
48.00	25 year (HUs)	392.01	856.32	392.01	791.02	827.16	392.01	821.16	827.16	856.32	821.16	821.16	788.16	818.30	839.33	788.16	788.16	791.02	506.65	392.01	392.01
Acres	50 year (HUs)	361.62	905.96	361.62	833.04	871.51	361.62	866.57	871.52	905.96	866.57	866.57	832.52	866.06	905.44	832.52	832.52	833.04	500.68	361.62	361.62
Reach 3	Initial (HUs)	613.67	1,038.07	927.86	1,064.28	916.25	613.67	913.45	782.06	981.51	952.23	896.48	949.51	846.07	1,035.65	789.49	712.92	776.98	642.28	890.77	613.67
101.15	25 year (HUs)	585.23	1,085.32	950.50	1,129.73	947.88	585.23	932.87	780.61	1,013.24	994.35	928.11	991.29	851.63	1,093.42	786.11	694.23	784.30	626.67	916.28	585.23
Acres	50 year (HUs)	510.27	1,106.16	960.21	1,179.83	970.27	510.27	940.46	767.89	1,037.04	984.42	950.51	982.55	817.69	1,133.61	734.47	629.71	745.65	559.87	889.12	510.27
Reach 4	Initial (HUs)	937.93	1,657.21	1,657.21	1,574.76	1,657.21	1,500.94	1,657.21	1,657.21	1,529.90	1,341.77	1,574.76	1,386.36	1,330.53	1,500.84	1,303.91	1,029.24	1,344.67	1,029.24	937.93	937.93
93.16	25 year (HUs)	890.93	1,741.15	1,741.15	1,642.86	1,741.15	1,564.35	1,741.15	1,741.15	1,589.63	1,365.59	1,642.86	1,419.78	1,353.32	1,556.15	1,321.50	1,011.99	1,387.55	1,011.99	890.93	890.93
Acres	50 year (HUs)	860.53	1,821.73	1,821.73	1,711.55	1,821.73	1,623.66	1,821.73	1,821.73	1,652.06	1,401.05	1,711.55	1,465.59	1,376.28	1,617.53	1,355.41	1,004.91	1,425.59	1,004.91	860.53	860.53
Reach 5	Initial (HUs)	811.23	1,083.85	1,083.85	984.26	978.05	1,083.85	970.54	977.96	1,017.04	860.73	811.23	1,094.07	811.23	1,017.04	811.23	811.23	860.73	811.23	811.23	811.23
67.71	25 year (HUs)	754.59	1,113.52	1,113.52	985.24	978.05	1,113.52	970.91	977.96	1,038.01	845.40	754.59	1,110.74	754.59	1,038.01	754.59	754.59	845.40	754.59	754.59	754.59
Acres	50 year (HUs)	729.35	1,143.96	1,143.96	1,002.51	978.05	1,143.96	970.97	977.96	1,059.75	845.46	729.35	1,128.01	729.35	1,059.75	729.35	729.35	845.46	729.35	729.35	729.35
Reach 6	Initial (HUs)	1,623.73	2,892.08	2,892.07	2,879.59	2,696.25	2,892.07	2,739.04	2,740.28	2,926.65	2,739.04	2,870.14	2,923.61	2,879.59	2,854.73	2,686.92	2,739.04	2,094.06	2,173.79	2,879.59	2,712.87
164.33	25 year (HUs)	1,534.70	3,041.53	3,041.53	3,027.83	2,818.04	3,041.53	2,868.82	2,883.89	3,096.69	2,868.82	3,017.13	3,093.68	3,027.83	2,999.28	2,808.70	2,868.82	2,119.24	2,209.45	3,027.83	2,839.23
Acres	50 year (HUs)	1,484.72	3,153.51	3,153.51	3,138.55	2,901.35	3,153.51	2,960.41	3,000.84	3,241.02	2,960.41	3,126.57	3,238.04	3,138.55	3,106.18	2,892.01	2,960.41	2,123.70	2,224.76	3,138.55	2,928.05
Reach 7	Initial (HUs)	367.49	923.89	923.89	897.37	846.09	819.08	872.61	649.14	896.70	394.01	896.70	896.70	588.80	897.37	536.04	846.09	671.68	677.54	897.37	367.49
58.90	25 year (HUs)	346.46	998.25	998.25	968.19	910.78	883.09	940.85	677.24	967.90	376.52	967.90	967.90	607.23	968.19	547.68	910.78	697.68	709.56	968.19	346.46
Acres	50 year (HUs)	311.25	1,035.60	1,035.60	1,004.70	940.63	917.27	971.53	699.25	1,004.50	342.15	1,004.50	1,004.50	603.36	1,004.70	536.76	940.63	690.86	715.11	1,004.70	311.25
Reach 8	Initial (HUs)	430.71	2,588.27	430.71	2,664.22	2,555.66	430.71	2,528.23	2,089.10	2,369.54	448.95	2,162.68	2,448.70	2,370.63	1,103.82	2,162.68	2,340.14	2,302.25	1,074.41	430.71	430.71
153.31	25 year (HUs)	425.58	2,846.53	425.58	2,930.99	2,809.65	425.58	2,769.79	2,274.19	2,625.92	445.47	2,374.01	2,715.58	2,608.07	1,158.78	2,374.01	2,592.65	2,510.32	1,125.51	425.58	425.58
Acres	50 year (HUs)	415.36	3,069.37	415.36	3,164.50	3,028.42	415.36	2,981.45	2,424.22	2,834.58	435.50	2,545.29	2,935.12	2,781.84	1,211.05	2,545.29	2,797.32	2,685.56	1,173.78	415.36	415.36
Total	Initial (HUs)	6,119.38	12,920.89	9,250.21	12,711.76	12,241.40	8,674.95	12,268.67	10,577.63	12,365.07	9,216.04	11,884.26	12,050.11	11,374.23	11,009.62	10,897.76	11,022.81	10,441.76	8,799.73	8,895.97	7,208.52
842.36	25 year (HUs)	5,690.71	13,657.14	9,423.75	13,411.89	12,891.42	8,766.52	12,872.59	10,928.89	13,042.78	9,434.10	12,441.81	12,716.92	11,833.42	11,504.09	11,302.94	11,470.26	10,779.91	8,865.86	9,005.18	6,995.24
Acres	50 year (HUs)	5,291.32	14,216.86	9,510.22	13,973.13	13,369.81	8,743.87	13,338.28	11,187.12	13,591.57	9,550.47	12,872.80	13,210.78	12,128.88	11,896.13	11,555.62	11,742.84	10,983.74	8,837.49	9,023.68	6,734.65

Net Benefits by Reach		Baseline	Alternative 1: Comprehensive	Alternative 2: City: Atwater to Cornfields	Alternative 3: Banks and Tribs Only	Alternative 4: Highest Scoring Objectives (over 3)	Alternative 5: City: Los Feliz to Arroyo Seco	Alternative 6: Corps Team	Alternative 7: Highest Scoring Objectives (over 5)	Alternative 8: Charette Team 1	Alternative 9: Soft Bottom Channel and Associated Banks	Alternative 10: Highest Other Criteria (over 11)	Alternative 11: Charette Team 4	Alternative 12: Charette Team 3	Alternative 13: Charette Team 6	Alternative 14: Charette Team 5	Alternative 15: Charette Team 2	Alternative 16: Side Channels Only	Alternative 17: Charette Team 7	Alternative 18: Comprehensive Pockets	Alternative 19: Taylor Yard
Reach 1	Initial (HUs)	0.00	1,037.27	0.00	1,003.07	915.48	0.00	918.38	5.48	943.46	810.10	1,003.07	713.76	885.01	919.21	970.08	906.73	747.13	969.69	713.76	0.00
155.81	25 year (HUs)	0.00	1,213.31	0.00	1,174.82	1,097.51	0.00	1,065.84	5.48	1,093.86	955.58	1,174.82	868.57	1,051.23	1,089.72	1,160.99	1,087.81	883.18	1,160.22	868.57	0.00
Acres	50 year (HUs)	0.00	1,362.35	0.00	1,320.23	1,239.63	0.00	1,206.94	5.48	1,238.43	1,096.68	1,320.23	1,006.22	1,197.52	1,239.64	1,311.58	1,229.77	1,015.65	1,310.80	1,006.22	0.00
Reach 2	Initial (HUs)	0.00	365.65	0.00	309.61	341.79	0.00	334.59	341.79	365.66	334.59	334.59	302.79	327.76	346.35	302.79	302.79	309.62	86.93	0.00	0.00
48.00	25 year (HUs)	0.00	464.31	0.00	399.01	435.15	0.00	429.15	435.15	464.31	429.15	429.15	396.15	426.29	447.32	396.15	396.15	399.01	114.65	0.00	0.00
Acres	50 year (HUs)	0.00	544.34	0.00	471.42	509.90	0.00	504.96	509.90	544.34	504.96	504.96	470.90	504.44	543.83	470.90	470.90	471.42	139.07	0.00	0.00
Reach 3	Initial (HUs)	0.00	424.40	314.19	450.60	302.58	0.00	299.78	168.39	367.84	338.56	282.81	335.84	232.40	421.98	175.82	99.25	163.31	28.61	277.10	0.00
101.15	25 year (HUs)	0.00	500.09	365.27	544.51	362.65	0.00	347.64	195.38	428.01	409.12	342.88	406.06	266.40	508.19	200.88	109.01	199.07	41.44	331.05	0.00
Acres	50 year (HUs)	0.00	595.89	449.95	669.56	460.01	0.00	430.19	257.63	526.77	474.16	440.24	472.28	307.43	623.34	224.20	119.45	235.39	49.60	378.86	0.00
Reach 4	Initial (HUs)	0.00	719.28	719.28	636.83	719.28	563.01	719.28	719.28	591.97	403.84	636.83	448.43	392.60	562.91	365.98	91.31	406.75	91.31	0.00	0.00
93.16	25 year (HUs)	0.00	850.22	850.22	751.93	850.22	673.42	850.22	850.22	698.70	474.66	751.93	528.85	462.39	665.22	430.57	121.06	496.62	121.06	0.00	0.00
Acres	50 year (HUs)	0.00	961.20	961.20	851.02	961.20	763.13	961.20	961.20	791.53	540.52	851.02	605.07	515.76	757.01	494.89	144.38	565.06	144.38	0.00	0.00
Reach 5	Initial (HUs)	0.00	272.62	272.62	173.03	166.82	272.62	159.31	166.73	205.80	49.50	0.00	282.84	0.00	205.80	0.00	0.00	49.50	0.00	0.00	0.00
67.71	25 year (HUs)	0.00	358.93	358.93	230.64	223.46	358.93	216.31	223.37	283.42	90.81	0.00	356.15	0.00	283.42	0.00	0.00	90.81	0.00	0.00	0.00
Acres	50 year (HUs)	0.00	414.60	414.60	273.16	248.70	414.60	241.61	248.61	330.39	116.11	0.00	398.66	0.00	330.39	0.00	0.00	116.11	0.00	0.00	0.00
Reach 6	Initial (HUs)	0.00	1,268.34	1,268.34	1,255.86	1,072.52	1,268.34	1,115.31	1,116.55	1,302.92	1,115.31	1,246.41	1,299.88	1,255.86	1,231.00	1,063.18	1,115.31	470.33	550.06	1,255.86	1,089.14
164.33	25 year (HUs)	0.00	1,506.83	1,506.83	1,493.13	1,283.33	1,506.83	1,334.12	1,349.19	1,561.98	1,334.12	1,482.43	1,558.98	1,493.13	1,464.58	1,274.00	1,334.12	584.54	674.74	1,493.13	1,304.53
Acres	50 year (HUs)	0.00	1,668.80	1,668.80	1,653.83	1,416.63	1,668.80	1,475.69	1,516.12	1,756.31	1,475.69	1,641.85	1,753.32	1,653.83	1,621.46	1,407.29	1,475.69	638.99	740.04	1,653.83	1,443.34
Reach 7	Initial (HUs)	0.00	556.40	556.40	529.88	478.60	451.60	505.12	281.65	529.21	26.52	529.21	529.21	221.31	529.88	168.55	478.60	304.19	310.05	529.88	0.00
58.90	25 year (HUs)	0.00	651.79	651.79	621.73	564.33	536.63	594.39	330.78	621.45	30.06	621.45	621.45	260.78	621.73	201.22	564.33	351.22	363.11	621.73	0.00
Acres	50 year (HUs)	0.00	724.35	724.35	693.45	629.38	606.02	660.28	388.00	693.25	30.90	693.25	693.25	292.11	693.45	225.51	629.38	379.61	403.87	693.45	0.00
Reach 8	Initial (HUs)	0.00	2,157.55	0.00	2,233.51	2,124.95	0.00	2,097.52	1,658.38	1,938.83	18.24	1,731.97	2,017.99	1,939.91	673.10	1,731.97	1,909.43	1,871.54	643.70	0.00	0.00
153.31	25 year (HUs)	0.00	2,420.95	0.00	2,505.41	2,384.07	0.00	2,344.22	1,848.62	2,200.34	19.89	1,948.43	2,290.01	2,182.49	733.20	1,948.43	2,167.07	2,084.74	699.93	0.00	0.00
Acres	50 year (HUs)	0.00	2,654.00	0.00	2,749.14	2,613.05	0.00	2,566.09	2,008.86	2,419.22	20.13	2,129.93	2,519.76	2,366.47	795.68	2,129.93	2,381.95	2,270.20	758.41	0.00	0.00
Total	Initial (HUs)	0.00	6,801.51	3,130.83	6,592.38	6,122.02	2,555.57	6,149.29	4,458.25	6,245.69	3,096.66	5,764.88	5,930.73	5,254.85	4,890.24	4,778.38	4,903.43	4,322.38	2,680.35	2,776.59	1,089.14
842.36	25 year (HUs)	0.00	7,966.43	3,733.04	7,721.18	7,200.71	3,075.81	7,181.88	5,238.18	7,352.07	3,743.39	6,751.10	7,026.21	6,142.71	5,813.38	5,612.23	5,779.55	5,089.19	3,175.15	3,314.47	1,304.53
Acres	50 year (HUs)	0.00	8,925.55	4,218.90	8,681.81	8,078.49	3,452.55	8,046.97	5,895.80	8,300.25	4,259.15	7,581.48	7,919.46	6,837.56	6,604.81	6,264.30	6,451.52	5,692.42	3,546.17	3,732.36	1,443.34

CHAP Appendix
Appendix I
HUs by Reach
for Final Array of Alternatives

Final Array: HUs by Reach

River Reach	Acres	Future Without Project			Alternative 10 (ART)			Alternative 13 Alt 13 (ACE)		
		Base HUs	25 yr HUs	50 yr HUs	Base Net HUs	25 yr Net HUs	50 yr Net HUs	Base Net HUs	25 yr Net HUs	50 yr Net HUs
1	155.81	901.86	761.22	618.23	1,025.47	1,143.18	1,238.58	1,025.47	1,143.18	1,238.58
2	48.00	432.76	392.01	361.62	576.13	630.63	674.99	576.13	630.63	674.99
3	101.14	613.67	585.23	510.27	82.51	85.60	86.44	298.56	317.98	333.17
4	93.16	937.93	890.93	860.53	705.60	748.48	786.52	705.60	959.16	786.52
5	67.71	811.23	754.59	729.35	233.70	234.06	234.12	233.70	234.06	234.12
6	164.33	1623.73	1534.70	1484.72	1,980.45	2,102.23	2,185.54	2,324.74	2,469.29	2,576.19
7	58.90	367.49	346.46	311.25	42.48	45.42	45.94	367.13	403.30	434.14
8	153.32	430.71	425.58	415.36	2,187.89	2,440.43	2,645.09	2,187.89	2,440.43	2,645.09
	842.37	6119.38	5690.71	5291.32	6,834.22	7,430.03	7,897.22	7,719.22	8,598.02	8,922.80

River Reach	Alternative 16 (AND)			Alternative 20 (RIVER)		
	Base Net HUs	25 yr Net HUs	50 yr Net HUs	Base Net HUs	25 yr Net HUs	50 yr Net HUs
1	1,025.47	1,143.18	1,238.58	1,025.47	1,143.18	1,238.58
2	576.13	630.63	674.99	667.59	727.81	793.92
3	298.56	317.98	333.17	556.10	593.67	620.28
4	705.60	959.16	786.52	705.60	959.16	786.52
5	632.40	662.07	692.51	632.40	662.07	692.51
6	2,324.74	2,469.29	2,576.19	2,324.74	2,469.29	2,576.19
7	367.13	403.30	434.14	454.58	497.03	523.14
8	2,591.99	2,858.77	3,092.29	2,591.99	2,858.77	3,092.29
	8,522.02	9,444.38	9,828.39	8,958.47	9,910.99	10,323.43

Alternative 10 (ART) [R1A11; R2A11; R3A17; R4A16; R5A9; R6A14; R7A9; R8A15]*
Alternative 13 Alt 13 (ACE) [R1A11; R2A11; R3A16; R4A16; R5A9; R6A13; R7A12; R8A15]*
Alternative 16 (AND) [R1A11; R2A11; R3A16; R4A16; R5A5; R6A13; R7A12; R8A3]*
Alternative 20 (RIVER) [R1A11; R2A13; R3A18; R4A16; R5A5; R6A13; R7A16; R8A3]*

*R#A#: This represents which of the original 19 alternatives each reach is derived from. For example, R1A11 means that Reach 1 of that final array alternative was derived from the original alternative 11.

8. Griffith Park SEA

Location

General

The Griffith Park Significant Ecological Area (SEA) is located within Griffith Park, the central park of the City of Los Angeles, situated on the extreme eastern end of the Santa Monica Mountains. The SEA is an extensive, relatively undisturbed island of natural vegetation in an urbanized, metropolitan area. It supports the coastal sage scrub, chaparral, riparian, and southern oak woodland plant communities that are typical in the interior mountain ranges of Southern California. What makes the SEA important is its geographical location. It has become an island of natural vegetation surrounded by urban and suburban development. The geographic location makes the area important for scientific study, for genetic interchange between otherwise isolated populations, and for recreation of urban residents.

The SEA is located partially in each of the following United States Geological Survey (USGS) 7.5' California Quadrangles: Burbank and Hollywood.

General Boundary and Resources Description

The SEA encompasses most of Griffith Park, south of the State Route-134, and west of Interstate-5. The SEA boundary generally follows the natural area near the Griffith Park boundaries in most cases. Isolated areas are important for preserving and documenting the geographical variability of vegetation and wildlife that formerly occurred throughout the region. They serve as reservoirs of native species that could be of scientific and economic value in the future. In addition, birds rely on these islands for areas to rest and feed along their north-south and east-west migration routes. In the case of Griffith Park, this function is made even greater than might be expected because it serves as a corridor for any gene flow and species movement that may take place between the Santa Monica and San Gabriel mountains via the Verdugo Mountains.

Beginning in the northwest corner, and proceeding eastward, the SEA follows the natural vegetation on the mountain slopes at the junction with the flood plain of the former Dark Canyon and the Los Angeles River. This area of the SEA includes the recently-acquired (2010) Cahuenga Peak, at 1820 feet, which is now the highest point of Griffith Park. Cahuenga Peak slopes have rocky outcrops, chaparral, and regenerating oak woodland and chaparral on the north-facing slopes. (This area was part of the 800 acres burned in the Griffith Park Fire of 2007.)

The Los Angeles River is channelized, but there is remnant oak riparian woodland in this area. Bordering the apartment complex on the east side of Barham Boulevard, there is a somewhat abrupt change in slope where the previous Dark Canyon Creek flowed. (Barham Boulevard was evidently constructed in this Canyon.) The SEA includes the remnant riparian coast live oak woodland (*Quercus agrifolia)*, which has many jurisdictional oak trees and in many places, the natural understory. Residents and staff at the apartments report frequent sightings of wildlife, particularly mule deer (*Odocoileus hemionus*) and coyotes (*Canis latrans*), in their parking lots, which line the Griffith Park side of the complex. On the slopes above, the chaparral of this west-facing slope grades upward into an extensive area of coastal sage scrub. The SEA includes these natural areas. From the natural areas on slopes above the junction of Barham Boulevard and Forest Lawn Boulevard, the SEA boundary continues eastward along the border of natural vegetation on the slopes above Forest Lawn Boulevard, including oak woodland in the ravines and mixed chaparral and grassland on the upper slopes. Occasionally, an ash (*Fraxinus velutina*) or Southern California black walnut (*Juglans californica*) are in these ravines, along with oak trees and other chaparral plants.

The boundary follows natural vegetation southward, away from the Los Angeles River, at the boundary of Forest Lawn Memorial Park (Forest Lawn). A slope and ridge top that have been cleared by Forest Lawn have been excluded from the SEA, but the chaparral on the east-facing side of the slope is included. From this ridge, the SEA roughly follows at the edge of the natural areas around the south side of the Forest Lawn and returns northward on the parcel line between the Forest Lawn and Griffith Park.

From the east side of Forest Lawn, the SEA boundary includes a chaparral-covered slope that is south of Travel Town and Zoo Drive. Cooper and Mathewson (2008) describe how coastal sage scrub occurs through a broad section of the northern part of Griffith Park, from end to end with patches of the sensitive valley needlegrass grassland. From the natural area near the Interstate-5 and State Route-134 interchange, the SEA boundary swings around westward, north of the Los Angeles Zoo, and forming a lobe on the chaparral-covered slopes. This area has ravines and a gradually sloping area near Travel Town, with riparian forest that includes sycamores (*Platanus racemosa*), oaks, willows (*Salix* spp.), and mulefat (*Baccharis salicifolia*), which are easily seen along Griffith Park Drive. Travel Town is not in the SEA, but its periphery of native riparian and chaparral is included. The north-facing upper slopes have chaparral, and the south-facing upper slopes have coastal sage scrub or grassland with chaparral plants here and there, especially elderberry (*Sambucus* spp.) Along Zoo Drive, ravines have typical chaparral of north-facing slopes. The SEA boundary continues past the Los Angeles Zoo along a road to a landfill area within Griffith Park, and goes around the landfill, forming a cherry-stem shaped area at the landfill road, and then continuing southeastward on the west side of Griffith Park Drive, excluding the Harding Municipal Golf Course. The Spring Canyon picnic area is excluded, as the understory of the sycamores and oaks is unnatural lawn, and the SEA boundary continues south along natural vegetation along Griffith Park Drive to the southern boundary of Griffith Park, near the Los Feliz offramp from the Interstate-5. A golf course practice area at the corner is excluded from the SEA.

From the southeast corner, the SEA boundary goes west along with the Griffith Park boundary at the edge of development to another golf course, which is excluded due to extensive modification of the slopes. The Greek Theater in Vermont Canyon and Griffith Park Observatory on the slope beyond are included, as the modified vegetation for each covers less than 40 acres. The SEA boundary continues west and then north with the Griffith Park boundary at the edge of development. A small quarry is excluded. The undeveloped upper Brush Canyon in Griffith Park is included. Griffith Park and SEA have oak woodland along the drainages, transitioning uphill into chaparral and then grassland on the upper slopes. Within Griffith Park, north-facing sides of rocky outcrops often have a cliffside vegetation that is characterized by multiple kinds of lichens, mosses, liverworts and other non-vascular plants along with live-forever (*Dudleya* spp.), and other flowering plants. The SEA boundary follows Griffith Park boundaries around the development in the Blackwood Canyon area. A ridge area in Griffith Park on the south side of Mulholland Drive overlook is excluded. The SEA boundary follows Griffith Park boundaries on the southern edge and then turns north after including the grassland and coastal sage scrub-covered slopes that cover the open area between the two northern arms of the Hollywood Reservoir. On the west side of the SEA, the boundaries lap west outside of Griffith Park boundaries to include the oak woodland and chaparral of the lower elevations of Cahuenga Peak in the neighborhood of Dark Canyon (Barham Boulevard) and Caguenga Pass.

Vegetation

Vegetation within the SEA is comprised of a large variety of community types. The diversity of the communities reflects the topography of the mountainous park and include coastal sage chaparral scrub, riparian and coast live oak woodland, riparian, many kinds of chaparral, grassland, and cliffside vegetation. The maintenance of the diverse vegetation mosaic and the contacts of the different vegetation types (ecotones) has been cited as one of the principal qualities of importance to maintaining biotic diversity in Griffith Park (Cooper & Mathewson, 2008). The southern slopes are affected by more moist marine weather conditions, while the northern slopes are influenced by drier inland weather conditions. In addition, the steepness of many slopes causes sharp differences in vegetation on either side of a ridge. Sensitive plant species and plant communities occurring or potentially occurring within the SEA are discussed in the Sensitive Biological Resources section.

Descriptions and general locations of the each plant community present within the SEA are given below.

<u>Chaparral</u>: A shrub community composed of robust species. Within this SEA, a number of chaparral subcommunities are found, and differentiated by their dominant plant species. These include chamise (*Adenostoma fasciculatum*), buck brush (*Ceanothus* spp.), scrub oak (*Quercus berberidifolia*), coast live oak (*Quercus agrifolia* var. *agrifolia*) and mosaics of these depending on mixture of species and elevation. These and other shrub species form dense vegetation covers, and grow 5 to 10 feet in height. The development of chaparral is pronounced over large hillside areas throughout the SEA.

Corresponding MCV communities:

- *Adenostoma fasciculatum* (chamise chaparral) Shrubland Alliance
- *Adenostoma fasciculatum-Salvia apiana* (chamise-white sage chaparral) Shrubland Alliance
- *Arctostaphylos glauca* (bigberry manzanita chaparral) Shrubland Alliance
- *Ceanothus greggii* [*vestitus*] (cup leaf ceanothus chaparral) Shrubland Alliance
- *Ceanothus spinosus* (greenbark ceanothus chaparral) Shrubland Alliance
- *Ceanothus oliganthus* (hairy leaf ceanothus chaparral) Shrubland Alliance
- *Prunus ilicifolia* (holly leaf cherry chaparral) Shrubland Alliance
- *Rhus ovata* (sugarbush chaparral) Shrubland Alliance

<u>Coastal Sage Chaparral Scrub</u>: A shrubland community exhibiting less robust structure found in this SEA. This plant community is dominated by California sagebrush (*Artemisia tridentata*), California brittle bush (*Encelia californica*), white sage (*Salvia apiana*), black sage (*Salvia mellifera*), and California buckwheat (*Eriogonum fasciculatum*). Dense stands may grow three to four feet in height. Within this SEA, it is generally found in scattered patches, which are highly integrated with mixed chaparral. These are located throughout the SEA at middle elevations and on hillsides.

Corresponding MCV communities:

- *Artemisia californica* (California sagebrush scrub) Shrubland Alliance
- *Artemisia californica-Eriogonum fasciculatum* (California sagebrush-California buckwheat scrub) Shrubland Alliance
- *Encelia californica* (California brittle bush scrub) Shrubland Alliance
- *Dendromecon rigida* (bush poppy scrub) Shrubland Alliance
- *Salvia leucophylla* (purple sage scrub) Shrubland Alliance
- *Salvia mellifera* (black sage scrub) Shrubland Alliance
- *Eriogonum fasciculatum* (California buckwheat scrub) Shrubland Alliance
- *Lotus scoparius* [*Acmispon glaber*] (deer weed scrub) Shrubland Alliance
- *Opuntia littoralis* (coast prickly pear scrub) Shrubland Alliance
- *Malacothamnus fasciculatus* (bush mallow scrub) Shrubland Alliance

<u>Coast Live Oak Woodland</u>: A plant community dominated by *Quercus agrifolia.* Within this SEA, this community includes coast live oak, which typically grows to heights of 20 to 40 feet, and forms either

closed or open tree canopies. Oak woodland is most commonly found on north-facing slopes and in drainage bottoms and often intergrades with shrub communities. Understory vegetation varies from grassland in level areas to shrubs where topography is steeper.

Corresponding MCV community:

- *Quercus agrifolia* (coast live oak woodland) Woodland Alliance

Riparian Forest: Along the major drainages riparian forest is found, which typically grows along streams in bedrock-constrained, steep-sided canyons, which results in a fairly narrow riparian corridor. The specific dominant plants are not known but riparian trees such as California bay (*Umbellularia californica*), white alder (*Alnus rhombifolia*), coast live oak, western sycamore (*Platanus racemosa*) and willow (*Salix* spp.) occur. There are also a greater number of hydrophytic (moister favoring) plant species in the understory.

Corresponding MCV communities:

- *Alnus rhombifolia* (white alder groves) Forest Alliance
- *Umbellularia californica* (California bay forest) Forest Alliance
- *Quercus agrifolia* (coast live oak woodland) Woodland Alliance
- *Platanus racemosa* (California sycamore woodlands) Woodland Alliance

Wildlife

Mammals making their home in Griffith Park include mule deer (*Odocoileus hemionus*), coyote (*Canis latrans*), raccoon (*Procyon lotor*), red fox (*Vulpes vulpes*), common gray fox (*Urocyon cinereoargenteus*), Virginia opossum (*Didelphis virginiana*), striped skunk (*Mephitis mephitis*), California ground squirrel (*Spermophilus beecheyi*), the non-native eastern fox squirrel (*Sciurus niger*), and house mouse (*Mus musculus*). Bobcat (*Lynx rufus*) have been observed in the northwest and eastern portions of Griffith Park, and there have been sightings of a mountain lion (*Puma concolor*) that some believe may have incorporated Griffith Park into its range.

The last survey of insects in Griffith Park was in the spring 2003, which was a year with a cool, late spring; it is not clear how that weather impacted the survey results. During that survey, the most frequently observed butterfly was the gulf fritillary (*Agraulis vanillae*), which uses ornamental passion vines as a host plant. Bumblebees and honeybees were the most abundant bee species, although carpenter bees were also observed. Sand wasps were observed along some of the hiking trails, where sandy patches are present. Scorpions, tarantulas and other spiders are commonly observed.

Amphibians observed in Griffith Park have included arboreal salamander (*Aneides lugubris*), California slender salamander (*Batrachoseps attenuatus*), Baja California chorus frog (*Pseudacris hypochondriaca*) and California toad (*Anaxyrus halophilus*). Non-native amphibians found in many streams in Griffith Park are the American bullfrog (*Lithobates catesbeianus*) and the African clawed frog (*Xenopus laevis*). In addition to stream habitats, the Los Angeles River, on the eastern side of Griffith Park provides abundant habitat for amphibians.

Reptiles identified in Griffith Park include the Great Basin fence lizard (*Sceloporus occidentalis longipes*), western skink (*Plestiodon skiltonianus skiltonianus*), San Diego alligator lizard (*Elgaria multicarinata webbii*), coastal whiptail (*Aspidoscelis tigris stejnegeri*), western side-blotched lizard (*Uta stansburiana elegans*), California legless lizard (*Anniella pulchra*), California striped racer (*Coluber lateralis lateralis*), red racer (*C. flagellum piceus*), California kingsnake (*Lampropeltis getula californiae*), San Bernardino ringneck snake (*Diadophis punctatus modestus*), San Diego gopher snake (*Pituophis catenifer annectens*), and southern Pacific rattlesnake (*Crotalus oreganus helleri*).

Ornithologists have identified about 200 bird species in Griffith Park, and about 150 of those are regularly seen (every year–Cooper and Mathewson 2008). Griffith Park is also an important stopover for migrating birds and provides an abundance of habitat for wintering birds. Resident birds during the 2003 survey included the acorn woodpecker (*Melanerpes formicivorus*), American crow (*Corvus brachyrhynchos*), Anna's hummingbird (*Calypte anna*), Bewick's wren (*Thryomanes bewickii*), bushtit (*Psaltriparus minimus*), California towhee (*Melozone crissalis*), California quail (*Callipepla californica*), California thrasher (*Toxostoma redivivum*), common raven (*Corvus corax*), European starling (*Sturnus vulgaris*, non-native), great horned owl (*Bubo virginianus*) and the red-tailed hawk (*Buteo jamaicensis*). Migratory birds include the ash-throated flycatcher (*Myiarchus cinerascens*), black-chinned hummingbird (*Archilochus alexandri*), black-headed grosbeak (*Pheucticus melanocephalus*) and western wood-pewee (*Contopus sordidulus*). Aquatic species, such as herons, egrets, ducks and migrating geese are seen in the Los Angeles River as it flows by Griffith Park. These species are also observed on the golf course water features within Griffith Park.

Sensitive wildlife species occurring or potentially occurring within the SEA are discussed in the Sensitive Biological Resources section.

Wildlife Movement

Griffith Park has become increasingly isolated from the rest of the Santa Monica Mountain Range, the Los Angeles River, the Los Angeles Basin, the San Fernando Valley, and the Verdugo Mountains (a little less than two miles to the east) because of the freeways, concrete river projects and urbanization that surround Griffith Park. Although some species have disappeared, including the ringtail (*Bassariscus astutus*), the gray fox is still seen.

River-bed vegetation is quickly returning in the Los Angeles River as sand deposits on the hard channel bottom, and re-vegetation should be encouraged. Major bird and mammal populations exist on the re-vegetated portions of the Los Angeles River. Although some stretches of the Los Angeles River may not provide suitable primary corridors, it is important to reinstate Griffith Park's connection to the Los Angeles River for the future of wildlife and plant connectivity. In the management draft for Griffith Park wildlife (Cooper and Mathewson 2008), the authors outline some of the important connections to maintain or enhance: bridges and underpasses over and under State Route-101 and culverts that feed into the Los Angeles River Channel.

Griffith Park is viewed as an important connective island for the Santa Monica Mountains to the west of State Route-101 and the Verdugo Mountains and San Gabriel Mountains to the east. Wildlife may also use the natural areas and even concrete channels of the Los Angeles River to connect to the Tujunga Wash and Hansen Dam SEA and to the San Gabriel Mountains.

Sensitive Biological Resources

Sensitive biological resources are habitats or individual species that have special recognition by federal, state, or local conservation agencies and organizations as endangered, threatened, and/or rare. This is due to the species' declining or limited population sizes, which usually results from habitat loss. Watch lists of such resources are maintained by the California Department of Fish and Game (CDFG), the United States Fish and Wildlife Service (USFWS), and special groups, such as the California Native Plant Society (CNPS). The following sections indicate the habitats as well as plant and animal species present, or potentially present within the SEA, which have been accorded special recognition.

Sensitive Plant Communities and Habitats

The SEA supports several habitat types considered sensitive by resource agencies. These are inventoried by California Department of Fish and Game (CDFG) in the California Natural Diversity

Database (CNDDB) [2011]. The CNDDB includes state and federally-listed endangered, threatened, and rare vascular plants, as well as several sensitive vertebrate species. These communities include chamise-white sage chaparral, holly leaf cherry chaparral, California brittle bush scrub, California bay forest, and California sycamore woodlands, which occur throughout the SEA. These communities, or closely related designations, are considered high priority communities by the CDFG, which indicates that they are experiencing a decline throughout their range. The array and composition of these communities has been discussed in the Vegetation section.

Sensitive Plant Species

The statuses of rare plants are hierarchically categorized by the CNPS using a rank and decimal system. The initial category level of Rare Plant Rank is indicated by the ranks 1A (presumed extinct in California), 1B (rare or endangered in California and elsewhere), 2 (rare or endangered in California but more common elsewhere), 3 (more information needed, a review list), and 4 (limited distribution). In cases where the CNPS has further identified the specific threat to the species, a decimal or Threat Code is added: .1 (seriously endangered in California), .2 (fairly endangered in California), or .3 (not very endangered in California).

The following special-status plant taxa have been reported or have the potential to occur within the SEA, based on known habitat requirements and geographic range information:

- Braunton's milk-vetch (*Astragalus brauntonii*) FE, RPR 1B.1
- Nevin's barberry (*Berberis nevinii*) FE, SE, RPR 1B.1
- Round-leaved filaree (*California macrophylla*) RPR 1B.1
- Lewis' evening-primrose (*Camissonia lewisii*) RPR 3
- Southern tarplant (*Centromadia parryi* ssp. *australis*) RPR 1B.1
- San Fernando Valley spineflower (*Chorizanthe parryi* var. *fernandina*) FC, SE, RPR 1B.1
- Parry's spineflower (*Chorizanthe parryi* var. *parryi*) RPR 1B.1
- Many-stemmed dudleya (*Dudleya multicaulis*) RPR 1B.2
- Palmer's grapplinghook (*Harpagonella palmeri*) RPR 4.2
- Mesa horkelia (*Horkelia cuneata* ssp. *puberula*) RPR 1B.1
- Coulter's goldfields (*Lasthenia glabrata* ssp. *coulteri*) RPR 1B.1
- White rabbit-tobacco (*Pseudognaphalium leucocephalum*) RPR 2.2
- San Bernardino aster (*Symphyotrichum defoliatum*) RPR 1B.2
- Greata's aster (*Symphyotrichum greatae*) RPR 1B.3
- Slender mariposa lily (*Calochortus clavatus* var. *gracilis*) RPR 1B.2
- Plummer's mariposa lily (*Calochortus plummerae*) RPR 1B.2
- Vernal barley (*Hordeum intercedens*) RPR 3.2
- California Orcutt grass (*Orcuttia californica*) FE, SE, RPR 1B.1

Sensitive Animal Species

The following special-status animal species are reported or are likely to be present within the SEA based on habitat requirements and known range attributes:

- Gertsch's socalchemmis spider (*Socalchemmis gertschi*) CDFG Special Animals List
- Western spadefoot (*Spea hammondii*) BLMS, SSC
- Coast range newt (*Taricha torosa*) SSC
- Silvery legless lizard (*Anniella pulchra pulchra*) FSS, SSC
- Coastal whiptail (*Aspidoscelis tigris stejnegeri*) CDFG Special Animals List
- Western pond turtle (*Emys marmorata*) BLMS, FSS, SSC

- Coast horned lizard (*Phrynosoma blainvillii*) BLMS, FSS, SSC
- Two-striped garter snake (*Thamnophis hammondii*) BLMS, FSS, SSC
- Southwestern willow flycatcher (*Empidonax traillii extimus*) FE, FSS, SE, USBC, AWL, ABC
- Least Bell's vireo (*Vireo bellii pusillus*) FE, BCC, SE, USBC, AWL, ABC
- Pallid bat (*Antrozous pallidus*) FSS, BLMS, SSC, WBWG High
- Western mastiff bat (*Eumops perotis californicus*) BLMS, SSC, WBWG High
- Silver-haired bat (*Lasionycteris noctivagans*) WBWG Medium
- Hoary bat (*Lasiurus cinereus*) WBWG Medium
- San Diego desert woodrat (*Neotoma lepida intermedia*) SSC
- Pocketed free-tailed bat (*Nyctinomops femorosaccus*) SSC, WBWG Medium
- Big free-tailed bat (*Nyctinomops macrotis*) SSC, WBWG Medium-High
- Los Angeles pocket mouse (*Perognathus longimembris brevinasus*) FSS, SSC
- Pacific pocket mouse (*Perognathus longimembris pacificus*) FE, SSC
- American badger (*Taxidea taxus*) SSC

Ecological Transition Areas (ETAs)

There are no ETAs designated within this SEA.

Regional Biological Value

The SEA meets all SEA designation criteria and supports many regional biological values. Each criterion and how it is met is described below.

Criteria Analysis of the Griffith Park SEA

Criterion		Status	Justification
A)	The habitat of core populations of endangered or threatened plant or animal species.	Not Met	No known core populations occur within this SEA.
B)	On a regional basis, biotic communities, vegetative associations, and habitat of plant or animal species that are either unique or are restricted in distribution.	Not Met	No known unique or rare plant or animal species occur within this SEA that would be regionally uncommon. No rare plant habitats occur in Griffith Park. Griffith Park has extensive wild areas that are little studied according to Cooper and Mathewson 2008. Such areas could be discovered.
C)	Within the County, biotic communities, vegetative associations, and habitat of plant or animal species that are either unique or are restricted in distribution	Not Met	No known unique or rare plant or animal species occur within this SEA that would be particularly uncommon in the County. No rare plant habitats are known in Griffith Park. Griffith Park has extensive wild areas that are little studied according to Cooper and Mathewson 2008. Such areas could be discovered.

D)	Habitat that at some point in the life cycle of a species or group of species, serves as concentrated breeding, feeding, resting, or migrating grounds and is limited in availability either regionally or in the County.	Met	Griffith Park is the easternmost extent of the Santa Monica Mountains, and a stepping stone to the Verdugo and San Gabriel mountains, which are only two miles distant. It is a very important natural area for animals and plants species that go between the Santa Monica and San Gabriel mountains. Because of its large acreage, Griffith Park maintains sizable populations of biological communities, even top predators, such as bobcats. Griffith Park is teetering between becoming an island of natural habitat in a metropolis and maintaining connections to the rest of the Santa Monica Mountains to the west.
E)	Biotic resources that are of scientific interest because they are either an extreme in physical/geographical limitations, or represent unusual variation in a population or community.	Met	Griffith Park is the easternmost extent of the Santa Monica Mountains, and a stepping stone to the Verdugo and San Gabriel Mountains, which are only two miles distant. It is a very important natural area for animals and plants species that go between the Santa Monica and San Gabriel mountains. Because of its large acreage, Griffith Park maintains sizable populations of biological communities, even top predators, such as bobcats. Griffith Park is teetering between becoming an island of natural habitat in a metropolis and maintaining connections to the rest of the Santa Monica Mountains to the west.
F)	Areas that would provide for the preservation of relatively undisturbed examples of the original natural biotic communities in the County.	Met	Griffith Park has extensive areas of coastal chaparral and is an island of refuge for native animals in the Santa Monica Mountains. Its mosaic of habitats includes coastal sage scrub, riparian areas, and southern oak woodland. The mosaic of habitats is especially valuable to preserve. Griffith Park is in the City of Los Angeles and protected in this respect, but no management plan preserves its natural habitat in perpetuity.

In conclusion, the area is an SEA because it contains: D) concentrated breeding, feeding, resting, or migrating grounds, which are limited in availability in the County; E) biotic resources that are of scientific interest because they are either an extreme in physical/geographical limitations, or represent unusual variation in a population or community; and F) areas that provide for the preservation of relatively undisturbed examples of original natural biotic communities in the County

8. Griffith Park SEA Sources

Baldwin, Bruce G., Douglas H. Goldman, David J. Keil, Robert Patterson, and Thomas J. Rosatti (editors, 2012) *The Jepson Manual: Vascular Plants of California, Thoroughly Revised and Expanded.* Second Edition. Jepson Herbarium, Berkeley, CA. 1600 pp., illus.

California Department of Fish and Game, Natural Diversity Database. January 2011. *Special Animals* (898 taxa). 60 pp.

California Department of Fish and Game, Natural Diversity Database. April 2011. *Special Vascular Plants*, *Bryophytes*, *and Lichens List.* Quarterly publication. 71 pp.

California Department of Fish and Game, Natural Diversity Database. January 2011. *State and Federally Listed Endangered and Threatened Animals of California.* 13 pp.

County of Los Angeles, Department of Regional Planning. 2006. *The Griffith Park SEA Description*, Los Angeles County, California.

City of Los Angeles, Department of Recreation and Parks. 2005. *Griffith Park Master Plan Draft/ Redraft of Chapter Four*, *The Plant and Animal World.*

Cooper, Daniel S. and Paul Mathewson. 2008. Griffith Park Wildlife Management Plan – Draft. 88 pp.

http://www.laparks.org/dos/parks/griffithpk/wildlife/GP_WMP_Draft4.pdf.

Dale, N. 1986. Flowering Plants: The Griffith Park, Coastal & Chaparral Regions of Southern California.

Griffith Park Master Plan Working Group. December 2005. *Griffith Park Master Plan*, *Draft* [*Redraft of Chapter Four*], City of Los Angeles, California.

Sawyer, Keeler-Wolf and Evens. 2009. *A Manual of California Vegetation*, *Second Edition* Sacramento: California Native Plant Society Press.

U.S. Department of the Interior, Fish and Wildlife Service. 1998. *Draft Recovery Plan for Six Plants from the Mountains Surrounding the Los Angeles Basin*, Region One, Portland, Oregon.

8. Griffith Park: D, E, F			
Criteria Letter	Criteria Description	Criteria Met	Reason SEA meets Criteria
A	The habitat of core populations of endangered or threatened plant or animal species.	No	
B	On a regional basis, biotic communities, vegetative associations, and habitat of plant or animal species that are either unique or are restricted in distribution.	No	
C	Within Los Angeles County, biotic communities, vegetative associations, and habitat of plant or animal species that are either unique or are restricted in distribution.	No	
D	Habitat that at some point in the life cycle of a species or group of species, serves as concentrated breeding, feeding, resting, migrating grounds and is limited in availability either regionally or in Los Angeles County.	Yes	Griffith Park is the easternmost extent of the Santa Monica Mountains, a stepping stone to the Verdugo and San Gabriel Mountains, only two miles distant. It is a very important natural area for animals and plant seeds that go between the Santa Monica and San Gabriel Mountains. Because of its large acreage, Griffith Park maintains sizeable populations of the biological community, even top predators such as bobcats. The Park is teetering between becoming an island of natural habitat in a metropolis and maintaining connections to the rest of the Santa Monica Mountains to the west. Recently (2010) a coalition of donors added Cahuenga Peak and surroundings on the west to the Park lands.
E	Biotic resources that are of scientific interest because they are either an extreme in physical/geographical limitations, or represent unusual variation in a population or community.	Yes	Griffith Park is an island of natural habitat surrounded by urban areas. These inland islands are reservoirs of native species that may be of scientific and economic value in the future. Birds rely on these islands for areas to rest and feed along their north-south migration routes.
F	Areas that would provide for the preservation of relatively undisturbed examples of the original natural biotic communities in Los Angeles County.	Yes	Griffith Park has extensive areas of coastal chaparral and is an island refuge for native animals of the Santa Monica Mountains. Its mosaic of habitats includes coastal sage scrub, riparian areas, and southern oak woodland.