Volume 1 of 2: Integrated Feasibility Report

Volume 2 of 2: Technical Appendices

Los Angeles River Ecosystem Restoration Integrated Feasibility Report

Feasibility Study and Environmental Impact Statement/Environmental Impact Report

DRAFT

VOLUME 1: INTEGRATED FEASIBILITY REPORT

Los Angeles County, California

September 2013

US Army Corps of Engineers®
Los Angeles District

Los Angeles River Ecosystem Restoration Feasibility Study
Draft Integrated Feasibility Report (Feasibility Study/Environmental Impact Statement/Environmental Impact Report)
Los Angeles County, California

The Federal lead agency responsible for implementing the National Environmental Policy Act (NEPA) is the U.S. Army Corps of Engineers, Los Angeles District (USACE). The local lead agency responsible for implementing the California Environmental Quality Act (CEQA) is the City of Los Angeles.

The Draft Integrated Feasibility Report (IFR) for the Los Angeles River Ecosystem Restoration Feasibility Study evaluates alternatives for the purpose of restoring 11 miles of the Los Angeles River from approximately Griffith Park to downtown Los Angeles while maintaining existing levels of flood risk management.

Restoration measures considered include creation and reestablishment of historic riparian strand and freshwater marsh habitat to support increased populations of wildlife and enhance habitat connectivity within the study area, as well as to provide opportunities for connectivity to ecological zones such as the Santa Monica Mountains, Verdugo Hills, Elysian Hills, and San Gabriel Mountains. Restoration also includes the reintroduction of ecological and physical processes such as a more natural hydrologic and hydraulic regime that reconnects the river to historic floodplains and tributaries, reduces flow velocities, increases infiltration, improves natural sediment processes, and improves water quality. The study also evaluates opportunities for passive recreation that is compatible with the restored environment. The study evaluates the No Action Alternative and four action alternatives, Alternative 10, 13, 16, and 20. The tentatively selected plan is Alternative 13.

Written comments pursuant to NEPA will be accepted until the close of public review at close of business on November 5, 2013.

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LOS ANGELES RIVER ECOSYSTEM RESTORATION INTEGRATED FEASIBILITY REPORT

FEASIBILITY STUDY AND
ENVIRONMENTAL IMPACT STATEMENT/
ENVIRONMENTAL IMPACT REPORT

LOS ANGELES COUNTY, CALIFORNIA

SEPTEMBER 2013

Prepared by:
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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THE CITY OF LOS ANGELES

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VOLUME 1: INTEGRATED FEASIBILITY REPORT

VOLUME 2: TECHNICAL APPENDICES

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ACRONYMS AND ABBREVIATIONS

AAHU	Average Annual Habitat Units
AAQS	Federal Ambient Air Quality Standard
ACE	Annual Chance Exceedance
ADA	Americans with Disabilities Act
AFB	Alternative Formulation Briefing
APE	Area of Potential Effects
AQMP	Air Quality Management Plan
ARBOR	Area with Restoration Benefits and Opportunities for Revitalization
BMP	Best Management Practice
BNSF	Burlington Northern-Santa Fe Railway
CADC	California Department of Conservation
Caltrans	California Department of Transportation
CASP	Cornfield Arroyo Specific Plan and Redevelopment Plan
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife
CDPR	California Department of Parks and Recreation
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESA	California Endangered Species Act
cfs	Cubic feet per second
CGS	California Geological Survey
CHAP	Combined Habitat Assessment Protocol
CHL	California Historical Landmarks
CNEL	Community Noise Equivalent Level
CNPS	California Native Plant Society
CO	Carbon monoxide
CO_2	Carbon dioxide
COLD	Cold Freshwater Habitat
CRHR	California Register of Historical Resources
CRWQCB	California Regional Water Quality Control Board
CWA	Clean Water Act
dB	Decibels
dBA	Decibels A-weighted
DCA	Dichloroethane
DNL	Day-Night Level
DWR	California Department of Water Resources
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EO	Executive Order
EOO	Emergency Operations Organization
EQ	Environmental Quality
ER	Environmental Regulation
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency

FHWA	Federal Highway Administration
FoLAR	Friends of the Los Angeles River
ft/s	Feet per second
GHG	Greenhouse Gases
GIS	Geographic Information System
GLACVCD	Greater Los Angeles County Vector Control District
HFC	Hydrofluorocarbons
HTRW	Hazardous, toxic, or radioactive waste
HU	Habitat unit
IFR	Integrated Feasibility Report
IRP	Integrated Resources Plan
IWR	Institute for Water Resources
LACC	Los Angeles County Code
LACDA	Los Angeles County Drainage Area
LACDPW	Los Angeles Department of Public Works
LACFCD	Los Angeles County Flood Control District
LADOT	Los Angeles Department of Transportation
LADWP	Los Angeles Department of Water and Power
LAEDC	Los Angeles County Economic Development Corporation
LAFD	Los Angeles Fire Department
LAHCM	Los Angeles Historic-Cultural Monuments
LAMC	Los Angeles Municipal Code
LAPD	Los Angeles Police Department
LA-RIO	Los Angeles River Improvement Overlay
LARRC	Los Angeles River Revitalization Corporation
LARRMP	Los Angeles River Revitalization Master Plan
LERRD	Lands, easements, rights-of-way, and disposal sites
MCL	Maximum Concentration Levels
Metro	Los Angeles County Metropolitan Transit Authority
Metrolink	Southern California Regional Rail Authority
mm/year	Millimeter per year
MTBE	Methyl tertiary butyl ether
MUN	Municipal
NED	National Economic Development
NER	National Ecosystem Restoration
NHPA	National Historic Preservation Act
NO	Nitric oxide
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides
NPDES	National Pollution Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
O_3	Ozone
OHW	Ordinary high water
O&M	Operations and Maintenance
OSE	Other social effects
OSHA	Occupational Safety and Health Administration

Pb	Lead
PCE	Perchloroethylene
PEMC	Palustrine emergent, seasonally flooded
PFOC	Palustrine forested, seasonally flooded
PLUM	Planning and Land Use Management Committee, Los Angeles City Council
PM	Particulate matter
Ppm	Parts per million
PSSC	Palustrine scrub-shrub, seasonally flooded
PSSF	Palustrine scrub-shrub, semi-permanently flooded
RCRA	Resource Conservation and Recovery Act
REC1	Water Contact Recreation
REC2	Non-contact Water Recreation
RED	Regional Economic Development
ROG	Reactive Organic Gas
RUM	River Update Meetings
RWQCB	Los Angeles Regional Water Quality Control Board
SCAB	South Coast Air Basin
SCAG	Southern California Association of Governments
SCAQMD	South Coast Air Quality Management District
SCCWRP	Southern California Coastal Watershed Research Program
SCS	Soil Conservation Service
SF_6	Sulfur hexafluoride
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO_2	Sulfur dioxide
SR	State Route
SVOC	Semi-volatile organic compounds
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TAC	Toxic Air Contaminants
TCE	Trichloroethylene
TMDL	Total Maximum Daily Load
TNW	Traditional Navigable Waters
TSS	Total Suspended Solids
ULARA	Upper Los Angeles River Area
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geologic Survey
VOC	Volatile Organic Compounds
WARM	Warm Freshwater Habitat
WET	Wetland Habitat
WILD	Wildlife Habitat
WRP	Water Recycling Program

EXECUTIVE SUMMARY

ES.1 Introduction

This document is an Integrated Feasibility Study, Environmental Impact Statement, and Environmental Impact Report—known as an Integrated Feasibility Report (IFR) -- for the United States Army Corps of Engineers (USACE or Corps) Los Angeles River Ecosystem Restoration Feasibility Study (Study), for which the City of Los Angeles (City) is serving as non-Federal sponsor. The primary purpose of the alternative plans, including the Tentatively Selected Plan (TSP), considered in this IFR is to restore approximately 11 miles of the Los Angeles River from Griffith Park to downtown Los Angeles by reestablishing riparian strand, freshwater marsh, and aquatic habitat communities and reconnecting the River to major tributaries, its historic floodplain, and the regional habitat zones of the Santa Monica, San Gabriel, and Verdugo Mountains at this central nexus of the Los Angeles River Watershed's former and existing ecosystems (Figure ES-1) while maintaining existing levels of flood risk management. A secondary purpose is to provide recreational opportunities consistent with the restored ecosystem within this 11-mile reach of the river. This study area is identified as the "Area with Restoration Benefits and Opportunities for Revitalization" reach, or ARBOR Reach. This reach will be referred to as the study area or ARBOR reach for the purposes of this IFR.

Figure ES-1 Historic LA River Drainage Area (Gumprecht 2001)

ES.2 Background

The Los Angeles River is the 51-mile-long backbone of an 870 square mile watershed. It once anchored a vast system of riparian foothill, riverine and freshwater marsh habitat that carried seasonal rains and subterranean flows across the coastal plain to the Pacific Ocean. Over the last 150 years, the River has been degraded by a cycle of increasing urban development in the floodplain, flooding, and channelization, culminating in the mid-20th century with the construction of the Federal flood risk management project known as Los Angeles County Drainage Area (LACDA).

Like many other rivers in the Southwestern United States, much of the River was an ephemeral stream, which would appear dry for much of the year, but become a powerful torrent during the rainy season, expanding over the floodplain. Prior to development, the river's course was fairly consistent through the San Fernando Valley, but *"[o]nce the river rounded the bend of the Santa Monica Mountains at Griffith Park, however, its path became much more circuitous. Between the mouth of Verdugo Wash and the Arroyo Seco, the river spread over a broad depression two thousand feet wide, its course meandering considerably from year to year*" (Gumprecht 136). Below the gap between the Elysian and San Rafael Hills, the channel widened and banks disappeared, with floodwaters able to stretch more than a mile wide (Gumprecht 136). During storm events, the river's course could shift by as much as 90 degrees, changing its outlet from Santa Monica Bay to San Pedro Bay (see Figure ES 1). Development removed vegetation and converted floodplains to agricultural uses, vineyards, and later, residential, industrial, and commercial areas. When the railroads arrived in the 1870s, they placed tracks close along its banks, hemming the river in further, and bridges and trestles constrained and quickened flows and created barriers during major storm events. Groundwater and surface withdrawals reduced regular river flows significantly, but flood threats to the populace from the seasonal storm flows increased as development and infrastructure expanded within the river's natural floodplain, constraining the river's flow and removing supporting vegetation and areas for infiltration.

In the late 19th and early 20th centuries, storm flows in the river caused catastrophic flooding that resulted in the loss of lives and millions of dollars in property damage to areas in the river's floodplain. As a result, City and County leaders initiated a formal flood risk management program (then known as "flood control") to channelize the natural river system with the goal of moving flood flows to the ocean as efficiently as possible. In the 1930s, the USACE was tasked by Congress with engineering the flood risk management system, as outlined in the County's Comprehensive Plan, which resulted in the channelization of the river and its tributaries in concrete as part of the LACDA project (Figure ES-3).

Houses, businesses, and infrastructure in the floodplain that encroached on the river channel; the increase in impervious surfaces accompanying development; and a complex system of storm drains that delivered runoff to the river made concrete channels one of the few options left at the time for effective flood risk management. "*Federal flood control engineers had little choice but to confine the Los Angeles River to a relatively narrow channel, a fraction of the width of natural floodplain, because of the nature of existing development and the high price of real estate along its course.*" (Gumprecht 209).

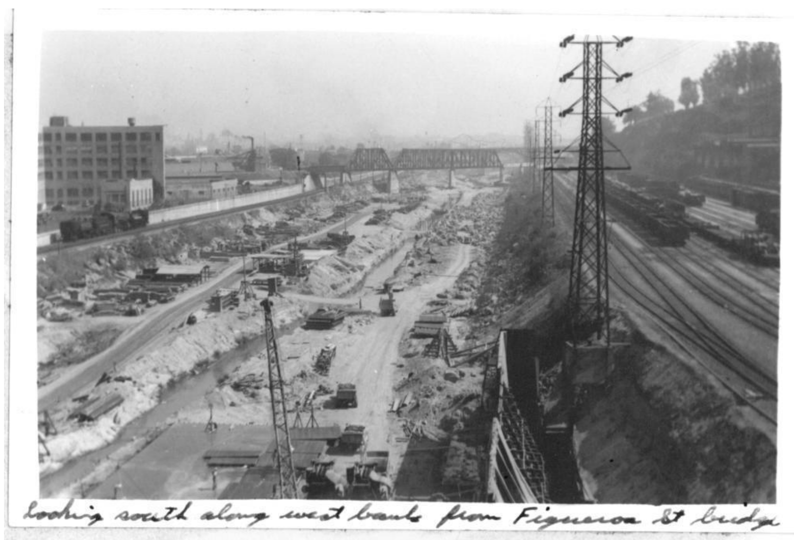


Figure ES-2 The LACDA Project Under Construction, Downsteam of Arroyo Seco Confluence 1940

The further channelization and engineering of the already degraded river provided flood protection for the increasingly developed region and a consistent path for the River course. However, by encasing the river in concrete banks and a mostly concrete bed, widening and deepening its channel, and straightening the river's course,[1] the channelization project further diminished the river system's plant and wildlife diversity and quality and disconnected it from its floodplain and significant ecological zones. The final section of the LACDA project in the Study Area was completed in 1959 as one component of the transformation of the region's watersheds through development and flood risk management projects. The LACDA project continues to provide critical protection against flooding of surrounding and downstream areas and is operated by the Corps and the County of Los Angeles.

[1] Earlier sinuosity of the river is partially visible in the boundaries of adjacent features, such as Griffith Park. By one assessment, channelization reduced the river's length by 28 percent between Tujunga Wash and Glendale Boulevard, cutting it from 11.3 to 8.1 miles (see Figure ES-1; Glendale Blvd is roughly 2.5 miles upstream of the Arroyo Seco confluence. (Gumprecht 228-230).

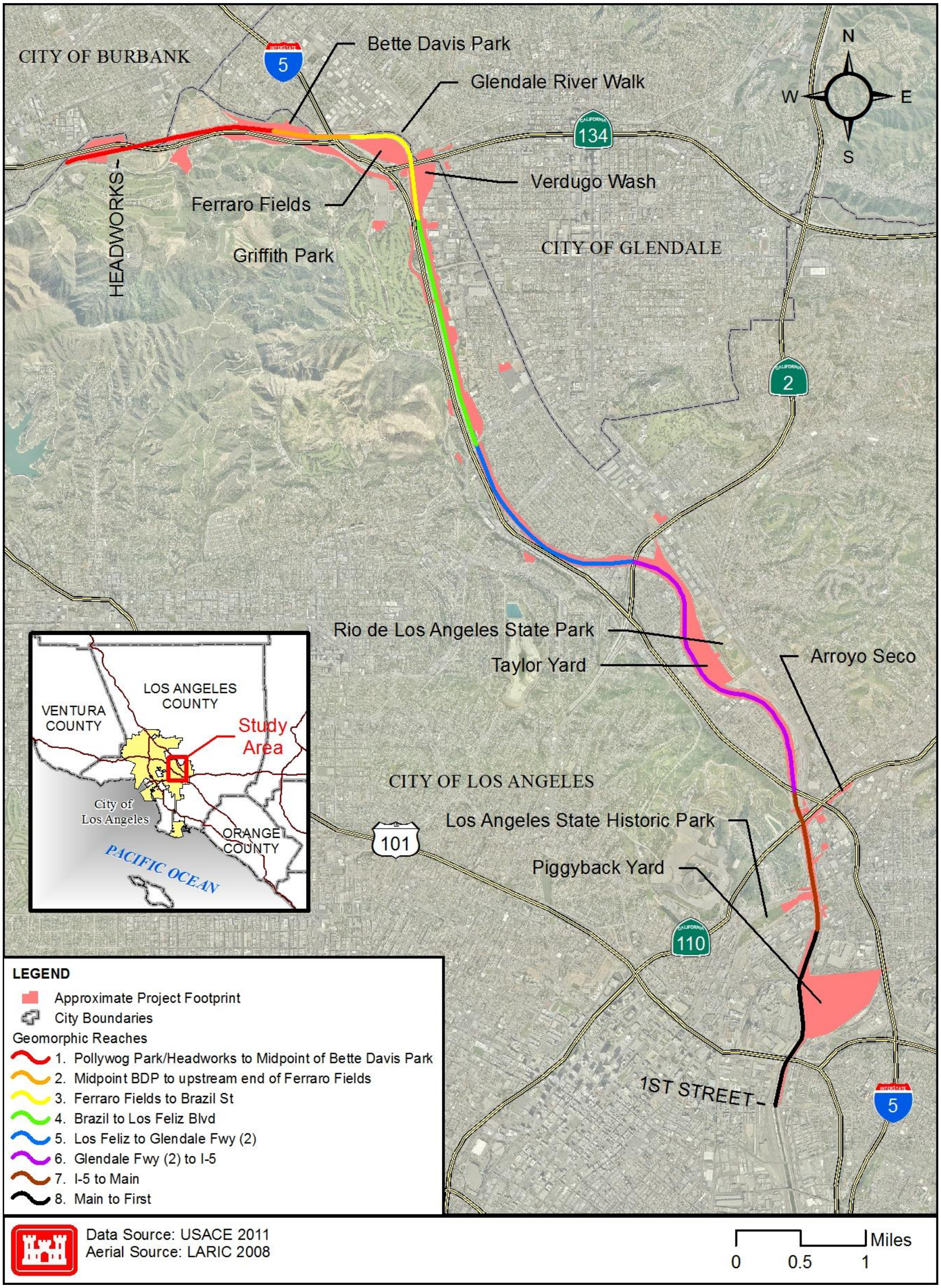


Figure ES-3 Study Area, the ARBOR Reach

ES.3 Los Angeles River Study Area

Today the Los Angeles River flows through the nation's second-largest urban region—from the San Fernando Valley into the Pacific Ocean at Long Beach. The first 32 miles of the river flow through the City of Los Angeles and along the cities of Burbank and Glendale. Restoration of the river has been a long-standing priority of the City, and this is reflected in the Los Angeles River Revitalization Master Plan (Plan), adopted by the City Council in 2007. The Plan proposes a network of trails, parks, natural open spaces, wildlife habitat areas, recreational facilities and more than 240 projects connecting to 5 key "opportunity areas": Canoga Park, River Glen, Taylor Yard, Cornfields/Chinatown, and Downtown Industrial. Initially, the study area for this IFR included the 32 miles of the river within the City. However, the iterative study process resulted in a narrowing of the Study's geographic focus from the entire 32 miles to the 11 mile soft-bottomed Glendale Narrows stretch because that area shows the most promise for ecosystem restoration (Figure ES-3). Apart from the Sepulveda Basin, the San Fernando Valley area of the River (upstream of the study area) is characterized by large segments of channel that are entirely concrete with very few opportunities for adjacent land acquisition. In Studio City, the River is even more constrained—with a narrow boxed channel configuration less than 200 feet wide with development on either side. The lower reach of the river is highly constrained by development, including downtown Los Angeles and a heavy industrial corridor that also includes a major transmission corridor and a freeway system. The upper and lower reaches of the river have less potential to connect nationally and regionally significant ecological zones because of the state of existing development. These considerations make the potential for habitat connectivity and expansion very difficult in the near term.

The Glendale Narrows stretch of the river, in contrast, features a non-concrete bottom or natural bed (due to the high groundwater levels), which has robust patches of vegetation—important habitat for birds and other wildlife—and free-flowing water that supports aquatic species. In addition, this area offers an opportunity to connect to existing large habitat areas of importance. It is situated along and within Griffith Park, the eastern terminus of the Santa Monica Mountains, and includes connections to key tributary confluences—the Verdugo Wash, which connects to the Verdugo Mountains, and the Arroyo Seco, which connects to the San Gabriel Mountains and another USACE Feasibility Study area further upstream on the Arroyo Seco. The area also directly connects large open spaces either used as publicly-accessible parks with habitat areas or intended for this future use: USACE Headworks Feasibility Study area, California State Parks' Bowtie Parcel, the Taylor Yard, Río de Los Angeles State Park, and Los Angeles State Historic Park (formerly known as the Cornfields), which allows a west bank connection to Elysian Park. Three of the five key opportunity areas of the City's Plan are located within the Study area: River Glen, Taylor Yard, and Cornfields/Chinatown, and restoration within the study area would assist with the goal of transforming the river corridor into the "green spine" of the City. Existing habitat and perennial surface flow in the ARBOR reach provide a base for restoration and maintain the most diverse assemblages of wildlife on the river today. Alternatives for restoration are thus focused in the ARBOR reach, from Griffith Park to downtown Los Angeles.

ES.4 Significant Resources

Consideration of significant resources is central to plan formulation, especially in the context of ecosystem restoration planning because non-monetary outputs are being considered. Per USACE Engineering Regulation (ER) 1105-2-100, significance of resources and effects will be derived from institutional, public, or technical recognition.

Institutional and Plan Recognition

- The River is the subject of important national efforts, such as the Urban Waters Federal Partnership, which selected the LA River Watershed as one of seven nationwide first-phase pilots. The Partnership includes the USACE, the Departments of Interior, Commerce, Agriculture, and Housing and Urban Development, the Environmental Protection Agency, four state agencies, seven local governmental entities, and 11 nongovernment organizations. One of the goals specific to the watershed includes restoration of ecosystem functions, and there are several restoration projects ongoing throughout the watershed. This restoration study was selected as the group's top priority.
- At the national level, the LA River has been protected by the Clean Water Act since the Act's inception. However, in 2010, the river was designated as a Traditionally Navigable Water in its entirety, recognizing the river's historic and continuing importance and the potential beneficial impacts of river restoration on the region. This designation increased institutional and public recognition of the river's resources, with national news reports focusing on the designation and the degraded condition of the river. The State of California cited the TNW designation and the character of the river in codifying the river's status as a

navigable water of the state protected under the State Constitution in SB 1201, signed by the Governor in 2012.

- The President's America's Great Outdoors initiative identified the Los Angeles River watershed as a priority project, and specifically called out the importance of its trail system in its "50 State Report." Leaders including the Secretary of Interior, the USEPA Administrator, the Assistant Secretary of the Army for Civil Works, the Chair of the White House Council on Environmental Quality, Congressional representatives, and state agency heads joined the Mayor of Los Angeles on the river's banks in the study area in 2012 to highlight the need to transform the river.
- The City's Los Angeles River Revitalization Master Plan contains input of Federal, State, and regional agencies and stakeholders, and Congress specifically directed in WRDA 2007, section 4018, that this study develop a plan that is consistent with the goals of the City's Los Angeles River Revitalization Master Plan. The Los Angeles City Council adopted the Los Angeles River Revitalization Master Plan in 2007. That plan identified opportunities for environmental restoration, including habitat improvements, in concert with recreation, water quality, flood risk management, and community revitalization benefits. One of the major goals is to restore a functional riparian ecosystem with recommendations to (1) create a continuous functional riparian corridor that provides habitat for birds, mammals, amphibians, reptiles, invertebrates, and fish within the channel bottom; (2) connect this corridor to other significant habitat and migration routes along the tributaries and into the mountains; (3) provide support for desirable fish species; and (4) bioengineer or naturalize the river's edge where feasible.
- In 2012, the portion of the Los Angeles River Trail that extends throughout the study area was designated by the Secretary of the Interior as part of the National Recreation Trail System. The designated trail is an approximately 10- mile section of greenway/bikepath along the river that helps tell the story of the founding of Los Angles and its relationship to water resources. The trail also coincides with the National Park Service's Juan Bautista de Anza National Historic Trail.
- The State of California has been involved in revitalization activities on the Los Angeles River since the 1990s through the Santa Monica Mountains Conservancy and its affiliate agency, the Mountains Recreation and Conservation Authority, by constructing a series of pocket parks along its banks.
- In the last decade, California State Parks has established two new state parks along the river corridor in the study area, Río de Los Angeles State Park (opened 2007) and Los Angeles State Historic Park (established 2001).
- The County completed a Los Angeles River Master Plan in 1996 with plans for bikeways and park areas.
- New pedestrian bridges proposed or in progress within the study area and increased riverwalk construction at the Glendale section of the River in Glendale Narrows have been funded in part with grants from the State's California River Parkways program, funds from the Metropolitan Transportation Authority, and other local sources.

Technical Recognition

- Over 90 percent of the region's riparian habitat including Valley Foothill riparian habitats and over 95 percent of the region's wetlands including freshwater marsh have been lost. What does remain is largely isolated and no longer connected to surrounding habitat resources. Already a scarce habitat in this arid region, it is becoming more rare.
- The study area is located within the California Floristic Province—an area that Conservation International identified as one of its top 25 global hotspots experiencing rapid bio-diversity loss.
- Increases in riparian and wetland vegetation would provide essential habitat for resident/migratory songbirds (including the least Bell's vireo (listed as endangered under the Endangered Species Act); native fish, including threatened species such as the Santa Ana Sucker and arroyo chub that have been fully extirpated from the river; reptiles; amphibians and small and medium-size mammals. Prior to development and channelization, these species and habitats were prevalent within the meandering river floodplain. These historic ecosystems and wildlife communities were degraded by the development, water withdrawals, and channelization that have occurred across southern California, further fragmenting habitat.
- The technical significance of restoration in the ARBOR reach is also based on the importance of nodal habitat connectivity (i.e., large and small aquatic habitat patches connected via habitat corridors). Improvements along the mainstem of the LA River would restore habitat connectivity and would provide synergy with and further enhance both aquatic and terrestrial habitat values within other natural areas in the vicinity. By restoring additional habitat and wildlife movement pathways nodal connections could be made to now-isolated open space areas. Vegetated corridors and flyways restored by the proposed project would

provide regional habitat connectivity (direct or potential) to surrounding National Forest land, including the Angeles National Forest, Santa Monica Mountains National Recreation Area, and other areas currently being studied by the Department of Interior for possible inclusion in the national park system (e.g., the Rim of the Valley Corridor Special Resource Study). The Rim of the Valley study area extends north, east and west of the study area, and the river serves as a vital connection between the Santa Monica and San Gabriel Mountains within its boundaries. These two mountain ranges have previously been found by the National Park Service to contain nationally-significant resources, including unique geologic and cultural resources, as well as high quality biodiversity. The proposed LA River ecosystem restoration project would provide an essential backbone of physically connected habitats along a primary wildlife movement corridor/migratory pathway. This would, in turn, provide opportunities for additional connections to currently isolated or disjointed restoration/open space areas within upstream tributaries.

- The ARBOR reach is also located just upstream of the Lower LA River Important Bird Area, as designated by the Audubon Society.
- The highly seasonal hydrology and permeable sediments characteristic of the southwest region create a dynamic system, where the river courses are constantly shifting with the highly variable flood regime and the floodplains are expansive. This in turn supports a diverse channel and floodplain structure, and a diverse assemblage of plant and wildlife communities. Development and flood risk and water supply projects have constrained and eliminated most such systems in the southwest. The flood risk management system on the Los Angeles River results in flood flows moving at high velocities in a narrow channel, and smaller storm events moving at faster speeds than would occur without channelization. The natural processes and habitat that would be maintained under a dynamic system are altered under the closed system. In short, the current system has a highly altered regime that is simplified (reduced flow options) and magnified (higher flows concentrated in smaller spaces). The river now functions more as a drainage channel to swiftly move water out of the system, rather than functioning as it did historically as a river ecosystem.
- Opportunities for restoration of even a portion of a southwestern riparian ecosystem (as opposed to restoration of only riparian plant communities and habitat) are exceedingly rare in the Los Angeles Watershed, but are present within the study area at critical opportunity areas at Taylor Yard and Piggyback Yard, two large parcels where the river could be widened and restored to reconnect directly with the floodplain. This would result in restoring a portion of the river's natural processes and providing areas that could support essential elements for fish habitat.

Public Recognition

- Public attention to the River has increased steadily since 1986, when Friends of the Los Angeles River (FoLAR) was founded. FoLAR's mission is to protect and restore the natural and historic heritage of the Los Angeles River and its riparian habitat. FoLAR's early efforts have been joined by North East Trees, The River Project, establishment of the Los Angeles River Center, and the annual La Gran Limpieza river cleanup.
- As noted under institutional recognition above, there are 11 nongovernmental organizations participating in the Urban Waters Federal Partnership. That participation and those groups also denote public recognition of the River as a significant resource and include: the Arroyo Seco Foundation, the Council for Watershed Health, FoLAR, the LA Conservation Corps, the LA River Revitalization Corporation, The River Project, Tree People, the Trust for Public Land, the Urban Rivers Institute, and Urban Semillas.
- The LA River Corps of the LA Conservation Corps, a nonprofit organization, engages in stewardship of parks, open space, and recreational improvements along the river, while the Los Angeles River Revitalization Corporation promotes economic revitalization through capital projects and community activities, such as "Greenway 2020"—a campaign to build out the entire LA River bike path by 2020.
- Significant in the policy shift for governance and operation of the River, and for the first time since the LACDA project was constructed, a portion of the river channel within the study area was opened for seasonal recreational activities in summer 2013. This access to the River has promoted activities such as hiking, bird-watching, and non-motorized boating. This is part of an effort spearheaded by the City of Los Angeles and the Mountains Recreation and Conservation Authority in coordination with the USACE and County, and which relates to SB 1201 as part of the direction to facilitate restoration and recreation where compatible with flood risk management.

- The river, including its degraded condition and potential for restoration, has been the subject of increasing scholarly attention and national and international news reports, including environmental history texts, art exhibitions, and news and magazine stories.

ES.5 Planning Objectives

The significant resources identified were used to develop problems and opportunities, and from there, objectives. The objectives of the study are to:

1. Restore Valley Foothill Riparian Strand and Freshwater Marsh Habitat: Restore Valley Foothill Riparian wildlife habitat types, aquatic freshwater marsh communities, and native fish habitat within the ARBOR reach throughout the period of analysis, including restoration of supporting ecological processes and biological diversity, and a more natural hydrologic and hydraulic regime that reconnects the river to historic floodplains and tributaries, reduces velocities, increases infiltration, and improves natural sediment processes.
2. Increase Habitat Connectivity: Increase habitat connectivity between the river and the historic floodplain, and increase nodal connectivity for wildlife between restored habitat patches and nearby significant ecological zones such as the Santa Monica Mountains, Verdugo Hills, Elysian Hills, and San Gabriel Mountains within the ARBOR reach throughout the period of analysis.
3. Increase passive recreation: Include recreation that is compatible with the restored environment in the ARBOR reach throughout the period of analysis.

ES.6 Key Considerations and Policy Issues Influencing Alternatives Formulations, Comparison, and Selection

Just as the national and regional perspective on the Los Angeles River has changed over time, the USACE mission has grown to include ecosystem restoration. Projects proposed by the Corps for ecosystem restoration should be responsive to the purpose, intent, and scope of the restoration mission.

- Purpose: “... to restore significant structure, function and dynamic processes that have been degraded." (EP 1165-2-501)
- Intent: “... to partially or fully reestablish the attributes of a naturalistic, functioning, and self-regulating system." (EP 1165-2-502)
- Scope: “Nationally and regionally significant wetlands, riparian and other floodplain and aquatic systems" (ER 1105-2-100)

In developing and comparing alternatives, the Corps and City gave substantial consideration to the way in which structure, function and dynamic processes work together to achieve restoration objectives. Corps guidance states that, “Restoration projects should be conceived in a systems context … in order to improve the potential for long-term survival as self-regulating, functioning systems. This system view will be applied both in examination of the problems and the development of alternative means for their solution. Consideration should be given to the interconnectedness and dynamics of natural systems…” (ER 1105-2-100). The final array of alternatives takes into account the physical dynamics of the aquatic ecosystem.

Further, the proposed restoration has a direct association with historic and ongoing Corps activities. Nationwide, the Corps is engaged in transforming single-purpose, 20th century infrastructure that did not evaluate environmental effects before construction into multi-purpose, 21st century infrastructure that incorporates consideration for the natural environment and public access and use. The Corps has a central role to play in ecosystem restoration projects that are related to its existing projects. The Corps continues to operate the LACDA project within the river in the study area today, and that project remains necessary for the continued management of flood risk in surrounding areas. In addition, the Corps is uniquely suited as the Federal proponent in this endeavor because it is a lead water resources agency with appropriate engineering and ecological expertise. In order to appropriately respond to the scale of the identified problems in and along the River and warrant Federal investment, ecosystem restoration features that directly connect overbank areas with the channel to restore degraded functions and processes are critical.

Key issues encountered in developing the alternatives were the high costs of real estate, the presence of sites contaminated with hazardous substances, levee policies that restrict planting on levees, and flood risk. Each of these issues is typical of urban areas—acquisition of lands in urban areas are more expensive because of development pressures; a long-standing history of mixed uses for commerce, industry, and intensive intermodal transportation yields contamination concerns; and intensive development in historic floodplains, including the associated building of roadways and other paved surfaces, tax aging flood risk management infrastructure still critical to protecting adjacent communities. While these challenges are daunting, they are not insurmountable.

Real Estate Costs
Corps policy provides that ecosystem restoration projects should not be composed primarily of land acquisition. To reflect that projects should be restoration focused, the Corps uses a target of 25 percent for land costs as a percentage of total project cost. The policy states,

> *Land acquisition in ecosystem restoration plans must be kept to a minimum. Project proposals that consist primarily of land acquisition are not appropriate. As a target, land value should not exceed 25 percent of total project costs. Projects with land costs exceeding this target level are not likely to be given a high priority for budgetary purposes (ER 1105-2-100, Appendix E, para. E-30f).*

Real estate and potential relocation costs are known to be exceptionally high in the Los Angeles area. Initially, a conceptual alternative that restored the river to an area similar to its historic floodplain and removed the concrete channel within the study area was estimated to have real estate costs of approximately $7.6 billion, an excessive amount that did not include relocation costs or construction costs. Mindful that real estate costs would be high for any alternative that involved urban Los Angeles lands, the study examined lands already included in the LACDA project boundary, open space lands adjacent to the existing LACDA boundary, and other parcels that would support restoration goals such as habitat connectivity. Despite efforts to minimize land acquisition, real estate costs for the alternatives in the final array range from approximately 83 percent of total project cost for the smaller alternatives to approximately 45 percent for the largest alternatives. In recognition of the unusual nature of the real estate costs of the proposed alternatives and in commitment for the project, the City of Los Angeles proposed to waive reimbursement of real estate costs that exceed its statutorily required 35 percent share of total ecosystem restoration costs. The Assistant Secretary of the Army (Civil Works) has granted the request to waive reimbursement. The Corps and City would cost share the recreation feature costs 50-50, and other costs would be governed by the partnership agreement.

Hazardous and Toxic Waste Contamination
The Corps' policy is for ecosystem restoration projects to avoid lands with hazardous, toxic, and radioactive waste (HTRW) whenever practicable to do so. In most scenarios, avoidance of HTRW is possible. However, given the highly constrained river corridor and the historical industrial uses within it, HTRW contaminated lands and groundwater cannot be fully avoided in plan formulation while still providing a project responsive to the project objectives. The proposed project area for the four action alternatives contains three major areas of known contamination, and one area with high potential for contamination of concern. The northern half of the river, including Reaches 1-6 in the Study Area, is underlain by a groundwater plume known as the San Fernando Valley Superfund Site, which is currently being remediated with oversight by EPA. Furthermore, the Taylor Yard has two sites (G1 and G2) with known contamination resulting from its historical use as a railyard. In addition to these three sites, the Piggyback Yard, another key site within the study area, is a railyard that can reasonably be anticipated to have some contaminated soils requiring remediation given the similarity of historical use at that site to Taylor Yard uses, although it has been paved for several decades. There are 19 other sites in various stages of remediation, adjacent to the alternative plan footprints, which were avoided by the alternatives, and these sites are considered to be low impact to a potential project. An exhaustive search for other appropriate real estate parcels was conducted, but no other parcels or groups of parcels of sufficient size to address study objectives and fully avoid HTRW impacted sites were identified. Although initial plans were developed that excluded the Taylor and Piggyback Yard parcels, they did not meet the restoration objectives for restored habitat and habitat connectivity and were eliminated through the planning process.

Therefore, in order to meet project objectives, the project footprint for the four action alternatives includes sites with known and suspected soil and groundwater contamination requiring response and remediation. For the sites with soil contamination, the City must undertake or otherwise ensure the remediation of the sites to the standards necessary to support the restoration project at 100 percent non-project cost, prior to construction at those sites. For the groundwater contamination that cannot be addressed prior to construction, the City will undertake necessary dewatering activities including treatment and disposal, at 100 percent non-project cost in areas with contaminated groundwater. The City of Los Angeles is aware of these requirements, and has accepted responsibility for delivering lands suitable for ecosystem restoration and addressing groundwater contamination during dewatering.

Although excluded from cost shared project costs, effort and costs of HTRW response and remediation have been considered in evaluating and comparing plans for implementation. The City understands its responsibility to ensure completion of remediation efforts on affected parcels and provide sites cleaned to the standard required to support the restoration project prior to project construction being undertaken on those sites, and its responsibility for addressing contaminated groundwater during dewatering, including treatment and disposal.

Levee policies

The Corps' levee guidance provides, among other requirements, that levees must remain visible for inspection and maintenance and remain free of vegetation that can cause structural damage. The study area contains several levees subject to this limitation. For this reason, restoration features in the final array have been designed to be compatible with the levee guidelines. Levee vegetation guidelines allow for forbs (native perennial grasses) which meet the guidance requirements for root and stems of vegetation to be grown on the levee and other vegetation to be planted farther from the levee. Forbs provide habitat for small mammals, reptiles, birds and insects, and are an important part of the riparian community. The identification of the need for such features limits some of the restoration benefits compared to features that would be inconsistent with the policy.

Flood Risk

The study area includes a portion of the Los Angeles River that was altered and engineered as part of the LACDA Project. Any restoration alternatives had to take into account the continued functioning of the flood risk management system and avoid induced flooding. The existing river channel in this reach does not provide a high level of protection (with or without existing vegetation). The existing channel provides less than a 1percent annual chance exceedence (ACE) (100-year) level of protection. For this reason, an alternative located solely within the existing LACDA project right of way was infeasible, as it would be likely to reduce conveyance capacity and/or be unsustainable and unable to meet restoration objectives given the high velocity flows carried by the system during storm events. Widening the channel at opportunity areas is thus critical to provide restoration benefits while maintaining existing levels of flood risk. The inclusion of the Taylor Yard and Piggyback Yard properties provided the only opportunities in the study area to substantially widen the channel and increase channel vegetation. The study analyzes flood impacts by looking at potential water surface elevation change. As part of the request for authorization of the project, the Corps would propose to modify the operations and maintenance of the LACDA project to accommodate and complement the ecosystem restoration features, which would be maintained by the City while the Corps continues to maintain the channel for flood risk management.

ES.7 Plan Formulation, Evaluation, and Comparison

Management measures, the components of alternatives, were developed based on the expert opinions of Federal, State, and local agencies, the Corps, and the Sponsor. The measures were combined along the potential project area based on the problems, opportunities, objectives, and the practicability of implementation of each measure at each site given the constraints and land uses along the river. Teams of experts in the disciplines of economics, biology, engineering, hydraulics, landscape architecture, geotechnical/soils engineering, planning, and recreation were able to apply their expertise—along with the information gathered from the public and other stakeholders during the Revitalization Master Plan outreach efforts—to a focused charette process. The participants considered refinement of the study objectives and a wide variety of measures that could be combined into alternatives meeting the planning objectives. The alternatives were formulated for the entire study area during the planning charette with additional alternatives formulated during public outreach and individual team efforts including the USACE design team, City design team, and a multi-agency habitat team (with members from the USACE, the Sponsor, CRWQB, USFWS, California State Parks, CDFC, and academic experts). Other conceptual alternatives such as widening of the entire channel were initially considered and dismissed based on feasibility.

This produced a preliminary array of 19 alternatives. Typical designs, costs, and habitat benefits were developed for the elements of these alternatives. For this study, benefits (or outputs) were quantified using a habitat model called the Combined Habitat Assessment Protocols (CHAP) approach. CHAP looks at species and their function within the habitat. After mapping, doing a field inventory of the study area, and assessing a species list, the habitat team forecast the change in habitat for each measure at each site along the river. Habitat value was measured in habitat units (HU) based on an assessment of multiple species, habitat features, and functions by habitat type. Since the CHAP model utilized species, habitat, and functions in calculating HUs, there is more than 1 HU per acre.

Due to the high velocity flows that are carried in the channel during storm events, several of the preliminary alternatives relied, in whole or in part, on the diversion of flood flows through an underground tunnel or storage mechanism. The alternatives requiring the most extensive and expensive engineering interventions, such as the creation of underground detention/retention basins or very large bypass culverts or tunnels, were determined to be infeasible because of their cost and because they only exacerbated or moved the problems with the current channelized system and deferred important decisions about what needs to occur regarding peak flow reduction in the river's watershed.

The original 19 alternatives were each divided into eight reaches based on geomorphology, which includes their physical shape, and configuration. Each reach plan from each of the 19 preliminary alternatives was input into the CE/ICA software (IWR Plan). The preliminary alternatives were also entered as a whole. The IWR Plan then recombined the geomorphic reaches into plans for comparison and evaluation with the preliminary plans, providing plans that were more cost effective and not dependent on a tunnel or other diversion measure. The recombination of plans by reach produced an array of 152 cost effective plans and 21 best buy plans.

As described in the Corps' Planning Guidance Notebook, CE and ICA are two distinct analyses that must be conducted to evaluate the effects of alternative plans. First, it must be shown through cost effectiveness analysis that an alternative restoration plan's output cannot be produced more cost effectively by another alternative. "Cost effective" means that, for a given level of non-monetary output, no other plan costs less, and no other plan yields more output for less money. The subset of cost effective plans are examined sequentially (by increasing scale and increment of output) to ascertain which plans are most efficient in the production of environmental benefits. Those most efficient plans are called "Best Buys." They have the lowest incremental cost per unit of output.

The final array was selected from the best buy plans based on the incremental analysis and the study objectives. CE/ICA analysis outputs showed that cost effective, best buy alternatives should be grouped and considered for inclusion in the final array based on the incremental increases in costs and benefits. Four plans were identified that best combined the reach plans, to present a reasonable range of alternatives. The alternatives included in the final array involve a mix of working with and building upon the existing habitat in the river and providing new solutions that extend existing habitat with new upstream-to-downstream (such as at the key tributary confluences) and in-channel-to-outer-bank (such as with adjacent large areas) connections.

Four action alternatives compose the final array and have received detailed analysis in this IFR in addition to the No Action Alternative. The alternatives were named to assist the team, reviewers, and the public.

Alternative 10 is called the ART (for ARBOR Riparian Transitions) as it provides some restoration in all reaches and provides transitions or connections between existing riparian corridors and concrete lined river reaches. Alternative 10 is the minimally-acceptable alternative that provides an increase in habitat of 93 percent with 5,321 habitat units (HU) and increases aquatic habitat connectivity through riparian corridors and daylighted streams by restoring 528 acres at cost of $375 million. In Reach 1, it includes riparian corridors on both sides of the channel with connections under Highway 134 to the Pollywog Park Area of Griffith Park which is restored to a riparian area and through the Headworks Study Site to the Santa Monica Mountains. In Reach 2, the riparian corridor is continued on both sides with connections to the Santa Monica Mountains. Reach 3 includes daylighted streams (with riparian and freshwater marsh restoration) on the east bank and a single daylighted stream on the west bank, and Reach 4 is restored with a riparian corridor on the east bank, a side channel at the edge of Griffith Park Golf Course with inlet and outlet to the Los Angeles River (LAR) under I-5, a side channel through Los Feliz Golf Course, and several daylighted streams. Reach 5 continues the riparian corridor on the east bank and includes a daylighted stream at the downstream end. In reach 6, the channel is widened by approximately 80 feet along Taylor Yard with a small terraced area in the Bowtie parcel. In addition, the channel banks are vegetated with overhanging vines and implanted vegetation. Restoration is continued in reach 7 with daylighted streams on both sides of the channel. In reach 8, the Piggyback Yard is restored with riparian habitat and its historic wash. This restoration is hydrologically connected to the LAR allowing flows from the ephemeral wash to enter the river through culverts under the railroad. This basic restoration plan includes only minimal restoration at Taylor Yard, and excludes restoration at both major confluence areas at the Arroyo Seco and Verdugo Wash

Alternative 13 is named ACE (for ARBOR Corridor Extension) as it includes all the features in Alternative 10, including restoration of the historic wash at Piggyback Yard, terracing at the Bowtie Parcel, and restoration of side channels, riparian corridors, and daylighted streams, and adds additional restoration increasing restored habitat over no action by 104 percent, including restoration of the full Taylor Yard site and restoration of the Arroyo Seco tributary. Added restoration occurs in 3 reaches. This includes a side channel entering upstream from the LAR behind Ferraro Fields and re-entering the river through a daylighted stream and marsh area at the downstream end of reach 3. In reach 6, there is additional widening of over 300 feet in Taylor Yard with significant restoration of the floodplain and freshwater marsh in the widened channel. Major tributary restoration with nodal connections on the east side of the river to the nationally significant Arroyo Seco watershed is included at the Arroyo Seco (reach 7). This is accomplished through softening of the bed and banks with development of a riparian corridor in the tributary confluence and for one half mile upstream. This supports habitat connections through the river from the Santa Monica Mountains to the San Gabriel Mountains. Instead of the daylighted streams included this reach for Alternative 10, the banks of the LAR downstream from the Arroyo Seco are lined with overhanging vines and implanted vegetation through this reach. Alternative 13 delivers about 600 more HUs (an increase of 104 % over no action and 11% above Alternative 10) and 60 additional acres, increasing nodal connections for wildlife by a significant 309 percent, and meeting objectives in all reaches for approximately $79 million more ($453 million total).

Alternative 16 is called AND (for ARBOR Narrows to Downtown). This alternative includes the features of Alternatives 10 and 13 but adds additional restoration in reaches 5 and 8 and removes concrete from the bed of the river. Additionally, the bank is removed between the river and Piggyback Yard. This alternative widens reach 5 along the west bank and adds vegetated terracing on the east bank. In reach 8, the alternative adds additional restoration by terracing upstream of Piggyback Yard on the west bank, and removal of the east bank and the concrete bed in the LAR adjacent to Piggyback Yard for 0.75 mile. The channel bed will be naturalized to support freshwater marsh in the river and another area of wetland through the restored Piggyback Yard adjacent to the river. The river is widened in Piggyback Yard by 500 feet on a low terrace and another 1000 feet on a second terrace. Another set of vegetated terraces are constructed along the downstream bank on the east side of the river. The added features in Alternative 16 provide an increase in habitat value over no action of 114 percent (10% above Alternative 13) with about an additional 600 habitat units and 71 acres of added restoration. Nodal connections are increased above that provided in Alternative 13 by 85 percent. This added restoration is accomplished for an additional cost of approximately $350 million above Alternative 13 ($804 million total), nearly an 80 percent increase in cost for a 10 percent habitat increase and 85 percent habitat connectivity increase.

Alternative 20 is called RIVER (for Riparian Integration via Varied Ecological Reintroduction) as it includes all the elements of Alternatives 10, 13 and 16 and additional features in reaches 2, 3 and 7, including restoration of the Verdugo Wash confluence and the Cornfields site. It includes widening in Reach 2 on the west bank. In reach 3, this alternative restores the confluence with Verdugo Wash by softening the bed of the stream and significantly widening the mouth of the wash thus providing riparian habitat and an additional connection to the San Gabriels through the Verdugo Hills. In Reach 7, daylighted streams also included in Alternative 10 are reintroduced in lieu of channel bank vegetation features that were in Alternatives 13 and 16. Also in reach 7, wetlands are restored at the Los Angeles State Historic Park with a terraced connection to the mainstem. For Alternative 20, the there is some degree of channel naturalization and restoration in nearly all reaches, and inclusion of two major confluences (Verdugo Wash restoration bordering the City of Glendale is added, along with a connection between the river and its western bank at the Los Angeles State Historic Park (Cornfields/Chinatown area)). This is comes with an added cost of approximately $276 million more than Alternative 16 ($1.08 billion total.) Habitat is increased over no action by 119 percent (5% more than Alternative 16) and 273 habitat units above alternative 16 with inclusion of 60 additional restored acres and an increase in nodal habitat connectivity over Alternative 16 of 120%.

To further inform the decision on the NER and TSP, the final array was compared using the study objectives, Principles and Guidelines comparison criteria, and the four comparison accounts. While habitat models and CE/ICA (IWR Plan) are key tools in plan comparison and selection, other factors may also be considered. The plans' environmental impacts were evaluated, as required by the Corps planning process and NEPA. These considerations all provide information to the public in comparing alternatives and assist the Corps and City in identifying what is called the NER Plan, and choosing a plan to recommend for authorization.

ES.8 Identification of the NER plan and Tentatively Selected Plan

As part of the planning process, the Corps and City identify an "NER" Plan, the National Ecosystem Restoration Plan. The NER Plan is not always the plan recommended for authorization by Congress, as the City can decide to take on the additional costs of implementing what is called a Locally Preferred Plan (LPP). Either an NER plan or an LPP can be the recommended plan. The discussion below provides a comparison of the final array of alternatives costs and restoration benefits as compared by CE/ICA.

As described in Corps planning guidance, the NER Plan is the alternative and scale having the maximum monetary and non-monetary beneficial effects over monetary and nonmonetary costs. This plan occurs where the incremental beneficial effects just equal the incremental costs, or alternatively stated, where the extra environmental value is just worth the extra costs. The guidance also notes that in all but the most unusual cases, the NER Plan should be derived from the final set of "Best Buy" solutions. To put it simply, the Corps and City have to answer the question about whether the plan's benefits are worth the costs, but this is a difficult process because monetary calculations do not capture all ecosystem benefits. Environmental benefits analysis is still developing as an area of study. Table ES-1 below summarizes cost and output for the Final Array of alternatives based upon the costs used for the CE/ICA. Note that these costs were later refined based upon updated contingency estimates. These updated costs for each alternative are presented at the bottom of the table and also on Table ES-3.

Table ES-1 Comparison of the Final Array of Alternatives

Reach	Alt 10	Alt 13	Alt 16	Alt 20
1. Pollywog Park to Bette Davis Park				
Cost ($)	$7,000,000			
Output (HU)	866			
Acres	82	*same as 10*	*same as 10*	*same as 10*
Incremental First Cost/AAHU	$8,100			
Incremental First Cost/Acre	$85,600			
2. Bette Davis Park to Ferraro Fields (Alt 20 Adds Reach 2 Channel Widening)				
Cost ($)	$2,200,000			Δ = $37,500,000
Output (HU)	392			Δ = 55
Acres	39	*same as 10*	*same as 10*	Δ = 20
Incremental First Cost/AAHU	$5,500			$681,600
Incremental First Cost/Acre	$55,300			$1,874,400
3. Ferraro Fields to Upstream Glendale Narrows (Alt 13 Adds Ferraro Fields; Alt 20 Adds Verdugo Wash)				
Cost ($)	$1,100,000	Δ = $22,400,000		Δ = $179,000,000
Output (HU)	40	Δ = 160		Δ = 130
Acres	33	Δ = 17	*same as 13*	Δ = 30
Incremental First Cost/AAHU	$27,400	$140,000		$1,375,700
Incremental First Cost/Acre	$33,200	$1,317,400		$5,961,300
4. Upstream Glendale Narrows to Los Feliz				
Cost ($)	$36,200,000			
Output (HU)	492			
Acres	59	*same as 10*	*same as 10*	*same as 10*
Incremental First Cost/AAHU	$73,500			
Incremental First Cost/Acre	$613,100			
5. Los Feliz to Bowtie Parcel (Alt 16 adds Reach 5 widening/terracing)				
Cost ($)	$200,000		Δ = $135,000,000	
Output (HU)	87		Δ = 265	
Acres	41	*same as 10*	Δ = 27	*same as 16*
Incremental First Cost/AAHU	$2,400		$511,100	
Incremental First Cost/Acre	$5,200		$5,016,000	

Reach	Alt 10	Alt 13	Alt 16	Alt 20
6. Bowtie Parcel to Downstream Glendale Narrows/Arroyo Seco (Alt 13 adds marsh/widening)				
Cost ($)	$100,000,000	Δ = $37,600,000		
Output (HU)	1,256	Δ = 191		
Acres	138	Δ = 21	*same as 13*	*same as 13*
Incremental First Cost/AAHU	$79,700	$196,900		
Incremental First Cost/Acre	$725,700	$1,790,700		
7. Downstream Glendale Narrows/Arroyo Seco to Main Street (Alt 13 Adds Arroyo Seco, Alt 20 Adds Cornfields)				
Cost ($)	$2,800,000	Δ = $35,400,000		Δ = $61,600,000
Output (HU)	29	Δ = 230		Δ = 88
Acres	27	Δ = 22	*same as 13*	Δ = 10
Incremental First Cost/AAHU	$96,000	$153,800		$699,800
Incremental First Cost/Acre	$103,100	$1,608,300		$6,158,000
8. Main Street to First Street (Alt 16 Adds Channel Bottom Concrete Removal, Terracing, Off Channel Wetlands, and H&H connection at PBY)				
Cost ($)	$197,000,000		Δ = $180,000,000	
Output (HU)	2,159		Δ = 342	
Acres	109	*same as 10*	Δ = 44	*same as 16*
Incremental First Cost/AAHU	$91,100		$527,700	
Incremental First Cost/Acre	$1,803,600		$4,101,900	
Total First Cost Used in CE/ICA Analysis	$346,000,000	$442,000,000	$757,000,000	$1,040,000,000
Total Average Annual Habitat Units	5,321	5,902	6,509	6,782
Total Acres	528	588	659	719
Incremental Cost	$346,000,000	$95,000,000	$316,000,000	$279,000,000
Incremental First Cost/Habitat Unit	$65,100	$164,200	$519,800	$1,023,300
Total First Cost/AAHU	$65,100	$74,800	$116,300	$152,800
Incremental Cost/Acre	$655,600	$1,589,700	$4,444,200	$4,656,200
Updated First Cost with Revised Contingency	374,782,600	453,406,100	803,928,700	1,080,627,300
Note: Errors due to rounding may be present.				

Final Array Comparison: Resource Significance

Habitat Scarcity

All alternatives would address scarcity of Valley Foothill Riparian and freshwater marsh habitat, with some alternatives providing greater habitat, as shown in the CHAP outputs in the table above. Alternative 10 would provide restored riparian corridors at side channels and daylighted streams outside the main river channel and restoration of habitat at Piggyback Yard, with some habitat at Taylor Yard. Alternative 13 would restore riparian habitat, but it would also provide a significant increase in freshwater marsh and fish habitat in the Taylor Yard reach. Alternatives 16 and 20 add substantial freshwater marsh restoration in Piggyback Yard and restore larger riparian areas. Alternative 20 also includes restoration of riparian and marsh habitat at the Verdugo Wash confluence and Cornfields sites.

Biodiversity and Special Status Species

All alternatives would provide support for the species diversity and abundance associated with western riparian and aquatic habitat, but to different degrees, as shown in the CHAP outputs in Table 1 above. Alternative 10 and 13 would restore large habitat areas at Piggyback Yard. Alternative 13 would also restore a sizeable area at Taylor Yard and widen the river substantially to support aquatic and riparian dependent species. Alternatives 16 and 20 would provide more freshwater marsh habitat and more support for fish by reconnecting the channel directly to Piggyback Yard and restoring habitat. Alternative 20 would restore additional freshwater marsh at the Los Angeles State Historic Park. All alternatives would add to the life requisites for the endangered least Bell's vireo.

Habitat Connectivity

All alternatives would restore habitat corridors and reduce habitat fragmentation throughout the study area by including restoration in all reaches. Alternative 13 would provide a habitat node at Taylor Yard, restore the confluence at Arroyo Seco, and restore the historic wash at Piggyback Yard. Alternatives 16 and 20 would increase the size of the restored habitat node at Piggyback Yard and remove the barrier between that restored habitat and the river, facilitating wildlife movement and dispersal.

With regard to regional habitat connectivity, all alternatives would improve habitat connectivity (both aquatic and terrestrial) to the Santa Monica Mountains at Griffith Park. In addition, the restoration at the Arroyo Seco confluence provided by Alternatives 13 and 16 creates a nodal connection to the San Gabriel Mountains. Alternative 20 would provide restoration of regional aquatic habitat connectivity through tributaries by restoring the Verdugo Wash confluence to provide a nodal connection to the Verdugo Hills. Alternative 20 would also connect to the Elysian Hills through the Cornfields site restoration.

Attainment of Restored Hydrologic and Geomorphic Processes
Alternative 10 has limited restoration of natural hydrologic and geomorphic processes, as it includes minimal channel widening only at Taylor Yard in Reach 6. Alternative 13 adds greater reconnection to the floodplain at Taylor Yard with more significant widening, and it restores the confluence at Arroyo Seco, naturalizing the bed and banks of the first half mile of the tributary. Alternative 16 adds two reaches with channel modifications, modifying the channel in Reach 5 by changing it from trapezoidal to vertical and removing the channel wall and bed in Reach 8 to reconnect the Piggyback Yard site to the river, facilitating natural river processes consistent with the natural channel areas present above this reach. Alternative 20 adds modification of the channel in reaches 3, 2 and 7.

Final Array Comparison: Objectives

Alternative 10 minimally meets objectives. Alternative 13 meets objectives for restoration of Valley Foothill riparian and freshwater marsh habitats to support aquatic and riparian species, Alternative 13 also provides improved habitat connectivity, both in local reduction of habitat fragmentation and restoration of habitat corridors and in regional connectivity, through restoration of direct connections to Griffith Park (which leads to the Santa Monica Mountains) and through future potential connections to the San Gabriel Mountains via restoration of the confluence of the Arroyo Seco to San Gabriel Mountains. Alternatives 16 and 20 also meet objectives with incremental increases in both habitat values and in nodal and regional habitat connectivity. Natural hydrologic connections between the river and floodplain are restored at Piggyback Yard by removal of the concrete bed and banks. In Alternative 20, regional connectivity is incrementally improved through restoration of the confluence of Verdugo Wash, which provides future potential connections to the Verdugo Mountains and through the Los Angeles River State Historic Park wetlands to the Elysian Hills. Figure ES-4 provides a visual comparison of how the alternatives meet Objective 1 with the comparison of AAHUs and restored acres.

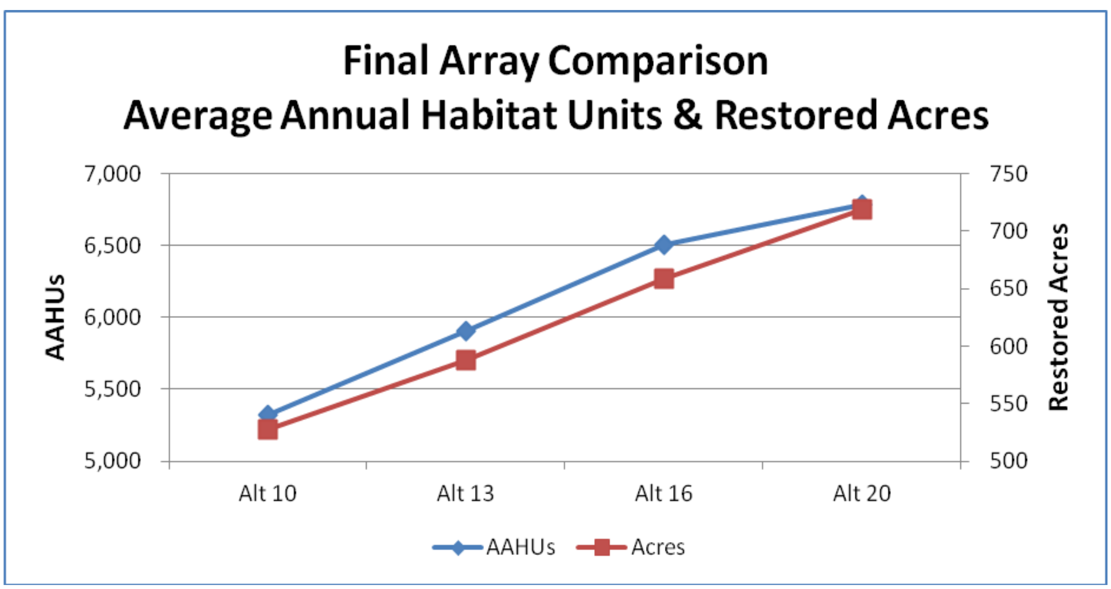


Figure ES-4 Final Array Comparison-AAHUs and Restored Acres

Table ES-2 Final Array Comparison by Objectives-Habitat Connections

Habitat Connections	10 ART	13 ACE	16 AND	20 RIVER
Incremental nodal increase between alternatives	Minor improvement	309%	85%	120%
Added Regional Connections	Santa Monica Mtns	Santa Monica & San Gabriel Mtns	Santa Monica & San Gabriel Mtns	Verdugo & Elysian Hills, Santa Monica & San Gabriel Mtns

Final Array Comparison: Principles and Guidelines Criteria

The Principles and Guidelines (U.S. Water Resources Council 1983) and the USACE Institute for Water Resources (IWR) Planning Manual (USACE 1996) present decision criteria for evaluation, comparison, and selection of measures. These are effectiveness, completeness, efficiency, and acceptability, as defined in Chapter 4.

Alt 10 ART

- *Effectiveness.* Alt 10 ART is judged to be minimally effective, in that while it meets the planning objectives overall, it fails to meet the key target objective of reconnection to tributaries, and thereby does not realize those potential habitat benefits, nor does it provide key nodal connections to tributaries along the ARBOR reach. It provides an effective increase in RED and OSE benefits.
- *Completeness.* Alt 10 ART is considered complete, though it is considered less resilient than alternatives 13, 16 AND or 20 RIVER. It is less sustainable on its own as it will not be supported by natural river processes
- *Efficiency.* Alt 10 ART is efficient. All components of the plan were judged to be cost effective and best buys in the CE/ICA.
- *Acceptability*. Alt 10 ART complies with applicable laws, regulations, and public policies, and any adverse effects would be mitigated per discussion provided in Chapter 5.

Alt 13 ACE

- *Effectiveness.* Alt 13 ACE is judged to be effective; it meets the planning objectives overall, including the target objectives related to tributaries by restoring the Arroyo Seco confluence, which Alt 10 ART did not address. The extent of tributary confluence restoration is less than alternatives 16 and 20. RED and OSE benefits are incrementally higher than those achieved in Alternative 10.
- *Completeness.* Alt 13 ACE is considered complete and incrementally more resilient than Alternative 10..
- *Efficiency.* Alt 13 ACE is efficient. All components of the plan were judged to be cost effective and best buys in the CE/ICA. Cost is incrementally increased above Alternative 10.
- *Acceptability*. Alt 13 ACE complies with applicable laws, regulations, and public policies and any adverse effects would be mitigated per discussion provided in Chapter 5.

Alt 16 AND

- *Effectiveness.* Alt 16 AND is judged to be effective. It meets the planning objectives, in terms of contiguous restoration within and across reaches, and the extent of restoration at tributary confluences and side channel/floodplain areas which contribute to key nodal habitat connections regionally. It incrementally increases RED and OSE benefits above those achieved by Alternatives 10 and 13.
- *Completeness.* Alt 16 AND is considered complete, and incrementally increases resiliency than Alt 10 ART or Alt 13 ACE.
- *Efficiency*. Alt 16 AND is efficient. All components of the plan were judged to be cost effective and best buys in the CE/ICA. However, Alt 16 AND is substantially less efficient than Alt 13 ACE due to a significant increase in incremental cost per gain in output (HUs) compared to Alt 13 ACE.
- *Acceptability*. Alt 16 AND complies with applicable laws, regulations, and public policies, and any adverse effects would be mitigated per discussion provided in Chapter 5.

Alt 20 RIVER

- *Effectiveness.* Alt 20 RIVER is judged to be effective as it incrementally increases contribution toward achievement of the planning objectives, including key nodal habitat connections for wildlife and habitat. It incrementally increases the potential for near and long term RED and OSE benefits.
- *Completeness.* Alt 20 RIVER is considered complete. It would be resilient, and likely to achieve the estimated habitat benefits over the period of analysis.
- *Efficiency*. Alt 20 RIVER is efficient. All components of the plan were judged to be cost effective and best buys in the CE/ICA. It is the most expensive of the four final alternatives and is substantially less efficient than Alt 13 ACE due to a significantly higher incremental cost per gain in output (HUs).
- *Acceptability*. Alt 20 RIVER complies with applicable laws, regulations, and public policies and any adverse effects would be mitigated per discussion provided in Chapter 5.

Final Array Comparison: National Ecosystem Restoration

The NER account displays the monetary costs and the non-monetary benefits related to each alternative plan. The NER plan is identified by examining the average annual HUs for each alternative versus the average annual costs for the alternative. Determination of the NER plan is typically the primary decision-making factor for identification of the recommended plan. The incremental cost analysis indicates that alternatives in the final array are incrementally cost effective and efficient.

There are some distinct differences between these four alternatives. First, there is the consideration of cost versus benefits. Each alternative is progressively more beneficial as it becomes more costly. Table ES-3 below includes a summary of the NER benefits and costs. The table includes the ecosystem restoration alternatives and displays costs and benefits as total and annualized values.

Table ES-3 Final Array Comparison National Ecosystem Restoration

Criteria	No Action	10 (ART)	13 (ACE)	16 (AND)	20 (RIVER)
Plan Description	**No Action**	**ARBOR Riparian Transitions**	**ARBOR Corridor Extension**	**ARBOR Narrows to Downtown**	**ARBOR Riparian Integration via Varied Ecological Reintroduction**
ASSESSMENT					
National Ecosystem Restoration (NER)					
1) Total First Cost	*$0*	$375 Million	$453 Million	$804 Million	$1.08 Billion
2) Total Investment Cost	$0	$376 Million	$456 Million	$824 Million	$1.10 Billion
3) Annualized Cost	*$0*	$17 Million	$20 Million	$37 Million	$49 Million
4) Annualized O&M	*$0*	$579 Thousand	$872 Thousand	$2.3 Million	$2.5 Million
5) Real Estate Percentage of Cost	*$0*	83%	69%	47%	46%
6) Benefits a. Net gain in AAHU	*0*	5,321	5,902	6,509	6,782
b. Incremental Cost/AAHU c. % increase in AAHU versus no action	*0*	$3,259 93%	$6,651 104%	$29,253 114%	$46,827 119%

The recreation plan described in Chapter 4 was developed to be compatible with the NER Plan. The first cost of the recreation plan is $6.1 million, and annual cost $318,000. Annual benefits are estimated at $2.4 Million, with a benefit to costs ratio of 7.51. Additional recreation measures and benefits could be achieved with Alternatives 16 or 20.

Regional Economic Development and Other Social Effects

RED impacts include, principally, changes in income and employment. Indirect and induced impacts are the focus of the RED account, and differences between it and NED are considered transfers from the rest of the nation. The study area for RED is the Los Angeles metropolitan area, which is home to 15.4 million people with the largest population and largest area in the United States. Table ES-4 provides the RED impacts of construction of the ecosystem restoration and recreation, redevelopment construction, and long-term redevelopment. This is discussed in more detail in the Appendix B, Economics.

Table ES-4 RED Assessment

Regional Economic Development From Construction					
Criteria	**No Action**	**10 (ART)**	**13 (ACE)**	**16 (AND)**	**20 (RIVER)**
Plan Description		**ARBOR Riparian Transitions**	**ARBOR Corridor Extension**	**ARBOR Narrows to Downtown**	**ARBOR Riparian Integration via Varied Ecological Reintroduction**
Ecosystem Construction Cumulative Impacts					
Jobs	0	913	1,986	6,491	9,001
Labor Income	$0	$52,560,000	$114,350,000	$373,823,000	$518,341,000
Sales	$0	$125,936,000	$273,986,000	$895,690,000	$1,241,959,000
GRP	$0	$73,445,000	$159,785,000	$522,357,000	$724,297,000
Recreation Construction Cumulative Impacts					
Jobs	0	74	74	74	74
Labor Income	$0	$4,998,000	$4,998,000	$4,998,000	$4,998,000
Value	$0	$12,958,000	$12,958,000	$12,958,000	$12,958,000
Output	$0	$7,265,000	$7,265,000	$7,265,000	$7,265,000
Redevelopment Construction Cumulative Impacts					
Jobs	0	1,226	1,281	1,281	5,087
Labor Income	$0	$80,981,000	$84,665,000	$84,665,000	$336,278,000
Value	$0	$111,132,000	$115,791,000	$115,791,000	$460,153,000
Output	$0	$185,630,000	$193,002,000	$193,002,000	$767,247,000
Redevelopment Long-term Economic Activity Cumulative Impacts					
Jobs	0	628	675	675	2,671
Labor Income	$0	$897,646,000	$964,851,000	$964,851,000	$3,815,989,000
Taxes - Local	$0	$5,386,000	$5,789,000	$5,789,000	$22,896,000

Other Social Effects, the OSE account, describes the potential effects of project alternatives in areas that are not dealt with explicitly in the NER and RED accounts. The Principles and Guidelines state that the OSE, when included in USACE documents, should "display plan effects on social aspects such as community impacts, health and safety, displacement, energy conservation and others." Each of the alternatives includes benefits to various OSE categories such as public health and safety, environmental health, community well-being, and connectivity to the community. All of the alternatives result in business displacement in Reach 8, and Alternative 20 also includes business relocations in Reach 3.

Table ES-5 Final Array Comparison: Summary of Environmental Impacts

Unavoidable Adverse Impacts				
Resource	**Alternative 10 (ART)**	**Alternative 13 (ACE)**	**Alternative 16 (AND)**	**Alternative 20 (RIVER)**
AIR QUALITY	The construction phase of the proposed project is expected to exceed the following thresholds: (1) the CEQA regional significance thresholds for ROG and NOx; (2) the CEQA localized significance thresholds for NOx, PM10, and PM2.5; and (3) the NEPA significance thresholds for NOx and CO.	Air quality impacts the same as Alt 10, as well as additional exceedances of the CEQA regional significance thresholds for CO and the CEQA localized significance thresholds for CO.	Air quality impacts are the same as Alt 13, as well as additional exceedances of the CEQA regional significance thresholds for PM2.5 and the NEPA significance thresholds for ROG.	Same as Alt 16.
LAND USE	Restoration of Piggyback Yard would conflict with the Industrial land use designation, and potential adverse indirect impacts could also occur should new industrial uses not desire to relocate. This results in a significant adverse impact.	Same as Alt 10.	Same as Alt 10.	Same as Alt 10, additional displacement of businesses within Reach 3 at Verdugo Wash.
TRAFFIC AND CIRCULATION	Restoration of Piggyback Yard would result in temporary removal of rail lines. Permanent removal of spur lines in Piggyback Yard would remove rail capacity.	Same as Alt 10.	Same as Alt 10.	Same as Alt 10.
SOCIO-ECONOMICS AND ENVIRONMENTAL JUSTICE	Jobs at Piggyback Yard that may be transferred elsewhere may disproportionately affect the low-income and minority populations.	Same as Alt 10.	Same as Alt 10.	Same as Alt 10.

Unavoidable adverse impacts are summarized in Table ES-5. All of the action alternatives include unavoidable impacts to air quality, land use, traffic, and socioeconomics and environmental justice. Alternative 20, due to its size, has the most impacts to air quality resulting from construction activities and also has the most land use impacts with business relocations in two areas.

However, all four alternatives provide significant benefits as described by the ecosystem restoration above. The additional long term benefits from restored river and associated recreation and open space are significant. Since the project will result in long-term benefits by providing new public access to restored natural open space areas with associated passive recreational amenities and oversight and security elements, including lighting and more frequent patrolling of the areas, it is expected to result in environmental justice benefits.

ES.9 Conclusion and TSP Identification

The increased benefits for habitat value, habitat connectivity (nodal and regional), restoration of hydrologic processes, and aquatic ecosystem restoration provided by alternatives 16 and 20, including the increase in RED benefits attained by these two larger alternatives make them reasonably acceptable and supportable alternatives. However, these added benefits also come at a higher relative increase in costs. Comparing cost to relative benefits gained, for a much smaller increase in costs over Alternative 10, Alternative 13 includes all the features of 10 and adds side channel restoration and floodplain connection in Reach 3, additional natural river bed in Reach 6, a natural channel confluence in Reach 7 with riparian vegetation lining channel walls, and a significant increase of 309 percent in nodal connectivity as well an increase in regional habitat connectivity. This alternative provides the greatest increase in net benefits within the final array for the least increase in cost while reasonably meeting the objectives. In addition, Alternative 13 meets all of the Principles and Guidelines criteria as an effective, efficient, complete, and acceptable plan.

After consideration of the materials presented, Alternative 13 has been identified as the Tentatively Selected Plan, as it reasonably maximizes net NER benefits.

1 INTRODUCTION

This document is an Integrated Feasibility Study, Environmental Impact Statement, and Environmental Impact Report for the Los Angeles River Ecosystem Restoration Study, which is referred to as the IFR. This IFR presents the potential alternatives for environmental restoration of the Los Angeles River, analyzes the environmental impacts of implementing those alternatives, reviews the process for selecting the best alternative, and concludes with recommendations for project implementation.

The U.S. Army Corps of Engineers, Los Angeles District (USACE or Corps) is the National Environmental Policy Act (NEPA) lead agency, and the City of Los Angeles, Department of Public Works (LADPW) Bureau of Engineering, referred to as the City of Los Angeles, City or non-Federal sponsor, is the California Environmental Quality Act (CEQA) lead agency for this IFR. These two co-lead agencies, as well as the Los Angeles County Department of Public Works (LACDPW), have historically been responsible for overseeing various functional aspects of the Los Angeles River (River). They have been engaged, both separately and cooperatively, in ongoing efforts to manage flood risks, maintain and improve water quality and supply, restore natural ecosystem functions of the River, and enhance the quality of life along the River.

> *<u>Integrated Feasibility Report</u>*
>
> *Los Angeles River Ecosystem Restoration Integrated Feasibility Study, Environmental Impact Statement, and Environmental Impact Report*
>
> *<u>NEPA Lead Agency</u>*
>
> *U.S. Army Corps of Engineers, Los Angeles District*
>
> *<u>CEQA Lead</u>*
>
> *City of Los Angeles, Department of Public Works, Bureau of Engineering*

1.1 PROJECT PURPOSE AND NEED

1.1.1 <u>Purpose</u>

The primary purpose of the proposed project and alternatives considered in this Study is to restore approximately 11 miles of the Los Angeles River from Griffith Park to Downtown Los Angeles by reestablishing riparian strand, freshwater marsh, and aquatic habitat communities and reconnecting the River to major tributaries, its historic floodplain, and the regional habitat zones of the Santa Monica, San Gabriel, and Verdugo mountain ranges while maintaining existing levels of flood risk management. A secondary purpose is to provide recreational opportunities consistent with the restored ecosystem. This reach is identified as the "Area with Restoration Benefits and Opportunities for Revitalization" reach, or ARBOR (Figure 1-1). This reach will be referred to as the study area or ARBOR reach for the purposes of this IFR.

> *<u>Study Area</u>*
>
> *The initial study area included the 32 miles of the Los Angeles River from its origination in Canoga Park to Washington Boulevard downstream of Downtown Los Angeles.*
>
> *<u>ARBOR Reach</u>*
>
> *This is the 11-mile reach identified in the City's Master Plan as having the best opportunities for restoration within the larger 32 mile stretch of the River.*

1.1.2 <u>Need</u>

The Los Angeles River was once a 51-mile-long backbone of a vast system of riparian foothill, riverine, and freshwater marsh habitat that carried seasonal rains and subterranean flows to the coastal plain and the Pacific Ocean. Over time, the River has been degraded by a cycle of increasing urban development, flooding, and channelization, culminating in the mid-20th Century with the Federal flood risk management project, the Los Angeles County Drainage Area (LACDA) project. The LACDA project encased the river in concrete banks and a mostly concrete bed, and straightened the river's course, thereby diminishing its plant and wildlife diversity and quality, and disconnecting it from its floodplain and significant ecological zones. The entire river corridor is degraded due to historic activities. Apart from the

Sepulveda Basin, the San Fernando Valley area of the River (upstream of the study area) is characterized by large segments of channel that are entirely concrete with very few opportunities for adjacent land acquisition. The lower reach of the river is highly constrained by development, including downtown Los Angeles and a heavy industrial corridor that also includes a major transmission corridor and a freeway system. The upper and lower reaches of the river have less potential to connect nationally and regionally significant ecological zones because of the state of existing development. These considerations make the potential for habitat connectivity and expansion very difficult in the near term.

Despite its degraded condition, the ARBOR reach has the greatest potential for restoration along the River because it includes the Glendale Narrows, one of the few reaches in the River with a non-concrete bed and natural flows fed by underground sources. This portion of the River also has connections to the Verdugo Wash and Arroyo Seco tributaries that can eventually link to significant habitat areas, as well as to Griffith Park, the eastern terminus of the Santa Monica Mountains. Habitat within the Glendale Narrows area continues to be nourished by treated effluent discharges, which supplement the remaining natural flows in the River. Although wildlife use is primarily by species adapted to urban environments, habitat continues to degrade due to both the establishment of invasive species, such as giant reed (*Arundo donax*), and inflows from storm drain runoff. The existing habitat and perennial surface flow in the ARBOR reach provide a base for restoration and support the most diverse assemblages of wildlife on the River today. This reach is adjacent to state and local parks and natural areas. Some of the railroad facilities have been abandoned or removed from the channel corridor, providing opportunity for widening the channel while maintaining existing flood risk management levels. The ARBOR reach, therefore, provides the backbone for restoring significant habitat and reconnecting the River to other vital habitat areas. Expansion of riparian and marsh habitat along this portion of the River and at the confluences of key tributaries is a first step in putting the portions of the once vast riverine ecosystem back together.

1.2 BACKGROUND

1.2.1 Location of Study Area

The baseline study area that was initially considered during the planning process includes 32 miles of the River that is within the City of Los Angeles, within a half mile of each bank. This reach begins at the origin of the River, which is the confluence of Bell Creek and Arroyo Calabasas in the northwest San Fernando Valley at Owensmouth Boulevard, and ends near the City of Vernon in the Downtown Los Angeles area. Figure 1-1 shows the City of Los Angeles where the study area is located. The upper watershed, which begins in the Santa Susana, Santa Monica, and San Gabriel Mountains, is dominated by coastal sage, chaparral, pine forest, and open space. The watershed is highly urbanized and densely populated, encompassing a broad alluvial plain dominated by residential, commercial, and industrial land uses. The 51-mile River enters the Pacific Ocean at the San Pedro/Long Beach Harbor.

Figure 1-1 Los Angeles and Study Area

Through initial investigation of constraints in the baseline study area and the identification of where ecosystem restoration might best be accomplished, the planning process defined the focused study area as the ARBOR Reach, which extends from the Headworks site downstream to First Street (see Figure 1-2). This study area includes the Glendale Narrows, which is one of the few portions of the River that does not have a hardened bed (bottom of the river channel), and contains several distinctive sites and connections including the Headworks, Pollywog Park, Bette Davis Park, the Burbank-Western Channel, the Glendale River Walk, Griffith Park, Ferraro Fields, Verdugo Wash, Atwater Village, Taylor Yard and the Rio de Los Angeles State Park, the "Cornfields" (Los Angeles State Historic Park), Arroyo Seco, Elysian Park, "Piggyback Yard" (also known as "Los Angeles Transportation Center" as well as "Mission Yard"), and Downtown Los Angeles. These sites (which are identified in later figures) provide key opportunities for restoration and enhanced habitat connectivity.

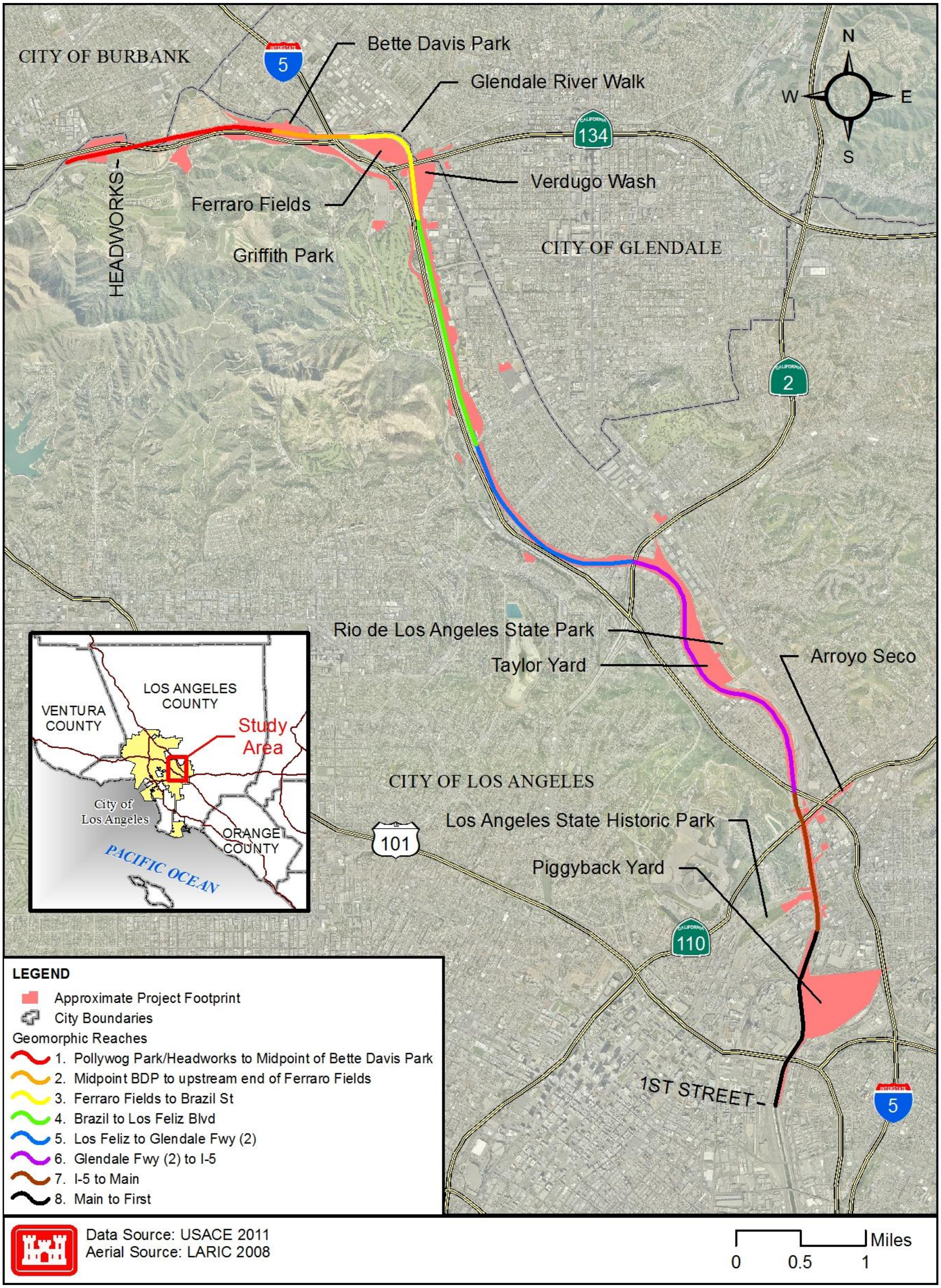
The major reason this narrowed focus was made was to start in a location that would allow for increased habitat connectivity—there was very little ability to connect among/across/between key San Fernando Valley sites because of the urbanization in the surrounding areas and the 100% concrete character of the LA River and tributary channels between those "node" areas. Although some restoration has been accomplished along a completely concrete channel—such as the Tujunga Wash project (a tributary of the LA River), the restoration only occurred next to the channel and benefited from gravity flow of off-line flows. Because of the general lack of available space to accomplish this kind of restoration along the river and because this kind of restoration is limited in its habitat connectivity potential via in- channel to out-of-channel connections, these were not considered as high of a priority as the Glendale Narrows stretch. By contrast, in the Glendale Narrows there is considerable indigenous in-channel habitat that may be connected to adjacent areas and, since the survivability of the existing habitat in the Narrows is under threat from invasive species and further fragmentation if connections are not strengthened, that area was prioritized above others for near-term restoration. Moreover, there are already meaningful habitat connections for avian species and small mammals between the LA River in the Glendale Narrows and nearby large habitat areas, including Griffith Park, Angeles National Forest, and the Santa Monica, San Gabriel, and Verdugo mountain ranges. Finally, the Glendale Narrows area was most robustly supported by community stakeholders when asked for their input regarding the greatest ecosystem restoration potential. This was also evidenced by recent actions in the area—given that large open spaces had recently been acquired by California State Parks (at Taylor Yard and the Cornfields), that small parks and greenways had been implemented throughout the area by various organizations and individuals, and that informal fishing, boating, and wildlife viewing activity was increasing in the area. The narrowing of the study area early in the process based on the factors stated above represents a narrowing of the scope and purpose to identify attainable and implementable alternatives within the existing constraints.

1.2.2 Historic Conditions

The Los Angeles Basin is a broad alluvial plain stretching from Santa Monica to Newport Beach, where historically the waters of the Los Angeles, San Gabriel, and Santa Ana Rivers joined during intense flood events. The natural rivers' braided channels spread across wide areas and their courses migrated considerably over time. These channels carried various sediments (boulders, rocks, gravel, sand, and silt) that were eroded from the adjacent mountains and deposited in the valleys and plains along the path to the ocean (Gumprecht 2001).

Due to the deposition of this alluvium, much of the runoff during winter rains infiltrated into the ground, creating large underground basins. As a result, the river channel only carried significant surface flow during major storms. This periodic surface flow resulted in shallow, poorly defined river channels where sudden storms transformed the typically dry streambed into a powerful, flowing river. Seasonal storm flows overtopped the ill-defined river banks, flooding large areas and creating lakes on the coastal plain. The forceful floodwaters, which carried large amounts of rock, sediment, and debris, carved new river channels, reshaped the topography of the surrounding landscape, and created new sloughs, marshes, and ponds. For much of the year, the river on the surface was a gentle stream that flowed through a wide, sandy bed. Winter storms, however, generated powerful and unpredictable flows that resulted in the river's course shifting significantly across the coastal plain from year to year (Gumprecht 2001). The river's historic course to the ocean often migrated by as much as ninety degrees. Some years the river flowed west emptying into Santa Monica Bay near Playa del Rey, some years the river flowed south emptying into San Pedro Bay, and other years it was so dry it never met the ocean and instead emptied into small lakes along its course. On its southerly course, the river channel was very indistinct, sometimes meandering east toward Long Beach or joining with the San Gabriel River. Where flows were pushed to the surface or seasonal floodwaters inundated the surrounding lands, large marshlands were created. At San Pedro Bay, the river mouth and its location were in constant flux, with the mouth migrating 1,400 feet over 20 years in the late 1800s (Hughes 1937). Seasonal winter overflow at the river mouth created extensive saltwater marshes and tidal lagoons along the coast between Palos Verdes and Long Beach. Likewise, 2,100 acres of mud flats and lagoons were created at the river outlet to Santa Monica Bay. Most of the year, the river would not have carried enough water to reach the ocean and, therefore, each new flood flow created a new outlet (Gumprecht 2001).

As late as 1888, after some marshlands had been drained and groundwater pumped for human consumption, surveys of the coastal plain documented nearly 6,000 acres of freshwater marsh, 3,000 acres of wetlands, and 15,000 acres of coastal salt marshes and estuaries (Hall 1888). The river historically meandered across the coastal plain, periodically flooding the area during the rainy winter season and changing course. The photograph in Figure 1-3 was taken from a balloon in June 1887 and shows the river flowing across its floodplain and the beginnings of urban encroachment in Downtown Los Angeles (downtown in foreground of photo, with farthest north river crossing on Mission Street on left side of photo). Loss of habitat can also be seen in Figure 1-5, which illustrate a comparison of study area mapping created in 1896-97 to cover types in 2010 (Compston and Dockweiler 1897). As is apparent, vast expanses of valley foothill riparian habitat once existed in the floodplain.



1 *Figure 1-2 Study Area, the ARBOR Reach*

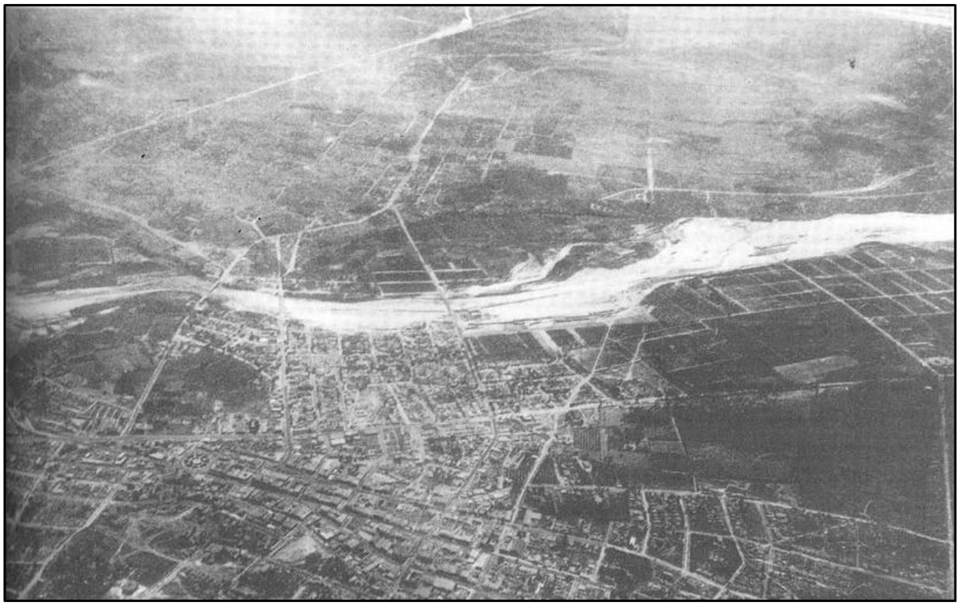


Figure 1-3 A Photo from 1887 (Seaver Center for Western Research, Natural History Museum of Los Angeles)

The original Pueblo de Los Angeles location was chosen because of its adjacency to the river, near where Downtown Los Angeles is today. The river north of downtown had in some cases fairly constant flows, fed by springs in the study area and other underground sources. South of downtown, the river's course would disappear at times into floodplain forest but would reappear during seasonal rains and major storm events, jumping its old channel and changing direction, as mentioned above.

When the railroads arrived in the 1870s, tracks were constructed along the river's banks, hemming it in and quickening flows. Bridges and trestles further constrained flows and created barriers during major storm events. After William Mulholland secured the Owens River water to supply the city, the city's dependence on the river's surface flow as a water source diminished, and it became a dumping ground for trash, dead horses, and sewage. In the late 19th and early 20th Centuries, very large storm flows in the river caused catastrophic flooding that resulted in the loss of lives and millions of dollars in property damage. As a result, the City of Los Angeles and Los Angeles County leaders initiated a flood risk management program that eventually channelized the natural river system with the goal of moving flood flows to the ocean as efficiently as possible.

The USACE joined the effort in the 1930s during the Great Depression, directed by Congress to assist with flood risk management efforts under Emergency Relief Acts. Soon after, Congress authorized the USACE, with the County as partner, to undertake a modified version of the County's comprehensive plan, thereby solidifying the implementation of a structural solution to flood risk management. Urbanization and infrastructure constrained options for flood risk management. Development in the floodplain included agricultural, residential, commercial, and industrial uses, as well as paved surfaces and railroads alongside the channels. Multiple bridges depended on a narrowed riverbed, and the County developed a complex system of storm drains delivering runoff to the river. The channel built in the 20th Century—constrained and largely concrete—was thus one of the few options left at the time without revisiting the entire system of development. And even though the river was already substantially altered, channelization and concreting under the Federal project degraded the remaining habitat values by straightening the river's course, diminishing its plant and wildlife diversity and quality, fully disconnecting it from its floodplain and significant ecological zones, and dramatically changing its appearance and function. Figure 1-4, below, illustrates the history of the changes to the river system.

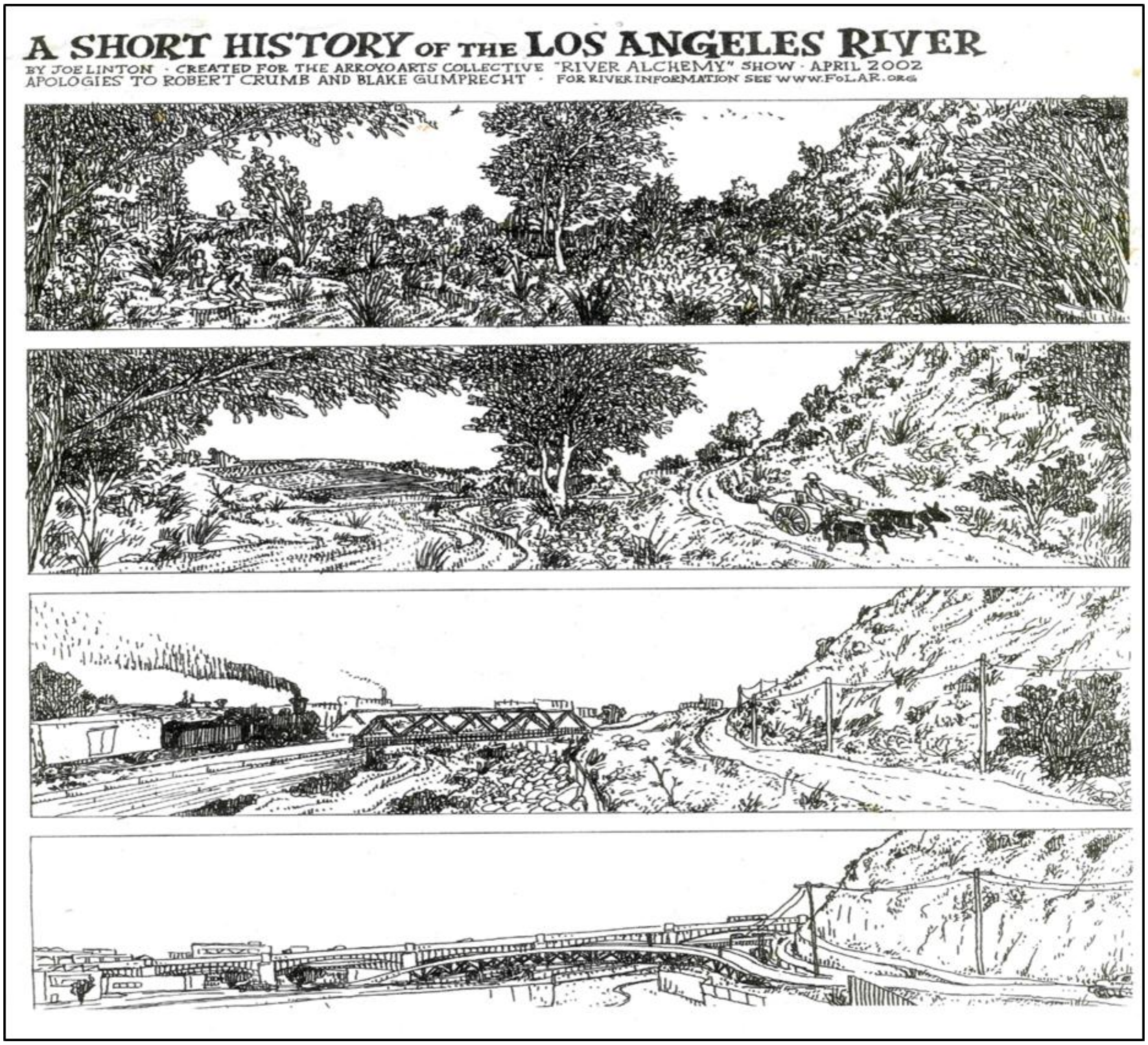


Figure 1-4 Artist's illustration of changes to the Los Angeles River through urbanization

(Source: Joe Linton with permission)

1.2.3 River Systems in the Southwest

The natural river is typical of watercourses in the arid/semi-arid southwest, which are unlike river systems in any other part of the country. Landscapes in the arid southwest are characterized by low, but highly variable rainfall. The resulting dry conditions create a stark contrast between riverine and riparian areas and the adjacent upland vegetation. In this way, the riparian ecosystem in the southwest is a critically important system because it occupies a very small area but supports the majority of the ecological and hydrologic connectivity in the local landscape and the biodiversity in the region (Levick et al. 2008). The highly seasonal hydrology and permeable sediments that are characteristic of the southwest region create a dynamic system, wherein river courses are constantly shifting in response to the highly variable seasonal storm regime, creating expansive floodplains that are often miles wide. Where river beds are dry much of the year, seasonal storms can result in high velocity, turbulent flash floods that carry heavy sediment loads (including coarse sediments) through the system.

In some southwestern rivers and streams, there may not be perennial or intermittent surface flow, but rather water may be present below ground and accessible to a rich assemblage of plant and animal life. These more ephemeral streams also perform the same critical hydrologic functions as perennial streams: they move water, sediment, nutrients, and debris through the river system and provide both hydrologic and habitat connectivity within the watershed (Levick et al. 2008).

Vegetation communities along ephemeral and intermittent streams provide wildlife habitat and structural elements not otherwise available in adjacent dry upland communities, such as food, shelter, breeding habitat, and movement corridors. In the southwest region, approximately 80 percent of all wildlife uses the riparian ecosystem at some life stage, with more than 50 percent of bird species nesting primarily in riparian habitats (Krueper 1993). The high wildlife species density and diversity associated with riparian habitats are attributed to the presence of highly varied vegetative structure, high vegetative density and diversity, availability of water and insect prey, and adjacency to several floral and faunal ecoregions (Krueper 1995).

River channels in arid and semi-arid regions also 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 importance of western riparian areas cannot be overemphasized (Carothers 1977), especially in the arid and semi-arid southwest, because of the high temperatures and severe dryness outside of the riparian ecosystem (Levick et al. 2008). The abundance and diversity of riparian vegetation, compared to upland areas are therefore critical wildlife habitat features of rivers and streams in the southwest.

Western riparian ecosystems are one of the rarest habitat types in the Western Hemisphere (Krueper 1995). Of the 106 forested types identified in North America, the western cottonwood-willow forest association has been identified as the rarest (Krueper 1995). Historically, riparian habitats occupied 1 percent of the land mass in western North America. Within the past century, an estimated 95 percent of this habitat has been altered, degraded, or destroyed due to such land use activities as river channelization, unmanaged livestock utilization, clearing for agriculture, water impoundments, and urbanization (Krueper 1995). Due to habitat conversion, natural riparian communities persist only as isolated remnants of what was once a vast, interconnected system of rivers, streams, marshes, and vegetated washes (Krueper 1995).

Figure 1-5 below provides an example of this habitat loss within the study area. It is a map showing LA River vegetation cover types in 1896 and 2010. The 1896 vegetation map was developed from an 1897 map developed by C.S.Compton and J.H. Dockweiler, City Engineers. Wide expanses of valley foothill riparian were still present in 1896 and the river channel still meandered through the floodplain and contained emergent wetlands.

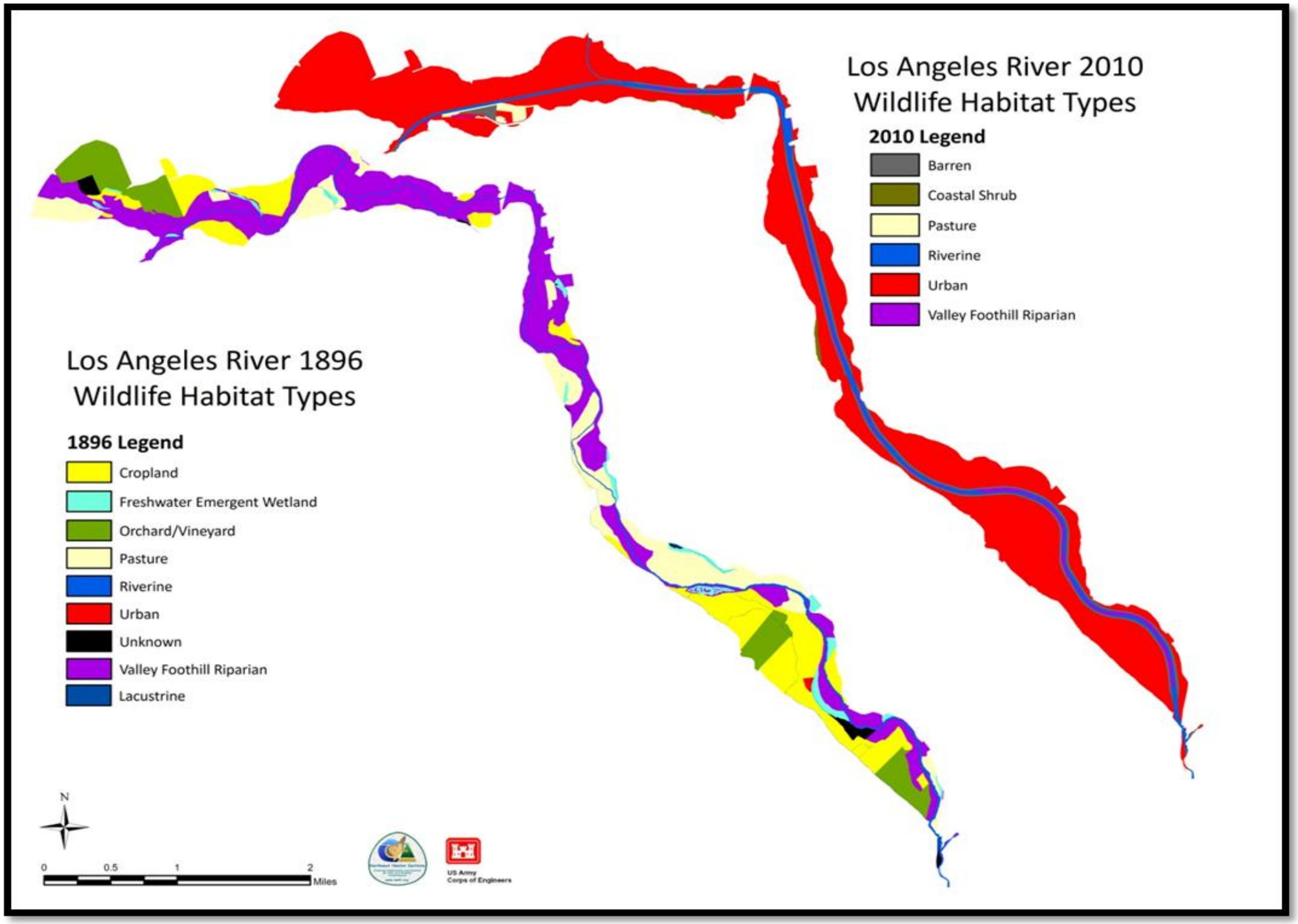


Figure 1-5 Comparison of Los Angeles River Habitat Covers 1896-2010.

(1897 Map obtained from Huntington Library, developed by C.S. Compton and J.H. Dockweiler, City Engineers)

Historically Occurring Plants and Wildlife

The natural river once covered the Los Angeles River Basin with marshes, thickets, and dense woodlands. The lowlands were covered by a dense floodplain forest of cottonwoods and willows (Garrett 1993). Where water ponded and soils were perennially saturated, marshland formed that supported cattails and bulrushes. At the coast, the salt marshes and lagoons were dominated by pickleweed and cordgrass. Nearby drier areas supported oaks and walnuts, cacti and yuccas, sage, and native prairie (Garrett 1993; Gumprecht 2001).

The diverse assemblage of vegetation provided habitat for a variety of wildlife. Historically the river system supported such species as deer, antelope, mountain lion, and grizzly bear (Gumprecht 2001). A wide variety of now rare birds such as golden eagle, yellow-billed cuckoo, least Bell's vireo, clapper rail, and burrowing owl occupied the river and surrounding landscape (Garrett 1993). Seven species of native fish historically occurred on the river (Friends of the Los Angeles River 2008). The varied nature of the river created a highly diverse environment and the floodplain forests formed one of the most biologically rich habitats in Southern California (Garrett 1993).

In developing and channelizing the river, the species and structural diversity of cottonwood and willow floodplain forests, oak woodlands and prairies, and fresh and salt water marshlands were lost, as well as the wildlife species that depended on these habitats (Garrett 1993). Of the eleven historic vegetation types, four were particularly devastated by channelization of the river, two of which include (1) seasonal and permanent freshwater and brackish wetlands and (2) lowland riparian forests and thickets, which would be restored by this study (Garrett 1993). The other 2 vegetation types are coastal estuaries and alluvial scrub.While minimal habitat is still supported in certain portions of the river system, the historic habitat has been almost entirely eliminated (Garrett 1993).

Changes to populations of mammal species are most evident in the lack of native carnivores, such as foxes, weasels, bear, and mountain lion, with remnant populations in the Santa Monica and San Gabriel Mountains (Barkley 1993). The channelized river now supports little remaining habitat suitable for native mammal species. The seven native fish species are no longer supported on the river, except on a few tributaries in the most upstream reaches (Friends of the Los Angeles River 2008; Swift and Seigel 1993). Only 58 percent of the pre-development reptile and amphibian fauna remain on the river today (Bezy et al. 1993). There has been local extirpation of several Federal and state sensitive bird species, including California condor, clapper rail, snowy plover, yellow-billed cuckoo, burrowing owl, as well as other common species. Data suggest that declines in many of these species are associated with river channelization in the early 20th Century (Garrett 1993). A myriad of bird species still inhabit the river in the remaining isolated habitats; however, much of the wildlife diversity of the natural river system has been lost (Garrett 1993).

In addition to loss of wildlife species, habitat corridors for wildlife movement have been fragmented (Garrett 1993). The river and its tributaries historically provided biologically rich habitats that connected the San Gabriel and Verdugo Mountains to the Santa Monica and Santa Susana Mountains and to the Pacific Ocean (Gumprecht 2001). After build out of the Los Angeles Basin and the channelization of the river, connectivity between these nationally significant ecological areas is exceedingly limited in the region (Garrett 1993). Limited habitat connectivity contributes to declines in wildlife populations including restricted access to food, shelter, and mates; inhibited gene flow and dispersal of offspring resulting in inbreeding depression; inability to migrate and avoid seasonally unfavorable conditions; increased incidence of disease; and conflicts over territories and resources (Beier et al. 2006).

The continuing degradation is of concern, since over 90 percent of the region's riparian habitat and over 95 percent of the region's wetlands have been lost. The river is located within the California Floristic

Province, which Conservation International identified as one of their top 25 global hotspots experiencing rapid biodiversity loss – the only hotspot in North America. Currently, wildlife in the Los Angeles River is restricted primarily to large mammals that are adapted to urban areas, as well as other small mammals and reptiles. Birds continue to use the river as much as is possible under current conditions. A diversity of shorebirds is consistently abundant on the river using the open water habitat where sediment and algal deposits encourage vegetation to establish in concrete reaches during winter rains. The least Bell's vireo, a Federal and state endangered species, has been known to inhabit these reaches.

Wildlife use river systems as guiding paths and corridors for movement at multiple temporal and geographic scales. Plants use river systems as corridors for dispersal of their genetic material. The biggest challenge to restoring habitat connectivity in the Los Angeles region for plants and wildlife at all scales is the 51 miles of channelization. Although small in the context of the river's full length and its historic floodplain, the study area is the critical, central backbone in the restoration of regional habitat connectivity. Restoration of the study area would provide nodal habitat connections from the San Gabriel and Verdugo Mountains to the Santa Monica Mountains, and would provide opportunities for future direct habitat connections to these mountain ranges as well via tributaries. Since the study area is adjacent to Griffith Park (and includes areas within the original Griffith Park land grant) the eastern terminus of the Santa Monica Mountains, it provides opportunity for habitat and wildlife connectivity to the nationally significant Santa Monica Mountains National Recreation Area and the Pacific Ocean. The study area also includes the confluences of the Verdugo Wash and Arroyo Seco tributaries, which provide additional long distance connections to the Verdugo Mountains and nationally significant San Gabriel Mountains (respectively).

The study area includes the Glendale Narrows, which currently supports some of the only remaining riparian and freshwater marsh habitat on the river. The existing habitat and perennial surface flow in the Narrows provide a base for restoration and maintenance of one of the most diverse assemblages of wildlife on the river today. The USACE currently has other ecosystem restoration studies and projects on the Los Angeles River and its tributaries, including Arroyo Seco, Headworks (adjacent to Griffith Park), Tujunga Wash, and Sun Valley. Without restoration of the river, these projects would only provide isolated patches of habitat and would not be able to contribute to a greater regional habitat connectivity effort. The study area, therefore, provides the "bones" (structure) for restoring the river and serves as a hub for such regional connectivity.

1.2.4 Study Authorization

The study was authorized by Senate Committee on Public Works Resolution, approved June 25, 1969, reading in part:

> *Resolved by the Committee on Public Works of the United States Senate, that the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act, approved June 13, 1902, be, and is hereby requested to review the report of the Chief of Engineers on the Los Angeles and San Gabriel Rivers and Ballona Creek, California, published as House Document Numbered 838, Seventy-sixth Congress, and other pertinent reports, with a view to determining whether any modifications contained therein are advisable at the present time, in the interest of providing optimum development of all water and related land resources in the Los Angeles County Drainage Area.*

Section 4018 of the Water Resources Development Act of 2007 provided authorization for a "feasibility study for environmental ecosystem restoration, flood risk management, recreation, and other aspects of

Los Angeles River revitalization that is consistent with the goals of the Los Angeles River Revitalization Master Plan published by the city of Los Angeles…." The implementation guidance for this section[2] identified that the scope and substance of the study under the Senate resolution is identical to the study mandated by section 4018 and directed that the ongoing study incorporate the section 4018 study. The feasibility study incorporates, where applicable, conceptual elements and addresses restoration goals from the City's Los Angeles River Revitalization Master Plan.

This feasibility study provides an interim response to the study authority, and the study efforts will determine the feasibility of ecosystem restoration of the Los Angeles River and surrounding environment. There is no sponsor available to investigate flood risk management at this time.

1.2.5 Resource Significance

Consideration of significant resources is central to plan formulation, especially in the context of ecosystem restoration planning because non-monetary outputs are being considered. Per ER 1105-2-100, significance of resources and effects will be derived from institutional, public, or technical recognition.

Institutional recognition of a resource or effect means its importance is recognized and acknowledged in the laws, plans, and policies of government and private groups. Technical recognition of a resource or an effect is based upon scientific or other technical criteria that establish its significance. Public recognition means some segment of the general public considers the resource or effect to be important (USACE 2000). The importance of these resources is further described in Section 2.1.

Institutional Recognition

- The River is the subject of important national efforts, such as the Urban Waters Federal Partnership, which selected the LA River Watershed as one of seven nationwide first-phase pilots. The Partnership includes the USACE, the Departments of Interior, Commerce, Agriculture, and Housing and Urban Development, the Environmental Protection Agency, four state agencies, seven local governmental entities, and 11 nongovernment organizations. One of the goals specific to the watershed includes restoration of ecosystem functions, and there are several restoration projects ongoing throughout the watershed. This restoration study was selected as the group's top priority.
- At the national level, the LA River has been protected by the Clean Water Act since the Act's inception. However, in 2010, the river was designated as a Traditionally Navigable Water in its entirety, recognizing the river's historic and continuing importance and the potential beneficial impacts of river restoration on the region. This designation increased institutional and public recognition of the river's resources, with national news reports focusing on the designation and the degraded condition of the river. The State of California cited the TNW designation and the character of the river in codifying the river's status as a navigable water of the state protected under the State Constitution in SB 1201, signed by the Governor in 2012.
- The President's America's Great Outdoors initiative identified the Los Angeles River watershed as a priority project, and specifically called out the importance of its trail system in its "50 State Report." Leaders including the Secretary of Interior, the USEPA Administrator, the Assistant Secretary of the Army for Civil Works, the Chair of the White House Council on Environmental Quality, Congressional representatives, and state agency heads joined the Mayor of Los Angeles on the river's banks in the study area in 2012 to highlight the need to transform the river.

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[2] CECW-PB Memorandum For: Commander, South Pacific Division, SUBJECT: Implementation Guidance for Section 4018 of the Water Resources Development Act of 2007 (WRDA 2007) – Los Angeles River Revitalization Study, California (28 May 2010)

- The City's Los Angeles River Revitalization Master Plan contains input of Federal, State, and regional agencies and stakeholders, and Congress specifically directed in WRDA 2007, section 4018, that this study develop a plan that is consistent with the goals of the City's Los Angeles River Revitalization Master Plan. The Los Angeles City Council adopted the Los Angeles River Revitalization Master Plan in 2007. That plan identified opportunities for environmental restoration, including habitat improvements, in concert with recreation, water quality, flood risk management, and community revitalization benefits. One of the major goals is to restore a functional riparian ecosystem with recommendations to (1) create a continuous functional riparian corridor that provides habitat for birds, mammals, amphibians, reptiles, invertebrates, and fish within the channel bottom; (2) connect this corridor to other significant habitat and migration routes along the tributaries and into the mountains; (3) provide support for desirable fish species; and (4) bioengineer or naturalize the river's edge where feasible.
- In 2012, the portion of the Los Angeles River Trail that extends throughout the study area was designated by the Secretary of the Interior as part of the National Recreation Trail System. The designated trail is an approximately 10- mile section of greenway/bikepath along the river that helps tell the story of the founding of Los Angles and its relationship to water resources. The trail also coincides with the National Park Service's Juan Bautista de Anza National Historic Trail.
- The State of California has been involved in revitalization activities on the Los Angeles River since the 1990s through the Santa Monica Mountains Conservancy and its affiliate agency, the Mountains Recreation and Conservation Authority, by constructing a series of pocket parks along its banks.
- In the last decade, California State Parks has established two new state parks along the river corridor in the study area, Río de Los Angeles State Park (opened 2007) and Los Angeles State Historic Park (established 2001).
- The County completed a Los Angeles River Master Plan in 1996 with plans for bikeways and park areas.
- New pedestrian bridges proposed or in progress within the study area and increased riverwalk construction at the Glendale section of the River in Glendale Narrows have been funded in part with grants from the State's California River Parkways program, funds from the Metropolitan Transportation Authority, and other local sources.

Technical Recognition

- Over 90 percent of the region's riparian habitat including Valley Foothill riparian habitats and over 95 percent of the region's wetlands including freshwater marsh have been lost. What does remain is largely isolated and no longer connected to surrounding habitat resources. Already a scarce habitat in this arid region, it is becoming more rare.
- The study area is located within the California Floristic Province—an area that Conservation International identified as one of its top 25 global hotspots experiencing rapid bio-diversity loss.
- Increases in riparian and wetland vegetation would provide essential habitat for resident/migratory songbirds (including the least Bell's vireo (listed as endangered under the Endangered Species Act); native fish, including threatened species such as the Santa Ana Sucker and arroyo chub that have been fully extirpated from the river; reptiles; amphibians and small and medium-size mammals. Prior to development and channelization, these species and habitats were prevalent within the meandering river floodplain. These historic ecosystems and wildlife communities were degraded by the development, water withdrawals, and channelization that have occurred across southern California, further fragmenting habitat.
- The technical significance of restoration in the ARBOR reach is also based on the importance of nodal habitat connectivity (i.e., large and small aquatic habitat patches connected via habitat corridors). Improvements along the mainstem of the LA River would restore habitat connectivity and would provide synergy with and further enhance both aquatic and terrestrial habitat values

within other natural areas in the vicinity. By restoring additional habitat and wildlife movement pathways nodal connections could be made to now-isolated open space areas. Vegetated corridors and flyways restored by the proposed project would provide regional habitat connectivity (direct or potential) to surrounding National Forest land, including the Angeles National Forest, Santa Monica Mountains National Recreation Area, and other areas currently being studied by the Department of Interior for possible inclusion in the national park system (e.g., the Rim of the Valley Corridor Special Resource Study). The Rim of the Valley study area extends north, east and west of the study area, and the river serves as a vital connection between the Santa Monica and San Gabriel Mountains within its boundaries. These two mountain ranges have previously been found by the National Park Service to contain nationally-significant resources, including unique geologic and cultural resources, as well as high quality biodiversity. The proposed LA River ecosystem restoration project would provide an essential backbone of physically connected habitats along a primary wildlife movement corridor/migratory pathway. This would, in turn, provide opportunities for additional connections to currently isolated or disjointed restoration/open space areas within upstream tributaries.

- The ARBOR reach is also located just upstream of the Lower LA River Important Bird Area, as designated by the Audubon Society.
- The highly seasonal hydrology and permeable sediments characteristic of the southwest region create a dynamic system, where the river courses are constantly shifting with the highly variable flood regime and the floodplains are expansive. This in turn supports a diverse channel and floodplain structure, and a diverse assemblage of plant and wildlife communities. Development and flood risk and water supply projects have constrained and eliminated most such systems in the southwest. The flood risk management system on the Los Angeles River results in flood flows moving at high velocities in a narrow channel, and smaller storm events moving at faster speeds than would occur without channelization. The natural processes and habitat that would be maintained under a dynamic system are altered under the closed system. In short, the current system has a highly altered regime that is simplified (reduced flow options) and magnified (higher flows concentrated in smaller spaces). The river now functions more as a drainage channel to swiftly move water out of the system, rather than functioning as it did historically as a river ecosystem.
- Opportunities for restoration of even a portion of a southwestern riparian ecosystem (as opposed to restoration of only riparian plant communities and habitat) are exceedingly rare in the Los Angeles Watershed, but are present within the study area at critical opportunity areas at Taylor Yard and Piggyback Yard, two large parcels where the river could be widened and restored to reconnect directly with the floodplain. This would result in restoring a portion of the river's natural processes and providing areas that could support essential elements for fish habitat.

Public Recognition

- Public attention to the River has increased steadily since 1986, when Friends of the Los Angeles River (FoLAR) was founded. FoLAR's mission is to protect and restore the natural and historic heritage of the Los Angeles River and its riparian habitat. FoLAR's early efforts have been joined by North East Trees, The River Project, establishment of the Los Angeles River Center, and the annual La Gran Limpieza river cleanup.
- As noted under institutional recognition above, there are 11 nongovernmental organizations participating in the Urban Waters Federal Partnership. That participation and those groups also denote public recognition of the River as a significant resource and include: the Arroyo Seco Foundation, the Council for Watershed Health, FoLAR, the LA Conservation Corps, the LA River Revitalization Corporation, The River Project, Tree People, the Trust for Public Land, the Urban Rivers Institute, and Urban Semillas.

- The LA River Corps of the LA Conservation Corps, a nonprofit organization, engages in stewardship of parks, open space, and recreational improvements along the river, while the Los Angeles River Revitalization Corporation promotes economic revitalization through capital projects and community activities, such as “Greenway 2020”—a campaign to build out the entire LA River bike path by 2020.
- Significant in the policy shift for governance and operation of the River, and for the first time since the LACDA project was constructed, a portion of the river channel within the study area was opened for seasonal recreational activities in summer 2013. This access to the River has promoted activities such as hiking, bird-watching, and non-motorized boating. This is part of an effort spearheaded by the City of Los Angeles and the Mountains Recreation and Conservation Authority in coordination with the USACE and County, and which relates to SB 1201 as part of the direction to facilitate restoration and recreation where compatible with flood risk management.
- The river, including its degraded condition and potential for restoration, has been the subject of increasing scholarly attention and national and international news reports, including environmental history texts, art exhibitions, and news and magazine stories.

1.3 STUDY/PROJECT PARTICIPANTS AND COORDINATION

The development of proposed restoration efforts has been conducted with the assistance of a wide variety of organizations, communities, agencies, and other stakeholders and achieved through a systematic 3-step process of (1) evaluating the river’s existing conditions and the associated problems and opportunities, (2) identifying objectives to help solve the problems, and (3) inviting public and agency coordination and input to identify the types of measures that would achieve restoration of the study area in a way compatible with local desires and regulatory needs. Throughout this process, public involvement has been essential. Over the course of the past 8 years, the public has been invited to engage in the decision-making process at each step. An overview of public and stakeholder involvement throughout this process has been described in detail in Chapter 8.

1.4 RELATED STUDIES AND REPORTS

The following section provides a list of the studies that have been conducted within the study area in the past, and which are relevant to this IFR. It includes several reports prepared primarily by the City of Los Angeles, USACE, and LACDPW, and also includes reports prepared by other agencies, individuals, and local community groups. Each of the reports listed below was reviewed as a part of this study. Several study efforts connected to the River are being conducted concurrently and, as a result, are not ready for review or incorporation into this study. Finally, several studies were particularly relevant to the preparation of the IFR and have been described in more detail below.

1.4.1 U.S. Army Corps of Engineers Reports

- Los Angeles County Drainage Area Review, December 1991.
- Final Report, Review of Water Resources within the Los Angeles County Drainage Area, 1985.
- Hansen Dam Preliminary Formulation Report, 1984.
- Hansen Dam Sediment Modeling Study, 1983.
- Interim Feasibility Report for Ballona Creek and Tributaries, 1982.
- Report on Floods of February and March 1978 in Southern California, 1978.
- Interim Report on Hydrology and Hydraulic Review of Design Features of Existing Dams for Los Angeles County Drainage Area Dams, 1978.
- Operations and Maintenance Manual, Los Angeles County Drainage Area, 1975.
- Flood Control in the Los Angeles County Drainage Area, 1939.

1.4.2 Individual, Local, and Agency Reports

- Tujunga Wash Ecosystem Restoration Feasibility Study, 2012.
- Los Angeles Stormwater, Water Quality Compliance Plan, 2009.
- City of Los Angeles, Los Angeles River Revitalization Master Plan, 2007.
- City of Los Angeles, Widening and Seismic Retrofitting of the Riverside Drive Bridge at Zoo Drive, June 2007.
- Arroyo Seco Watershed Management and Restoration Plan, 2005.
- California Department of State Parks, Los Angeles District Office, Cornfield Interim Public Use Plan, June 2003.
- Cal Poly Pomona's College of Environmental Design Graduate Program, Case Studies Relative to Taylor Yard, January 2002.
- California Coastal Conservancy, Taylor Final Multiple Objective Feasibility Study Final Report, June 2002.
- UCLA Berkeley's Environmental Planning Studio, Connecting Communities at Taylor Yard, February 2002.
- The River Project for the California Coastal Conservancy, Taylor Yard Preliminary Groundwater and Surface Water Study, March 2002.
- Common Ground from the Mountains to the Sea, San Gabriel and Los Angeles Rivers Watershed and Open Space Plan, 2001.
- California Department of Fish and Wildlife, The California Natural Diversity Database, Last updated spring 2001.
- Los Angeles County Department of Public Works, 1999-2000 Hydrologic Report, June 2001.
- Los Angeles County Department of Public Works, Watershed Hydrology Study, March 2001.
- Mountains and Rivers Conservation Authority, Arroyo Seco/Los Angeles River Confluence Park Plan, 2001.
- UCLA Extension's Landscape Architecture Program, Bridging Brownfields to Greenfields - The Los Angeles River State Park at Taylor Yard, March 2001
- California Coastal Conservancy, Wetlands of the Los Angeles River Watershed: Profiles and Restoration Opportunities, May 2000.
- California Regional Water Quality Control Board, Los Angeles Region, Total Maximum Daily Load of Trash for the Los Angeles River Watershed Draft Report, November 2000.
- Deverell, William and Greg Hise, Eden by Design: The 1930 Olmsted-Bartholomew Plan for the Los Angeles Region, 2000.
- Los Angeles and San Gabriel Rivers Watershed Feasibility Study, 2000.
- Los Angeles and San Gabriel Rivers Watershed Council, Current Water Quality Improvement, Land Acquisition and Restoration Projects in Los Angeles County, August 1999.
- U.S. Environmental Protection Agency, Review of California's 1998 303(d) List, 1998.
- Tetra Tech, Inc. (Simons, Li & Associates), Los Angeles River Alternative Flood Control Study, Volume I: Baseline Conditions Report, Los Angeles: Los Angeles County Department of Public Works, 1997.
- Tetra Tech, Inc. (Simons, Li & Associates), Los Angeles River Alternative Flood Control Study. Volume II: Evaluation of Alternatives, Los Angeles: Los Angeles County Department of Public Works, 1997.
- Tetra Tech, Inc. (Simons, Li & Associates), Los Angeles River Alternative Flood Control Study. Volume III: Final Report Appendices, Los Angeles: Los Angeles County Department of Public Works. 1997.
- Los Angeles County Department of Public Works, Los Angeles River Master Plan and Update, June/July 1996.
- Los Angeles River Advisory Committee, Los Angeles River Master Plan, Los Angeles, 1996.

- Friends of the Los Angeles River, Proposed Flood Control Strategy for the Los Angeles and San Gabriel River Systems, January 1995.
- Los Angeles County Department of Public Works, Final Master Environmental Impact Report: Los Angeles County Drainage Area Project, Prepared by Woodward-Clyde Consultants. 1995.
- Los Angeles County Department of Public Works, Multi-Use Study on the Los Angeles River at Taylor Yard, 1994.
- Garrett, Kimball. California Department of Fish and Wildlife, The Biota of the Los Angeles River: An Overview of the Historical and Present Plant and Animal Life of the Los Angeles River Drainage, March 1993.
- Los Angeles County Departments of Public Works, Parks and Recreation, Regional Planning, National Parks Service, Rivers, Trails and Conservation Assistance Program.

1.4.3 Concurrent Studies

- Headworks Ecosystem Restoration Feasibility Study. This ongoing USACE feasibility study, initiated in 2004, is within the ARBOR Reach of Forest Lawn Drive adjacent to the River and Griffith Park and is sponsored by the Los Angeles Department of Water and Power. The study is evaluating restoration of wetlands and riparian habitats as well as water quality improvements and recreation opportunities. The ARBOR connects to this study's area.
- Arroyo Seco Watershed Ecosystem Feasibility Study. This USACE feasibility study, initiated in 2005, is evaluating alternatives within the watershed that covers Arroyo Seco from the Angeles National Forest boundary to 0.5 mile above the confluence (W. Avenue 25) with the River. The LA River Study extends up to this point to take advantage of the ecological significance of the confluence. The ARBOR connects to this study's area and is a tributary watershed of the Los Angeles River. The Sponsor for this Study is the County of Los Angeles Department of Public Works.
- Sun Valley Ecosystem Restoration Feasibility Study. The Sun Valley Watershed Study, initiated in 2006, is a 2,800-acre urban watershed located approximately 14 miles northwest of Downtown Los Angeles; the watershed is a tributary to the River also sponsored by the County of Los Angeles. The USACE completed a 905(b) report, although the study is on hold pending funding. It will evaluate environmental restoration, flood risk management, stormwater recharge, water quality, recreation, and open space.
- None of the boundaries of these studies overlap with this study's project area.

1.4.4 Details of Selected Background Reports

This IFR has drawn on existing planning efforts that have been recently completed or are ongoing in the Los Angeles River watershed. Notable inclusions are the LARRMP, LARRMP Final Programmatic Environmental Impact Report/Environmental Impact Statement (EIR/EIS), Integrated Regional Water Management Plan for the Los Angeles River watershed, City General Plans, Arroyo Seco Watershed Management and Restoration Plan EIR, Los Angeles State Historic Park (Cornfields) reports, and City of Los Angeles Integrated Resources Plan (IRP) and EIR.

Los Angeles River Master Plan, 1996

Los Angeles County's Department of Parks and Recreation and Department of Regional Planning coordinated the development of the original master plan for the Los Angeles River right-of-way. The plan identified ways to revitalize the publicly owned rights-of-way along the River and Tujunga Wash by developing a uniform landscaping protocol featuring appropriate native vegetation and enhancement of aesthetic, recreational, flood risk management, and environmental values, thereby creating a community resource, enriching the quality of life for residents, and recognizing the River's primary purpose of flood risk management.

The Los Angeles River Revitalization Master Plan, 2007

Over the past two decades, the City of Los Angeles, non-governmental organizations, stakeholder groups, and individual communities have been actively pursuing the objectives of restoring the River by reconnecting it to its neighborhoods and improving its environmental/ecological health. The integration and conceptualization of these initiatives resulted in preparation of the Los Angeles River Revitalization Master Plan (LARRMP) (City of Los Angeles 2007). With extensive public, private, nonprofit, and resident involvement, the plan was developed as a conceptual framework to guide the City of Los Angeles in the long-term revitalization of the River. The LARRMP provides a blueprint for restoring the River's former ecological significance as a natural system, as a place that brings neighborhoods together and provides green space in the heart of the city, and as an amenity and investment that restores value to the city. Conceptual designs in the LARRMP call for improved natural habitat, water quality, recreation, open space, and public access to the river, as well as incidental recreational space/trails, and opportunities to reinvest in the urban infrastructure system to encourage economic growth.

LARRMP Programmatic EIR/EIS, 2007

The USACE participated in the development of the LARRMP and acted as the lead Federal agency for the accompanying Final Programmatic Environmental Impact Report/Environmental Impact Statement (EIR/EIS). The USACE determined that no Federal action resulted from the information and analyses developed for, and presented in, the LARRMP and accompanying Programmatic EIR/EIS since it was a local master plan with no associated Federal recommendations. Therefore, no finalization (e.g., Record of Decision) was prepared by the USACE for the Programmatic EIR/EIS.

City of Los Angeles Integrated Resources Plan, 2006

The City of Los Angeles applied a contemporary approach to develop its IRP by incorporating wastewater, stormwater and runoff, and recycled water management into a single strategy. This reflects the understanding that all water services are interdependent and recognizes the complex, intertwined relationships of the City's varied water resource departments and functions. The Los Angeles Department of Public Works and Department of Water and Power partnered in developing the IRP, a departure from prior single-purpose plans.

Los Angeles County Integrated Regional Water Management Plan for the Los Angeles River Watershed

The purpose of the Integrated Regional Water Management Plan (IRWMP) is to define a clear vision and direction for the sustainable management of water and land resources in the greater Los Angeles County region over the next 20 years—a process that is required by the State of California to demonstrate coordination on the local level. The plan, adopted in December 2006, presents basic information regarding possible solutions, the costs and benefits of those solutions, quantified goals and objectives, and a list of projects that can be implemented to achieve the goals. Management agencies and groups that participate include those in the watersheds of North Santa Monica Bay, Upper Los Angeles River, Upper San Gabriel River and Rio Hondo, Lower San Gabriel and Lower Los Angeles Rivers, and the South Bay.

Arroyo Seco Watershed Management and Restoration Plan and EIR

In 2000, two non-governmental organizations, the Arroyo Seco Foundation and North East Trees, initiated the Arroyo Seco Watershed Restoration Program. This program assessed resource challenges including flood and stream management, habitat restoration, water resources, and recreational opportunities in the Arroyo Seco watershed. The program also identified goals and projects for conservation, better management, and restoration. Out of these efforts, North East Trees, in partnership with the Arroyo Seco Foundation, released the Arroyo Seco Watershed Restoration Feasibility Study in 2002. This study provided a blueprint for an environmentally sensitive and sustainable plan to manage and restore the Arroyo Seco watershed. The Arroyo Seco is one of the LA River's most significant tributaries and its confluence with the River is included in each of the study's final alternatives.

City General Plans, 2012

General Plans have been prepared for the purpose of guiding and regulating development and protection of land uses within each city that borders the study area, including the Cities of Los Angeles (2012), Burbank (2012), and Glendale (2012). These General Plans, prepared and maintained by the cities' planning departments, have a comprehensive, long-range declaration of purposes, policies, and programs for developing lands and protecting common uses into the future. They provide a comprehensive strategy for accommodating long-term growth should it occur as predicted. General Plans are regularly amended and updated.

Los Angeles State Historic Park Reports (Cornfields), 2003-2012

A Cornfields Reconnaissance Study, Section 905(b) Analysis (USACE 2003) was conducted to determine if there was a Federal interest in participating in a cost-shared feasibility phase study to provide environmental and riparian restoration, improved water quality, and flood risk management for a 5-mile reach of the river channel named the Cornfields area located approximately between the Glendale Freeway (CA-2) to the north and First Street to the south. This study was expanded to encompass the entire River, and was a precursor to the current study.

California State Parks prepared the Los Angeles State Historic Park General Plan and Final EIR, resulting in an interim park opening in September 2006 (California State Parks 2005). The Cornfield State Park Advisory Committee saw the Cornfield as a place to engage both nature and culture, to create a regional gathering space around the theme of a larger, more diverse Los Angeles history, which reconnected the City to the River.

In June 2013 the Cornfields-Arroyo Seco Specific Plan (CASP) and associated EIR was adopted by the Los Angeles City Council. The CASP was prepared through a comprehensive, community-based planning and environmental review process. The objective was to produce three documents, including: (1) the Specific Plan, which will guide future land uses, community development strategies, and infrastructure improvements; (2) goals, guidelines, and regulations for the plan area; and (3) a programmatic EIR, which will support the preparation and adoption of the Specific Plan and its associated land use instruments.

Rio De Los Angeles State Park (Taylor Yard), 2005

California State Parks prepared a General Plan and EIR for a park at the Taylor Yard site, about 2.5 miles north of downtown and within the IFR study area. The General Plan serves as a guide for future development, parkland acquisition, and construction of trails, parks, and other public facilities.

1.5 REPORT ORGANIZATION

This document has been divided into 10 primary chapters, each dealing with a specific subject area relating to the project components, alternatives, and planning process. Chapters noted below by an asterisk (*) are compliant with and required by the Council on Environmental Quality's Regulations for Implementing the National Environmental Policy Act. These include Section 1.1 in Chapter 1, and Chapters 3, 4, 5, 8, 11, 12, and 14.

- Chapter 1*, Introduction, provides background information concerning the purpose of and need for the project, project authorization, and project status, as well as the scope of the study. This chapter also notes relevance and integration of other related studies and reports.

- Chapter 2*, Problems and Opportunities, identifies current and expected problems and opportunities in the study area based on the evaluation of existing and expected future without project conditions.
- Chapter 3*, Affected Environment, provides a detailed presentation of the existing environmental conditions within the study area. This chapter also includes a complete discussion of environmental resources that would be affected by implementation of project alternatives.
- Chapter 4*, Formulation of Alternative Plans, describes the USACE planning process with respect to the selection of candidate alternative plans for detailed analysis. In this chapter, planning goals are set, objectives are established, and constraints are identified. This chapter identifies a range of potential management measures that address specific problems identified in Chapter 2 and various combinations to create a series of alternative plans that adequately address the goals and objectives established. Likewise, a discussion is also provided for why some alternatives were eliminated from further consideration.
- Chapter 5*, Evaluation of Alternative Plans and Potential Environmental Consequences, qualitatively and quantitatively describes potential impacts on and benefits to the environment as a result of implementation of the alternative plans relative to existing conditions.
- Chapter 6*, Comparison of Alternative Plans, explains the criteria applied to the alternative screening process and the rationale and methodology behind the identification of final alternatives for detailed evaluation. This chapter includes a comparison and analysis of the final array of alternative plans and preliminary selection of one alternative plan that best meets the study objectives.
- Chapter 7, Details of Recommended Plan, summarizes the environmental, economic, and social benefits and costs of the recommended plan.
- Chapter 8*, Public Involvement, describes the numerous coordination and public involvement activities conducted throughout the course of the study. These activities include information workshops, status reports, informal briefings, presentations, and correspondence with various resource agencies.
- Chapter 9, Remaining Reviews, Approvals, Implementation, and Schedule, identifies the estimated project timeline for future actions, defines commitments and responsibilities, and verifies the fulfillment of procedural notice and review requirements.
- Chapter 10*, Environmental Compliance, identifies key environmental regulations that are relevant to this project,
- Chapter 11, Recommendations, presents the study conclusions and recommendations by the District Engineer.
- Chapter 12*, List of Preparers, identifies the list of individuals and organizations that contributed to the preparation of this report.
- Chapter 13*, Document Recipients, lists the individuals and organizations that will receive a copy of the draft IFR.
- Chapter 14, References, lists references including studies, reports, analyses, and other reference materials used in the preparation of this report.
- Chapter 15*, Index, includes an alphabetical listing of important terms, phrases, and acronyms to aid the reader in understanding the document.

2 PROBLEMS AND OPPORTUNITIES

2.1 WATERSHED DESCRIPTION AND LOCATION

The confluence of Arroyo Calabasas and Bell Creek forms the start of the Los Angeles River. From that confluence, the River flows through the western San Fernando Valley to the Sepulveda Basin (a USACE flood risk management facility)—receiving flows from various tributaries along the way (e.g., Browns Canyon Wash, Aliso Creek/Canyon Wash, Caballero Creek and within the Basin, Bull, Hayvenhurst, Woodley, and Encino Creeks). In Studio City, the River connects with the Tujunga Wash. The Tujunga Wash receives flows from the USACE's Hansen Dam facility and the Pacoima Wash. The Burbank-Western Channel connects to the Los Angeles River just north of Griffith Park in the City of Burbank, and smaller creeks draining the western San Gabriel Mountains join the River as it flows through the eastern San Fernando Valley. The River bends southward at its confluence with the Verdugo Wash, which flows from the east and serves as the border between the cities of Glendale and Los Angeles at the confluence. From this point, the River flows south through the Glendale Narrows and onto the broad coastal plain. Along the way, the River is joined by a number of tributaries, including the Arroyo Seco and the Rio Hondo Diversion Channel, which carries runoff from Whittier Narrows Dam. From the Rio Hondo Diversion Channel confluence, the River continues south another 12 miles and discharges into the Pacific Ocean at the San Pedro/Long Beach Harbor

The watershed has highly varied terrain consisting of precipitous mountains, low-lying foothills, valleys, and coastal plains. The upper portion of the watershed (about 360 square miles) is predominantly forest or open space including more than 100 square miles of the Angeles National Forest. The remainder of the watershed (about 464 square miles) lies in the coastal plain, which includes the entire City of Los Angeles. It is a highly developed area with commercial, industrial, and residential land uses. North of Downtown Los Angeles to the confluence with the Rio Hondo, the River flows through industrial and commercial areas and is bordered by rail yards, freeways, and major commercial/industrial and government facilities. From the Rio Hondo Diversion Channel to the Pacific Ocean, the River flows through industrial, residential, and commercial areas, including major refineries and petroleum products storage facilities, freeways, rail lines, and rail yards serving the Ports of Los Angeles and Long Beach. The River and most of its tributaries in the urbanized portions of the Los Angeles watershed have been highly modified from their original natural courses to protect property and human life from the effects of flooding.

From its headwaters to the Pacific Ocean, the River drops approximately 790 feet in elevation over roughly 51 miles (about 15 feet per mile, yielding an average slope of approximately 0.3 percent). During the rainy season from October to March, heavy flows and occasional floods occur. In times of peak flow the river carries more than 180,000 cubic feet of water per second (cfs) at velocities exceeding 25 feet per second in some areas. That volume of discharge is approximately 14 times the flow of New York's Hudson River moving at a velocity of more than 17 miles per hour.

Today, the River no longer resembles the naturally meandering and ephemeral stream that periodically caused devastating floods during winter. Even though the River could no longer support the area's rapidly growing water demands by the late 19th Century, extensive development in its natural floodplain continues into the present. Prior to channelization, seasonal flows slowed to a trickle throughout most of the dry season, and the winter storm flood threat increased as development expanded on the River's natural floodplain. Storms produced massive flows in the River causing flooding that resulted in the loss of lives and millions of dollars in property damage in the late 19th and early 20th centuries.

Modifying the River to contain these periodic floods has rendered it a flood damage reduction channel that does not resemble a natural river system. Improvements for flood risk management have included bank hardening and lining the bed of the channel with concrete for approximately 44 of its 51 miles. An approximately 7-mile stretch of the River near the Verdugo Wash confluence has grouted riprap side slopes and is the only portion of the study area left with a soft bed, even though this area has also been engineered with a cobblestone bed that has migrated or washed away over the years. During the dry season, base flows in the channel are often less than 100 cfs and are entirely composed of discharge from municipal and industrial wastewater treatment plants and urban/irrigation runoff. Open space, parks, and greenways are scarce. Instead, impervious surfaces, industrial development, and residential and commercial areas dominate the study area.

Significant resources based on institutional, technical, and public recognition are summarized in Section 1. The importance of these resources is further discussed below.

2.1.1 Importance and Scarcity of Southwestern Riparian Ecosystems

Riparian ecosystems in the Los Angeles River watershed, as well as the arid/semi-arid southwest region overall, are critical for wildlife, yet are exceedingly scarce. The natural LA River is typical of watercourses in the southwest, which are unlike river systems in any other part of the country. Landscapes in the southwest are characterized by low, but highly variable rainfall. The resulting dry conditions create a stark contrast between riverine and riparian areas and the adjacent upland vegetation. In this way, the riparian ecosystem in the southwest is such an important system because it occupies a very small area but supports the majority of ecological and hydrologic connectivity in a landscape and biodiversity in the region (Levick 2008).

Vegetation communities along ephemeral and intermittent streams provide wildlife habitat and structural elements not otherwise available in adjacent dry upland communities, such as food, shelter, breeding habitat, and movement corridors. In the southwest region, approximately 80% of all wildlife use the riparian ecosystem at some life stage, with more than 50% of bird species nesting primarily in riparian habitats (Krueper 1993). The high wildlife species density and diversity associated with riparian habitats is attributed to the presence of highly varied vegetative structure, high vegetative density and diversity, availability of water and insect prey, and adjacency to several floral and faunal Eco regions (Krueper 1995).

The importance of western riparian areas cannot be overemphasized (Carothers 1977), because of the high temperatures and dryness outside of the riparian ecosystem (Levick 2008). The abundance and diversity of riparian vegetation, as compared to uplands areas, is therefore a critical wildlife habitat feature of rivers and streams in the southwest.

Western riparian ecosystems are one of the rarest habitat types in the Western Hemisphere (Krueper 1995). Of the 106 forested types identified in North America, the western cottonwood-willow forest association has been identified as the rarest (Krueper 1995). Noss and Peters (1995) concluded that Southwestern riparian forests and California riparian forests and wetlands are two of the 21 most endangered ecosystems in the United States. Historically, riparian habitats occupied 1% of the land mass in western North America. Within the past century**,** an estimated 95% of this habitat has been altered, degraded, or destroyed due to such land use activities as river channelization, unmanaged livestock utilization, clearing for agriculture, water impoundments, and urbanization (Krueper 1995). Due to habitat conversion, natural riparian communities persist only as isolated remnants of what was once a vast, interconnected system of rivers, streams, marshes, and vegetated washes (Krueper 1995).

The LA River Ecosystem Restoration Study focuses on restoration of the historically occurring marsh and riparian habitats, specifically the cottonwood-willow habitat which is the rarest habitat type in the

Western Hemisphere (Krueper 1995). Restoration of this community would provide the habitat elements required to support high density and diversity of wildlife species.

In Southern California, the valley foothill riparian habitat is composed of willow riparian vegetation communities including the cottonwood-willow forest. The freshwater marsh habitat is aquatic wetland that is often associated with the riparian system. The LA River Ecosystem Restoration Study focuses on restoration of these historically occurring freshwater marsh and riparian habitats, specifically the cottonwood-willow habitat which is the rarest habitat type in the Western Hemisphere (Krueper 1995). Restoration of these communities would provide the habitat elements required to support high density and diversity of wildlife species.

2.1.2 Importance of Restoring Biological Diversity on the River

Vegetation communities along ephemeral and intermittent streams provide wildlife habitat and structural elements not otherwise available in adjacent dry upland communities, such as food, shelter, breeding habitat, and movement corridors.

Over 175 species are known to occur on the LA River. Restoration of dense, structurally diverse riparian habitat and wetland communities would provide expanded habitat for species populations and restoration of habitat for sensitive and charismatic species. Restoration of riffle/pool complexes and natural geomorphology could support native species including the Santa Ana Sucker (Federally threatened) and the Arroyo chub (State Species of Concern). Amphibian numbers are on the decline globally and restoration of a riparian ecosystem would provide for expansion, refuge, and habitat for amphibian populations on the river.

Approximately 140 bird species are supported on the LA River, which are federally protected under the Migratory Bird Treaty Act. The project would restore large nodes of riparian habitat that would support the Federally endangered least Bell's vireo. Vireo have been observed in recent years along the Glendale Narrows (Reaches 4-6) and restoration of the riparian ecosystem would allow for significant expansion of their populations in the LA Basin, particularly in Taylor Yard and Piggyback Yard. Restoration of large nodes of riparian habitat could also support yellow breasted chat and yellow warbler (State Species of Concern). Many other charismatic bird species would be supported by restoring the river including the hooded and Bullock's oriole, lazuli bunting, blue grosbeak, western tanager, several species of woodpeckers, owls, many species of ducks (Cinnamon teal, ring-necked duck, northern pintail), hawks (sharp shinned hawk, osprey), and shorebirds (great blue heron, spotted sandpiper, black necked stilt).

Over 20 species of mammal are supported on the LA River. Implementation of restoration could support top predators such as bobcat and coyote whose ranges are currently limited by physical barriers and lack of regional pathways connecting populations. These are important species because they regulate the population of mesopredators (such as skunks and weasels). Left unchecked, mesopredators can impact populations of bird species (i.e. eating eggs) and other smaller wildlife. Nine species of bat are supported on the LA River (1 State Species of Special Concern). Restoration would expand bat habitat along bridges and support local bat populations that are known to regulate insect populations (vector control).

Restoration of a the higher wildlife species density and diversity associated with riparian habitats is attributed to the presence of highly varied vegetative structure, high vegetative density and diversity, availability of water and insect prey, and adjacency to several floral and faunal Eco regions (Krueper 1995).

2.1.3 Importance of Restoring Hydrology

Ecological and evolutionary processes include natural disturbance regimes maintained by hydrologic processes, which facilitate nutrient recycling and biotic interactions (EPA 1999). Ecosystems are characterized by natural hydrologic patterns that move water through the system, to support organisms (plant and wildlife) and reshape the landscape. These patterns also move abiotic and biotic materials through the system, such as energy and nutrients. Biodiversity, production, and sustainability of ecosystems are dependent on the dynamic nature and variation in the physical environment. Aquatic ecosystems are completely dependent on hydrology; the hydrologic patterns are integral to this dynamic physical environment. Furthermore, hydrology provides connectivity between ecosystems that is critical to regional ecological functioning (EPA 1999).

Hydrologic patterns of high and low flows shape the physical environment of the ecosystem. High flows can transport sediment, killing or displacing benthic invertebrates; flushing flows can clear gravel beds of accumulated silt which provide sites for attachment of insect eggs and other organisms. High flows import woody debris, allowing for creation of new habitat. Overbank flows connect channels to floodplains, which increases overall productivity and diversity, while scouring of the channel and floodplains rejuvenates habitat for plant species. Low flows may determine the amount of habitat available in the channel during critical periods. In some systems, temporary drying of stream channels provides habitat for specialized species (EPA 1999). The natural hydrologic pattern is important for maintaining the form of the channel and floodplain, habitat diversity, ecosystem productivity, and biodiversity.

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. These natural connections support contiguous aquatic and riparian habitat and direct habitat connections for wildlife, which facilitate wildlife movement via restored corridors. Natural hydrologic connections also support aquatic processes such as exchange of sediment, nutrients, and energy between the river and floodplain. Connections may also be made through culverts or other constructed features to assist hydrology and 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 ecological processes and exchanges. Hydrologic and hydraulic connectivity address the need to restore underlying processes that support a functioning ecosystem, to reestablish habitat patches and corridors, and to reduce the habitat fragmentation created by urbanization. Removal of the concrete channel bed and banks recreate natural hydrologic connections by reconnecting the river to its floodplain.

Maintaining ecological and evolutionary processes includes natural disturbance regimes, hydrologic processes, nutrient recycling and biotic interactions (EPA 1999). This 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).

Reconnection of the river to the floodplain is important from a hydraulic perspective as well. Removal of concrete and widening the river into the floodplain could increase the flood carrying capacity of the river. This added conveyance may be offset by additional vegetation; however removal of concrete and widening restores other 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 allows the river to connect to the overbank, which restores a dynamic floodplain and supports diverse riparian and in stream habitat for plants and wildlife. The larger sites are more beneficial to flood risk management. Without channel widening in the proposed locations 'removal of concrete' would be unacceptable from a flood risk standpoint and opportunities to restore a comprehensive, sustainable ecosystem would be limited.

Floodplain connectivity is also important for 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). In addition, confluence restoration provides an improved hydraulic connection to the LA River. Widening or laying back the side slopes adds capacity. Removal of concrete sides slopes and/or inverts allow establishment of vegetation which reduces velocities, increases infiltration, and improves the natural sediment processes.

Habitat connectivity to the historic floodplain can be achieved through direct or indirect means. Direct connections are those in which the channel is widened and a more natural configuration is realized or in some cases where flows are diverted from the main channel and allowed to run through the overbank area. Flora and fauna establish themselves more in line with a typical natural river system. Indirect connections are those in which lands adjacent to the river are restored for riparian habitat and wildlife can more easily migrate between the river and these adjacent parcels. Daylighting streams creates additional habitat connectivity especially if a direct connection can be made.

2.1.4 Importance of Nodal Habitat Connectivity

River channels in the southwestern region 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, 2008).

The remaining fragments of aquatic and riparian habitat in the urban landscape (or habitat “nodes”) contribute significantly to 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). Improving nodal connectivity addresses aquatic habitat fragmentation.

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 restore the biological integrity of a landscape, corridors must 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).

Ideally, movement corridors would consist of a relatively wide strand of natural channel bed, with patches or a contiguous length of vegetative cover for shelter, shading and forage opportunities. However, the opportunistic species that occur in urban settings can use almost any walkable surface of almost any width, as long as sufficient cover is present to avoid predators, and as long as a desired forage opportunity or other destination is within sight. The presence of vegetation and absence of barriers provides a visual cue that encourages movement.

As most wildlife movement occurs from dusk to dawn (when noise and human presence is somewhat diminished), even a narrow corridor would be sufficient to provide safe passage. Wildlife movement between patches of habitat is important to reconnect genetically isolated populations of species and prevent inbreeding depression, to provide necessary interactions between predators and prey to control population size and provide a healthy ecosystem balance, and to connect individual wildlife to required resources that may not be present within one isolated area.

2.1.5 Regional or Watershed Habitat Connectivity

Regional connectivity is a more general term referring to longer distance connections that could potentially be made. Connectivity to the Santa Monica Mountains, San Gabriel Mountains, and Verdugo Mountains are the specific regional connections made within some alternatives. Immediate opportunities for regional connectivity apply mainly to birds. Additionally, direct connections can be made to the Santa Monica Mountains via Griffith Park for other species including reptiles and mammals. Future opportunities for connections that link other projects on the Arroyo Seco and Verdugo Wash tributaries to the project area would support improved regional connectivity to the San Gabriel and Verdugo Mountains for reptiles and mammals. Improved connectivity within the watershed is also at a regional scale, with connections to other restored habitat along the river (IE Sepulveda Basin) as well as tributaries (i.e. Tujunga Wash, on-going Arroyo Seco restoration study).

This IFR - the Los Angeles River Ecosystem Restoration Feasibility Study focuses on the critical, central backbone in the restoration of regional habitat connectivity (Figure 2-1). Restoration of the study area would provide nodal habitat connections from the San Gabriel and Verdugo Mountains to the Santa Monica Mountains, and would provide opportunities for direct habitat connections to these mountain ranges as well via tributaries. Since the study area is adjacent to and includes lands of Griffith Park and the eastern terminus of the Santa Monica Mountains, it provides opportunity for habitat and wildlife connectivity to the nationally significant Santa Monica Mountains National Recreation Area and the Pacific Ocean. The study area also includes the confluences of the Verdugo Wash and Arroyo Seco tributaries, which provide more long distance connections to the Verdugo Mountains and nationally significant San Gabriel Mountains (respectively).

The study area includes the Glendale Narrows, which currently supports some of the only remaining riparian and freshwater marsh habitat on the River. The existing habitat and perennial surface flow in the Narrows provide a base for restoration and maintain one of the most diverse assemblages of wildlife on the River today.

The USACE also is currently conducting ecosystem restoration studies and projects on the River and its tributaries, including Arroyo Seco, Headworks (adjacent to Griffith Park), Tujunga Wash, and Sun Valley. Without restoration of the Los Angeles River, these projects would only provide isolated patches of habitat and would not be able to contribute to a greater regional connectivity effort. The study area, therefore, provides the “bones” (structure) for restoring the Los Angeles River and serves as a hub for regional connectivity. Expansion of riparian and marsh habitat along this portion of the River and at the confluences of the Arroyo Seco and Verdugo Wash tributaries is a first step in putting the pieces of the once vast natural river ecosystem back together.

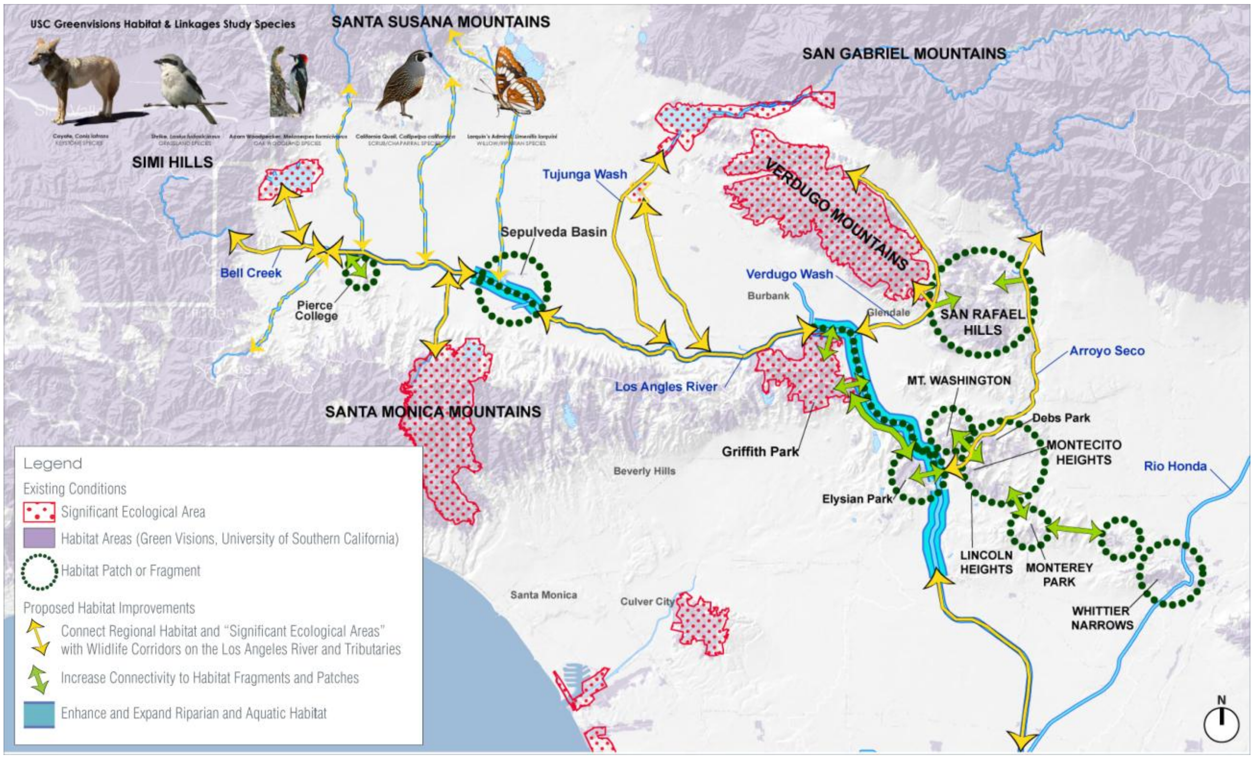


Figure 2-1 Regional Potential for Habitat Connectivity (Los Angeles River Revitalization Master Plan)

2.2 DESCRIPTION OF STUDY REACHES

There are eight geomorphically different reaches within the study area (Figure 1-2). They were defined based on the physical characteristics of channel morphology, bank characteristics, soil exposure, existing habitat, and surrounding land uses. Specific geomorphic criteria include: (1) channel bed type (either soft bed with groundwater/surface water exchange, or concrete), (2) side slope type (vertical or trapezoidal), and (3) adjacent land uses or open space. The eight reaches are described in the following sections with photographs and example channel cross sections taken from LACDA as-built summary sheets circa 1962-1986.

2.2.1 Reach 1: Pollywog Park/Headworks to Midpoint of Bette Davis Park

Reach 1 is the upstream segment of the study area and is approximately 1.5 river miles in length. It connects the study area to the Pollywog Park area of Griffith Park, the USACE Headworks Ecosystem Restoration Study Site, and the city of Burbank at Disney Studios. In this reach the River's channel has a rectangular concrete-lined configuration with subdrains and no low flow channel (Figure 2-2). The low-flow channel is located in the bottom center in other, all-concrete reaches and it is designed to convey flows). There is a small temporary dam within the river bed near the upstream end of this reach that was once used to help divert water to the Headworks spreading grounds operated by the Los Angeles Department of Water and Power (LADWP). The channel is approximately 18 feet deep and the bank-to-bank width is approximately 115 feet.

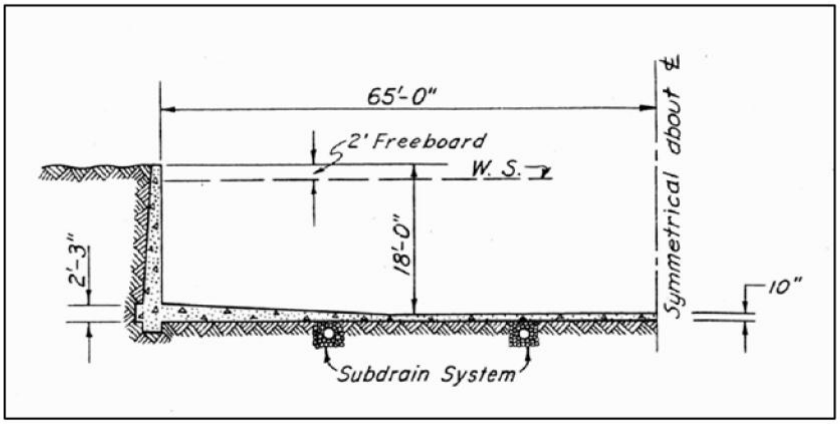
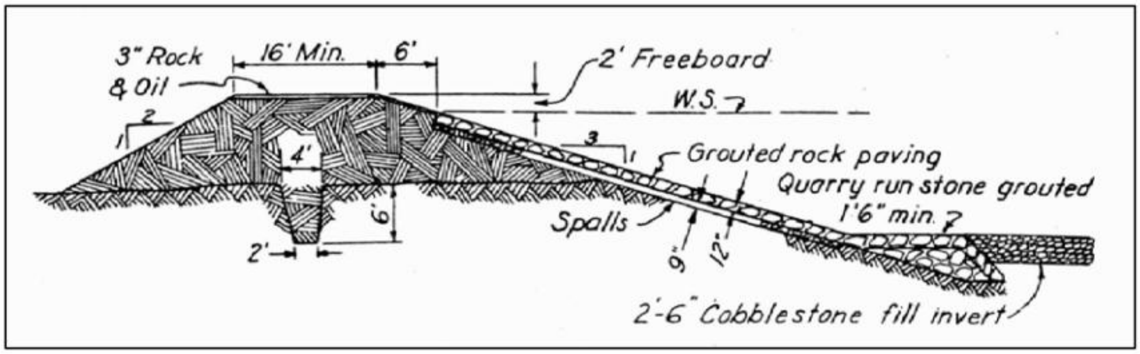


Figure 2-2 Typical Cross Section and Aerial Photo of Reach 1

2.2.2 Reach 2: Midpoint of Bette Davis Park to Upstream End of Ferraro Fields

This reach is approximately 0.75 mile in length. It extends from the midpoint of the Bette Davis Park area on the left bank (facing downstream), where the bed transitions from concrete-lined to a cobblestone bed, and then transitions back to concrete at approximately the upstream edge of Ferraro Fields 9 (public soccer field facility) on the right bank (Figure 2-3). The channel has a trapezoidal configuration with grouted Derrick stone banks. The banks are toed-down (secured by extending the bank wall below the river bed) with sheet pile and quarry run stone. The bed is approximately 18 feet deep from the top of bank and approximately 175 feet wide. Sediment deposited in the channel has formed sand bars/islands, which have stabilized as the root systems of the many trees and other vegetation in the channel have trapped sediment over time. This reach, however, is not as densely vegetated as areas farther downstream in Reaches 4 to 6.



EXISTING TYPICAL SECTION
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Figure 2-3 Typical Cross Section and Aerial Photo of Reach 2

2.2.3 Reach 3: Ferraro Fields to Brazil Street

This reach is approximately 1 mile in length. It begins at the upstream edge of the Ferraro Fields on the right bank where the bed transitions from cobbles to concrete. It makes an approximately 90-degree curve to the south around Griffith Park and transitions back to cobbles at approximately Brazil Street on the left bank. The channel in this area has a rectangular concrete configuration (Figure 2-4). The bed is approximately 18 to 23 feet deep from the top of bank and approximately 180 feet wide, widening to 380 feet downstream of the Verdugo Wash confluence. State Route (SR)-134 (Ventura Freeway) crosses the River at Verdugo Wash.

Figure 2-4 Aerial Photos of Reach 3

2.2.4 Reach 4: Brazil Street to Los Feliz Boulevard

This reach is approximately 1.75 miles long and extends from Brazil Street on the left bank downstream to the Los Feliz Boulevard Bridge. The bed transitions from a concrete-lined rectangular channel to a trapezoidal channel with a cobble bed and grouted derrick stone banks (Figure 2-5). Banks are toed-down with sheet pile and quarry run stone. The bed was constructed approximately 18 feet deep from the top of the slope, and the channel ranges from approximately 130 to 160 feet wide from top of bank to top of bank. Sediment deposited in the channel has formed sand bars/islands, which are stabilized by the root systems of the many trees and other vegetation. This reach ends at the Los Feliz Boulevard Bridge, where localized concrete lining of the bed and banks plus pier noses that extend upstream have been constructed to protect the bridge and lower the water surface underneath the bridge.

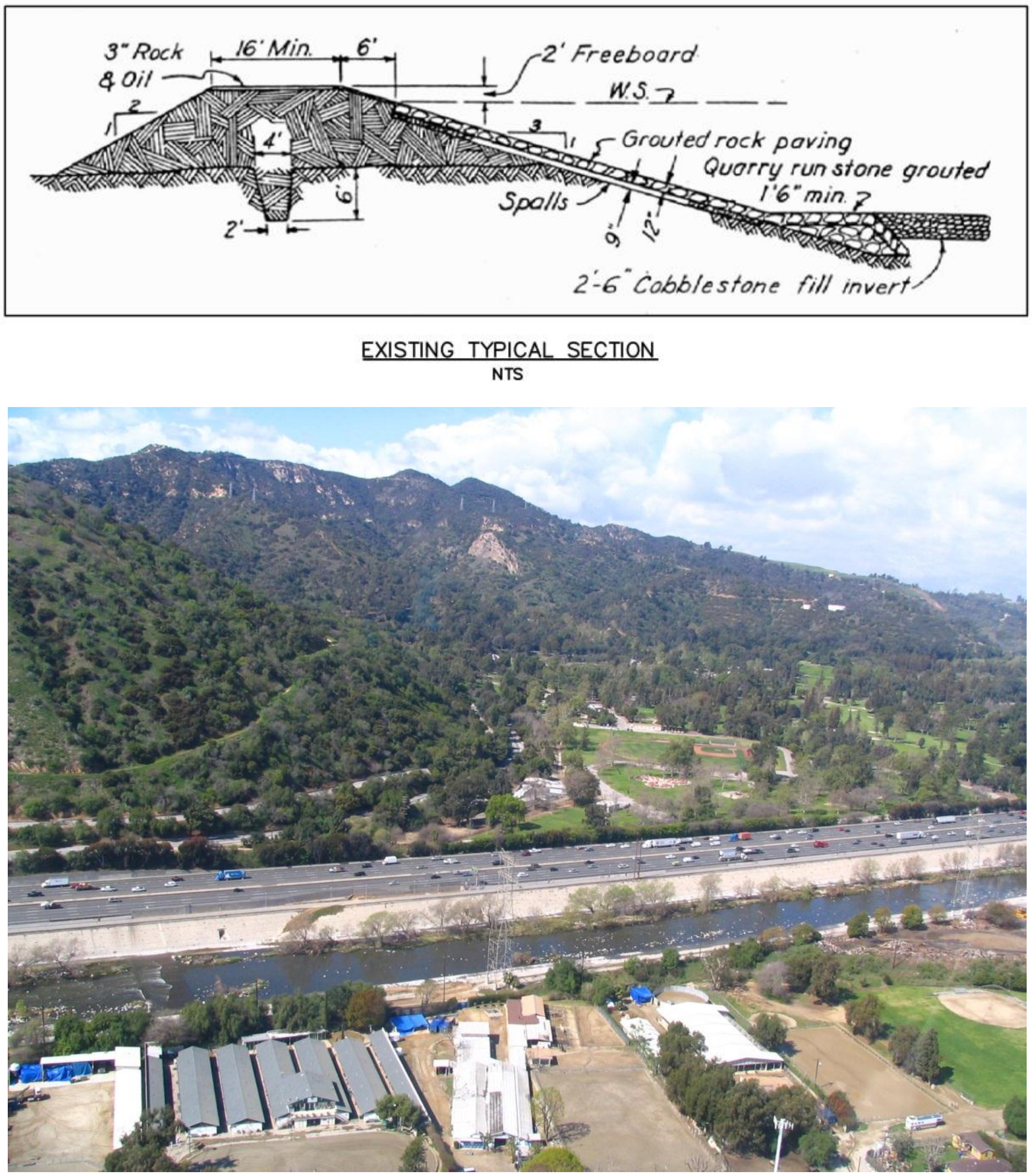
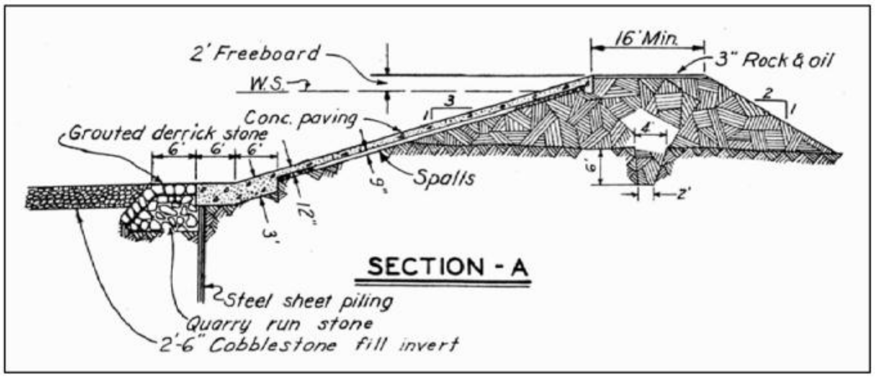


Figure 2-5 Typical Cross Section and Aerial Photo of Reach 4

2.2.5 Reach 5: Los Feliz Boulevard to Glendale Freeway

This reach is approximately 1.55 miles long and veers east between Hyperion Avenue and SR-2 (Glendale Freeway). The reach extends from the Los Feliz Boulevard Bridge, under the Sunnynook pedestrian bridge and the Hyperion Avenue Bridge, downstream to the Fletcher Drive Bridge and ends at the SR-2 Bridge. The bed transitions from concrete under each of the large bridges (e.g., Los Feliz Boulevard, Hyperion Avenue) to a trapezoidal channel with a cobblestone bed and grouted derrick stone banks between the bridges (Figure 2-6 and Figure 2-7). Banks are toed-down with sheet pile and quarry run stone. The bed is approximately 18 feet deep and the top of the channel is approximately 130 to 160 feet wide. Sediment deposited in the channel has formed sand bars/islands, which have stabilized as the root systems of the many trees and other vegetation have trapped sediment. This reach ends as the River begins to curve back east as it approaches Taylor Yard.



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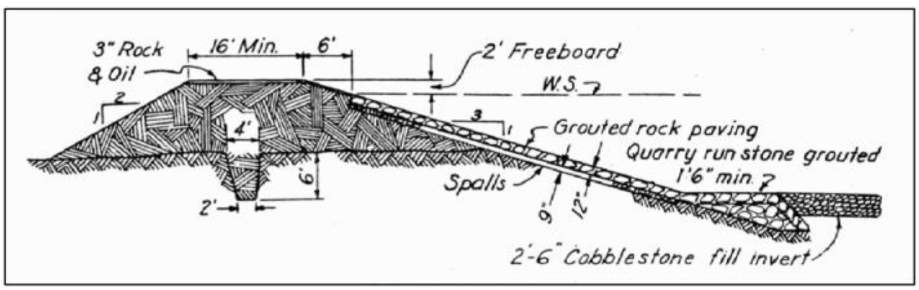

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Figure 2-6 Typical Cross Sections of Reach 5

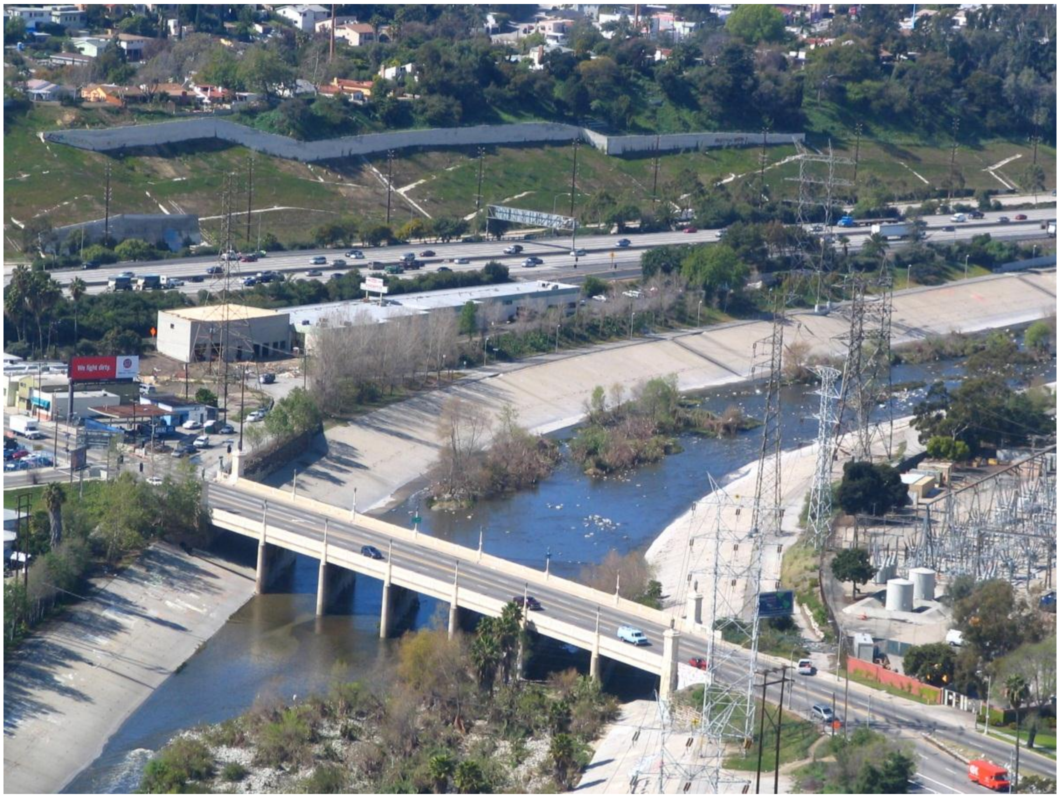
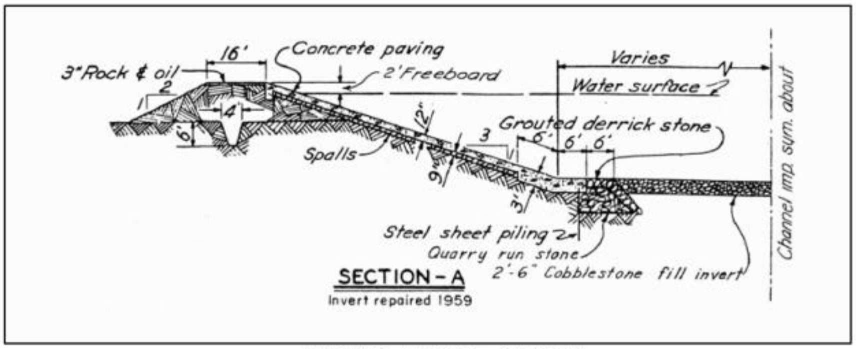


Figure 2-7 Aerial Photo of Reach 5

2.2.6 Reach 6: Glendale Freeway to I-5 Freeway

This reach is approximately 2.34 miles long and meanders through three river bends. It extends from the SR-2 Bridge to the downstream crossing of Interstate 5 (I-5), where the bed transitions from cobblestone to concrete-lined. Here, the channel is in a trapezoidal configuration with a cobble bed and grouted derrick stone banks (see Figure 2-8 and Figure 2-9). The banks are toed-down with sheet pile and quarry run stone. The bed is approximately 30 feet deep from the top of the slope and the top of the channel ranges from approximately 190 to 215 feet wide. Sediment deposited in the channel has formed sand bars/islands, which have become stabilized as the root systems of the many trees and other vegetation have trapped sediment. The channel narrows to 170 feet and transitions to a rectangular configuration just upstream of the complicated I-5 and SR-110 interchange.



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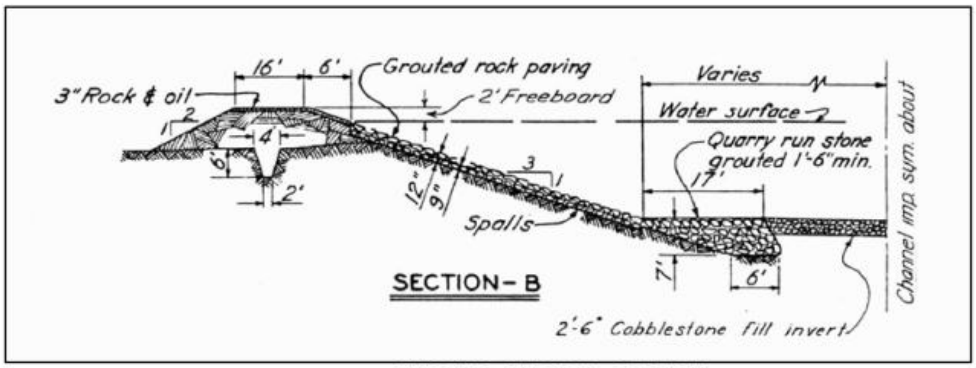

EXISTING TYPICAL SECTION
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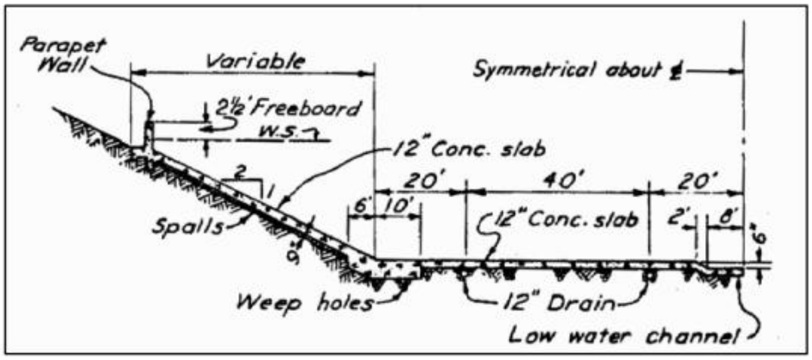
Figure 2-8 Typical Cross Sections of Reach 6

Figure 2-9 Aerial Photo of Reach 6

2.2.7 Reach 7: I-5 Freeway to Main Street

This approximately 1-mile-long reach begins at the I-5 Bridge and extends to the Main Street Bridge. The channel in this area transitions out of the rectangular concrete channel at the Arroyo Seco confluence, and becomes a trapezoidal concrete channel that is approximately 30 feet deep, with a top of bank width that ranges from approximately 150 to 190 feet (Figure 2-10). Three bridges cross the River in this reach, including a railroad bridge, the North Broadway Bridge, and the Spring Street Bridge. The channel has adjacent rail lines on both banks.



EXISTING TYPICAL SECTION
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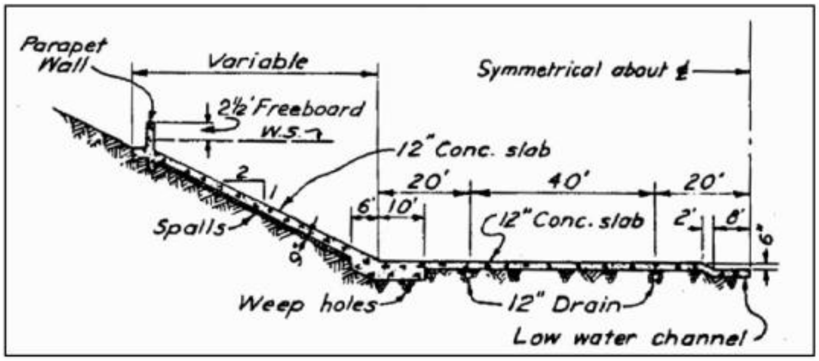
Figure 2-10 Typical Cross Section and Aerial Photo of Reach 7

2.2.8 Reach 8: Main Street to First Street

This approximately 1-mile-long reach begins at the Main Street Bridge and extends downstream to the First Street Bridge. The trapezoidal concrete channel is approximately 30 feet deep with a top of channel width that ranges from approximately 170 to 200 feet (Figure 2-11). Rail lines run adjacent to the channel on both banks, and two railroad bridges cross the river. US-101 crosses the river between César Chàvez and First Street.



EXISTING TYPICAL SECTION
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Figure 2-11 Typical Cross Section and Aerial Photo of Reach 8.

2.2.9 Reach Groupings

In many cases, because adjoining reaches are so similar in land use conditions, they have been addressed as a group, particularly in Chapters 4 and 5 where environmental conditions and impacts are presented. These reach groupings include:

- Reaches 1 through 3, adjacent to Griffith Park. Reach 2 is soft bottomed but Reach 1 and 3 predominantly have concrete bed and banks that transition between rectangular and trapezoidal configurations.
- Reaches 4 through 6, which predominantly have grouted rock side slopes with a soft cobblestone bed; these reaches also have more vegetation than the other reaches.
- Reaches 7 and 8, which predominantly have a concrete trapezoidal configuration through downtown industrial, residential, and commercial areas.

2.3 SUMMARY OF PROBLEMS AND OPPORTUNITIES

The problems and opportunities in the Los Angeles River watershed and along the 32 miles of river from the San Fernando Valley downstream through the City of Los Angeles were identified and assessed during the reconnaissance study. The USACE conducted plan formulation meetings with the Sponsor, key agencies, and stakeholders during this feasibility phase.

2.3.1 Problems

The Los Angeles River study area is unique due to the extremely large human population and massive infrastructure development in and adjacent to the river channel and floodplain. The study team and the agencies involved with these planning efforts identified the following problems during planning charettes held in December of 2009.

Urbanization and flood risk management projects have created the following problems:

1. The elimination of the ability of aquatic species to move freely upstream-to-downstream and to find adequate locations for refuge and proliferation—in particular, there is a considerable absence of aquatic habitat for fish and other wildlife species;
2. The degradation of ecological processes, such as the exchange and flow of nutrients and sediment within the system, that are necessary to support ecosystem function in valley foothills riparian and freshwater marsh habitats;
3. The replacement of diverse substrate, such as naturally-occurring mixes of fine silts and boulders, necessary to support valley foothills riparian, freshwater marsh, and fish habitats with concrete;
4. Breaks in connections between the river and its historic floodplain, such as a meandering, fluctuating relationship with its tributaries, which associated loss of ecosystem functioning;
5. A highly-altered hydrologic regime that is simplified (reduced flow options) and magnified (higher flows concentrated in smaller spaces);
6. A highly-altered habitat cycle since extremely high velocity flows within the study area prevent robust establishment of riparian habitat and the adequate protection of species attracted to it;
7. Disruption of natural sedimentation processes and exaggeration of atypical/altered regimes, discouraging the ability of existing areas to support diverse habitat communities;
8. The inability of surface flows to infiltrate and recharge groundwater aquifers, which is necessary to restore native flow regimes and support native habitat communities;
9. The degradation of aquatic habitat due to flows conveyed through the many storm drains of

the channelized flood management system;
10. The proliferation of non-native/exotic species and trash/debris, which have degraded aquatic habitat and prevented establishment of native species; and
11. An unpleasant human experience that provides very little understanding of the river's natural history and value and reinforces an inability to access and participate in recreation at the river to learn more about its restoration potential.

The conceptual ecosystem model shown in Figure 2-12 and described in Table 2-1 presents the primary drivers and stressors to the riverine, riparian, and floodplain environments. The primary drivers of habitat quality, quantity and distribution within the study area are: 1) climate and precipitation patterns; 2) hydrology and runoff; 3) sediment and wood transport; 4) connections (or the lack thereof) between the River and its floodplain; and 5) adjacent upland conditions. The primary stressors on the habitats include: 1) altered hydrology due to channelization and development (impervious surfaces) that increase the rapidity of runoff and increase overall volumes and velocities; 2) altered sediment and wood transport due to disrupted connections between natural sediment and wood sources and the river system (including the elimination of those sources); 3) adjacent upland conditions; and 4) disruption of natural river to floodplain connections and river/floodplain to groundwater connections.

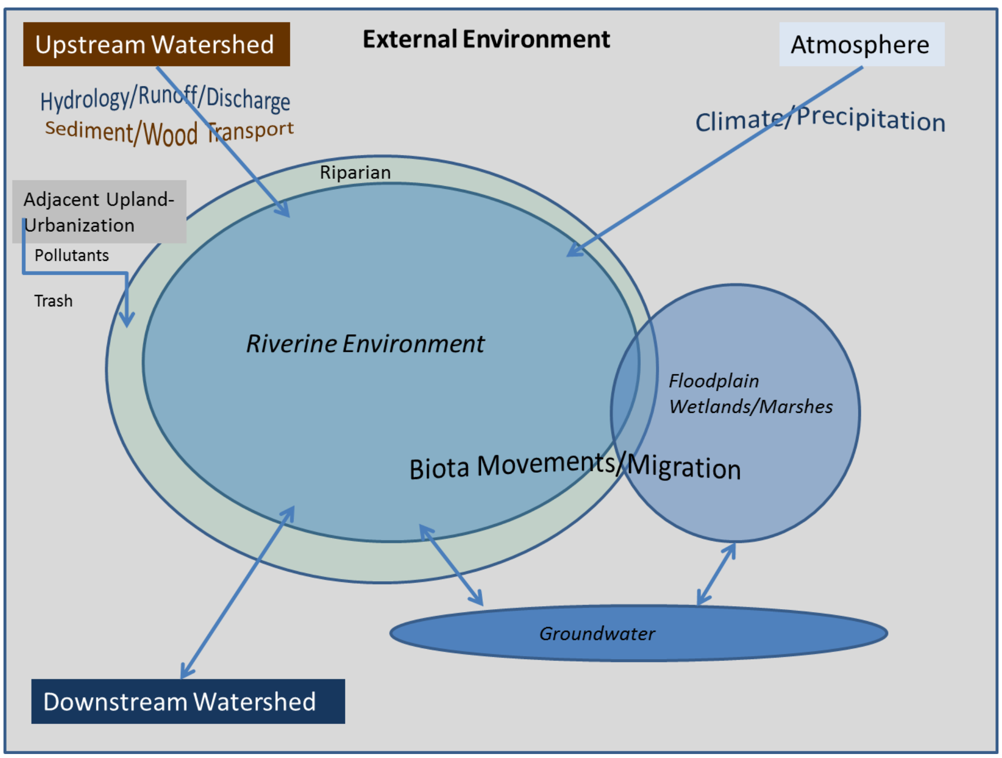


Figure 2-12 Conceptual Model Depicting the Study Area

Table 2-1 Conceptual Model Components

Model Parameter	Ecological Component	Description
Upstream Watershed		
	Hydrology	Annual and decadal variations in flow volume and timing based on precipitation and runoff
	Runoff	Volume and rate at which precipitation runs off watershed surfaces as surface water
	Sediment/wood Transport	The source volume and delivery of sediment and wood into the river system and its rate of transport
Riverine and Floodplain Environment		
	Water quality	Water temperature, dissolved oxygen, nutrients, and other chemical constituents including pollutants
	Habitat types	Quantity and distribution of habitat types (i.e., pools, riffles)
	Substrate/sediment	Type of substrate and sediments (i.e., gravel/cobble, concrete, silt)
	Adjacent riparian	Quantity, quality, and distribution of riparian habitats normally adjacent to river channels (i.e., cottonwood/willow forested and thickets)
	Floodplain	Quantity, quality, and distribution of floodplain habitats normally adjacent to river channels (also including topography, connections; plant communities)
	Groundwater	Elevation of and connections between groundwater table and river and floodplain habitats
	Sediment chemistry	Presence/absence of various chemical constituents and pollutants
Biota		
	Movements/ migration	Movements of biota laterally between river, riparian, and floodplain and upstream/downstream to other habitat types; disrupted by habitat and corridor fragmentation
	Primary production	The synthesis and storage of organic molecules during the growth and reproduction of photosynthetic organisms
	Invertebrates	Various invertebrate species typical for riverine and floodplain habitats (i.e., mayflies, caddisflies, annelid worms)
	Amphibians/reptiles	Amphibians and reptiles native to Southern California riverine and floodplain systems (i.e., Western toad, arroyo toad, salamanders)
	Fish	Fish species native to Southern California riverine systems
	Waterbirds	Birds most commonly found in and on water (i.e.,waterfowl, alcids, pelicans, cormorants, grebes, and gull-like birds)
	Other birds	Birds commonly found foraging or resting in riparian or upland areas (i.e., songbirds, raptors, including threatened and endangered species)
	Mammals	Native mammals for Southern California region
Adjacent Upland		
	Pets and non-native wildlife	Pets and introduced species such as rats, bullfrog
	Non-native plan species	Plants including ornamental species and non-native invasive species
	Impervious surfaces	Development has led to primarily impervious surfaces in the uplands adjacent to the river preventing groundwater interactions and promoting rapid runoff of precipitation that can entrain pollutants
	Trash and debris	Trash and debris washed into or dumped into riverine and floodplain habitats
Atmosphere		
	Precipitation	Rain, snow, or other precipitation typical for the study area climate
	Chemical Constituents	Quantities of various chemicals present in air
	Temperature	Seasonal or typical air temperatures in the study area
	Climate	Prevailing precipitation and temperature regimes; potential changes to climate over time
Downstream Watershed		
	Estuary/ocean	Water, sediment, wood, pollutants, and biota move from riverine/floodplain environment towards downstream estuary reaches and the ocean, and biota may move upstream
	Sea level rise	Elevation of estuary/tidal reaches likely to move upstream over time and change habitat types and species distribution

2.3.2 Public Concerns

While flooding remains a concern in this reach, much has already been accomplished to manage flood risk, including upstream dams and channelization of the River and its tributaries through the many USACE flood risk management projects in the watershed. The channel within the ARBOR Reach provides a design conveyance that is less than the 1 percent Annual Chance Exceedance (ACE) (100-year) event. Following completion of the LACDA project, additional height was built into flood walls in the 1990s to protect the interests of downstream cities. However, no additional flood risk management features were constructed in the ARBOR reach in the years since LACDA, and extensive growth of vegetation, especially invasive species, and concentration of sediment have occurred within the soft-bottomed reaches of the River, including within the study area. This has the effect of reducing the flood flow capacity that can be conveyed by the LACDA project, thereby diminishing the benefits of higher walls. Therefore, the level of flood risk management in the ARBOR reach and the vegetation within the channel are important considerations—for both problems and opportunities—in formulating the study alternatives.

2.3.3 Opportunities

The study team and the agencies involved with these planning efforts agreed that the problems present the following opportunities for restoration of nationally and regionally significant ecosystem function within the study area. The relationship between each problem and opportunity is noted in parentheses. For example P1 refers to problem one in the previous list. Opportunities are as follows:

- Restore lost aquatic habitat including valley foothill riparian, freshwater marsh, and native fish habitat (P1).
- Improve diversity and abundance of native valley foothill riparian and freshwater marsh plants to support the diversity and abundance of wildlife species (P1).
- Improve and restore ecological processes in the project area to support ecosystem function in valley foothill riparian communities, freshwater marsh, and native fish habitats (P2).
- Restore substrate in valley foothill riparian, freshwater marsh, and native fish habitats (P3).
- Improve habitat connectivity to floodplains and functioning ecological zones (P4).
- Restore a more natural hydrologic regime (P5).
- Decrease peak discharges and/or increase floodplain area in the mainstem and at tributary confluences to reduce discharges and velocities that prevent establishment of native habitats (P6).
- Improve natural sedimentation processes (P7).
- Improve infiltration and recharge (P8).
- Improve water quality from urban runoff in the river, its tributaries, and other drainages entering the river to prevent degradation of aquatic habitat (P9). This project is not proposing measures to address water quality; any improvements will be ancillary to the project.
- Remove and manage invasives/exotics and trash to reestablish native vegetation (P10).
- Increase recreation allowing compatible human interaction with restored ecosystems (P11).

The problems and opportunities were used to develop objectives for the study as described in Section 4, following Section 3 discussion of the Affected Environment.

3 AFFECTED ENVIRONMENT

The following sections describe the existing conditions within the study area for a suite of environmental resources. This provides a baseline by which to compare the potential impacts that may result from implementation of the proposed alternative (Figure 3-1). General descriptions are provided first, followed by reach-specific descriptions, typically grouped by geomorphic characteristics (Reaches 1-3, 4-6, and 7-8). Some resources cannot be described by reach, such as air quality. Also, operation and maintenance of the River is assumed to continue unchanged into the future. Impacts are described in Chapter 5.

3.1 GEOLOGY, SEISMOLOGY, SOILS AND MINERALS

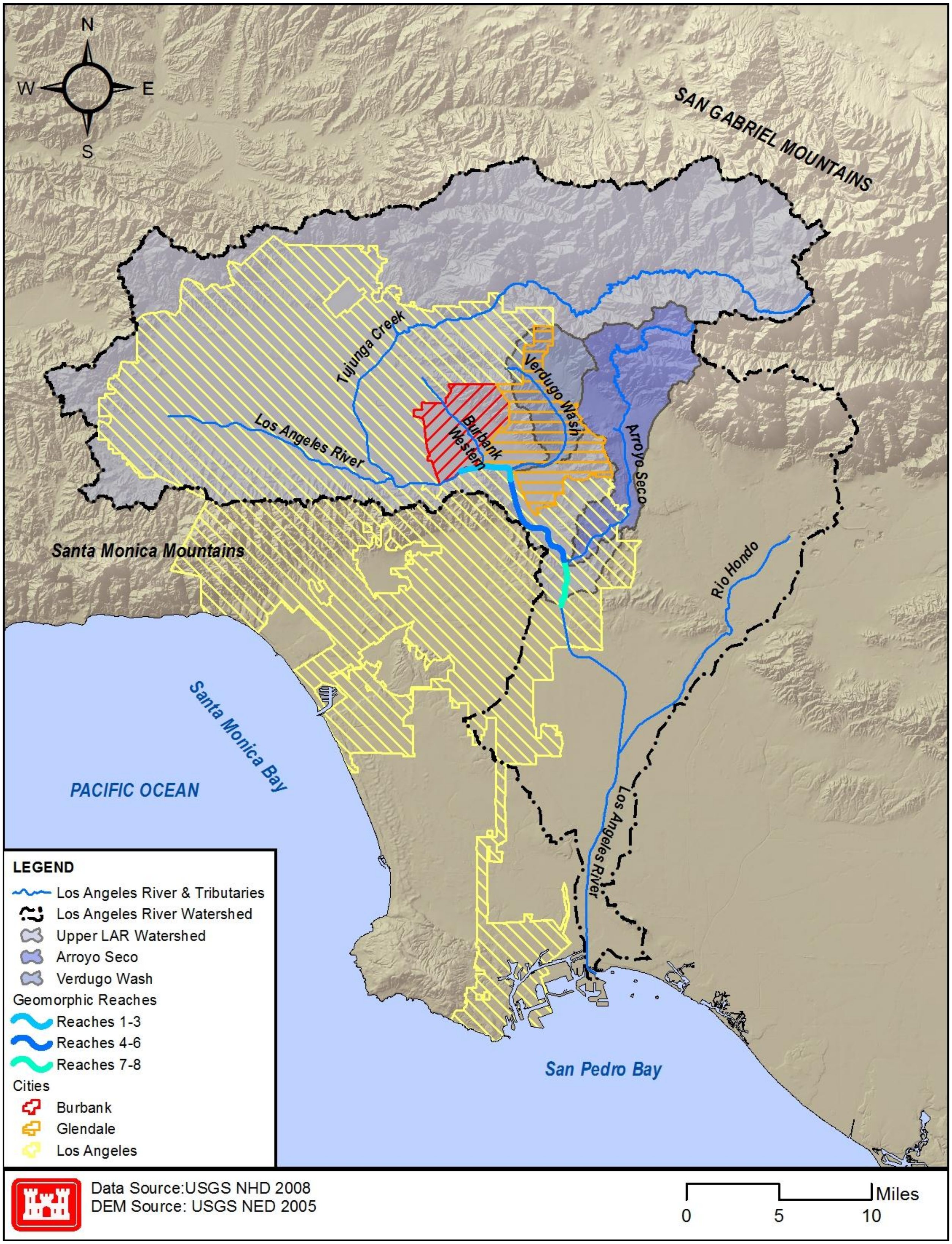
This section describes the geology, seismology, soils and minerals that are affected by the proposed project from an environmental impact viewpoint. In addition to the information provided herein, Appendix D (Geotechnical) provides descriptions, from an engineering perspective, of the geotechnical conditions of the study area. Appendix D also describes geotechnical constraints associated with each alternative as well as provides recommendations for future stages of study and design.

3.1.1 Topography, Geology, and Soils

The study area lies between two major geomorphic regions in the Los Angeles Basin: the east to west oriented Transverse Ranges and the north to south trending Peninsular Ranges (Figure 3-1). Elevations in the Los Angeles River watershed range from approximately 10,000 feet in the San Gabriel Mountains to sea level at the mouth of the river. Elevations within the study area range from a maximum of 490 feet at the upstream end of the study area to a minimum of 240 feet at the downstream end.

This upstream portion of the study area runs along the northeastern fringe of the Santa Monica Mountains in the Hollywood Hills through the San Fernando Valley. Elevations in Reaches 1-3 range from 490 feet upstream to 420 feet downstream. The San Fernando Valley is bounded by the Santa Susana Mountains to the northwest, the Simi Hills to the west, the Santa Monica Mountains to the south, the Verdugo Mountains to the east, and the San Gabriel Mountains to the northeast. These mountains and hills are part of the Transverse Ranges. Elevations in Reaches 4-6 range from 420 feet upstream to 300 feet downstream. Elevations in Reaches 7-8 range from 300 feet upstream to 240 feet downstream. Reaches 7-8 are bounded by the Elysian Hills to the west and the Repetto Hills to the east.

The parent material in the San Fernando Valley is derived from Miocene sedimentary rock consisting of siliceous and diatomaceous shale, siltstone, sandstone, and conglomerate. Santa Monica shale and old and highly metamorphosed sediment are found along the southern side of the valley (SCS 1980). The sediment within the westerly portion of the San Fernando Valley is comprised of relatively fine-grained silty and clayey debris eroded from the Santa Monica and Santa Susana Mountains which are principally comprised of Miocene sedimentary rock consisting of siliceous and diatomaceous shale, siltstone sandstone and conglomerate. The easterly portion of the valley is comprised of alluvial materials that were derived from granitic and metamorphic terrain to the north and east and contain significantly more sand gravel and boulders. The soils of the study area have been highly modified as a result of grading and cut and fill practices. Artificial fill was generally brought in and deposited along the major streams and river channels to fill in low lying areas and to channelize the river. Fill was also used in areas to raise the grade for the construction of roads, bridges, and railroads. In general, fill soils are brownish and consist of silty sands with gravel. However, fill material in the area ranges from clayey silt and silty clay to angular gravel with sand (City of Los Angeles 2005).



1 *Figure 3-1 Los Angeles River Watershed*

Prior to development and construction of the existing flood risk management features the dominant soil within the river channel was Tujunga fine sandy loam (LACDPW 2006). This soil consists of deep and somewhat excessively drained soils formed in alluvium, weathered primarily from granitic sources. These soils are found on floodplains and alluvial fans with slopes of 0 to 9 percent (Figure 3-2). This soil type is characteristic of much of the western San Fernando Valley (Natural Resources Conservation Service [NRCS] 2012).

Other soil types found in the study area and displayed in Figure 3-2 include:

- **Altamont Clay Loam:** This soil series consists of deep, well drained soils that are formed from the weathering of sandstone and shale found on gentle slopes to very steep upland areas. This soil type is found on the right bank of Reaches 4-6, on the gradually sloping to steep sloped areas of the northeastern fringe of the Santa Monica Mountains, and above the left bank along the Repetto Hills.
- **Upper Los Angeles River:** These soils are located above the right bank on the slopes of the Santa Monica Mountains.
- **Hanford Fine Sandy Loam:** These soils are very deep, well drained soils that are formed in moderately coarse textured granitic alluvium. Hanford soils are usually found on stream bottoms, floodplains, and alluvial fans that have slopes of 0 to 15 percent. Hanford fine sandy loams can be found in this reach above the left bank at the base of the Repetto Hills. From the Arroyo Seco confluence to the end of Reach 8, the dominant underlying soil type is Hanford fine sandy loam.
- **Yolo Loam:** These soils consist of fine silty alluvial material, primarily found on nearly level, or flat sloped alluvial fans. Yolo loam is found in Reaches 4-6 in drainages along the River and upper drainage areas.
- **Ramona Clay Loam:** These soils are fine-loamy, mixed soils formed in alluvium derived from granitic and related rock sources. Ramona soils are located on nearly level to moderately sloping terraces and fans. Ramona soils are found in Reaches 4-6 at various locations along the Elysian and Repetto Hills.
- **Chino Silt Loam:** These soils are somewhat poorly drained silty loam soils found in basins and floodplains. Chino soils are found along the base of the Repetto Hills.
- **Hanford Gravelly Sandy Loam:** These soils are very deep, well drained soils that are formed in moderately coarse textured granitic alluvium. Hanford soils are usually found on stream bottoms, floodplains, and alluvial fans that have slopes of 0 to 15 percent (NRCS 2012). Hanford gravelly sandy loam occurs at the Arroyo Seco confluence in Reach 7 (LADPW 2006).

A preliminary review by the California Geological Survey (CGS) indicates that most of the project area is located on lands classified MRZ-2 for Portland cement concrete-grade aggregate (Busch, pers. comm., 2012). This classification occurs in areas where adequate information indicates that significant mineral deposits are present, or where it is judged that a high likelihood exists for their presence. However, the project footprint is not in an area designated by the State Mining and Geology Board as containing significant mineral resources.

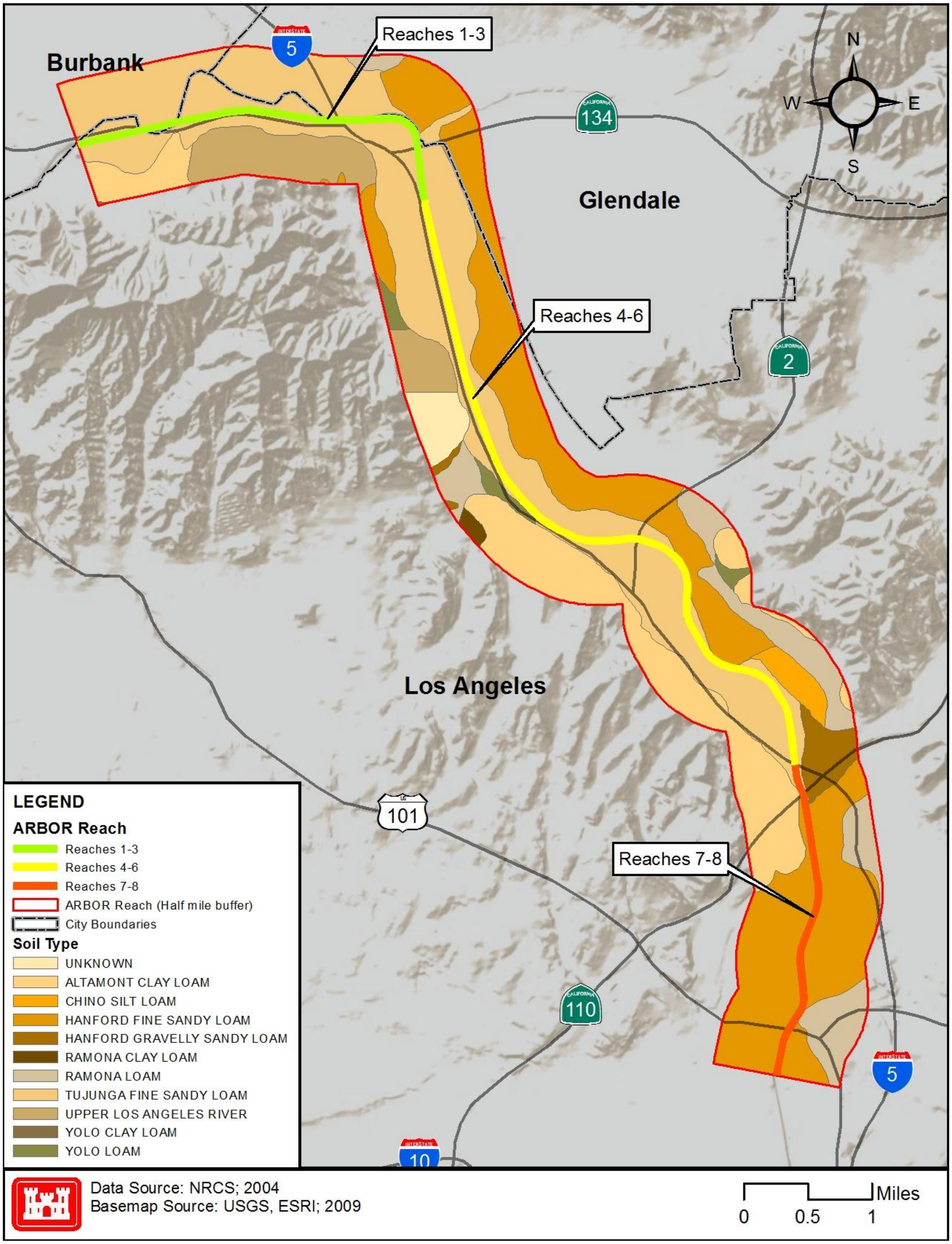


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Figure 3-2 Soils

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3.1.2 Seismicity, Faults, and Landslides

The study area is located in an active seismic zone where approximately 30 earthquakes of generally low Richter magnitude occur daily (below 2.0). The last appreciable earthquake in the Los Angeles area was in January 1994 when the Northridge Earthquake hit the San Fernando Valley at a magnitude of 6.7 (USGS 2012).

Faults in the project area are shown in Figure 3-3. The San Andreas Fault, located 30 miles to the northeast of the study area, forms the boundary between the North America and Pacific Tectonic Plates, and is the most significant fault in the area (Figure 3-3). It runs along the base of the San Bernardino and San Gabriel Mountains (Harden 1998). Other nearby faults include the San Fernando Fault Zone and the Verdugo Fault, which occur within 2 miles of the northern end of the project area. Faults that pass through the project area include the Elysian Park, Raymond, and Hollywood Faults. The Verdugo Fault has a minimum uplift rate of 1.1 millimeters per year (mm/year) (Arkle and Armstrong 2009). The Elysian Park anticline forms a segment of the southern boundary of the Transverse Ranges and has an estimated time-average rate of slip of 0.8 to 2.2 mm/year (Oskin et al. 2000). The Raymond Fault, which runs through Reach 5 upstream of Glendale Boulevard, is about 16 miles long, with a slip rate of between 0.10 and 0.22 mm/yr (Southern California Earthquake Data Center 2006). It has been identified by the California Alquist-Priolo Earthquake Zoning Act as an active surface fault or fault that has been active in the past 11,000 years (California Department of Conservation [CADC] 2012a). The Hollywood Fault is about 9.3 miles long and has a slip rate of between 0.33 mm/yr and 0.75 mm/yr. The San Fernando Fault Zone is about 10.5 miles long and runs from the area of Big Tujunga Canyon north to the San Fernando Valley. The slip rate is not well known but is believed to be about 5 mm/yr. The last major rupture was February 9, 1971, and is known as the Sylmar or San Fernando Earthquake, which had a magnitude of 6.6. The rupture was roughly 12 miles long, with a maximum slip of 6 feet (Southern California Earthquake Data Center 2012).

Ground shaking is the primary cause of earthquake damage in Southern California rather than the creation of fissures, ground ruptures, or landslides. The intensity of the ground shaking is related to the magnitude of the earthquake, type of fault, depth of the quake, and distance from the epicenter. Buildings on poorly consolidated and thick soils typically incur more damage than buildings on consolidated soils and bedrock. Areas near major active faults generally experience stronger seismic shaking more frequently (Los Angeles County 2005).

In addition to causing property damage and the loss of human life, seismic events have the potential to cause liquefaction, modify surface water courses, and depending on the time of year and ambient weather conditions, may be the catalyst for landslides.

Liquefaction is caused when the ground shakes wet granular soil and changes it to an unstable liquid state. Areas prone to liquefaction have thick alluvial soils that are poorly consolidated. Areas with high liquefaction potential in the study area include all lowland areas along the Los Angeles River and tributaries (Figure 3-4). In addition there is high liquefaction potential along the foothills of the Santa Monica Mountains in Reaches 1-3, along the base of the Elysian and Repetto Hills in Reaches 4-6, and along the base of the Elysian Hills in Reaches 7 and 8.

Landslides are rated a moderate priority natural hazard in Los Angeles County, especially along hillsides (Los Angeles County 2005). Factors that affect slope failure are angle, substrate, climate (e.g., precipitation), and seismic shaking. Mudslides due to heavy precipitation are more localized in small gullies. These are typically shallow landslides, where the surface material becomes saturated and begins to flow downhill. Debris flows are known to start on slopes as low as 15 degrees but are more likely to develop on steeper slopes. Within the study area, landslide potential occurs along the eastern Santa Monica Mountains (Reaches 1-6), Elysian Hills (Reaches 4-8), and Repetto Hills (Reaches 4-6).

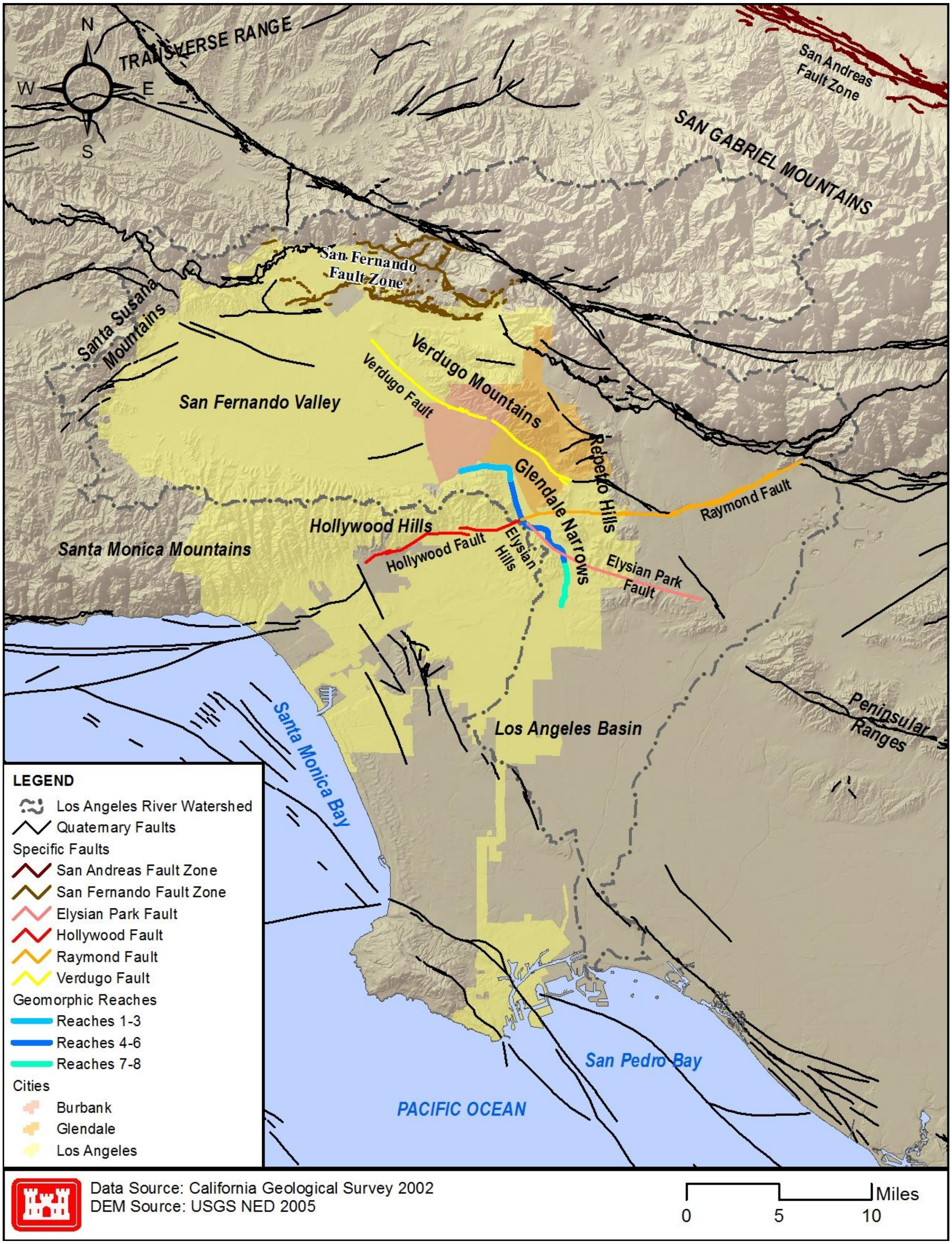
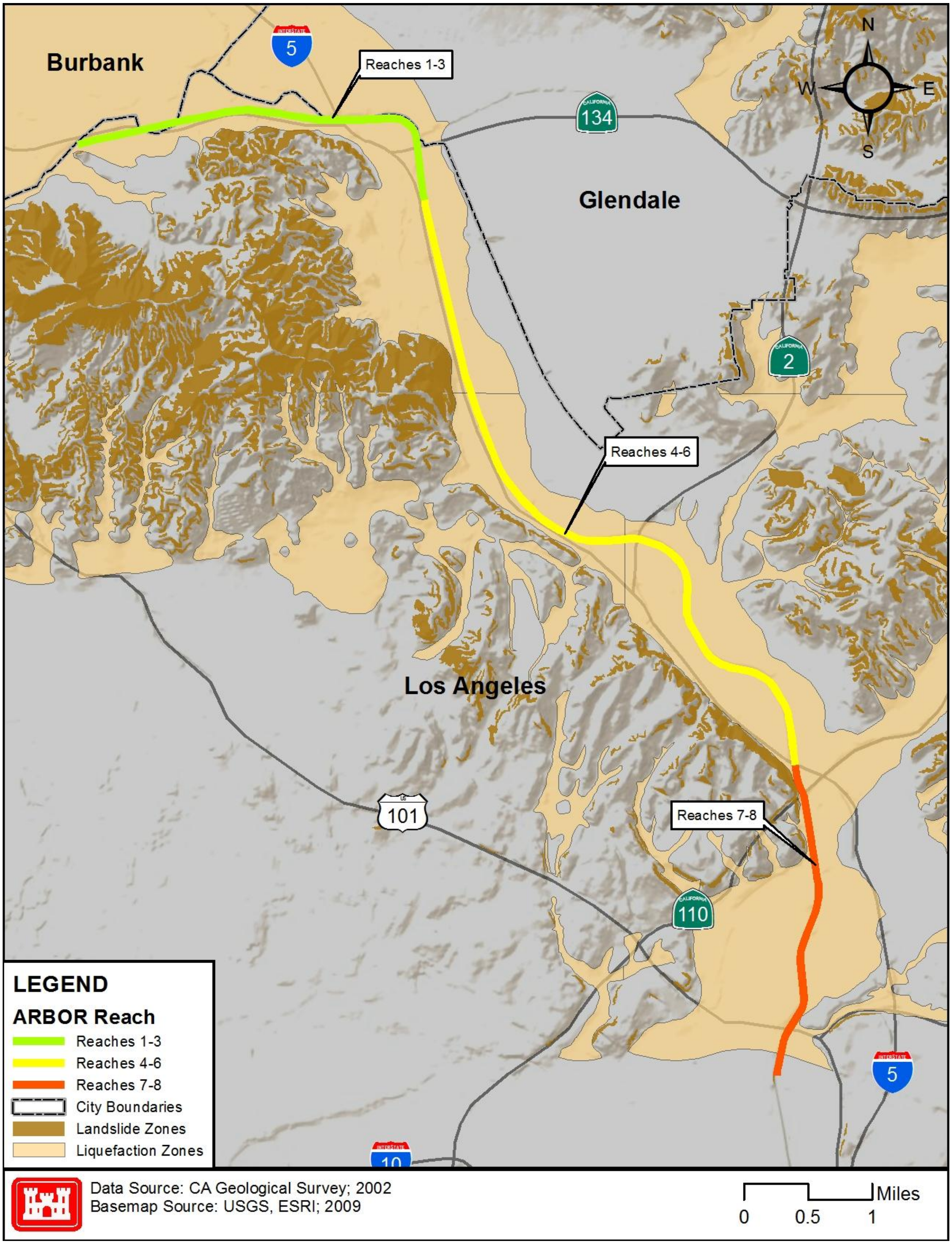


Figure 3-3 Seismicity and Faults



1 *Figure 3-4 Landslide and Liquefaction Zones*

3.2 AIR QUALITY AND GREENHOUSE GASES

This section describes the existing setting for ambient air quality and discusses the applicable air quality regulations in the study area.

3.2.1 Environmental Setting

Area of Influence

The study area is located within the South Coast Air Basin (SCAB) under the jurisdiction of the South Coast Air Quality Management District (SCAQMD). Emissions from construction and operation of the Proposed Project would affect air quality in the immediate Project area and the surrounding region. The air quality area of influence for the proposed project is included in the SCAB, which consists of the urbanized areas of Los Angeles, Riverside, San Bernardino and Orange Counties, and the ocean offshore of the South Coast waters. The SCAB onshore area covers 6,000 square miles.

Climate and Meteorology Conditions

The SCAB lies within the semipermanent high-pressure zone of the eastern Pacific Ocean. The climate of the region is classified as Mediterranean; the climate is generally characterized by warm, dry summers and mild winters with moderate rainfall. Prevailing daily winds in the region are westerly, with a nighttime return flow. This pattern is typically broken five to ten days a year when strong northeasterly winds, commonly known as "Santa Ana Winds," sweep down from the desert.

The SCAB's climate and topography are conducive to the formation of ozone (O_3). The heaviest concentrations of O_3 occur during the summer months when there are warm temperatures, stagnant wind conditions, high solar radiation, and an inversion layer at lower elevations. An inversion layer forms when cooler, denser air is trapped by warmer, lighter air. Sea breezes transport air pollutants to adjacent air basins, such as the Mojave Desert Air Basin and the SSAB. Carbon monoxide (CO) concentrations are highest during the winter, when relatively stagnant air conditions result in an accumulation of this pollutant. Highest CO concentrations are found near heavily traveled and congested roadways (SCAG 1994). However, in the case of particulate matter, maximum concentrations may occur during high wind events or near man-made ground-disturbing activities, such as vehicular activities on roads and earth moving during construction activities.

Winds across the study area are an important meteorological parameter as they control both the initial rate of dilution and direction of pollutant dispersion. Winds blowing from the west are dominant during February and April, and the prevailing winds during March and summer (May through July) blows from the south. During August through January, dominant winds blow from the west-northwest.

Regional and Localized Air Quality

Air pollutant emissions in the SCAB are generated from stationary, mobile, and natural sources. Stationary sources can be divided into two major subcategories: point and area sources. Point sources occur at an identified location and usually are associated with manufacturing and industry. Examples are boilers or combustion equipment that produce electricity or generate heat. Area sources are distributed widely and produce many small emissions. Examples of area sources include residential and commercial water heaters, painting operations, portable generators, lawn mowers, agricultural fields, landfills, and consumer products such as barbeque lighter fluid and hair spray. Construction activities that create fugitive dust such as excavation and grading also contribute to area source emissions. Mobile sources refer to emissions from on- and off-road motor vehicles, including tailpipe and evaporative emissions. On-road sources may be operated legally on roadways and highways. Off-road sources include aircraft, trains, and construction equipment. Mobile sources account for the majority of the air pollutant emissions within the air basin. Air pollutants also can be generated by the natural environment such as when fine dust particles are pulled off the ground surface and suspended in the air during high winds.

To protect the public health and welfare, the Federal and state governments have identified five criteria air pollutants and a list of air toxics and have established ambient air quality standards through the Federal Clean Air Act and the California Clean Air Act. The air pollutants for which Federal and state standards have been promulgated and that are most relevant to air quality planning and regulation in the air basins include ozone (O_3), carbon monoxide (CO), suspended particulate matter (PM), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), and lead (Pb). PM comes in a range of sizes. PM emissions are regulated in two size classes: Particulates up to 10 microns in diameter (PM_{10}) and particulates up to 2.5 microns in diameter ($PM_{2.5}$). PM_{10} and $PM_{2.5}$ are so small that they can enter the lungs and cause serious health problems.

Ozone (O_3) is a problematic air contaminant in the SCAB. O_3 is formed from the precursor pollutants volatile organic compounds (VOC) and nitrogen oxides (NO_X). VOC and NO_X react to form O_3 in the presence of sunlight through a complex series of photochemical reactions. As a result, unlike inert pollutants, O_3 levels usually peak several hours after the precursors are emitted and many miles downwind of the source.

Nitrogen dioxide (NO_2) is a byproduct of combustion, such as fuel combustion in power plants and internal combustion engines. Carbon monoxide (CO) is a product of inefficient combustion, principally from automobiles and other mobile sources of pollution. In many areas of California, CO emissions from sources such as wood-burning stoves and fireplaces also can be measurable contributors during cold-weather months. Industrial sources of pollution generally contribute less than 10 percent of ambient CO levels. Peak CO levels occur typically during winter months because of a combination of seasonal contributions from home heating devices and stagnant weather conditions. Sulfur dioxide (SO_2) is produced when any sulfur-containing fuel is burned. Chemical plants that treat or refine sulfur or sulfur-containing chemicals also emit SO_2. Because of the complexity of the chemical reactions that convert SO_2 to other compounds (such as sulfates), peak concentrations of SO_2 occur at different times of the year in different parts of the state, depending on local fuel characteristics, weather, and topography. In moist environments, SO_2 may combine with water to form sulfuric acid, a component of acid rain.

Particulate matter in the air is composed of windblown fugitive dust; particles emitted from combustion sources (usually carbon particles); and organic, sulfate, and nitrate aerosols formed in the air from emitted hydrocarbons, sulfur oxides, and oxides of nitrogen. Lead is found in old paints and coatings, plumbing, and various other materials.

Typically, air pollutants are classified as primary or secondary pollutants. Carbon monoxide, nitrogen dioxide, particulate matter, sulfur dioxide, and lead are considered primary pollutants because they are emitted directly into the atmosphere. Ozone is considered a secondary pollutant because it is formed through a photochemical reaction in the atmosphere with VOCs and NO_X in the presence of sunlight.

Both the Federal and state governments have established ambient air quality standards for outdoor concentrations of various pollutants to protect public health, as shown in Table 3-1. These standards have been set at levels whose concentrations could be generally harmful to human health and welfare and that protect the most sensitive persons from illness or discomfort with a margin of safety.

Table 3-1 Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards [1]		Federal Standards [2]		
		Concentration [3]	Measurement Method [4]	Primary [3,5]	Secondary [3,6]	Measurement Method [7]
Ozone (O_3)	1 Hour	0.09 ppm (180 µg/m^3)	Ultraviolet Photometry	—	Same as Primary Standard	Ultraviolet Photometry
	8 Hours	0.070 ppm (137 µg/m^3)		0.075 ppm (147 µg/m^3)		
Respirable Particulate Matter (PM_{10})	24 Hours	50 µg/m^3	Gravimetric or Beta Attenuation	150 µg/m^3	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	20 µg/m^3		—		
Fine Particulate Matter ($PM_{2.5}$)	24 Hours	No Separate State Standard		35 µg/m^3	35 µg/m^3	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	12 µg/m^3	Gravimetric or Beta Attenuation	12 µg/m^3	15 µg/m^3	
Carbon Monoxide (CO)	8 Hours	9.0 ppm (10mg/m^3)	Non-Dispersive Infrared Photometry (NDIR)	9 ppm (10 mg/m^3)	None	Non-Dispersive Infrared Photometry (NDIR)
	1 Hours	20 ppm (23 mg/m^3)		35 ppm (40 mg/m^3)		
	8 Hours (Lake Tahoe)	6 ppm (7 mg/m^3)		—	—	—
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	0.03 ppm (56 µg/m^3)	Gas Phase Chemiluminescence	0.053 ppm (100 µg/m^3)	Same as Primary Standard	Gas Phase Chemiluminescence
	1 Hour	0.18 ppm (339 µg/m^3)		100 ppb (188 µg/m^3)	None	
Sulfur Dioxide (SO_2)	24 Hours	0.04 ppm (105 µg/m^3)	Ultraviolet Fluorescence	0.14 ppm (for certain areas)	—	Ultraviolet Fluorescence; Spectrophotometry (Pararosaniline Method)[9]
	3 Hours	—		—	0.5 ppm (1300 µg/m^3)	
	1 Hour	0.25 ppm (655 µg/m^3)		75 ppb (196 µg/m^3)	—	
	Annual Arithmetic Mean	-		0.030 ppm	-	
Lead (Pb) [8]	30 Days Average	1.5 µg/m^3	Atomic Absorption	—	—	—
	Calendar Quarter	—		1.5 µg/m^3 (for certain areas)	Same as Primary Standard	High Volume Sampler and Atomic Absorption
	Rolling 3-Month Average	—		0.15 µg/m^3		
Visibility Reducing Particles	8 Hours	Extinction coefficient of 0.23 per kilometer, visibility of ten miles or more (0.07-30 miles or more for Lake Tahoe) due to particles when relative humidity is less than 70%. Method: Beta Attenuation and Transmittance through Filter Tape.		No Federal Standards		
Sulfates (SO_4)	24 Hours	25 µg/m^3	Ion Chromatography			
Hydrogen Sulfide	1 Hour	0.03 ppm (42 µg/m^3)	Ultraviolet Fluorescence			

Pollutant	Averaging Time	California Standards [1]		Federal Standards [2]		
		Concentration [3]	Measurement Method [4]	Primary [3,5]	Secondary [3,6]	Measurement Method [7]
Vinyl Chloride[8]	24 Hours	0.01 ppm ($26\ \mu g/m^3$)	Gas Chromatography			

[1]California standards for ozone, carbon monoxide (except Lake Tahoe), sulfur dioxide (1 and 24 hour), nitrogen dioxide, suspended particulate matter (PM_{10}, and $PM_{2.5}$) and visibility reducing particles, are values that are not to be exceeded. All others are not to be equaled or exceeded. California ambient air quality standards are listed in the table of Standards in Section 70200 of Title 17 of the California Code of Regulations. [2]National standards (other than ozone, particulate matter, and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest eight-hour concentration in a year, averaged over three years, is equal to or less than the standard. For PM_{10}, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 $\mu g/m^3$ is equal to or less than one. For $PM_{2.5}$, the 24-hour standard is attained when 98% of the daily concentrations, averaged over three years, are equal to or less than the standard. [3]Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 torr (760 torr equals to 1 atmospheric pressure). Most measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 torr; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas. [4]Any equivalent procedure that can satisfy the California Air Resources Board (CARB), which gives equivalent results at or near the level of the air quality standard, may be used. [5]National Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health. [6]National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant. [7]Reference method as described by the USEPA. An "equivalent method" of measurement may be used but must have a "consistent relationship to the reference method" and must be approved by the USEPA. [8]CARB has identified lead and vinyl chloride as 'toxic air contaminants' with no threshold level of exposure for adverse health effects determined. These actions allow for implementing control measures at levels below the ambient concentrations specified for these pollutants. Source: CARB 2010a, CARB 2010b, SCAQMD 2007.

While ambient air quality standards have been developed specifically for O_3 and NO_X, there is no state or Federal Ambient Air Quality Standard (AAQS) for VOCs. VOCs include many compounds of carbon. There are certain classes of carbon compounds that are not VOCs, including: carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, ammonium carbonate, and methane, among others. While the state and Federal government agencies have not established ambient attainment levels for VOCs, they have for O_3. Because VOCs react with NO_X through photochemical reactions to form ozone, air districts, including SCAQMD, have provided VOC significance thresholds for study level analysis in order to further limit the levels of VOCs in the atmosphere that could be converted to ozone.

A state or region is given the status of "attainment" or "unclassified" if ambient air quality standards have not been exceeded. A status of "nonattainment" for particular criteria pollutants is assigned if the ambient air quality standard for that pollutant has been exceeded. Once designated as nonattainment, attainment status may be achieved after three years of data showing non-exceedance of the standard. When an area is reclassified from nonattainment to attainment, it is designated as a "maintenance area," indicating the requirement to establish and enforce a plan to maintain attainment of the standard.

California classifies areas of the state as attainment, nonattainment, nonattainment-transitional, extreme or unclassified with respect to the state AAQS.

State and Federal attainment status designations for the SCAB are summarized in Table 3-2.

Table 3-2 Federal and State Attainment Status Designations for the South Coast Air Basin

Air Pollutants	State	Federal
Ozone (1-Hour)	Extreme[1]	-
Ozone (8-Hour)	Nonattainment	Nonattainment - extreme
$PM_{2.5}$	Unclassified	Nonattainment
PM_{10} (24-Hour)	Unclassified	Attainment/Maintenance
PM_{10} (Annual)	Unclassified	Unclassified
NO_2	Attainment	Attainment/Maintenance
CO	Unclassified	Attainment/Maintenance
SO_2	Attainment	Attainment
Lead	Nonattainment	Nonattainment[2]
Particulate Sulfate	Unclassified	-
Hydrogen Sulfide	Unclassified	-
Visibility Reducing Particles	Unclassified	-

[1]CARB classification of ozone ambient concentration exceeding 0.2 ppm. Source: CARB 2011, USEPA 2010.
[2]EPA classification of the Los Angeles area as nonattainment for the 2008 lead standard on November 8, 2011

Air quality problems in the SCAB include periodic violations of Federal and state air quality standards for ozone, PM_{10}, and $PM_{2.5}$. The frequency with which ozone standards have been exceeded has declined significantly over recent decades.

Ambient Air Monitoring Stations

The State and Local Air Monitoring Network Plan provides the results of the annual review of the air monitoring stations in California. These stations house monitoring instruments that measure ambient levels of air pollutants. The closest air monitoring stations to the study area include: (1) Reseda Air Monitoring Station, which is about two miles north of the study area; (2) Burbank West Palm Avenue Air Quality Monitoring Station, which is about 0.5 miles west of the study area; and (3) Los Angeles-North Main Street Air Quality Monitoring Station, which is about 0.5 miles west of the study area.

Table 3-3 presents the exceedance data for 2011 at these three air quality monitoring stations.

Table 3-3 Ozone Exceedances at Air Quality Monitoring Stations (2011)

Pollutant	Measurement	Standard	Reseda	Burbank West Palm Avenue	Los Angeles-North Main Street
Ozone	Highest 1-hour observation, ppm	0.09	0.130	0.120	0.087

Standard set by SCAQMD (2010) and USEPA (2010).

All other pollutants measured at these stations were below threshold.

Toxic Air Contaminants

Toxic air contaminants (TACs) are a diverse group of air pollutants that can affect human health, but without established AAQS. This is not because they are fundamentally different from the pollutants discussed above, but because their effects tend to be local rather than regional. Major sources of TACs are typically industrial plants, which are commonly located near populated centers and impacts from TACs emissions are thus considered local effects.

CARB has designated nearly 200 air contaminants as toxic. Additionally, CARB has implemented control measures for numerous compounds that pose high risks and show potential for effective control. The majority of the estimated health risks from TACs can be attributed to a relatively few compounds, the most important of which are toxic ingredients in the form of particulate matter from diesel-fueled engines. Other TACs include benzenes, toluene and xylene.

Reactive Organic Gases (ROG) ROGs are organic compounds that can react with nitrogen oxides in the atmosphere to form ozone under direct sunlight. Major source of ROG are coatings and solvents.

Secondary PM2.5 Formation

Within the SCAB, PM2.5 particles are directly emitted into the atmosphere (i.e., primary particles) and are formed through atmospheric chemical reactions from precursor gases (i.e., secondary particles). Primary PM2.5 includes diesel soot, combustion products, road dust, and other fine particles. Secondary PM2.5 is formed from reactions with directly emitted NOX, sulfur oxides (SOX), VOCs, and ammonia some distance downwind of the emission sources. However, the air quality analysis in this EIR/EIS focuses on the effects of direct PM2.5 emissions and their ambient impacts. This approach is consistent with the recommendations of the SCAQMD.

Sensitive Receptors

The impact of air emissions on sensitive members of the population is a special concern. Sensitive members of the population include those that may be more negatively affected by poor air quality than other members of the population, such as children, the elderly, or the infirm. Schools, hospitals, and convalescent homes are considered sensitive land uses because children, the elderly, and the infirm are more susceptible to respiratory distress and other air-quality-related health problems than the general public.

Greenhouse Gases

Gases that trap heat in the atmosphere are often called greenhouse gases (GHGs). GHGs are emitted by natural processes and human activities. Examples of GHGs that are produced both by natural processes and industry include carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O). Examples of GHGs created and emitted primarily through human activities include fluorinated gases (hydrofluorocarbons [HFCs] and perfluorocarbons [PFCs]) and sulfur hexafluoride (SF6).

The accumulation of GHGs in the atmosphere regulates the earth's temperature. Without these natural GHGs, the earth's surface would be about 61°F cooler (AEP 2007). However, emissions from fossil fuel combustion for activities such as electricity production and vehicular transportation have elevated the concentration of GHGs in the atmosphere above natural levels. According to the Intergovernmental Panel on Climate Change (IPCC 2007), the atmospheric concentration of CO2 in 2005 was 379 ppm compared to the pre-industrial levels of 280 ppm. In addition, the Fourth U.S. Climate Action Report concluded, in assessing current trends, that CO2 emissions increased by 20% from 1990 to 2004, while methane and nitrous oxide emissions decreased by 10% and 2%, respectively.

There appears to be a close relationship between the increased concentration of GHGs in the atmosphere and global temperatures. Scientific evidence indicates a trend of increasing global temperatures near the earth's surface over the past century due to increased human-induced levels of GHGs.
GHGs differ from criteria pollutants in that GHG emissions do not cause direct adverse human health effects. Rather, the direct environmental effect of GHG emissions is the increase and/or change in global temperatures, which in turn has numerous indirect effects on the environment and humans. For example,

some observed changes include shrinking glaciers, thawing permafrost, later freezing and earlier break-up of ice on rivers and lakes, a lengthened growing season, shifts in plant and animal ranges, and earlier flowering of trees (IPCC 2001). Other, longer term environmental impacts of global warming may include sea level rise, changing weather patterns with increases in the severity of storms and droughts, changes to local and regional ecosystems including the potential loss of species, and a significant reduction in winter snow pack (for example, estimates include a 30 to 90% reduction in snow pack in the Sierra Nevada mountain range). Current data suggest that in the next 25 years, in every season of the year, California could experience unprecedented heat, longer and more extreme heat waves, greater intensity and frequency of heat waves, and longer dry periods. More specifically, the California Climate Change Center (Roland-Holst 2006) predicted that California could witness the following events:

- Temperature rises between 3 to 10.5ºF
- 6 to 20 inches or more of sea level rise
- 2 to 4 times as many heat-wave days in major urban centers
- 2 to 6 times as many heat-related deaths in major urban centers
- 1 to 1.5 times more critically dry years
- 10 to 55 percent increase in the risk of wildfires

3.3 LAND USE

This section discusses the land use within and near the study area. Land uses typically include habitation, economic production, institutional uses, recreation, and natural resources conservation. The River channel flows through the central corridor of the study area, flanked by maintenance roads. The SR-134 and I-5 Freeway run close alongside the river for much of its length in the study area. A LADWP utility corridor runs alongside the north and east side of the channel. Other surrounding land uses include Griffith Park, state and local parks including Los Angeles State Historic Park and Taylor Yard, industrial areas at Piggyback Yard and the mouth of Verdugo Wash, and residential areas near Bette Davis Park and Pollywog Park. Land uses are displayed in Figure 3-5 through 3-7.

Land use is guided and influenced by management plans, policies, zoning ordinances, and regulations that determine the types of uses allowable and occur at the Federal, state, regional, and local levels. The City of Los Angeles and other municipalities have regulatory authority for land use within the study area. Regional land use management is provided by the Southern California Association of Government (SCAG) Regional Comprehensive Plan and Guide. Local management is found in various land use plans and policy documents such as the General Plans of the Cities of Los Angeles, Glendale, and Burbank and the associated Community Plans and Specific Plans for those communities that fall within and adjacent to the study area. These guidelines and regulations are discussed below.

Management of land uses in the study area includes the USACE and the LACFCD if those uses have potential to affect the flood risk management function of the LACDA system. The water is owned by the local jurisdiction, the Los Angeles Department of Water and Power, a subdivision of the City of Los Angeles, through long-held pueblo rights that have been subject to numerous legal interpretations over the years and will not be further discussed in this section.

3.3.1 Land Management and Administration Agencies and Organizations

The USACE and Los Angeles County have jurisdiction over the River and its major tributaries for flood risk management. These agencies maintain service roads along the channels for inspection and study area maintenance activities. Although the USACE is responsible for the actual flood risk infrastructure, it does not own the River channel itself. The channel is largely owned by the LACFCD and the City of Los Angeles along with others. Maintenance of the channel and associated appurtenances within the study area is the responsibility of the USACE. Maintenance of the Arroyo Seco and Verdugo Wash within the study area is the responsibility of LACDPW. Operation and maintenance of the river and tributaries for flood risk management purposes is conducted in accordance with the LACDA OMRRR Manual, and construction activities, channel modifications, and other uses of and within the river channel may not conflict with the flood risk management purpose and flood risk management operation and maintenance needs.

Sponsored by the LACFCD, the Integrated Regional Water Management Plan is intended to define a clear vision and direction for the sustainable management of water resources in the greater Los Angeles County region through at least the year 2025, to present the basic information regarding possible solutions, and the costs and benefits of those solutions, and to inspire the region and potential funding partners outside the region that these solutions make sense, are good for the community, and are economically feasible. The draft plan was released for comment in 2006, and is still in draft form to date. The plan includes proposed projects within the study area and identifies priority projects for initial funding and implementation (Los Angeles County 2006, 2012).

The Rio de Los Angeles State Park (247 acres) extends into Reach 5 and is jointly managed by California State Parks and the Los Angeles Department of Parks and Recreation. The Los Angeles State Historic Park along Reach 7 (32 acres) is under development with funds from the California State Parks system (California State Parks 2009).

SCAG is the primary regional planning agency for Southern California. SCAG represents six counties, including Los Angeles County, and approximately 18 million people. SCAG’s Intergovernmental Review section is responsible for performing consistency review of regionally significant local plans, projects, and programs with SCAG’s adopted regional plans. SCAG’s criteria for determining regional significance include any proposed local General Plan, element, or amendment thereof for which an EIR was prepared.

The LACFCD developed the Los Angeles River Master Plan for the entire 51-mile reach of the River in 1996. It provides planning for the optimization and enhancement of aesthetic, recreational, flood risk management, and environmental values by creating a community resource, enriching the quality of life for residents and recognizing the River’s primary purpose for flood risk management (LACDPW 1996). The master plan also includes published guidelines for landscaping (LADPW 2004b) and signage (LADPW 2003). This plan and its associated goals, objectives, and design guidelines serves as a guide to the development of subsequent River planning and development efforts.

The City of Los Angeles developed and adopted the Los Angeles River Revitalization Master Plan in 2007. The plan is a 20- to 50-year planning document for revitalizing the first 32 miles of the River that flow through the City of Los Angeles (and which flow along the cities of Burbank and Glendale in the study area). In an effort to explore the potential for expanded revitalization of the River, the plan identified community revitalization measures as well as natural resource, recreation, and open space opportunities in a manner that reflects the unique geographic and existing land use patterns of these areas and, for the first time, called for changes to the river’s concrete channel. The Plan’s proposed community reinvestment opportunities were designed with local communities in mind to achieve economic redevelopment and revitalization objectives that include, but are not limited to, replacing aging infrastructure and addressing land uses changes to ameliorate blight, encourage the attraction and retention of family-sustaining jobs and foster stability in existing neighborhoods. This plan is further described elsewhere in this IFR.

3.3.2 Applicable General Plans

California state law (Government Code Section 65300 et seq.) requires that each city prepare and adopt a comprehensive, long-term General Plan for its future development. The General Plans must contain seven elements, including land use, circulation, housing, conservation, open space, noise, and safety. In addition to these, state law permits cities to include optional elements in their General Plans, thereby providing local governments with the flexibility to address the specific needs and unique character of their jurisdictions. In the City of Los Angeles, the General Plan contains citywide elements for all topics except land use for which community plans establish policy and standards for each of the 35 community planning areas. The General Plans of the Cities of Glendale and Burbank also include land use elements. More specifically, Government Code Sections 65860, 66473.5, and 656474 require that zoning ordinances and subdivision and parcel map approvals be consistent with the General Plan (State of California 2012).

Table 3-4 Community Planning Areas within or near the Study Area

Community Planning Area	Reaches
Hollywood	1-5
Northeast Los Angeles	3-6
Silverlake/Echo Park/Elysian Valley	5-6
Central City North	6-7
Central City	7-8
Boyle Heights	7-8

The land use element of the City of Los Angeles General Plan is composed of 35 Community Plans. These plans are the official guide to future development in the City, and are intended to promote an arrangement of land uses that foster economic growth, as well as the social and physical health of the people who live and work in these communities. The Community Plan Areas within the study area are shown in Table 3-4.

Additionally, specific plans are sometimes developed to describe allowable land uses, to identify open space, and to detail infrastructure availability and financing for a portion of a community. Specific plans implement, but are not technically a part of, the General Plan. Los Angeles, Glendale, and Burbank have various specific plans throughout their cities. A specific plan may not be adopted or amended unless the proposed plan or amendment is consistent with the General Plan pursuant to State Code (65454). Zoning, subdivision, and public works projects must be consistent with the General Plan and specific plan pursuant to §65455 (State of California 2012).

3.3.3 Land Use Plans Under Development

Located within the Central City North and Northeast Los Angeles Community Plans is the Cornfield Arroyo Seco Specific Plan (effective 8/13/13) created as a direct result of the LARRMP (City of Los Angeles 2007). Reflecting many of the recommended changes put forth in the LARRMP, the plan changes much of the existing zoning from industrial to new zoning designations and zoning districts. One example of a new zoning designation would be Hybrid Industrial. The use of zoning districts is based on development intensity and use mix instead of segregated land use zones. The zoning districts would include Greenway, Urban Center, Urban Innovation, and Urban Village.

The Los Angeles River Improvement Overlay (LA-RIO) District is a special use district that was proposed by the Department of City Planning in 2009, updated in 2012, passed by the City Planning

Commission, and is now being considered for adoption by the Los Angeles City Council. The LA-RIO would implement many of the design and land use goals proposed in the LARRMP. The purpose of the overlay district, which includes approximately 2,500 feet on either side of the River, is to support the goals of the LARRMP, contribute to the environmental and ecological health of the City's watersheds, establish a positive interface between river adjacent property and river parks/ and or greenways, promote pedestrian, bicycle and other multi-modal connections between the River and its surrounding neighborhoods, provide native habitat and support local species, provide an aesthetically pleasing environment for pedestrians and bicyclists accessing the River area, and promote the river identity of river adjacent communities. The LA-RIO establishes landscaping and urban design standards that will be required of all future development projects within the LA-RIO District. All of the study's reaches are within the LA-RIO District.

3.3.4 Land Use in the Study Area

Land uses in the study area include parkland, residential, industrial, and commercial. It is also a major transportation corridor, with the I-5 and SR-134 adjacent to much of the river corridor. The areas upstream of the study area have similar uses. Descriptions of general land use designations are shown in Table 3-5. Within the study area, open space/recreation is the most prevalent type of land use in the study area followed by industrial, at approximately 59 and 25 percent, respectively (Table 3-5). These are the primary land use categories potentially most affected by implementation of the proposed project.

Table 3-5 Land Use Acreages and Percent of Total in Study Area

Land Use Category	Types of Land Uses in Category	Acres	Percent
Commercial	Retail uses, professional offices, business parks.	1.69	0.24%
Industrial	Manufacturing activities, warehouse and storage, utilities and substations, freight operations.	195.96	25.24%
Open Space/Recreation	Environmentally sensitive habitat, wildlife refuge/preserve, river, stream or floodplain, coastal bluff, vacant urban land. State, county, city parks or beach, recreation facility, cultural center, golf course, campground.	455.61	58.68%
Public Facilities	Major facilities built and maintained for public use such as civic buildings, airports, military installations, hospitals, water and sewer facilities, maintenance yards, roads, freeway, and river channels.	113.78	14.84%
Residential	Single and multiple family residential, condominium and apartment, mobile homes, hillside management area.	9.76	1%
Total Study Area		**776.80**	**100.00%**

Open Space/Recreation

The study area contains many existing recreational amenities. Reaches 1-3 include portions of one of the City of Los Angeles' oldest and largest parks, Griffith Park. With a wide variety of uses from large preserved open space to the zoo and golf courses, Griffith Park affords many opportunities for wildlife and habitat enhancement. Reaches 4-6 contain some of the City's newest parks including Rio de Los Angeles State Park at Taylor Yard, and the City's oldest park, Elysian Park. There are a number of small "pocket parks" adjacent to the River in these reaches that have been developed by various agencies as part of the overall effort to green the River and make it more accessible. In Reaches 7-8, the Los Angeles State Historic Park is on a site formally known as the Cornfields. The Los Angeles River bikeway runs along the west side of the River (from Zoo Drive near Griffith Park to Barclay Street in Elysian Valley-approximately 10 miles) directly connecting some of the smaller parks; the bikeway is a multi-year effort to connect the entire River from the San Fernando Valley to Long Beach. There are plans currently underway to expand or build parks on parcels adjacent to the River; this trend is likely to continue even without alterations to the River flood conveyance infrastructure.

Residential

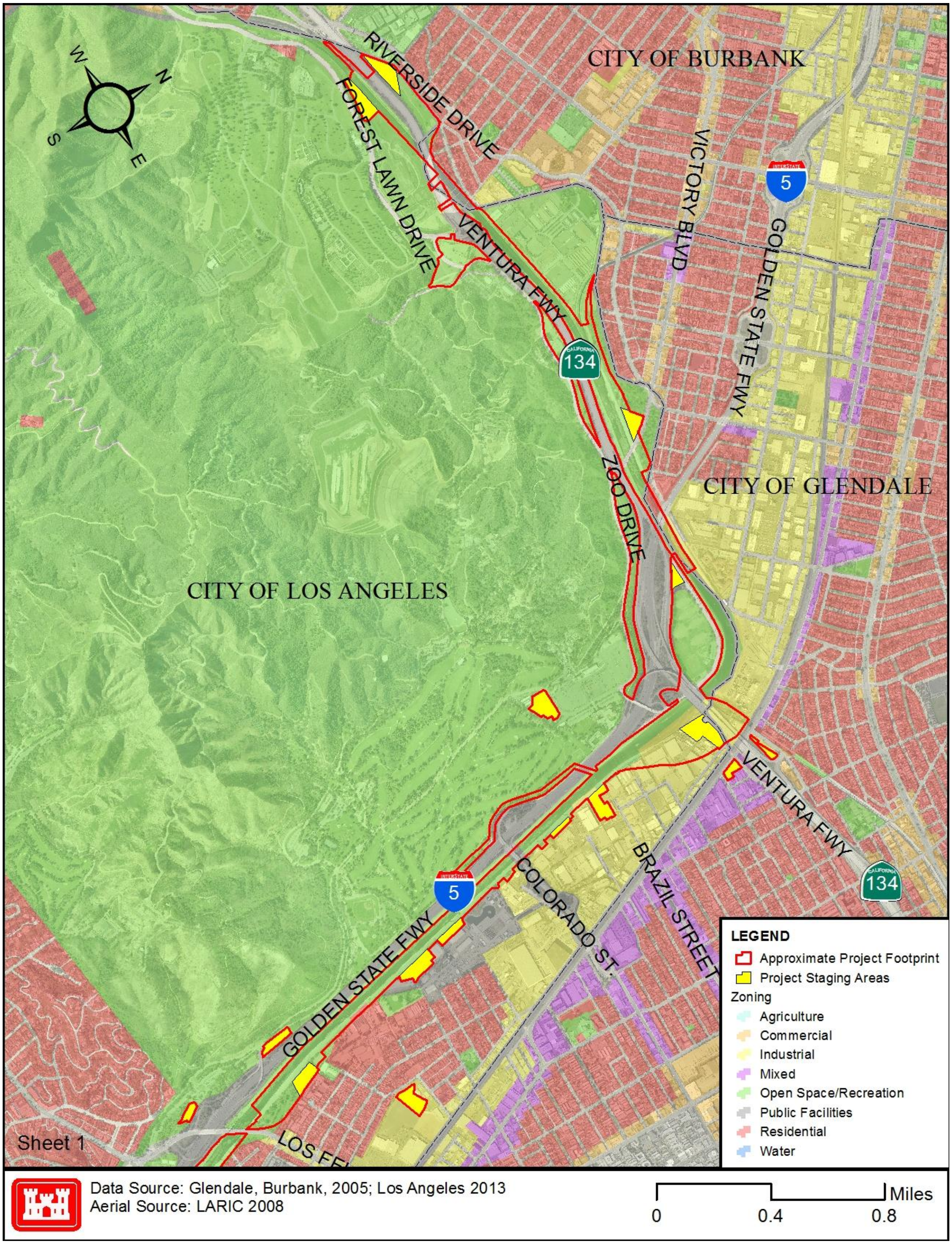
Residential neighborhoods line many parts of the River and include both single and multiple family dwellings. Downtown Los Angeles (Reaches 7-8) has seen an increase of residences due to a change in zoning laws promoting residential uses and many buildings are being re-purposed as residences. Despite being stalled by the recession beginning in 2008, the number of people residing in Downtown Los Angeles is likely to increase. As other parts of the study area are already built out, some increase in density may occur as the result of rehabilitating or changing housing stock, but uses are unlikely to dramatically change.

Industrial

At some locations, industrial enterprises are directly adjacent to the River, especially near SR 134 in Reaches 1-3, the neighborhoods of Atwater Village and Elysian Valley in Reaches 4-6, and south of Elysian Park as the River flows into downtown LA. Many of the older industrial facilities in all the study areas may be ripe for conversion to other purposes. However, because there is a desire on the part of the cities to preserve jobs, changes to zoning may not be forthcoming in the near future. Heavy rail, rail yards and utility lines are adjacent to the River on its east side, most notably Piggyback Yard (Mission Yard) in Reaches 7-8. Rail lines are found on both sides of the River south of the confluence with the Arroyo Seco.

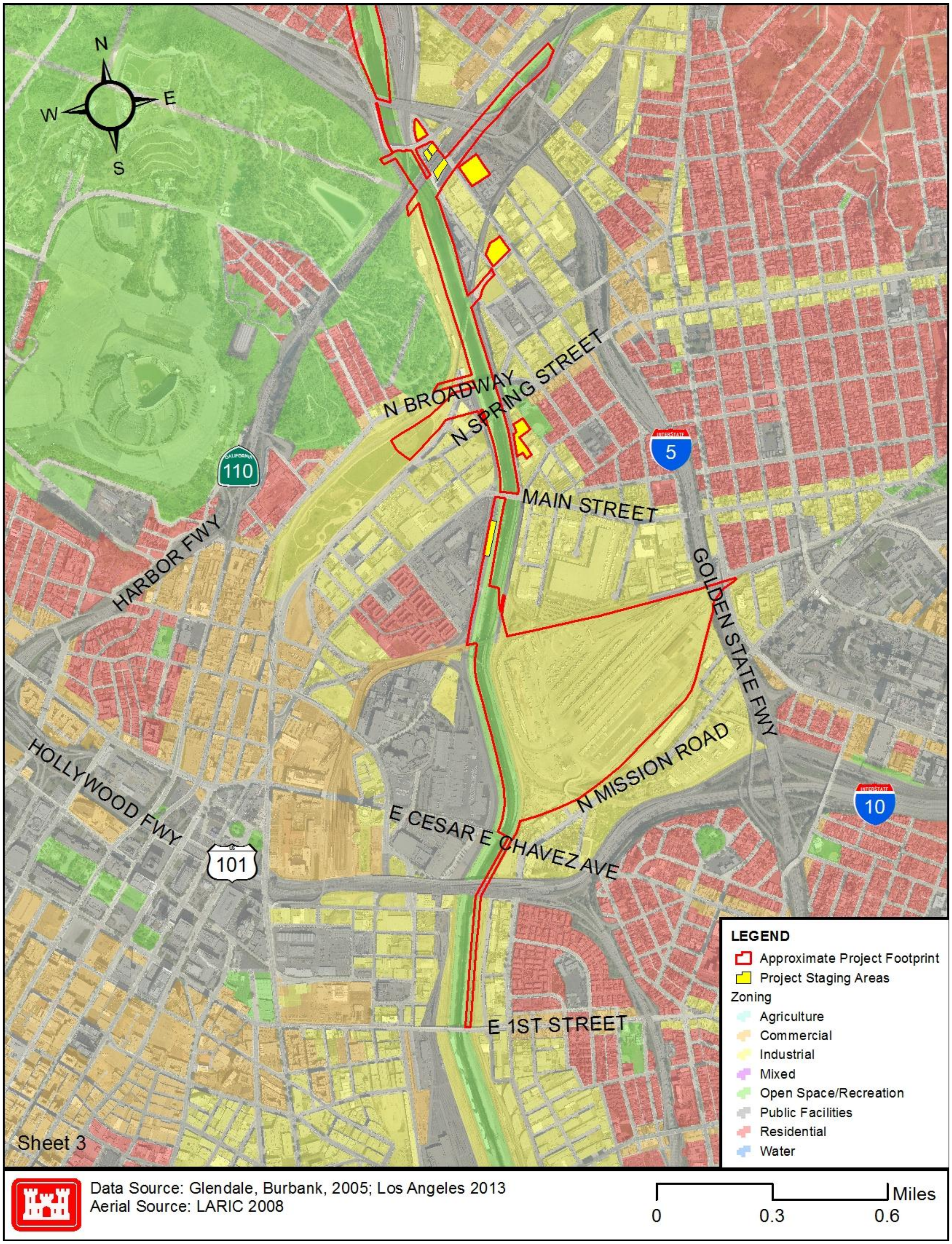
Public Facilities

In addition to recreation, the City of Los Angeles owns and maintains a number of parcels in the study area for various purposes. In Reaches 1-3 these include the Los Angeles/Glendale Water Treatment Plant, which treats sewage to advanced tertiary treatment and discharges to the River. Just downstream of the plant on the east side, LA Department of Recreation and Parks have a large maintenance facility-the Central Service Yard. Adjacent to the confluence of the River and Arroyo Seco in Reaches 4-6, the City operates a trash and recycling center transfer facility. Downstream of the area on the east side is the old City Jail in Lincoln Heights and a tow yard facility at the corner of Pasadena Avenue and Avenue 19. The LADWP facility at Main Street and the River has a maintenance yard used for repairs to both water and power infrastructure. Some of these parcels have been in discussion for conversion to other uses; however, the costs of relocating such facilities and finding other suitable sites for these activities have been severely limiting factors. Major freeways in the area include I-5 and SR-134.



1 *Figure 3-5 Land Use, Reaches 1-3*

Figure 3-6 Land Use, Reaches 4-6



1 *Figure 3-7 Land Use, Reaches 7-8*

3.4 WATER RESOURCES

3.4.1 Los Angeles River

The Los Angeles River watershed has a total drainage area of 570 square miles at its downstream study area boundary at First Street. The principal tributaries of the study area include Burbank Western Channel, Verdugo Wash, and Arroyo Seco. The main channel of the River is 51 miles long, and the study area has a stream length of 11.5 miles. Its tributaries have an aggregate length of 40.6 miles (from their headwaters). Stream slopes range from very steep in the mountain tributaries with slopes commonly over 200 feet per mile (3.8 percent) to approximately 3 feet per mile (less than 1 percent) in the River mainstem and coastal plain.

Impervious drainage in the study area is estimated to be 32 percent of ground cover, based on assumptions of impervious areas of each land use type in the River watershed (LADPW 2005). Due to the high amount of impervious surfaces in the drainage area, water makes its way to the storm drains, creeks, and eventually to the River in a short time. Flood hydrographs from single storm events are typically of less than 12 hours duration and are almost always less than 48 hours duration. An example of the quick response (flashiness) to excess rainfall occurred in February 1980 when the flow rate increased from approximately two-thirds of the channel capacity (86,000 cfs) to full (129,000 cfs) in the River at Wardlow, located 0.5 miles downstream of the 405 Freeway, in less than an hour (USACE 1991).

Shallow surface soils, impervious bedrock, fan-shaped stream systems, steep gradients, and occasional denudation of the area by fire result in intense debris-laden floods. However, flood and debris flows are regulated at dams and debris basins.

Flooding

The Los Angeles River is a central component in the LACDA flood risk management project. Federal flood risk management improvements in the reach of the Los Angeles River being studied in this IFR were first authorized for construction under Emergency Relief Acts, then authorized by the Flood Control Act of June 1936, as amended by the Flood Control Acts of 1937 and 1938. Modifications to the Los Angeles River channel have been addressed in later Flood Control Acts. Design discharges of the Los Angeles River range from 40,000 ft^3/s to 104,000 ft^3/s within the study area. A complete list of design flows for all 8 reaches in the study area can be found in Table 14 of the Hydrology and Hydraulics Appendix (Appendix E).

The Los Angeles River as originally constructed within the study area from the 1930s to the 1950s was designed to convey a design flood, not a specific frequency event such as the 1% ACE (100-year) event. The Corps studied improvements to flood risk management conveyance capacity along the Los Angeles River in its 1992 LACDA Review. The 1992 LACDA Review Feasibility Study showed that the LACDA channel and dam flood control system had a relatively low level of flood protection for a metropolitan area. This low level of protection was and is attributable to the following factors: (1) the original design storm, which was based upon the Capital Flood/Standard Project Flood concept in use in the 1930s was too small; (2) modern day freeboard requirements for flood control channel design means that the safe conveyance capacity of a portion of the Los Angeles River is significantly lower than the original design capacity with a lower freeboard; and (3) the increased runoff response of the watershed due to intensive urbanization produces a higher peak discharge for the same rainfall event.

Although the Corps was authorized to upgrade flood risk management features for the Los Angeles River downstream of the Rio Hondo confluence to provide for the 0.8 ACE event (133 year), no upgrades were authorized for the upper Los Angeles River including the ARBOR reach. Flood risk management upgrades within the study area were not found to be economically justified in the 1992 review. Therefore, the flood risk management design conveyance capacity remains far less than the 1% ACE. Existing vegetation within the channel further decreases the conveyance capacity below that of design.

As described in the Hydrology and Hydraulics Appendix, inundation mapping was generated for the 4% ACE (25-year), 2% ACE (50-year), 1% ACE (100-year), and the 0.2% ACE (500-year) events using the most current survey data. The floodplain maps show significant floodplain areas for all the flood events that were analyzed. The channel has two major breakout areas within the ARBOR reach in the non-concrete bottom reaches. The upstream area with extensive overbank flooding is between Barham Boulevard and the confluence with Verdugo Wash and has an average floodwater depth of 5.2 feet in the overbank areas during the 1% ACE (100-year) event. The downstream area with extensive overbank flooding is from the Verdugo Wash confluence to the Golden State Freeway, where the in-channel vegetation ends, and has an average floodwater depth of 3.9 feet in the overbank areas during the 1% ACE (100-year) event. Floodplain mapping can be found within Appendix E.

Levees

The National Levee Database indicates that five levees are within the study area. Each of these levees is maintained by the Federal government and is designed to provide 100-year flood protection. These include LAR 2, LAR 3, LAR 5, LAR 6, and LAR 7 and are found in Reaches 2 to 5, and Reach 7. Additional information pertaining to the levees is found in Appendix D, Geotechnical.

3.4.2 Los Angeles River Study Area Tributaries

The Burbank Western Channel originates in La Tuna Canyon in the northern end of the Verdugo Mountains and conveys 25 square miles of drainage to its confluence with the Los Angeles River at the downstream portion of Reach 1 (Figure 3-1). As seen in Table 3-6, the Burbank Western Channel adds 15,000 cfs during design flows. The channel’s design flows are between the 200-year (0.5 percent annual exceedance chance) and 500-year (0.2 percent annual exceedance chance) event frequency discharges.

As the River bends to the south, the Verdugo Wash joins from the east in Reach 3 (Figure 3-1). Draining approximately 28.8 square miles, including the City of Glendale, the Verdugo Wash is a concrete-lined channel. Maximum daily peak flows in the lower reaches of Verdugo Wash are typically less than 400 cfs, with many years actually measuring peaks of considerably less than 100 cfs. However, maximum daily peak flows have occasionally exceeded 1,000 cfs. As seen in Table 3-6, Verdugo Wash adds 42,900 cfs during design flows. The channel’s design flows are well above the 0.2 percent ACE (500-year) frequency discharge. Downstream of the confluence of Verdugo Wash, the River flows through what is colloquially known as the Glendale Narrows. All of the water from the San Fernando Valley funnels through this narrow passage between the hills.

The 22-mile-long Arroyo Seco drains the southwestern section of the San Gabriel Mountains. Starting high in the San Gabriel Mountains and running through Pasadena near the Rose Bowl, it continues through South Pasadena to meet the River at Reach 6 just north of downtown Los Angeles (Figure 3-1). The Arroyo Seco flows through the communities of La Canada-Flintridge, Altadena, Pasadena, South Pasadena, and northeast Los Angeles with a watershed of approximately 47 square miles (Figure 3-1). The upper Arroyo Seco watershed is in the Angeles National Forest and is managed for recreation, watershed protection, and wildlife conservation. The upper watershed is generally undeveloped, whereas the lower portion is highly urbanized. As seen in Table 3-6, Arroyo Seco adds 43,000 cfs during design flows; the Arroyo Seco channel’s design flows are well above the 0.2 percent ACE (500-year)frequency discharge.

Table 3-6 Tributary Frequency Discharges

Arbor Reach	RS	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year	Design
Burbank Western	18+04	2,150	4,320	4,990	7,040	8,360	12,400	14,200	16,900	15,000
Verdugo Wash	12+62	3,790	7,550	8,720	12,700	15,100	23,200	26,500	30,300	42,900
Arroyo Seco	9+26	1,500	3,200	4,190	10,200	12,500	17,700	22,200	26,400	43,000
Source: USACE 2012a.										

3.4.3 Surface Water Quality

Water quality in the study area is affected by point source and non-point source pollution entering tributaries and the main channel of the River. The River is an effluent-dominated waterbody. Nearly 70 percent of the volume in the River is from Water Reclamation Plant tertiary-treated effluent discharged outside of storm events (Ackerman 2003). Although groundwater interactions exist (particularly in the Glendale Narrows and Arroyo Seco tributary), the majority of storm drain discharges are believed to arise from urban discharges.

Stormwater runoff and associated contaminants found in the study area are from surrounding urban areas and are the prominent sources of water quality degradation. Runoff from pervious and impervious areas (i.e., streets, parking lots, lawns, golf courses and agricultural land) carry accumulated contaminants (i.e., atmospheric dust, trace metals, street dirt, hydrocarbons, fertilizers and pesticides) directly into receiving waters. The Southern California Coastal Water Research Project (SCCWRP) conducted a stormwater sampling program over five seasons (2000 through 2005) to characterize the effect of stormwater on water quality. Constituent concentrations were measured over entire storm durations from eight different land use types over 11 storm events in five watersheds in the greater Los Angeles region (SCCWRP 2007). These data were collected to better characterize contributions of specific land use types to loading of bacteria, trace metals, and organic compounds and to provide data for watershed model calibration.

The 2007 SCCWRP study found that all pollutants were strongly correlated with high levels of total suspended solids (TSS), and the highest concentrations of TSS were correlated with urbanized land uses and degraded watershed habitat. Stormwater sampling revealed that TSS concentrations were higher in early season storms (October – December) than late season storms (April-May), which suggests that the amount of time available for pollutant buildup affects the magnitude of pollutants; there is a longer period of time (summer months) before early season storms in comparison to late season storms.

Stormwater runoff from watershed and land use-based sources is a significant contributor of pollutant loading and often exceeds water quality standards. Results indicate that urban stormwater is a substantial source of a variety of constituents to downstream receiving waters. Substantially high constituent concentrations were observed throughout the study, and constituent concentrations frequently exceeded water quality criteria.

All constituents were strongly correlated with TSS. High TSS loads in rivers contribute to water quality impairments, habitat loss, and excessive turbidity, resulting in impairments in recreational, fish/wildlife, and water supply designated uses of the rivers. These results suggest that controlling TSS at specific land uses may reduce other particle-bound constituents.

Land use-based sources of pollutant concentrations and fluxes varied by constituent. No single land use type was responsible for contributing the highest loading for all constituents measured. Industrial land use sites contributed higher trace metals than other land use types. Recreational (horse) land use sites contributed significantly higher storm fluxes for E. coli, while agricultural land use sites contributed the highest TSS fluxes. Substantially higher TSS fluxes were also observed at the industrial sites.

Stormwater runoff of trace metals from the urban watersheds in this study produced a similar range of annual loads as those from point sources such as large publicly owned treatment plants. When combined with estimates of pollutant loading during dry conditions, the total non-point source contribution from all watersheds in the greater Los Angeles area far exceeds that of the point sources.

Stormwater runoff concentrations improved over time when compared with the Nationwide Urban Runoff Program. Results showed an improvement in water quality between constituent concentrations reported by the program in 1983 and those observed in this study. Long-term overall trends of decreasing median constituents were observed at all land uses with the exception of total zinc, which showed an increase over the course of the studies. For example, lead concentrations have exhibited a 10-fold reduction over the last 20 years. The decreasing concentrations of lead observed in these studies can most probably be attributed to regulations banning the use of leaded gasoline.

Peak concentrations for all constituents were observed during the early part of the storms. For all storms sampled, the highest constituent concentrations occurred during the early phases of stormwater runoff (first flush) with peak concentrations usually preceding peak flow. In all cases, constituent concentrations increased rapidly, stayed high for relatively short periods, and often decreased back to base levels within one to two hours.

Because the Los Angeles region is so densely populated and industrialized, the quality of its surface water runoff is typically degraded. Baseflow in the River is substantially affected by permitted discharges associated with industry and municipal water treatment. The Clean Water Act National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Industrial, municipal, and other facilities must be permitted if their discharges go directly to surface waters. There are two general types of permits: individual permits are specifically tailored to an individual facility based on the type of activity, nature of discharge, and quality of receiving water while general permits cover multiple facilities within a specific category and region (USEPA 2006).

Section 303(d) of the CWA requires states to develop lists of impaired waters that do not meet established water quality standards (State Water Resources Control Board [SWRCB] 2010a). Water quality standards are developed in order to protect existing watershed beneficial uses identified by the SWRCB, and designated in specific regions by local regional boards. The Los Angeles Regional Water Quality Control Board has designated over 25 beneficial uses for the Los Angeles region, ranging from recreation and wildlife to resource extraction and hydropower (SWRCB 1994). Specific to the study area the following surface water beneficial uses have been designated for the mainstem and tributaries:

- <u>Municipal (MUN)</u> Water used for military, municipal, individual water systems, and may include drinking water.
- <u>Recreation 1 (REC1)</u> Uses of water body for recreational activities, where skin contact with water is probable, and the potential for ingestion of water is possible (swimming, wading, surfing, fishing, etc.).
- <u>Recreation 2 (REC2)</u> Recreational activities are near water body, but skin contact with water body is unlikely (picnicking, sunbathing, beachcombing, camping, hiking, sightseeing, etc.).
- <u>Warm Freshwater Habitat (WARM)</u> Uses that support warm water ecosystems for preservation or enhancement of aquatic habitats, vegetation, fish, wildlife, and aquatic invertebrates.
- <u>Coldwater Habitat (COLD)</u> Uses of water that support cold water ecosystems for the preservation and maintenance of aquatic habitat and wildlife species (flora and fauna).

- Wildlife Habitat (WILD) Uses of water that support terrestrial ecosystems.
- Wetland Habitat (WET) Uses of water that support wetland habitat.

The CWA requires the states to establish priority rankings for waters on the lists and to develop total maximum daily loads (TMDLs) for these waters. A TMDL specifies the maximum amount of a pollutant that a water body can receive and still meet water quality standards and allocates pollutant loadings among point and nonpoint pollutant sources. The USEPA must approve or disapprove lists and TMDLs. All three major tributaries converging with the River within the study area are water quality impaired. Water quality impairments within the study area tributaries include indicator bacteria, in-stream health (benthic macro-invertebrate indicators), metals (copper, lead, and selenium), cyanide, and trash.

The study area mainstem on the River is also listed as impaired for a number of pollutants: ammonia, copper, cyanide, indicator bacteria, lead, benthic macroinvertebrates, nutrients (algae), oil, selenium, and trash. Some of these constituents are of concern throughout the watershed. TMDLs in the River watershed, which includes upstream of and within the study area, have been developed for bacteria, metals, nutrients, and trash pollutants. Following is a summary of each TMDL.

The bacteria TMDL came into effect on March 23, 2012 due to high levels of bacteria not protective of beneficial uses. Bacteria levels are used to indicate the potential for human and non-human sources of pathogens and pollutants. The watershed, which includes all tributaries in the study area, upstream of the study area, and the southern study area from Figueroa downstream to First Street, is highly contaminated by bacteria (SWRCB 2010b). Bacteria impairments are not supportive of REC1 and REC2 uses, which include swimming, wading, fishing, picnicking, sunbathing, beachcombing, camping, hiking, and sightseeing.

In June 2005, the Regional Water Quality Control Board (RWQCB) adopted the TMDL for metals. Reaches of the River, which includes the entire study area and tributaries, are listed as impaired for copper, cadmium, lead, zinc, aluminum, and selenium. Numeric water quality targets are based on the numeric water criteria established by the California Toxics Rule (SWRCB 2005). Currently, watershed permitees are in the implementation phase of the TMDL process (SWRCB 2010c).

The current TMDL for trash was adopted by the RWQCB in September 2008 and is applicable for the study area and tributaries. Trash impairments are not protective of REC1, REC2, WARM, WILD, COLD, and WET beneficial uses (SWRCB 2007).

The nitrogen TMDL became effective on March 23, 2004 for the River main channel and tributaries due to impairments from nitrogen compounds and related effects, such as algae, pH, odor, and scum. These reaches were listed because water quality objectives for nitrogen compounds and related effects were exceeded, thereby impairing freshwater, wildlife habitats, and recreational uses. The principal source of nitrogen compounds is from Publicly Owned Treatment Works. Discharges from the Donald C. Tillman Water Reclamation Plant upstream of the study area, and the Los Angeles-Glendale and the Burbank Water Reclamation Plants are contributors to the River, contributing 20, 15.5, and 6.4 million gallons per day, respectively, or 31, 24, and 10 cfs, respectively (City of Burbank 2013). During dry weather periods, these major Publicly Owned Treatment Works contribute 84 percent of the total dry weather nitrogen load. Urban runoff, stormwater, and groundwater discharge also contribute to the nitrogen loadings (SWRCB 2003). Nitrogen impairments are not protective of aquatic life beneficial uses, which include WARM, COLD, and WET (SWRCB 1994).

In summary, the River is an effluent-dominated waterbody. Nearly 70 percent of the volume in the River is from Water Reclamation Plant tertiary-treated effluent discharged outside of storm events (Ackerman

2003). Although groundwater interactions exist (particularly in the Glendale Narrows and Arroyo Seco tributary), the majority of storm drain discharges are believed to arise from urban discharges.

3.4.4 Groundwater

The project area and tributaries sit above two major groundwater basins: the San Fernando Valley and the Coastal Plains of Los Angeles Central Groundwater Basins (see Groundwater Figure 3-8). Groundwater is a major component of the water supply in the Los Angeles metropolitan area and is also used by private industries, as well as a limited number of private agricultural and domestic users. Local groundwater provides about 15 percent of the total water supply and has provided nearly 30 percent of the total supply in drought years. Of this 15 percent, 86 percent comes from the Upper Los Angeles River Area (ULARA) and the Coastal Plains of Los Angeles Central Groundwater Basin. The remaining water for the city comes from the Los Angeles Aqueduct system and supplemental water purchased from the Metropolitan Water District of Southern California (City of Los Angeles 2005).

San Fernando Valley Groundwater Basin

The San Fernando Valley Groundwater Basin is part of the ULARA, which also includes the Sylmar, Verdugo, and Eagle Rock Basins. The ULARA was adjudicated in 1968 after a court decision to grant water rights to the City of Los Angeles. It is under management by an administrative committee, which consists of representatives from the cities of Burbank, Glendale, San Fernando, Los Angeles, and the Crescenta Valley Water District, who oversee and advise the ULARA watermaster (ULARA 2013). The primary job of the ULARA watermaster is to determine optimum water levels in the management area's groundwater basin.

The San Fernando Valley Groundwater Basin has a surface area of 145,000 acres, or 226 square miles, and includes water-bearing sediments beneath the San Fernando Valley, Tujunga Valley, Browns Canyon, and the alluvial areas surrounding the Verdugo Mountains near La Crescenta and Eagle Rock (DWR 4-12). As detailed in Section 4.1.1, surficial topographic features (mountains and hills) are abundant in this reach of the project (Reaches 1-6 and associated tributaries), and bound the San Fernando Valley. These same surficial topographic features extend underground, creating geologic boundaries that define the extent of the San Fernando Valley Groundwater Basin and sub-basins.

The storage capacity of the San Fernando Valley Groundwater Basin was calculated to be 3,670,000 acre-feet, which includes the total of the San Fernando, Sylmar, Verdugo, and Eagle Rock Basins. Groundwater levels have undergone a general decline during recent years due to an increase in urbanization (runoff leaving the basin before it can infiltrate), reduced artificial recharge, and continued heavy pumping (ULARA 2013). The San Fernando Valley Groundwater Basin is recharged by the spreading of imported water and runoff occurring in the Pacoima, Tujunga, and Hansen spreading grounds (ULARA 1999). Runoff includes natural mountain streamflow, precipitation, reclaimed wastewater, and industrial discharges (DWR 4-12).

Groundwater monitoring efforts in the San Fernando Valley Groundwater Basin, including responsible agencies, parameters, number of wells, and the frequency of measurements, are summarized in Table 3-8 (DWR 4-12). Water quality in public supply wells has also been used to characterize groundwater quality in the Central Basin. Table 3-9 displays constituent groups, number of wells sampled, and number of wells sampled in exceedance of water quality standards (DWR 4-12). The number of wells sampled represents the distinct number of wells sampled as required under the California Regulatory Compliance Title 22 program from 1994 through 2000. The program requires the monitoring of drinking supply wells to ensure compliance with drinking water standards for public health.

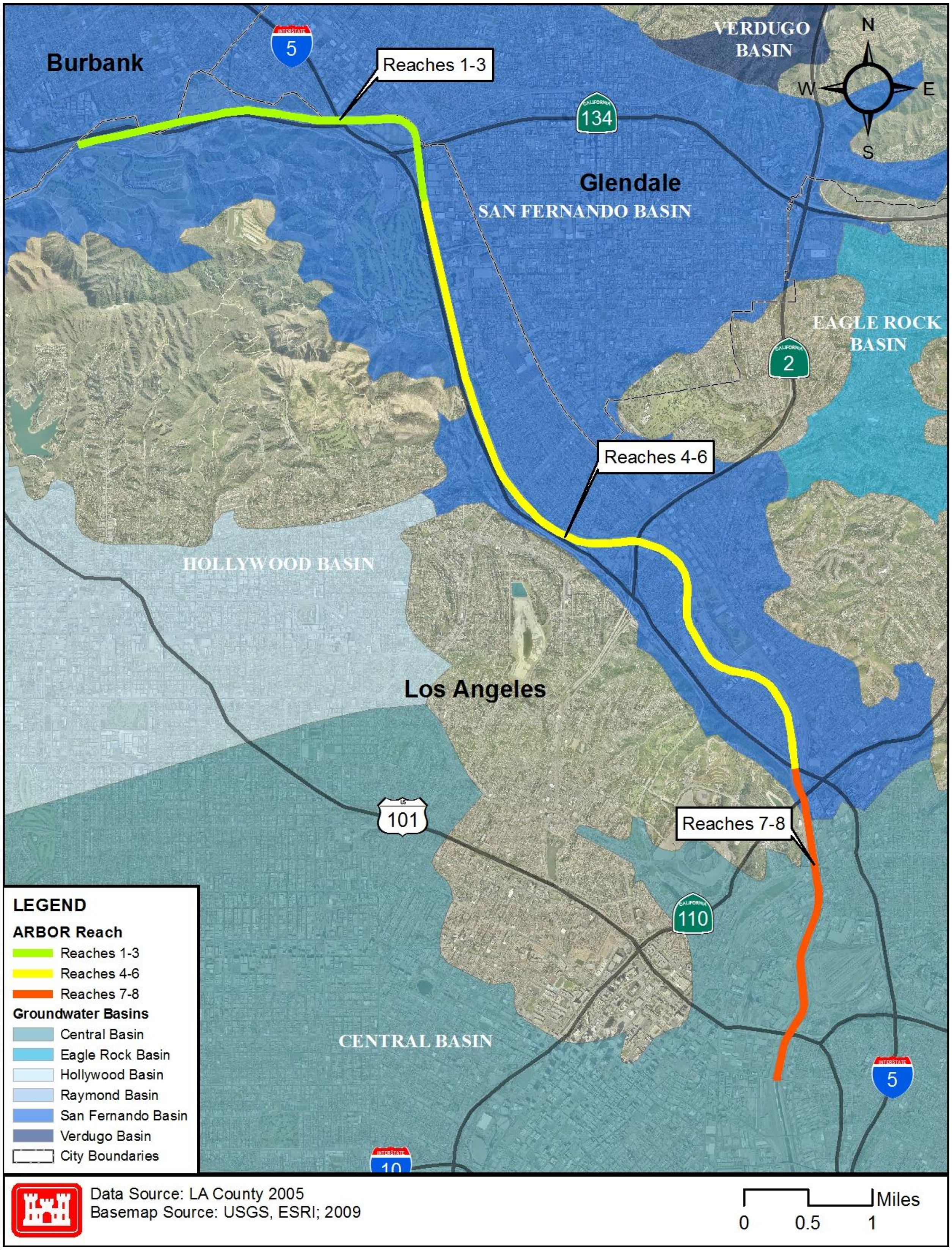


Figure 3-8 Groundwater Basins

Accordingly, the Los Angeles Region Water Quality Control Plan has identified groundwater beneficial uses, which serve to establish protective use criteria common to both the San Fernando and Central Basins, including:

- Municipal and Domestic Supply (MUN) Water used for military, municipal, individual water systems, and may include drinking water.
- Industrial Process Supply (PROC) Uses of water for industrial activities that depend primarily on water quality.
- Industrial Service Supply (IND) Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well re-pressurization.
- Agricultural Supply (AGR) Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.

Table 3-7 San Fernando Valley Groundwater Basin Monitoring Efforts

Agency	Parameter	Number of Samples and Frequency of Monitoring
ULARA	Groundwater Level and Water Quality	19 daily, monthly, and quarterly
EPA	Water Levels	1,379 daily, monthly, yearly, and quarterly
EPA	Water Quality	2,366 daily, monthly, yearly, and quarterly
Department of Health Services and Cooperators	Title 22 Water Quality	126 wells annually
Source: DWR 4-12		

Table 3-8 San Fernando Valley Public Supply Wells Water Quality

Constituent Group	Wells Sampled	Wells Above Maximum Concentration Level
Inorganics, Primary	129	6
Radiological	122	13
Nitrates	129	44
Pesticides	134	3
Volatile organic compounds and semi-volatile organic compounds	134	90
Inorganics, Secondary	129	17
Source: DWR 4-12		

It should be noted that each well confirmed with a concentration above Maximum Concentration Level (MCL) was confirmed with a second detection above MCL. This does not indicate the type of water quality that is delivered to the consumer, but the characteristics of contamination in the groundwater basin. Following is a detailed description of each water quality parameter.

- Inorganics Primary and Secondary Inorganics primarily include antimony, asbestos, barium, beryllium, mercury, chromium, cyanide, and thallium. Primary inorganics have a wide variety of health effects in humans and aquatic wildlife including kidney problems, cancer, nervous system disorders, and circulatory problems. Secondary inorganics include copper, aluminum, pH, chloride, color, fluoride, silver, zinc, and total dissolved solids. Secondary inorganics can cause poor taste in drinking water and cause teeth discoloration to consumers.

- <u>Radiological</u> Radiological constituents naturally occur at extremely low levels in groundwater basins and include radon, gross alpha, and uranium.
- <u>Nitrates</u> Though nitrates are classified as inorganic, they are one of California's leading contaminants, and are therefore addressed separately. High levels of nitrates can cause serious drinking water health risks to humans and can impair aquatic ecosystems. Natural levels of inorganic nitrogen are found in surface waters. However, the majority of nitrogen impairments originate from mismanaged agricultural land, where livestock are overcrowded or fertilizers are heavily applied. When nitrogen percolates its way down from the surface water to groundwater it becomes nitrate.
- <u>Pesticides</u> Pesticides can have damaging effects on plants and aquatic life that were not originally targeted (RWQCB 1995).
- <u>Volatile and Semi-volatile Organic Compounds</u> VOCs are chemical compounds that vaporize at normal temperature and pressure, typical of the lighter fuels and gasoline. Semi-volatile organic compounds (SVOCs) are heavier hydrocarbon compounds/oil products, which are less mobile in the environment and tend to cling to soils. SVOCs and VOCs are introduced into the environment by industrial activities, are carcinogenic and hazardous in drinking water, and detrimental to the health of aquatic organisms.

Specific VOCs and SVOCs include trichloroethylene (TCE) and perchloroethylene (PCE) (USEPA 2006). These contaminants are from numerous companies improperly disposing of chemicals. In spite of the presence of these contaminants, the LADWP performs the necessary actions to ensure that the city's drinking water meets or exceeds water quality standards. These actions include water quality monitoring of contaminant plumes, management of production well operations, operation of groundwater treatment facilities, and capital improvements (LADWP 2005).

The San Fernando Valley Superfund Site (SFVSS) (Areas 2 and 4) is near the Crystal Springs and Pollock Well Fields. The San Fernando Valley Superfund Site (SFVSS) (Areas 2 and 4) runs under the majority of the of study area, except most of Reaches 7-8, and is near the Crystal Springs and Pollock Well Fields. The Pollock and Crystal Springs Well Fields are part of the San Fernando Groundwater Basin. Groundwater is contaminated with various chlorinated VOCs, specifically TCE and PCE. Since the contamination was discovered, residents have been provided with alternate drinking water supplies, including imported water or groundwater mixed with imported water (USEPA 2006). This site is currently being remediated by the USEPA via a series of pumps and treatment wells that are strategically located along the plume. Treatment has been ongoing for approximately 10 years and has effectively stabilized much of the higher HTRW concentration; however, groundwater treatment is anticipated to be ongoing for approximately 50 years.

Coastal Plains of Los Angeles Central Groundwater Basin

The Coastal Plains of Los Angeles Central Groundwater Basin is one of four sub-basins found in the larger Coastal Plains of Los Angeles Groundwater Basin. The Central Basin has a surface area of 177,000 acres, or 277 square miles (DWR 4-11.04), only a small portion of which is located within the project area. As detailed in Section 4.1.1, Project Reaches 7-8 and associated tributaries are bound by the Elysian and Repetto Hills. The geology of these hills extends underground, creating impermeable boundaries that define the groundwater basin's extent within the project area.

The Central Basin was adjudicated in 1965 and the California Department of Water Resources (DWR) was appointed as the Watermaster, allowing DWR to regulate water rights in the sub-basin (DWR 4-

11.04). Water levels in the basin have varied over a range of 25 feet from 1961 to 1977 and 5 to 10 feet since 1996. In 1999, water levels were shown to be in the upper range of historical trends. The total storage capacity of the Central Basin is 13,800,000 acre-feet (DWR 4-11.04).

The Central Basin is recharged through surface and subsurface flows by percolation of precipitation, stream flow, and groundwater recharge management activities (DWR 4-11.04). Natural replenishment of the groundwater basin is primarily from surface infiltration, and secondarily from underflow through the Whittier Narrows from the San Gabriel Valley. Artificial recharge activities, located at the Rio Hondo and San Gabriel spreading grounds, utilizes purchased imported water (DWR 4-11.04).

Groundwater monitoring efforts in the Central Basin, including responsible agencies, parameters, number of wells, and the frequency of measurements are summarized in Table 3-10 (DWR 4-11.04). Water quality in public supply wells has also been used to characterize groundwater quality in the Central Basin. Table 3-11 displays constituent groups, number of wells sampled, and number of wells sampled in exceedance of water quality standards (DWR 4-11.04). The number of wells sampled represents the distinct number of wells sampled as required under the California Regulatory Compliance Title 22 program from 1994 through 2000. The program requires the monitoring of drinking supply wells to ensure compliance with drinking water standards for public health.

Table 3-9 Central Groundwater Basin Monitoring Efforts

Agency	Parameter	Number and Frequency of Monitoring
U.S. Geological Survey	Groundwater Level	90 wells annually
California Department of Water Resources	Groundwater Level	87 wells annually
Los Angeles County Public Works	Groundwater Level	212 wells bi-monthly
U.S. Geological Survey	Miscellaneous Water Quality	64 wells annually
Department of Health Services and Cooperators	Title 22 Water Quality	294 wells annually
Source: DWR 4-11.04		

Table 3-10 Central Groundwater Basin Public Supply Wells Water Quality

Constituent Group	Wells Sampled	Wells Above Maximum Concentration Level
Inorganics, Primary	316	15
Radiological	315	1
Nitrates	315	2
Pesticides	322	0
Volatile organic compounds and semi-volatile organic compounds	344	43
Inorganics, Secondary	316	113
Source: DWR 4-11.04		

As seen in Table 3-11, all constituent groups listed excluding the pesticides group were in exceedance of the MCL at least once. It should be noted that each well confirmed with a concentration above MCL was confirmed with a second detection above MCL. This does not indicate the quality of water that is delivered to the consumer, but the characteristics of contamination in the groundwater basin. Several sites along the study area may also contain localized groundwater contamination as discussed in the HTRW Survey Report (Appendix K). A detailed description of each parameter can be found under the San Fernando Valley Groundwater Basin discussion in this section.

3.5 BIOLOGICAL RESOURCES

Biological resources within the proposed study footprint are limited due to channelization and intense development along the River and its tributaries. The River is mostly confined to a concrete-lined channel surrounded by urbanized areas and much of it is virtually devoid of any natural vegetation. Exceptions include Reaches 4-6 in the study area, roughly from Brazil Street to the Glendale Freeway. Few areas exist where transportation, commercial, recreational, or residential development has not completely filled the adjacent areas that were once the riparian zone and floodplain. Therefore, riparian and aquatic habitat for fish and wildlife is extremely degraded and often non-existent.

3.5.1 Vegetation

A recent review of baseline habitat was conducted to determine habitat benefits based on the Combined Habitat Assessment Protocol (USACE 2012b). This study provides the most up-to-date inventory of vegetation conditions in the River corridor. Details regarding classification of community types and acreages can be found in the CHAP report (Appendix G), and a summary description of each appears below. Habitat types include 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.

Valley Foothill Riparian Dominant species include cottonwood, western sycamore, and willows. Forest understory may consist of shrubby willows and mule fat with herbaceous species including sedges, rushes, and mugwort. Scrub habitat has less vertical structure, with shorter willows dominant. These communities occur on sub-irrigated and frequently overflowed lands along rivers and streams. This is considered a very valuable habitat type as it provides habitat for a wide variety of species, including threatened and endangered species.

Eucalyptus 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. Eucalyptus is a non-native species that was introduced for ornamental purposes and to provide wood for rail construction.

Pasture Agricultural Characterized primarily by Bermuda grass.

Perennial Grassland Dominant species include introduced annual grasses such as wild oats, bromes, and fescues. Non-native forbs including filaree and clovers may be present. Native species may also be present.

Open Water Intermittent or continually running water distinguishes river and stream communities. 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 bed sediment, emergent freshwater marsh vegetation, such as rushes, sedges, and cattails, is established along river banks (Mayer and Laudenslayer 1988).

Urban This category includes landscapes dominated by urban structures, residential units, industrial areas, highways, and other such structures. Park areas may include alternately categorized vegetation such as ornamental or hardwood mixture.

Low Density Urban This is composed of urban uses such as parks, recreational fields, golf courses, and other such urban open space areas.

Vegetation within the River channel can inhibit the channel's capacity to convey floodwaters. The channel is designed to be maintained free of vegetation to avoid impacts to flood conveyance and channel structures. However, lack of funds for maintenance has resulted in substantial vegetation growing within the channel. Due to limited funds available to maintain vegetation in the channel, USACE has focused on removing non-native vegetation using both herbicide and mechanical means. Non-native plants often out-compete natives, degrading the ecological vitality and productivity of native habitats. The most prevalent non-native and invasive plant is giant reed (*Arundo donax*). It spreads quickly, has little habitat value, and contributes to fire hazards through fuel loading. Other invasive species targeted by removal efforts include tree of heaven (*Ailanthus altissima*), Mexican fan palm (*Washingtonia robusta*), castor bean (*Ricinus communis*) and eucalyptus (*Eucalyptus* spp.) (California Coastal Conservancy 2002).

According to CHAP, vegetation community types present in Reaches 1-3 include pasture, perennial grasses (invasives), eucalyptus, and valley foothill riparian (Figure 3-9). Riparian communities are narrow and disturbed throughout these reaches and occupy only small and disconnected areas. Several small patches of riparian habitat are located within the River channel and are subject to occasional mechanical removal by the USACE, with most recent efforts focused on non-native removal. The vast majority of the study area uplands in these upper reaches are composed of urban or residential landscaped vegetation. A sizeable patch of pasture agricultural habitat is present at Pollywog Park in Reach 1. Much of this land is ruderal or weedy. Staging areas between Forest Lawn Drive and Zoo Drive are bordered by perennial invasive grasses. The eucalyptus community stretches along Zoo Drive near Ferraro Fields (Reach 3).

Vegetation becomes established in the River channel where sediment tends to accumulate. As gravel, mud, and debris become trapped in the channel bed, vegetation can become rooted and contribute to additional gravel, mud, and debris collection. This process can result in sizeable areas of vegetation establishment, including native and non-native grasses, trees, and shrubs within the non-concrete (or "soft river bottom") channel bed in Reach 2. In Reaches 1 and 3, where concrete bed exists, minimal accumulation of sediment occurs and supports hummocks of herbaceous vegetation, which are typically washed out during high flows. Vegetation growth at Verdugo Wash has become a concern for inhibiting water flow and all vegetation is periodically mechanically removed in Reach 3.

Habitat value of these vegetation communities is degraded due to disturbance, small size, continuous noise of the adjacent highways, and presence of humans. Riparian vegetation does provide a visual buffer between highways and the River, as well as small islands of habitat within the open water area. However, overall, vegetation is limited and degraded in these reaches.

According to CHAP, habitat types present in Reaches 4-6 includes valley foothill riparian, urban, and open water (Figure 3-10). This reach is unique in that the bed of the channel is natural. Just downstream of SR-134, roughly parallel with Brazil Street in Glendale, the entirely concrete channel transitions to a soft bed channel with concrete trapezoidal walls. Because of this natural bottom, plants become more readily established. As a result, vegetation occupies much of the channel in these reaches, forming a nearly continuous strip of riparian habitat composed of native and non-native grasses, shrubs, and trees. In contrast to most of the upper reaches, vegetation that grows beneath the overpasses has been removed. In particular, extended bridge piers beneath Hyperion and Los Feliz Boulevards require vegetation removal to allow adequate flow conveyance. Riparian communities continue south throughout the reaches and stop just upstream of the I-5 overpass, where the channel bed becomes concrete once again.

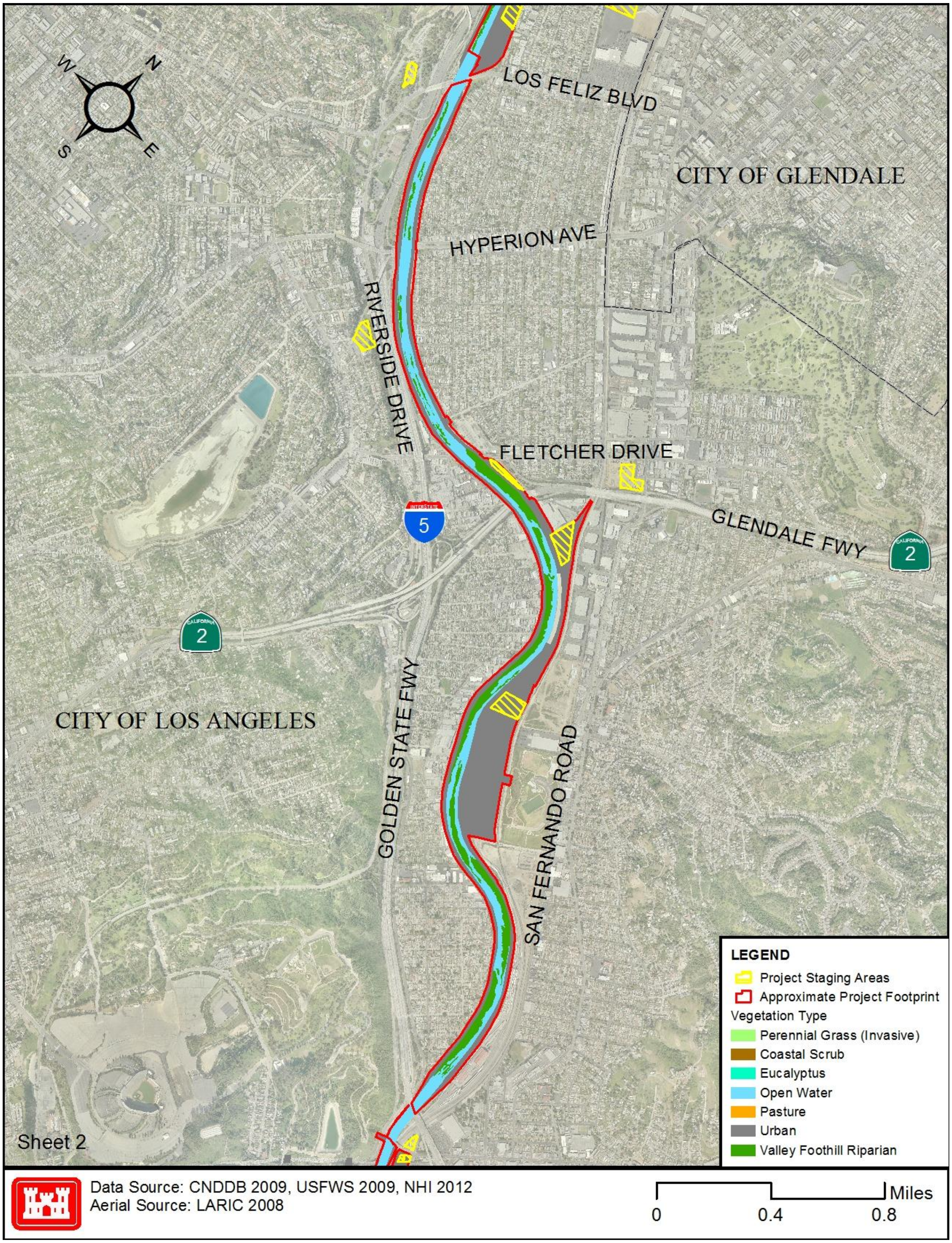
Herbaceous and woody species in these unlined reaches consist of low elevation mats and large islands of southern willow scrub vegetation. Some of these vegetated areas are so overgrown that physical access to and through them is quite restricted. Dominant species include: black willow (*Salix gooddingii*), Fremont cottonwood (*Populus fremontii*), and arroyo willow (*Salix laevigata*). Emergent marsh is dominated by cattail and bulrush. Exotic species include giant reed and non-native species of ash (*Fraxinus* spp.). While scouring during high floods has at times cleared some of the understory vegetation in these reaches, well-rooted willows have persisted.

No other vegetation community types have been identified in these reaches (USACE 2012b). CHAP data shows that the study area beyond the channel, including the proposed staging locations, is composed entirely of urban and residential use, where vegetation is ornamental.

The River in Reaches 7-8 is virtually devoid of vegetation within the channel, and has extremely limited community types outside the channel within the study area and its staging locations (Figure 3-11). A small area of riparian habitat occurs along the top of the left bank of the Arroyo Seco channel, but no instream vegetation occurs. Any vegetation within the main River channel is composed of weedy species that have become rooted in the cracks of the channel walls or hummocks of vegetation that grow on the minimal accumulated sediment and wash out with high flows. Outside the channel, a small patch of coastal scrub habitat occurs just north of Broadway Street on the west side of the channel. This community is part of the relatively undeveloped hills near the neighborhood of Solano Canyon. Urban land uses dominate the overbanks of the downstream reaches and any vegetation is ruderal or ornamental.

1 *Figure 3-9 Biological Resources, Reaches 1-3*

2



1 *Figure 3-10 Biological Resources, Reaches 4-6*

Figure 3-11 Biological Resources, Reaches 7-8

3.5.2 Wildlife

Because of the study area's scarce vegetation, minimal connection to other habitat areas, and extremely limited riparian communities, wildlife species that are the most tolerant of human activity and the extremely modified landscapes inhabit the study area. Common mammals include opossum (*Didelphis virginiana*), black rat (*Rattus rattus*), raccoon (*Procyon lotor)*, California ground squirrel (*Spermophilus beecheyi*), fox squirrel (*Sciurus niger*), striped skunk (*Mephitis mephitis*), coyotes (*Canis latrans*), and several species of bats (CDFW 1993).

Though abundance of native bird species is limited by habitat quantity and quality along the River, diversity of native birds in the study area fluctuates with seasonal migration and can be relatively high. Resident birds use the existing small and intermittent pockets of vegetation along the waterway to nest, roost, as a base for feeding, and to take cover. Birds commonly found along the River corridor include American robin (*Turdus migratorius*), red-winged black bird (*Agelaius phoeniceus*), house sparrow (*Passer domesticus*), killdeer (*Charadrius vociferous*), mallard (*Anas platyrhynchos*), northern mockingbird (*Mimus polyglottos*), common yellowthroat (*Geothlypis trichas*), swallows (e.g., *Hirundo* spp. and *Petrochelidon* spp.), and yellow warbler (*Dendroica petechia*) (Bureau of Reclamation 2004). In addition, bird species commonly seen in the city are also found within the study area including: rock dove (*Columba livia*), mourning dove (*Zenaida macroura*), American crow (*Corvus brachyrhynchos*), European starling (*Sturnus vulgaris*), and house finch (*Carpodacus mexicanus*). Migratory species include shorebirds, wading birds, and ducks of the Pacific Flyway. These species are primarily found roosting or feeding. The least Bell's vireo has been observed within the study area near Taylor Yard (USACE 2009, 2013).

Herpetofauna in the Los Angeles Watershed consists of a variety of amphibians and reptiles. Four salamanders that may occur within the study footprint include Pacific slender salamander (*Batrachoseps pacificus*), arboreal salamander (*Aneides lugubris*), ensatina (*Ensatinae schscholtzii*), and black-bellied slender salamander (*Batrachoseps nigriventris*). Three frogs may occur in the study area including western toad (*Bufo boreas*), Pacific tree frog (*Hyla regilla*), and bullfrog (*Rana catesbeiana*). Six lizards potentially occur within the study area including: California legless lizard (*Anniella pulchra*), western whiptail (*Cnemidophorus tigris*), western skink (*Eumeces skiltonianus*), southern alligator lizard (*Gerrhonotus multicarinatus*), western fence lizard (*Sceloporus occidentalis*), and side-blotched lizard (*Uta stansburiana*). Finally, six snakes are considered to occur within the study area including western rattlesnake (*Crotalus viridis*), ringneck snake (*Diadophis punctatus*), common kingsnake (*Lampropeltis getulus*), California whipsnake (*Masticophis lateralis*), gopher snake (*Pituophis melanoleucus*), and two-striped garter snake (*Thamnophis hammondii*) (CDFW 1993).

3.5.3 Fish

Seven species of fish historically occurred in the freshwaters of the River including the now endangered species of southern California Distinct Population Segment of steelhead (*Oncorhynchus mykiss*) and unarmored threespine stickleback (*Gasterosteusaculeatus williamsoni*), the now threatened species of Santa Ana sucker (*Catostomus santaanae*) and arroyo chub (*Gila orcuttii*) in its native habitat, the species of concern Pacific lamprey (*Lampetra tridentata*), and the non-listed species Pacific brook lamprey (*Lampetra pacifica*) and Santa Ana speckled dace (*Rhinichthys osculus*) (CDFW 1993; FoLAR 2008).

The City of Los Angeles conducted a fish survey of the River in September 2004 (LADWP 2004) with a 1-day field survey at Balboa Boulevard (upstream of study site), Los Feliz Boulevard (Reach 4), and near SR-2 (Reach 2). Six non-native species were collected, including mosquitofish (*Gambusia affinis*), green sunfish (*Lepomis cyanellus*), bluegill (*Lepomis macrochirus*), black bullhead (*Ameiurus melas*), fathead minnow (*Pimephales promelas*), and tilapia (*Oreochromis* spp.). Mosquitofish and green sunfish were the most prevalent species captured. No native fishes were collected. The timing of the survey was ideal to determine the presence or absence of native species such as Santa Ana sucker, arroyo chub, and speckled dace; none were collected. It is unlikely that species such as steelhead, lamprey, or stickleback exist. The report's authors also concluded that it is unlikely any endangered species or species of special concern inhabit the areas sampled (LADWP 2004).

In the late summer and fall of 2007, the Friends of the Los Angeles River conducted a fish study in the Glendale Narrows (Reaches 4-6), at four sites and on four occasions both before and after significant rainfall events. This study collected eight non-native fish species including fathead minnow, carp (*Cyprinus carpio*), black bullhead, Amazon sailfin catfish (*Pteroplichthys pardalis*), green sunfish, mosquito fish, tilapia, and largemouth bass (*Micropterus salmoides*). A total of 1,214 individuals were collected, with mosquitofish and tilapia being the most abundant (FoLAR 2008). No native fish were collected.

3.5.4 Special Status Species

The greater Los Angeles Basin includes portions of the Angeles National Forest, the Santa Monica Mountains, and coastal areas where a number of threatened, endangered, and sensitive plants and animals may occur. These include plants or wildlife listed under the Federal or state Endangered Species Acts (ESA and CESA). Special status species also include plant species designated by the California Native Plant Society (CNPS) as presumed extinct in California (List 1A); plants designated as rare, threatened, or endangered in California and elsewhere (List 1B); and plants designated as being rare, threatened, or endangered in California but more common elsewhere (List 2).

Although several special status plant species have historically occurred in the study area or environs (24 total), none of these species is currently expected to occur within the project footprint. Habitat conditions needed for listed plant species to grow are either not available or are in degraded condition and not suitable. Special status plant species that have historically occurred in the project area are reported, along with their preferred habitat types, in Appendix H.

There are a total of 28 special status wildlife species with the potential to occur in the greater Los Angeles Basin (Appendix G). However, of these, only three bird species have the potential to occur in the project area, including high potential for least Bell's vireo (*Vireo bellii pusillus*), and low potential for both the southwestern willow flycatcher (*Empidonax trailliiextimus*) and coastal California gnatcatcher (*Polioptila californica*). In general, the degraded conditions within the study area mean that it is likely to contain very few Federal or state listed endangered or threatened species. Protocol level surveys for least Bell's vireo, southwestern willow flycatcher, and California gnatcatcher were completed during the 2005 and 2007 bird-breeding season at USACE-managed areas within Los Angeles County. Least Bell's vireo were documented at Hansen Reservoir and Santa Fe Reservoir, in the lower Sepulveda Reservoir/Los Angeles River above and downstream of Burbank Boulevard, along the soft bed River, and near the Taylor Yard area. In 2009, least Bell's vireo were also observed, and again in 2013, non-protocol observation led to the identification of a least Bell's vireo within the Taylor Yard portion of the study area (USACE 2009, 2013). No flycatchers or gnatcatchers were found during these studies, and the most recent documented occurrence of the southwestern willow flycatcher was over 13 miles west of the project area in the Angeles National Forest. The gnatcatcher, which generally occupies coastal scrub habitat, is unlikely to occur since there is less than 1 acre of this habitat type in the corridor.

3.5.5 Waters of the United States including Wetlands

Waters of the United States, as defined under the Clean Water Act, are found in the Los Angeles River and tributaries within the study area. The discharge of dredged or fill materials into waters of the United States is regulated pursuant to Section 404 of the Clean Water Act. Waters of the United States also include wetlands and other special aquatic sites. As part of this study, the Corps will undertake a planning-level JD to identify the ordinary high water mark and extent of waters of the United States including wetlands. The Corps will evaluate 404 impacts under a Section 404(b)(1) analysis, a draft of which will be included in the Final IFR and a final 404(b)(1) included with the Record of Decision for this project.

The Los Angeles River has been identified as a traditionally navigable waterway (TNW), a term established by the Supreme Court in its Rapanos decision. The Los Angeles River has been protected by the CWA as a water of the United States since its passage in 1972. In 2008, in light of the Rapanos decision, the Corps further determined that two reaches of the river, within the Sepulveda Basin and the tidally influenced portion of the river, were TNWs. On August 17, 2008, EPA invoked procedures established in a memorandum of agreement between the agencies, designating the Los Angeles River as a “special case” to allow EPA to make the final determination of its jurisdictional status. On December 3, 2008, the EPA affirmed that available evidence supported the Corps’ TNW determinations for the two study reaches. In 2010, EPA determined that the entire mainstem, including the study area, constitutes a TNW. None of the TNW determinations changed the applicability of the CWA to the Los Angeles River, because the Los Angeles River, as a tributary of the Pacific Ocean, would also meet the Rapanos plurality test or the Kennedy test. The importance of a TNW determination for the CWA is generally in its relation to its tributaries.

No wetland delineation has been completed to date to identify jurisdictional wetlands. For planning purposes, CHAP and National Wetland Inventory information was consulted. Riverine wetlands were the only wetland type found during the habitat assessments conducted for the CHAP. Additional wetland data were reviewed using the USFWS National Wetland Inventory (NWI) maps. Although NWI maps are not definitive with regard to the presence or absence of wetlands, they are useful as an initial planning tool. NWI mapping shows the presence of six different types of wetlands within the study area. These wetlands occur within the River channel only and include R2UBH (lower perennial riverine), PSSC (palustrine scrub-shrub, seasonally flooded), PSSF (palustrine scrub-shrub, semi-permanently flooded), PSS/EMC (palustrine shrub/emergent), PFOC (palustrine forested, seasonally flooded), and PEMC (palustrine emergent, seasonally flooded) (USFWS 2012a).

Aerial mapping backdrops to NWI data indicate that emergent, shrub, and forested communities within the River channel have already migrated and are no longer in the locations shown on the wetland mapper. As a result, wetlands have not been shown in habitat mapping for this report. Existing in-channel vegetation was most recently mapped in the CHAP process and shown in Figures 3-8 to 3-10. Overall, wetlands within the study area are assumed to be only within the Los Angeles River channel. These areas are under the jurisdiction of the USACE and subject to modification for operation and maintenance of the flood risk management channel. There are no other special aquatic sites in the study area as defined under the CWA.

3.5.6 Significant Ecological Areas

The City of Los Angeles, through its General Plan, established Significant Ecological Areas that include a wide variety of ecological communities (City of Los Angeles 1995). Within the study area, Griffith Park is the only Significant Ecological Area. This park, located at the east end of the Santa Monica Mountains along Reaches 1-4, supports coastal scrub, chaparral, riparian, and oak woodland habitats. The area also includes the Hollywood Reservoir. Griffith Park is considered an important habitat island for migrating birds, as well as a reservoir for native species. Though the highly urbanized cities of Burbank and Glendale separate Griffith Park from the Verdugo Mountains, Griffith Park is an important extension of the Santa Monica Mountains and offers the nearest natural habitats to the Verdugo Mountains, which are adjacent to the much larger expanse of native habitats in the San Gabriel Mountains. Birds and larger mammals in particular utilize this area as a corridor. The Department of Recreation and Parks manages a portion of Griffith Park as a bird sanctuary.

3.5.7 Wildlife Corridors

A wildlife corridor is a strip of habitat that connects two otherwise separated larger habitat areas (Santa Monica Mountains Conservancy 1990). Connecting isolated habitats helps to reduce population isolation, increases the species' range, and allows for greater survival of the population. The combination of the River channel and the adjacent highways and development has effectively created a blockage to the wildlife movement that would have historically occurred between the Santa Monica Mountains to the west and Verdugo Mountains and San Gabriel Mountains to the east. Additional development further blocks wildlife passage between the Verdugo Mountains and the much larger Angeles National Forest.

Bats and birds are less restricted by development, though human occupation may discourage passage through the study area. Ground dwelling animals that occur in the study area are migrating into the project area via the extremely limited pathways available. These pathways can be composed of narrow riparian strips, but more often are provided by culverts, paved pathways along the River, and concrete tunnels beneath highways. Despite the man-made nature of these pathways, wildlife are known to utilize them. A study in the Simi Valley found that tunnels, equipment passages, corrugated culverts, paved roadways, and pathways were utilized by skunks, opossum, raccoons, grey fox, coyote, mule deer, mountain lions, and bobcats (LSA 2004).

3.6 CULTURAL RESOURCES

This section is an overview of cultural resources that may be present within the study area. Cultural resources are artifacts of human activity, occupation, or use. They include expressions of human culture and history in the physical environment, such as archaeological sites, historic buildings and structures, or other culturally significant places.

Archaeological resources refer to surface or buried material remains, buried structures, or other items used or modified by people. Prehistoric archaeological resources date to the time before the European presence in Los Angeles and can include villages or campsites, food remains, and stone tools and tool-making debris. Ethnohistoric or protohistoric archaeological resources are those that can be attributed to native cultures, but include evidence of European contact, such as trade beads in a site that otherwise appears to be prehistoric. Historic archaeological sites are those deposits that post-date European contact.

Historic building and structures generally must be over 50 years old and are typically identified through archival and library research, followed by field reconnaissance and recordation. Historic buildings and structures are architecturally, historically, or artistically important individual and groups of residential, commercial, industrial, and transportation properties.

Traditional cultural properties are places associated with the cultural practices or beliefs of a living community. The significance of these places is derived from the role the property plays in a community's cultural identity, as defined by its beliefs, practices, history, and social institutions. Examples include natural landscape features, plant gathering places, sacred sites, and Native American burial locations.

They can also include urban neighborhoods whose structures, objects, and spaces reflect the historically rooted values of a traditional social group.

The historic significance of a cultural resource is evaluated by applying federal, state, and/or local criteria as described in Section 5.6.1 Regulatory Framework.

3.6.1 Cultural Resource Identification

The record search and literature review conducted by Tetra Tech Inc. for the Los Angeles River Revitalization Master Plan EIS/EIR provided the basic overview information for this IFR (City of Los Angeles 2007). An updated cultural resource records and literature search was conducted by the staff of the South Central Coastal Information Center at California State University, Fullerton, in August 2012, focusing on the footprints and disturbance areas specific to the feasibility study and the River corridor with a 50-meter (164-foot) buffer. This is the preliminarily-identified Area of Potential Effects (APE) for the purposes of compliance with the National Historic Preservation Act (NHPA) Section 106 process for this study, for which the Corps will further consult with the SHPO and other consulting parties. The South Central Coastal Information Center is the regional repository for the California Historical Resources Information System. The record search included archaeological site records and reports, the California Points of Historical Interest, the California Historical Landmarks (CHL), the California Register of Historical Resources (CRHR), the National Register of Historic Places (NRHP), the California Historical Resources Inventory, the City of Los Angeles Historic-Cultural Monuments (LAHCM), and the Caltrans Historic Bridge Inventory. The record search includes the results only of previous archaeological or historical surveys and other investigations. Most of these parcels in the APE have not been fully inventoried and identification methods would need to be tailored to the specific locations. No new fieldwork to identify resources was conducted to support the feasibility study. Unrecorded and buried cultural resources may be present. Many Los Angeles River containment and flood risk management facilities are now of historic age, but have not been formally documented or evaluated for the NRHP or the CRHR.

The USACE contacted the California Native America Heritage Commission for a search of the Sacred Lands Inventory file to determine if there is any record of sensitive sites or traditional cultural properties that may be present and to obtain the most current list of Native American contacts for consultation. The Native America Heritage Commission responded that there were Native American cultural resources present and provided a list of tribal contacts for the USACE for consultation on these resources. The USACE contacted tribal representatives by letter in September of 2012. To date no responses have been received by the USACE. The USACE will continue efforts to inform and consult with tribal representatives regarding any cultural concerns that they might have. A copy of the draft EIS will be sent to the tribal contacts for their review and at each stage of the Section 106 process they will be invited to comment and participate.

For Federally funded or permitted actions, the NHPA Section 106 process needs to be completed in consultation with the State Historic Preservation Officer (SHPO) and other parties. Prior to study implementation, additional cultural resource identification efforts would need to be conducted, appropriate to the proposed measures at each location. The APE for cultural resources would be refined, and additional required consultations on study effects would be conducted. Identification efforts would likely include additional archaeological and historical surveys, test excavations, trenching, construction monitoring, and archival research. Focused, site-specific consultations would be conducted with Native American individuals and tribes and other ethnic communities to determine whether there are particular areas where there may be traditional cultural concerns. Adverse study effects under 36 CFR 800 would be resolved prior to implementation.

3.6.2 Cultural Resource Setting

Archaeologists have placed the earliest occupations of southern California at roughly 12,000 to 10,000 years before present (BP) based primarily on data from coastal and desert sites around Holocene marshes, lakes, and streams. As in all arid and semiarid lands, water sources and river systems are centers for settlement and food procurement. Prior to channelization, there were wetlands and marshes associated with the changing course of the free-flowing River. Soils in the floodplain were constantly enriched by sediment deposition and there was an abundant variety of plant and game resources that were available to native populations. At the time of contact, the Spanish encountered native populations who were organized in villages with social elites, well-established trade networks and elaborate mortuary customs. The local Tongva or Gabrielino oral traditions speak of the importance and use of the rivers in the inland valleys, and named settlements have been documented at locations along nearly every river and ephemeral stream. Missionization, disease, and colonization decimated the organized Tongva villages along the River, but some Native American use of the River continued throughout the nineteenth century.

The original Pueblo of Los Angeles was founded along the River by Spanish settlers who immediately constructed a ditch system to irrigate their crops. Land grants were later made to soldiers and other settlers and used primarily for grazing sheep and cattle. This trend continued through Mexican rule and into the time California was annexed into the United States. In the latter half of the nineteenth century, the land grants in the San Fernando Valley were broken up, and large-scale agriculture for the domestic and international markets largely replaced ranching. Rail lines and stations were constructed that paralleled the old River travel routes. Beginning in the 1880s, residential and industrial development along the River grew rapidly. This growth required a more reliable water supply than the River could provide and greater control of the River to protect life and property. In 1913 Owens River water was brought to Los Angeles via an aqueduct. After heavy storms that same year, the River flooded nearly twelve thousand acres of land and washed out roads, bridges, and rail facilities. Periodic devastating floods continued until 1959 when the River had been completely contained in a series of concrete channels, flood risk management reservoirs, and debris basins.

This section contains a brief overview of the past use of each of the three geomorphic reach groupings of the River, as well as a summary of the results of the record search and a table of the recorded cultural resources. Despite past disturbances, there is the potential for buried archaeological resources as well as unrecorded and evaluated building and structures. It should be emphasized that no new field work was conducted at this phase. In addition to the investigations summarized below, there are 54 investigations that are potentially in the study APE, but are not mapped due to insufficient or unconfirmed locational information. Although not formally documented or evaluated for historic significance, the containment and flood risk management facilities on the River and its tributaries appear to be eligible for listing on the NRHP for their association with important events and possibly for their engineering innovation, as further described in Section 5.6.3.

Reaches 1-3

The River in Reaches 1-3 travels to the west and then makes a sharp turn to the south at the confluence with the Verdugo Wash. The River marks the border between two pre-1800 Spanish land grants: Rancho Los Feliz on the west side and Rancho San Rafael on the east. Jose Vicente Feliz and José María Verdugo were military officers who had served Spain in the establishment of the colony in Alta California. A large portion of Rancho Los Feliz has remained intact and was donated to the City of Los Angeles in 1896 by Griffith J. Griffith and is now Griffith Park. Rancho San Rafael was broken up in 1869 and largely includes the City of Glendale.

The study area in Reaches 1-3 includes the confluence of the River with Burbank Western Channel and the Verdugo Wash. Los Angeles purchased surface water rights in this reach from Mr. Griffith in 1885, allowing the City to better control and to use this resource. Historic maps show little development in the immediate vicinity of the River prior to 1921, while Glendale, Burbank, and Los Angeles were experiencing a residential boom. Agricultural land uses north and east of the River were eventually replaced from the 1920s through the early 1960s by industrial development primarily related to aeronautical engineering and manufacture. Many structures from that era remain. Channelization beginning in the late 1930s allowed for more development of all kinds closer to the River.

The former location of the Griffith Park Aerodrome (later the California National Guard Airport) that operated from 1912 to 1939 is south and west of the River, encompassing Ferraro Fields, the I-5 (Golden State Freeway) and SR-134 (Ventura Freeway) interchange, and the current zoo parking lot. The Glendale Airport (later the Grand Central Airport) operated from 1923 to 1959 just north of the River. Grand Central was the first official airline terminal for the Los Angeles area. Also adjacent to the River on the east side is the former site of the Roger Jessup Dairy, which operated from the 1920s through the 1960s. Channelization and construction of the Golden State Freeway in 1947 and Ventura Freeway in 1962 took portions of the Griffith Park donation and separated the River and some parkland from recreational facilities at Griffith Park (City of Los Angeles 2007).

The record search confirmed 11 cultural resource investigations, reports, or inventories that have been conducted in or adjacent to the Reach 1-3 study area. From the summary of the available reports, it appears that the immediate River corridor through Reaches 1, 2, and 3 has been minimally investigated for cultural resources. Los Angeles River containment and flood risk management facilities have not been documented or evaluated. Bridges across the River have been inventoried and evaluated for historic significance. Pollywog Park has not been inventoried. Ferraro Fields has been surveyed for archaeological resources and approximately two-thirds of the Verdugo Wash study area has been inventoried for historic structures. No cultural resources have been identified at Ferraro Fields or the Verdugo Wash Study Area. Table 3-12 lists the recorded cultural resources present or adjacent to the Reach 1-3 study area.

Table 3-11 Recorded Cultural Resources in Reaches 1-3

Resource Designation	Resource Type	Listing or Status [1, 2]	Notes
Old House of Lopez P-19-150415	Historic Place - no physical remains are apparent.	Not located or evaluated	Mapped location of structures occupied in 1868. Structure destroyed. Near Reach 1 and Polliwog Park.
Griffith Park P-19-175297	District	NRHP CRHR LAHCM #942	1896 -1944 – Large urban park with contributing buildings and designed and natural landscapes. Not all areas or features fully documented evaluated. Includes Bette Davis Park, Ferraro Fields, Adjacent to Reaches 1, 2 and 3.
Riverside-Zoo Drive Bridge, 53C1298 P-19-187573	Bridge	NRHP CRHR LAHCM #910	1938 - Concrete bridge. Bette Davis Park, Reach 1 and 2.
The Little Nugget	Object	LAHCM #474	1937 – Stationary display – Railroad passenger car at Travel Town, Griffith Park. Reach 1

[1]CRHR: California Register of Historical Resources – Eligible, NRHP: National Register of Historic Places – Eligible, CHL: California Historic Landmark, LAHCM #: Los Angeles Historical-Cultural Monument and monument number, Not Evaluated: Resource has been recorded but not been evaluated for historic significance, Not eligible: Resource has been evaluated and there has been some level of determination that it does not meet eligibility criteria.
[2] Note: Eligible properties are not necessarily formally listed on the NRHP or the CRHR, but have been evaluated and meet the criteria for listing and consideration in the planning process.

Reaches 4-6

The River in Reaches 4-6 continues south and then southeast, bordered by the Golden State Freeway (I-5) and Griffith Park on the west and mostly industrial and commercial properties on the east. Adjacent to the River on the east side is the Los Feliz 3-Par Golf Course developed in 1962 and still operating. The River through Reaches 5 and 6 travels southeast through portions of the Los Angeles neighborhoods of Atwater Village, Silver Lake, Glassell Park, Elysian Valley, and Cypress Park. The River in this area was always a natural transportation route, even in prehistoric times. What became San Fernando Road along the River through this reach and to the north was part of El Camino Real linking Los Angeles with Mission San Fernando and the northern coastal settlements through the Cahuenga Pass and to the San Joaquin and Central Valleys via the Tejon Pass. Later, the Butterfield Overland Mail line passed through these reaches. Rail transportation through Reaches 4-6 began in 1876, connecting to the east coast via San Francisco with a second transcontinental line added in 1886. Very quickly the old ranches were broken up and new residential communities were laid out to accommodate the influx of people from the east and the growth of Los Angeles. Channelization of the River and freeway construction increased the industrial nature of adjacent land use through this reach. Table 3-13 lists the recorded cultural resources present or adjacent to the Reach 4-6 study area.

As rail traffic increased, it was necessary to construct a number of rail yards along the River north of downtown Los Angeles. In 1888 the Southern Pacific established a freight storage yard adjunct at what is now known as the Cornfields site in Reach 7. In 1925 the Southern Pacific Railroad shifted supervision of its entire Los Angeles freight handling operations from the Cornfields site to a new freight facility at Taylor Yard adjacent to the east side of the River in the southern part of Reach 6. The yard operated 24 hours a day and for much of its history; nearly all freight rail transport in and out of downtown had to pass through Taylor Yard. The workers would disassemble and reassemble as many as 60 freight trains a day.

Table 3-12 Recorded Cultural Resources in Reaches 4-6

Resource Designation	Resource Type	Listing or Status[1, 2]	Notes
Griffith Park P-19-175297	District	NRHP CRHR LAHCM #942	1896 -1944 – Large urban park with contributing buildings and designed and natural landscapes. Not all areas or features fully documented evaluated. Reaches 4 and 5.
Glendale-Hyperion Viaduct, P-19-180674, 53C1069	Bridge	NRHP CRHR LAHCM #164	1926- 1929 – Large multiple arch span concrete bridge with simplified classical elements. Reach 5.
Arroyo Seco Parkway, P-19-179645 SR110, Pasadena Freeway	Linear Transportation Facility, Bridges	NRHP CRHR	1940 – The first controlled-access freeway in the West. Arroyo Seco confluence, Reach 6 and 7 (boundary).
Riverside-Figueroa Street Bridge 53C0160	Bridge	NRHP CRHR LAHCM #908	1928, 1939 – Concrete and steel truss bridge. Scheduled for reconstruction. Reach 6.
Fletcher Drive Bridge P-19-173432	Bridge	NRHP CRHR LAHCM #332	1927 – Concrete bridge over the River. Reach 5.

[1]CRHR: California Register of Historical Resources – Eligible, NRHP: National Register of Historic Places – Eligible, CHL: California Historic Landmark, LAHCM #: Los Angeles Historical-Cultural Monument and monument number, Not Evaluated: Resource has been recorded but not been evaluated for historic significance, Not eligible: Resource has been evaluated and there has been some level of determination that it does not meet eligibility criteria.
[2] Note: Eligible properties are not necessarily formally listed on the NRHP or the CRHR, but have been evaluated and meet the criteria for listing and consideration in the planning process.

Repairs and maintenance of rail cars and engines were also done on site. Improvements and updates were continually made to yard facilities. Because Taylor Yard was situated above the River's natural floodplain and was protected by a levee, it was spared from extensive damage during the worst flood in the City's history in 1938 that led to the channelization of the River. Taylor Yard continued as the City's major railway hub and employed hundreds of workers in the surrounding communities until 1973. The completion of a modern freight yard in the City of Colton reduced the importance of Taylor Yard as a rail center. The Southern Pacific Railroad closed most operations at the yard in 1985 and the land was eventually cleared (CDPR 2005a). Metrolink now operates a rail maintenance facility on a portion of the site. Other parcels have been developed into the Rio de Los Angeles State Park, offices, and educational facilities, although large parcels remain undeveloped.

The record search confirmed 15 cultural resource investigations, reports, or inventories that have been conducted in or adjacent to the Reach 4-6 study area. The River corridor through Reaches 4, 5, and 6 has been minimally investigated for cultural resources and there are no surveys that are adjacent and/or directly follow the River. River containment and flood risk management facilities have not been documented or evaluated. Bridges across the River have been inventoried and evaluated for historic significance. There have been no surveys of two golf courses in Reach 4. There have been cultural resource surface surveys on adjacent parcels and along the edge of the Taylor Yard, but there has been no inventory of the study area or subsurface excavation reported.

Reaches 7-8

The River continues south through Cypress Park and Lincoln Heights and past the confluence with the Arroyo Seco toward downtown. Adjacent to and crossing the River are mostly industrialized zones and heavily used transportation corridors. The Arroyo Seco historically added substantial inflows to the River from the San Gabriel Mountains and was a major water supply for the growing city in the late 19th Century. In 1870 the Buena Vista Reservoir was built in the hills of Elysian Park immediately west of the confluence of the Arroyo Seco and the River. In the 1880s the reservoir was expanded and other facilities were constructed to tap the River for a rapidly growing population. In 1904 William Mulholland and Los Angeles built the southernmost of this series of diversion facilities, the Narrows Gallery, to capture more water. A 1,178-foot tunnel was drilled at a depth of 115 feet through the bedrock beneath the River and up the Arroyo Seco. Nine wells were drilled to allow water to percolate into the tunnel where it was then collected and conveyed through the Zanja Madre to downtown Los Angeles. The Zanja Madre was the main irrigation ditch supplying water to Los Angeles (Brick 2012).

The Cornfields site at the Los Angeles State Historic Park is located west of the River on the former location of the Southern Pacific River Station and freight yard. The River Station was the first Southern Pacific facility in Los Angeles and site of the first transcontinental railroad station and depot in the region from 1876 through 1888. It served as the center of railroad freight operations for the Southern Pacific in Los Angeles until 1925 and continued to serve as a freight yard until its closing in 1992. The railroad facility included a two-story depot and hotel, a large freight house, round house, turntable, ice house, and maintenance shops. No standing structures remain, but extensive archaeological resources have been recorded. Cornfields is immediately north of the site where Los Angeles was founded. Some of the earliest recorded Euro-American agriculture (1805) in Los Angeles was conducted in the River floodplain in this area, and remnants of the original Zanja Madre have also been found. Much of the early industrial development of Los Angeles occurred here, and it is surrounded by some of the original ethnic neighborhoods in Los Angeles (CDPR 2005b).

Farther south on the east side of the River is the Los Angeles Transfer Container Facility or Piggyback Yard. A rail maintenance facility was established by the Union Pacific in the early 1900s. Historic maps show a roundhouse and structures that comprised “general shops” where heavy repairs and building of freight cars took place. The need for general shops on all railroads decreased when they changed from steam engines to diesels in the 1940s and 1950s. The use of the land evolved into being a place to load truck trailers “piggyback” onto railroad flat cars, as well as a site for two or three big freight forwarder operations (FoLAR 2012).

The record search identified 46 cultural resource investigations, reports, or inventories that have been conducted in or adjacent to the Reach 7-8 study area. Given the intense urban development in this reach and transportation corridors on the edges of the concrete River channel, few of the investigations involve block surveys of open land. Many of the references are literature reviews and record searches focusing on the built environment and rail system or monitoring reports conducted for ground disturbing activities involving utilities and infrastructure. Los Angeles River containment and flood risk management facilities have not been documented or evaluated. Bridges across the River have been inventoried and evaluated for historic significance. There have been previous cultural resource investigations at the Arroyo Seco confluence site. The Cornfields site has been surveyed for cultural resources and limited subsurface excavations have been conducted locating features of the past uses. There have been no investigations of the Piggyback Yard study area. Table 3-14 lists the recorded cultural resources present in or adjacent to the Reach 7-8 study area

Table 3-13 Recorded Cultural Resources in Reaches 7-8

Resource Designation	Resource Type	Listing or Status[1, 2]	Notes
CA-Lan-3100 P-19-003100	Archaeological site	Not Individually Evaluated	Historic artifact scatter, within the River Station Area/Southern Pacific Railroad LAHCM #82 – Cornfields
CA-Lan-3101 P-19-003101	Archaeological site	Not Individually Evaluated	Historic artifact scatter, within the River Station Area/Southern Pacific Railroad LAHCM #82 – Cornfields
Cornfield/River Station P-19-003120	Archaeological site	LAHCM #82	Historic structural/rail yard remains and artifacts within the River Station Area/Southern Pacific Railroad. Cornfields. Reach 7.
Richmond Junction P-19-003685	Archaeological site	Not Evaluated	Historic artifact scatter – 1880s to present. Adjacent to Piggyback Yard. Reach 8.
1800 Baker Street Yard, P-19-100881	Isolate - 3 artifacts	Not Evaluated	Historic artifacts. Adjacent to Cornfields. Reach 7.
First Street Viaduct P-19-150195 53C1165	Bridge	NRHP CRHR	1927-28 –Neo-Classical style concrete bridge. Reach 8.
1709 North Spring Street, P-19-150244	Building	Not Eligible	Heavily altered 1895 brick commercial/industrial building. Adjacent to Cornfields. Reach 7.
1701 North Spring Street P-19-150245	Building	Not Eligible	Heavily altered 1894 commercial/industrial building. Adjacent to Cornfields. Reach 7.
1635-1639 North Spring Street P-19-150246	Building	Not Eligible	Heavily altered 1894 industrial building. Adjacent to Cornfields. Reach 7.
San Antonio Winery P-19-167098	Building	LAHCM #42	1917-1950 Building complex of the last remaining winery in Los Angeles. Near Piggyback Yard and Reach 8.
Portola Trail Campsite #1 P-19-174919	Historic Place-historic location, no physical remains.	CHL	1769, location where Portola camped and where the first Catholic Mass was celebrated in Los Angeles. Near Cornfields and Reach 7.
Department of Water and Power, General Services Headquarters P-19-176368	District	NRHP CRHR	1923-1944 grouping of municipal/industrial structures - adjacent to Reach 8.
Arroyo Seco Parkway, SR110, Pasadena Freeway P-19-179645	Historic Transportation Facility, Bridges	NRHP CRHR	1940 – The first controlled-access freeway in the West. Arroyo Seco confluence, Reach 7.

Resource Designation	Resource Type	Listing or Status[1, 2]	Notes
Union Pacific Railroad P-19-186110	Historic Transportation Route	Not Evaluated	1870-present – Railway corridor in continuous service. Adjacent to the River. Reaches 7 and 8.
Southern Pacific Los Angeles Division; Union Pacific P-19-186112	Historic Transportation Route	Not Eligible	1874-present – Railway corridor. Adjacent to Piggyback Yard, crosses Reach 8.
Arroyo Seco Flood Control Channel P-19-186859	Linear Water Conveyance Feature	Unknown	1937 – Concrete open flood risk management channel – appears eligible for the NRHP, but no concurrence. Arroyo Seco confluence. Reach 7.
P-19-187085	Linear		Missing record - requested
North Broadway Bridge, Buena Vista Viaduct 53C0545 P-19-188229	Bridge	NRHP CRHR LACHM #907	1910 – Beaux Arts details – first viaduct and the longest and widest concrete bridge in California at that time. Adjacent to the Cornfields, Reach 7.
Mission Tower, AT&SF[3] Tower P-19-188246	Building	NRHP CRHR	1916 – Enlarged 1938. Railroad Traffic Control Tower. Adjacent to Reach 8 across the River from Piggyback Yard.
Cesar Chavez-Macy Street Bridge	Bridge	NRHP CRHR LACHM #224	1926 – Concrete bridge in the Spanish Colonial Revival style to commemorate its location along the El Camino Real. Reach 8 near Piggyback Yard.
North Main Street Bridge 53C1010	Bridge	NRHP CRHR LACHM #901	1910 – Concrete arch bridge. Reach 7 and 8 boundary.
North Spring Street Bridge 53C0859	Bridge	NRHP CRHR LACHM #900	1928 – Concrete arch bridge. Reach 7 near Cornfields.

[1]CRHR: California Register of Historical Resources – Eligible, NRHP: National Register of Historic Places – Eligible, CHL: California Historic Landmark, LAHCM #: Los Angeles Historical-Cultural Monument and monument number, Not Evaluated: Resource has been recorded but not been evaluated for historic significance, Not eligible: Resource has been evaluated and there has been some level of determination that it does not meet eligibility criteria.
[2] Note: Eligible properties are not necessarily formally listed on the NRHP or the CRHR, but have been evaluated and meet the criteria for listing and consideration in the planning process.

3.7 TRAFFIC AND CIRCULATION

3.7.1 Transportation

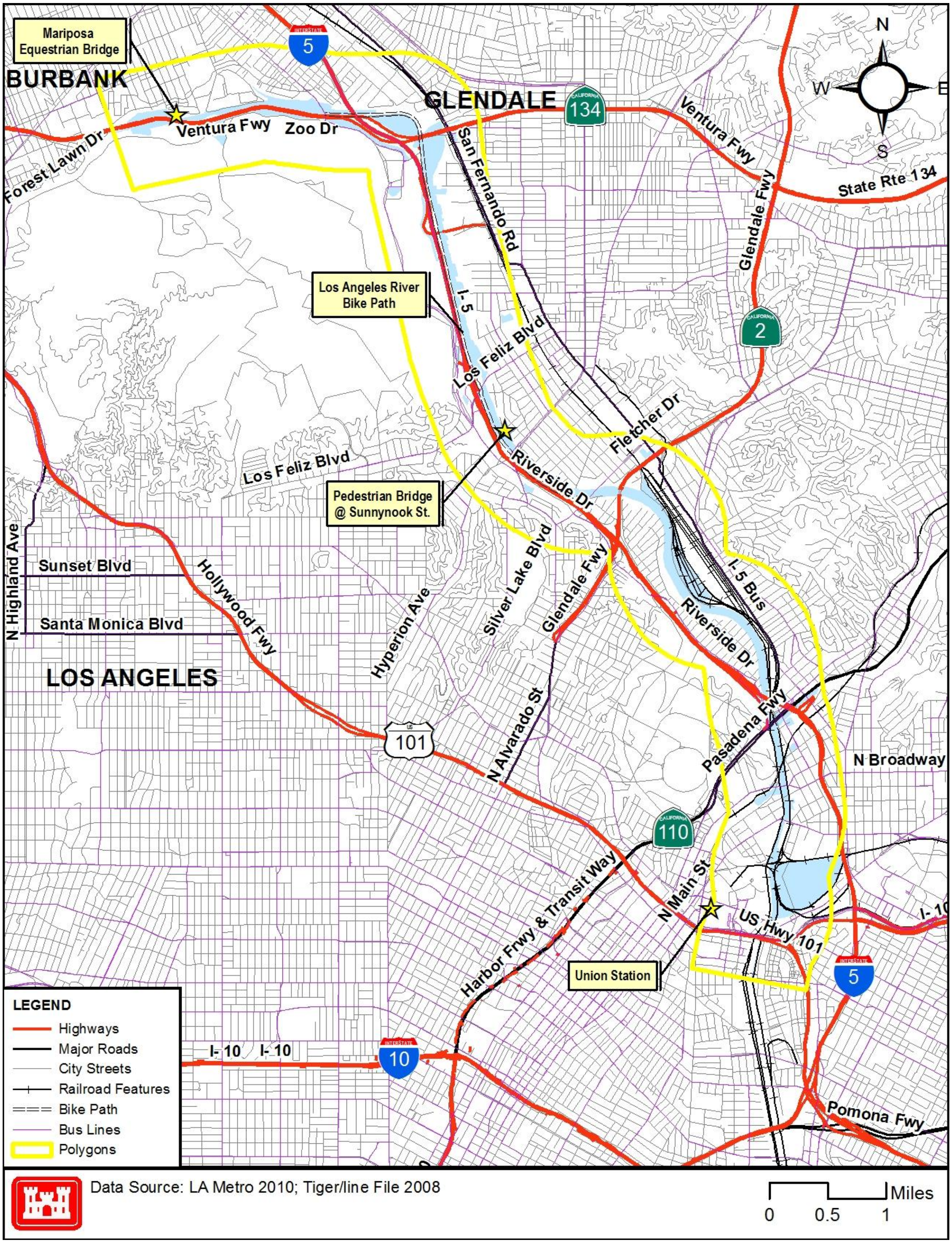
The roadway system in the study vicinity consists of a dense network of Federal and state highways and city streets. Federal and state highways include interstates, U.S. and state routes, and are managed and maintained by the California Department of Transportation (Caltrans). The Los Angeles Department of Transportation (LADOT) manages the approximately 6,500 miles of city streets (LADOT 2009). These streets generally carry less traffic than state highways and are managed and maintained by the city in which they are located.

Federal and state highways in the study area generally have three to five lanes of travel in each direction and experience very high traffic volumes. Such highways cross the River in six locations within the study area (see Table 3-15 and Figure 3-12). Interstate 5 runs alongside the channel between Reaches 3 and 6, and SR 134 runs very close to the channel in Reach 3. Rail lines servicing passenger and freight carriers run along the overbank area of the River in Reaches 7 and 8.

Table 3-14 Federal and State Highways in the Study Area

Route	Alternate Name	2011 Annual Average Daily Traffic[1]
State Route 2 (SR-2)	Glendale Boulevard, Glendale Freeway	156,000
Interstate 5 (I-5)	Santa Ana Freeway, Golden State Freeway	237,000
Interstate 10 (I-10)	Santa Monica Freeway, San Bernardino Freeway	207,000
U.S. Highway 101 (Hwy 101)	Hollywood Freeway, Ventura Freeway	209,000
State Route 110 (SR-110)	Pasadena Freeway, Harbor Freeway	123,000
State Route 134 (SR-134)	Ventura Freeway	112,000

[1]Total number of vehicles, both directions. In some cases, annual average daily traffic counts were not available in or near the study area for some state highway segments. In these cases, the traffic count location nearest the study area was chosen for inclusion in this table. Source: Caltrans 2011.



1 *Figure 3-12 Traffic and Circulation*

City streets are designed to accommodate various amounts of traffic and assigned one of five classifications. In descending order of traffic capacity, the five classifications are: major highway class I (126-foot right-of-way), major highway class II (104-foot right-of-way), secondary (90-foot right-of-way), collector (64-foot right-of-way), and local (60-foot right-of-way). Class I, class II, and secondary streets generally have four to eight lanes of travel (two to four in each direction) while collector and local streets have two lanes (one in each direction). There are no Class I streets in the study area (City of Los Angeles 1997). Glendale and Burbank use somewhat different terms for classifying city streets; however, the classifications serve the same purpose as the City of Los Angeles' classifications (City of Glendale 1998; City of Burbank 2012a). Selected roadways and intersections in the study area with their annual average daily traffic are shown in Table 3-15.

Table 3-15 Selected Roadways in the Study Area

Roadway	Annual Average Daily Traffic[1]	Cross Street Where Annual Average Daily Traffic Counted	Reach
Forest Lawn Drive	23,834	Zoo Drive	1-3
Zoo Drive	9,934	Zoo Drive N	1-3
Victory Boulevard	44,778	Laurel Canyon Blvd	1-3
Los Feliz Boulevard	35,485	Western Avenue	5
Hyperion/Glendale Boulevard	1,389	Hoover	5
Silver Lake Boulevard	25,331	Van Pelt Pl.	5
Fletcher Drive	38,707	Glendale Blvd	5
Riverside Drive	23,569	San Fernando Drive	5-7
Cypress	4,756	Jefferies	6-7
North Main Street	13,716	Gibbons Street	7
North Avenue 18	2,345	Pasadena Avenue	7
North Broadway	12,310	Avenue 18	7
Mission Road	23,315	Cesar E. Chavez Avenue	8
Cesar Chavez Avenue	28,566	Mission Road	8
First Street	10,468	Alameda Street	8

[1]Total number of vehicles, both directions) In some cases, annual average daily traffic counts were not available in or near the study area for some state highway segments. In these cases, the traffic count location nearest the study area was chosen for inclusion in this table. All roadways shown are classified as Local Neighborhood. Source: LADOT 2010.

Traffic congestion is an ongoing issue throughout Los Angeles; however, due to constraints to roadway expansion, local and regional governments have shifted focus to utilizing existing roadways more efficiently. Approximately 50 percent of the County's Federal and state highways and 20 percent of major arterials currently experience congestion in morning and evening commute periods. Because commuting patterns are more complex than the traditional suburban to urban regions, congestion can occur in both directions simultaneously (Metro 2010). Easing congestion has been addressed by the addition of carpool lanes and synchronization of traffic signals. Focus has also shifted to alternative means of travel such as public transit and non-motorized transport, as well as to encouraging land use development patterns where residents live close to public transit and job opportunities (City of Los Angeles 1997).

Caltrans is currently constructing a high occupancy vehicle lane (or carpool lane) in each direction on I-5 between SR-134 and Magnolia Boulevard across Burbank and Glendale in the study area, as well as sound and retaining walls. The project is expected to be completed in 2015 (Caltrans 2012).

3.7.2 Public Transit

Metro is the regional transportation planning agency for all of Los Angeles County and is the largest provider of mass transit in the study area. Metro develops and oversees transportation plans, policies, funding programs, and short-term and long-term solutions that address the County's increasing mobility, accessibility, and environmental needs. Metro also operates 200 bus lines, 2 heavy-rail subway lines (Red and Purple Lines), and 4 electric-powered light rail lines (Expo, Blue, Green, and Gold Lines).

LADOT separately provides local transit services including DASH, Commuter Express, and CityRide. LADOT's fleet consists of nearly 400 vehicles that accommodate approximately 30 million passenger boardings per year (LADOT 2012a). DASH provides bus service 7 days a week, while Commuter Express service generally operates Monday through Friday during peak commute hours. CityRide provides point to point service for citizens 65 years of age or older.

Overall, the usage of the transit system in the Los Angeles area is relatively stable or increasing. Metro's ridership statistics for the period of June 2010 and June 2012 indicate that monthly bus boardings decreased slightly from 30.9 million to 29.7 million while rail boardings increased from 8.7 million to 9.3 million (Metro 2012b). For the portion of the transit network evaluated in the Los Angeles County Congestion Management Program (including services within the study area), passenger throughput (a measure that combines the number of people moved and the speed at which they move) increased 44 percent and network speed increased about 6 percent from 1992 to 2009 (Metro 2010).

3.7.3 Railroads

The Los Angeles River corridor is one of the City's main rail transportation corridors (Figure 3-11). Railroad lines run immediately adjacent to both banks in Reaches 7 and 8. Major rail operators in the study area are Union Pacific, Burlington Northern Santa Fe Railway (BNSF), Southern California Regional Rail Authority (Metrolink), and Amtrak. Union Pacific and BNSF operate freight service, while Metrolink and Amtrak provide passenger rail service over Union Pacific and BNSF tracks (City of Los Angeles 2007). Demand for both passenger and freight rail capacity is at or near capacity in portions of Los Angeles and the surrounding area, and demand is expected to continue to grow. The closer the system operates to capacity, the more congested tracks become and delays become longer and more frequent (City of Los Angeles 2007; Wilbur Smith Associates 2008).

Union Pacific carries goods for import and export and operates over 100 freight trains per day in its Los Angeles service area, which passes through the study area. BNSF rail lines in the Los Angeles area transport passengers and a variety of freight, including intermodal containers, raw materials, and finished goods. They operate over 100 trains per day in the area, approximately 40 percent of which are passenger trains operated on behalf of Amtrak and Metrolink. BNSF tracks enter Los Angeles County from the north and pass through Union Station to three major rail yards. The nearest rail yard to the study area is an Intermodal Facility 3 miles south of the study area on Washington Boulevard (City of Los Angeles 2007). Metrolink is a regional commuter rail system that operates seven lines, six of which originate from Union Station. Metrolink has a 512-mile route network, operates 55 stations, and serves approximately 40,000 weekday riders (Metrolink 2012). Amtrak operates several long-distance passenger trains and also partners with the State of California to operate the Pacific Surfliner (City of Los Angeles 2007). In 2011, Amtrak served 1,606,121 passengers in Los Angeles (Amtrak 2012).

3.7.4 Parking

There are no public parking areas dedicated to River access, and public parking with nearby access to the River is limited. On-street parking is available near Reach 1 in Burbank and Reach 3 in Glendale. Public parking lots that are near the River in Reaches 1-3 are located in Griffith Park along Zoo Drive, at the Griffith Dog Park, at Ferraro Soccer Fields, south of Harding Golf Course at the Crystal Springs Picnic Area, and on the left bank at Atwater Park. There is also a large parking lot in Griffith Park between the Los Angeles Zoo and Autry National Center. In Reaches 4-6, public parking is found near the right bank of the River at the south end of Griffith Park near the Griffith Park swimming pool and William Mulholland Memorial Fountain and on the left bank of the River at the Rio de Los Angeles State Park. Street parking on the right bank of the River along Fletcher Drive, Ripple Street, and Crystal Street is frequently used by recreational users. Parking is also available at the following Mountains Recreation and Conservation Center parks that are near the River in the project area: Mark Park, Elyria Canyon Park, Elysian Valley Pocket Park, Vista Hermosa Natural Park, and the Los Angeles River Center and Gardens.

3.7.5 Airports

The nearest airport to the study area is the Bob Hope Airport, which is approximately 3 miles north of the study area in Burbank. The Los Angeles International Airport is the largest airport in Los Angeles, but is well outside the study limits, approximately 12 miles southwest.

3.7.6 Non-Motorized Transportation

Walking and biking are the primary means of non-motorized transportation in the study vicinity (Figure 4-11). The Los Angeles River Bike Path, also called the Los Angeles River Greenway Trail, follows the right bank of the River through much of the study area and is used by bicyclists and pedestrians (LADOT 2012c). Other streets in the study vicinity provide bike lanes. Most of the streets in the vicinity have sidewalks and sidewalks are provided on several bridges that cross the River. The Los Angeles River Bike Path follows the right bank of the River from the Riverside Drive Bridge at Bette Davis Park through the entire length of the study area, ending at North Figueroa Street. The Mariposa Equestrian Bridge and the Sunnynook Drive Pedestrian Bridge provide crossing points.

3.8 NOISE

This section presents information on existing noise conditions in the study area and identifies the noise sensitive receptors that are present.

Noise is measured in decibels (dB) and then frequencies are weighted based on the human response to sound, denoted as dBA. In general, a difference of more than 3 dBA is a perceptible change in environmental noise, while a 5 dBA difference typically causes a change in community reaction. An increase of 10 dBA is perceived by people as a doubling of loudness (USEPA 1974). Metrics used to describe sound pressure levels in this document include the L_{eq}, L_{max}, and CNEL:

- **L_{eq}:** Conventionally expressed in dBA, the L_{eq} is the energy-averaged, A-weighted sound level for the complete time period. It is defined as the steady, continuous sound level over a specified time, which has the same acoustic energy as the actual varying sound levels over the specified period.
- **L_{max}:** The maximum A-weighted sound level as determined during a specified measurement period. It can also be described as the maximum instantaneous sound pressure level generated by a piece of equipment.
- **CNEL:** Community Noise Equivalent Level (CNEL) is another average A-weighted Leq sound level measured over a 24-hour period; however, this noise scale is adjusted to account for some individuals' increased sensitivity to noise levels during the evening and nighttime hours. A CNEL

noise measurement is obtained after adding 5 dB to sound levels occurring during evening hours (7:00 p.m. to 10:00 p.m.) and 10 dB to sound levels occurring during nighttime hours (10:00 p.m. to 7:00 a.m.).

The ambient acoustic environment within 500 ft of the study area represents the limits of this acoustical analysis and encompasses a variety of noise sources. The assumed existing primary source of noise is from high traffic arterials, which generate consistent noise patterns in the study area. Other major noise sources include railways, industrial yards, events at Dodger Stadium, and surface street use.

Noise sensitive receptors are located within 500 ft of the study area. Generally, noise sensitive receptors are locations where people sleep or where noise can affect the function of the receptor. Examples of noise sensitive receptors include, but are not limited to, residential dwellings, schools, parks, community centers, public facilities, hotels, hospitals, places of worship, and office buildings. Noise sensitive receptors within the area studied are inventoried below.

Ambient noise conditions are documented in this report primarily through qualitative assessment of potential noise sources in the study area. Noise monitoring was not conducted as a part of this EIS/EIR. Instead baseline ambient noise levels were established by using referenced ambient noise levels as defined by the Los Angeles Department of City Planning which were a result of the City's monitoring program in 1998 and updated in 2012, see Table 3-17 (City of Los Angeles 1998b, City of Los Angeles 2012b).

Table 3-16 Presumed Ambient Noise Level by Zone within Los Angeles

Zone	Day (7:00 a.m.–10:00 p.m.)	Night (10:00 p.m.–7:00 a.m.)
Agricultural, Suburban, Residential including Single and Multiple Family Homes (A1, A2, RA, RE, RS, RD, RW1, RW2, R1, R2, R3, R4, and R5)	50 dBA	40 dBA
Parking Areas and Commercial (P, PB, CR, C1, C1.5, C2, C4, C5, and CM)	60 dBA	55 dBA
Limited and Restricted Light Industrial (M1, MR1, and MR2)	60 dBA	55 dBA
Light and Heavy Industrial (M2 and M3)	65 dBA	65 dBA

Source: City of Los Angeles 2012b.

Wildlife species are also sensitive to noise. Animals rely on meaningful sounds for communication, navigation, avoiding danger and finding food. Behavioral and physiological responses of wildlife to noise have the potential to cause injury, energy loss, decrease in food intake, habitat avoidance and abandonment, and reproductive losses (National Park Service 1994). Studies have reported noise impacts to least Bell's vireo from highway noise (Barrett 1996), and to other grassland and forest dwelling birds (AASHTO 2008). These species have the potential to occur in the study area and are subject to the effects of noise.

Reaches 1-3

Highway road noise is generated immediately adjacent to the River through much of its length in the upper reaches. Reaches 1-3 are paralleled by either Highway 134 or I-5 and have little or no noise buffer between them. These highways are major transportation arterials for commuters and commercial trucking. Industrial areas contribute noise from the east bank of the River, just south of the Highway 134 overpass.

Sensitive receptors within 500 ft of the study area include Griffith Park and its recreational facilities, specifically the Los Angeles Zoo and Botanical Gardens, Autry National Center, and Forest Lawn Cemetery. Other sensitive facilities include the Los Angeles Equestrian Center, Ferraro Fields, Disney Studios, Glendale Meditation House, and Bette Davis Park (Figure 3-13). There are no hospitals, schools, motels, libraries or retirement homes in the area. There are a few residential neighborhoods within 500 ft of the study area with the nearest neighborhood, Riverside Rancho, located north of Highway 134.

Reaches 4-6

Reaches 4 and 5 are immediately adjacent to I-5 and have little or no noise buffer between them. Reach 6 is separated from I-5 by a residential neighborhood, but is still within audible distance of the highway. Other noise sources include rail lines and yards immediately adjacent to Reach 6 on the east side of the river.

Sensitive receptors within 500 ft of the study area include Harding Golf Course, Griffith Park and its many recreational facilities, North Atwater Park, Los Feliz Golf Course, Rattlesnake Park, Glenhurst Park, Rio De Los Angeles State Park, Lincourt Stables, River Garden Park, Egret Park, Elysian Park, Kadampa Meditation Center, Dorris Place Elementary School, Glenfeliz Elementary, Los Feliz Nursery School, Los Feliz Charter School for the Arts, Kedren Community Head Start, Choong Hyun Mission Church, Iglesia Evangelica Shalom, Sumsang Korean Catholic Church, St. Ann Church and School, and Elysian Valley Recreation Center (Figure 3-14). There are no hospitals, motels, libraries or retirement homes in the area. Several residential neighborhoods are located within 500 ft of the study area including those of Atwater Village, Los Feliz, and Elysian Valley.

Reaches 7-8

Railroad lines run immediately adjacent to both banks in Reaches 7 and 8. Highways, surface streets, and industrial areas also contribute to the acoustic environment. Sensitive receptors within 500 ft of the study area include Elysian Park, the Downey Recreation Center and Swimming Pool, Los Angeles Historic State Park (Cornfields), Young Nak Presbyterian Church, Temple Gethsemani, Tribe of Los Angeles, and El Salvador Baptist Church (Figure 3-15). There are no hospitals, hotels, nursing homes, schools, or libraries within the area. Residential neighborhoods include portions of Lincoln Heights and Chinatown.

Figure 3-13 Noise Sensitive Receptors, Reaches 1-3

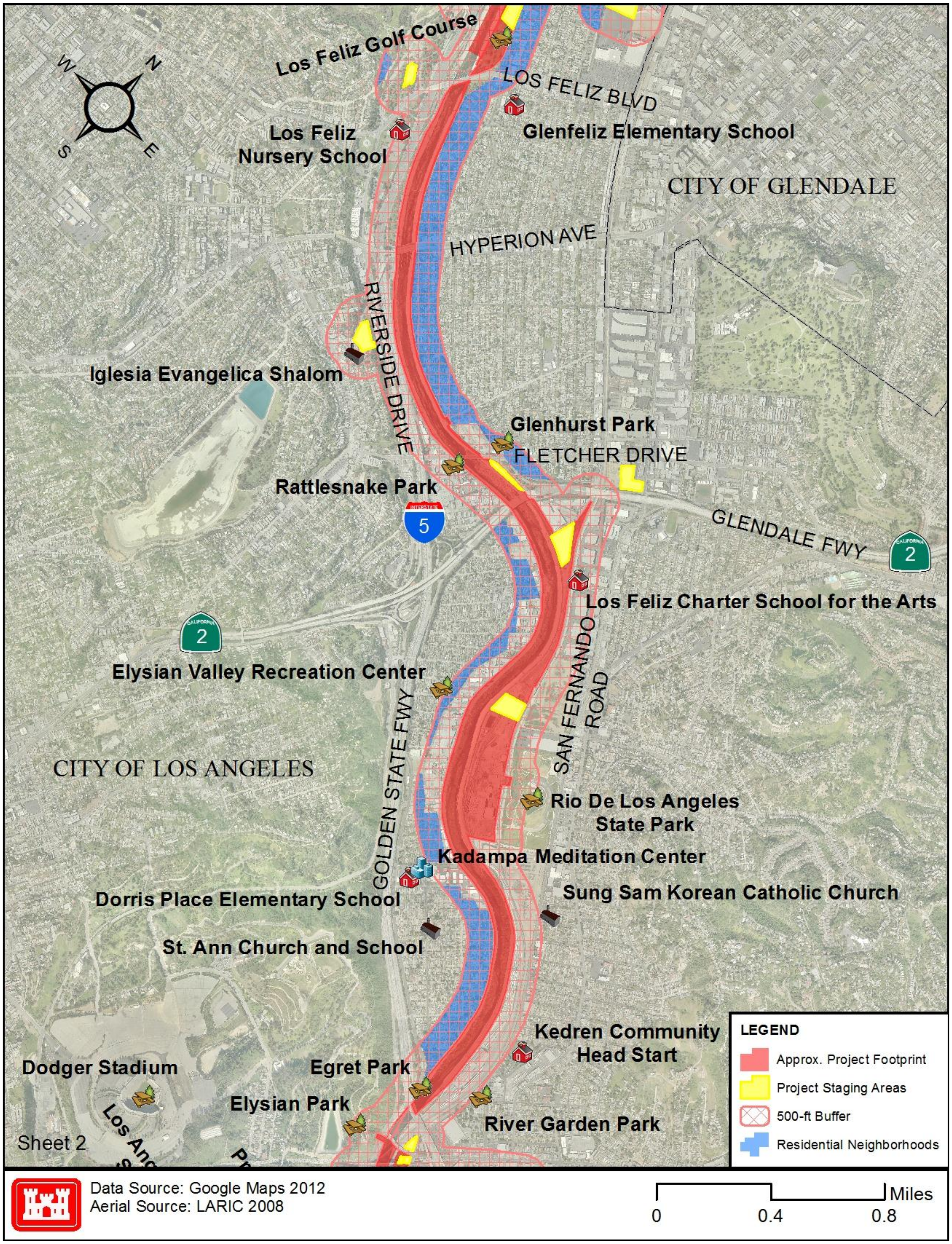


Figure 3-14 Noise Sensitive Receptors, Reaches 4-6

Figure 3-15 Noise Sensitive Receptors, Reaches 7-8

3.9 RECREATION AND PUBLIC ACCESS

For this analysis, the recreation resource area is defined as being a half-mile buffer on either side of the River. The inventory of larger regional parks and other resources that exist outside the study area are beyond the geographic scope of this assessment other than to demonstrate the lack of regional parks and open space available within the greater Los Angeles area.

3.9.1 Regional Context and Demand

The City of Los Angeles has approximately 24,000 acres of parks, with approximately 15,899 acres of parkland under the jurisdiction of the Department of Recreation and Parks. Other agencies managing parklands include the Los Angeles Department of Water and Power, Mountains Recreation and Conservation Authority, the Santa Monica Mountains Conservancy, California State Parks, and the County of Los Angeles. In all, this equates to a city-wide average of 6.26 acres of park per 1,000 residents (Trust for Public Land 2011). The City of Glendale has 39 developed parks comprising 280 acres, or about 1.4 acres per 1000 residents (City of Glendale 2012c). The City of Burbank operates 27 park facilities covering 155 acres, as well as 500 acres of open space, equating to approximately 6.34 acres of parkland per 1,000 residents (City of Burbank 2010). Including all parks identified in the assessment presented below, the recreation resource area has an estimated 5,000 acres of park, or 38.77 acres per 1,000 residents. This value is high compared to the city-wide average due to the presence of some larger than average parks near the study area, such as Griffith Park (the largest park at 4,210 acres) and Elysian Park (575 acres).

Much of Los Angeles is considered to be park deficient which refers to any geographic area that provides less than 3 acres of green space per 1,000 residents, as defined by California law (GreenInfo Network 2010). In particular, the industrial areas surrounding Reaches 7-8 have the least parkland, with fewer than 3 acres per 1,000 people. Other areas, particularly on the southwest side of Reaches 1-3, have greater than 3 acres of parkland per 1,000 residents, which is due to the presence of Griffith Park. In general, access to parks and acres of parkland per 1,000 residents is lowest in areas that have the highest number of families below the poverty line of $47,331.

According to Southern California Association of Governments (SCAG), public parks are intended to serve all residents, but not all neighborhoods and people have equal access to these public resources. SCAG calls for a multiagency effort and public transportation to improve access for all to parks throughout Southern California (SCAG 2008). The City Project, a local nonprofit research organization was founded to find ways to improve park availability for all neighborhoods, regardless of ethnicity or income level (Garcia et al. 2009).

Residents of Los Angeles place a high priority on the quality of natural and environmental resources. In a study from 2000, 75 percent of those surveyed said that preserving wetlands, rivers, and environmentally sensitive areas would be either “somewhat effective” or “very effective” at improving their quality of life. There is also strong support for protecting cultural resources and for environmental education (Public Policy Institute of California 2000).

3.9.2 Recreation Opportunities in the Study Area

Approved uses of the River in the study area are generally limited to pedestrian, cyclist, and equestrian trails along the banks. Some areas of the River’s watershed have recently been permitted for seasonal fishing or canoeing/kayaking on a year-to-year basis (Sepulveda Basin), were approved in Reach 6, between Fletcher Dr. and Egret Park, within the study area in summer 2013 (Memorial Day to Labor Day) as a Los Angeles River Pilot Recreational Zone authorized by the City of Los Angeles and administered by the Mountains Recreation and Conservation Authority, a state agency, in coordination with the USACE and the County of Los Angeles. This zone allowed kayaking and canoeing, bird watching, walking, and fishing within the riverbed through entry at designated points from Fletcher Drive to Steelhead Park, subject to clear weather conditions in the watershed and other safety restrictions. The pilot recreational zone function will be assessed by the coordinating agencies after summer 2013 for determination of future seasonal in-channel recreation in that zone. Outside the pilot zone, where public use is not currently authorized users are not often cited for fishing, mostly in the soft bed areas of the River (Los Angeles 2011a). Other activities along the River include bird watching, sightseeing, and tours by local interest groups. There are no areas approved for swimming in the study area, and instances of swimming and wading are likely low due to water quality concerns; local agencies and interest groups typically advise users to stay out of the water (Los Angeles River Revitalization Corporation [LARRC] 2011b).

Small parks along the River's pathways provide an improved pedestrian recreation experience with facilities such as benches and grassy areas. These parks are a combination of city parks and small pocket parks funded by local non-profit groups seeking to develop a greenway along the River (Santa Monica Mountains Conservancy and Mountains Recreation Conservation Authority 2007).

The Los Angeles River Bike Path is a Class II Bike Path (off-roadway, paved), and runs along the right bank of the River from Griffith Park through Glendale Narrows to Elysian Park, offering an off-roadway route for pedestrians and cyclists. Another route between Griffith Park and Elysian Park relies on a combination of bike lanes and bike routes (on-roadway) but does not follow the River, making it a Class III Route, less appropriate for recreation and more of a transportation route. Both of these routes are managed by Los Angeles County Metro, and are included in the City of Los Angeles Bicycle Plan (Metro 2012d). See Appendix H, Supplemental Baseline Conditions, for a list of recreational resources in the study area.

Figure 3-16 Recreation, Reaches 1-3

Figure 3-17 Recreation, Reaches 4-6

1

Figure 3-18 Recreation, Reaches 7-8

3.10 AESTHETICS

Aesthetic resources are generally defined as both natural and built features of the landscape that contribute to the public experience and appreciation of the environment. These include the urban and scenic characteristics which are observable from within the study area and which can be seen when looking at the area from the surrounding space. For the purposes of this report, visual resources in the study area include the channel of the River, its surrounding areas of residential, commercial, and industrial development, and open space, as well as the more distant areas that can be viewed from the River, including downtown Los Angeles, Griffith Park, Elysian Park, and the Verdugo Hills. This section will also consider the olfactory conditions that currently exist in the study area. The aesthetics of the study area affect local residents and visitors, those employed in or visiting adjacent buildings, recreationists at adjacent parks and golf courses, and travelers on the many surrounding highways, railways, surface streets, bikeways, and sidewalks.

Visually, the River and floodplain have changed dramatically from their historic appearance. The once free-flowing River has been channelized and surrounded to a large extent by impervious surfaces and highly urbanized areas. Sand banks and willow riparian zones have been widely replaced with concrete, stone, and asphalt. Roadways, homes, industrial areas, businesses, rail yards, parks and golf courses have replaced the historic floodplain.

Within the River, aesthetics are dominated by the trapezoidal concrete or hardened channel, urban development at the top of the banks, fluctuating water flows, debris and graffiti, and intermittent vegetation within the channel. The entire length of the study area has concrete or hardened walls, intermittently broken by stormwater outfalls or confluences with tributaries. The majority of the reaches within the study area also have a concrete bottom. This vast concrete expanse attracts graffiti artists and homeless encampments, which compromise the visual quality of the area for many residents. Homeless encampments are common within the river channel within the study area, particularly in Reaches 6 and 7.

Businesses, neighborhoods, and parks along the River are generally not oriented to view the River, and it is difficult to see the River from just beyond the top of the bank. The lack of visual connection to the River facilitates continued vandalism and camping, and also contributes to the River as a dumping ground for debris. Plastic bags, shopping carts, and beverage containers are just a few of the types of litter that are abundant within the River in all reaches, though reaches with vegetation tend to retain litter and debris more efficiently than other areas.

In general, water fluctuations change the view of the River from a flowing stream several feet deep in the winter and spring months to a shallow trickle in the summer. However, where non-concrete river bed is present, water levels can fluctuate in comparison to concrete bottom areas throughout the year. Greywater from Tillman Treatment Plant and the Los Angeles/Glendale Water Reclamation Plant, and stormwater from surrounding cities are discharged into the River. During the summer months these inputs may be the only source of water in the River and as a result, water levels may change several inches throughout the day based on these releases. As a result, and in combination with the debris and litter, the study area is markedly malodorous throughout the year. Trash, industrial air and water discharges, and motor vehicle exhaust also contribute to the smell.

Vegetation has become established within the study area including both those areas with a natural river bed and those that have been fully channelized. As cracks develop in the concrete or channel hardening materials, or as debris becomes lodged in the River, plant seeds are caught and vegetation begins to grow. Wide swaths of vegetated areas have become common.

Around the River are the Cities of Los Angeles, Glendale, and Burbank and their associated development, traffic, and utility corridors. In some cases, utilities pass over the River or utilize its path as a corridor. Green spaces are composed primarily of parks and golf courses, which are most abundant in the upstream reaches and diminish in size and quality moving downstream. From the River, views may extend out to include portions of downtown Los Angeles, the hills of Elysian Park and Griffith Park, and on a clear day, the distant Verdugo Mountains. Views from the upper reaches often include Griffith Park in particular, which rises above the study area to the west and offers a hilly, forested backdrop to the local views. Lighting in the area is provided along the River bike path, the surrounding surface streets, parks and sports fields. The River itself is lighted only where lighting incidentally broadcasts over the River. Continual fluctuations in nighttime lighting occur due to motor vehicle headlights.

3.10.1 Study Area Details

The aesthetic resources of Reaches 1-3 include views within the River of concrete channel walls in trapezoidal and box configurations, overpasses, utilities, and sparse vegetation. From the channel overbank areas, views are generally from the bike path and are largely limited to the channel, power lines on the right bank, Los Angeles Equestrian Center, Bette Davis Park, Ferraro Soccer Fields, and highway infrastructure. Views into the River are briefly afforded to passing motorists along SR-134 and I-5.

Left to right: River channel looking upstream near Pollywog Park (Reach 1). Looking southwest toward hills of Griffith Park (Reach 2). View from Ferraro Fields (Reach 3) to the northeast looking over the River.

Cyclone fencing runs along much of the length of both banks and very little vegetation is present in the historic riparian zone. Graffiti, trash, debris, and encampments are most abundant where the Riverside Drive and I-5 overpass pilings back up debris and trash, and allow vegetation to become established. Verdugo Wash was recently scraped to remove all vegetation at the confluence with the River. In some places, long range views are accessible from the study area in these reaches. Where there are no obstructions to the view, the green hills of Griffith Park can be seen and the even more distant Verdugo Mountains are sometimes visible.

Reaches 4-6 are generally soft bed and have amassed enough vegetation to create habitat within the channel. The channel through this area appears more natural than other areas; thick growths of cottonwoods and willows occur along the margins of the channel, and both low elevation mats of vegetation and large trees islands occur within the channel. Trapezoidal hardened banks occur throughout the length of these reaches.

Again, visual conditions within the channel and overbank area are generally limited to the immediately adjacent area. The bike path offers the best access and from here views are dominated by the channel itself, the vegetation within the channel, trash, debris, graffiti, power lines, and roadway infrastructure. Views of the River are possible from overpasses and adjacent roads including Colorado Boulevard, Los Feliz Boulevard, Hyperion Avenue, Fletcher Drive, SR-2, and I-5.

Top Left: Vegetation mats growing in the soft bed channel near Los Feliz (Reach 4). Top Right: Hardened trapezoid banks (Reach 4). Bottom: Channel along Taylor Yard overgrown with non-native giant reed and fan palms (Reach 6).

In some areas, the forested and scrub-shrub habitats of Griffith Park and Elysian Park can be seen rising in the west, though they are both separated from the River by roads and other development. Atwater Park just south of Chevy Chase Drive is the only overbank park with an open connection to the River. All other green spaces are fenced off from the channel area.

Moving south, Taylor Yard on the left bank comprises a large area of Reach 6 and dominates much of the visual landscape from within the River channel here. Long range views from unobstructed areas allow visitors to glimpse the distant Verdugo Mountains on a clear day. From some spots within these reaches, it may be possible to also view the skyscrapers rising from downtown Los Angeles.

Top left: Looking north from First Street downtown (Reach 1). Top right: Looking upstream into the Arroyo Seco confluence (Reach 7). Bottom: North Broadway Bridge near Cornfields (Reach 7).

South of I-5, Reaches 7 and 9 are once again a concrete trapezoidal channel with a concrete bottom. Decreasing vegetation and increasing industrial areas give this reach a dominantly urban aesthetic; rail yards, warehouses, parking lots, and overpasses are abundant. The lack of vegetation, both within the River and along the overbank areas, contributes to this apparent absence of any natural areas. Graffiti, trash, and encampments further deteriorate the appearance.

Aesthetic value is provided by a series of Art Deco and Classical Revival style bridges that span the River, including those at North Broadway, North Spring Street, and Main Street, which are also the most publicly accessible areas from which to view the River (Los Angeles County 1996). Other architectural samples or cultural resources are sparse. Businesses and industry in this reach have opted to orient away from the River, or have been disconnected from the River by railways. Views of the River itself are not currently an attractive value for businesses. Views of downtown Los Angeles buildings are possible from these downstream reaches. However, flat elevations and the urban infrastructure around the study area generally obstruct much of the downtown view, as well as long range views of surrounding mountain ranges.

The section of SR-110 in the area has been designated as a National Scenic Byway by the Federal Highway Administration (FHWA) due to its historic significance (U.S. Department of Transportation

2012). In addition, because it was built prior to 1945, the California Streets and Highways Code lists this section of highway as a Historic Parkway (Section 280).

3.11 PUBLIC HEALTH AND SAFETY INCLUDING HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

This section is a discussion of conditions in the study area related to public health and safety. The public health and safety topics of concern for this evaluation are: water safety; wildfire; methane zones; vector borne-diseases; and hazardous, toxic, and radioactive wastes (HTRW).

3.11.1 Public Health and Safety

Los Angeles River Water Safety

Under normal conditions, the River usually contains a low volume of slow-moving water which is often restricted to a concrete slot in the centerline of the channel bottom or a shallow depth in soft bottom reaches. However, during periodic storms, the channel volume increases with rapidly-moving water from the upper watershed and stormwater runoff. During and following these storms, water levels and flow velocities in the River channel rise quickly, without warning, dramatically increasing the risk of accidental death and injuries to people and animals venturing into the channel. Much of the River is fenced and signed to prevent accidental injury or death.

The Los Angeles Fire Department (LAFD) has a Swiftwater Rescue team of personnel specially trained and equipped to respond to water-related emergencies (LAFD 2012). The Glendale Fire Department, Burbank Fire Department, and the Los Angeles County Fire Department also have swiftwater rescue capabilities (Glendale Fire Department 2012, Burbank Fire Department 2011, Los Angeles County Fire Department 2012).

Access points to the River in Reaches 1-3 include Griffith Park, Bette Davis Park, and at Los Feliz Blvd., where pedestrians and cyclists are able to enter through gates onto the paved paths along the River. Access at Reaches 4-6 is offered near North Atwater Park, the pedestrian bridge at Sunnynook St., and residential areas that border the River. Access points along the more industrial downstream reaches (7-8) are limited by private and commercial properties, though surface streets do come near the River.

Wildfire

Portions of the study area are designated as very high, high, or moderate fire hazard severity zones (Figure 3-18). Fire is more likely to occur in these areas than in other areas due to the type of vegetation, topography, weather, and other conditions. Fire hazard severity zones are established by city ordinance. Such zones are prone to incidence of wildfires, which may be caused either by natural forces, such as lightning, or by human negligence or mischief. Very high, high, and moderate fire hazard severity zones are present in the study area throughout much of Griffith Park and Elysian Park. No very high, high, or moderate fire hazard severity zones are present in Reaches 7-8.

Methane Zones

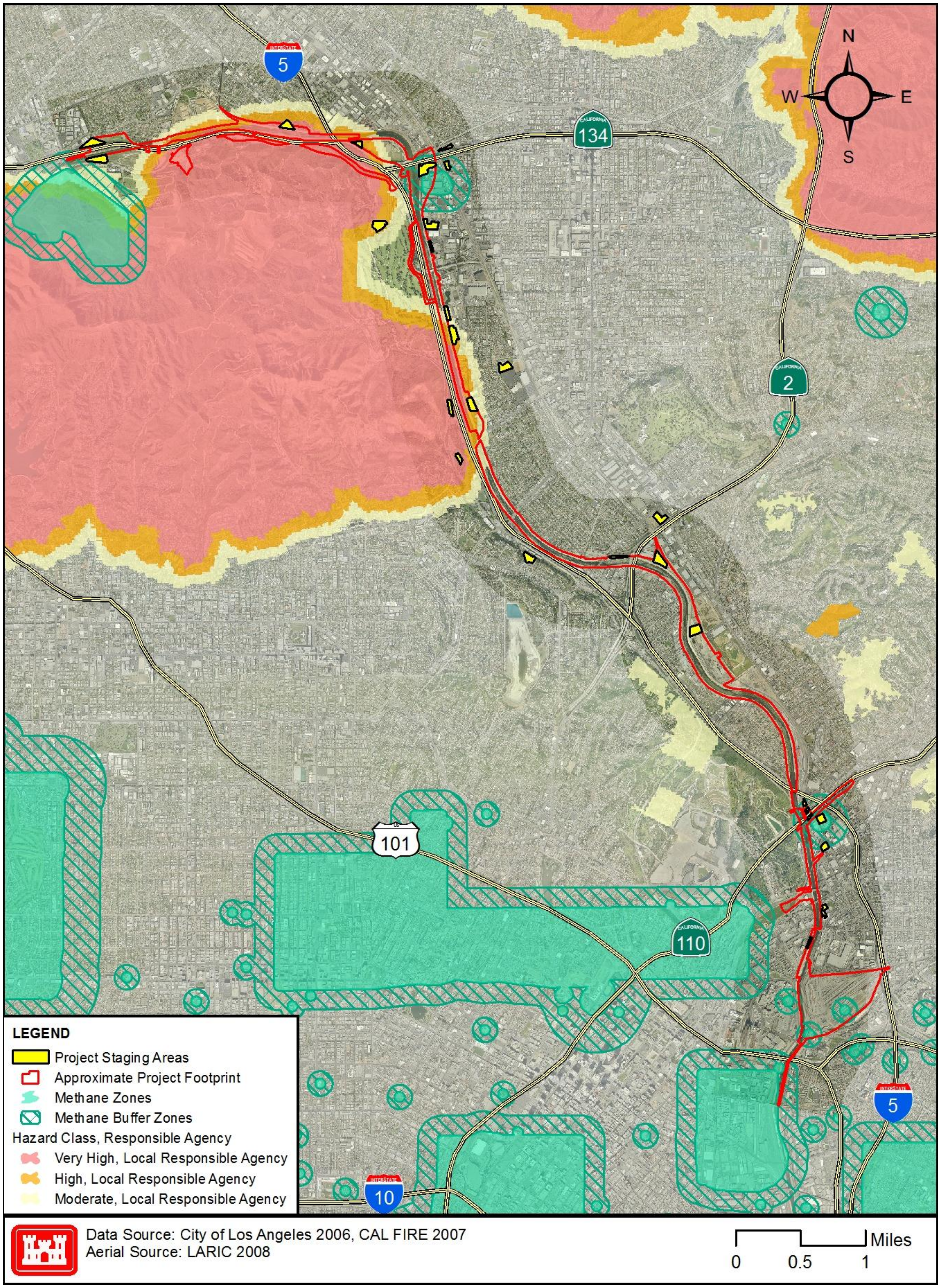
Methane gas is found below ground in proximity to methane gas sources such as former landfills and naturally-occurring petroleum deposits. Methane gas can be harmful if inhaled or can cause a fire or explosion under certain conditions. The City of Los Angeles has established methane gas zones and methane gas buffer zones under LAMC Section 91.7101 *et seq*. Portions of the study area are in such zones, as shown in Figure 3.18. Projects occurring in these zones must test for methane gas prior to construction and mitigation measures may be required to reduce health and safety hazards.

Methane zones occur east of I-5 and south of SR-134 and the buffer zone for this area overlaps the River (Reach 1). Methane zones may be present in Glendale or Burbank; however, a map of these zones was not available. There are no methane zones in Reaches 4-6. In Reach 7 a methane zone that overlaps the study area is located south of the intersection of I-110 and I-5. Several small methane zones overlap the study area in Reach 8 between Alhambra Ave. and the southern end of the study area at 1st St.

Vector-Borne Diseases

A vector is an animal or insect such as a rodent or mosquito that can transmit a disease to another animal or to humans. Vector-borne diseases are diseases that can be transmitted to humans from contact with a vector. The Greater Los Angeles County Vector Control District (GLACVCD) is a public health agency that works to keep the area in its jurisdiction free of vector-borne health threats. The GLACVCD is one of five mosquito and vector control districts in Los Angeles County serving approximately 6 million residents in a 1,330 square mile area that includes Los Angeles and Glendale. The GLACVCD provides mosquito abatement, disease surveillance, and public health outreach (GLACVCD 2012a).

Mosquitoes, black flies, and midges breed in water and may be found in the study area, though black flies and midges are not disease vectors in California. Mosquito-transmitted diseases that are of concern in Southern California are West Nile virus, Saint Louis encephalitis, western equine encephalomyelitis, malaria, and heartworm (heartworm affects dogs and cats, but rarely humans). With the exception of West Nile virus, incidences of these diseases are rare (GLACVCD 2012a). In 2011, there were 44 human cases of West Nile virus and 2 fatalities in the GLACVCD's jurisdiction (GLACVCD 2012b). As of September 2012, 12 human cases of West Nile virus and no fatalities have occurred (California West Nile Virus Website 2012).



1 *Figure 3-19 Fire Hazard and Methane Zones*

3.11.2 Hazardous, Toxic, or Radioactive Waste (HTRW)

The USACE prepared an HTRW survey report for the proposed project as required by Engineering Regulation 1165-2-132 (Appendix K). The study area is in a densely populated area with a history of manufacturing and industrial land use. A large number of HTRW cases listed in regulatory databases were initially identified. From these, 21 open cases were determined to overlap the study area. One additional site of localized groundwater contamination in remediation at the Cornfields site was determined through other document searches. The Piggyback Yard site is also anticipated to contain HTRW contamination, based on its similarity in historical use to Taylor Yard, for a total of 22 known and 1 likely HTRW sites in the study area. The site locations are depicted on figures found in Appendix K. As shown in Table 3-16, 3 of the 23 relevant HTRW sites have a high impact within the study area due to the larger size of the contaminated area compared to the others and their likelihood of overlapping with project features. The three high impact sites are the San Fernando Valley Superfund Site and Taylor Yard sites G1 and G2. The Piggyback Yard site is also a site of concern with potentially high levels of contamination based on its historical uses, although there are no public records available for that site. The USACE determined that the other 19 sites have a moderate amount of overlap within the study area, they are in various stages of remediation, and contamination is not as widespread at those sites. Each of the three known and one suspected high impact sites is discussed below.

The San Fernando Valley Superfund Site overlaps parts of the northern portion of the study area from Reach 1 to Reach 4. Shallow groundwater in the area is contaminated with various chlorinated VOCs, specifically TCE and PCE. The Environmental Protection Agency (EPA) is overseeing implementation of a basinwide remedial investigation and working with state and local agencies and other responsible parties to prevent exposure to contaminated groundwater, provide alternate sources of drinking water, determine the extent of the contamination, and address contamination through remediation and monitoring. Several areas of known groundwater contamination near the River are being treated by extracting groundwater and treating it at the surface. Groundwater extraction wells near the project area are at the Glendale and Pollock Treatment Plants and the Los Angeles Reclamation Plant. Although contaminant levels have been substantially reduced in many places, contaminants remain above safe drinking water levels and remediation is ongoing (CH2M Hill, Inc. 2009; EPA 2013). Remediation is anticipated to continue for the next 50 years. The project site primarily overlaps the outer portions of the groundwater plumes, where contaminant concentrations are lower. The lateral extent of groundwater contamination from these contaminants is shown on figures in Appendix K.

Taylor Yard is a 243-acre rail yard that has been used for about 100 years. The G1 (19 acres) and G2 (50 acres) sites are portions of this rail yard. At the G1 site, four areas with elevated levels of lead and arsenic in soil were identified. These were remediated to meet site remediation goals that satisfy human health standards for industrial properties but not ecological or recreational standards and the property was sold to the California Department of Parks and Recreation (Camp Dresser & McKee Inc. 2011).

Remediation at the Taylor Yard G2 site is ongoing. The primary contaminants of concern at this site are metals, volatile organic compounds, semi-volatile organic compounds, and petroleum products. The contaminants are present in soil and groundwater. Remedial activities that have already occurred at the site include soil removal and soil vapor extraction. The Department of Toxic Substances Control (DTSC) approved a Feasibility Study for site remediation of the site in August 2012 (DTSC 2012). The project proponent will then prepare a remedial work plan and conduct additional remediation. When remedial activities are complete, soil with residual levels of contamination will remain beneath caps and building foundations. The site remediation goals will satisfy human health standards for industrial properties but not ecological or recreational standards (Camp Dresser & McKee Inc. 2011).

Piggyback Yard is a modern railroad freight transfer yard. The USACE's HTRW survey found no records of any active or open CERCLA HTRW concerns or actions associated with this property. However, the City of Los Angeles has indicated that there are remaining HTRW concerns regarding the Piggyback property. In a 1953 USGS topographic map, a portion of Piggyback Yard is identified as a railroad maintenance yard, the same identifier used for Taylor Yard. Because Piggyback Yard and Taylor Yard were in use as railroad maintenance yards at the same time, similar activities likely occurred on both properties. Also, historical maintenance activities were the source of much of the contamination at Taylor Yard. Therefore, although there is no record confirmation of HTRW issues at Piggyback Yard, some HTRW is likely to exist at the site.

Despite investigations to identify HTRW sites of concern, it is possible that soil or groundwater contamination that is not documented is present in the study area and will be subject to further investigation as described in the HTRW appendix and summarized in Chapter 5.

Table 3-17 Relevant HTRW Sites

Site*	Database in which Case is Listed	Extent of Overlap with Study Area
San Fernando Valley Superfund Site	NPL	High
Taylor Yard G1	DTSC	High
Taylor Yard G2	DTSC	High
Former Manufactured Gas Plant	DTSC	Moderate
Former Manufactured Gas Plant	DTSC	Moderate
Bortz Oil	DTSC	Moderate
San Fernando Consolidated Facility	LARWQCB	Moderate
Three Chevron Gasoline Stations	LARWQCB	Moderate
Former Bortz Oil	LARWQCB	Moderate
Shell Gas Station	LARWQCB	Moderate
Former Triangle Gasoline Station	LARWQCB	Moderate
Former Hawkes Finishing	LARWQCB	Moderate
Mount Sinai Forest Lawn Cemetery	LARWQCB	Moderate
Former Albion Dairy	LARWQCB	Moderate
Burlington-Northern Santa Fe Tower	LARWQCB	Moderate
Valspar Corporation	LARWQCB	Moderate
Chromal Plating and Grinding Company	LARWQCB	Moderate
Infinity Outdoor Company	LARWQCB	Moderate
Gannett Outdoor System, Inc.	LARWQCB	Moderate
Metropolitan Transportation Agency	LARWQCB	Moderate
Morton International Whittaker Corporation	LARWQCB	Moderate

Source: USACE 2013
* Although some sites have similar names, each listing in the table represents a different regulatory case.
DTSC = (California) Department of Toxic Substances Control; LARWQCB = Los Angeles Regional Water Quality Control Board; NPL = National Priorities List

3.12 UTILITIES AND PUBLIC SERVICES

This section discusses the utilities infrastructure and public services in the study area. Utilities addressed in this section are electricity, water supply, sewer and wastewater treatment facilities, stormwater, natural gas, and telecommunications. An overview of utilities in the study area is shown on Figures 4-19 to 4-21. Nearly all the utilities in the study area are in Los Angeles; only a fraction of the utilities are in Glendale or Burbank. Accordingly, information about utilities in Glendale and Burbank is limited to a description of those utilities that are found in the study area.

3.12.1 Electric Power

LADWP provides power to 3.9 million people in a 465-square-mile service area that includes Los Angeles. In addition to serving residents and businesses in their territory, LADWP uses its electricity to light public roads and power the water supply system.

LADWP holds powerline easements and rights-of-way along the River in the study area. Easements sometimes coincide with County ownership and flood risk management easements. Aboveground transmission lines run along the River through nearly all of the study area. Substations and service buildings are also present in the study area.

Reaches 1-3 LADWP above-ground transmission lines run along one bank of the River or the other through this portion of the study area. The transmission lines cross the River at five locations: near the equestrian bridge in Burbank, just downstream of the equestrian center, near the intersection of I-5 and SR-134, near Brazil Street, and just north of Los Feliz Boulevard Although these lines are physically in Burbank for a short stretch in Reach 1 near the equestrian bridge, they are owned by LADWP. An electrical power plant and substation are in Reach 3 in Glendale on the left bank of the River south of Flower Street (City of Los Angeles 1996).

Reaches 4-6 LADWP above-ground transmission lines run along the right bank of the River, cross the River just north of Fletcher Drive, and then run along the left bank of the River for the remainder of this portion of the study area. An electrical substation is on the left bank of the River at the south end of Reach 5 just north of Fletcher Drive (City of Los Angeles 1996).

Reaches 7-8 LADWP above-ground transmission lines run along the right bank of the River until just south of Main Street, where the lines cross the River and run along both banks for the remainder of this portion of the study area. No electrical power plants or substations are in or near this portion of the study area (City of Los Angeles 1996).

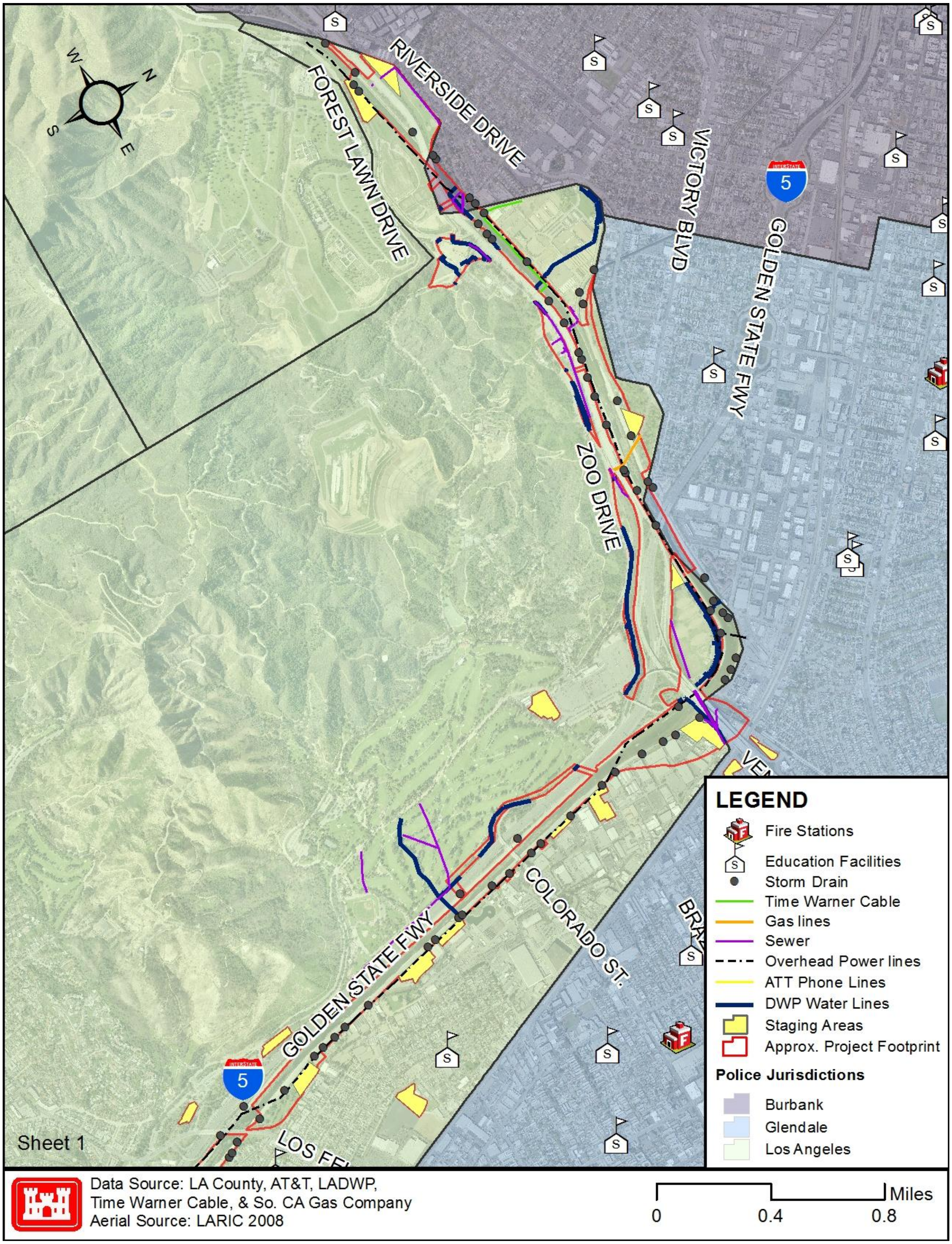


Figure 3-20 Utilities, Reaches 1-3

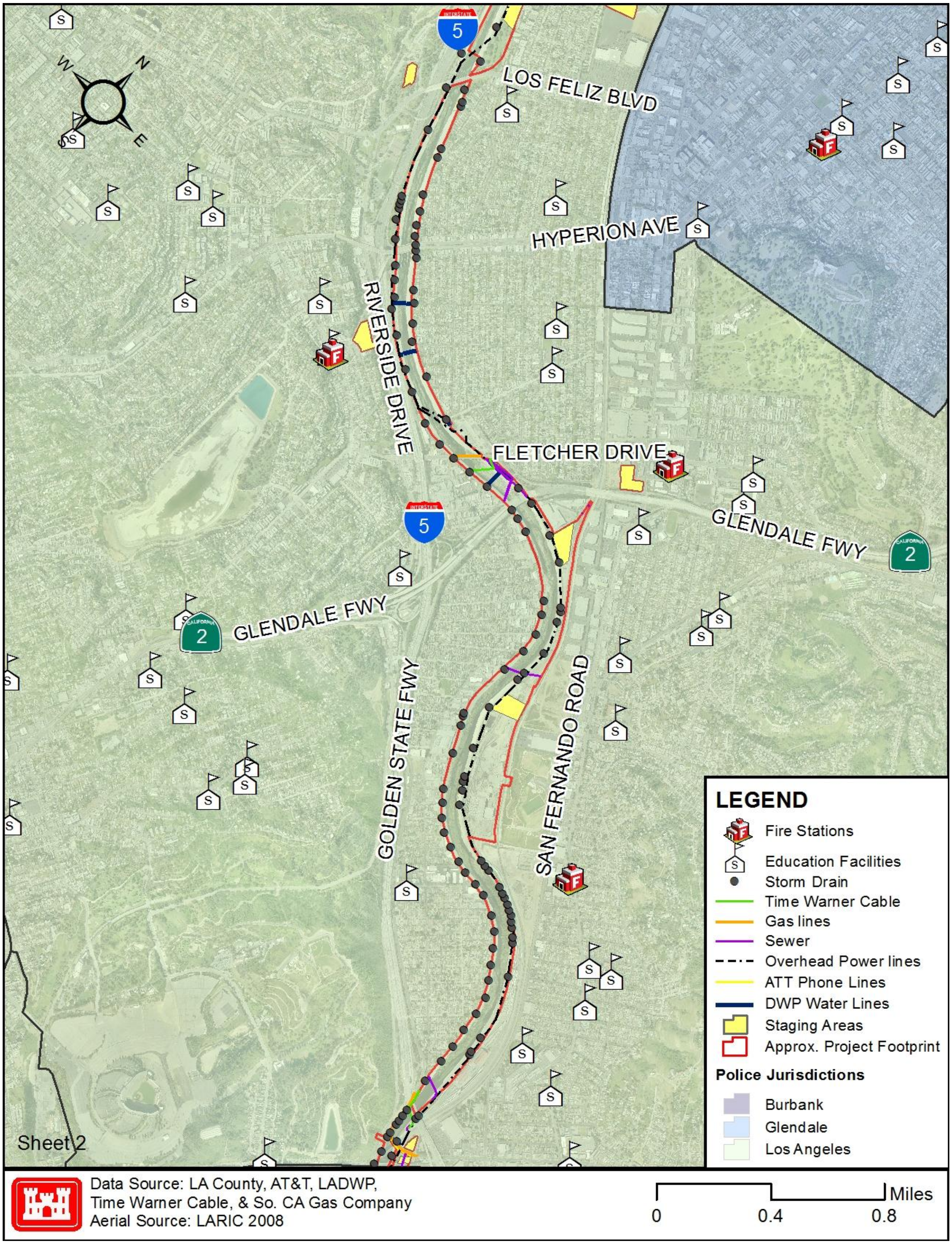


Figure 3-21 Utilities, Reaches 4-6

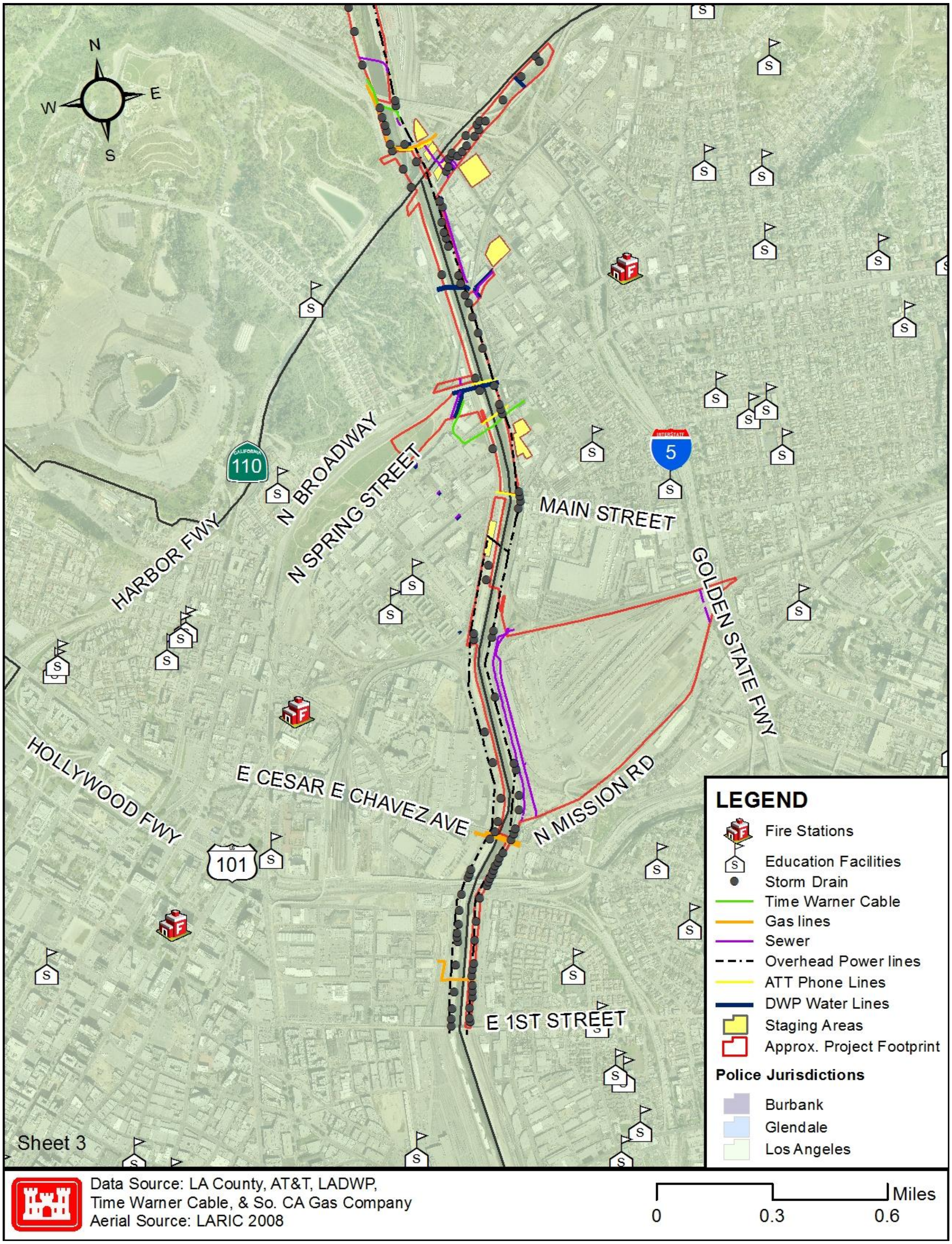
1 

Figure 3-22 Utilities, Reaches 7-8

3.12.2 Water Supply

LADWP provides water to Los Angeles's residents and businesses, over 60,000 fire hydrants, and for irrigation and recreation. Water supply and demand are central issues in arid and heavily populated Southern California. In Los Angeles, mandatory water conservation measures implemented in 2009 have reduced demand; at the same time, the increasing population increases demand. Overall, the demand for water is still increasing, although at a slower rate than before water conservation became a widespread practice. Los Angeles's 2010 Urban Water Management Plan projects a 1 percent average annual water demand growth rate over the next 25 years. Projected water demand can vary up to 5 percent from the baseline forecast depending on weather (LADWP 2011, 2012d). Water supply lines are present throughout the study area. The water lines range in diameter from 6 inches to 69 inches and cross the River in 13 locations (Figures 4-20 to 4-22).

Los Angeles's Integrated Resources Plan, adopted in 2006, recognizes that water supply, wastewater (including recycled or reclaimed water), and stormwater are interdependent systems and provides an integrated approach to infrastructure planning and management. The plan establishes the water infrastructure requirements to adequately serve the City's residents given projected population growth (Bureau of Sanitation and LADWP 2006). The Greater Los Angeles County Region Integrated Regional Water Management Plan, which takes an even wider view at integrating the region's approach to addressing its extremely complex water quality and water supply issues and planning for appropriate infrastructure (Leadership Committee of Greater Los Angeles County Integrated Regional Water Management Plan 2006).

Water lines cross the River in five locations: in Burbank near the equestrian bridge, at the equestrian center, near Flower Street, at SR-134, and near Goodwin Avenue All of the crossings are below the River, with the exception of the SR-134 crossing, which is part of the street bridge.

Reaches 1-3 Burbank Water and Power (BWP) is the municipal utility that provides drinking water to the portion of study area in Burbank. BWP's supply consists of imported water purchased from the Metropolitan Water District of Southern California, groundwater, and recycled water that is produced at the Burbank Water Reclamation Plant. Burbank's water system is composed of approximately 280 miles of pipelines ranging in size from 1.5 to 30 inches in diameter as well as booster pumps, reservoirs, and wells (BWP 2011). A water supply line in the study area briefly traverses a portion of Burbank in Reach 1 near the equestrian bridge.

Reaches 4-6 Water supply lines run along the left bank of the River in some places. Water lines cross the River in three locations: at Tyburn Street, just south of Garcia Street, and between Fletcher Drive and SR-2. The Tyburn Street water line is above-ground while the other two crossings are under the River.

Reaches 7-8 Water supply lines cross the River in three locations: at the North Figueroa Street Bridge, near the railroad bridge near Humboldt Street, and at the North Broadway Bridge. The crossing near the railroad is under the River while the other two crossings are part of the street bridges.

3.12.3 Wastewater

The Los Angeles Bureau of Sanitation is responsible for installing, operating, and maintaining the City's wastewater infrastructure. The Bureau's wastewater program provides collection, conveyance, treatment, and disposal of 550 million gallons of wastewater per day for over four million people in a 600-square-mile area. Treatment plants near the River contribute the bulk of the daily flow. Though Tillman Treatment Plant is not within the study area, it contributes 291 cfs to the River on average throughout the year. The Bureau maintains over 6,500 miles of sewer pipelines between 6 inches and 12 feet in diameter.

Wastewater entering the sewer system is routed to and treated at one of four treatment and water reclamation plants including the Los Angeles-Glendale Water Reclamation Plant in the study area (Bureau of Sanitation 2012a).

A major sewer line, the Northeast Interceptor Sewer, runs near the River from south of SR-2 to the southern end of the study area and crosses beneath the River bed just north of the Glendale Freeway through part of study area in Reaches 4-8. Another major piece of sewer infrastructure, the North Outfall Sewer, runs the length of the study area. Service access shafts for these major sewer lines are within a half mile of the River (LADPW 2012a).

Sanitary sewer lines that transport wastewater to treatment plants are present in the study area. The sewer lines range in diameter from 6 inches to 96 inches and cross the River in seven locations.

Multiple sewer lines are near the equestrian center, crossing the River several times. Sewer lines are near SR-134 in Griffith Park and cross the River along the SR-134 overcrossing near the intersection with I-5. A sewer line runs west of I-5 at Harding Golf Course.

The Glendale Department of Public Works is responsible for the sewer infrastructure in the study area within Glendale. Glendale's sewer system has approximately 360 miles of sewer lines (Glendale Department of Public Works 2012). A sewer line in the study area briefly traverses a portion of Glendale in Reach 3 near SR-134.

The Burbank Department of Public Works owns and operates the sewer infrastructure in the study area within Burbank. A sewer line in the study area traverses a portion of Burbank in Reach 1 near the equestrian bridge.

The Los Angeles-Glendale Water Reclamation Plant is in the study area on the left bank of the River south of Colorado Boulevard The plant serves the eastern San Fernando Valley, portions of Los Angeles, and the Cities of Glendale, Burbank, and La Crescenta. The plant treats approximately 20 million gallons of wastewater per day. The stringent treatment process results in some water that is suitable for reuse for irrigation and industrial processes, which conserves over a billion gallons of potable water per year (LADPW 2012b).

Sewer lines run near the left bank of the River from Fletcher Drive to SR-2, crossing the River just north of SR-2. Sewer lines also cross the River at Newell Street and just upstream of I-5.

Sewer lines run near the left bank of the River from SR-110 to Humboldt Street and in Piggyback Yard area (from the railroad overcrossing west of Alhambra Street to Cesar E Chavez Avenue). Sewer lines are near the right bank of the River near North Broadway. No sewer lines cross the River in this portion of the study area.

3.12.4 Stormwater System

The primary purpose of the stormwater system is to manage stormwater runoff to prevent flooding. Los Angeles's stormwater system consists of a network of approximately 35,000 catch basins (points where water enters the system), over 1,500 miles of underground pipes, and 100 miles of open channels. The stormwater system is completely separate from the sewer system and water that enters the stormwater system is not treated or filtered. Stormwater is captured in local catch basins, travels through local pipes, drains into larger channels such as the River and Ballona Creek, and eventually is discharged to the Pacific Ocean (City of Los Angeles Stormwater Program 2012).

The City's stormwater system averages 100 million gallons of water flow on days without rain. When it rains, the amount of water flowing through the system can increase to 10 billion gallons (City of Los Angeles Stormwater Program 2012). Portions of the City's stormwater system do not have the required capacity to handle a 10-year rain event, which is the maximum volume of rain expected to occur once in a 10-year period (Troyan 2003).

There are 283 stormwater outfalls throughout the study area that allow stormwater to enter the River. They range in size from 2 inches to 108 inches in diameter. The outfalls include multiple types of pipes, spillways, flap gates, and drainage ditches.

There are 70 stormwater outfalls along Reaches 1-3, ranging in size from a 12-inch-diameter pipe to a 15-foot by 15-foot box. Stormwater features along these reaches include pipes, spillways, and flap gates constructed of clay and reinforced concrete. Four stormwater outfalls are in Burbank and three are in Glendale. The Glendale and Burbank Departments of Public Works manage their respective stormwater infrastructure. There are 104 stormwater outfalls along Reaches 4-6, ranging in size from 6-inch-diameter pipe to a 12-foot by 11-foot box. Stormwater features along these reaches include pipes, spillways, flap gates, and ditches constructed of plastic, steel, and reinforced concrete. Reaches 7-8 have 109 stormwater outfalls along this section, ranging in size from 2-inch-diameter pipe to two 8-foot by 8-foot square boxes. Stormwater pipes along these reaches are constructed of iron, steel, and reinforced concrete.

3.12.5 Natural Gas

The Southern California Gas Company provides natural gas to 20.9 million people in a 20,000-square-mile service area that includes the study area through a series of transportation, distribution, and storage facilities. Its operations are regulated by the California Public Utilities Commission (Southern California Gas Company 2012).

Natural gas lines cross the River at Victory Boulevard, Fletcher Drive, North Figueroa Street, East Cesar E. Chavez Avenue, and just north of First Street via dedicated utility crossing. No natural gas lines run north-south along the banks of the River in the study area.

3.12.6 Telecommunications

Telecommunications infrastructure consists of both wired and wireless means of providing telephone, television, and internet service. Wired services include both overhead and underground lines. Wireless infrastructure includes towers containing antennas, and satellites that transmit wireless signals.

Time Warner Cable aerial lines are near the equestrian center in Reach 1, where they run along the left bank for 1,800 feet and then cross the River to the right bank. Time Warner Cable lines again cross the River just south of Fletcher Drive and at I-5. AT&T telephone lines cross the River at North Figueroa Street, North Broadway, North Spring Street, and Main Street.

3.12.7 Public Services

Public services relevant to the project area are police and fire protection, emergency medical services, and schools. Los Angeles, Glendale, and Burbank each have police departments, fire departments, and public school districts that provide those services to their respective cities. The city fire departments also provide emergency medical services (i.e., ambulance or paramedic services), swift water rescue, search and rescue, and hazardous materials response. Fire stations near the project area are shown in Figures 4-20 through 4-22.

3.13 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

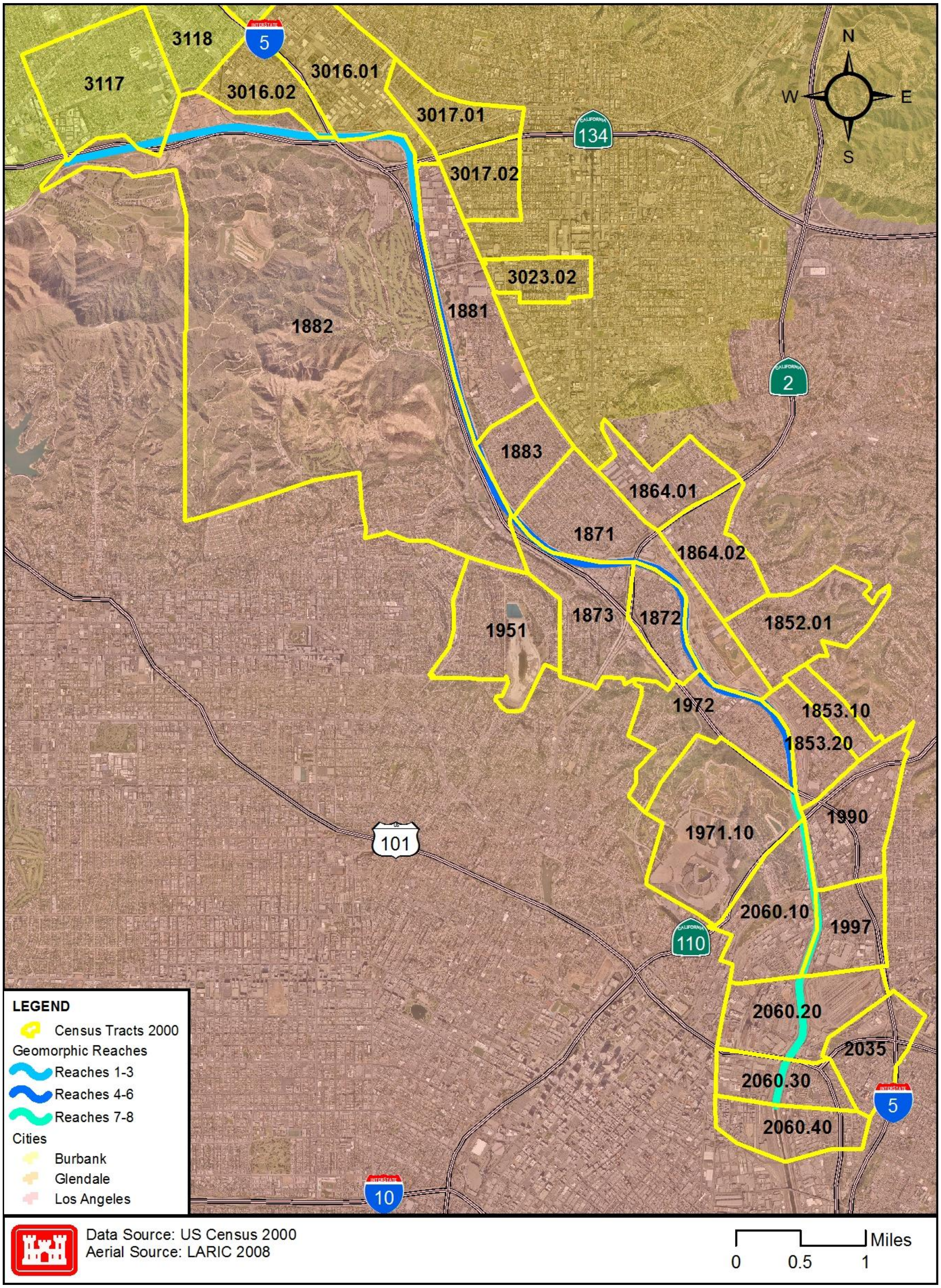
The study area is in a densely populated area of Los Angeles County with centers of substantial commercial and industrial activities. The study area contains a wide range of land uses and economic activities. Census tract and community level socioeconomic and demographic data are presented in this section. At the community level, data for the Cities of Los Angeles, Glendale, and Burbank are presented. Figure 3-22 displays the 28 census tracts, covering approximately 20.9 square miles, which are used to compute census tract level statistics. These census tracts were chosen by creating a 0.5 mile buffer on either side of the River and then including all census tracts that lie wholly or partially within it.

The description of the without-study economic conditions contained in the various sections below is based on the 2005-2009 American Community Survey as well as other regional and local data as available (U.S. Census Bureau 2010a).

3.13.1 Population and Housing

Los Angeles County spans over 4,700 square miles and has approximately 10 million residents (U.S. Census Bureau 2010b). Within the 28 census tracts in the assessment area, total population is estimated at approximately 129,000 residents, equating to an average density of 6,173 residents per square mile, about three times denser than the County as a whole. The population, density, and racial profile of the assessment area compared to adjacent communities and the County are provided in Table 3-19.

Table 3-20 and Figure 3-23 show the recent and projected population for the County and Cities in the study area. For both, the rate of annual growth has generally been declining, and the County and City population rate of growth is projected to be around 0.3 percent by 2040 (Los Angeles County Economic Development Corporation [LAEDC] 2012).



1 *Figure 3-23 Study Area Census Tracts*

Because the extent to which redevelopment and increased density will affect population in the socioeconomic assessment area has not been quantified, it is assumed that conditions in the assessment area will generally follow the same trends as the County and the City, with overall growth slowing throughout the period of analysis.

Housing in the socioeconomic assessment area is summarized in Table 3-21, which includes household, housing, and ownership metrics. Among the 28 census tracts, total housing units range from 105 to 3,343, with a total of 43,835 units in the assessment area, and an overall vacancy rate of 6.9 percent. About 36 percent of units are owner-occupied and 64 percent are renter-occupied in the assessment area. The vacancy rate in the assessment area is 0.4 percent greater than the City of Los Angeles, and 1.2 percent greater than the County. Additionally, the assessment area contains a larger proportion of rental units, with only 35.7 percent owner-occupied units, compared to 39.4 percent in the City of Los Angeles and 48.6 percent in the County.

Table 3-18 Population, Density, and Race

Area	2009 Population[1]	Density (per square mile)	% White	% Black	% Hispanic	% Asian	% Other
City of Burbank	102,364	5,890	60	2	25	10	1
City of Glendale	195,876	6,405	63	2	18	16	1
City of Los Angeles	3,796,840	7,553	29	10	49	11	1
Los Angeles County	9,785,295	2,397	29	9	47	13	1
Assessment Area Tracts[1]	128,969	6,173	30	4	50	14	2

[1]The most recent complete data source was the 2005-2009 American Community Survey. Future versions of this document may incorporate data based on the 2010 Census. Race information derived from tables "Hispanic or Latino and Race," where Hispanic includes all those identifying as Hispanic or Latino, and races are one-race statistics (White-Alone, Black-Alone, etc.) [1]Population is a sum. Race profile totals are weighted averages using population as the weights. Source: U.S. Census Bureau 2010a.

Table 3-19 Population by Year

Year	Compound Annual Growth Rate (1)	Population (thousands)			
		Los Angeles County	City of Los Angeles	City of Burbank	City of Glendale
2000	-	9,540	3,695	100	195
2005	-	9,810	3,731	100	195
2010	-	9,819	3,796	103	196
2015[1]	0.65%	10,140	3,917	107	198
2020[1]	0.70%	10,500	4,056	110	205
2030[1]	0.59%	11,140	4,303	117	217
2040[1]	0.27%	11,450	4,423	120	224

(1) Growth rate from LAEDC 2012 and applied to area cities
Source: LAEDC 2012 and U.S. Census 2012

Table 3-20 Housing in the Study Area (2010)

Area	# Households	# Housing Units	% Vacant	% Owner-Occupied
City of Burbank	40,505	42,623	5.0	44.7
City of Glendale	72,149	75,563	4.5	39.0
City of Los Angeles	1,298,350	1,385,394	6.3	39.4
Los Angeles County	3,178,266	3,370,108	5.7	48.6
Assessment Area Tracts	40,800	43,835	6.9	35.7
Source: U.S. Census Bureau 2010a.				

3.13.2 Employment and Income

Los Angeles County has a highly diverse economy, with a gross annual product in 2010 of approximately $544 billion (LAEDC 2012), or approximately 29 percent of the gross annual product for all of California. Table 3-22 shows some of the basic economic indicators at the county and state level compared to the assessment area. Socioeconomic conditions in the assessment area are likely to reflect similar trends as the county and state. Trends over the last decade largely mimic the effects of the Great Recession that began in 2008 and has had national impact. California still has one of the highest unemployment rates in the nation, and this is reflected in parts of the assessment area, though on the whole, the most recently evaluated unemployment rate in the assessment area is about 3.7 percent lower than the unemployment rate for Los Angeles County (12.4 percent) and 4.3 percent lower than the City of Los Angeles.

According to the Los Angeles County Economic Development Corporation (2012), Los Angeles County's economic base (based on the concept of exports of goods and services), in order of importance, resides in the entertainment, trade (transportation, logistics, distribution), business services, knowledge creation, and fashion industry clusters. While Los Angeles County had an estimated non-farm employment of 3.77 million in 2010, the Great Recession resulted in the loss of over 350,000 jobs and contributed to the high unemployment rate. Like the state overall, the LAEDC forecasts a slow but steady recovery for Los Angeles County.

Table 3-23 provides the aggregated employment by industry for the 28 census tracts in the socioeconomic assessment area. These data illustrate that while the largest industries in the County are entertainment and trade, employment in the assessment area is driven by the education, health care, social services, and professional and scientific industries.

Table 3-21 Comparison of Southern California County Economic Indicators (2010)

Area	Median Household Income	2010 Unemployment Rate	2010 Poverty Rate	2009 Median Home Value
City of Burbank	$62,255	9.2	8.9	$619,700
City of Glendale	$54,163	12.7	13.1	$641,600
City of Los Angeles	$48,570	13.0	21.6	$565,200
Los Angeles County	$54,828	12.4	17.5	$521,900
All of California	$60,392	12.8	15.8	$479,200
Assessment Area Tracts	$51,941	8.7	12.3	$492,569 (1)

(1) Average of assessment area tracts
Sources: U.S. Census Bureau 2010a, U.S. Census Bureau 2011, LAEDC 2012.

Table 3-22 Assessment Area Employment by Industry (2010)

Industry	Percent
Educational services, and health care and social assistance	18.4
Professional, scientific, and management, and administrative and waste management services	13.3
Retail trade	10.8
Arts, entertainment, and recreation, and accommodation and food services	10.6
Information	9.3
Manufacturing	8.6
Construction	6.2
Other services, except public administration	5.3
Finance and insurance, and real estate and rental and leasing	4.9
Transportation and warehousing, and utilities	4.7
Public administration	3.7
Wholesale trade	3.7
Agriculture, forestry, fishing and hunting, and mining	0.5

Source: U.S. Census Bureau 2010b.

3.13.3 Environmental Justice

This section provides a discussion of environmental justice in accordance with Executive Order (EO) 12898 and the protection of children from environmental health risks in accordance with EO 13045. The ethnic data from the 2005-2009 American Community Survey (U.S. Census Bureau 2010a) for the census tracts comprising the assessment area, as well as Los Angeles County, are described below.

As outlined in a 2009 City of Los Angeles report, *Los Angeles River Access and Use: Balancing Equitable Actions with Responsible Stewardship*, “Many local organizations have stressed the importance of making sure that the River's revitalization addresses environmental justice issues (See, e.g., the City Project's work at: www.cityprojectca.org.). Of key concern in Los Angeles is the growing disparity of access to and use of open space resources, including parks, ball fields, and natural areas by those living in low-income communities of color.”

Within the census tracts that encompass the study area, the Hispanic or Latino population was the dominant group, with about 50 percent of the population. The Caucasian population was second, with about 30 percent of the population. Third was the Asian population, with 14 percent, followed by the Black population at 4 percent, and other races at 2 percent. Largely similar, the City of Los Angeles reported 49 percent Hispanic, 29 percent White, 11 percent Asian, 10 percent Black, and 1 percent other races. In the County, some differences become apparent, where the population is 60 percent White, 25 percent Hispanic, 10 percent Asian, 2 percent Black, and 1 percent other races.

In 2010, approximately 25 percent of the state's population was made up of children (those under 18 years old). Approximately 24 percent of the population in Los Angeles County was under 18 years of age (U.S. Census Bureau 2011). Within the 28 census tracts of the assessment area, approximately 22 percent of the population was under 18 years of age (U.S. Census Bureau 2010a).

As shown in Table 3-24, below, about two-thirds of the population's primary language spoken at home is a language other than English. About 45 percent of the population in the study area tracts speaks Spanish at home, 32 percent speak English, and the remaining 23 percent speak other languages. The substantial Spanish-speaking population is consistent with the demographic information summarized previously.

Table 3-23 Language Spoken at Home (Percentage in 2010)

Area	English Only	Other than English	Spanish	Other Indo-European languages	Asian and Pacific Islander languages	Other languages
Study Area Tracts	32.4	67.6	44.7	10.6	11.8	0.5
Los Angeles County	43.9	56.1	39.6	5.3	10.2	1.0
Burbank	55.9	44.1	20.1	16.0	6.3	1.7
Glendale	32.7	67.3	15.2	37.8	12.8	1.5
Los Angeles	40.3	59.7	43.6	6.7	8.1	1.4

Source: U.S. Census 2010 and 2010a. Percentages for study area tracts are based on a weighted average using population as the weights.

As shown in Table 3-25, below, poverty in the study area is generally consistent with regional data. Poverty in the study area is about 3 percent lower than the City of Los Angeles, but about 1 percent higher than in the whole County. The portions of Burbank and Glendale within the study area have higher poverty rates than those cities do overall.

Table 3-24 People in Poverty (Percentage in 2010)

Area	All People	Under 18	18 to 64	Over 64
Study Area Tracts	16.2	20.3	14.3	13.1
Los Angeles County	15.4	22.1	13.5	10.7
Burbank	8.3	9.7	8.3	5.8
Glendale	12.3	16.4	10.8	13.1
Los Angeles	19.1	27.9	16.7	13

Source: U.S. Census 2010 and 2010a. Percentages for study area tracts are based on a weighted average using population as the weights.

Disability information is not available by census tract. Table 3-26 presents the percentage of people with disabilities in Los Angeles County, the City of Los Angeles, Burbank, and Glendale. It is assumed that the same general characteristics apply to the specific study area tracts, where approximately 8 to 10 percent of the population has a disability.

Table 3-25 People with Disabilities (Percentage in 2010)

Area	All People	Under 18	18 to 64	Over 64
Los Angeles County	9.3	2.8	7	38.1
Burbank	8.1	1.7	4.4	34.1
Glendale	10.1	0.9	6.4	44
Los Angeles	9.4	3	6.9	40.1

Source: U.S. Census 2010 and 2010a.

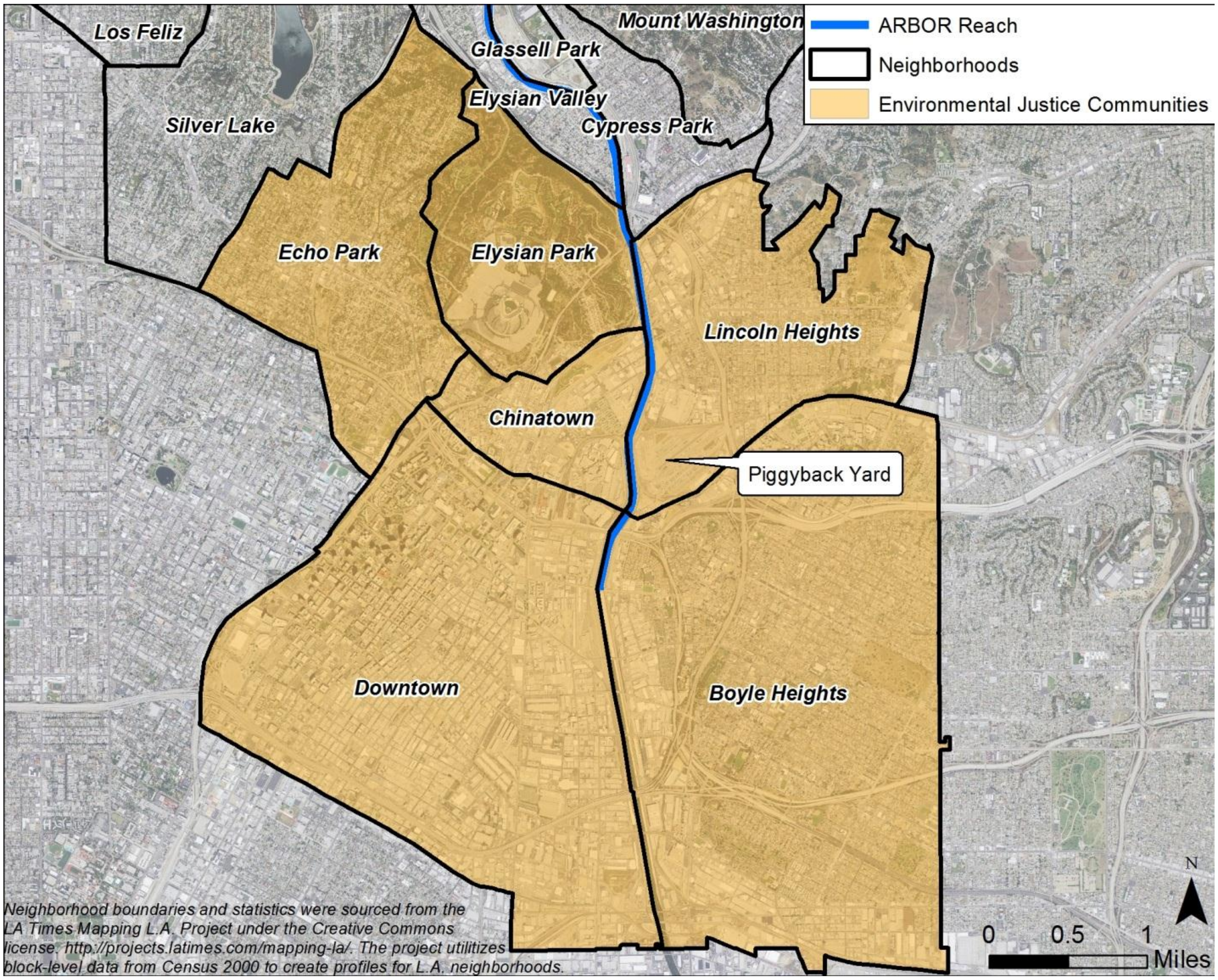


Figure 3-24 Environmental Justice Communities

4 FORMULATION OF ALTERNATIVE PLANS

4.1 PLAN FORMULATION PROCESS

This Integrated Feasibility Report (IFR) has followed the USACE's Six-Step Plan Formulation Process to develop, evaluate, and compare the array of potential alternatives that could solve identified problems described in the previous section. The following six steps were undertaken and are described elsewhere in the IFR as indicated:

1. Specify problems and opportunities relevant to the study area. Identify planning constraints and establish planning objectives (Chapters 2 and 4).

2. Inventory and forecast conditions. Identify and document existing and future without project conditions (Chapter 3(existing) and 4 (future without project)).

3. Formulate alternative plans. Develop alternatives comprising differing sets of measures to address the identified problems and planning objectives for ecosystem restoration (Chapter 4). Separate public input in this process was sought through a public involvement program (Chapter 8).

4. Evaluate alternative plans. Evaluate each of the ecosystem restoration alternatives derived from Step 3 for overall effectiveness, efficiency, completeness, and acceptability (Chapters 4 and 6). Impacts of the alternatives were evaluated using the USACE Code of Federal Accounts Framework. Topics included National Economic Development; Environmental Quality; Regional Economic Development; and Other Social Effects, as specified in the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (U.S. Water Resources Council 1983) and the Planning Guidance Notebook ER 1105-2-100 (USACE 2000).

5. Compare alternative plans. Compare each of the ecosystem restoration alternatives in terms of cost effectiveness (Chapters 4 and 6) and other considerations. Cost effectiveness and incremental cost analysis (CE/ICA) modeling was used to prioritize and rank ecosystem restoration alternatives.

6. Select recommended plan. Based on the information and results from the previous steps, select recommended plan for ecosystem restoration (Chapter 6 and 7). Prepare documentation to justify the plan selection.

4.2 PLANNING OBJECTIVES

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

As the USACE implements projects under the Ecosystem Restoration mission, it contributes to increasing the net quality and/or quantity of desired ecosystem resources. Assessing potential contributions to NER is based upon a system developed by the USACE for measuring changes in ecological resource quality as a function of improvement in habitat quality or quantity which are expressed quantitatively in physical units or indexes (non-monetary units). Contributions to NED, on the other hand, typically apply to flood risk management projects that result in increases in the net value of the national output of goods and services from the reduction of flood damages, expressed in monetary units.

This IFR is charged with determining the Federal interest in ecosystem restoration opportunities within the ARBOR Reach and how these opportunities can help meet the USACE mission and the Federal objective. This will be accomplished by developing a recommended NER plan composed of environmental restoration measures that result in an increase in net (non-monetary) value to the NER. Recreation may provide benefits to meet the NED Federal objective, and incidental flood risk management benefits may accrue. Sufficient passive recreation will be needed to manage the human impacts to the restoration project within this highly urban area. Regional Economic Benefits (RED) and Other Social Effects (OSE) will be considered in plan selection.

4.2.1 Specific Planning Objectives

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

Based on the problems and opportunities identified for Los Angeles River study area, the USACE, Sponsor, and key agencies and stakeholders developed specific planning objectives to guide the formulation and evaluation of alternatives and the development of the recommended plan. Objectives development began during the without project conditions phase of study and were consistent with ongoing state and local efforts within the watershed, including the Los Angeles River Revitalization Master Plan published by the City of Los Angeles in 2007.

The objectives were determined at the beginning of plan formulation. They were refined throughout the formulation process, resulting in the following study objectives for the 11-mile reach of the River extending from Pollywog Park (north of Griffith Park) to First Street in Downtown Los Angeles, which includes approximately 6.4 miles of soft bottom channel and 4.5 miles of concrete channel (ARBOR Reach).

1. ***Restore Valley Foothill Riparian Strand and Freshwater Marsh Habitat:*** Restore valley foothill riparian wildlife habitat types, aquatic freshwater marsh communities, and native fish habitat within the ARBOR reach throughout the period of analysis, including restoration of supporting ecological processes and biological diversity, and a more natural hydrologic and hydraulic regime that reconnects the River to historic floodplains and tributaries, reduces velocities, increases infiltration, and improves natural sediment processes.

Sub-objectives for Objective 1 are:

a) Restore and support ecological processes (i.e., biogeochemical processes, nutrient cycling).
b) Increase biological diversity.
c) Restore a more natural hydrologic and hydraulic regime with reconnections to floodplains and tributaries, areas of reduced velocities, increased infiltration, and improved natural sediment processes.

Meeting requirements for the sub-objectives for restoring valley foothill riparian strand and freshwater marsh will restore ecological processes, increase biological diversity and reduce the scarcity of this ecosystem in the region.

2. *Increase Habitat Connectivity:* Increase habitat connectivity between the River and the historic floodplain, and increase nodal habitat connectivity for wildlife between restored habitat patches and nearby significant ecological zones such as the Santa Monica Mountains, Verdugo Hills, Elysian Hills, and San Gabriel Mountains within the ARBOR reach throughout the period of analysis.

Sub-objectives for Objective 2 are:

a) Increase habitat connectivity to floodplains to reduce fragmentation of the river ecosystem.
b) Increase nodal habitat connectivity locally within the river ecosystem and regionally to nearby significant ecological zones such as the Santa Monica Mountains, Verdugo Hills, Elysian Hills, and San Gabriel Mountains within the ARBOR reach throughout the period of analysis to address patterns of habitat fragmentation, restore habitat corridors and remove barriers to wildlife movement.

Meeting sub-objectives for increased habitat connectivity will increase sustainability of the restored system areas and initiate regional opportunities for connectivity to nearby ecological zones. Areas have a greater interaction when they are larger and closer together (Lineham et al. 1995). The study assumes that connectivity is defined in ER 1105-2-100 22 Apr 2000 Appendix E, Section V Ecosystem Restoration E.37 Significance of Ecosystem Outputs c.(4) Technical Recognition as follows:

> *"(4) Connectivity. This is a measure of the potential for movement and dispersal of species throughout a given area or ecosystem, and should be considered in the context of an entire landscape or watershed. The variation and quality of links between habitats in a landscape or watershed determine the level of connectivity. Landscape spatial patterns that affect the level of connectivity include the existence and suitability of habitat corridors, the degree and pattern of habitat fragmentation, and the presence of natural and man-made barriers. Often, rivers, waterways, and riparian forests serve as highly functional habitat corridors, and aquatic ecosystems inherently serve a connective function to other waterways and terrestrial landscapes. Corps planners may recognize as technically significant those restoration alternatives that serve to improve connectivity by creating or re-establishing habitat corridors; eliminating or addressing the pattern of fragmentation; or removing barriers, such as dams and other water blockages, that disrupt otherwise contiguous habitats."*

2. *Increase passive recreation that is compatible with the restored environment in the ARBOR reach through the period of analysis.* Recreation features at an ecosystem restoration project are permissible if they are compatible with the restoration and economically justified. Recreation elements are cost shared 50% Federal/50% Non-Federal (ER 1105-2-100).

a. Provide connections to existing recreation infrastructure.
b. Increase environmental education opportunities.
c. Increase trail system to coincide with restored area.

Alternatives will be evaluated and compared to determine how well they meet the above ecosystem restoration objectives 1 and 2, and to what degree they result in restoration of a functioning, self-sustaining ecosystem within the study area. Then a recreation plan will be developed to complement and support the features of the tentatively selected alternatives. Recreation alternatives will be analyzed using a cost/benefit analysis.

4.2.2 Objectives Performance Criteria

While the extremely urbanized nature of the Los Angeles River watershed will prevent complete restoration of a natural, meandering river and floodplain, there are several opportunities to restore ecosystem functions on a limited scale. Alternatives considered for this study would be considered minimally successful if they accomplish the performance criteria below.

Since the minimum critical size of an ecosystem has not been determined for any region (Noses 1986), the following criteria were developed to evaluate and compare alternative plans. Quantitative criteria are based on review of scientific literature and the use of classes of animals (birds, reptiles, amphibians) as a proxy for the habitat requirements of other species.

Minimal performance criteria for meeting these objectives and success of a proposed project alternative are provided below:

1. Restore Valley Foothill Riparian and Freshwater Marsh Habitat

Each alternative carried forward must achieve each of the following criteria within restored aquatic areas:

a) Restore a minimum of two aquatic habitat nodes with a natural hydrologic connection to the river and riparian communities with a minimum distance of 150 meters from the water's edge to create areas capable of functioning as core habitat and refuge for native reptiles and amphibians (Semlitsch and Bodie 2003) and to minimize the risk of localized extinction due to natural disasters (i.e., flood, fire, drought) (Schippers et al. 1996; Dunning et al. 1995).
b) Removal and management of invasives to less than 10% within 5-7 years post-construction of each feature.
c) Restore seasonal overbank flooding to river adjacent areas within 5-10 years post-construction.

<u>For Valley Foothill Riparian Habitat:</u>

a) Restore structurally diverse riparian habitat consisting of herbaceous (e.g., herbaceous vine cover), shrub (e.g., shrubby willow thicket), and tree (e.g., mature cottonwood-willow trees) layers in a minimum of five reaches resulting in three contiguous reaches. Restore riparian habitats with a varying number of structural layers (one, two, and three layers) to support survival and reproductive requirements for riparian obligate and transient wildlife species, including food, water, shelter, breeding, migration, and dispersal (Krueper 1995).
b) Within 5-10 years of construction, restore and maintain dense, structurally diverse riparian habitat sufficient to maintain survival and reproductive needs of wildlife. Restore a minimum of one habitat node with a minimum width of 250 meters (820 feet) to support high frequencies of the Federally endangered least Bell's vireo (Kus 2002).

<u>For Freshwater Marsh and Fish Habitat:</u>

a) Restore functioning freshwater marsh habitat consisting of emergent herbaceous vegetation (i.e., cattails, rushes, sedges) adapted to saturated soil conditions.
b) Restore aquatic habitat to support survival and reproductive requirements for fish and wildlife species, including food, water, shelter, breeding, migration, and dispersal.
c) Restoration of natural channel geomorphology in at least one concrete reach support refugia for native fish including the Federally threatened Santa Ana sucker.

For a More Natural Hydrologic and Hydraulic Regime:

a) Expand River hydrology into at least one large, contiguous river adjacent area within the study area that promotes natural hydrologic connections to the floodplain and overbank areas.
b) Accommodate additional meandering of the River in at least one reach.
c) Connect river hydrologically (with assistance through culverts or naturally) to overbank with at least one such connection per reach.
d) Within the main stem of the river, reduce velocity to less than 12 feet per second (ft/s) and ideally 8 ft/s.
e) Restore seasonal overbank flooding to river adjacent areas to support riparian floodplain habitat.

2. Increase Habitat Connectivity

Each alternative carried forward must achieve each of the following criteria:

a) Restore riparian and wetland aquatic wildlife habitat at tributary confluences to create habitat connectivity to similar upstream habitats on the tributaries with ultimate nodal connection to the aquatic habitats in the San Gabriel and Verdugo Mountains (at least one major tributary connection should be restored.)
b) Restore wildlife habitat on channel banks to support movement along the river channel.
c) Improve aquatic habitat connectivity within the ARBOR area through restoration of habitat nodes with wetland and riparian habitat that are naturally hydrologically connected to the river corridor upstream and downstream of the Glendale Narrows.
d) Restore habitat corridors between large nodes in the ARBOR area to maximize connectivity for wildlife movement and dispersal on the local scale and minimize the risk of habitat sinks in an urban environment (Hilty et al. 2006; Hanski & Thomas 1994; Rudd 2002; Noss 1983), and to provide opportunities for regional wildlife movement.
e) Lengthen the extent of contiguous vegetated pathways for reptile and small/medium mammal movement (currently limited to Reaches 4 to 6), to achieve upstream and/or downstream connections to at least one additional tributary or habitat area that is currently isolated from the soft-bottom reach.
f) Reconnect natural hydrology between the river and at least one main tributary to support regional habitat connectivity to nearby significant ecological areas.

Ideally, the alternatives will also achieve the following:

a) Expand riparian and wetland habitat into large, contiguous river adjacent lands within the study area to support higher abundance of wildlife and support more significant nodal connections to nearby ecological zones. Provide habitat connectivity (via contiguous or near-contiguous vegetated movement pathways) between all of the reaches within the study area.
b) Include Reach 7 to provide nodal connections to San Gabriel Mountains via Arroyo Seco Confluence and/or other smaller tributaries and to provide potential for future direct connections to the mountains via other projects upstream on Arroyo Seco.

4.3 PLANNING CONSTRAINTS AND CONSIDERATIONS

4.3.1 Planning Constraints

Planning constraints represent significant barriers or restrictions that limit the physical or policy-related aspects of formulated plans. An example of a constraint related to flood risk is that vegetation added to the channel must also: (1) increase conveyance capacity, or (2) reduce the peak flows through detention or storage, otherwise, high velocities will rip out planted vegetation. Currently, flows vary in the reach between 15 to 19 ft/s, with some flows in the downtown areas potentially reaching 30 ft/s. The target velocity is closer to 8 to 12 ft/s or soft-bottomed channels areas. Several constraints apply specifically to this study. These are:

- HTRW sites will be avoided whenever practicable.
- Potentially contaminated groundwater plumes must be considered and avoided whenever practicable.
- Surrounding urbanization and infrastructure such as roads, highways, rail lines and power facilities must be avoided whenever practicable.
- The Sponsor must be able to provide lands for the potential project area.
- Existing levels of flood protection must be maintained. Restoration must avoid conflicts with the existing engineering policies for flood risk management projects, e.g., vegetation must not increase existing water surface elevations or floodplain extent.

In addition, there are several considerations specific to the study area. These are as follows:

- Limited water sources within the project reach will influence the sustainability of ecosystems, and alternatives will be formulated with understanding of the regional climate and understanding of water resources. Appropriate vegetation will be proposed to ensure future sustainability.
- Existing flood risk management project includes hardened bed and banks with levees that are important to maintain flood protection. If a measure shows induced flooding, mitigation will be required.
- In areas of existing habitat, construction must avoid nesting season, flood season, and minimize impacts to native vegetation where possible. Clearing of vegetation prior to construction would be performed outside of the bird breeding season, between August 15 and February 15, to avoid impacts to nesting birds. Once vegetation is cleared outside of the breeding season, construction may occur year-round with the implementation of mitigation measures such as buffers around adjacent habitat or sound-buffering fencing, as necessary.
- Restoration must avoid cultural or historic sites when possible. If unavoidable, a mitigation plan must be provided.
- Recreation must not degrade restored areas.Recreation measure locations must be limited to land identified for the project.

During the formulation of measures for inclusion in the alternatives, constraints and considerations are one basis for assessing and screening out measures.

For the current plan formulation effort, the highly urbanized nature of the floodplain limits opportunities for land acquisition, due to competing land uses. USACE policies limit land acquisition costs as a percentage of the total project cost, further limiting the scope of the project area. The study team identified potential restoration locations opportunistically, based in large part on the availability of lands and the ability to acquire significantly large parcels of floodplain lands.

Another important consideration in plan formulation is the funding authority of the USACE. The categories of project features that can be federally cost-shared include ecosystem restoration and passive recreation such as trails; however, active recreation costs are a Sponsor responsibility. Further, the USACE cannot pay for upland restoration unless it is necessary for project success. Operation and maintenance is a local cost following project completion, except that there is an “adaptive management” period of 3 to 5 years and monitoring for 10 years that is cost-shared with the Federal government. HTRW response and remediation are 100 percent non-Federal sponsor responsibility and 100 percent non-project cost. Any response or remediation of HTRW will be addressed by the sponsor or it will ensure responsible parties address it to provide sites remediated to the standards required to support the restoration project. No construction on sites with soil contamination will occur prior to the completion of remediation activities at those sites. At this time, it is anticipated that the City will need to remediate contamination at the two Taylor Yard sites and the Piggyback Yard site prior to Federal construction at those sites. For groundwater contamination that cannot be addressed prior to construction, the City would be responsible for addressing such contamination during construction dewatering activities, including proper treatment and disposal. Water supply to the project (irrigation) is an associated non-Federal cost.

4.4 ALTERNATIVE DEVELOPMENT AND EVALUATION PROCESS

The alternatives formulated during this study followed requirements for a USACE Feasibility Report and the NEPA process. The alternatives described in the report are not plans for actual construction, nor are they of sufficient design detail to be constructed. Detailed design analysis and preparation of plans and specifications would begin following the completion of the Integrated Feasibility Report (which incorporates the EIS) and project authorization by Congress, if such action occurs. Alternatives were formulated to a level of detail sufficient to determine economic feasibility and potential cost-sharing, technical feasibility, environmental feasibility, and resource issues associated with implementation and other criteria necessary to make an informed decision by the parties involved in its implementation. The selected ecosystem restoration plan must:

- Comply with NEPA and other environmental laws and regulations.
- Meet study objectives performance targets.
- Maintain (or improve) existing conveyance of flood flows and ensure that project implementation would not increase flood flows or worsen flooding conditions in existing developed areas.
- Produce NER benefits.
- Provide decision-makers, both Federal and local, with information that may be utilized to help determine plan selection and a balance between various competing interests.
- Blend existing and proposed improvements where possible. These improvements would take advantage of local projects, and provide consistency with the future master planning efforts of the local community.

a. Measures were developed based on the expert opinions of Federal, State, and local agencies, the Corps PDT, and the Sponsor PDT.

b. The measures were combined along the potential project area based on the problems, opportunities and objectives, the expert opinions of Federal, State, and local agencies, the Corps PDT and Sponsor PDT, and the practicability of implementation of each measure at each site given the constraints and land uses along the river.

c. This produced a preliminary array of 19 alternatives. Typical designs, costs, and habitat benefits were developed for the elements of these alternatives.

d. The 19 alternatives were divided by reaches for input into CE/ICA analysis. IWR Plan was used to formulate alternatives which would use the best plans for each of the reaches in the 19 alternatives. The incremental analysis formulated 21 Best Buy plans and over 150 cost effective plans for selection of the final array.

e. The final array was selected from the best buy plans based on the incremental analysis and the study objectives.

4.4.1 Local Involvement in Plan Development

Public input and local expertise with similar restoration projects was incorporated throughout the plan formulation process. The primary areas of local concern identified during the study include: (1) technical considerations based upon the specifics of the study area; (2) maintaining or improving the existing level of flood risk management; and (3) coordinating recommended plans with ongoing development and local efforts in ecosystem restoration within the study area.

The plan formulation process has included extensive involvement by the non-Federal Sponsor, agencies, and key stakeholders. Plan formulation workshops were conducted during the feasibility study to identify problems and opportunities, develop and refine measures and alternatives, address specific problems, and select the recommended plan.

To focus these efforts on ecosystem restoration, the USACE held a 3-day plan formulation charette on December 2, 3, and 4, 2009. The charette engaged stakeholders in a collaborative brainstorming process to expedite the development of plans, alternatives, and/or management measures to address study objectives. The purpose of the workshop was to receive input for the formulation of plans. The purpose of the plans was restoration of ecosystem function to the highest level possible within the Los Angeles River, with an emphasis on ecosystem restoration for development of the NER plan.

The charette included a 6-hour field outing to critical locations within the study area with discussion of specific problems and opportunities at each site. It engaged the participants in organized brainstorming that developed long lists of problems and measures as well as personal vision statements. It also grouped teams of experts in the disciplines of economics, biology, engineering, hydraulics, landscape architecture, geotechnical/soils engineering, planning, and recreation. These teams were able to apply their expertise—along with the information gathered from the public and other stakeholders during the City's Los Angeles River Revitalization Master Plan outreach efforts—to the focused charette process.

Participants in the charette workshop included representatives from the USACE, the City of Los Angeles as the non-Federal Sponsor, the U.S. Fish and Wildlife Service, the Los Angeles County Department of Public Works, the California Coastal Conservancy and the Mountains Recreation and Conservation Authority, the Audubon Society, California State Parks, the City of Glendale, non-governmental agencies such as the Friends of the Los Angeles River, The River Project, the Los Angeles and San Gabriel Rivers Watershed Council (now the Council for Watershed Health), and other stakeholders and experts having interest and knowledge about the Los Angeles River. Sixty-eight participants attended the workshop for either one or more of the three days.

During the charette, group brainstorming activities included problem identification and validation of problems, opportunities, and objectives. Participants were divided into teams that developed measures and alternatives. Those brainstorming ideas from the diverse group of participants were a starting point for additional formulation.

4.4.2 Measure Development

Measures are the building blocks of alternatives. The identified environmental restoration measures consist of one or more actions or features in a particular location that are intended to solve specific problems or help meet the identified planning objectives. Measures were initially developed at the charette described above. During this workshop, the participants considered refinement of the study objectives, and a wide variety of measures that could be combined into alternatives meeting the planning objectives. The process included assessment of each measure to determine whether to carry it forward into the alternatives. The public was given the opportunity to provide additional input to alternative formulation at public meetings held by the City of Los Angeles. As the study progressed the USACE's study team, the Sponsor, and the habitat team have screened out those measures that did not meet objectives, were excessive in cost, were technically infeasible, conflicted with constraints, or did not meet performance criteria.

4.4.3 Measure Screening

Decision criteria for evaluation, comparison, and selection of measures were based on application of evaluation criteria established under Principles and Guidelines (U.S. Water Resources Council 1983) and the USACE Institute for Water Resources (IWR) Planning Manual (USACE 1996). These are effectiveness, completeness, efficiency, and acceptability, as defined below. Additional criteria considered were technical, environmental, and public acceptance feasibility. These criteria were applied in the first screening of measures and were considered iteratively as more was known about each site and measure. Table 4-3 compares the retained and screened measures, and the criteria used to evaluate them.

Effectiveness

Effectiveness is the extent to which an alternative plan alleviates specified problems or achieves opportunities. Measures that did not address any objectives were screened out. Measures that did not accomplish their intended purpose were screened out.

Completeness

Measure completeness was considered in light of technical feasibility and whether constraints were too burdensome to implement the measure at a particular location (e.g., given current land use and known intensive infrastructure obstacles/constraints). For the purposes of the initial evaluation of alternatives, completeness was related to the level at which the measures contained with the alternative met objectives and the possibility of implementation of the measure. Evaluation of the implementability of the measure considered whether it could be implemented on sites within the historic floodplain, whether property is in public ownership or expected to become available, level of impacts to infrastructure, and technical feasibility of the requirements to implement the measure successfully. Features that were technically infeasible or conflicted with Federal or local law and policy were dropped. Features that were not sustainable without extreme measures were screened out, such as a 9-mile tunnel under the City of Los Angeles, and removal of all of the concrete in the channel while maintaining the same channel depth and width. In addition, features that were not feasible because of intense infrastructure or current or expected future land use conflicts were also screened out.

Efficiency

Efficiency is "the extent to which an alternative plan is the most cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment." Cost effectiveness analysis answers the question: "Does the measure accomplish the objective with the least cost?" Efficiency evaluation of the initial array included consideration of technical feasibility and constraints. The resulting array was further evaluated for efficiency through Cost Effectiveness and Incremental Cost Analysis (CE/ICA).

Acceptability

Acceptability is the workability of a plan with respect to acceptance by State and local entities and the public, and compatibility with existing laws, regulations, and policies. If there was a known conflict with Federal, state, or local laws or policies, the measure was screened out. Public acceptability was considered qualitatively.

4.4.4 Screened Measures Descriptions

Some measures were intended for implementation along the entire reach of the project area, and some sites along the project reach were screened from further consideration during the course of plan formulation. Eliminated measures are described below along with the reasons for their elimination.

1. **Create Underground Basins for Attenuation -- ineffective, inefficient, and incomplete.** Install underground basins to store floodwaters, and provide temporary water supply for restoration. Potential locations where basins could be constructed are identified throughout the study area. These are storm-type water storage modules, which are developed for subsurface stormwater detention or infiltration systems. Installation would require excavation of the site, which would then be covered with geotextile and filled with crushed stone; existing land uses would be returned to the site. The system is designed to be utilized under parking lots, athletic fields, parks, etc. The estimated depth of the tank would be 11.3 feet.

    a) Six areas were identified as potential sites and would have provided a total storage of 3,128 acre-feet. These are the Equestrian Center, Bette Davis Park, Ferraro Fields, Griffith Park Golf Course, and Taylor Yard. Piggyback Yard.
    b) Assuming basins are constructible and a structure could be designed to perfectly take the flow off the top of the design flow hydrograph (based on the frequency hydrographs from the 1992 LACDA study), flows would be "diverted" and adjusted downward downstream based on the size of the potential basin. In the preliminary analysis, there was some peak flow reduction showing some flood risk management benefit, but the amount of diversion was not enough to reduce the need for diversion of flow into tunnels sufficiently to reduce their size significantly nor did it allow for an adequate increase in vegetation within the channel. This reduction assumes that the upstream basins are also in operation. Because this analysis showed that the basins would be largely ineffective for attenuation and would provide little to no additional habitat value for the associated costs of their implementation, this measure was dropped.
    c) Use of the basins for water conservation would present difficulty in offloading because of the slope of the river. In addition, groundwater recharge would be difficult due to the existing high groundwater levels in the area and the distance to other spreading basins far upstream and/or downstream.

2. **Tunnels/Culverts -- ineffective.** Construction of tunnels or large culverts to divert storm season flows around the project reach.

    a) This would require excavation and construction of culverts that would need to be sized and designed based on results of hydraulic modeling. The culvert measure would include a culvert from Headworks to the Piggyback Yard diagonally across the City to move storm flows around the project area. Culverts would divert storm flows into underground basins.
    A tunnel diversion at Headworks would need to contain approximately 40,000 cuffs of flow. Moving downstream, the diversion amount required increases. At Cornfields, a diversion to accommodate approximately 104,000 cuffs would be required with an associated 42-foot-diameter tunnel. This means the tunnel would need to follow the River's alignment so additional flow could be added. As additional flow volume is diverted, tunnel sizing would need to be increased downstream – taking on additional volume at Verdugo and Arroyo Seco, etc. where additional flows are being added to the system.

    The CE/ICA analysis showed that this measure would be excessive in terms of construction costs and lands, easements, rights-of-way, and disposal sites (LERRDS) because the preliminary alternative plans that included the measure provided only an 8 percent (643 habitat unit) increase in habitat benefit for at least a 113 percent ($1.8 billion) increase in total cost. Given this, the measure was deemed ineffective and inappropriate at this time. Moreover, construction and operational impacts of the tunnel infrastructure were determined to be unacceptable to the Sponsor and the public because of anticipated cumulative adverse impacts with respect to priorities to preserve existing open spaces and to avoid creating another engineered channel for the river.

b) ***Freeway Water Bypass.*** This measure would have widened the river under the freeways. Similar to the tunnel measure, it would have been used to pass storm flows through the restored reach. It was eliminated for the same reasons the tunnel measure was eliminated and due to the expense and difficulty of installing a tunnel under the freeway.

c) ***Culvert under the Los Angeles River for Diversion of Storm Flows.*** While it would be potentially cheaper than a diversion tunnel across the City of LA, the inlet and outlet for storm flows to the underground or under-river diversion structure would be cost prohibitive so the measure was eliminated

3. **Wildlife Bridges -- ineffective and incomplete.** These measures were deleted based on the assumption that bridges may facilitate the movement of wildlife into urban areas where wildlife would not benefit (i.e., bobcats/coyotes in urban LA would likely be killed in urban neighborhoods and could be a danger to pets and children). The preliminary analysis determined that bridges would not lead to any substantial/beneficial habitat to support any introduced wildlife.

4. **Widen Channel/cantilever Channel Bank -- ineffective and incomplete**. This includes widening of the channel by converting trapezoidal slopes to vertical walls, and installing a cantilevered section extending out over the channel from the top of the vertical wall. It was proposed in portions of Reaches 7 and 8. The measure would include excavation and rebuilding of the channel and adjacent infrastructure. The associated overhang would likely be walkways or promenades tied to hiking trails and adjacent streets. The cost of modifying and reconstructing the channel was determined to be too expensive when evaluated with respect to the habitat benefit that would result from this measure.

5. **Wildlife Tunnels -- ineffective and incomplete.** These were deleted based on the expert advice of the biologists on the team and wildlife agencies participating in the habitat evaluation. They advised that wildlife would likely not use the tunnels due to the projected length and size of the tunnel being too small to comfortably accommodate wildlife.

6. **Pervious Parking on Streets and in Lots Outside the ARBOR in the Watershed -- unacceptable.** This measure was eliminated because it did not address the objectives and is outside the USACE's authority for aquatic ecosystem restoration . However, it is a "best management practice" that would facilitate long-term watershed health and expanded ecosystem restoration and could be implemented by other projects.

7. **Tujunga Channel System Modification -- ineffective and incomplete.** The Tujunga is a tributary located upstream and outside of the study reach. Much is already being done to restore this stream's ecosystem including a project built by the USACE. This measure suggested modifications on the Tujunga Channel System to divert storm flows and slowly return water to the river system. It was eliminated because it is over 6 miles upstream, which is too far upstream to be effective.

8. **Relocate/Bury Railroads or Other Utilities – not a measure.** This measure was eliminated as a stand-alone measure because it is a design consideration rather than a restoration measure but would be employed as part of LERRD if the subject facilities could not be avoided or put on trestles.

9. **Deepen Entire Channel to Gain Capacity – ineffective.** This measure would remove concrete within the entire project area and deepen the channel to carry the design flows. It requires modifications to over 20 bridges, 3 confluences, and numerous storm drains. There are unknown quantities of utilities that run directly beneath or cross the existing channel. The depth of the channel would have to more than double to convey the same design flow with concrete removed and vegetation included. The trapezoidal sections could not be deepened enough and would require conversion to vertical wall configuration. It would require a gradual deepening as it approached the restored areas and a gradual return to the invert grade at the downstream end of the project area. For these reasons, this measure was determined to be ineffective.

10. **Modify Upstream Dams -- ineffective and incomplete.** Three types of modifications were considered.

    a) ***Deepening or raising dams to modify capacity.*** Sepulveda Dam and Hansen Dam are the only two possible dams to consider for modifications. USACE believes that these dams are too far upstream of the study reach to have a significant impact on flow reduction. The amount of storage required greatly exceeds the amount that can reasonably be acquired. There is a significant cost issues regarding raising dams, which include modifications to unrated outlets, spillway gates, and other pertinent structural features. Modifications to increase storage raise a number of other significant issues that include impacts on past, current, and future restoration projects within the reservoir as well as recreation uses within the reservoir. This measure would also require mitigation for other approved uses within the reservoir.
    b) ***Modification to dam operations.*** Re-operation to reduce downstream discharges is not a viable option. Sepulveda Dam currently does not provide the authorized level of protection. There is insufficient storage in both reservoirs to accommodate the volume of water necessary to reduce downstream releases sufficiently.
    c) Re-operation to provide water through the dryer months of the year is not necessary. There is enough water flowing into the project reach in the Los Angeles River to sustain any proposed ecosystem restoration configurations. Moreover, Sepulveda and Hansen Dams have each been rated as a DSAC III dam. Reallocation of storage for water supply is not allowed for DSAC III dams.

11. **Modify Pool Riffle Complex in Existing Soft-Bottom Channel Restoration -- ineffective.** This measure would have reshaped existing soft bottom channel for pool riffle complexes. The soft-bottom beds in the ARBOR study reach are in good geomorphic health and behave like a natural river. The geomorphology of the river bed within soft bottom reaches does not need restoration. Removal of this measure does not mean that bank restoration, invasive species removal, and trash removal are eliminated.

4.4.5 Retained Ecosystem Restoration Management Measures

As noted above management measures for alternative formulation consisted of ecosystem restoration measures to address Objectives 1 and 2, and recreation measures will address Objective 3. Ecosystem restoration measures were formulated based on input from the USACE technical team, the City, the general public outreach, and local expertise from Federal, state, and local agencies, other cities within the study area, academic experts, non-governmental organizations, and consultants. Ecosystem restoration management measures retained for inclusion in alternatives are described below.

The environmental restoration measures identified consist of one or more actions or features in a particular location that are intended to solve specific problems or help reach particular planning objectives. Measures are broken out into six major categories as described below:

1. **Adjacent or off channel modifications**. These include restoration measures both immediately adjacent to and separated from the main river channel. Features include establishment of riparian, wetland, or open water areas.

   a) ***Major tributary channels/widen channel (Objectives 1, 2)***. Widening tributary channels removes a significant amount of concrete and overlaps with concrete removal measures on the mainstem (see Section V). It consists of removal of existing structures, including on properties adjacent to the channel, and excavation/grading to expand the tributary channel and tie into adjacent lands. Bank modifications include terraces and gradual slopes to allow creation of habitat.
   b) ***Restore riparian and marsh by day lighting streams (Objectives 1, 2)***. River systems naturally have a large number of small channel tributaries as well as large tributaries contributing flow. In urban areas, many of the river's smaller tributaries are now in underground pipes or storm drains. Daylighting in this instance is defined as opening these underground pipes and storm drains near their confluence with the River to restore them to a natural stream channel. This would include opening and daylighting storm drains and developing riparian and marsh habitat within the new channel. Existing storm drains are gated and would likely need to remain gated after modification, except where wildlife passage is designed (see Section 3). Design of the outlet and adjacent wetlands are site specific and depend on sizing, discharge, and available right-of-way. For the purpose of cost and habitat analysis, it was assumed that at least 1 acre of aquatic wetland would be created at the mouth of each of these daylighted storm drains.
   c) ***Create geomorphology and plant for freshwater marsh in adjacent side channel (Objectives 1, 2)***. Side channels would be created in River-adjacent areas to allow flows to meander off of the river channel mimicking a more natural braided river system. Shallow water (less than 6 feet deep) will be required for freshwater marsh. Freshwater marsh will be interspersed with open water and riparian vegetation. Modifications include removal of concrete, excavation to create uneven riverbed bottom with pools and shallow zones, stabilization of the off-channel area with boulders or weirs, and planting of wetland and riparian vegetation. The existing River soft bottom reaches that include wetlands and pools/riffles, such as those found within Reach 4, will be a prototype for what can be created in remaining reaches. Water quality is sufficient to support vegetation. The wetland plant palette will include plants from Table 4-1 below.

Table 4-1 Wetland Plant Palette for Freshwater Marsh

Scientific Name	Common Name
Carex praegracilis	clustered field sedge
Cyperus odoratus	fragrant flatsedge
Eleocharis parishii	Parish's spikerush
Juncus effusus	common rush
Mimulus cardinalus	scarlet monkeyflower
Schoenoplectus californicus	California bulrush
Typha angustifolia	narrow leaved cattail
Typha latifolia	common cattail

d) ***Grade areas adjacent to the channel to lower elevation for habitat, floodplain reconnection, and offline detention (Objectives 1, 2)***. This measure includes lowering of sites adjacent to the channel to allow for retention of water and habitat creation. It would include excavation to create basins or terraces that tie into the channel and adjacent topography. These would be terraced or have slopes at a 3 to 1 transition ratio or more gradual and be interspersed with freshwater marsh (retention basins) and riparian vegetation.

e) ***Create geomorphology for open water adjacent to the channel (combined with measure 3) (Objectives 1, 2)***. Water deeper than 6 feet would remain open water and not allow for vegetation growth. Modifications to accomplish this measure could include removal of concrete, excavation to restore uneven bottoms, bank stabilization, and creation of pool and riffle habitat through installation of boulders or weirs.

f) ***Rebuild geomorphology for historic wash (Objectives 1, 2).*** A wash is an intermittent or ephemeral stream subject to flashy flows during seasonal rains associated with riparian dependent upon groundwater or seasonal wetland vegetation dependent upon groundwater. This measure restores historic washes through grading and excavation. Detailed channel design will depend on any discharge expected within the wash. The restored historic wash would likely be a shallow channel with gradual (3:1 or less) slopes and terraces with both riparian and buffer vegetation. It would reconnect with its upstream areas as well as the River channel. It is different from daylighting streams (measure 2) because these historic washes were not necessarily put into the storm drain system. Development has occurred around them, and the historic washes have been directed to other parts of the drainage system.

2. Attenuation. These measures include capture of flows from the main channel, storm drains, and tributaries into side channels or detention basins.

a) ***Creation of attenuation basin with wetlands (Objectives 1, 2).*** This measure includes slowing input of storm flows, restoring wetlands, and creating a confluence with the River (overlaps with off channel measures in Section 1). This measure would require connection to the River. Wetland attenuation basins would be sized to capture runoff from the local area (not the main channel) and would include a basin surrounded by terraced slopes. The basin would slow down flows before they enter the mainstem of the River system and would provide seasonal wetland habitat. There would be a trade-off between the wetland and attenuation. This measure would provide some incidental water quality and recharge benefits. Preliminary design includes excavation of a basin that would have an impermeable layer of either geotextile or fine materials installed. The basin would then be planted with wetland vegetation. Average depth of the basin is assumed to be 3 feet and there would be some deeper areas up to10 feet deep. It was assumed that this measure would provide 25 percent riparian habitat and 75 percent wetland habitat, resulting in one to two structural layers.

3. Wildlife access. These measures provide access and crossings for wildlife between the River and adjacent landscape. They include bridges, undercrossings, access slopes, or tunnels. This measure was later determined as one that would be common to all alternatives and added where possible and reasonable. The basis for design will be based on the wildlife expected to benefit in that location.

a) ***Bridge undercrossing for wildlife (Objectives 2).*** Paved bridge undercrossings act as an impediment to some wildlife movement. To reduce this impediment, modify or install corridors along the bank, which would allow wildlife to cross below bridges within the river.

b) ***Wildlife access from River to bank (Objectives 2)***. Create slopes suitable for ingress/egress of wildlife (generally 3:1 or more gradual slopes) in areas with vertical banks (this would include access to safety ramps in vertical walled channel areas).

c) ***Wildlife passage (Objectives 2)***. Modify storm drains and culverts to allow wildlife passage from existing and created natural habitat areas into the river. For example, daylighted storm drain culverts that pass through the levee would be widened to accommodate wildlife passage. They would also be modified to create appropriate side slope angles for wildlife passage and to remove storm drain grates to allow passage between the river and daylighted streams. The team assumed wildlife passage would only be created to connect wildlife to habitat areas; this measure should not connect wildlife to urban areas that would not be beneficial to their survival.

4. Planting. Planting includes measures to restore vegetation within various locations throughout the study area. Measures included revegetation of wetland, riparian, and buffer zones including bioengineering of channel walls where possible. Valley foothill riparian and freshwater marsh habitat will be planted in the following ways: restructuring and planting walls, planting in overbank corridors, planting alongside channels, planting in concrete terraces, and planting on natural terraces and slopes. Planting efforts would include invasives removal.

a) ***Restructure/vegetate River concrete channel walls (Objectives 1, 2)***. This measure includes modification of the concrete channel walls to allow the growth of vegetation. This herbaceous layer is one component of a riparian/wetland habitat complex. Its addition as a stand-alone element in the form of overhanging vines between larger, multi-canopy restoration areas will provide several important functions. As the vines and other herbaceous vegetation mature, this feature will provide shading, cover, potential nesting habitat, and foraging opportunities in areas that are now bare concrete. The habitat would attract and be utilized by many species, including insects (key food source for other wildlife), amphibians, lizards, birds, and small mammals. This vegetation could also provide visual cues and extended segments of greenway that would encourage wildlife movement toward larger restored parcels, downstream or upstream of these reaches. The team assumed the composition would be 50 percent herbaceous riparian (i.e., vines) and 50 percent concrete, resulting in one structural layer of vegetation. Geotextile fabric has been proposed for design of this measure at this time. The fabric, which can be planted with vegetation (grasses and forbs), is reported to withstand velocities of up to 25 ft/s and shear stress of up to 15 lb/ft^2. Depending on the site specific conditions this measure could be accomplished using a range of features including:

- Notching,
- Vegetated terraces with hardened erosion protection,
- Vegetated sidewalls,
- Vegetation hanging from the top of bank, or
- Plantings in or at the tops of channel walls (requiring permanent irrigation for drought conditions).

b) ***Habitat corridors/riparian planting on overbanks of the main channel or tributaries (Objectives 1, 2).*** This measure includes planting riparian vegetation on the overbanks of the River to establish habitat corridors. Species lists proposed for riparian and transitional zones are provided below in Table 4-2. The team assumed that this measure would restore 50 percent riparian trees and 50 percent riparian shrubs, resulting in two to three structural layers. Development of a detailed site specific planting plan will be completed during the design phase (species and densities). Irrigation of overbank areas will be used for establishment period and in cases of extreme drought. The City is committed to providing necessary water for the project.

Table 4-2 Riparian and Buffer/Transitional Plant Palette

Riparian Tree & Shrub	
Ambrosia psilostachya	western ragweed
Artemisia douglasiana	mugwort
Baccharis salicifolia	mulefat
Mimulus cardinalis	scarlet monkeyflower
Platanus racemosa	western sycamore
Populus fremontii	Fremont's cottonwood
Salix laevigata	red willow
Salix lasiolepis	Arroyo willow
Buffer/Transitional (minimal acreage)	
Artemisia californica	California sagebrush
Eriogonum fasciculatum	California buckwheat
Eschscholzia californica	California poppy
Helianthus annuus	sunflower
Leymus condensatus	giant wild rye
Lotus scoparius	deerweed
Malacothamnus fasciculatus	chaparral mallow
Malosma laurina	laurel sumac
Rhus integrifolia	lemonade berry
Salvia apiana	white sage
Vines	
Marah macrocarpa	wild cucumber
Vitis girdiana	Southern California grape/desert grape
Vitis Californica	California wild grape
Cuscuta californica	California dodder
Calystegia macrotegia	Island morning glory
Rubus ursinus	California blackberry

c) ***Terrace concrete banks/planting built into modified channel walls (Objectives 1, 2)***. This measure modifies existing concrete walls by adding structures able to support vegetation. It includes planting vegetation in the structures. This could include terraces with erosion protection such as concrete liners, or openings in the concrete where vegetation is planted on terraces or slopes. Terrace dimensions and/or types and density of vegetation would be refined to accommodate wildlife habitat where appropriate with available space. Vegetation is assumed to be riparian with two to three structural layers.

d) ***Invasives Removal and Replanting (Objectives 1, 2).*** An initial removal of 90 percent of invasives and trash in soft bottom reaches, and replanting of native vegetation (if needed and if the reach is included within the selected alternative).

e) ***Buffer Zone (Objective 1).*** A buffer zone between human activities area and restored areas would be provided with native vegetation consistent with the surrounding ecosystem.

5. **Remove concrete or naturalize channel bed and/or banks**. Concrete removal measures include modifying the channel by removing concrete and/or grouted stone. Erosion control would accompany removal and removal would include modifications to the channel bed, terracing of the banks, etc.

a) ***Lower channel banks (Objectives 1, 2).*** This measure lowers the channel banks to connect with adjacent areas, setting back levees or providing berms as needed per site to avoid inducing flood damages.

b) ***Widen channel banks (Objectives 1, 2).*** This measure widens the channel, removing concrete and reconstructing channel banks with site-appropriate erosion control to create more capacity, support more habitats and natural river processes, as well as tying into adjacent areas.

c) ***Lowering banks and widening the channel (Objectives 1, 2).*** The measure includes lowering channel walls and widening the channel, linking the River to adjacent areas. These combined measures could involve construction of levees or berms to contain flood flows; this is assumed to be limited and will require hydraulic modeling to determine if necessary.

d) ***Channel bed deepening (Objective 1)***. This measure excavates the channel to create more capacity and allow for additional aquatic habitat in the channel where concrete currently exists. It would require removal of concrete or grouted rock substrate and excavation of the channel to desired depth. The channel would need to be stabilized either by replacing the grouted rock/concrete bed or grade control structures or both to maintain channel integrity. This measure includes number 6 below.

e) ***Terraces with earthen banks (Objective 1, 2)***. This measure requires site-specific measurement of available space and dimensions adjusted accordingly. Channel banks would be terraced to provide a gradual slope and transition between the channel and top of bank. Terraces would be earthen and stabilized for flood flows and safety. Dimension of the terraces will need to consider wildlife movement with gentler slopes sufficient for transit by wildlife. It is similar to measure the design providing for concrete lined terraces in the banks, without the use of concrete stabilization.

f) ***Create geomorphology and plant for freshwater marsh in main River channel (Objective 1)***. This measure includes modification of the existing concrete River channel to allow suitable bed conditions for restoration of freshwater marsh. Shallow water (less than 6 feet) will be required for freshwater marsh, which will be interspersed with open water and riparian vegetation. Modifications to the channel include removal of concrete, excavation to create an uneven riverbed with pools and shallow zones, stabilization of the channel with boulders or weirs, and planting of wetland and riparian vegetation. Native fish such as Santa Ana sucker and arroyo chub, although currently extirpated from the project area, could be reintroduced into restored areas with appropriate habitat such as freshwater marsh in combination with existing open water. These species are supported on tributaries to the LA River in the most upstream reaches (FoLAR 2008). Rainbow trout (non-anadramous steelhead), which are also present in upstream reaches may also be reintroduced into appropriate habitat.

4.4.6 Recreation Management Measures

ER 1105-2-100 lists recreation measures, which may be cost shared in recreation developments as Ecosystem Restoration Projects. These measures address **Objective 3**:

- Access and Circulation: Roads, turnarounds, trails (multiple-use), parking, footbridges, and culverts;
- Structures: Sanitation – (e.g., toilets, comfort stations, shelters for picnicking and trail-related uses);
- Utilities: Water supply – (e.g., municipal system, drinking fountains and faucets, sewage and waste water disposal - storm drainage, public telephone);
- Site Preparation/Restoration: Clearing and grubbing, grading and land form;
- Park Furniture: Picnic tables, trash and recycling receptacles/holders, bicycle racks;

- Signs: Entrance directional markers, traffic control (vehicular and pedestrian), instructional (includes fire danger notices), wayfinding;
- Interpretive Guidance and Media: Display boards, interpretive markers (natural, historical, archeological, etc.), bulletin board; and
- Protection, Control, Health and Safety: Gates and barricades, walls and fencing, guardrails, entrance stations, lighting, and handrails.

This list of recreation measures assumes the following:

- Facilities to be cost shared are limited to standard designs consistent with the natural environment of the surrounding area, but should not include embellishments, elaborate designs, or be ostentatious.
- Footbridges are to be austere and used only when other crossings methods are impractical. Footbridges that are the central recreation experience are to be a non-Federal cost. Pedestrian bridges at highways or railroads are normally a non-Federal cost; however, if they are integral to the recreation feature and the most cost effective alternative, they may be cost shared.
- Connections to an existing municipal system for water supply and sanitation needed. Recreation measures suited only to rural settings (e.g. vault toilets) are excluded.

4.5 DEVELOPMENT OF ALTERNATIVES

During the planning charettes, alternatives were developed based on expertise from Federal, state, and local agencies, university and environmental organizations, the USACE, and the Sponsor. These are referred to as the preliminary array of alternatives. The alternatives were formulated for the entire study area during the planning charette with additional alternatives formulated during public outreach, and individual team efforts including the USACE design team, City design team, and the habitat team, which was formed to work together on the habitat evaluation.

4.5.1 Real Estate Considerations

The selection of the areas of land in the study area where ecosystem restoration alternatives might reasonably and appropriately be implemented was accomplished through an iterative process by the project team composed of USACE personnel, the non-Federal Sponsor, and their respective technical specialists and consultants. The team considered advice of local non-profits with an interest in River restoration, City Council representatives, and agencies including U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), and the California Regional Water Quality Board (CRWQB). Geographic Information System (GIS) mapping resources, recent aerial photographs, field inspections, and the local knowledge base and professional opinion were the tools applied in the delineation of a rational area within which alternatives could be formulated.

The team presumed that the River channel, confluences with major tributaries, and areas of open space adjacent to these watercourses within the study area would be available for restoration features. Lands within associated historic floodplains were considered for the restoration alternatives. Vacant parcels located within the historic floodplain and close to existing watercourses were evaluated on a case-by-case basis. If portions of privately owned lands could be acquired without impact to residential structures, they were considered. The following strategy assisted in identifying the area for alternatives formulation:

- Publicly owned lands were favored over privately held lands.
- Existing residential buildings, commercial and institutional developments, and currently utilized freeway, street and road rights of way were avoided as potential areas for implementation of a project unless plan objectives could not be met within the reach without those lands and there was

potential for acquisition. Vacant lands presently zoned for residential or commercial development were considered available for the project.
- Some known utility corridors were included because they tended to follow the tributaries and were unavoidable. The project would not relocate the utility lines themselves unless there were unavoidable access or engineering requirements directing the need for a particular location.

This delineated area included the land most suitable for ecosystem restoration within the River study area. The area included selected portions of the channel itself, the river right-of-way, the confluence and some area upstream on major tributaries, and open space areas along the channel. Table 4-3 provides a summary of land ownership in those areas considered for inclusion in the project. While over 3,000 acres were considered in the initial potential project area, evaluation of the location and availability for river restoration resulted in a smaller potential project area of 973 acres.

A total of 316 parcels within the study area were included in the preliminary array of alternatives. Of those parcels, 81 were found to be improved with buildings. Preliminarily, 188 parcels are government owned, at least 22 parcels are owned by railroad companies, and the remaining parcels are privately owned.

Table 4-3 Land Zoning in the Project Area

Zoning	Acres
Unknown (misc) District Plan	23
Agricultural (A2)	13
Commercial Manufacturing (CM)	36
Industrial (M1-M3, MR2)	235
Open Space & Public Facilities (OS, PF)	2,788
Residential (All Rs)	33
TOTAL	3,128

4.5.2 Publically Owned Lands Screened from the Potential Project Area

The team continued to consider plan efficiency as it related to land availability, costs, and other lands, easements, rights-of-way, relocations, and disposal sites (LERRD). Under the ecosystem restoration project authority, cost sharing for such projects is 65 percent Federal to 35 percent non-Federal. Although permissible under law, land costs above the Sponsor's share are disfavored under USACE policy, which provides a 25 percent target for maximum percentage of land value for a restoration project. This is, in part, to ensure that the USACE is engaging in a true restoration project, increasing habitat functions and services rather than serving as an avenue for land acquisition. The USACE's Planning Guidance Notebook states the policy:

> *Land acquisition in ecosystem restoration plans must be kept to a minimum. Project proposals that consist primarily of land acquisition are not appropriate. As a target, land value should not exceed 25 percent of total project costs. Projects with land costs exceeding this target level are not likely to be given a high priority for budgetary purposes (ER 1105-2-100, Appendix E, para. E-30f).*

Real estate and potential relocation costs are known to be exceptionally high in the Los Angeles area and these costs will likely compose a substantial portion of the potential restoration alternative costs. Mindful that real estate costs would be high for any alternative that involved urban Los Angeles lands, the study examined, as described above, lands already included in the river right of way (LACDA project boundary), open space lands adjacent to the existing LACDA boundary, and other parcels that would support restoration goals such as connectivity.

Other lands considered for inclusion in the project (in addition to being located within or adjacent to the river right of way) would preferably be in Federal or local government ownership wherever possible. Private lands were included only if restoration benefits in that reach could not be accomplished any other way. In some cases, inclusion of an entire identified site was considered infeasible in the highly urban context because very few other appropriate areas are available for relocation of the current uses, but in some cases, a portion of the site can be utilized. Appendix H includes a list of lands considered for the project.

4.5.3 Preliminary Array of Alternatives

As described above, the charrette teams, the USACE, and other habitat team members initially assembled alternative plans composed of the measures above (including measures later eliminated). In the discussion below, the preliminary array of 19 alternatives is ordered by the number of acres included within each and range from Alternative 1 Comprehensive with 621 acres to Alternative 19 Taylor Yard with 102, not including the main channel. These are described briefly in the table below (Table 4-4) and further detailed in the Alternative Matrix (Table 4-6) with sub-reaches described in the following section. Elimination of the tunnel measure, as identified above, resulted in elimination of all but three complete preliminary alternatives to carry forward for further analysis: Preliminary Alternative 16 "Side Channels Only," Preliminary Alternative 18 "Comprehensive Pockets," and Preliminary Alternative 19 "Taylor Yard." However, the other alternatives' reach plans that did not require a tunnel were also carried forward and recombined to create additional alternatives as described below.

4.6 DESIGNS

Conceptual designs were developed based on the measures described and existing channel geometries in the ARBOR Reach. These designs were developed to have enough detail to estimate quantities and costs only and do not account for scour analysis, geotechnical investigation, or other more detailed analysis to be completed during design. Additional information, including figures, is found in Appendix A, Design. The project team made several assumptions pertaining to the designs, including the following:

- Daylighting streams would result in a riparian area and freshwater marshes at their confluences.
- Grade control structures would be used to stabilize the bed of the river when concrete was removed.
- Erosion control would be included where banks were modified to allow for planting.
- Invasives removal and management would be included throughout the project area.
- Levees would be modified with protection maintained as necessary.
- Maintenance requirements for levees, riverbed, and banks would be met.

Table 4-4 Preliminary Array of 19 Alternatives

No.	Alternative	Description
0	No Action	Future Without-Project Conditions
1	Comprehensive A	Includes development of freshwater marsh, open water ponds, fish refugia, and riparian corridors, exposing storm drain outlets and converting to natural stream confluences, diversion of flow into side channels lined with habitat, underground basins and culverts to attenuate flow, bioengineering of channel walls, channel modification to increase width by terracing, channel widening, and/or modification of channel walls, connections to green streets, modification along tributary confluences to more natural habitat, and wildlife crossings.
2	Atwater to Cornfields	Implements all of the above within the Atwater to Cornfields part of the reach.
3	Banks & Tributaries Only	Leaves the flood risk management channel bed primarily “as is” and restores floodplain by creating side channels in open areas along the river with freshwater marsh and riparian corridors and restoring tributary confluences. Includes modification of storm drain outlets and bank terracing.
4	Comprehensive B	Includes most of measures included in Alt 1 Comprehensive A with fewer locations, less terracing and side channels, and omits elevating railroads on trestles, bioengineering walls, open water, and modifying trap channel to vertical.
5	Los Feliz to Arroyo Seco	Implements all measures within Los Feliz to Arroyo Seco reach.
6	Comprehensive C	Includes most of measures included in Alt 1 Comprehensive A with fewer locations and omits railroad elevation, bioengineering walls, open water, and modifying trap channel to vertical. Includes more terracing and storm drain modifications and different locations for wildlife crossings than Alt 4 Comprehensive B.
7	Channel Reshaping A	Focus is on channel reshaping and attenuation of flow – detention, bypass and widening. Using culverts and underground basins to attenuate flows, the channel is geomorphically changed to a wider, softer channel, naturalized storm drain outlets, and some restored riparian corridors.
8	Habitat Variation	Maximizing habitat restoration for a species diversity, including fish, motivated formulation of alternative. Attenuation or reduction in flow is included in each reach as well as freshwater marsh, riparian and aquatic habitat measures.
9	Soft Bottom Channel & Associated Banks	This alternative focuses restoration in reaches that already have a soft riverbed. Where open areas are adjacent to the river, the river will be widened rather than terraced. Storm drains are converted to natural stream confluences and restored with vegetation. Habitats include aquatic, freshwater marsh and riparian areas.
10	Channel Modifications with least structural and engineering impacts and public acceptability	This alternative implements measures in locations with the least impact to infrastructure and engineering challenges, while still including measures in all reaches to attenuate flow, restore riparian and freshwater marsh habitat and tributary confluence restoration.
11	Habitat Connectivity	This alternative focuses on bank to bank and upstream to downstream connections for wildlife, linkages to wildlife areas, channel widening and terracing.
12	Hydrologic Connection Improvements	This alternative focuses on lowering grade for adjacent large open areas, improved hydrologic connections between the banks, storm drains and the river. It also intends to increase wildlife movement between the river and adjacent open areas.
13	Channel Reshaping B	Using culverts to attenuate flows, the channel is geomorphically changed to a wider, softer channel, naturalized storm drain outlets, and restored riparian corridors. Includes bioengineering of channel walls, side channels and has more riparian and freshwater marsh replanting than Channel Reshaping A.
14	Channel Widening	This alternative focuses on widening the channel. Attenuation is accomplished with culvert bypasses. Includes planting of freshwater marsh and riparian corridors.

No.	Alternative	Description
15	Bypass with Bank and Tributary Confluence Restoration	Reduces flow using culvert bypass to allow for terracing and channel bank softening. Improves freshwater marsh habitat in soft bottom area and adds riparian habitat to downstream locations on the river overbank. Emphasizes widening and restoration at tributary confluences.
16	Side Channels Only	Leaves the flood risk management channel bed and banks primarily "as is," and restores floodplain by creating side channels in open areas along the river with freshwater marsh and riparian corridors and restoring tributary confluences.
17	Opportunity area restoration with channel widening at tributaries	Restores wetlands on the overbank and major tributaries at River Glen - Verdugo Wash confluence, Griffith Park, Bowtie/Taylor Yard, Arroyo Seco confluence, Burbank Western Channel, Cornfields (Los Angeles Historical Park) and the Piggyback Yard (Mission Yard). Widens the river at Verdugo, Arroyo Seco and Burbank Western Channel.
18	Opportunity area restoration to large open areas	Leaves flood risk management channel bed and banks "as is" and restores wetlands on the overbank and major tributaries at River Glen - Verdugo Wash confluence, Bowtie/Taylor Yard, Arroyo Seco confluence, and Cornfields (Los Angeles Historic Park).
19	Taylor Yard	Restores wetlands on the overbank and widens the river at this single key location on the river (includes the Bowtie parcel).

4.7 COSTS

Cost estimates were developed based on the conceptual designs developed for the measures, as described above. Appendix C, Cost, describes assumptions, unit costs, and price levels developed for the measures and alternatives.

Cost estimates for the Preliminary Array ranged from a high of $3.9 billion dollars for Preliminary Alternative 1: Comprehensive, which included $1.5 billion in estimated tunneling costs (the tunneling estimate did not include LERRD for tunneling) to $211 million for Alternative Preliminary 19: Taylor Yard. These estimates were done for each preliminary alternative and each reach. They included construction, mobilization (7.5 percent), tunneling costs if any (without associated LERRD), a 25 percent contingency for construction, preliminary engineering, and design with engineering during construction estimated at 11 percent, and supervision and administration costs of 6.5 percent. The estimate for interest during construction was 6.5 percent. The real estate estimate was based on the GIS mapping for each alternative and included business relocations cost for Verdugo Wash and Piggyback Yard and a 20 percent contingency. Operations and maintenance costs were estimated and annualized for each alternative and reach. A matrix displaying the costs of each of the 19 preliminary alternatives by reach is shown in the Cost appendix.

4.8 FORMULATION OF SUB-REACH PLANS

Once the preliminary array of alternatives was formulated, the team used the geomorphic reaches within the study area to divide each of the alternatives in the preliminary array into sub-reach plans. Each of the 19 preliminary alternatives incorporated combinations of measures that varied substantially by location from upstream to downstream, based upon existing geomorphology and opportunities and constraints within these sub-area reaches. Hence, each alternative represented a combination of alternative features, which varied from reach to reach, to ensure that the best possible combination of features was identified, based upon cost effectiveness and incremental cost analysis criteria. While not all of these 19 alternatives included all eight reaches, they were connected between reaches. Sub-reach plans would consist of the measures included in each geomorphic reach of each alternative in the preliminary array. This allowed recombination of the sub-reach plans and comparison of those newly formed hybrid plans to the preliminary plans in the economic analysis to ensure that the most efficient plans were carried forward into the final array.

Table 4-5 below summarizes the sub-reach plans and shows their relationship to the preliminary array. Measures common to all alternatives are not included, but assumed and were considered for costs and benefits. Each of the 19 preliminary plans are shown with an “x” indicating included measures by reach or sub-reach plan.

1

Table 4-5 Preliminary and Sub-Reach Plans

Reach	Measure Type	Sub-measure	Alternative																		
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Pollywog Park	I. Adjacent or off channel modifications	Create geomorphology and plant (pool/riffle system)	x		x	x					x	x				x	x	x	x		
		Restore storm drain to natural stream confluence	x		x			x			x	x				x		x			
	II. Attenuation	Side channels	x		x			x		x	x	x						x			
		Create underground basin for attenuation	x		x			x			x					x		x		x	
		Tunnels to divert flood flows	x		x	x		x	x	x	x						x		x		
	IV. Planting	Restructure channel walls & plant vines	x							x					x						
		Riparian corridors	x		x	x		x		x	x	x	x	x	x	x	x	x	x	x	
	V. Remove concrete	Channel banks mainstem/widen channel (implies erosion control)	x													x					
		Deepen channel bed	x			x		x		x	x	x		x		x					
		Widen tributary channel	x		x			x			x										
		Terrace banks	x		x			x		x	x	x		x	x	x			x		
	VI Reshape Channel	Modify trap channel to vertical sides	x			x			x						x						
2. Bette Davis Park	I. Adjacent or off channel modifications	Create geomorphology and plant (pool/riffle system)	x		x	x					x	x				x	x	x	x		
		Restore storm drain to natural stream confluence	x		x			x			x	x						x			
	II. Attenuation	Side channels	x		x			x		x	x	x						x			
		Tunnels to divert flood flows	x		x	x		x	x	x	x						x		x		
	IV. Planting	Restructure channel walls & plant vines	x							x					x						
		Riparian corridors	x		x	x		x	x	x	x	x	x	x	x	x	x	x			
	V. Remove concrete	Deepen channel bed				x			x												
		Terrace banks	x					x		x	x	x		x							
	VI Reshape Channel	Modify trap channel to vertical sides	x			x			x						x						
3. Ferraro Fields/ Verdugo	I. Adjacent or off channel modifications	Create geomorphology and plant (pool/riffle system)	x		x	x					x	x			x	x		x		x	
		Restore storm drain to natural stream confluence	x	x	x			x		x	x							x	x		
	II. Attenuation	Side channels	x		x	x				x	x	x	x	x				x		x	
		Tunnels to divert flood flows	x	x	x	x		x	x	x	x				x		x		x		
	IV. Planting	Restructure channel walls & plant vines	x	x						x					x						
		Riparian corridors	x	x	x	x		x	x	x	x	x	x	x	x	x		x		x	
		Open water	x								x								x		
	V. Remove concrete	Lower channel banks			x						x		x		x					x	
		Deepen channel bed		x		x			x												
		Widen channel mainstem	x					x		x	x		x	x	x	x	x			x	
		Terrace banks	x		x			x			x		x		x						

Reach	Measure Type	Sub-measure	Alternative																		
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	VI. Reshape Channel	Modify trap channel to vertical sides	x	x		x			x					x	x						
4. Griffith Park	I. Adjacent or off channel modifications	Create geomorphology and plant (pool/riffle system)	x	x	x	x			x	x		x						x	x		
		Restore storm drain to natural stream confluence	x	x	x	x	X	x	x	x	x	x		x			x	x	x		
		Grade adjacent areas to lower level for offline detention and habitat	x	x	x	x		x	x			x		x							
	II. Attenuation	Side channels	x	x	x	x	x	x	x	x		x			x			x			
		Create underground basin for attenuation	x		x					x				x	x			x			
		Tunnels to divert flood flows	x	x	x	x	x	x	x	x	x						x		x		
	III. Wildlife Access	Bridge undercrossings for wildlife	x	x													x				
	IV. Planting	Restructure channel walls & plant vines	x	x			x			x					x						
		Riparian corridors	x	x		x	x	x	x	x			x	x	x			x			
	V. Remove concrete	Widen channel mainstem	x	x		x		x	x					x		x					
		Deepen channel bed		x		x	x		x												
		Terrace banks	x	x	x	x		x	x	x	x	x	x		x	x					
	VI Reshape Channel	Modify trap channel to vertical sides	x	x		x	x		x						x						
5. Riverside Drive	I. Adjacent or off channel modifications	Create geomorphology and plant (pool/riffle system)	x	x	x		x			x		x	x		x						
		Restore storm drain to natural stream confluence	x	x			x	x			x							x			
	II. Attenuation	Tunnels to divert flood flows	x	x	x	x	x	x	x	x	x						x		x		
	III. Wildlife Access	Wildlife access from river to bank (in daylighted storm drain)	x	x			x	x		x		x					x				
	IV. Planting	Restructure channel walls & plant vines	x	x			x			x					x						
		Riparian corridors	x	x		x	x	x	x	x			x	x	x			x			
	V. Remove concrete	Deepen channel bed		x		x	x		x												
		Terrace banks	x	x	x		x						x								
	VI Reshape Channel	Modify trap channel to vertical sides	x	x		x	x		x						x						
Reach 6. Taylor Yard	IV. Planting	Restructure channel walls & plant vines	x	x			x			x					x						
		Riparian corridors	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x
		Planting built into channel walls	x	x	x		x					x	x	x	x					x	
	V. Remove concrete	Lower bank to channel level (riparian)	x	x	x	x	x	x			x				x	x	x			x	x
		Widen channel	x	x	x	x	X	x	x				x	x	x	x	x		x	x	x
		Deepen channel bed		x		x	X		x												
		Terrace banks	x	x	x		X	x		x	x	x	x	x			x		x	x	x

Reach	Measure Type	Sub-measure	Alternative																		
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	VI Reshape Channel	Modify trap channel to vertical sides	x	x		x	X		x						x						
7. Cornfields/ Arroyo Seco	II. Attenuation	Side channels	x	x	x										x			x		x	
		Creation of wetlands flood risk management basin	x	x	x			x					x							x	
		Tunnels to divert flood flows	x	x	x	x	x	x	x	x	x						x		x		
	IV. Planting	Restructure channel walls & plant vines	x	x			x			x					x						
		Riparian corridors	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x		x	
		Planting built into channel walls	x	x	x		x					x	x	x	x					x	
	V. Remove Concrete	Widen channel mainstem	x	x	x	x	x	x				x	x	x	x	x	x		x	x	
		Deepen channel bed	x	x		x	x		x			x	x		x	x					
		Widen tributary channel		x	x	x	x	x	x	x		x	x				x			x	
		Terrace banks	x	x	x		x	x		x		x	x		x						
	VI Reshape Channel	Modify trap channel to vertical sides	x	x		x	x		x						x						
8. Piggyback Yard	II. Attenuation	Side channels	x		x	x		x							x			x	x		
		Tunnels to divert flood flows	x		x	x		x	x	x	x						x		x		
	IV. Planting	Restructure channel walls & plant vines	x							x					x						
		Riparian corridors	x		x	x		x	x	x		x	x	x	x	x	x	x			
	V. Remove concrete	Widen channel mainstem	x		x			x					x	x		x					
		Deepen channel bed	x			x			x			x	x			x					
		Terrace banks			x			x					x								
	VI Reshape Channel	Modify trap channel to vertical sides	x			x			x						x						

4.9 HABITAT ANALYSIS

USACE guidance requires that the ecosystem related benefits of proposed alternatives be subjected to detailed economic analysis, allowing an explicit comparison of the costs and benefits associated with the alternatives. Consequently, it is necessary that the environmental benefits of the alternatives be based on some quantifiable unit of value. Since restoration value is difficult to monetize, instead of calculating benefits in monetary terms, USACE 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).

For this study, benefits (or outputs) have been quantified using the Combined Habitat Assessment Protocols (CHAP) approach for the existing, future without project, and future with project conditions. The CHAP has been approved for single use on the LA River Ecosystem Restoration Study (21 June 2013).

The CHAP output is in the form of Habitat Units (HUs). HUs are derived from the U.S. Fish and Wildlife Service's (USFWS) methodology known as the Habitat Evaluation Procedures (USFWS, 1980). 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 HUs by multiplying the HSI by site acreage.

Unlike HEP, where the preliminary output (HSI) ranges from 0 to 1[3], 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; i.e., more acreage = more HUs), the HUs generated by CHAP are not dependent on acreage and reflect the value of a particular habitat type as based on species, functions, and habitat. Average Annual HUs are ultimately used in an economic analysis to generate cost effective and best buy restoration alternatives.

4.9.1 Methods

The CHAP method quantifies habitat value and generates HUs based on an assessment of multiple species, habitat features, and functions by habitat type. CHAP incorporates the HAB methodology, developed by the Northwest Habitat Institute (NHI). HAB 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.

[3] 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).

In the HAB approach, fish and wildlife species 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 G.

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 G. While other methods consider few to many habitat components, the HAB approach considers over 350 different KECs and over 100 KEFs.

Over 175 species were evaluated in CHAP for the LA River Ecosystem Restoration Study including fish, amphibians, reptiles, birds, and mammals. Approximately 140 bird species were evaluated. With project, restored riparian habitat could support the Federally endangered least Bell's vireo, yellow-breasted chat, and yellow warbler (State Species of Concern). Many other charismatic bird species were evaluated including the hooded and Bullock's oriole, lazuli bunting, blue grosbeak, western tanager, several species of woodpeckers, owls, many species of ducks (cinnamon teal, ring-necked duck, northern pintail), hawks (sharp shinned hawk, osprey), and shorebirds (great blue heron, spotted sandpiper, black necked stilt). The evaluation also included top predators such as bobcat and coyote, among other small mammals. For a complete list of species evaluated in CHAP, see Appendix G.

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 accounts for species, habitat, and function are combined to generate a quantitative per-acre HAB value. This HAB value is then combined with elements of HEP (i.e. multiplication by acres) to generate HUs as the output (Per Acre HAB Value x Acres = HUs). This combined approach (HAB + HEP) is

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[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.

referred to as CHAP (Combined Habitat Assessment Protocol) (NHI 2007). The detailed steps of the CHAP analysis and calculations are outlined in Appendix G.

HUs were generated for existing, future without project, and future with project conditions for the 19 preliminary alternatives. HUs were calculated for the base year, 25-year, and 50-year time horizons (for summary of HUs see Appendix G). HUs capture the habitat value of a given polygon based on the elements that compose the habitats (KECs), the species that inhabit them, and the functions that those species provide in the ecosystem (KEFs). In this way, the HU output provides a quantitative means of comparison of habitat value. The gain in HUs for the future with project is compared to the future without project, in order to determine the increase in habitat value of a given alternative over the habitat value resulting from taking no action.

For this study, the HUs generated by CHAP does not capture all benefits associated with restoration of an ecosystem. No model captures every element for consideration. The HU output for this study measured habitat value as described above, but did not give greater weight to the value of in-channel habitat and hydrologic connectivity or habitat connectivity for wildlife movement. In-channel habitat and natural hydrologic connections are more sustainable, supporting sediment and nutrient exchange with floodplain habitats, however in-channel habitat was given equal weight to habitat on the overbanks that is supported by assisted hydrology (such as pipes or pumps. The level of such connectivity was not captured in the CHAP output for this study, as higher levels of connectivity were not given weighted benefits. Restoration of habitat patches and vegetated corridors to link them improves connectivity for the movement of wildlife within the study area and to nearby ecological areas. The CHAP assessment was used to identify the final array of alternatives. Additional comparisons were made to assess restoration of hydrologic and hydraulic function and nodal and regional habitat connectivity. A comparison of attainment of hydrologic function and habitat connectivity for the final array was performed to assess how the alternatives met the hydrologic component of Objective 1 and the habitat connectivity objective (Objective 2). This comparison is provided in Section 6.3.

4.9.2 <u>Results</u>

Habitat types currently existing in the potential project area include eucalyptus, open water riverine, agriculture, perennial grassland, valley foothill riparian, and urban. Mapping of habitat types for baseline existing conditions shows that approximately 67 percent 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 percent of the study area (62.42 acres); however, it provides 16.84 HUs per acre. These riparian areas occupy nine times fewer acres than the urban areas, yet provide almost four times more HUs per acre. The open water areas also provide substantial HUs per acre, totaling 22 percent of the study area (182.21 acres) and providing 11.89 HUs per acre. Other habitat types account for less than 4 percent of the study area.

Total baseline HUs equaled 6,119. For the 50-year future without project condition HUs fell to 5,291, (Figure 4-1). This reflects a 14 percent decrease in value without project in this already degraded environment. The gain in HUs over the 50-year future without project was calculated for the 19 preliminary alternatives. The detailed CHAP calculations for the preliminary alternatives are described in detail in Appendix G.

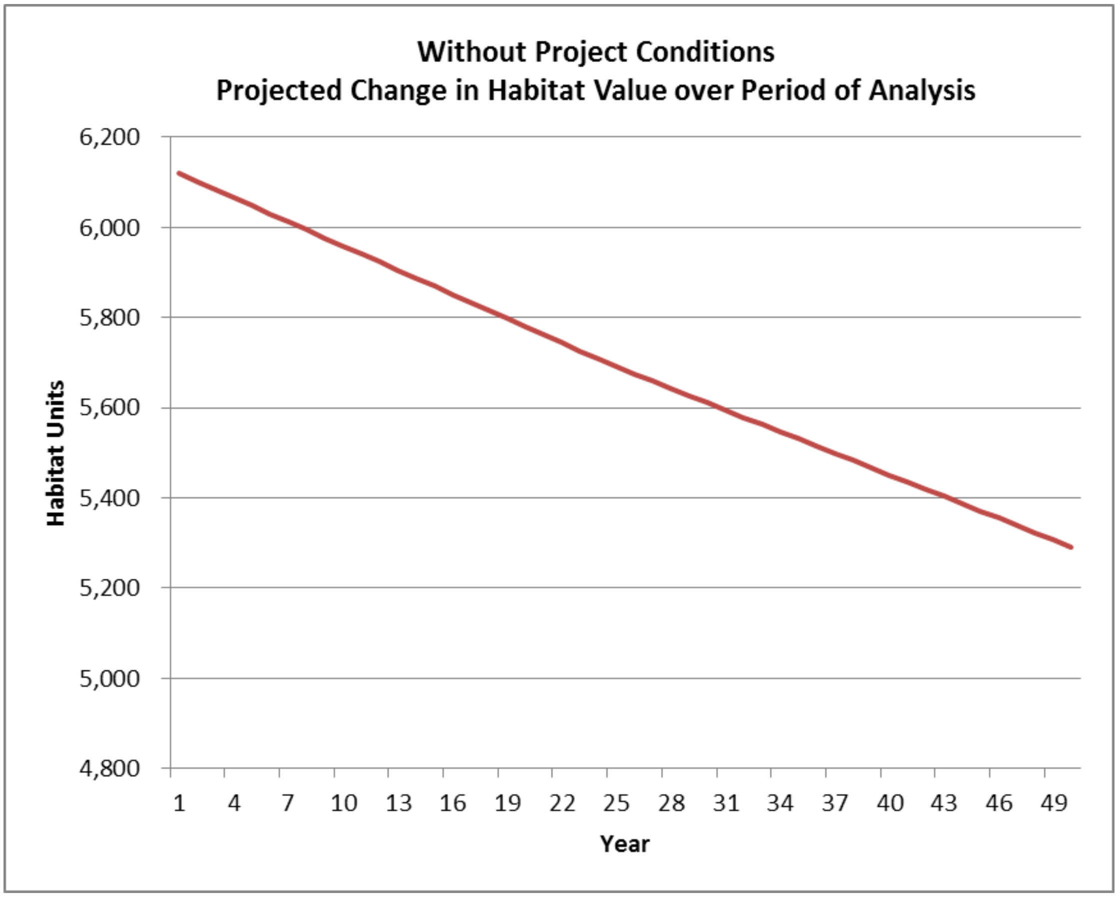


Figure 4-1 Baseline to Future HU Comparison

These total HUs for the preliminary alternatives were then annualized to inform the economic analysis and to generate the final array of cost effective and "best buy" plans as described in detail on the following pages. These results quantify the overall value of the restored habitat, based on species, habitat, and functions being provided by each alternative as compared to the future without project condition. Results show that riparian and riverine restoration has the potential to provide restored habitat function and value in the urban setting of Los Angeles. Maximizing acreage of these habitats would benefit ecosystem functioning and species diversity in the highly urbanized, degraded study area.

4.10 FLOODING RISK AND TUNNEL DEPENDENCIES

Consideration was given to the potential for alternatives and individual measures to increase flood risk. Several alternatives included removal of the concrete channel, or large portions of it. This would require diversion of flood flows around the study area to avoid damaging infrastructure and inducing flooding. To that end, the preliminary array of alternatives was reviewed, by reach, to determine if the features would require a diversion tunnel.

Diversion tunnel costs were developed as a separate measure. Reaches and alternatives dependent on the diversion tunnel are indicated in grey cells and X in Table 4-6 below. The costs and benefits of these alternatives were compared, although the high tunnel cost, $1.5 billion, was considered excessive and meant that they were not cost effective and they were not evaluated further.

Table 4-6 Tunnel Dependencies by Reach and Alternative

Preliminary Alternative	Reach							
	1	2	3	4	5	6	7	8
1	x	x	x	x	x		x	x
2			x	x	x		x	
3	x	x	x	x	x		x	
4	x	x	x	x	x		x	
5				x			x	
6	x	x	x	x	x		x	
7	x	x	x	x	x		x	
8	x	x	x	x	x		x	
9	x		x					
10	x	x	x	x			x	
11			x	x	x		x	
12	x	x		x				
13	x		x	x	x		x	
14	x			x			x	
15	x						x	
16								
17	x	x					x	
18								
19								

Note: Gray shaded cells indicate reaches dependent on a diversion tunnel that were dismissed from further consideration due to excessive cost. White cells indicated reaches that were not dependent on a diversion tunnel and were therefore carried forward for further analysis. Black cells indicate no reach plan was included in the relevant preliminary alternative.

4.10.1 Other Alternatives Considered

Two additional alternatives that were considered in concept were to: (1) limit the project area to the LACDA right-of-way, and (2) widen the entire river channel. Both of these were removed from further consideration due to the reasons described below.

Limiting Project Area to LACDA Right-of-Way

The LACDA alternative involved consideration of whether an alternative situated wholly within the existing LACDA boundary could meet objectives. The LACDA boundary includes the river channel bottom and sides with very limited right-of-way on either side, much of which is occupied by bicycle paths on the west/south side of the river. The team concluded that a LACDA-footprint-limited alternative would not meet objectives because it would fail Objective 2, restoring regional connectivity, and it would also likely fail Objective 1 because flow velocities would not be sufficiently reduced to support restored habitat. Therefore, LACDA lands will be included in alternatives, but it was determined that they are not sufficient in themselves to support restoration objectives.

Channel Widening to accommodate natural riparian river system

The team considered an alternative that involved channel widening sufficient to accommodate a natural riparian river system within the channel. This would require increasing the channel's width by 3 to 5 times (900 feet to 1,500 feet) based on the volume and velocity of water flowing through the channel during high flow scenarios. A rough estimate of the potential real estate acquisition cost was done assuming $50 to $120 per square foot depending upon the development on the parcels. The estimated real estate acquisition cost would be at least $7.6 billion. This would not include utility, infrastructure, business and residential relocation costs, or first costs of construction, which would greatly increase costs.

Due to this incredibly high and excessive cost and the unlikelihood of acquiring, assembling, and preparing the parcels necessary in the study timeframe, channel widening to this extent was eliminated. If best management practices are adopted throughout the entire watershed to increase permeability and accomplish substantial peak flow reduction, and if a floodplain buy-back program is instituted, this measure may become more viable in the future.

4.11 Cost Effectiveness/Incremental Cost Analysis

USACE does not consider monetary benefits or the generation of benefit to cost ratios when evaluating restoration projects. Rather than putting a monetary value on habitat benefits, the focus of the final evaluation is on the relationship of habitat benefits to project costs to ensure cost-effective and justified plans are put forth for recommendation for implementation. This process is summarized below and described in more detail in Appendix B, Economics.

Cost-effectiveness and incremental cost analyses were performed using the certified IWR Planning Suite software version 1.0.11.0. The CE/ICA is an evaluation tool that considers and identifies the relationship between changes in cost and changes in quantified, but not monetized, habitat benefits. The evaluation is used to identify the most cost-effective alternative plans to reach various levels of restoration output and to provide information about whether increasing levels of restoration are worth the added cost.

Functionally, the CE/ICA provides a framework for combining individual measures and sub-measures and scales into alternative plans. The software expedites this effort of testing each combination of measures and tabulating the resulting costs and environmental benefits.

4.11.1 Cost Effectiveness Analysis

The cost effectiveness analysis seeks to answer the question: given an adequately described objective, what is the least costly way of attaining the objective? A plan is considered cost effective if it provides a given level of output for the least cost. Cost effectiveness analysis shall be used to identify the least cost solution for each level of environmental output being considered.

The cost effectiveness analysis is the first step in the CE/ICA. It compares the Average Annual Habitat Units (AAHUs) potentially achieved by each alternative to the cost of each alternative to generate a cost per AAHU. This cost provides a means to compare the cost-effectiveness of each plan. The three criteria used for identifying non-cost-effective plans or combinations include: (1) the same level of output could be produced by another plan at less cost; (2) a larger output level could be produced at the same cost; or (3) a larger output level could be produced at the least cost. Cost-effectiveness is one of the criteria by which all plans are judged and plays a role in the selection of the NER plan. Non-cost-effective combinations of plans are dropped from further consideration.

4.11.2 Incremental Cost Analysis

Incremental cost analysis compares the additional costs to the additional outputs of an alternative. It is a tool that can assist in the plan formulation and evaluation process, rather than a dictum that drives that process. The analysis consists of examining increments of plans or project features to determine their incremental costs and benefits. Increments of plans continue to be added and evaluated as long as the incremental benefits exceed the incremental costs. When the incremental costs exceed the incremental benefits, no further increments are added. Incremental analysis helps to identify and display variations in costs among different restoration measures and alternative plans. Thus, it helps decision makers determine the most desirable level of output relative to costs and other decision criteria.

The incremental cost analysis portion of the CE/ICA compares the incremental costs for each additional unit of output from one cost effective plan to the next to identify “best buy” plans. The first step in developing best buy plans is to determine the incremental cost per unit. The plan with the lowest incremental cost per unit over the No Action Alternative is the first incremental best buy plan. Plans that have a higher incremental cost per unit for a lower level of output are eliminated. The next step is to recalculate the incremental cost per unit for the remaining plans. This process is reiterated until the lowest incremental cost per unit for the next level of output is determined. The intent of the incremental analysis is to identify large increases in cost relative to output.

4.11.3 Identification of the Final Array

The CE/ICA allows comparison of successive levels of output and their incremental costs between alternatives. Results of the CE/ICA then inform the selection of an alternative. The results do not provide the discrete decision; rather they are a tool to help inform a decision. The CE/ICA provides an array of alternatives that undergo a separate tradeoff analysis, which may result in alternatives being screened out or selected based on considerations external to the CE/ICA.

For ecosystem restoration, a plan that reasonably maximizes ecosystem restoration benefits compared to costs, consistent with the Federal objective, is identified as the NER plan. The selected plan should be cost effective and justified in achieving the desired level of output. Thus, the NER plan is selected from the suite of cost effective plans identified in the CE/ICA. While the NER plan is not required to be a best buy plan, this is often the case.

Each sub-plan from the 19 preliminary alternatives was input as a measure into the CE/ICA software (IWR Plan) to compare with costs of implementing each combination of measures for each reach. The preliminary alternatives were also entered as a whole. The program then combined the sub-reach plans (geomorphic reach plans) into recombined plans for comparison and evaluation with the preliminary plans. This produced an array of 152 cost effective plans, which included 21 best buy plans. A best buy plan is one that is both cost effective combination and the most efficient plan for providing different levels of habitat value for the cost. Figure 4-2 shows how the best buy plan benefits compare by alternative and by reach. This chart illustrates the significant increase in benefits gained with the addition of Reaches 6 and 8.

The recombination of plans by reach provided a more cost effective combination of measures for the least overall cost. The annual cost and output of each of the cost effective plans is shown in Figure 4-2 . The red dots show the original 19 alternatives, which were not cost effective as formulated. These do not account for tunnel costs. The sub-reach plan combinations that were cost effective are shown as green boxes and the best buy plans area shown as blue triangles when only some reaches are included and purple diamonds where all reaches are included.

The CE/ICA analysis outputs showed that cost effective, best buy alternatives should be grouped and considered for inclusion in the final array based on the incremental increases in costs and benefits. These groupings are Alternatives 1-5, Alternatives 6-9, Alternatives 10-13, and Alternatives 14-16. Alternatives 17-21 begin to show higher incremental jumps in cost with fewer added benefits until you reach Alternative 21 (Figure 4-3). The best buy alternatives are composed of sub-reach plans, with the average annual costs and benefits shown in Table 4-7.

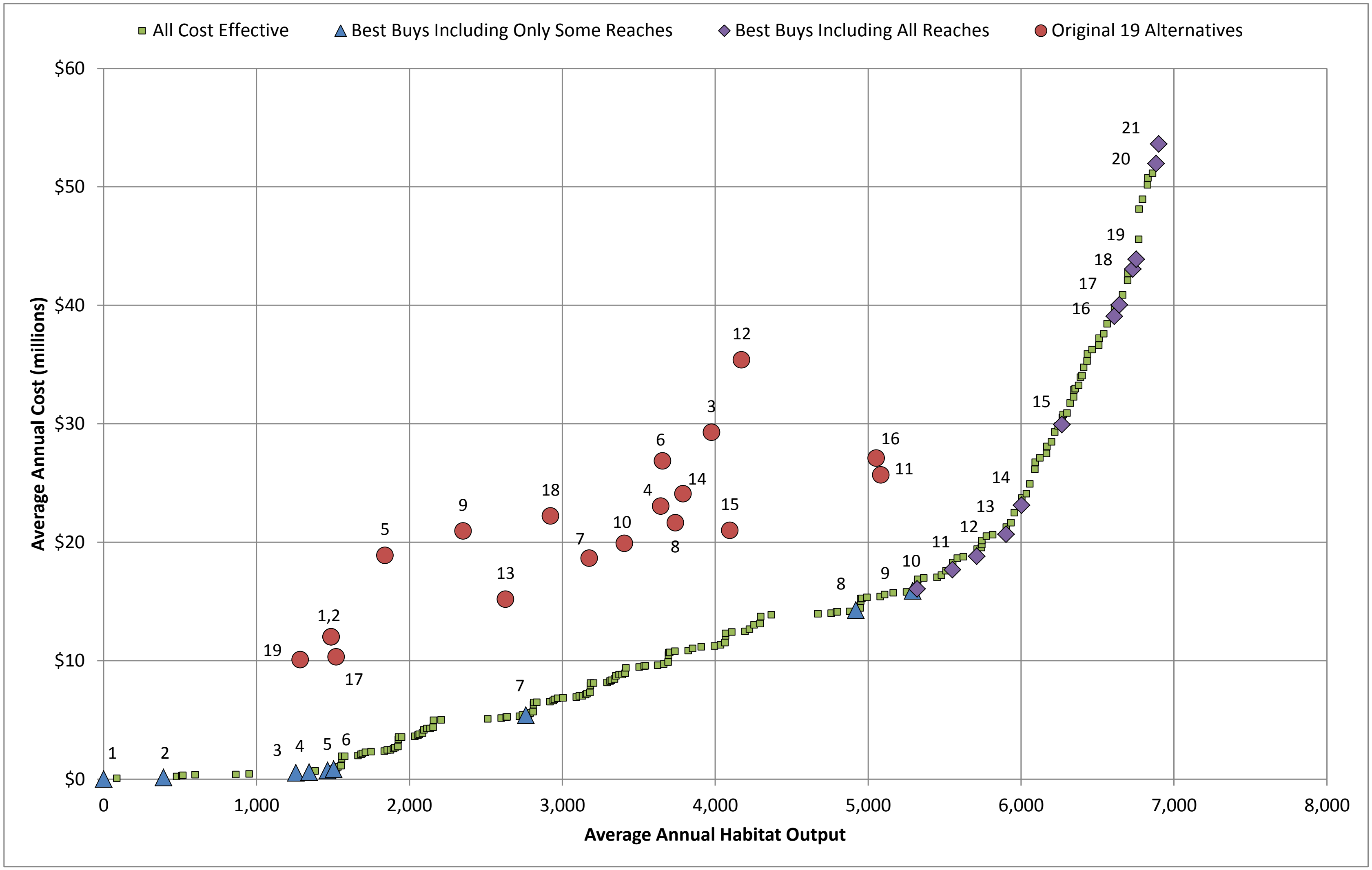


Figure 4-2 Best Buy Scatter Plot – Average Annual Habitat Output – All Plans AA Cost/AAHU Summary

(Preliminary Alternatives Shown as Red Dots Do Not include Tunnel Costs)

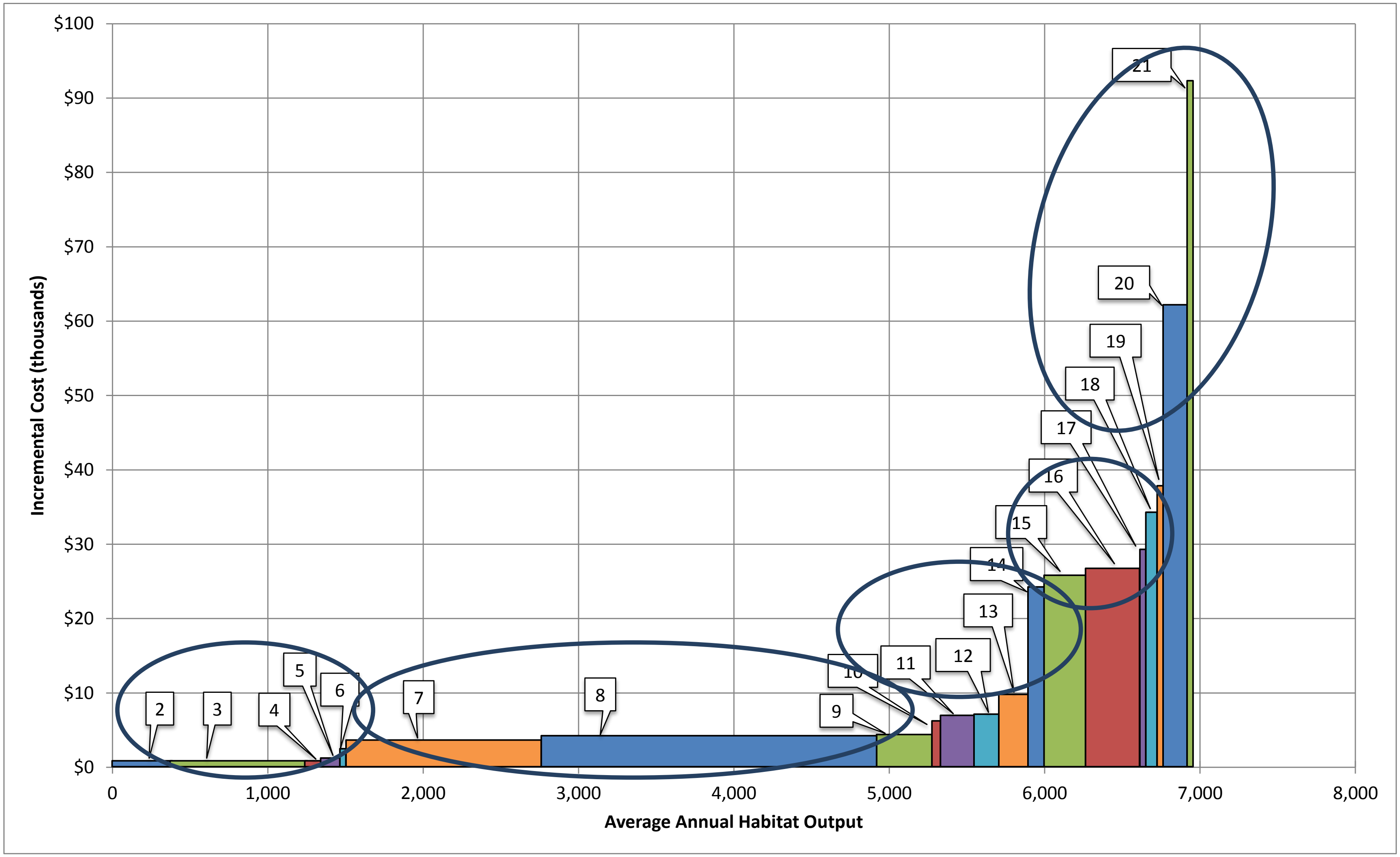


Figure 4-3 Box Plots of Annualized Costs vs. Benefits – All Best Buys

Table 4-7 Detailed Best Buy Plan Summary

Best Buy Plan No.	Plan Components (Reach/Alternative)	Plan Components (Name)	Average Annual Cost	Average Annual Habitat Unit	Total Cost (No O&M)	Real Estate Percentage of Total Cost
1	No Action	No Action	$0	0	$0	0
2	R2 - A11	Reach 2 - Charette Team 4	$146,743	392	$2156,267	
3	**R1 - A11**	**Reach 1 - Charette Team 4**	$523,358	1,258	$9,205,282	97
	R2 - A11	Reach 2 - Charette Team 4				
4	R1 - A11	Reach 1 - Charette Team 4	$583,950	1,345	$9,420,465	
	R2 - A11	Reach 2 - Charette Team 4				
	R5 - A9 OR R5 - A16	Reach 5 - (Soft Bot. Ch. & Assoc. Banks) or (Side Channels Only)				
5	R1 - A11	Reach 1 - Charette Team 4	$733,885	1,465	$11,460,534	74
	R2 - A11	Reach 2 - Charette Team 4				
	R4 - A15	**Reach 4 - Charette Team 2**				
	R5 - A9 OR R5 - A16	Reach 5 - (Soft Bot. Ch. & Assoc. Banks) or (Side Channels Only)				
6	R1 - A11	Reach 1 - Charette Team 4	$839,159	1,505	$12,564,176	66
	R2 - A11	Reach 2 - Charette Team 4				
	R3 - A17	**Reach 3 - Charette Team 7**				
	R4 - A15	Reach 4 - Charette Team 2				
	R5 - A9 OR R5 - A16	Reach 5 - (Soft Bot. Ch. & Assoc. Banks) or (Side Channels Only)				
7	R1 - A11	Reach 1 - Charette Team 4	$5,396,226	2,761	$113,045,682	62
	R2 - A11	Reach 2 - Charette Team 4				
	R3 - A17	Reach 3 - Charette Team 7				
	R4 - A15	Reach 4 - Charette Team 2				
	R5 - A9 OR R5 - A16	Reach 5 - (Soft Bot. Ch. & Assoc. Banks) or (Side Channels Only)				
	R6 - A14	**Reach 6 - Charette Team 5**				
8	R1 - A11	Reach 1 - Charette Team 4	$14,260,310	4,920	$130,404,666	84
	R2 - A11	Reach 2 - Charette Team 4				
	R3 - A17	Reach 3 - Charette Team 7				
	R4 - A15	Reach 4 - Charette Team 2				
	R5 - A9 OR R5 - A16	Reach 5 - (Soft Bot. Ch. & Assoc. Banks) or (Side Channels Only)				
	R6 - A14	Reach 6 - Charette Team 5				
	R8 - A15	**Reach 8 - Charette Team 2**				
9	R1 - A11	Reach 1 - Charette Team 4	$15,884,884	5,292	$344,492,270	85
	R2 - A11	Reach 2 - Charette Team 4				
	R3 - A17	Reach 3 - Charette Team 7				
	R4 - A16	**Reach 4 - Side Channels Only**				
	R5 - A9 OR R5 - A16	Reach 5 - (Soft Bot. Ch. & Assoc. Banks) or (Side Channels Only)				
	R6 - A14	Reach 6 - Charette Team 5				
	R8 - A15	Reach 8 - Charette Team 2				

Best Buy Plan No.	Plan Components (Reach/Alternative)	Plan Components (Name)	Average Annual Cost	Average Annual Habitat Unit	Total Cost (No O&M)	Real Estate Percentage of Total Cost
10	R1 - A11	Reach 1 - Charette Team 4	$16,062,161	5,321	$347,280.353	85
	R2 - A11	Reach 2 - Charette Team 4				
	R3 - A17	Reach 3 - Charette Team 7				
	R4 - A16	Reach 4 - Side Channels Only				
	R5 - A9 OR R5 - A16	Reach 5 - (Soft Bot. Ch. & Assoc. Banks) or (Side Channels Only)				
	R6 - A14	Reach 6 - Charette Team 5				
	R7 - A9	**Reach 7 - Soft Bot. Ch. & Assoc. Banks**				
	R8 - A15	Reach 8 - Charette Team 2				
11	R1 - A11	Reach 1 - Charette Team 4	$17,680,091	5,551	$383,175,827	77
	R2 - A11	Reach 2 - Charette Team 4				
	R3 - A17	Reach 3 - Charette Team 7				
	R4 - A16	Reach 4 - Side Channels Only				
	R5 - A9 OR R5 - A16	Reach 5 - (Soft Bot. Ch. & Assoc. Banks) or (Side Channels Only)				
	R6 - A14	Reach 6 - Charette Team 5				
	R7 - A12	**Reach 7 - Charette Team 3**				
	R8 - A15	Reach 8 - Charette Team 2				
12	R1 - A11	Reach 1 - Charette Team 4	$18,817,690	5,711	$405,921,076	73
	R2 - A11	Reach 2 - Charette Team 4				
	R3 - A16	**Reach 3 - Side Channels Only**				
	R4 - A16	Reach 4 - Side Channels Only				
	R5 - A9 OR R5 - A16	Reach 5 - (Soft Bot. Ch. & Assoc. Banks) or (Side Channels Only)				
	R6 - A14	Reach 6 - Charette Team 5				
	R7 - A12	Reach 7 - Charette Team 3				
	R8 - A15	Reach 8 - Charette Team 2				
13	R1 - A11	Reach 1 - Charette Team 4	$20,673,266	5,902	$444,149,831	72
	R2 - A11	Reach 2 - Charette Team 4				
	R3 - A16	Reach 3 - Side Channels Only				
	R4 - A16	Reach 4 - Side Channels Only				
	R5 - A9 OR R5 - A16	Reach 5 - (Soft Bot. Ch. & Assoc. Banks) or (Side Channels Only)				
	R6 - A13	**Reach 6 - Charette Team 6**				
	R7 - A12	Reach 7 - Charette Team 3				
	R8 - A15	Reach 8 - Charette Team 2				
14	R1 - A11	Reach 1 - Charette Team 4	$23,119,812	6,003	$494,777,190	65
	R2 - A11	Reach 2 - Charette Team 4				
	R3 - A16	Reach 3 - Side Channels Only				
	R4 - A16	Reach 4 - Side Channels Only				
	R5 - A9 OR R5 - A16	Reach 5 - (Soft Bot. Ch. & Assoc. Banks) or (Side Channels Only)				
	R6 - A8	**Reach 6 - Charette Team 1**				
	R7 - A12	Reach 7 - Charette Team 3				
	R8 - A15	Reach 8 - Charette Team 2				

Best Buy Plan No.	Plan Components (Reach/Alternative)	Plan Components (Name)	Average Annual Cost	Average Annual Habitat Unit	Total Cost (No O&M)	Real Estate Percentage of Total Cost
15	R1 - A11	Reach 1 - Charette Team 4	$29,930,469	6,268	$636,484,639	50
	R2 - A11	Reach 2 - Charette Team 4				
	R3 - A16	Reach 3 - Side Channels Only				
	R4 - A16	Reach 4 - Side Channels Only				
	R5 - A5	**Reach 5 - City: Los Feliz to Arroyo Seco**				
	R6 - A8	Reach 6 - Charette Team 1				
	R7 - A12	Reach 7 - Charette Team 3				
	R8 - A15	Reach 8 - Charette Team 2				
16	R1 - A11	Reach 1 - Charette Team 4	$39,069,505	6,610	$825,036,738	43
	R2 - A11	Reach 2 - Charette Team 4				
	R3 - A16	Reach 3 - Side Channels Only				
	R4 - A16	Reach 4 - Side Channels Only				
	R5 - A5	Reach 5 - City: Los Feliz to Arroyo Seco				
	R6 - A8	Reach 6 - Charette Team 1				
	R7 - A12	Reach 7 - Charette Team 3				
	R8 - A3	**Reach 8 - Banks & Tribs Only**				
17	R1 - A11	Reach 1 - Charette Team 4	$40,036,386	6,643	$845,245,201	42
	R2 - A9	**Reach 2 - Soft Bot. Ch. & Assoc. Banks**				
	R3 - A16	Reach 3 - Side Channels Only				
	R4 - A16	Reach 4 - Side Channels Only				
	R5 - A5	Reach 5 - City: Los Feliz to Arroyo Seco				
	R6 - A8	Reach 6 - Charette Team 1				
	R7 - A12	Reach 7 - Charette Team 3				
	R8 - A3	Reach 8 - Banks & Tribs Only				
18	R1 - A11	Reach 1 - Charette Team 4	$43,055,891	6,731	$909,313,628	41
	R2 - A9	Reach 2 - Soft Bot. Ch. & Assoc. Banks				
	R3 - A16	Reach 3 - Side Channels Only				
	R4 - A16	Reach 4 - Side Channels Only				
	R5 - A5	Reach 5 - City: Los Feliz to Arroyo Seco				
	R6 - A8	Reach 6 - Charette Team 1				
	R7 - A16	**Reach 7 - Side Channels Only**				
	R8 - A3	Reach 8 - Banks & Tribs Only				
19	R1 - A11	Reach 1 - Charette Team 4	$43,887,027	6,753	$927,188,747	40
	R2 - A13	**Reach 2 - Charette Team 6**				
	R3 - A16	Reach 3 - Side Channels Only				
	R4 - A16	Reach 4 - Side Channels Only				
	R5 - A5	Reach 5 - City: Los Feliz to Arroyo Seco				
	R6 - A8	Reach 6 - Charette Team 1				
	R7 - A16	Reach 7 - Side Channels Only				
	R8 - A3	Reach 8 - Banks & Tribs Only				

Best Buy Plan No.	Plan Components (Reach/Alternative)	Plan Components (Name)	Average Annual Cost	Average Annual Habitat Unit	Total Cost (No O&M)	Real Estate Percentage of Total Cost
20	R1 - A11	Reach 1 - Charette Team 4	$51,955,779	6,883	$1,108,341,724	43
	R2 - A13	Reach 2 - Charette Team 6				
	R3 - A18	**Reach 3 - Comprehensive Pockets**				
	R4 - A16	Reach 4 - Side Channels Only				
	R5 - A5	Reach 5 - City: Los Feliz to Arroyo Seco				
	R6 - A8	Reach 6 - Charette Team 1				
	R7 - A16	Reach 7 - Side Channels Only				
	R8 - A3	Reach 8 - Banks & Tribs Only				
21	**R1 - A16**	**Reach 1 - Side Channels Only**	$53,616,857	6,901	$1,142,415,672	42
	R2 - A13	Reach 2 - Charette Team 6				
	R3 - A18	Reach 3 - Comprehensive Pockets				
	R4 - A16	Reach 4 - Side Channels Only				
	R5 - A5	Reach 5 - City: Los Feliz to Arroyo Seco				
	R6 - A8	Reach 6 - Charette Team 1				
	R7 - A16	Reach 7 - Side Channels Only				
	R8 - A3	Reach 8 - Banks & Tribs Only				

4.12 SELECTION OF THE FINAL ARRAY

This section describes how the final array was identified and the elements of each plan. A final array was selected from the best buy plans for further analysis. Selection of the final array was also based on the output from the CE/ICA analysis and the performance criteria for objectives. The final array provides a reasonable range of alternatives and at least minimally meets project objectives.

4.12.1 Objectives Performance Targets

The objective performance targets for ecosystem restoration were met, or not met, by the best buy alternatives as shown in Table 4-8 and Table 4-9 below.

Table 4-8 Targets Met by Best Buy Plans under Objective 1

OBJECTIVE 1: RESTORE VALLEY FOOTHILL RIPARIAN AND FRESHWATER MARSH HABITAT	
Target	**Alternatives Analysis**
Removal and management of invasives to less than 10 percent within 5 to 7 years post-construction of each feature. Includes both existing habitat in soft bottom reaches and proposed in channel habitat.	Each of the best buy Alternatives 2 to 21 would meet this part of the objective.
For Valley Foothill Riparian Habitat:	
Restore structurally diverse riparian habitat consisting of herbaceous (e.g., herbaceous vine cover), shrub (e.g., shrubby willow thicket), and tree (e.g., mature cottonwood-willow trees) layers in a minimum of five reaches resulting in 3 contiguous reaches. Restore riparian habitats with a varying number of structural layers (one, two, and three layers) to support survival and reproductive requirements for riparian obligate and transient wildlife species, including food, water, shelter, breeding, migration, and dispersal(Krueper, 1995).	This is accomplished beginning with Alternative 6, which restores overbanks in Reaches 1 and 2 and daylights streams in Reaches 3 to 5 (4 and 5 being soft bottom reaches). An additional reach and increasing area of restoration is added in Alternatives 7 to 21 to incrementally greater degrees.
Restore a minimum of 2 aquatic habitat nodes with a natural hydrologic connection to the river and riparian communities with a minimum distance of 150 meters from the water's edge to create areas capable of functioning as core habitat and refuge for native reptiles and amphibians (Semlitsch and Bodie 2003) and to minimize the risk of localized extinction due to natural disasters (IE flood, fire, drought) (Schippers et al. 1996; Dunning et al. 1995).	Habitat nodes are added in all alternatives in increasing degrees, but is not accomplished as described here for nodal core habitat and refuge until reach 6 is added in Alternative 7and is not accomplished in a second node until Alternative 8 adds reach 8, with an additional large node added in Alternative 20.
Within 5-10 years of construction, restore and maintain dense, structurally diverse riparian habitat sufficient to maintain survival and reproductive needs of wildlife. Restore a minimum of one habitat node with a minimum width of 250 meters (820 feet) to support high frequencies of the Federally endangered least Bell's vireo (Kus 2002).	A riparian strand with a width greater than 250 meters can only be achieved at the Piggyback Yard site, where these river adjacent parcels can support larger scale restoration and sustain enough riparian habitat to support high frequencies of least Bell's vireo. This is accomplished only by Alternatives 8 to 21 that include Reach 8 measures at Piggyback Yard.

OBJECTIVE 1: RESTORE VALLEY FOOTHILL RIPARIAN AND FRESHWATER MARSH HABITAT	
Target	**Alternatives Analysis**
For Freshwater Marsh and Fish Habitat:	
Restore functioning freshwater marsh habitat consisting of emergent herbaceous vegetation (i.e., cattails, rushes, sedges) adapted to saturated soil conditions.	There is minimal restoration of freshwater marsh in Alternatives 2 to 12 through daylighted streams. There is a significant increase in freshwater marsh restoration added in Reach 6 in Alternatives 13 to 15. There is an incremental increase in marsh restoration in Alternatives 16 to 21, with restoration of marsh in the Los Angeles River State Historic Park in Reach 7 beginning in Alternatives 18 to 21 and at Piggyback Yard beginning with Alternatives 16 to 21.
Restore aquatic habitat to support survival and reproductive requirements for fish and wildlife species, including food, water, shelter, breeding, migration, and dispersal.	Freshwater marsh adds refugia for fish and supports requirements for survival and reproduction for fish and other aquatic wildlife. There is some potential increase in freshwater marsh beginning with widening in Reach 6 in Alternative 7. There is a significant increase in freshwater marsh restoration added in Reach 6 in Alternatives 13 to 15, and an incremental increase in this restoration in Alternatives 16 to 21 that meets the needs for resting, nesting, and escape.
For a More Natural Hydrologic and Hydraulic Regime:	
Expansion of River hydrology into at least one large, contiguous river adjacent area within the study area that promotes hydrologic connections to the floodplain and overbank areas.	This can only occur with inclusion of Taylor Yard or Piggyback Yard. Taylor Yard is first added with expansion of river hydrology in Alternatives 7 to 12 with an incremental increase in this reach in Alternative 13. Piggyback Yard is first added in Alternatives 8 to 15 with diversion of flows and then greatly increased hydrologic/hydraulic connection is added in Alternatives 16 to 21
Widen channel to accommodate meandering of the River in at least one reach	This can occur with inclusion of Taylor Yard or Piggyback Yard. Taylor Yard is first added with expansion of river hydrology in Alternatives 7 to 12 with an incremental increase in this reach in Alternative 13. Piggyback Yard is first added in Alternatives 8 to 15 with diversion of flows and then greatly increased hydrologic/hydraulic connection is added in Alternatives 16 to 21. Further widening occurs in Alternatives 15 to 21 in Reach 5 with widening of the river from trap to vertical banks in Reach 5, and in Alternatives 17 to 21 with widening of the river from trap to vertical banks in Reach 2.
Connect river hydrologically (assisted or naturally) to overbank with at least one such connection per reach	The river is connected hydrologically to the overbank in each reach in Alternatives 10 to 21 through daylighting streams, using stormwater capture to sustain riparian vegetation on the overbank and then letting overbank flows enter the river, reconnection of the floodplain through widening, terracing and creating side channels. And by slowing any overbank flooding with riparian overbank habitat areas.
Within the main stem of the river, when increasing vegetation, target velocity should be less than 12 ft/s and ideally 8 ft/s	In channel vegetation is increased beginning with Alternative 7 when Reach 6 is added and with incremental increases at Alternatives 15, 16, and 17.
Restore seasonal overbank flooding to river adjacent areas for sustainability of habitat and natural ecological, hydrologic processes	This is accomplished by best buy Alternatives 7 to 21 in Reach 6 in Taylor Yard and 16 to 21 in Reach 8 in Piggyback Yard. It is minimally accomplished with side channels in Reach 3 in 12 to 21 and in Reach 4 in 9 to 21

Table 4-9 Targets Met by Best Buy Plans under Objective 2

OBJECTIVE 2: INCREASE HABITAT CONNECTIVITY	
Target	**Alternatives Analysis**
Restoration of riparian and wetland aquatic wildlife habitat at tributary confluences to create connectivity to similar upstream habitats on the tributaries with ultimate nodal connection to the aquatic habitats in the San Gabriel and Verdugo Mountains (at least one major tributary connection should be restored.)	Reconnection hydrologically with at least one main tributary is first added in Alternative 11 with connection to the San Gabriels. Hydrologic reconnection with a second major tributary is added in Alternative 20 with added connection to the Verdugo Mountains.
Restore habitat corridors between large nodes in the ARBOR area to maximize connectivity for wildlife movement and dispersal on the local scale and minimize the risk of habitat sinks in an urban environment (Hilty et al. 2006, Hanski & Thomas 1994, Rudd 2002, Noss 1983), and to provide opportunities for regional wildlife movement	Large nodes that can be restored are at Taylor Yard, Piggyback Yard and Verdugo Confluence. Existing habitat nodes adjacent to the river with connection to the Santa Monica Mountains are through Headworks in reach one and Griffith Park in reach 4. Reach 1 is first added t in alternative 3 with a connection through Headworks, Reach 6 is first added creating a large nodal connection to the river in Alternative 7, a second large nodal connection in Reach 8 is added in Alternative 8, Reach 4 with a side channel connection into Griffith Park is added in Alternative 9, a second connection to Griffith Park with a side channel in Ferraro Fields is added in reach 3, Alternative 12, and a third large nodal connection is added in Verdugo Wash in reach 3 in Alternative 20.
Restoration of wildlife habitat on channel banks	This is accomplished in Alternative 1 and is increased incrementally through Alternative 21. Restoration on the channel bank increases with inclusion of Taylor Yard in 7, and jumps again with inclusion of Piggyback Yard in Alternative 7. Further reconnection is made with banks to Los Angeles River State Historic Park (Cornfields) in Reach 7 in Alternative 18.
Improved connectivity within the ARBOR area through restoration of habitat nodes with wetland and riparian habitat that are naturally hydrologically connected to the river corridor upstream and downstream of the Glendale Narrows.	The first natural hydrological connection to restored habitat nodes connected to the river corridor is added in Alternative 4 with a daylighted stream in reach 5, and each larger alternative adds incrementally increased hydrologic connections with the most significant jumps in connections added with Alternatives 9, 11, 13, 16 and 20
Lengthen the extent of contiguous vegetated pathways for reptile and small/medium mammal movement (currently limited to Reaches (4 to 6), to achieve upstream and/or downstream connections to at least one additional tributary or open space area that is currently isolated from the soft-bottom reach. This may be achieved by either in-channel or side-channel vegetated corridors.	Upstream riparian restoration connections in contiguous reaches begin with Alternative 2. However, downstream contiguous vegetated pathways are not wholly achieved. Downstream pathways are increased incrementally beginning with Alternative 10 and incrementally increase through Alternative 21. Alternatives 11 to 21 have the greatest amount of contiguous vegetated pathways.
Ideally, the alternatives will also achieve the following:	
Expansion of riparian and wetland wildlife habitat into large, contiguous river adjacent lands within the study area to support higher abundance of wildlife and more significant nodal connections to nearby ecological zones.	This occurs in alternatives that include Taylor Yard, Piggyback Yard, or the Griffith Park or Ferraro Fields side channels. The Griffith Park side channel is first added in Alternative 9, Taylor Yard is first added in Alternative 8, Piggyback Yard is first added in Alternative 8, and Ferraro Fields side channel is first added in Alternative 12
Provide connectivity (via contiguous or near-contiguous vegetated movement pathways) between all of the reaches within the study area.	Upstream riparian restoration connections in contiguous reaches begin with Alternative 2. However, downstream contiguous vegetated pathways are not wholly achieved. Downstream pathways are increased incrementally beginning with Alternative 10 and incrementally increase through Alternative 21

OBJECTIVE 2: INCREASE HABITAT CONNECTIVITY	
Target	**Alternatives Analysis**
Include Reach 7 to provide nodal connections to San Gabriel Mountains via Arroyo Seco confluence and/or other smaller tributaries and to provide potential for future direct connections to the mountains via other projects upstream on Arroyo Seco	Reach 7 with restoration of the Arroyo Seco confluence is first added in Alternative 11. Smaller daylighted streams are added in Reach 5 in Alternative 4 with additional small streams added in Reach 4 in Alternative 5, Reach 3 in Alternative 6, Reach 6 in Alternative 7, Reach 8 in Alternative 8, and Reach 7 in Alternative 10. A second major tributary (Verdugo Wash) is connected in Alternative 20.

4.12.2 Comparisons

Using the results of the CE/ICA analysis, the design team and Sponsor closely examined the CE/ICA box plots, descriptions, and cost data. Based on performance targets for objectives and CE/ICA analysis, best buy alternatives were screened or retained for inclusion in the final array as follows:

- All alternatives met targets for their included reaches for invasives removal and management.
- Alternatives 2 to 6 range in incremental benefits from 392 to 1,505 and a gradual increase in first costs from $2 million to $12 million. They were screened out because they did not significantly meet performance targets for restoration of freshwater marsh, a more natural hydrologic and hydraulic regime, or increase in habitat connectivity.
- Alternatives 7 to 9 range in first costs from $108 million to $330 million and incremental benefits increase from 2,761 to 5,292. Alternatives 8 and 9 meet performance targets for valley foothill riparian restoration, Alternatives 7-9 partially meet criteria for 3 out of 5 targets for restoring hydrology and hydraulics meet 1 out of 2 criteria for restoration of freshwater marsh and fish habitat; and minimally meet criteria in 4 out of 8 targets for connectivity. Therefore, they were not carried forward.
- The extent of upstream to downstream habitat connectivity is important for restoration of wildlife corridors. The Glendale Narrows (Reaches 4, 5, and 6) currently support riparian vegetation with concrete slopes, but upstream and downstream areas (Reaches 1, 3, 7 and 8) have a fully concrete channel. Alternatives 2 to 9 do not significantly meet connectivity criteria for connections between upstream and downstream areas.
- Alternative 10 first costs are $345 million, adds the additional reach (7) connecting the entire study area, and provides 5,321 habitat units. This is the first alternative that includes all reaches. Alternative 10 meets targets for valley foothill riparian by restoring a structurally diverse habitat, in contiguous reaches, with varying structural layers, supports wildlife survival requirements, and includes riparian nodes of sufficient width to support wildlife requirements. It minimally meets targets for a more natural hydrologic and hydraulic regime by inclusion of Taylor Yard widening. Overbank connections are made with daylighted streams, stormwater capture, widening, terracing, and side channels. It restores seasonal and overbank flows in Reach 6 and increases naturalized areas in the river mainstem in Reach 6. It minimally meets all conditions for Objective 1 except it does not meet all criteria for hydrologic connections.
- Restoration of tributary confluences was included to begin to improve hydrologic and habitat connectivity in the watershed and improve wildlife corridors to other significant ecological areas such as the Verdugo and San Gabriel Mountains. Ultimately, other in-progress restoration efforts on the tributaries (beyond the study area boundaries) would provide further improvements to these connections. Measures that address these criteria were daylighting storm drains, adding side channels, and restoration work on tributaries to address Objective 2. Alternative 10 increases hydrologic and hydraulic connections by daylighting streams, reconnecting floodplains, and reconnecting wildlife habitat to overbanks. It connects not only to upstream but downstream through Reach 8 but does not restore connections to a major tributary. **Alternative 10 provides**

the lowest cost ($347 million) opportunity to meet objectives for connectivity and changes in hydrology, and is therefore carried forward into the final array.

- The group of Alternatives 10 to 13 range in total costs from $347 million to $444 million (Alternative 13). Habitat benefits increase from 5,321 units to 5,902 (Alternative 13). Within this grouping there are significant changes within Alternatives 10 to 13. Reaches 3, 6, and 7 are changed. Alternative 13 accomplishes all that Alternative 10 does, and adds freshwater marsh habitat to better meet Objective 1. Connectivity is increased with additional contiguous pathways and restoration of the confluence at Arroyo Seco, the most significant tributary in the ARBOR Reach with potential to connect to future restoration planning on that tributary. **Alternative 13 is the second alternative to be carried forward into the final array for further comparison, providing 5,902 habitat units and costing $442 million.**
- The next incrementally grouped alternatives are 14 to 16. These alternatives range in benefits from 6,003 to 6,610 with a total cost range from $495 million to $825 million. These all meet targets for performance on Objective 1 with Alternative 16 showing an incremental jump in restoration of freshwater marsh, riffle-pool complexes, and conditions for native fish survival, greater hydrologic/hydraulic connections, and other related conditions. **Alternative 16 is the third alternative carried forward into the final array, providing benefits of 6,610 HUs and a cost of $774 million.**
- The remaining Alternatives 17 to 21 incrementally increase the habitat value from 6,643 to 6,901 HUs and have significantly increased total costs ranging from $845 million to $1.1 billion. In addition to the benefits and measures included in the other alternatives, these alternatives include widening and increased habitat in the river bed in Reach 2, and connection to the Los Angeles River State Historic Park (Cornfields) in Alternatives 18 to 21. Alternative 20 shows the greatest single increase in habitat value in this group with the addition of restoration of the confluence of a second major tributary (Verdugo Wash), increasing natural hydraulic conditions and regional connectivity. **This is the fourth alternative carried forward into the final array with benefits of 6,883 HUs and a cost of $1.04 billion.**

4.12.3 Final Array of Alternatives

The CE/ICA analysis yielded 21 Best Buy plans with a very wide range of both cost and output. The cost of the Best Buy Plans ranged from approximately $3 million to $1.2 billion. Output, measured by the CHAP analysis in terms of increased average annual habitat units (AAHUs), ranged from 392 AAHUs to 6,901 AAHUs. The wide range of plans represented a challenge in terms of identifying a subset of final array plans that best met planning objectives while also providing a distinct tradeoff between cost and output necessary for the ultimate identification of the National Ecosystem Restoration (NER) Plan. As described in the ER 1105-2-100 the NER Plan is the alternative and scale having the maximum excess of monetary and non-monetary beneficial effects over monetary and nonmonetary costs. This plan occurs where the incremental beneficial effects just equal the incremental costs, or alternatively stated where the extra environmental value is just worth the extra costs. The PGN also notes that in all but the most unusual cases, the NER Plan should be derived from the final set of Best Buy solutions.

Key considerations in the determination of the final array alternatives to carry forward included not only the results of efficiency, as measured by the CEICA, but the extent to which plans met key planning objectives, the significance of plan outputs, and plan acceptability, completeness and effectiveness. The table below summarizes cost and output data for the final array plans (Table 4-10).

Table 4-10 Final Array Costs and Outputs

Criteria	No Action	Alt 10 ART	Alt 13 ACE	Alt 16 AND	Alt 20 RIVER
NER Costs & Benefits					
Total First Cost	$0	$346 million	$442 million	$757 million	$1.04 billion
Total Investment Cost	$0	$347 million	$444 million	$774 million	$1.06 billion
Average Annual Project Cost	$0	$16.06 million	$20.67 million	$36.61 million	$49.76 million
Incremental Annual Cost	$0	$16.06 million	$4.61 million	$15.93 million	$13.15 million
Net Average Annual Habitat Output	0	5,321	5,902	6,509	6,782
% Increase versus No Action	0%	93%	104%	114%	119%
Incremental Output	0	5,321	581	607	273
Inc. Cost per Unit Output *	$0	$3,019	$7,936	$26,249	$48,186

* These incremental cost stats are calculated for only the final array plans
Costs in this table to do not include risk based contingencies, applied in later tables

Alternative 10 was identified as the minimally acceptable plan to include in the final array as meeting objectives and the purpose and need, since it was the first one to include features in all eight reaches of the Study Area, and creating a corridor of continuous restoration was one of the most important considerations in the assessment of plan effectiveness and acceptability.

Alternatives 13, 16 and 20 represented key break points in the CE/ICA curve. As shown in the figure below, incremental costs increase substantially for larger scale Best Buy plans. These are logical plans to carry forward for the final array, since they represent potential decision points for focusing the "Is it worth it?" questioning process. As shown in the table above, the final array plans vary substantially in terms of cost, output, and incremental costs per unit of output. The following figure depicts the CE/ICA graph, focusing exclusively on the final array plans (Figure 4-4).

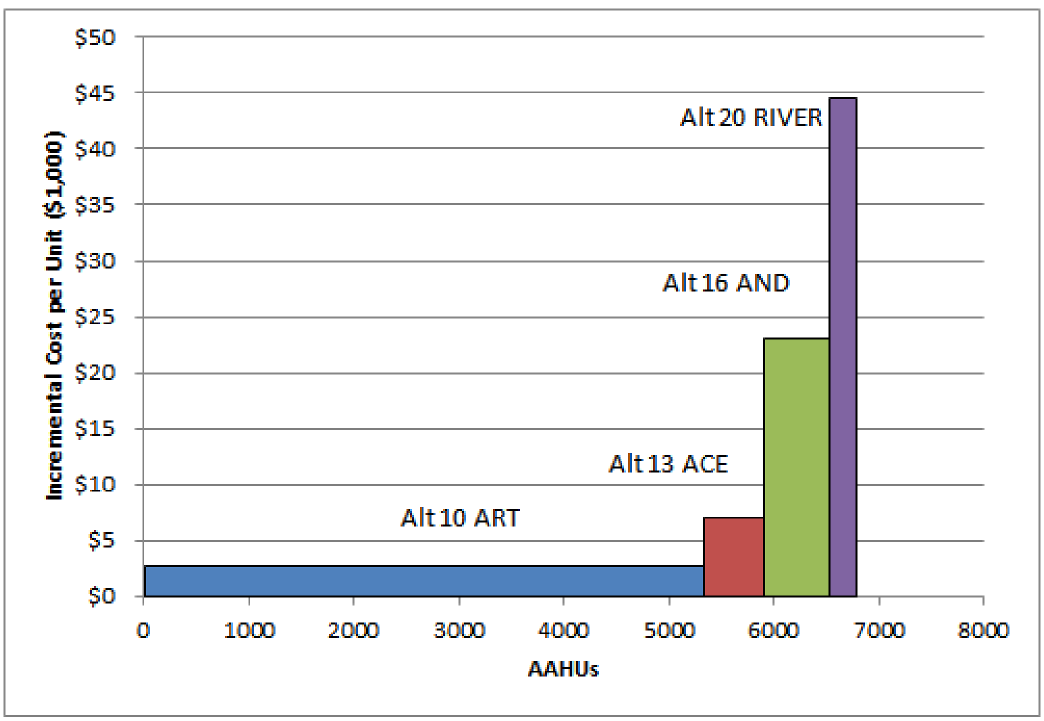


Figure 4-4 Incremental Cost Graph of the Final Array

Substitution - For the Final Array Plans to be carried forward for more detailed analysis, the Study Team modified the composition of Best Buy Plans 16 and 20 as identified through the CE/ICA analysis to substitute a smaller best buy alternative within Reach 6. Based upon the CE/ICA analysis, Best buy Alternative 13 included preliminary Alternative 13 in Reach 6, but Best Buy Plans 16 and 20 included Preliminary Alternative 8 instead. Preliminary Alternative 13 in Reach 6 includes freshwater marsh and widens the riverbed more than the reach sub-plan from Preliminary Alternative 8. Preliminary Alternative 13 also represents a cost savings of $51 million dollars versus Preliminary Alternative 8. Alternatives 16 and 20 remain cost effective and efficient plans with this substitution of including the smaller scale best buy alternative for Reach 6, since they are both comprised of best buy alternatives for all reaches. In particular, preliminary Alternative 13 for Reach 6 has a lower average cost per habitat unit than preliminary Alternative 8, while only having a minor reduction in AAHUs (1448 AAHUs vs. 1548 AAHUs). For these reasons, Reach 6 Alternative 13 was carried forward as a component of Final Array Plans 16 and 20.

4.13 NO ACTION ALTERNATIVE

The USACE is required to consider "No Action" as one of the alternatives to comply with the requirements of NEPA. The No Action Alternative is synonymous with the "without project condition" and is the basis against which all other alternative plans are measured. It assumes that no new project(s) will be implemented by the Federal government to achieve the planning objectives. Future development in the ARBOR reach would occur in accordance with currently adopted plans. This alternative has already been considered in the without project condition. For CEQA purposes, the City is required to consider the No Project Alternative. For purposes of this analysis, it is assumed that the No Action Alternative and No Project Alternative are the same.

Under the No Action Alternative, the identified problems would continue during the period of analysis. Continued human intervention and activities associated with urban development would further degrade habitat in the study area, and possibly prevent any future restoration from being practical, feasible, or cost-effective. The habitat team assumed that there would be an increase in the presence of invasive plant species in riparian areas on the river and on the tributaries, urban influences from future planned developments, and a reduction in the number of species present within the study area overtime. A 25- and 50-year planning horizon was used to evaluate these assumed changes. These assumptions are described in further detail in Appendix G. Baseline habitat units were based on 842 acres. Baseline habitat value was 6,119 habitat units with a reduction in habitat value over the next 50 years to 5,291 habitat units. This represents a 14 percent reduction in habitat value in an already severely degraded habitat. Most of this reduction is expected to occur because of an increase in invasive vegetation with some increased effects of urbanization.

4.14 ACTION ALTERNATIVES

4.14.1 Summary

Four action alternatives compose the final array and have received detailed analysis in this IFR. The alternatives were named to assist the team, reviewers, and the public. The no action alternative is a part of the final array and provides a fifth alternative.

Alternative 10 is called the ART (for ARBOR Riparian Transitions) as it provides some restoration in all reaches and provides transitions or connections between existing riparian corridors and concrete lined river reaches. Alternative 10 is the minimally-acceptable alternative, costing $346 million, provides an increase in habitat of 93 percent over without project conditions with 5,321 habitat units (HU) and increases habitat connectivity through riparian corridors and increases hydrologic connectivity through daylighted streams by restoring 528 acres. This basic restoration plan includes only minimal restoration at Taylor Yard and excludes restoration at both major confluence areas at the Arroyo Seco and Verdugo Wash. In Reach 1, it includes riparian corridors on both sides of the channel with connections under Highway 134 to the Pollywog Park Area of Griffith Park which is restored to a riparian area and through the Headworks Study Site to the Santa Monica Mountains. In Reach 2, the riparian corridor is continued on both sides with connections to the Santa Monica Mountains. Reach 3 includes daylighted streams (with riparian and freshwater marsh restoration) on the east bank and a single daylighted stream on the west bank, and Reach 4 is restored with a riparian corridor on the east bank, a side channel at the edge of Griffith Park Golf Course with inlet and outlet to the Los Angeles River (LAR) under I-5, a side channel through Los Feliz Golf Course, and several daylighted streams. Reach 5 continues the riparian corridor on the east bank and includes a daylighted stream at the downstream end. In Reach 6, the channel is widened by approximately 80 feet along Taylor Yard with a small terraced area in the Bowtie parcel. In addition, the channel banks are vegetated with overhanging vines and implanted vegetation. Restoration is continued in Reach 7 with daylighted streams on both sides of the channel. In Reach 8, the Piggyback Yard is restored with riparian habitat and its historic wash. This restoration is hydrologically connected to the LAR allowing flows from the ephemeral wash to enter the river through culverts under the railroad.

Alternative 13 is named ACE (for ARBOR Corridor Extension) as it includes all the features in Alternative 10, and adds additional restoration increasing restored habitat by 104 percent over without project conditions and by 11 percent over Alternative 10. Added restoration occurs in 3 reaches. This includes a side channel entering upstream from the LAR behind Ferraro Fields and re-entering the river at the downstream end of Reach 3. In Reach 6, there is additional widening of over 300 feet in Taylor Yard with significant restoration of the floodplain and freshwater marsh in the widened channel. Major tributary restoration with nodal connections on the east side of the river to the nationally significant Arroyo Seco watershed is included at the Arroyo Seco (Reach 7). This is accomplished through softening of the bed and banks with development of a riparian corridor in the tributary confluence and for one half mile upstream. This supports connections through the river from the Santa Monica Mountains to the San Gabriel Mountains. Instead of the daylighted streams included this Reach for Alternative 10, the banks of the LAR downstream from the Arroyo Seco are lined with overhanging vines and implanted vegetation through this reach. Alternative 13 delivers 581 more HUs and 60 additional acres, increasing nodal connections for wildlife by 309 percent, and meeting objectives in all reaches for approximately $95 million more ($442 million total).

Alternative 16 is called AND (for ARBOR Narrows to Downtown). This alternative includes all the features of both Alternatives 10 and 13. Alternative 16 adds additional restoration in Reaches 5 and 8. This alternative widens Reach 5 along the west bank and adds vegetated terracing on the east bank. In Reach 8, the alternative adds additional restoration by terracing upstream of Piggyback Yard on the west bank, and removal of the east bank and the concrete bed in the LAR adjacent to Piggyback Yard. The channel bed will be naturalized to support freshwater marsh in the river and another area of wetland through the restored Piggyback Yard adjacent to the river. The river is widened in Piggyback Yard by 500 feet on a low terrace and another 1000 feet on a second terrace. Another set of vegetated terraces are constructed along the downstream bank on the east side of the river. The added features in Alternative 16 provide an increase in habitat of 114 percent over without project conditions and 10 percent over Alternative 13. It provides an additional 607 habitat units and 71 acres of added restoration. Nodal connections are increased above that provided in Alternative 13 by 85 percent. This added restoration is accomplished for an additional cost of approximately $315 million above Alternative 13 ($757 million total).

Alternative 20 is called RIVER (for Riparian Integration via Varied Ecological Reintroduction) as it includes all the elements of Alternatives 10, 13 and 16 and additional features in Reaches 2, 3 and 7 are described as follows. It includes channel widening in Reach 2 on the west bank. In Reach 3, the alternative restores the confluence with Verdugo Wash by softening the bed of the stream and significantly widening the mouth of the wash thus providing riparian habitat and an additional connection to the San Gabriels through the Verdugo Hills. In Reach 7, daylighted streams also included in Alternative 10 are reintroduced in lieu of channel bank vegetation features that were in Alternatives 13 and 16. Also in Reach 7, wetlands are restored at the Los Angeles State Historic Park with a terraced connection to the mainstem. For Alternative 20, the Study's planning objectives are met with some degree of channel naturalization and restoration in nearly all reaches, and inclusion of two major confluences (Verdugo Wash restoration bordering the City of Glendale is added, along with a connection between the river and its western bank at the Los Angeles State Historic Park (Cornfields/Chinatown area)). This is achieved with an added cost of approximately $279 million more than Alternative 16 ($1.04 billion total.) Habitat is increased by 119 percent over without project conditions and 5 percent over Alternative 16. It adds and 273 habitat units above alternative 16 with inclusion of 60 additional restored acres and an increase in nodal habitat connectivity over Alternative 16 of 120%.

While Alternative 10 includes restoration measures in each Reach, the subsequent alternatives provide a greater extent of restoration. Alternative 13 has the highest increase in nodal connectivity (309%), while both Alternatives 13 and 16 provide an increase above that of Alternative 10 with about 600 habitat units each. Alternative 20 increases HU by just 273 units. Each incremental increase in acres is approximately the same; however, the incremental increase in cost is only $79 million for Alternative 13 over Alternative 10, while Alternatives 16 and 20 each increase costs by more than $315 and $279 million respectively. Alternative 13 adds major tributary restoration with inclusion of one half mile of the Arroyo Seco, while Alternative 20 adds another major tributary with restoration of the Verdugo Wash confluence. Alternative 10 has some channel widening in Reach 6, but the increased widening of Reach 6 in Alternative 13 is much more significant. Alternatives 16 and 20 include increasingly more extensive restoration that includes removal of concrete with naturalization of the channel bed and removal of the channel wall barrier in Reach 8, channel widening in Reaches 5 and 8 in Alternatives 16 and 20 with added widening in Reach 2 in Alternative 20. In summary:

- **Alternative 10** is called the **ART** (for ARBOR Riparian Transitions) as it provides restoration in all reaches, restores habitat at the Piggyback Yard, includes some widening at Taylor Yard, and provides transitions or connections between existing riparian corridors and concrete lined river reaches.

- **Alternative 13** is named **ACE** (for ARBOR Corridor Extension) as it includes all the features in Alternative 10, and adds additional restoration in the natural bed reaches of the Glendale Narrows, increased widening in Taylor Yard, and restoration at the Arroyo Seco confluence.

- **Alternative 16** is called **AND** (for ARBOR Narrows to Downtown) as it includes all the features in Alternatives 10 and 13, and widens and adds terracing in Reach 5, and adds terracing, widening, concrete removal in the channel bed, and restored wetlands in the channel and in Piggyback Yard.

- **Alternative 20** is called **RIVER** (for Riparian Integration via Varied Ecological Reintroduction) includes all the features of Alternatives 10, 13 and 16, and adds widening in Reach 2, restores the confluence with Verdugo Wash in Reach 3, and restores wetlands at the Los Angeles Historic State Park with a terraced connection to the mainstem in Reach 7.

The Corps is required to consider a reasonable range of alternatives in the IFR. Where alternatives are considered but dismissed from further consideration, the reasons for their dismissal are briefly provided. The full formulation strategy and dismissal of alternatives initially considered is discussed earlier in this chapter.

The alternatives presented in the final array for detailed consideration are composed of various reach plans, as explained in Chapter 4. These four alternatives represent the spectrum of reasonable alternatives that substantially respond to the purpose and need statement. Agencies are obligated to evaluate a reasonable range of alternatives in enough detail so that a reader can compare and contrast the environmental effects of the various alternatives. The EIS portion of this IFR evaluates the impacts associated with each alternative and discloses the impacts by reach or major feature where appropriate.

In some cases, the Corps may receive a comment indicating that a reasonable alternative should be modified somewhat. If the modification is reasonable, the Corps should discuss it in the final IFR. If a comment indicates a variation on an alternative that was not considered by the agency, the Corps will also consider whether that variation is reasonable and if it is reasonable, will consider it in the final IFR. If the Corps does not view the modification or variation to be reasonable, the Corps will explain why it does not warrant further response. If it is qualitatively within the spectrum of alternatives that were discussed in the draft, a supplemental draft will not be needed. (Memorandum to Agencies: Forty Most Asked Questions Concerning Council on Environmental Quality's NEPA Regulations, 46 Fed. Reg. 18026 (1981)) If a reasonable variation is suggested by a comment that is qualitatively beyond the spectrum of alternatives already discussed, then a supplemental draft would be needed to consider and solicit comment on that new and substantially different plan. The alternatives considered in detail provide a range of restoration efforts, with Alternative 10 including the lowest level of restoration and Alternative 20 the most intensive and largest footprint of restoration. Therefore, identification of variations or alternatives within this spectrum generally would not require a supplemental IFR and instead would be addressed in the final IFR.

Ultimately, this process is intended to result in an informed recommendation of a project for authorization. The recommended project could be any of the four action alternatives and one no-action alternative analyzed in this draft IFR. The recommended project could also be a plan that modifies one of the four action alternatives to add features present in another alternative, or to substitute one or more reach plans from a larger alternative, or any other plan within the spectrum analyzed in the final IFR. Therefore, agencies, stakeholders, and the public should be aware that the plan ultimately selected may be an alternative within the spectrum of the final array alternatives fully analyzed in this draft IFR.

Table 4-11 includes a matrix of the measures in each alternative in the final array. These measures are described in more detail in each alternative description. As described earlier the final array alternatives were formulated by recombining reaches from the original 19 alternatives to identify the most cost effective plans that met the planning objectives. This formulation process resulted in alternatives having some reach plans in common.

Table 4-11 Final Alternatives Measure Matrix

Reach	Submeasure	Alternative			
		10	13	16	20
1. Pollywog Park area of Griffith Park	Riparian habitat corridors	x	x	x	x
2. Bette Davis Park area of Griffith Park	Restructure top of bank to support vines				x
	Riparian habitat corridors	x	x	x	x
	Modify trap channel to vertical banks				x
3. Ferraro Fields area of Griffith Park	Create pool & riffle system and plant for freshwater marsh		x	x	x
	Daylight streams plant with riparian fringe and freshwater marsh	x	x	x	
	Divert flow into side channels with riparian fringe and return to the river		x	x	x

Reach	Submeasure	Alternative			
		10	13	16	20
	Riparian habitat corridors		x	x	x
	Open water habitat	x			
	Widen mainstem				x
	Widen tributaries				x
4. Griffith Park	Create pool & riffle system and plant for freshwater marsh	x	x	x	x
	Daylight streams plant with riparian fringe and freshwater marsh	x	x	x	x
	Divert flow into side channels with riparian fringe and return to the river	x	x	x	x
	Riparian habitat corridors	x	x	x	x
5. Riverside Drive	Create pool & riffle system and plant for freshwater marsh			x	x
	Daylight streams plant with riparian fringe and freshwater marsh	x	x	x	x
	Wildlife access from river to bank (in daylighted streams)			x	x
	Restructure channel walls to support vines			x	x
	Riparian habitat corridors	x	x	x	x
	Terrace banks			x	x
	Modify trap channel to vertical banks			x	x
6. Taylor Yard	Create pool & riffle system and plant for freshwater marsh		x	x	X
	Restructure channel walls to support vegetation		x	x	x
	Riparian habitat corridors	x	x	x	x
	Restructure to of bank to support vines and other vegetation		x	x	x
	Widen channel mainstem	x	x	x	x
	Widen channel sloping or terracing back to overbank levels	x	x	x	x
7. Arroyo Seco/ Los Angeles State Historic Park	Create pool & riffle system and plant for freshwater marsh				x
	Daylight streams plant with riparian fringe and freshwater marsh	x			x
	Divert flow into side channels with riparian fringe and return to the river				x
	Riparian habitat corridors		x	x	x
	Restructure channel walls to support vegetation, plantings.		x	x	
	Widen channel (Arroyo Seco) sloping or terracing back to overbank levels		x	x	x
8. Piggyback Yard	Create pool & riffle system and plant for freshwater marsh			x	x
	Restore historic wash with riparian habitat	x	x	x	x
	Divert flow into side channels with riparian fringe and return to the river			x	x
	Wildlife access from river to bank	x	x	x	x
	Riparian habitat corridors	x	x	x	x
	Widen channel			x	x
	Terrace banks			x	x

4.14.2 Alternative 10 (ART) Description by Reach

In the ARBOR Riparian Transitions or ART plan, reaches would be restored to increase connections between upstream and downstream riparian areas and restore lost riparian strands on the overbank. This alternative restores a total of 528 acres, and each reach is described below. Figures 4-5 through 4-8 at the end of this section display mapping of this alternative.

Reach 1 Pollywog Park Area of Griffith Park

Reach 1 for all alternatives in the final array would implement the habitat corridor with riparian planting on the overbanks. This would restore approximately 60 acres of riparian habitat corridors along the overbanks of both sides of the river. Overbanks are those areas adjacent to the river where overland flow in flood events could occur in a natural river environment. Areas of restoration include Pollywog Park, the bank between Headworks and the River with a connection under SR-134 to Headworks, the open area directly downstream of Headworks with a connection under Forest Lawn Drive on the same side of SR-134 with Headworks, and on the left bank of Burbank Western Channel (tributary from the north/west).

This would involve planting a riparian community of cottonwood/willow, sycamore, mugwort, mulefat, and scarlet monkeyflower with a buffer of sagebrush, buckwheat, and native herbaceous plants. It would include irrigation for establishment and water harvesting features to sustain plants, including micro-grading and/or swales to capture and infiltrate water. Water sources could include reclaimed water, harvesting of stormwater and street runoff (with small wetland features at the end of adjacent streets), and/or highway runoff. Where stormwater or street runoff is excessive during storm events, a connection to the River would allow it to overflow into the channel, creating a hydrologic connection. Soil amendments would be required. Establishment and drought management for this vegetation would utilize irrigation, either through flood irrigation (simulating a natural riparian regime) or drip irrigation, dependent upon the availability of water. There would be no channel modifications within this reach. While there is a levee at the downstream end of this reach, any planting in that area would comply with all levee regulations. This set of measures in this reach sub plan was the most incrementally cost effective and beneficial plan for all alternatives in the final array. Figure 4-21 includes a rendering of Pollywog Park with restoration.

Reach 2 Bette Davis Park Area of Griffith Park

Implementation of the habitat corridors/riparian planting measure would result in restoration of approximately 26 acres of riparian habitat corridors along the overbanks of both sides of the River as described for Reach 1. This includes restoration of riparian habitat in the Bette Davis Park area of Griffith Park on the left bank and the area between Zoo Drive and SR-134, with connections under the highway to a restored linear riparian planting along the River extending into Reach 3. There would be no channel modifications within this reach. Modifications to levees would comply with levee regulations. This alternative restores 273 acres of valley foothill riparian vegetation and 26 acres of freshwater marsh, and manages invasives on 406 acres, including 182 acres of existing open water. This reach sub-plan was the most incrementally cost effective with the most benefits for Alternatives 10, 13, and 16.

Reach 3 Ferraro Fields/Verdugo Wash Area of Griffith Park.

This reach would include a daylighted stream currently confined in a large culvert just downstream of Ferraro Fields on the right bank in the Zoo Drive area. A freshwater marsh would be located in the daylighted area outside of the mainstem of the River channel. Two additional smaller streams would be daylighted on the left bank. These would include a riparian fringe with freshwater marsh at the confluence. There would be no modifications to the channel itself. Levee protection would remain. In addition, the riparian corridor along Zoo Drive extends into this reach from Reach 2. This reach sub-plan was the most incrementally cost effective with the most benefits for Alternative 10.

Reach 4 Griffith Park

Restoration in Reach 4 (via implementation of measures to daylight and restore stream geomorphology and habitat in seven areas, a side channel through both the Griffith Park Golf Course on the west and the Los Feliz Golf Course on the east bank, and a riparian habitat corridor) would include approximately 30 acres of restored riparian and wetland habitat. This would be accomplished through a diversion of river flow into a side channel up to 10 feet deep with a riparian fringe through Griffith Park on the right bank, lining the left river bank with a riparian corridor within levee regulation requirements, and daylighting approximately seven small streams. Figure 4-25 is a rendering of restoration at Los Feliz.

The riparian corridor measure would involve planting a riparian strip of mugwort and scarlet monkeyflower with a buffer of native herbaceous plants. It would include irrigation for establishment and water harvesting features to sustain plants, including micro-grading and/or swales to capture and infiltrate water. Water sources could include reclaimed water, harvesting of stormwater and street runoff (with small wetland features at the end of adjacent streets), and/or highway runoff. Where stormwater or street runoff is excessive during storm events, a connection to the river would allow it to overflow into the channel, creating a hydrologic connection. Soil amendments would be required. Establishment and drought management for this vegetation would utilize irrigation, which would be either through flood irrigation (simulating a natural riparian regime) or drip irrigation, dependent upon the availability of water. This would be implemented as continuously as possible within the requirements of levee regulations. There would be no channel modifications within this reach.

The storm drains would be opened and naturalized as tributaries as far upstream as possible (at a minimum opening up the stream within the River right-of-way). Depending upon the length of the daylighted stream, it would be planted with riparian vegetation and end at the confluence with the river in a small freshwater marsh. If it is not possible to design an efficient confluence, the connection to the River would remain gated. Freshwater marsh vegetation would include clustered field sedge, fragrant flatsedge, Parish’s spikerush and common rush, scarlet monkey flower, California bulrush, narrow leaved cattail, and common cattail.

The side stream through Griffith Park would enter the park from the River under the I-5 Freeway (or farther upstream if necessary) and exit the park to reenter the River downstream under the I-5 as well. A riparian fringe of trees and marsh vegetation would line new side tributary. The Los Feliz Golf Course would be lowered, rebuilt, and allowed to seasonally flood (with no changes to the River channel walls) in order to establish a riparian habitat interspersed with the golf course greens. This reach sub-plan was the most incrementally cost effective with the most benefits for Alternatives 10, 13, 16, and 20.

Reach 5 Riverside Drive

This reach would continue implementation of the habitat corridor restoration in a narrow strip along the east bank to avoid interference with the existing levee system (in compliance with current USACE guidance for vegetation on levees), and restoration of one daylighted stream area with a riparian fringe and freshwater marsh. The storm drain would be opened and naturalized as a tributary stream as far upstream as possible (at a minimum, this would open up a confluence within the River right-of-way). Depending upon the length of the daylighted stream, it would be planted with riparian vegetation and end at the confluence with the river in a small freshwater marsh of approximately 1 acre. If it is not possible to design an efficient confluence due to the levee, the connection to the river would remain gated. Examples can be found in Los Angeles at North Atwater Park.

Freshwater marsh vegetation would include clustered field sedge, fragrant flatsedge, Parish's spikerush and common rush, scarlet monkey flower, California bulrush, narrow leaved cattail, and common cattail. This reach sub-plan was the most incrementally cost effective with the most benefits for Alternatives 10 and 13.

Reach 6 Taylor Yard

Restoration measures in this reach include increasing riparian habitat by at least 80 acres in the channel, within the Bowtie site and at Taylor Yard. This would include widening the channel bed by a minimum of 80 feet and connecting this new channel bed to the existing level of the overbank with a sloped bank vegetated with riparian plants. The length of this widening would extend through the beginning of the bend in Bowtie downstream for 700 feet through the G-2 Taylor Yard parcel and beyond, for a maximum of about 1,000 feet if additional land is available. Widening would include removal of concrete and excavation followed by reconstruction of the channel structure to stabilize the bank using grade control, rock walls with toe-ins (an extension of the wall below the bed), and/or geotextiles, and would provide for a gradual, undulating four-to-one (4:1) slope up to current grade. The riparian area on the overbank would be similar to that described for Reach 1 and the bank would be vegetated with plants that would survive seasonal inundation and would lay down in flood events.

At the upstream end of the Bowtie site, the channel banks would be lowered in an approximate 100-foot-wide by 600-foot-long riparian area by creating a setback in the channel wall with a terrace planted with riparian and marsh habitat. The terrace would be 10 feet above the channel invert transitioning from upstream and downstream ends. The overbank would be planted with a riparian corridor, irrigated for establishment, and water harvested from stormwater drainages. This reach sub-plan was the most incrementally cost effective with the most benefits for Alternative 10.

Reach 7 Arroyo Seco/Los Angeles State Historic Park

This reach would involve daylighting three streams currently confined in storm drains. One is just upstream of Arroyo Seco on the opposite bank (right bank), and the others are downstream of Arroyo Seco. The second is on the right bank upstream of Los Angeles State Historic Park, and the third is on the left bank in the same location. Both streams on the right bank connect to the hills in Elysian Park. A freshwater marsh would be located in the daylighted area outside of the mainstem of the River channel. The storm drains would be opened and naturalized as tributaries as far upstream as possible (at a minimum opening up the stream within the river right-of-way). Depending on the length of the daylighted stream, it would be planted with riparian vegetation and end at the confluence with the River in a small freshwater marsh. If it is not possible to design an efficient confluence, the connection to the River would remain gated. Freshwater marsh vegetation would include clustered field sedge, fragrant flatsedge, Parish's spikerush and common rush, scarlet monkey flower, California bulrush, narrow leaved cattail, and common cattail. There would be no modifications to the channel itself. This reach sub-plan was the most incrementally cost effective with the most benefits for Alternatives 10.

Reach 8 Piggyback Yard

In Reach 8, the Piggyback Yard site would be restored with 113 acres of riparian habitat. Micro-grading would slope the site to restore the historical wash that once ran through this area. The restored historical wash would meander through the property and would be connected to the existing river channel through a wide culvert or designed confluence, if possible. The wash location would be determined by the USACE's hydrology and hydraulic analysis and would be located in the most appropriate place.

The riparian corridor measure would involve planting a riparian strip of cottonwood/willow, sycamore, mugwort, mulefat, and scarlet monkeyflower with a buffer of sagebrush, buckwheat, and native herbaceous plants. It would include irrigation for establishment and water harvesting features to sustain plants, including micro-grading and/or swales to capture and infiltrate water. Water sources could include overflows from the restored historical wash, reclaimed water, harvesting of stormwater and street runoff (with small wetland features at the end of adjacent streets), and/or highway/roadway runoff. Soil amendments would be required. Establishment and drought management for this vegetation would utilize irrigation, which would be either through flood irrigation (simulating a natural riparian regime) or drip irrigation, dependent upon the availability of water. There would be no channel modifications within this reach as water entering the River from the historical wash would be routed through existing storm drains in the channel wall. This reach sub-plan was the most incrementally cost effective with the most benefits for Alternatives 10 and 13.

4.14.3 Alternative 13 (ACE) Description by Reach

ARBOR Corridor Extension (ACE) Alternative 13 restores a total of 588 acres. Similar to Alternative 10 there would be six reaches with restored riparian corridors in overbank areas (1, 2, 4, 5, 6, and 8). Restoration features in each reach are described below and shown in figures 4-9 through 4-12 at the end of this section.

Reach 1 Pollywog Park Area of Griffith Park

The set of measures in this reach sub-plan would be the same as those described for Alternative 10. These Reach 1 sub-plan was the most incrementally cost effective and beneficial plan for all alternatives in the final array.

Reach 2 Bette Davis Park Area of Griffith Park

The set of measures in this reach sub-plan are the same as those described for Alternative 10. This Reach 2 sub-plan was the most incrementally cost effective with the most benefits for Alternatives 10, 13, and 16.

Reach 3 Ferraro Fields/Verdugo Wash area of Griffith Park

In this reach a side channel would divert water from the river into a side channel flowing on the west side of Ferraro Fields and would daylight a stream currently confined in a large culvert just downstream of Ferraro Fields on the right bank in the Zoo Drive area, this is depicted in Figure 4-23. The side channel would support a riparian fringe, and open water and freshwater marsh would be located in the daylighted area outside of the mainstem of the River channel. Two additional smaller streams would be daylighted on the left bank. These would include a riparian fringe with freshwater marsh at the confluence. Riparian areas would be located on the right or west bank along Zoo Drive, on the River’s edge of Ferraro Fields, and between the daylighted streams on the left bank. There would be no modifications to the channel itself. Levee protection would remain and levee vegetation policy would be followed. This reach subplan was the most incrementally cost effective with the most benefits for Alternatives 13 and 16.

Reach 4 Griffith Park

The set of measures in this reach sub-plan are the same as those described for Alternative 10. It was the most incrementally cost effective with most benefits across all of the final array.

Reach 5 Riverside Drive

This reach sub-plan is the same as described for Alternative 10. It was the most incrementally cost effective with the most benefits for Alternatives 10 and 13.

Reach 6 Taylor Yard

Reach 6 in this alternative includes riparian corridors and widening of the soft bottom river bed by over 300 feet with additional slope back to the overbank elevation along the reach length approximately 1,000 feet. At the upstream end of the reach, a back water wetland would be developed on a setback bench and there would be a small terraced area at the downstream end of the Bowtie parcel. Freshwater marsh would dominate the new river bed. The banks of the river would be restructured to support overhanging vines and other vegetation. This reach sub-plan was the most incrementally cost effective with the most benefits for Alternative 13. Restoration at Taylor Yard is depicted in Figure 4-27 at the end of this section.

Reach 7 Arroyo Seco/Los Angeles River State Historic Park

In Reach 7, the Arroyo Seco tributary would be restored with riparian habitat. This ephemeral stream would have its banks and bed softened for approximately one-half mile upstream and be stabilized with erosion control elements to maintain the existing protection. At the confluence on the upstream edge of the River, a backwater riparian wetland would be established. Within the River channel itself, the banks would be restructured to support vegetation on the banks. This reach subplan was the most incrementally cost effective with the most benefits for Alternatives 13 and 16. Figure 4-28 is a rendering of a restored Arroyo Seco.

Reach 8 Piggyback Yard

This reach sub-plan is the same as for Alternative 10. It was the most incrementally cost effective with the most benefits for Alternatives 10 and 13.

4.14.4 Alternative 16 (AND) Description by Reach

ARBOR Narrows to Downtown Alternative 16 (AND), would include restoration of a total of 659 acres. Specific restoration features in each reach are described below and shown in Figures 4-13 through 4-16 at the end of this section.

Reach 1 Pollywog Park Area of Griffith Park

The set of measures in this reach sub-plan are the same as those described for Alternative 13. These Reach 1 measures are incrementally cost effective and beneficial for all alternatives in the final array.

Reach 2 Bette Davis Park Area of Griffith Park

The set of measures in this reach sub-plan are the same as those described for Alternative 10. This Reach 2 sub-plan was the most incrementally cost effective with the most benefits for Alternatives 10, 13, and 16.

Reach 3 Ferraro Fields/Verdugo Wash Area of Griffith Park

This reach sub-plan is the same as described for Alternative 13. It was the most incrementally cost effective with the most benefits for Alternatives 13 and 16.

Reach 4 Griffith Park

The set of measures in this reach sub-plan are the same as those described for Alternative 10. It was the most incrementally cost effective with most benefits across all of the final array.

Reach 5 Riverside Drive

In Reach 5, the right bank would be modified from a trapezoidal bank to a vertical bank. This would increase the width of the soft bottom river bed by over 100 feet. The top of the bank would be notched and planted with overhanging vines. The left bank would be modified with terraces planted with herbaceous vegetation and necessary erosion measures, which would consist of concrete-lined beds. The inland bank would be planted with riparian vegetation. At the downstream end of this reach, the river will also be widened on the left bank with appropriate erosion control measures in place. This would further increase the natural river bottom area. All of these measures would comply with levee vegetation regulations. This reach sub-plan was the most incrementally cost effective with the most benefits for Alternatives 16 and 20.

Reach 6 Taylor Yard

This reach sub-plan is the same as for Alternative 13. It was the most incrementally cost effective with the most benefits for Alternative 13, and substituted by the team for Alternatives 16 and 20.

Reach 7 Arroyo Seco/Los Angeles River State Historic Park

This reach sub-plan is the same as for Alternative 13. It was the most incrementally cost effective with the most benefits for Alternatives 13 and 16.

Reach 8 Piggyback Yard

Reach 8 would be modified with terracing on the right bank upstream of Piggyback Yard and on the left bank downstream of Piggyback Yard. This terracing would be planted with riparian vegetation. The channel would be changed from concrete to soft bottom to support freshwater marsh, and the reach would be widened. The marsh would extend into the Piggyback Yard 500 feet, with riparian area extending another 1,000 feet into Piggyback Yard, gradually sloping up to existing bank elevations. The historical wash would be restored through the property with a riparian fringe as well as other side channels, and river flows would be diverted out of the River into Piggyback Yard creating a large wetland area. A railroad trestle would be included with this alternative to allow the described restoration to occur and allowing for the connection of the river channel and the adjacent restored areas. This reach sub-plan was the most incrementally cost effective with the most benefits for Alternatives 16 and 20. This is displayed on Figure 4-30 at the end of this section.

4.14.5 Alternative 20 (RIVER) Description by Reach

Riparian Integration via Varied Ecological Reintroduction (RIVER) Alternative 20 would include restoration of a total of 719 acres. Restoration features within each reach are described below and displayed in Figures 4-17 through 4-20 at the end of this section.

Reach 1 Pollywog Park Area of Griffith Park

The set of measures in this reach sub-plan are the same as those described for Alternative 16. These Reach 1 measures are incrementally cost effective and beneficial for all alternatives in the final array.

Reach 2 Bette Davis Park Area of Griffith Park

Like Alternatives 10, 13, and 16, implementation of the habitat corridors/riparian planting measure would result in restoration of approximately 26 acres of riparian habitat corridors along the overbanks of both sides of the river as described for Reach 1. This includes restoration of riparian habitat in the Bette Davis Park area of Griffith Park on the left bank and the area between Zoo Drive and SR-134 with connections under the highway to a restored linear riparian planting along the River extending into Reach 3. This reach is soft bottom and would include invasives management in the existing vegetation in the channel and on the overbank. Unlike the other alternatives, Alternative 20 would add additional modification in Reach 2. The right bank would be modified from trapezoidal to a vertical bank creating 80 feet of additional soft bottom width in the channel with overhanging vines. This reach sub-plan was the most incrementally cost effective with the most benefits for Alternative 20. Figure 4-22 at the end of this section includes a rendering of modified river banks in this reach.

Reach 3 Ferraro Fields/Verdugo Wash area of Griffith Park

In this reach a side channel would divert water from the river into a side channel flowing on the west side of Ferraro Fields and would daylight a stream currently confined in a large culvert just downstream of Ferraro Fields on the right bank in the Zoo Drive area. The side channel would support a riparian fringe, and open water and freshwater marsh will be located in the daylighted area outside of the mainstem of the River channel. Two additional smaller streams would be daylighted on the left bank. These would include a riparian fringe with freshwater marsh at the confluence. Riparian areas are located on the right or west bank along Zoo Drive, on the River's edge of Ferraro Fields, and between the daylighted streams on the left or east bank. There would be no modifications to the channel itself. In the Verdugo Wash confluence, the channel mouth will be widened and the south slope would be sloped back to the existing overbank elevation as depicted in Figure 4-24 at the end of this section. One potential design would use riparian vegetation to stabilize the south bank and a combined riparian and marsh community in the widened channel. Levee protection would be tied-in to the bank, and other levee protection will remain. Levee vegetation policy will be followed.

Reach 4 Griffith Park

The set of measures in this reach sub-plan are the same as those described for Alternative 10. It was the most incrementally cost effective with most benefits across all of the final array.

Reach 5 Riverside Drive

This reach sub-plan is the same as described for Alternative 16. It was the most incrementally cost effective with the most benefits for Alternatives 16 and 20.

Reach 6 Taylor Yard

This reach sub-plan is the same as for Alternative 16. It was the most incrementally cost effective with the most benefits for Alternative 13, and substituted by the team for Alternatives 16 and 20.

Reach 7 Arroyo Seco/Los Angeles State Historic Park

In Reach 7, the Arroyo Seco tributary would be restored with riparian habitat. This ephemeral stream would have the banks and bed softened for approximately one half mile upstream and would be stabilized with erosion control elements to maintain the existing protection. At the confluence on the upstream edge of the Los Angeles River, a backwater riparian wetland and marsh would be established. Within the River channel itself, the banks would be restructured to support vegetation on the banks. Downstream, freshwater marsh would be restored and connected under a railroad trestle with water flowing back into the River from the freshwater marsh, connecting the main channel of the River with the Los Angeles River State Historic Park as shown in Figure 4-29.

Reach 8 Piggyback Yard

This reach sub-plan is the same as for Alternative 16. It was the most incrementally cost effective with the most benefits for Alternatives 16 and 20.

4.15 Operation, Maintenance, Repair, Replacement and Rehabilitation

Operation, maintenance, repair, replacement, and rehabilitation activities (OMRR&R) would occur after the project is constructed in order to keep project features functioning as designed. Activities would be similar among the alternatives and vary in scale consistent with each alternative. This will include annual inspections and maintenance, periodic repair and/or replacement of project features, management of invasives, and provision of irrigation during drought. Costs are based on a percentage of the initial construction cost of items anticipated to require maintenance over the life of the project, and listed in Appendix C Cost. A more detailed Operation and Maintenance Plan will be developed during implementation and will be coordinated with the current O&M plan for the existing flood risk management project.

USACE identified that a modification to the LACDA OMRRR plan would be needed to avoid contradictory maintenance requirements for the areas of restoration features. The LACDA OMRRR plan would thus be modified to accommodate the restoration features, with maintenance of those features a City responsibility under the restoration OMRRR plan.

At the same time, the USACE would modify the LACDA OMRRR plan for the rest of the ARBOR reach to preserve flood risk management function while complementing the restoration project. These modifications would allow some native vegetation to remain in the rest of the reach to the extent that design conveyance capacities would be met or would experience only minimal changes from the design conditions. Such OMRRR would be contingent on funding and would be anticipated to be phased in over time. These OMRRR modifications would be refined during design of the restoration project.

4.16 RECREATION PLAN

As described above one of the study objectives and secondary purpose is to increase passive recreation that is compatible with the restored environment. To that end USACE and the non-Federal sponsor cooperatively formulated a recreation plan with features integrated into the ecosystem restoration plan; however, these features are evaluated as separable components of the plan. The features of the recreation plan are designed to capitalize on the areas where substantial ecosystem restoration is proposed. As such, it is assumed that the ecosystem restoration will have taken place when considering the effects of the recreation plan features. More detailed description of the recreation analysis can be found in Appendix B, Economics and Chapter 6, with potential impacts included in Chapter 5.

4.16.1 Proposed Recreation Features

The recreation plan includes the modification, upgrade, or creation of multi-use trails and related basic amenities (access points, wildlife viewpoints, parking lots, restrooms, signage). The plan also includes non-motorized multi-use bridges across the LA River and smaller pedestrian bridges across tributaries or within large restored areas. Specifically, the plan calls for:

- A new unpaved non-motorized multi-use trail (4.04 miles long),
- One bridge spanning Arroyo Seco,
- Two small to medium bridges/crossings within Taylor Yard and Piggyback Yard,
- Two parking lots, one at Taylor Yard and one at Piggyback Yard,
- Three restrooms, one at Bette Davis Park, one at Taylor Yard, and one at Piggyback Yard,
- One pedestrian tunnel beneath the railroad track on the east side of Taylor Yard,
- Nineteen trail access points throughout the study area, and
- Five wildlife viewing points throughout the study area.

The plan would result in 7% of existing trails being upgraded, and a 36% increase in total accessible trails and multi-use paths along the river. A total of 20.61 miles of existing trail would not be modified by the recreation plan. However, there would be 1.95 miles of existing length that would be upgraded to a fully developed multi-use trail. There would also be 4.04 miles of new trail added in the study area, and 5.23 miles of newly accessible multi-use pathway created by the ecosystem restoration plan. At the current level of design, trails are assumed to be multiple-use, 12 feet wide, with a decomposed granite surface. Safety ramps will be a part of project design and will be multi-use for maintenance, safety exits, and potential access by kayakers and canoeists.

4.16.2 Benefits of the Recreation Plan

The proposed recreation features would provide both direct and indirect benefits to recreation participants as well as the communities surrounding the ARBOR reach. Direct benefits of the recreation plan would include:

- Improved quality and quantity of trails for multiple user groups along the river
- Increased connectivity of each side of the river's recreation resources
- Increased public safety through better signage and trail development along the river
- Improved viewing and lines of sight along the river, especially in areas of substantial restoration via the ecosystem restoration plan
- Opportunity for interpretive signage and environmental education\
- Improved public health by providing opportunities for exercise and psychological respite

In addition to these direct benefits, communities along the ARBOR reach will receive benefits in the form of increased quantity and quality of neighborhood parks. The addition of trails and amenities in the restored Piggyback Yard will benefit the surrounding historically underserved communities along the downstream end of the ARBOR reach, providing substantial open space in highly developed neighborhoods, which are currently considered park-deficient. The recreation plan will also help support the projected RED benefits related to redevelopment in the study area.

4.16.3 Expected Recreation Benefits

Visitation estimates generated utilizing a unit day value method described in the Economic Appendix generated recreation values for the without and with project conditions were calculated. Taking the difference between the with-project and the without project, net recreation benefits were estimated. Table 4-12 summarizes expected recreation benefits in terms of net present value (NPV) and an amortized annual value. Amortization over the period of analysis uses the FY2013 Federal discount rate of 3.75% over a 50-year period of analysis. The analysis estimates amortized annual net benefits of $2,389,644.

Table 4-12 Summary of Recreation Value Calculation

	Without Project	With Project
Average Annual Visitation	463,582	672,002
Value per Visit	$6.27	$7.88
Average Annual Recreation Value	$2,905,732	$5,295,376
Average Annual Net Benefits	**$2,389,644**	
Net Present Value of Benefits	**$53,610,447**	

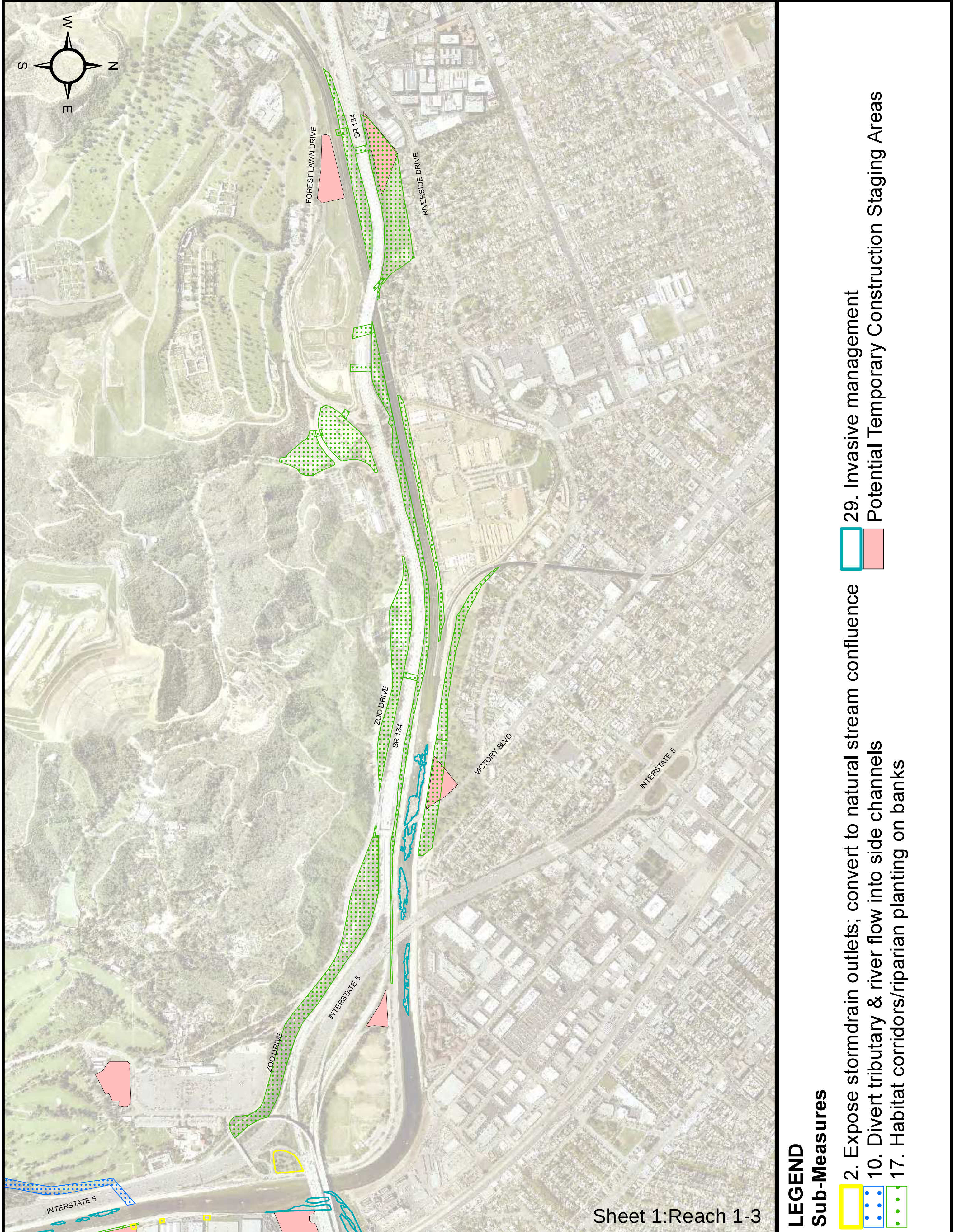
4.16.4 Benefit Cost Analysis

Construction costs were developed for the proposed recreation features. Costs are presented in FY2013 price level. As summarized in the table below, the present value total estimated investment cost for the proposed recreation features is $6,190,701, or $275,946 in amortized annual dollars. Operations and maintenance of the recreation plan features adds an additional amortized annual cost of $42,206 or $946,870 in present value dollars. Total present value project cost is estimated at $7,137,571. The Cost Appendix (Appendix C) provides more detail on the recreation plan cost estimate.

Based on the results of the recreation analysis, recreation benefits would be approximately $2,389,644 amortized annual dollars over the 50-year period of analysis. In this analysis, benefits exceed the cost, which is anticipated to be an amortized annual cost of $318,152. The benefit cost ratio (BCR) is therefore estimated to be 7.51. The benefits exceed the costs for the proposed recreation features, and therefore the recreation features are economically justified (Table 4-13).

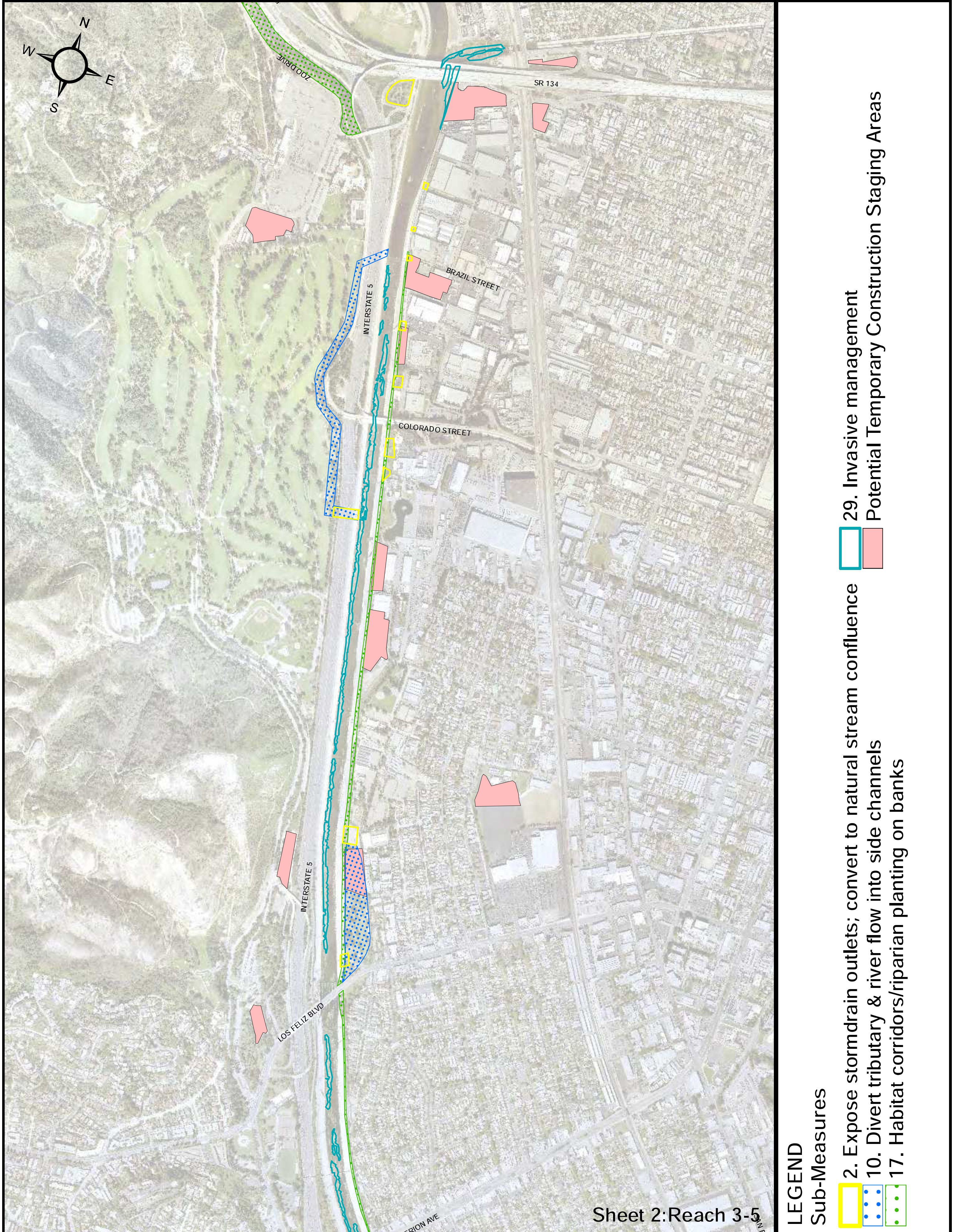
Table 4-13 Benefit-to-Cost Ratio by Alternative

Alternative	Annual Benefits ($)	Annual Costs ($)	BCR
No Action	$0	$0	0.00
Proposed Recreation Plan	$2,389,644	$318,152	**7.51**



Data Source: USACE, 2011
City of Los Angeles, 2011
Aerial Source: LARIC 2008

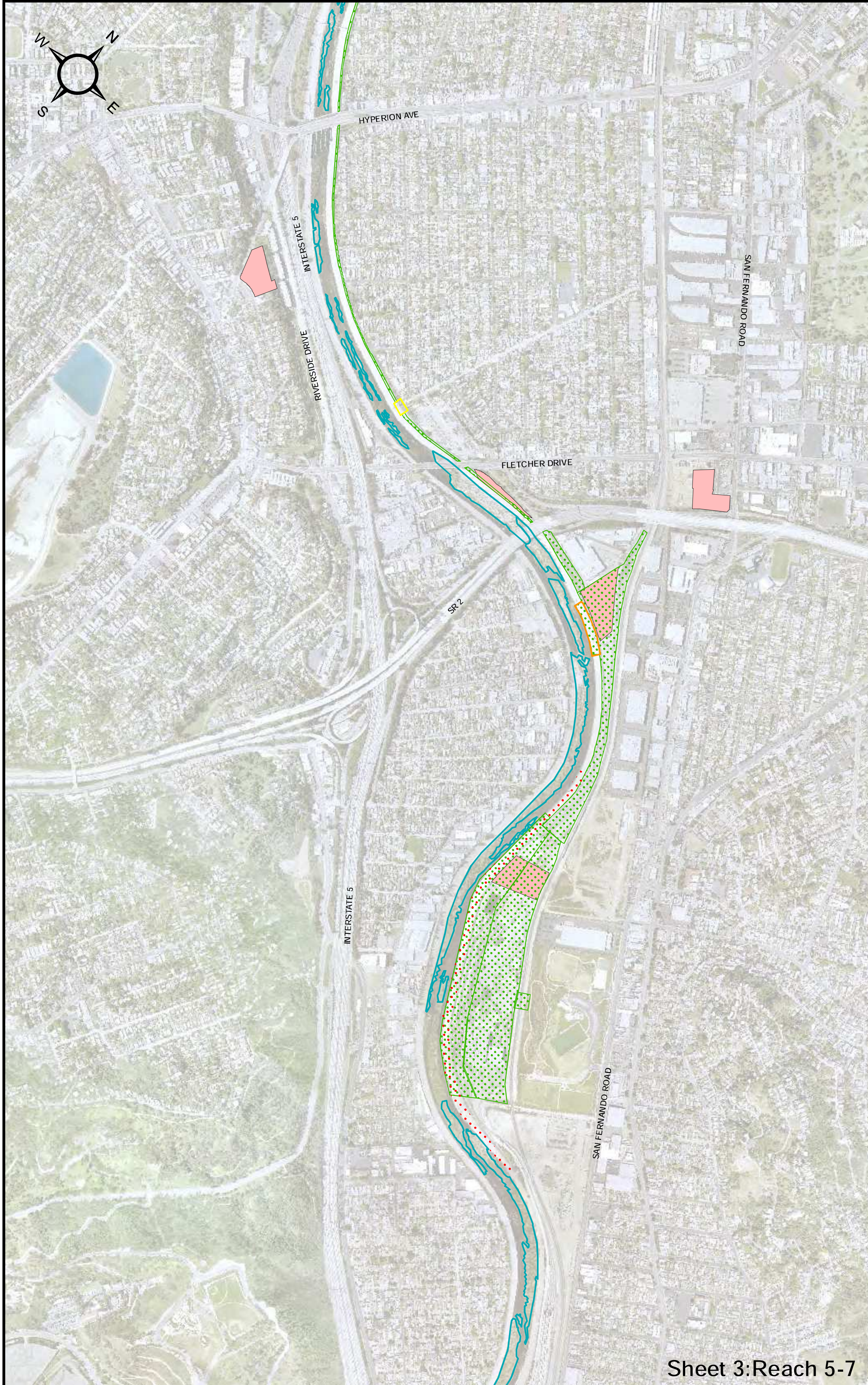
Alternative 10, ARBOR Riparian Transitions (ART)
Los Angeles River Ecosystem Restoration (Feb, 2013)



Data Source: USACE, 2011
City of Los Angeles, 2011
Aerial Source: LARIC 2008

Alternative 10, ARBOR Riparian Transitions (ART)
Los Angeles River Ecosystem Restoration (Feb, 2013)

0 0.2 0.4 Miles

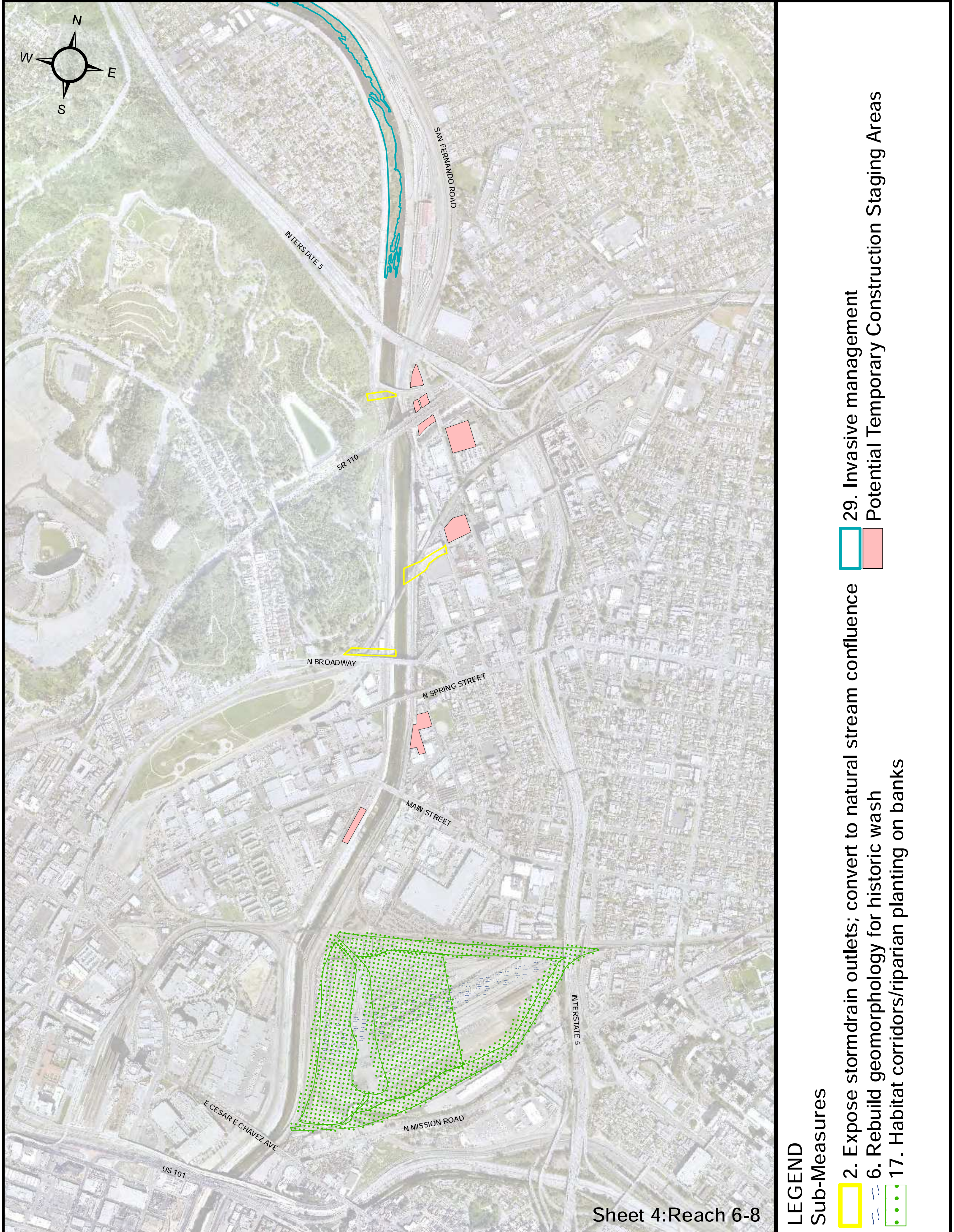


LEGEND
Sub-Measures
2. Expose stormdrain outlets; convert to natural stream confluence
17. Habitat corridors/riparian planting on banks
21. Lower channel banks and provide setback levees or vegetated berms
22. Channel banks mainstem/widen channel with concrete removal
29. Invasive management
Potential Temporary Construction Staging Areas

Data Source: USACE, 2011
City of Los Angeles, 2011
Aerial Source: LARIC 2008

Alternative 10, ARBOR Riparian Transitions (ART)
Los Angeles River Ecosystem Restoration (Feb, 2013)

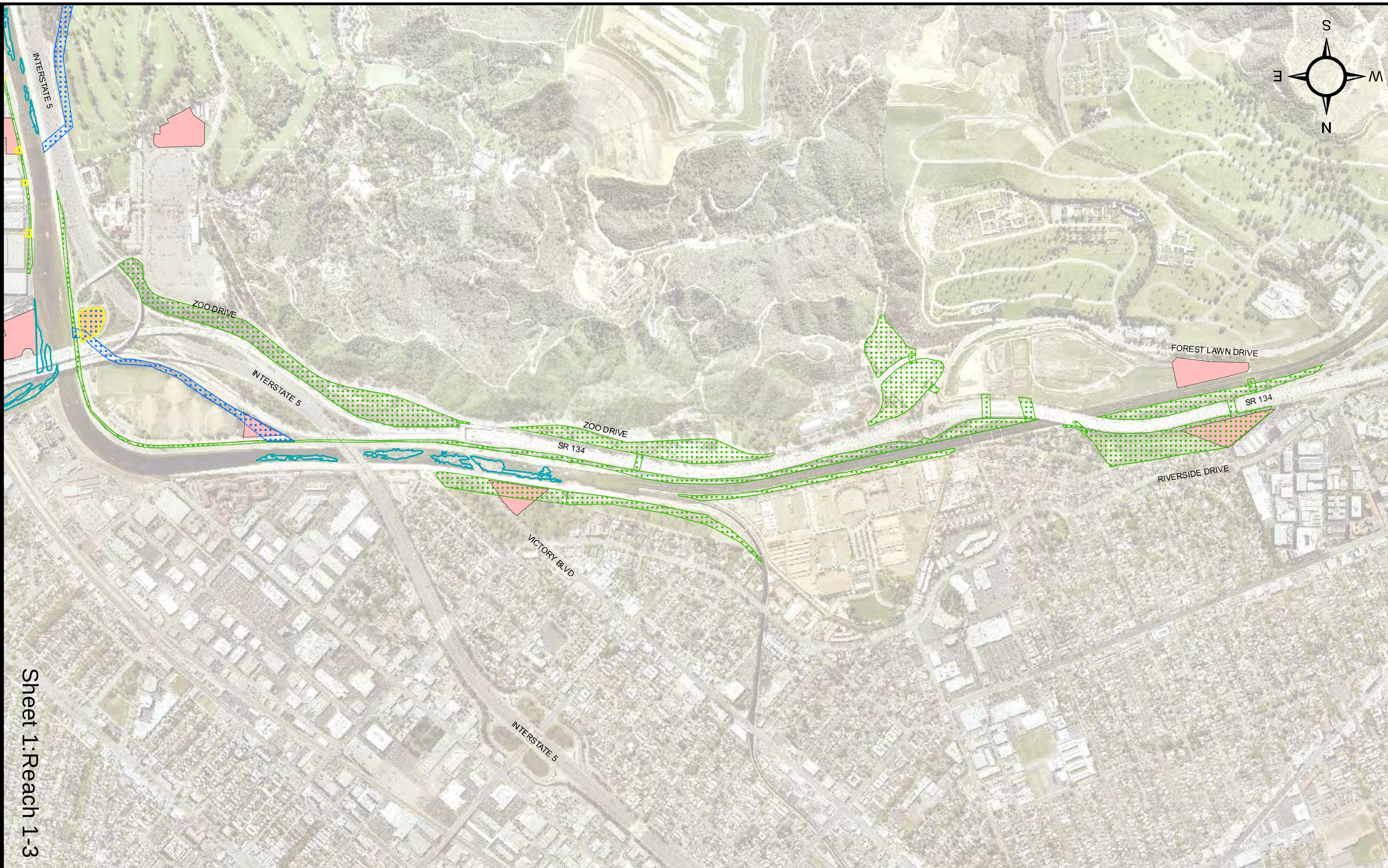
0 0.2 0.4 Miles



Data Source: USACE, 2011
City of Los Angeles, 2011
Aerial Source: LARIC 2008

Alternative 10, ARBOR Riparian Transitions (ART)
Los Angeles River Ecosystem Restoration (Feb, 2013)

0 0.2 0.4 Miles



LEGEND

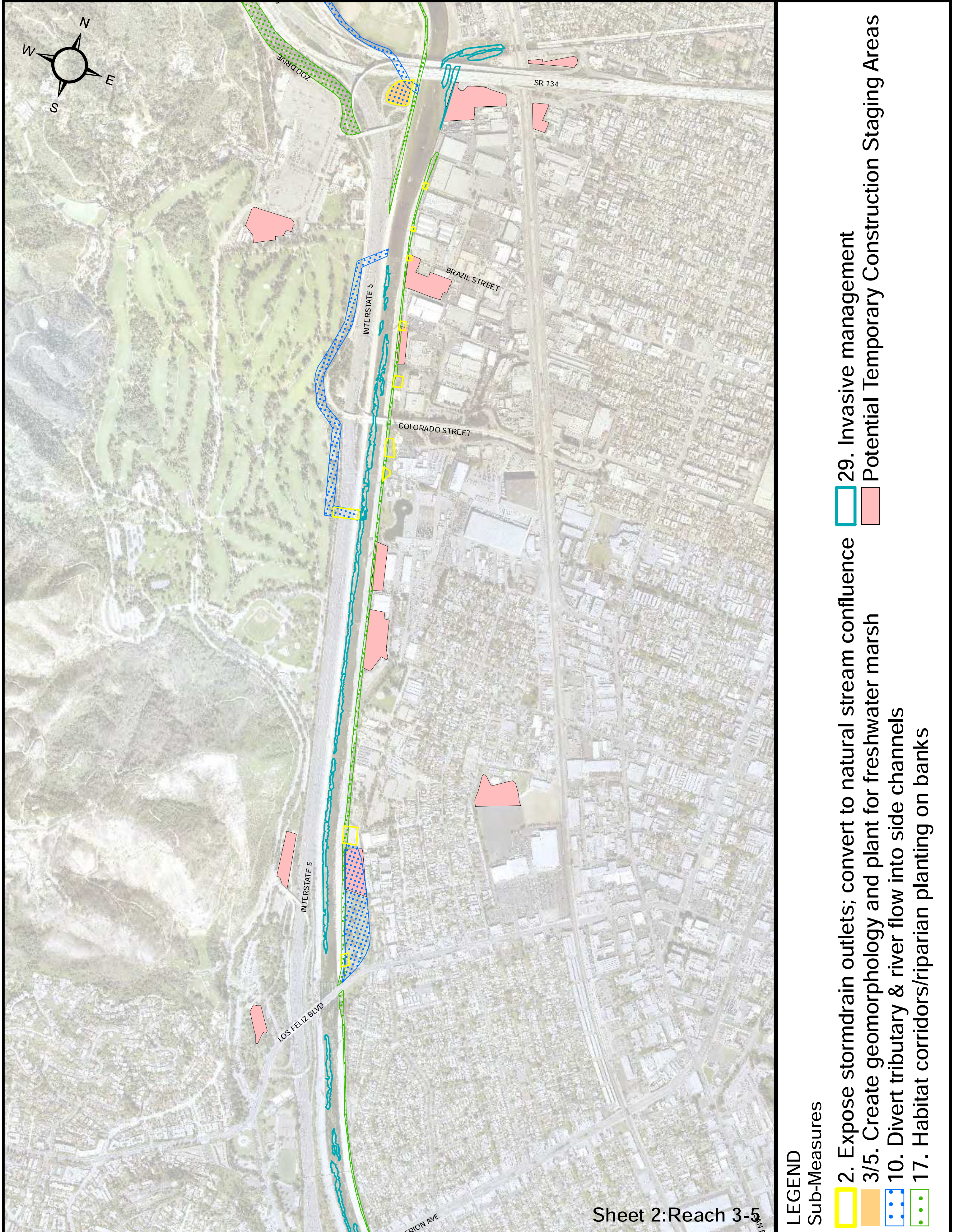
Sub-Measures

- 2. Expose stormdrain outlets; convert to natural stream confluence
- 3/5. Create geomorphology and plant for freshwater marsh
- 10. Divert tributary & river flow into side channels
- 17. Habitat corridors/riparian planting on banks
- 29. Invasive management
- Potential Temporary Construction Staging Areas

Data Source: USACE, 2011
City of Los Angeles, 2011
Aerial Source: LARIC 2008

Alternative 13, ARBOR Corridor Extension (ACE)
Los Angeles River Ecosystem Restoration (Feb, 2013)

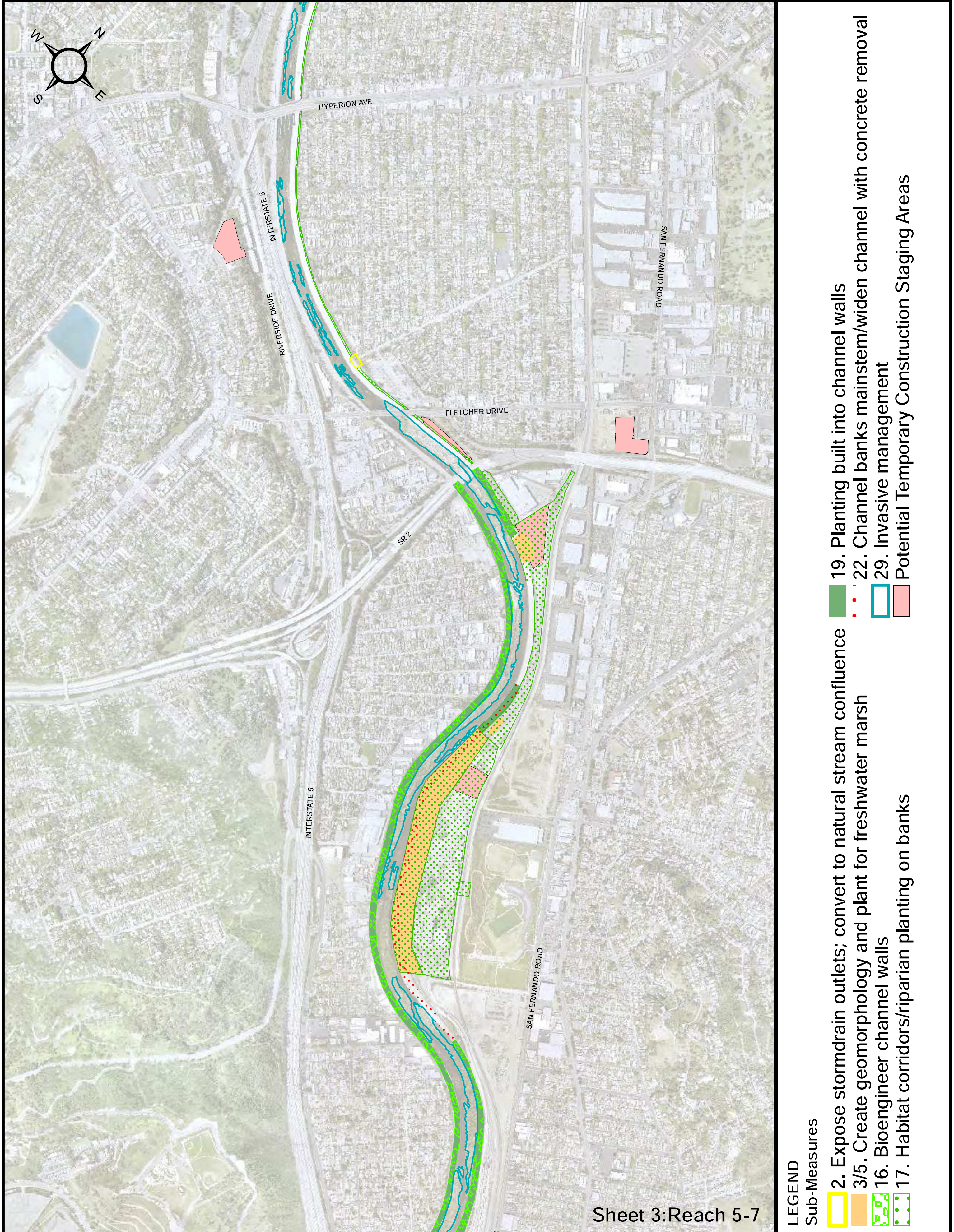
0 0.2 0.4 Miles



Data Source: USACE, 2011
City of Los Angeles, 2011
Aerial Source: LARIC 2008

Alternative 13, ARBOR Corridor Extension (ACE)
Los Angeles River Ecosystem Restoration (Feb, 2013)

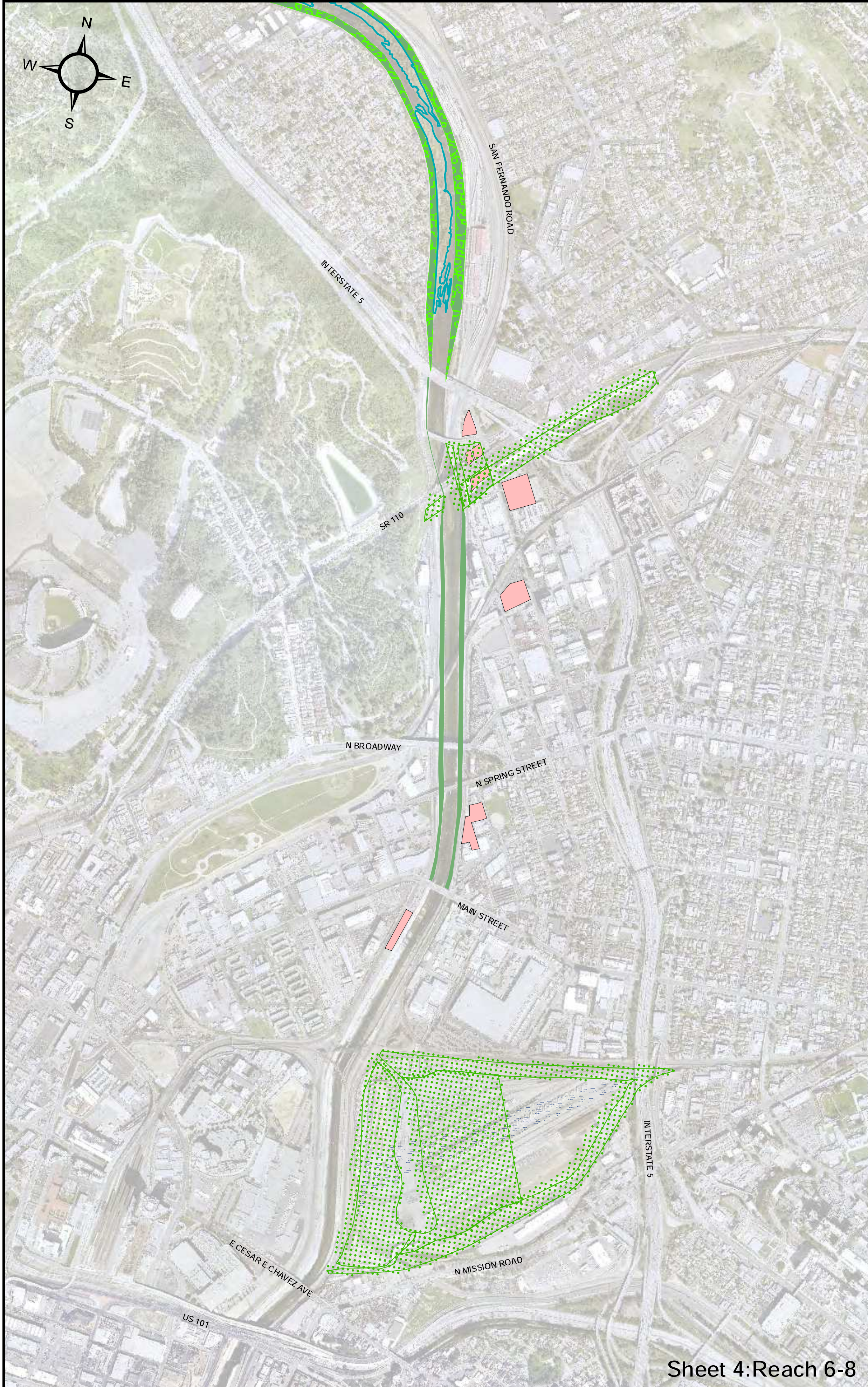
0 0.2 0.4 Miles



Data Source: USACE, 2011
City of Los Angeles, 2011
Aerial Source: LARIC 2008

Alternative 13, ARBOR Corridor Extension (ACE)
Los Angeles River Ecosystem Restoration (Feb, 2013)

0 0.2 0.4 Miles



LEGEND

Sub-Measures

6. Rebuild geomorphology for historic wash

16. Bioengineer channel walls

17. Habitat corridors/riparian planting on banks

19. Planting built into channel walls

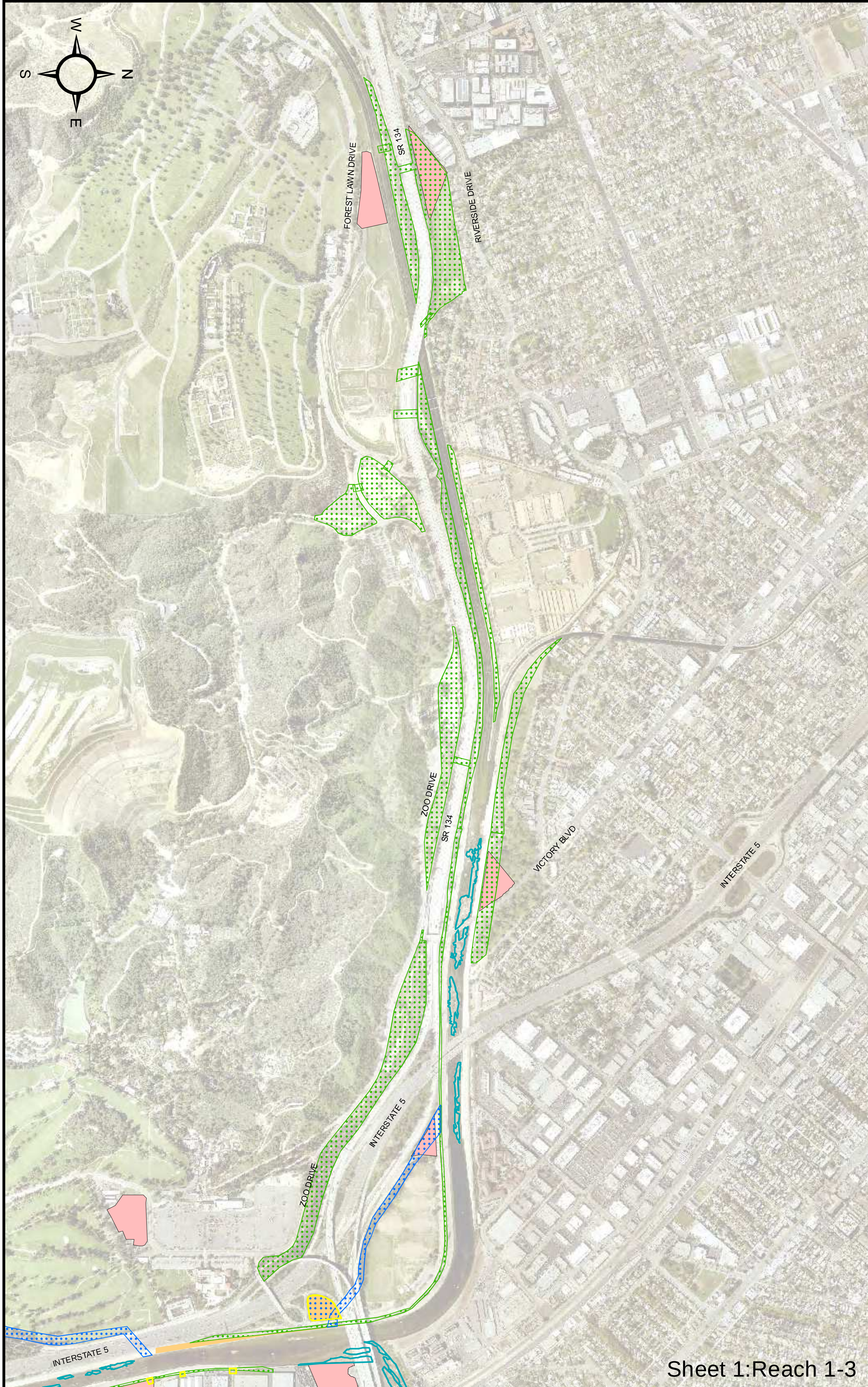
29. Invasive management

Potential Temporary Construction Staging Areas

Data Source: USACE, 2011
City of Los Angeles, 2011
Aerial Source: LARIC 2008

Alternative 13, ARBOR Corridor Extension (ACE)
Los Angeles River Ecosystem Restoration (Feb, 2013)

0 0.2 0.4 Miles



LEGEND

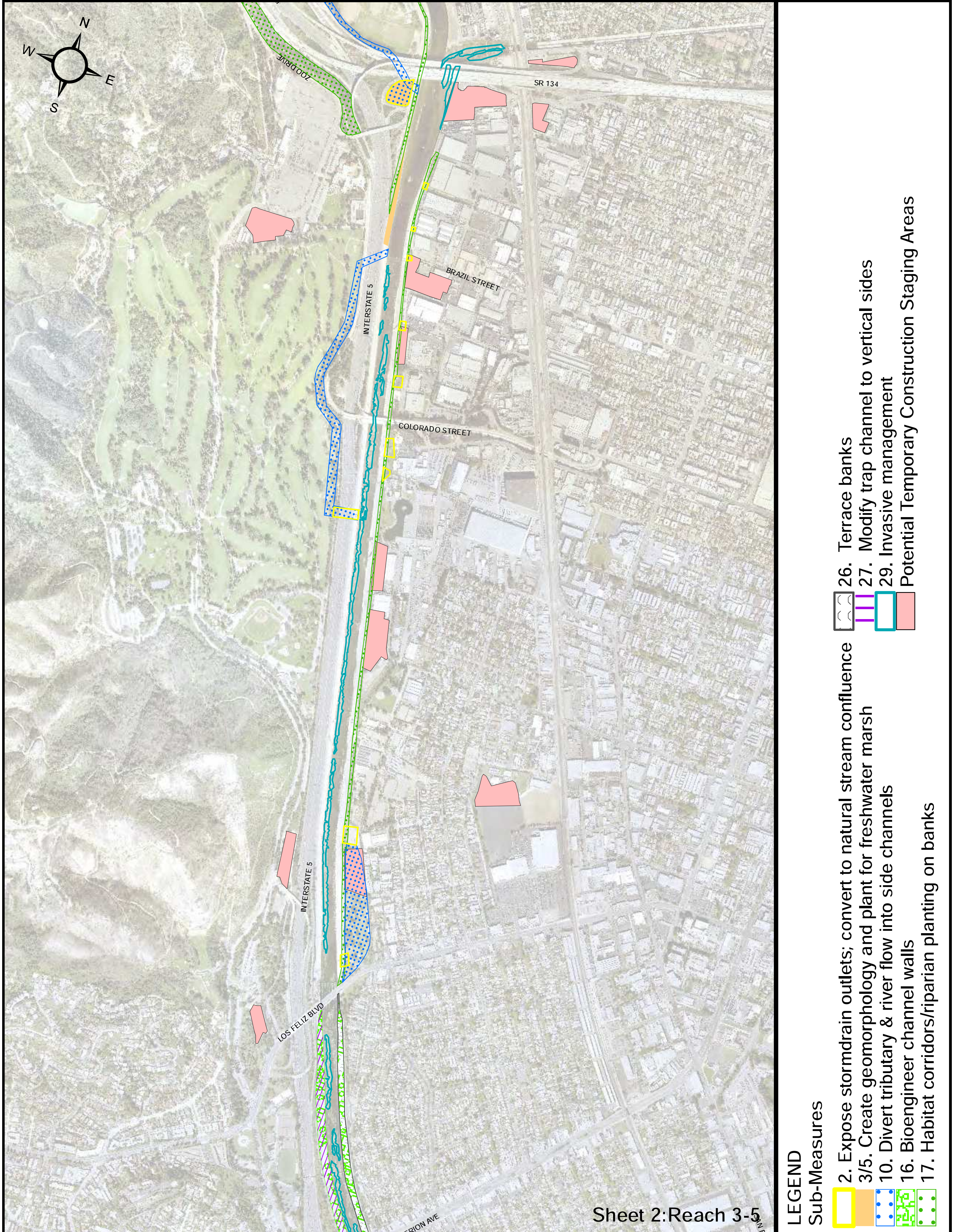
Sub-Measures

- 2. Expose stormdrain outlets; convert to natural stream confluence
- 3/5. Create geomorphology and plant for freshwater marsh
- 10. Divert tributary & river flow into side channels
- 17. Habitat corridors/riparian planting on banks
- 29. Invasive management
- Potential Temporary Construction Staging Areas

Data Source: USACE, 2011
City of Los Angeles, 2011
Aerial Source: LARIC 2008

Alternative 16, ARBOR Narrows to Downtown (AND)
Los Angeles River Ecosystem Restoration (Feb, 2013)

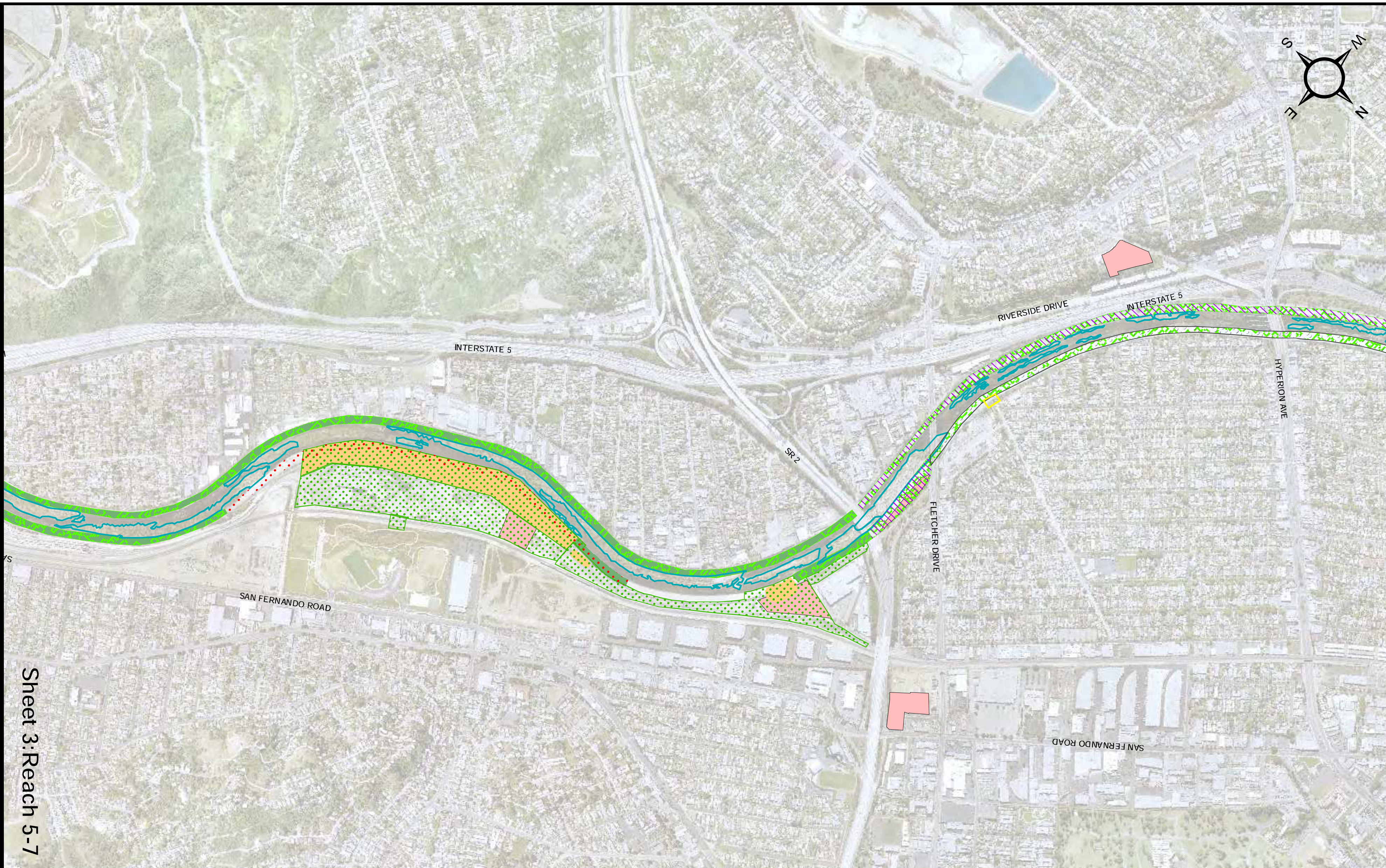
0 0.2 0.4 Miles



Data Source: USACE, 2011
City of Los Angeles, 2011
Aerial Source: LARIC 2008

Alternative 16, ARBOR Narrows to Downtown (AND)
Los Angeles River Ecosystem Restoration (Feb, 2013)

0 0.2 0.4 Miles



LEGEND

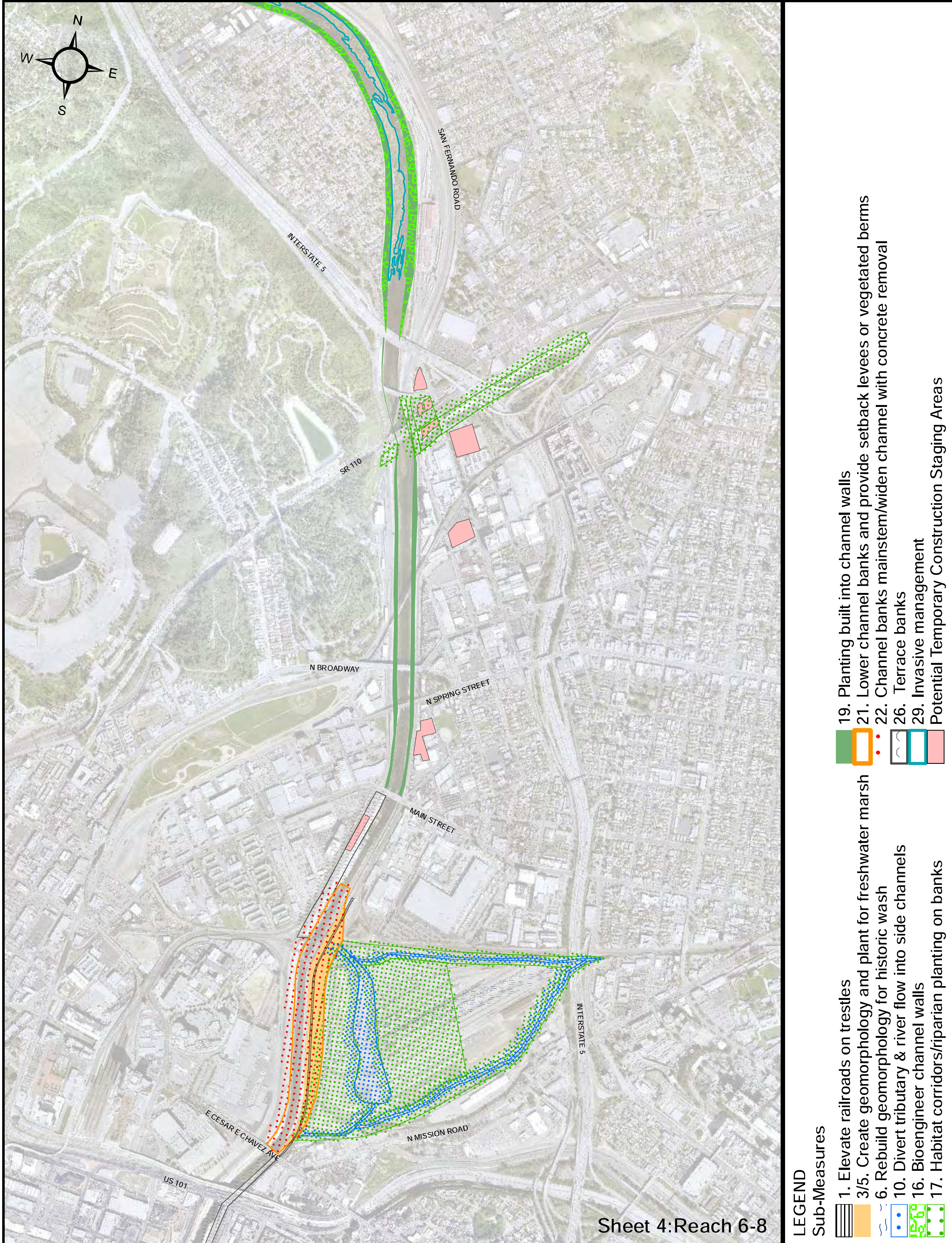
Sub-Measures

- 2. Expose stormdrain outlets; convert to natural stream confluence
- 3/5. Create geomorphology and plant for freshwater marsh
- 16. Bioengineer channel walls
- 17. Habitat corridors/riparian planting on banks
- 19. Planting built into channel walls
- 22. Channel banks mainstem/widen channel with concrete removal
- 26. Terrace banks
- 27. Modify trap channel to vertical sides
- 29. Invasive management
- Potential Temporary Construction Staging Areas

Data Source: USACE, 2011
City of Los Angeles, 2011
Aerial Source: LARIC 2008

Alternative 16, ARBOR Narrows to Downtown (AND)
Los Angeles River Ecosystem Restoration (Feb, 2013)

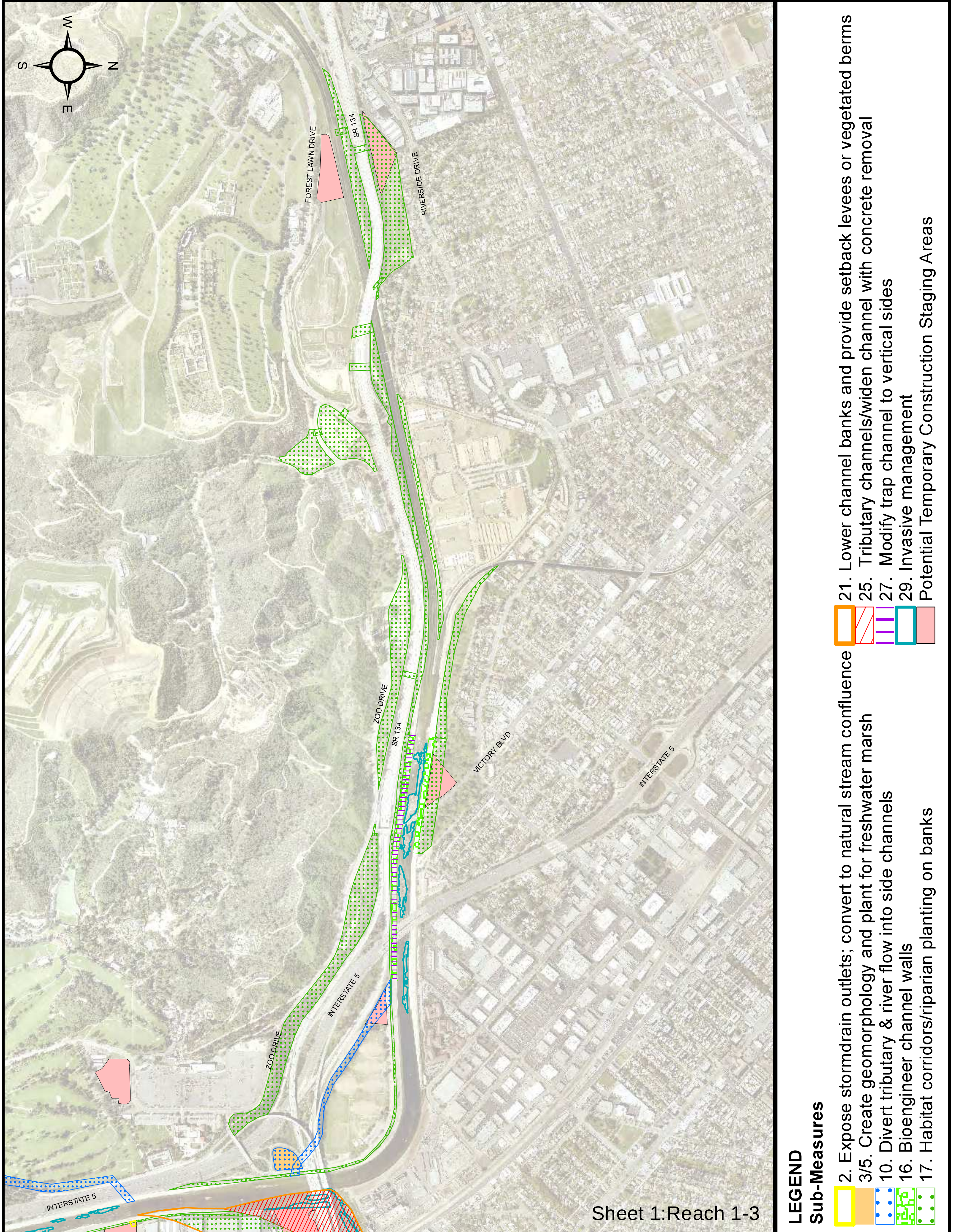
0 0.2 0.4 Miles



Data Source: USACE, 2011
City of Los Angeles, 2011
Aerial Source: LARIC 2008

Alternative 16, ARBOR Narrows to Downtown (AND)
Los Angeles River Ecosystem Restoration (Feb, 2013)

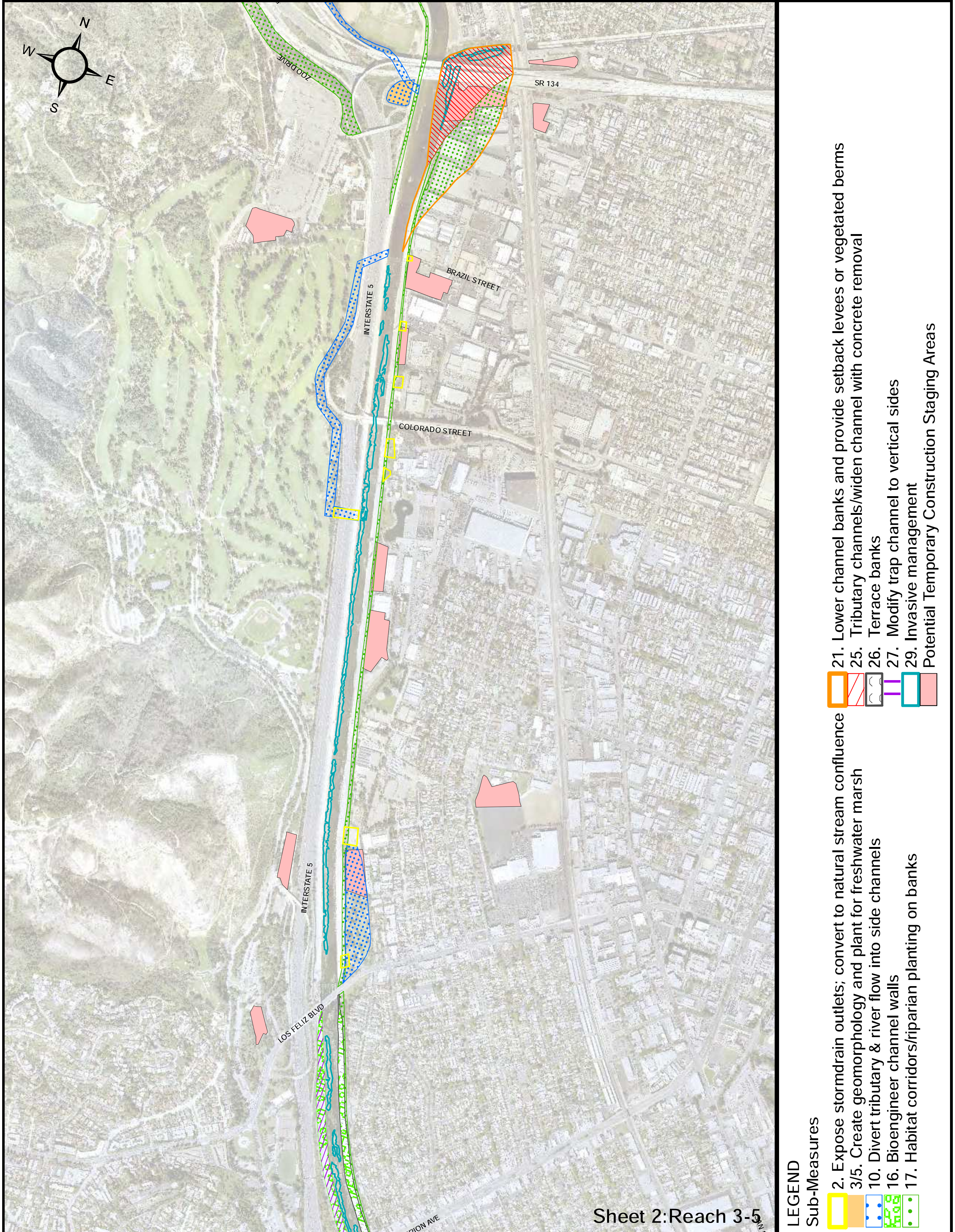
0 0.2 0.4 Miles



Data Source: USACE, 2011
City of Los Angeles, 2011
Aerial Source: LARIC 2008

Alternative 20, ARBOR, Riparian Integration via Varied Ecological Restoration (RIVER)
Los Angeles River Ecosystem Restoration (Feb, 2013)

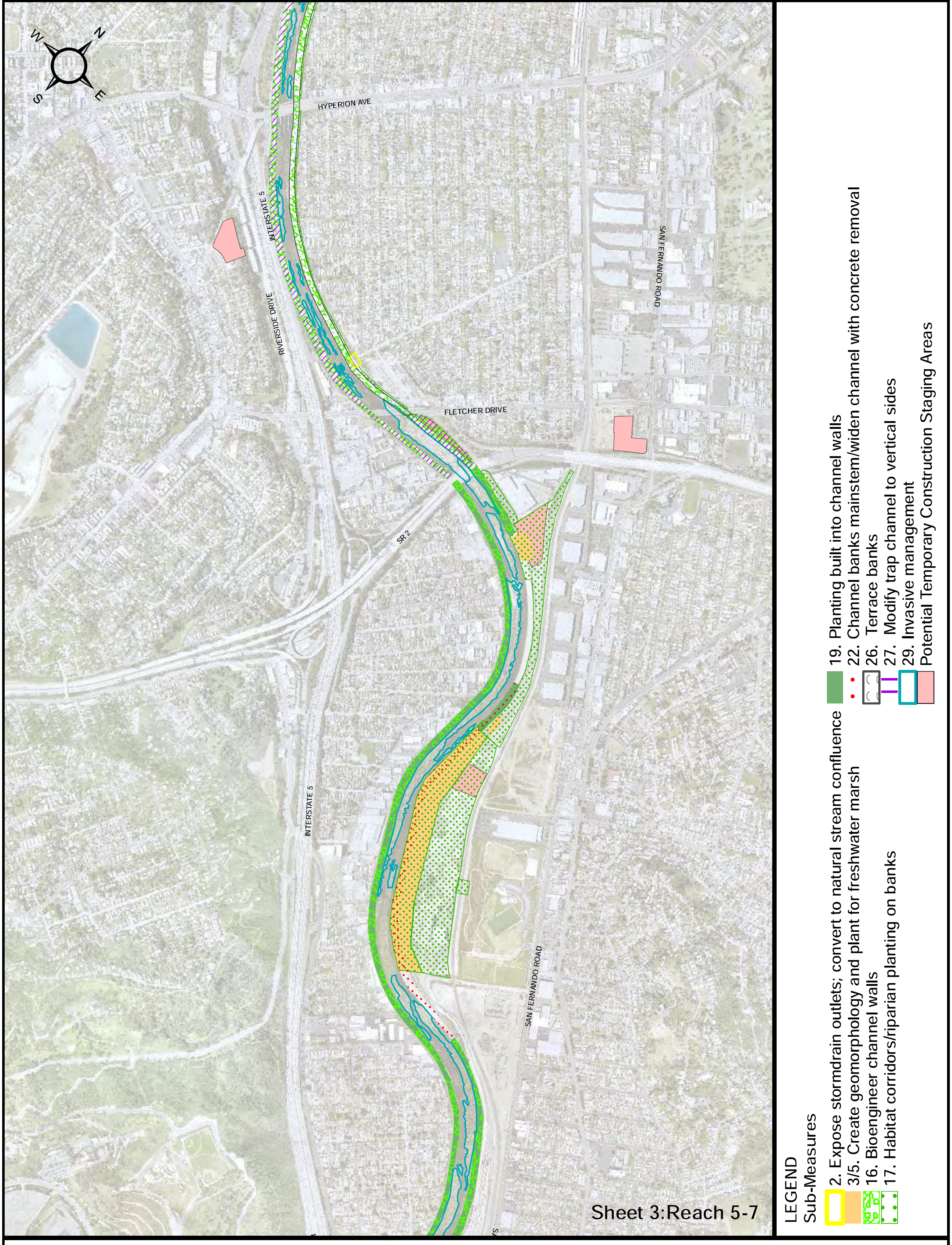
Miles
0 0.2 0.4



Data Source: USACE, 2011
City of Los Angeles, 2011
Aerial Source: LARIC 2008

Alternative 20, ARBOR, Riparian Integration
via Varied Ecological Restoration (RIVER)
Los Angeles River Ecosystem Restoration (Feb, 2013)

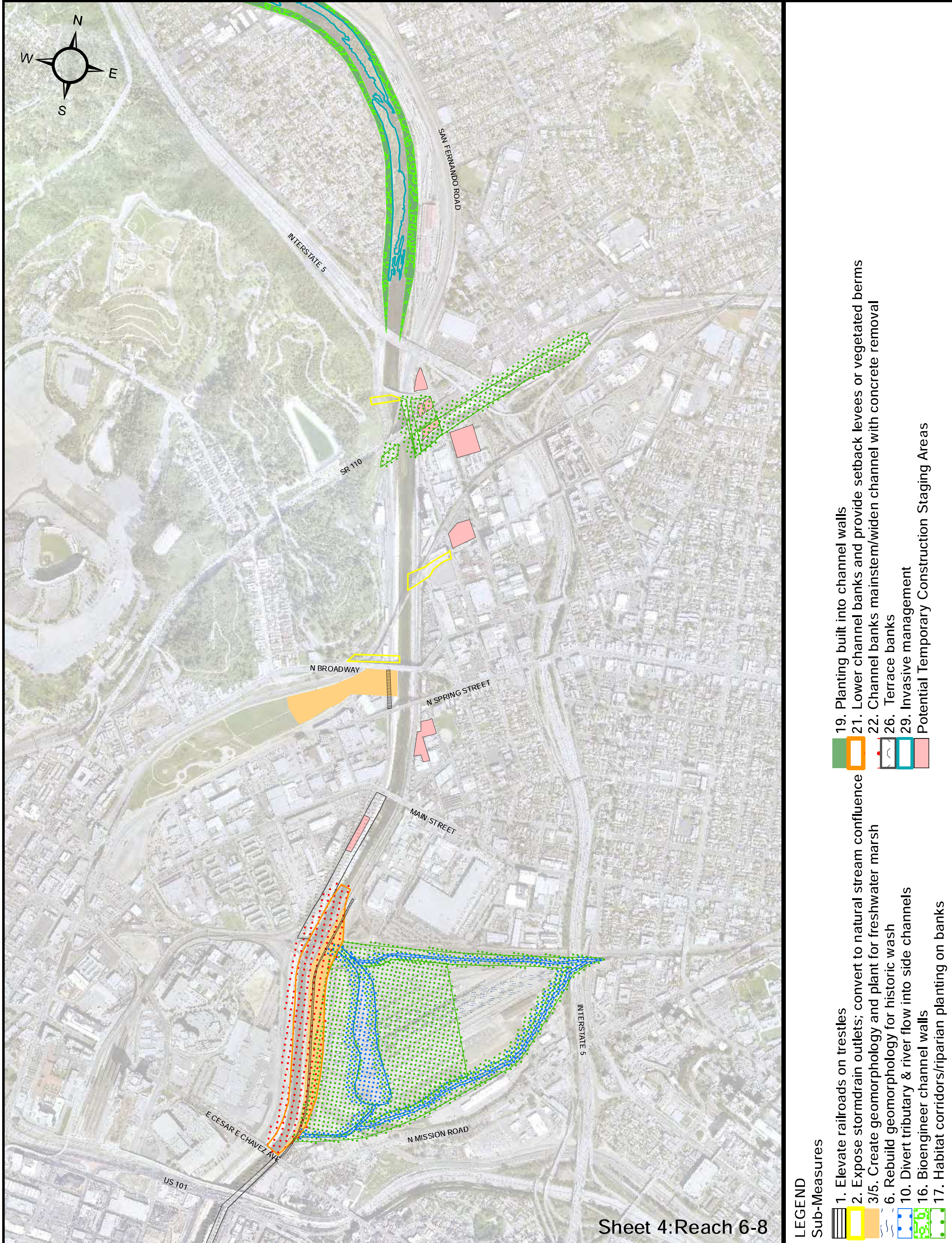
0 0.2 0.4 Miles



Data Source: USACE, 2011
City of Los Angeles, 2011
Aerial Source: LARIC 2008

Alternative 20, ARBOR, Riparian Integration
via Varied Ecological Restoration (RIVER)
Los Angeles River Ecosystem Restoration (Feb, 2013)

0 0.2 0.4 Miles



Data Source: USACE, 2011
City of Los Angeles, 2011
Aerial Source: LARIC 2008

Alternative 20, ARBOR, Riparian Integration
via Varied Ecological Restoration (RIVER)
Los Angeles River Ecosystem Restoration (Feb, 2013)

0 0.2 0.4 Miles

Figure 4-21. Reach 1. Pollywog Park, looking southeast.
Existing and Rendering of Proposed Restoration and Recreation Features

Figure 4-22. Reach 2. Looking Upstream from Riverside Drive Bridge
Existing Channel and Rendering of Proposed Terraced Banks/Vegetated Channel Walls

Figure 4-23. Reach 3. Ferraro Fields. Looking Westward/Upstream. Existing and Rendering of Proposed Side Channel with Daylighted Stream.

Figure 4-24. Reach 3. Verdugo Wash. Looking Downstream.
Existing and Rendering of Proposed Restoration Measures

Reach 4. Los Feliz Golf Course. Looking Westward.
Existing and Rendering of Proposed Restoration Measures

Figure 4-26. Reach 6. Looking West, with the Bowtie Parcel in the Foreground and Marsh Park in the Background. Existing Channel and Rendering of Proposed Daylighted Stream and Vegetated Walls.

Figure 4-27. Reach 6. Taylor Yard, Looking Downstream
Existing and Rendering of Proposed Restored Reach

Figure 4-28. Reach 7. Arroyo Seco Channel, Looking Westward
Existing Channel and Rendering of Proposed Restored Arroyo Seco Tributary

Figure 4-29. Reach 7. Cornfields, Looking Downstream. Existing and Rendering of Proposed Restoration Measures at the River Channel and the Los Angeles State Historic Park

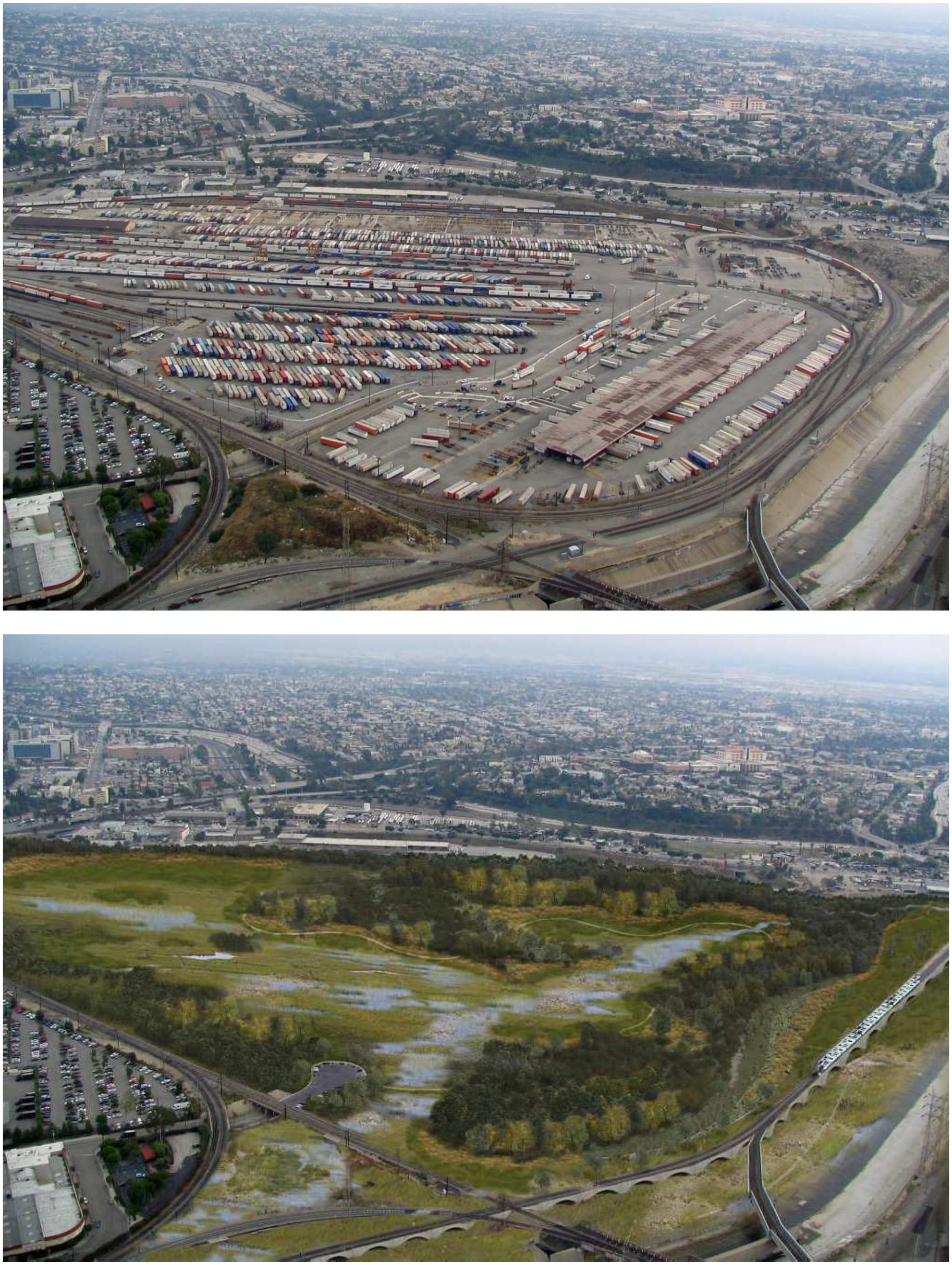


*Figure 4-30. Reach 8. Piggyback Yard, Looking Southeastward
Existing and Rendering of Proposed Restoration Measures*

5 EVALUATION OF ALTERNATIVE PLANS AND ENVIRONMENTAL CONSEQUENCES

This section evaluates the environmental impacts of the no action alternative and the four action alternatives. The environmental conditions for each resource are compared with future conditions for each alternative plan. Both beneficial and adverse effects are considered, including direct effects during construction and indirect effects resulting from restoration under each of the proposed alternatives. A short description of relevant regulations is given for each resource area; additional information regarding specific regulations that may require permits or consultation is given in Section 10 of this report.

The basis of significance for each resource is used to evaluate the significance of any adverse effects, and measures are proposed to avoid, minimize, or mitigate any significant adverse effects for each resource. The USACE has integrated NEPA requirements into its regulations, policies, and guidance. Engineering Regulation 1105-2-100, "Planning Guidance Notebook," April 2000, provides the following for identifying significant effects:

- Significance based on institutional recognition means that the importance of the effect is acknowledged in the laws, adopted plans, and other policy statements of public agencies and private groups. Institutional recognition is often in the form of specific criteria.
- Significance based on public recognition means that some segment of the general public recognized the importance of the effect. Public recognition may take the form of controversy, support, conflict, or opposition expressed formally or informally.
- Significance based on technical recognition means that the importance of an effect is based on the technical or scientific criteria related to critical resource characteristics.

For this EIS/EIR, the NEPA analysis typically adopts the CEQA thresholds of significance stated for each resource to address significance. However, for some resources, the NEPA analysis identifies significance thresholds in addition to the CEQA thresholds. In the case of the air quality and greenhouse gas analysis, the NEPA analysis does not adopt the CEQA thresholds and instead applies separate significance criteria in accordance with the Clean Air Act.

The following alternatives are under review in this chapter:

- No Action Alternative.
- Alternative 10 or ART (for ARBOR Riparian Transitions) provides restoration in all reaches and provides transitions or connections between existing riparian corridors and concrete lined river reaches.
- Alternative 13 or ACE (for ARBOR Corridor Extension) adds additional restoration in the soft bottom reaches of the Glendale Narrows, increased widening in Taylor Yard, and restoration at the Arroyo Seco confluence.
- Alternative 16 or AND (for ARBOR Narrows to Downtown) widens and adds terracing in Reach 5, and adds terracing, widening, softening of the bed and restored wetlands in Piggyback Yard.
- Alternative 20 or RIVER (for Riparian Integration via Varied Ecological Reintroduction) widens Reach 2, restores the confluence with Verdugo Wash in Reach 3, and restores wetlands at the Los Angeles State Historic Park with a terraced connection to the mainstem in Reach 7.

As discussed in Chapter 4, the plan ultimately selected may be an alternative within the spectrum of the final array alternatives fully analyzed in this draft IFR.

Where appropriate, descriptions of potential impacts for each alternative have been identified by geomorphic reach grouping (Reaches 1-3, 4-6, and 7-8). For other resources, impacts have been provided for individual reaches or by study area as appropriate. A summary of potential effects by alternative is shown in Table 5-1.

Table 5-1 Comparison of Potential Impacts

Resource	No Action Alternative	Alternative 10 (ART)	Alternative 13 (ACE)	Alternative 16 (AND)	Alternative 20 (RIVER)
GEOLOGY, SEISMOLOGY, SOILS, AND MINERALS	***Construction Impacts*** None. ***Operation Impacts*** None.	***Construction Impacts*** Soil erosion resulting from heavy equipment would be controlled through BMPs and would be temporary, making impacts less than significant. ***Operation Impacts*** Soil erosion resulting from heavy equipment necessary for operation and maintenance will be controlled through BMPs and would be less than significant. Beneficial impacts to operations would include the vegetation and stabilization of project area soils.	***Construction Impacts*** Potential impacted area increases from Alt 10 as does type of demolition and construction. However, BMP protection of soils and the temporary nature of construction mean less than significant adverse impacts. ***Operation Impacts*** Operation impacts are the same as Alternative 10. Beneficial impacts would increase where additional riparian vegetation is established and non-native plants are removed.	***Construction Impacts*** Alt 16 construction is larger in scale and duration than Alt 10 and 13, yet employs the same methods. BMPs and temporary disturbance result in less than significant adverse impacts. ***Operation Impacts*** Operation impacts are the same as Alternative 10. Beneficial impacts would increase where additional riparian vegetation is established and non-native plants are removed.	***Construction Impacts*** Alt 20 construction is larger in scale and duration than other alternatives, yet employs the same methods. BMPs and temporary disturbance result in less than significant adverse impacts. ***Operation Impacts*** Operation impacts are the same as Alternative 10. Beneficial impacts would increase where additional riparian vegetation is established and non-native plants are removed.
AIR QUALITY AND GREENHOUSE GASES	***Construction Impacts*** None. ***Operation Impacts*** There would be no change in operations or operational impacts. Benefits to air quality through revegetation would not occur.	***Construction Impacts*** Construction of the proposed project is expected to exceed the following thresholds: (1) the CEQA regional significance thresholds for ROG and NOx; (2) the CEQA localized significance thresholds for NOx, PM10, and PM2.5; and (3) the NEPA significance thresholds for NOx and CO. These constitute significant, unavoidable adverse impacts. Overall project-related odor impacts during construction would be less than significant. No exceedances of GHG thresholds. ***Operation Impacts*** Newly created mixed used areas will attract both motor and non-motor vehicles, resulting in an offset of potential impacts resulting from additional motor vehicle visitation.	***Construction Impacts*** Air quality impacts are the same as Alt 10, as well as additional exceedances of the CEQA regional significance thresholds for CO and the CEQA localized significance thresholds for CO. These constitute significant, unavoidable adverse impacts. Odor impacts are the same as Alt 10. ***Operation Impacts*** Same as Alt 10.	***Construction Impacts*** Air quality impacts are the same as Alt 13, as well as additional exceedances of the CEQA regional significance thresholds for PM2.5 and the NEPA significance thresholds for ROG. These constitute significant, unavoidable adverse impacts. ***Operation Impacts*** Same as Alt 10.	***Construction Impacts*** Air quality impacts are the same as Alt 16. These constitute significant, unavoidable adverse impacts. ***Operation Impacts*** Same as Alt 10.
LAND USE	***Construction Impacts*** None. ***Operation Impacts*** There would be no change in operations or operational impacts. Improved land use conditions adjacent to the river would not occur.	***Construction Impacts*** None. ***Operational Impacts*** Restoration of Piggyback Yard to riparian habitat would conflict with the Industrial land use designation, as well as specific goals and policies concerning industrial land uses in local plans. This results in a significant adverse impact.	***Construction Impacts*** None. ***Operational Impacts*** Same as Alt 10.	***Construction Impacts*** None. ***Operational Impacts*** Same as Alt 10.	***Construction Impacts*** None. ***Operational Impacts*** Same as Alternative 10. Additional significant impact would occur under this alternative by converting Industrial land at Verdugo Wash to riparian habitat.
WATER RESOURCES	***Construction Impacts*** None. ***Operation Impacts*** No adverse impacts. Benefits to water quality and quantity would not occur.	***Construction Impacts*** Potential temporary impacts to surface water quality could include contamination by erosion, release of grease or oils, and resuspension of sediment. Use of BMPs and temporary nature of construction ensure that potential impact would be less than significant. Restoration measures are designed to not impair flood risk management functions. Base flows supportive of beneficial uses, which protect aquatic life and human uses, may be temporarily affected in the immediate construction zone, but would not be affected upstream or downstream of the study area. ***Operation Impacts*** No adverse impacts from operation/maintenance measures will be guided by BMPs. Beneficial impacts result from increased pervious surfaces for infiltration, attenuation of flood waters from side channels, and decreased flows resulting from increased use in habitat functions. Incidental benefits would occur from removal of impervious surfaces and through physical and biological pollutant removal mechanisms when riverine habitat is established.	***Construction Impacts*** Same as Alternative 13, though covering a greater footprint. The same safeguards and BMPs would ensure that potential adverse impacts are less than significant. ***Operation Impacts*** Operation impacts and benefits under Alternative 13 would not significantly affect hydrologic features, water quality, and groundwater resources and would be similar to those found under Alternative 10, but over a larger area.	***Construction Impacts*** Same as Alternative 13, though covering a greater footprint. The same safeguards and BMPs would ensure that potential adverse impacts are less than significant. ***Operation Impacts*** Operation impacts and benefits would not significantly affect hydrologic features, water quality, and groundwater resources similar to those found under Alternative 10 and 13, but over a larger area than 13.	***Construction Impacts*** Same as Alternative 16, though covering a greater footprint. The same safeguards and BMPs would ensure that potential adverse impacts are less than significant. ***Operation Impacts*** Operation impacts and benefits would not significantly affect hydrologic features, water quality, and groundwater resources similar to those found under Alternative 10, 13, and 16, but over a larger area than any other alternative.
BIOLOGICAL RESOURCES	***Construction Impacts***	***Construction Impacts*** The effects of constructing riparian habitat corridors could include temporary air and noise pollution, which could	***Construction Impacts*** Same as Alt 10, though covering a larger footprint. All	***Construction Impacts*** Despite the increasing footprint, impacts will remain	***Construction Impacts*** Construction impacts for this alternative would be the similar to

Table 5-1 Comparison of Potential Impacts

Resource	No Action Alternative	Alternative 10 (ART)	Alternative 13 (ACE)	Alternative 16 (AND)	Alternative 20 (RIVER)
	None. ***Operation Impacts*** No adverse impacts. No new riparian, marsh, side channel or other habitat would be created and no *benefits* would be realized for fish and wildlife assemblages in the study area.	disturb sensitive (nesting, breeding, or fledging) populations of wildlife; sediment runoff into the River, which could impair habitat quality for fish and other aquatic creatures; and increased potential for infestation of invasive plant species. Temporary construction, ability of species to move into other areas, revegetation of disturbed areas, and the already degraded biological conditions result in adverse impacts from construction that are less than significant. ***Operation Impacts*** Operation and maintenance activities will be managed to ensure no adverse impacts. Following completion of restoration, the improved size and quality of habitat will be a significant beneficial impact to biological resources. Increased native riparian, wetland, and in channel habitats will benefit fish and wildlife. Greater connectivity of habitats and wildlife corridors will allow increased wildlife movement through the study area and into adjacent habitat areas.	construction impacts would be temporary and would ultimately result in improved aquatic and terrestrial conditions, making certain any potential adverse impacts were less than significant. ***Operation Impacts*** Same as Alt 10 though larger areas would be subject to operation and maintenance activities. This alternative would have greater beneficial impacts over the life of its operation than Alternative 10, since additional habitat would be restored.	less than significant for the same reasons detailed for Alt 10. ***Operation Impacts*** Operation of the project area would require the same maintenance and operations activities as those previously mentioned for Alternative 10 and 13. Because larger areas would be restored, truck and heavy equipment access, if needed, would be more limited. Benefits to biological resources would incrementally increase from Alt 13 due to the larger footprint.	those described for Alternatives10, 13, and 16, although the area involved and amount of earthwork needed would increase. ***Operation Impacts*** Operation of the project area would require the same maintenance and operations activities as those previously mentioned for Alternative 10, 13 and 16. Because larger areas would be restored, truck and heavy equipment access, if needed, would be more limited. Benefits to biological resources would incrementally increase from Alt 16 due to the larger footprint.
CULTURAL RESOURCES	***Construction Impacts*** No adverse impacts. Beneficial impacts associated with the locating, cataloguing, and protecting of cultural resources would not occur. ***Operation Impacts*** No adverse impacts.	***Construction Impacts*** Cultural resources are not fully recorded or evaluated and there is potential for their disturbance during construction. Based on the current plan, it is highly likely that historic properties could be encountered during construction and there is potential for impacts to historic archaeological resources associated with implementing this measure. However, by completing the required Section106 process and resolution of any adverse effects, significant impacts are not anticipated. ***Operation Impacts*** Operation and maintenance activities typically do not involve extensive ground disturbance, though further protection would be afforded if it were necessary under Section 106 and proper protocols. No significant adverse impacts are anticipated.	***Construction Impacts*** Same as Alt 10. ***Operation Impacts*** Same as Alt 10.	***Construction Impacts*** Same as Alt 10. ***Operation Impacts*** Same as Alt 10.	***Construction Impacts*** Though additional known cultural resources are present in the footprint of this alternative, including at Verdugo Wash and the Los Angeles State Historic Park, Section 106 protocols ensure that no significant adverse effects would occur. ***Operation Impacts*** Same as Alt 10.
TRAFFIC AND CIRCULATION	***Construction Impacts*** None. ***Operation Impacts*** No adverse impacts. Benefits to pedestrian, bicycle, and equestrian traffic through the study area would not occur.	***Construction Impacts*** Construction activities would occur over 161 days. A construction traffic management plan would be prepared and submitted to LADOT for review and approval prior to project implementation to ensure that impacts to railroads, bike lanes, and roadways are minimized. With implementation of a traffic management plan and traffic control plan, and the appropriate BMPs, additional construction traffic and temporary closures and diversions would have a minimal impact on roadways and intersections. LADOT considers temporary impacts to be less than significant. ***Operation Impacts*** The project would not alter the existing roadway network, introduce new hazards, change the roadway capacity or negatively impact emergency access. The project would add vehicle trips to area roads because it would make portions of the River a recreational destination, but would not likely affect the performance of the roadway network. Piggyback Yard rail spurs running would remain in place and continue to operate; however, the spur lines in the Yard's interior and the railyard storage capacity would be permanently removed. The reduction in railyard capacity would result in a long-term moderate adverse impact. Improved appearance and access would provide benefits to non-motorized trail users.	***Construction Impacts*** Construction activities would occur over 282 days, but for the same reasons noted in Alt 10, would not result in significant adverse effects. ***Operation Impacts*** Operational impacts on traffic and transportation would be similar to those described for Alternative 10.	***Construction Impacts*** Construction activities would occur over 624 days and the number of daily worker commute trips would be approximately three times as many as Alt 13. In addition, existing railroad alignments (left bank) would be raised onto trestles through Piggyback Yard. This would require temporary closure of the affected portion of the railroad line and rerouting of traffic using this line, which would result in delays for the rerouted rail traffic and for rail traffic on the lines to which traffic is rerouted. This short-term impact would be significant, since it would be difficult to find sufficient capacity on other rail lines to reroute freight, passenger, and high-speed rail trains while the trestles are being constructed. ***Operation Impacts*** Operational impacts on traffic and transportation would be similar to those described for Alternative 10 and 13.	***Construction Impacts*** Construction activities would occur over 726 days and the number of daily worker commute trips would be higher than all other alternatives. Additional impacts would result from raising an additional railroad trestle (right bank) through Piggyback Yard. This would be a greater short-term significant adverse impact to rail transportation than Alt 16 by requiring an additional temporary closure and rerouting of traffic using this line. For those reasons noted in Alts 10, 13, and 16, there would be short-term significant adverse effects but no long-term effects. ***Operation Impacts*** Operational impacts on traffic and transportation would be similar to those described for Alternative 10, 13 and 16.
NOISE	***Construction Impacts*** None.	***Construction Impacts*** Construction activities could increase noise levels at nearby sensitive receptors, but would be less than significant with the incorporation of avoidance measures and because of the relatively short	***Construction Impacts*** Although the overall duration of construction would be longer than Alt 10, impacts at each restoration	***Construction Impacts*** Although the overall duration of construction would be longer than Alt 13, impacts at each restoration	***Construction Impacts*** Although the overall duration of construction would be longer than Alt 16, impacts at each restoration

Table 5-1 Comparison of Potential Impacts

Resource	No Action Alternative	Alternative 10 (ART)	Alternative 13 (ACE)	Alternative 16 (AND)	Alternative 20 (RIVER)
	Operation Impacts None.	duration of increased noise at any given location. Noise impacts to wildlife are not likely to occur as animals may move to new habitat easily and, if necessary, construction will be timed to avoid sensitive species habitat, thereby avoiding significant impacts. ***Operation Impacts*** Operational impacts to noise-sensitive resources are not anticipated.	location would be short-term and similar in intensity. Construction noise impacts are expected to be less than significant. ***Operation Impacts*** Same as Alt 10.	location would be short-term and similar in intensity. Construction noise impacts are expected to be less than significant. ***Operation Impacts*** Same as Alt 10.	location would be short-term and similar in intensity. Construction noise impacts are expected to be less than significant. ***Operation Impacts*** Same as Alt 10.
RECREATION	***Construction Impacts*** None. ***Operation Impacts*** No adverse impacts. Benefits to recreation access would not occur.	***Construction Impacts*** During construction, potential adverse impacts will result from temporary or partial closure or relocation of trail systems, access points, bridges, or crossings along the River and golf courses. Temporary increases in noise and air pollution in the vicinity of construction may degrade the recreation experience at adjacent facilities. These effects may temporarily impact activities such as walking/jogging, cycling, equestrian, and bird watching. However, the minor and temporary nature of these impacts is considered to be less than significant. ***Operation Impacts*** Alternative 10 would have no significant adverse effect on recreation and public access resources in the study area. Beneficial effects would include improved aesthetic quality of the River, and increased quality, quantity, and diversity of recreation resources along the River. Habitat quality improvements may have larger beneficial effects on specific recreation activities which are heavily dependent on the health of the river, such as bird watching.	***Construction Impacts*** Minor temporary adverse effects would be similar to Alternative 10 with the addition of potential access impacts access to playing fields at Ferraro Fields. ***Operation Impacts*** Additional beneficial effects to recreational facilities, uses, access, opportunities and experiences would be expected for Alternative 13 due to the increased level of restoration.	***Construction Impacts*** Minor and temporary adverse recreation and public access effects during the construction period would be similar to those described for Alternative 13. ***Operation Impacts*** Potential benefits to recreation may be slightly higher than for Alternative 13 due to the increased level of restoration under Alternative 16.	***Construction Impacts*** Minor and temporary adverse recreation and public access effects during the construction period would be similar to those described for Alternative 16 with the potential temporary full or partial closure of Los Angeles State Historic Park for construction of marsh/wetland restoration features. ***Operation Impacts*** Potential benefits to recreation may be slightly higher than for Alternative 16 due to the increased level of restoration under Alternative 20.
AESTHETICS	***Construction Impacts*** None. ***Operation Impacts*** No adverse impacts. Benefits to aesthetic value would not be realized through plantings, creation of new habitats, and greening of channel.	***Construction Impacts*** Components of this alternative would result in temporary, non-significant impacts to aesthetic condition during construction. However, many of these areas are already in industrial use and therefore visually degraded. In areas regularly utilized for recreation, where aesthetic appeal is particularly desirable, construction efforts would be streamlined to occur quickly, to avoid interfering with recreational opportunities, and to affect as small an area as possible in order to minimize impacts. ***Operation Impacts*** Aesthetics will be greatly improved as a result of the restoration through riparian plantings along daylighted culverts, side channels, and overbank areas will mature and flourish, providing a greening and softening of the channel. Operation activities that require the presence of trucks will not significantly interfere with visual appeal.	***Construction Impacts*** Though proposed measures are anticipated to take longer to implement due to the expanded area covered by this alternative, impacts are the same as Alt 10. ***Operation Impacts*** Aesthetics along the River would be greatly improved as a result of the restoration. Operation and maintenance activities would not interfere with visual appeal.	***Construction Impacts*** Though proposed measures are anticipated to take longer to implement due to the expanded area covered by this alternative, impacts are the same as Alt 10. ***Operation Impacts*** Aesthetics along the River would be greatly improved as a result of the restoration. Operation and maintenance activities would not interfere with visual appeal.	***Construction Impacts*** Though proposed measures are anticipated to take longer to implement due to the expanded area covered by this alternative, impacts are the same as Alt 10. ***Operation Impacts*** Aesthetics along the River would be greatly improved as a result of the restoration. Operation and maintenance activities would not interfere with visual appeal.
PUBLIC HEALTH AND SAFETY/ HTRW	***Construction Impacts*** None. ***Operation Impacts*** No adverse impacts. Benefits to well-being of local residents through biological, recreational, and aesthetic improvements would not be realized.	***Construction Impacts*** Significant impacts of public health and safety hazards will be avoided through implementation of OSHA and USACE safety standards, and BMPs addressing each of these risks during construction, and compliance with all applicable laws, regulations, and ordinances. The sponsor would remediate or ensure remediation of HTRW contaminated soils on project lands prior to construction at those sites. The sponsor would be responsible for addressing HTRW contaminated groundwater during dewatering activities necessary for construction. These actions would reduce any potential impacts to less than significant. ***Operation Impacts*** Improved access could increase water-related injuries and bring people in proximity to HTRW areas. River channel designs would maximize safety and vector control agencies will be coordinated with to ensure that issues are addressed. As a result, impacts are anticipated to be less than significant.	***Construction Impacts*** Impacts would be the same as Alternative 10. The larger project footprint for this alternative is not anticipated to result in significant adverse impacts during construction. BMPs would reduce potential impacts to less than significant. ***Operation Impacts*** Impacts would be the same as Alternative 10.	***Construction Impacts*** Impacts would be the same as Alternatives 10 and 13. The larger project footprint for this alternative is not anticipated to result in significant adverse impacts during construction. BMPs would reduce potential impacts to less than significant. ***Operation Impacts*** Impacts would be the same as Alternatives 10 and 13.	***Construction Impacts*** Impacts would be the same as Alternatives 10, 13 and 16. The larger project footprint for this alternative is not anticipated to result in significant adverse impacts during construction. As with the other alternatives, BMPs would reduce potential impacts to less than significant. ***Operation Impacts*** Impacts would be the same as Alternatives 10, 13 and 16.

Table 5-1 Comparison of Potential Impacts

Resource	No Action Alternative	Alternative 10 (ART)	Alternative 13 (ACE)	Alternative 16 (AND)	Alternative 20 (RIVER)
UTILITIES AND PUBLIC SERVICES	***Construction Impacts*** None. ***Operation Impacts*** None.	***Construction Impacts*** Utility and stormwater management plans would be prepared prior to the start of construction to ensure impacts are less than significant. Alternative 10 would generate 2,081 tons of debris per day which would not exceed landfill capacity. No additional public services are anticipated to be needed during construction. ***Operation Impacts*** Maintenance of plantings may result in a long-term increased demand for water and electricity, resulting in a minor impact. Beneficial impacts to outdoor education would arise in the form of opportunities for local schools.	***Construction Impacts*** Though construction activities would occur over a longer time period than for Alt 10, adverse impacts would remain less than significant. Alternative 13 would generate 1,498 tons of debris per day, which would not exceed landfill capacity. ***Operation Impacts*** Impacts to public services and utilities would be the same as those described for Alternative 10 and would be less than significant.	***Construction Impacts*** Though construction activities would occur over a longer time period than for Alt 13, adverse impacts would remain less than significant. Alt 16 would generate 2,022 tons of debris per day, which would not exceed landfill capacity. ***Operation Impacts*** Impacts to public services and utilities would be the same as those described for Alternatives 10 and 13 and would be less than significant.	***Construction Impacts*** Though construction activities would occur over a longer time period than for Alt 13, adverse impacts would remain less than significant. Alt 20 would generate 2,383 tons of debris per day, which would not exceed landfill capacity. ***Operation Impacts*** Impacts to public services and utilities would be the same as those described for Alternatives 10, 13, and 16 and would be less than significant
SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE	***Construction Impacts*** None. ***Operation Impacts*** No adverse impacts. Benefits to populations of minorities and those living at the poverty level would not be realized through the improvement of existing recreation access, aesthetic improvement, and biological restoration.	***Construction Impacts*** Temporary closures or reduced access to recreational facilities would be temporary, coordinated with appropriate entities, and less than significant. The infusion of construction funds into the regional economy will generate economic benefits. No populations would be disproportionately affected. ***Operation Impacts*** Relocation of Piggyback Yard function/facilities would be assisted by the sponsor per the Uniform Relocation Act of 1970, as amended, resulting in less than significant adverse impacts to socioeconomics. Working class jobs at Piggyback Yard that may be transferred elsewhere may disproportionately affect low-income and minority populations surrounding Piggyback Yard, resulting in a potentially significant adverse impact. Improved aesthetic quality, habitat value, quality and quantity of recreation resources, and improved accessibility would provide beneficial effects. Tourism at the restored Piggyback Yard could potentially provide a partial offset to socioeconomic losses.	***Construction Impacts*** Generally the same as Alt 10, or slightly amplified. ***Operation Impacts*** Generally the same as Alt 10, or slightly amplified.	***Construction Impacts*** Generally the same as Alt 13, or slightly amplified. ***Operation Impacts*** Generally the same as Alt 13, or slightly amplified.	***Construction Impacts*** Generally the same as Alt 10, but slightly amplified. In addition, requires temporary partial closure of Los Angeles State Historic Park; a less than significant impact due to the temporary nature of the closure and the availability of substitute recreation areas in the vicinity. ***Operation Impacts*** Same as Alt 10 with additional adverse impacts at Verdugo Wash where commercial/industrial parcels would need to be acquired and businesses relocated. The sponsor would provide relocation assistance in accordance with the Uniform Relocation Act of 1970, as amended, which that is expected to ensure impacts would be less than significant.
CUMULATIVE IMPACTS	None.	Significant adverse long-term cumulative impacts have been identified for Land Use and potentially significant adverse impacts to Environmental Justice could also occur. Significant adverse short-term cumulative impacts have been identified for Air Quality. Significant beneficial long-term cumulative impacts have been identified for Biological Resources. Beneficial cumulative impacts have been identified for Water Resources, Recreation, and Aesthetics.	Cumulative Impacts would be the same as those described for Alternative 10.	Cumulative Impacts would be the same as those described for Alternative 10.	Cumulative Impacts would be would be similar to those described for Alternative 10, 13 and 16 but would be greatest with Alternative 20 because of the additional acquisition of industrial properties at the Verdugo Wash.

5.1 GEOLOGY, SEISMOLOGY, SOILS, AND MINERALS

5.1.1 Regulatory Framework

Numerous environmental laws and regulations govern the geologic and seismic resources in the study area. An overview of some of the more pertinent regulations and responsible agencies is presented below.

The United States Geologic Survey (USGS) of the U.S. Department of the Interior provides reliable scientific information to describe and understand the earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life. The USGS does not have regulatory authority/jurisdiction, but rather it provide scientific information that can be used to help mitigate impacts from natural disasters such as earthquakes, landslides, and volcanoes.

California has promulgated a number of regulations regarding geology and soils. The International Building Code regulates construction practices including sections pertinent to design and construction to avoid geotechnical hazards. The codes include design standards and general design parameters for seismic design. The State Building Standards Commission is responsible for administering California's building codes, including adopting, approving, publishing, and implementing codes and standards.

The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to address the hazards of surface faulting to buildings. This state law was a direct result of the 1971 San Fernando Earthquake. The purpose of the Alquist-Priolo Earthquake Fault Zoning Act is to prevent the construction of buildings used for human occupancy on the surface trace of active faults. This act only addresses the hazard of surface fault rupture. Other earthquake hazards are addressed by the Seismic Hazards Mapping Act passed in 1990, which addresses non-surface fault rupture earthquake hazards, including liquefaction and seismically induced landslides.

The Seismic Hazards Mapping Act requires the mapping of seismic hazard zones to mitigate hazards to help protect public health and safety. Included are shaking hazards, liquefaction, and landslides. Amplified shaking hazard zones are areas where historic occurrence of amplified ground shaking or local geological and geotechnical conditions indicate a potential for ground shaking to be amplified to such a level that mitigation would be required. Liquefaction hazard zones are areas where historic occurrences of liquefaction, or local geological, geotechnical, and groundwater conditions, indicate a potential for permanent ground displacement. Earthquake-induced landslide hazard zones are areas where Holocene occurrence of landslide movement, or local slope of terrain, and geological, geotechnical and ground moisture conditions indicate a potential for permanent ground displacements.

A number of local building permits and programs regulate development and construction of facilities in the City and Los Angeles County. The Los Angeles Building Code provides requirements for construction, grading, excavation, use of fill, and foundation work including types of materials and design, so as to minimize the likelihood and severity of consequences from geologic hazards. The Los Angeles Department of Building and Safety regulates construction and development in hillside areas.

5.1.2 Significance Criteria

Significance criteria for this resource are based primarily on the environmental checklist in the California Environmental Quality Act (2005) and Los Angeles Environmental Quality Act (City of Los Angeles 2006) guidelines. Restoration measures would be considered to have a significant impact to geologic and soil resources or topography if any of the following were to occur:

- They increased the exposure of people or structures to risk of loss, injury, or death resulting from earthquakes, liquefaction, or landslides.
- They resulted in substantial soil erosion loss or the loss of topsoil.
- They were constructed within a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landside, lateral spreading, subsidence, liquefaction, or collapse.
- They were constructed on expansive soil, as defined in the Uniform Building Code (1994), creating substantial risks to life or property.
- They would result in loss of a known valuable mineral resource or in the loss of availability of a locally important mineral resource identified in an approved land use plan.
- One or more distinct and prominent geologic or topographic features were destroyed, permanently covered, or materially and adversely modified. Such features may include, but are not limited to, hilltops, ridges, hillslopes, canyons, ravines, rock outcrops, waterbodies, streambeds, and wetlands.

5.1.3 Environmental Impacts

No Action Alternative

Construction Impacts

Under the No Action Alternative, topography and geology, soils, and seismic hazards would not be significantly affected by construction activities, since no construction would occur under this alternative. Topographic and geologic features, which include, but are not limited to, mountain range shifting, crustal spreading, subsidence, seismic ocean floor uplift, and basin sediment in-fill and subsequent aggradation would persist indefinitely, subject to weathering and possibly by other effects.

Soils would continue to be eroded and deposited from fluvial processes. Soil erosion in the headwaters of the watershed would continue to result in the transport and deposition of sediment along the soft bed channel sections of the study area.

Seismicity in Southern California is highly active and would continue to cause damages to people and structures in the study area and surrounding area, dependent upon the frequency and magnitude of seismic events. Threats to property and life where soils, topography, and climate are favorable for landslides along the foothills and slopes of the Santa Monica Mountains and the Repetto and Elysian Hills would continue. Areas identified as potential locations for liquefaction along the base of the Santa Monica Mountains, the Elysian and Repetto Hills, and along the Los Angeles River would remain hazards.

Operation Impacts

Under the No Action Alternative restoration measures would not be constructed; operation and maintenance would continue under the current LACDA operation manual, subject to funding availability. Operation impacts would not have a significant effect on topography and geology, soils, and seismic hazards.

Alternative 10 (ART)

Construction Impacts

Implementation of Alternative 10 would not have a significant impact on study area topography and geology, soils, or seismic hazards in the study area. Construction would be designed to code, as applicable for structural stability during earthquakes.
Alternative 10 would not have a significant impact on study area topography or underlying geology. Restoration measures under this alternative do not propose to alter or modify distinct topographic or

geologic landforms in the study area. Terracing of channel banks would result in slight changes in topography, but these changes are within the already modified topography of the River channel.

Ground-disturbing activities during construction could result in soil erosion, or loss of top soil in areas both within the channel itself and on upland areas above the channel. Under Alternative 10, ground-disturbing activities that may occur include:

- Demolition and excavation of concrete and earthen material for the construction of channel connectors under roadways,
- Demolition of channel walls and excavation of overbank areas at storm drain outlets for daylighting and wetland habitat creation,
- Demolition of concrete paved and or grouted rock channel bed and side slope protection,
- Widening of channel bed and top of banks via excavation and grading of earthen material,
- Excavation of channel bed and side slopes for riprap structures and terraced and in-channel planters,
- Use of heavy equipment for hauling away of concrete debris and excavated material, and
- Excavation for topsoil fill and vegetation establishment on side slopes of maintenance roads and channel.

Disturbances to soil in all areas would be otherwise controlled through a suite of erosion control measures designed for construction activities. The extent of ground disturbance would be minimized prior to construction by identifying the minimum required area for staging and access routes. Selection of staging areas and access routes would consider existing conditions, and would be located where soils are not already exposed or where disturbance has already occurred. Industrial districts, parking lots, and undeveloped ruderal areas would provide the best locations. Areas that have aesthetic, recreational, open space or habitat value would be avoided to the extent possible.

During construction, areas that would be disturbed within the project footprint, at staging locations, and along hauling routes would be evaluated to determine where erosion control measures would be necessary. These controls would include BMPs such as (1) the placement of straw bales or other filters that prevent soils from moving off-site during precipitation events, (2) placement of mulch or chemical stabilizers, and/or use of watering trucks where dry conditions could result in creation of fugitive dust, (3) identification of suitable locations for deposit of excavation spoils, and (4) minimization of number of truck trips or hauling distances, among others. Following construction efforts, disturbed ground would be restored with native plantings to stabilize exposed areas and return the site to aesthetically suitable conditions.

Following completion of restoration measures, areas planted with native species would incur beneficial impacts. Restored riparian zones would provide native plant cover to reduce erosion, while removal of impervious surfaces and daylighting of enclosed tributaries and storm drains would allow for increased nutrient exchange and groundwater percolation.

Measures that could increase the potential for harm to human health and safety during a fault rupture would result in a significant adverse impact. Other than the relocation and reconstruction of existing channel walls to widen the channel in Reach 6, the proposed measures are limited to habitat restoration; no major structures that could incur damages or pose a threat to the safety of persons in the event of failure would be built under the proposed alternative. Implementation of measures under this alternative would not cause or increase the risk of exposure of any person or structure to an active fault in the study area, and therefore would result in a less than significant impact.
The California Department of Conservation's Seismic Hazards and Zonation Program has classified all reaches of the study area as susceptible to liquefaction (CADC 2012b). Measures proposed under this

alternative include the removal of channel concrete in Reach 6, widening of the channel banks in Reach 6, vegetation of channel side slopes in Reach 6, and the naturalization of overbank areas in Reach 1, 2, 4, 5, 6, and 8. These measures would not be significant alterations in comparison to the existing channel's original construction nearly 70 years ago; as a conservative estimate and worst case scenario, it is assumed that measures would only slightly increase the chance of liquefaction due to minimal disturbance of the underlying soils and geology. This would not increase the hazard for liquefaction enough to be considered significant.

The California Department of Conservation's Seismic Hazards and Zonation Program has classified and mapped areas susceptible to landslides. These areas include the foothills and mountainous slopes of the Santa Monica Mountains and the Elysian and Repetto Hills (CADC 2012b). These areas do not overlap with the study area and the proposed restoration measures. As a result, proposed measures would not cause or increase the risk of landslides in the study area.

Operation Impacts

Operation impacts to topography, geology, soils, and seismicity post-construction are expected to be minimal and non-significant. Operation impacts would be similar in nature to the channel's current operation and maintenance activities. During the establishment of riparian and in-channel vegetation, topsoil erosion could occur due to high flows and may need to be replaced and/or replanted. Maintenance of restoration features would need to either follow existing, or develop new, channel maintenance BMP guidelines to prevent impacts to restoration measures and the project area during maintenance activities. Beneficial impacts from operations would include increased maintenance of substrate for vegetation establishment and stabilization of project area soils.

Alternative 13 (ACE)

Construction Impacts

Restoration measures in this alternative would include the measures in Alternative 10, but would add a pool and riffle system, riparian habitat corridors, and restructured channel walls, and would include more construction work in the Taylor Yard area. Erosion control procedures and post-construction restoration of disturbed sites are anticipated to occur in all project areas, as described under Alternative 10. As a result, implementation of Alternative 13 is not expected to result in significant adverse impacts to topography and geology, soils, and seismic hazards in the study area, nor would it increase the potential for liquefaction or landslides. In comparison to Alternative 10, beneficial impacts would increase in the areas identified for riparian restoration, which would increase by 22 acres, and 26 acres of freshwater habitat would be restored.

Operation Impacts

Operation impacts would be similar to Alternative 10, but may be slightly more extensive due to the larger area of restoration.

Alternative 16 (AND)

Construction Impacts

Alternative 16 proposes restoration measures that would cover a larger portion of the study area in comparison to Alternative 10. In comparison to Alternatives 10 and 13, measures under Alternative 16 would also include the relocation of existing railroad tracks to trestles, construction of planter boxes built into channel walls, and channel bed deepening. Construction impacts would be similar to those occurring under Alternative 10 and 13, but would include larger footprints of disturbance at Verdugo Wash, Taylor Yard, the Arroyo Seco confluence, and Piggyback Yard, and the following additional impacts:

- Demolition and excavation of channel walls to construct vegetated planter boxes,
- Demolition and excavation to deepen channel bed, and
- Demolition and excavation of old railroad features and construction of trestles for relocating the railroad above the restoration area.

As summarized in Alternative 10 and 13, all project area ground disturbances under Alternative 16 would be similarly treated for erosion control, and post-construction restoration would return disturbed areas to their original, or better, condition. As a result, implementation of Alternative 16 is not expected to have significant adverse impacts on topography and geology, soils, and seismic hazards in the study area, nor would it increase the potential for liquefaction or landslides. Instead, this alternative would provide benefits to soils in restored riparian zones that cover 19 additional acres compared to Alternative 10.

Operation Impacts

Operation impacts would not be significant and would be similar to Alternative 10 and 13, but with the potential for additional maintenance of topsoil and vegetation in proposed channel planter boxes and the more extensive footprint of restored riparian zones. Benefits to the stabilization of project area soils would be seen over an area 19 acres larger than under Alternative 10 due to more extensive restoration and revegetation efforts.

Alternative 20 (RIVER)

Construction Impacts

In comparison to Alternatives 10, 13, and 16, Alternative 20 proposes the most extensive restoration measures over the largest area, including 37 more acres of restored riparian habitat than the next largest alternative (16) spread amongst all reaches. Restoration measures under Alternative 20 are comparable to Alternative 16, but additionally include the widening of Verdugo Wash confluence and more extensive channel reshaping activities. Alternative 20 does not include the construction of channel planter boxes. Construction impacts would be similar to Alternative 16, with the following additional effects:

- Demolition, excavation, and reshaping of existing channel walls to widen channel invert, and
- Demolition and excavation at the confluence area of Verdugo Wash.

As discussed in Alternatives 10, 13, and 16, construction activities resulting in project area ground disturbances in Alternative 20 would be similarly treated for erosion control, and post-construction restoration would return disturbed areas to their original, or better, condition. As a result, implementation of Alternative 20 is not expected to have significant adverse impacts on topography and geology, soils, and seismic hazards in the study area, nor would it increase the potential for liquefaction or landslides. Implemented restoration measures would benefit existing soil conditions in restored riparian areas by stabilizing them.

Operation Impacts

Operation impacts under Alternative 20 would not be significant and would be similar to Alternative 16, but would not include the needed maintenance of planter box topsoil and vegetation.

5.1.4 Best Management Practices and Impact Avoidance Measures

For all four action alternatives, BMPs would include, but not be limited to, the following:

- Minimizing the extent of areas to be cleared, graded, or recontoured,
- Erecting construction fencing in all areas that require clearing, grading, revegetation, or recontouring,

- Conducting all construction work in accordance with site-specific construction plans that minimize the potential for sediment to enter the stream,
- Applying mulch or chemical stabilizers to disturbed areas as needed, and/or using a water truck to reduce fugitive dust,
- Stabilizing and reseeding disturbed areas with native grasses after construction is complete,
- Installing silt fences to prevent silt and sediment from entering the River channel,
- Grading spoil sites to minimize surface erosion and prevent sediment from entering water courses or the stream channel to the maximum extent feasible,
- Designing and implementing a dewatering plan to avoid operating equipment in flowing water by using temporary cofferdams or some other suitable diversion to divert channel flow around the channel and bank construction area, and
- Limiting certain aspects of in-channel construction to the low-flow period between April 15 and October 31 (non-flood season) to minimize soil erosion.

5.2 AIR QUALITY AND GREENHOUSE GASES

5.2.1 Regulatory Framework

Sources of air emissions in the SCAB are regulated by the USEPA, CARB, and SCAQMD. In addition, regional and local jurisdictions play a role in air quality management. The role of each regulatory agency is discussed below.

Federal Regulations

The federal Clean Air Act (CAA) of 1963 and its subsequent amendments form the basis for the nation's air pollution control effort. The USEPA is responsible for implementing most aspects of the CAA. Basic elements of the act include the NAAQS for major air pollutants, hazardous air pollutant standards, attainment plans, motor vehicle emission standards, stationary source emission standards and permits, acid rain control measures, stratospheric ozone protection, and enforcement provisions.

The CAA delegates the enforcement of the federal standards to the states. In California, the CARB is responsible for enforcing air pollution regulations. In the SCAB, the SCAQMD has this responsibility.

General Conformity Rule

Section 176(c) of the CAA states that a federal agency cannot issue a permit for, or support an activity within, a nonattainment or maintenance area unless the agency determines it will conform to the most recent USEPA-approved State Implementation Plan (SIP). This means that projects using federal funds or requiring federal approval must not: (1) cause or contribute to any new violation of a NAAQS; (2) increase the frequency or severity of any existing violation; or (3) delay the timely attainment of any standard, interim emission reduction, or other milestone. The General Conformity Rule was updated in March 2010.

Based on the present attainment status of the SCAB (see Table 3-2), a federal action would conform to the SIP if its annual emissions remain below 100 tons of CO or PM2.5, 70 tons of PM10, 10 tons of NOx or VOC, or 25 tons of lead. These *de minimis* levels apply to both construction and operation activities. SCAQMD Rule 1901 adopts the guidelines of the General Conformity Rule.

State Implementation Plan

For areas that do not attain the NAAQS, the CAA requires the preparation of a SIP, detailing how the State will attain the NAAQS within mandated timeframes. In response to this requirement, the SCAQMD and Southern California Association of Governments (SCAG) developed the 2003 Air Quality

Management Plan (2003 AQMP) (SCAQMD, 2003a). The focus of the 2003 AQMP was to demonstrate attainment of the federal PM10 standard by 2006 and the federal one-hour O3 standard by 2010, while making expeditious progress toward attainment of State standards. The 2003 AQMP also includes a NO2 maintenance plan.

The SCAQMD and SCAG, in cooperation with the CARB and the USEPA, have developed the 2007 AQMP for the primary purposes of demonstrating compliance with the new PM2.5 and 8-hour O3 NAAQS. This plan also provides additional measures beyond the 2003 AQMP for the attainment of the PM10 standard that was not attained by 2006, the one-hour O3 NAAQS (the standard was revoked by the USEPA, but the SCAQMD is still tracking progress towards attainment of this standard), and other planning requirements. The SCAQMD Governing Board adopted the Final 2007 AQMP on June 1, 2007 (SCAQMD, 2007). Since it will be more difficult to achieve the 8-hour O3 NAAQS compared to the 1-hour O3 NAAQS, the 2007 AQMP contains substantially more emission reduction measures compared to the 2003 AQMP. The 2003 AQMP is still the latest approved Attainment Plan for PM10; however, the SCAQMD submitted a PM10 Redesignation Request and Attainment Plan for the SCAB to USEPA in 2010 that is currently pending USEPA action.

USEPA approved the 2007 8-hour O3 plan in March 2012, and approved nearly all elements of the 2007 PM2.5 plan in September 2012. However, in August 2012 USEPA proposed to withdraw approval of parts of the approved ozone planning requirements (VMT emissions offset demonstration), and proposed to find that the 1 hour O3 plan is inadequate for meeting the standard, which would require a new attainment plan be submitted as part of a revised SIP within 12 months of approval of this proposed inadequacy finding. The SCAQMD is currently in the process of preparing the 2012 AQMP and published the Draft 2012 AQMP in July 2012, a revised Draft 2012 AQMP in September 2012, and a Draft Final 2012 AQMP in November 2012.

On June 11, 2007, the USEPA re-designated the SCAB from nonattainment to attainment for the CO one-hour and eight-hour NAAQS. The USEPA also approved a SIP revision for the SCAB nonattainment area in California as meeting the CAA requirements for maintenance plans for CO. The USEPA made an adequacy finding and approved motor vehicle emission budgets, which are included in the maintenance plan. The USEPA also approved the California motor vehicle inspection and maintenance (I/M) program as meeting the low enhanced I/M requirements for CO in the South Coast region (USEPA, 2007).

Non-Road Diesel Fuel Rule

In May 2004, the USEPA set sulfur limits for non-road diesel fuel. Under this rule, starting January 1, 2012 (USEPA, 2004), diesel fuel used by all non-road equipment (not including marine and aircraft fuel) would be limited to 15 ppm sulfur, which would be equivalent to the sulfur content restrictions of the California Diesel Fuel Regulations.

Emission Standards for On-Road Trucks

To reduce emissions from on-road, heavy-duty diesel trucks, the USEPA established a series of cleaner emission standards for new engines, starting in 1988. These emission standards regulations have been revised over time and the latest effective regulation, the 2007 Heavy-Duty Highway Rule, provides for reductions in PM, NOx, and non-methane hydrocarbon emissions that were phased in during the model years 2007 through 2010 (USEPA, 2000).

Environmental Protection Agency Diesel Fuel Rule

This EPA rule limited the sulfur content in on-road diesel fuel to 15 ppm starting June 1, 2006 (EPA 2006a).

Off-Road Diesel Engine Rule

To reduce emissions from off-road diesel equipment, the EPA established a series of increasingly strict emission standards for new engines. Locomotives and marine vessels are exempt from this rule. Manufacturers of off-road diesel engines would be required to produce engines with certain emission standards under the following compliance schedule:

- Tier 1 standards were phased in from 1996 to 2000 (year of manufacture), depending on the engine horsepower category.
- Tier 2 standards were phased in from 2001 to 2006.
- Tier 3 standards were phased in from 2006 to 2008.
- Tier 4 standards, which likely will require add-on emissions control equipment to attain them, will be phased in from 2008 to 2015.

Greenhouse Gases

Under the provisions of the CAA, the USEPA has the authority to regulate GHGs should a finding be made that GHGs have the potential to create adverse impacts. In April 2007, the U.S. Supreme Court held that GHG emissions are pollutants within the meaning of the CAA. In reaching its decision, the Court also acknowledged that climate change results, in part, from anthropomorphic causes (Massachusetts et al. v. Environmental Protection Agency 549 U.S. 497, 2007). The Supreme Court's ruling paved the way for the regulation of GHG emissions by USEPA under the CAA. In response to this Supreme Court decision, on December 7, 2009 the USEPA Administrator signed two distinct findings regarding GHGs under Section 202(a) of the CAA:

- Endangerment Finding: That the current and projected concentrations of the GHGs in the atmosphere threaten the public health and welfare of current and future generations; and,
- Cause or Contribute Finding: That the combined emissions of GHGs from new motor vehicles and new motor vehicle engines contribute to the GHG pollution which threatens public health and welfare.

USEPA has enacted a number of GHG regulations and other environmental regulations that will impact GHG emissions, including:

- Mandatory GHG Reporting
- GHG Tailoring Rule for PSD Permits
- GHG Vehicle Emissions Standards
- Corporate Average Fuel Economy Standards
- Renewables Fuel Standard

On February 18, 2010, the Council for Environmental Quality (CEQ) issued its "Draft NEPA Guidance on Considerations of the Effects of Climate Change and Greenhouse Gas Emissions." On page 1 of the Draft NEPA Guidance, CEQ "affirms the requirements of the statute [*i.e.*, NEPA] and regulations and their applicability to GHGs and climate change impacts." CEQ also underscores the practical limits on the analysis of global climate change. For example, CEQ provides that "agencies should recognize the scientific limits of their ability to accurately predict climate change effects, especially of a short-term nature, and not devote effort to analyzing wholly speculative effects." (Draft NEPA Guidance, p. 2.) By the Draft NEPA Guidance, CEQ proposes that if a project would be reasonably anticipated to cause direct emissions of 25,000 metric tons or more of GHG emissions annually (or less than that amount on a long-term basis), lead agencies should provide a qualitative and quantitative assessment, and consider mitigation measures and reasonable alternatives. (Draft NEPA Guidance, pp. 1-2, 5.) However, CEQ does not propose that the "indicator level" (*i.e.*, 25,000 metric tons) be used measure indirect effects, which CEQ notes "must be bounded by limits of feasibility in evaluating upstream and downstream effects of Federal agency actions." (*Id.* at p. 3.) Also of note, "CEQ does not propose this [*i.e.*, 25,000 metric tons] as an indicator of a threshold of significant effects, but rather as an indicator of a minimum level of GHG emissions that may warrant some description in the appropriate NEPA analysis." (*Id.* at p. 2.).

State Regulations

California Clean Air Act

In California, the CARB is designated as the responsible agency for all air quality regulations. The CARB, which became part of the California Environmental Protection Agency (Cal/EPA) in 1991, is responsible for implementing the requirements of the federal CAA, regulating emissions from motor vehicles and consumer products, and implementing the California Clean Air Act of 1988 (CCAA). The CCAA outlines a program to attain the CAAQS for O3, NO2, SO2, and CO by the earliest practical date. Since the CAAQS are often more stringent than the NAAQS, attainment of these more stringent CAAQS will require more emission reductions than what will be required to show attainment of the NAAQS. Similar to the federal system, the State requirements and compliance dates are based on the severity of the ambient air quality standard violation within a region.

Assembly Bill (AB) 1807 – Air Toxics Program

AB 1807 established California's Air Toxics Program in 1983. The Air Toxics Program is a two-phased program for the identification and control of air toxics. During the first phase (identification), the CARB and the Office of Environmental Health Hazard Assessment (OEHHA) prepare draft reports on exposure assessment and health assessment. The draft reports are distributed for public review and comment. Comments can be made in writing or at public workshops. The report is then submitted to the independent scientific review panel (SRP), which reviews the reports for scientific accuracy and submits its findings to the CARB. The SRP is a nine-member group of professionals with backgrounds in disciplines such as medicine, atmospheric science, statistics, and toxicology. The SRP members are appointed by the Governor or the State legislature. At a public hearing, the Board decides whether to list the substance as a TAC.

Once the CARB identifies a substance as a TAC, it begins the second phase (control) of California's TAC program. In this phase, an assessment is conducted to determine the need for, and degree of, further controls. As in the identification phase, public outreach is an essential element in the development of a control plan and any control measures. The CARB works with districts and holds numerous public workshops and individual meetings with stakeholders in an open public process. If appropriate, each air toxic control measure is then adopted by the CARB at a public hearing.

AB 2588 – Air Toxics "Hot Spots" Information and Assessment Act

AB 2588, enacted in 1987, is designed to provide information to State and local agencies and to the general public on the extent of airborne emissions from stationary sources and the potential public health impact of those emissions. The "Hot Spots" Act requires that OEHHA develop risk assessment guidelines for the "Hot Spots" Program (Health and Safety Code Section 44360[b][2]). In addition, the "Hot Spots" Act specifically requires OEHHA to develop a "likelihood of risks" approach to health risk assessment. The "Hot Spots" Act requires stationary sources of TACs to prepare facility-wide health risk assessments in accordance with OEHHA guidelines, and to notify the public in the event of a potential health risk. The "Hot Spots" Act also establishes criteria for requiring implementation of risk reduction measures for high-risk facilities.

Heavy Duty Diesel Truck Idling Regulation

This CARB rule became effective February 1, 2005 and prohibits heavy-duty diesel trucks from idling for longer than five minutes at a time, unless they are queuing, provided the queue is located beyond 100 feet from any homes or schools (CARB, 2006a).

CARB Drayage Truck Regulation

This CARB rule became effective December 3, 2009. The regulation requires trucks to meet engine emission requirements by a certain date. Under Phase 1, by December 31, 2012, all trucks must reduce PM emissions by 85 percent and must meet 2007 engine emission standards. The Drayage Truck Regulation also requires trucks to be registered in the Drayage Truck Registry.

California Diesel Fuel Regulations

In 2004, the CARB set limits on the sulfur content of diesel fuel sold in California for use in on-road and off-road motor vehicles (CARB, 2004). Under this rule, diesel fuel used in motor vehicles except harbor craft and intrastate locomotives has been limited to 500 ppm sulfur since 1993. The sulfur limit was reduced to 15 ppm beginning on September 1, 2006. Diesel fuel used in harbor craft in the SCAB also was limited to 500 ppm sulfur starting January 1, 2006 and was lowered to 15 ppm sulfur on September 1, 2006.

Statewide Portable Equipment Registration Program (PERP)

The PERP establishes a uniform program to regulate portable engines and portable engine–driven equipment units (CARB, 2005b). Once registered in the PERP, engines and equipment units may operate throughout California without the need to obtain individual permits from local air districts, as long as the equipment is located at a single location for no more than 12 months. There may be construction equipment that would be required to be PERP registered, but there are no known operating emissions sources that would be subject to this regulation.

Heavy-Duty Diesel Truck Idling Regulation

This CARB rule affected heavy-duty diesel trucks in California beginning in 2008. The rule requires that heavy-duty trucks be equipped with a non-programmable engine system that shuts down the engine after 5 minutes to prevent long idling times or, as an alternative, meet a stringent NO_X idling emission standard.

On-Road Heavy-Duty Diesel Vehicles (In Use) Regulation

On December 12, 2008, CARB approved the on-road heavy-duty diesel vehicle (in use) regulation to significantly reduce PM and NO_X emissions from existing diesel vehicles operating in California. The regulation applies to nearly all diesel-fueled trucks and buses with a gross vehicle weight rating (GVWR) greater than 14,000 pounds that are privately or federally owned and for privately and publicly owned school buses.

Starting January 1, 2012, the regulation would phase-in requirements for heavier trucks to reduce PM emissions with exhaust retrofit filters that capture pollutants before they are emitted to the air or by replacing vehicles with newer vehicles that are originally equipped with PM filters. Starting on January 1, 2015, lighter trucks with a GVWR of 14,001 to 26,000 pounds with engines that are 20 years or older would need to be replaced with newer trucks. Starting January 1, 2020, all remaining trucks and buses would need to be replaced so that they would all have 2010 model year engines or equivalent emissions by 2023.

Greenhouse Gas Emissions

Responding to growing scientific and political concern regarding global climate change, California has recently adopted a series of laws to reduce the level of GHGs in the atmosphere and emissions of GHGs from commercial and private activities within the state. Assembly Bill (AB) 1493 requires the development and adoption of regulations to achieve “the maximum feasible reduction of greenhouse gases” emitted by noncommercial passenger vehicles, light-duty trucks, and other vehicles used primarily for personal transportation. It also requires CARB to design and implement emission limits, regulations, and other measures to reduce GHG emissions to 1990 levels by 2020.

Local Regulations and Agreements

The SCAQMD is primarily responsible for planning, implementing, and enforcing federal and State ambient standards within this portion of the SCAB. As part of its planning responsibilities SCAQMD prepares Air Quality Management Plans and Attainment Plans as necessary based on the attainment status of the air basins within its jurisdiction. The SCAQMD is also responsible for permitting and controlling stationary source criteria and air toxic pollutants as delegated by the USEPA.

Through the attainment planning process, the SCAQMD develops the SCAQMD Rules and Regulations to regulate sources of air pollution in the SCAB (SCAQMD, 2012b). The applicable SCAQMD rules to the Project are listed below.

SCAQMD Rule 401 – Visible Emissions

This rule prohibits discharge of air contaminants or other material, which are as dark or darker in shade as that designated No. 1 on the Ringelmann Chart or obscure an observer’s view.

SCAQMD Rule 402 – Nuisance

This rule prohibits discharge of air contaminants or other material that cause injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public; or that endanger the comfort, repose, health, or safety of any such persons or the public; or that cause, or have a natural tendency to cause, injury or damage to business or property.

SCAQMD Rule 403 – Fugitive Dust

The purpose of this rule is to control the amount of PM entrained in the atmosphere from man-made sources of fugitive dust. Under Rule 403, no person shall conduct active operations without utilizing the applicable best available control measures to minimize fugitive dust emissions. Construction and operation fugitive dust emission sources are subject to this rule, which covers all fugitive dust emissions sources, such as unpaved and paved roads, storage piles, and earthmoving operations.

Additional requirements apply to operations on a property with 50 or more acres of disturbed surface area, or for any earth-moving operation with a daily earth-moving or throughput volume of 5,000 cy or more three times during the most recent 365-day period. These requirements include submittal of a dust control plan, maintaining dust control records, and designating a SCAQMD-certified dust control supervisor.

SCAQMD Rule 1113 – Architectural Coatings

This rule requires manufacturers, distributors, and end-users of architectural and industrial maintenance coatings to reduce VOC emissions from the use of these coatings, primarily by placing limits on the VOC content of various coating categories.

SCAQMD Regulation XI – Source Specific Standards

This regulation is composed of several dozen individual rules, most of which are not applicable to the project.

SCAQMD Regulation XIII – New Source Review

This regulation requires the permitting of new stationary sources and requires the use of BACT to control criteria pollutant emissions and requires offsetting emissions, other than CO, if they are over four tons per year.

5.2.2 Assessment Methodology

Criteria Pollutants

Air pollutant emissions from proposed construction and operation activities were calculated using the most current emission factors and methods, then compared to the thresholds to determine their significance. For impacts that exceed a significance criterion, the feasibility of mitigation measures has been analyzed. The Air Quality Technical Appendix (Appendix F) presents more detailed analyses, including emissions calculation methodologies, assumption, input data and model run files.

Lead

The CalEEMod model does not calculate lead emissions, and data on lead emissions is not readily available since lead additives to fuels have been phased out. In general, the following assumptions were made regarding equipment use:

Off-Road Construction Equipment

- All alternatives would utilize the same number and hours of off-road construction equipment.
- All nine off-road construction equipment listed in Table 2.2 of Appendix F will be utilized simultaneously for eight hours a day for 250 workdays during the year.
- All off-road construction equipment will utilize 500 hp diesel engines.
- All 500 hp, off-road diesel engines will utilize approximately 12,037 gallons of fuel per year USEPA Construction Fleet Inventory Guide.
- Lead emission rate of 0.0083 lbs./1,000 gallons is utilized.

On-Road Construction Equipment

- All alternatives would differ in the amount of on road diesel emissions due to the differences in the amount of excavated and demolished materials to be transported.
- Daily truck trips from Table 2.2 of Appendix F which distinguished the number of trips between 12 cy and 16 cy dump trucks were combined.
- Daily trips will occur for each of the 250 workdays during the year.
- Each trip is equal to a distance of 30 miles.
- Dump trucks, regardless of size, will consume approximately 400 gallons of diesel per
- 1,000 miles per USDOT fuel consumption by vehicle weight class table. See Attachment C.
- Lead emission rate of 0.0083 lbs./1,000 gallons was utilized.

The resulting figures were multiplied by the fuel consumption rate, lead emission rate, and conversion factor from pounds to tons. Results are given in tons of lead per year. The following formulas were developed to give a rough estimate of emissions per year:

Alternative 10:

$$250\ \underline{\text{days}} \times 411\ \frac{\text{trips}}{\text{days}} \times 30\ \frac{\text{miles}}{\text{trip}} \times \frac{400\text{ gallons}}{1000\text{ miles}} \times \frac{0.0083\text{ lb. of Pb}}{1{,}000\text{ gallons}} \times \frac{1\text{ ton}}{2000\text{ lb}} = 0.005\ \frac{\text{ton Pb}}{\text{year}}\ \text{year}$$

Alternative 13:

$$250\ \underline{\text{days}} \times 338\ \frac{\text{trips}}{\text{days}} \times 30\ \frac{\text{miles}}{\text{trip}} \times \frac{400\text{ gallons}}{1000\text{ miles}} \times \frac{0.0083\text{ lb. of Pb}}{1{,}000\text{ gallons}} \times \frac{1\text{ ton}}{2000\text{ lb}} = 0.004\ \frac{\text{ton Pb}}{\text{year}}\ \text{year}$$

Alternative 16:

$$250\ \underline{\text{days}} \times 424\ \frac{\text{trips}}{\text{days}} \times 30\ \frac{\text{miles}}{\text{trip}} \times \frac{400\text{ gallons}}{1000\text{ miles}} \times \frac{0.0083\text{ lb. of Pb}}{1{,}000\text{ gallons}} \times \frac{1\text{ ton}}{2000\text{ lb}} = 0.005\ \frac{\text{ton Pb}}{\text{year}}\ \text{year}$$

Alternative 20:

$$250\ \underline{\text{days}} \times 477\ \frac{\text{trips}}{\text{days}} \times 30\ \frac{\text{miles}}{\text{trip}} \times \frac{400\text{ gallons}}{1000\text{ miles}} \times \frac{0.0083\text{ lb. of Pb}}{1{,}000\text{ gallons}} \times \frac{1\text{ ton}}{2000\text{ lb}} = 0.006\ \frac{\text{ton Pb}}{\text{year}}\ \text{year}$$

5.2.3 Air Quality Significance Thresholds

Disclosure of environmental impacts under NEPA and CEQA typically include defining or selecting a level of significance for each potential impact. Once these significance thresholds have been established, the alternative-related impacts can be compared to the thresholds to determine whether those impacts would be significant. The selection of significance thresholds may differ under NEPA and CEQA. Therefore, the following discussion will indicate whether each of the selected thresholds was used to determine significance under NEPA, CEQA, or both.

In general, significance impact thresholds were based on current CEQA Guidelines, specifically the guidelines established by the SCAQMD for assessing air quality impacts. Air emissions would be significant if implementation of a proposed project or its alternatives would result in any of the following:

AQ-1 Conflicts with or obstructs implementation of the applicable air quality plan.

AQ-2 Violates any air quality standard or contributes substantially to an existing or projected air quality violation.

AQ-3 Results in a cumulatively considerable net increase of any criteria pollutant for which the project region is in non-attainment under an applicable Federal or state ambient air quality standard (including releasing emissions that exceed quantitative threshold for ozone precursors).

AQ-4 Exposes sensitive receptors to substantial pollutant concentrations.

AQ-5 Creates objectionable odors affecting a substantial number of people.

AQ-6 Results in greater than 3,000 MT per year of greenhouse gas emissions from the construction or operation of the selected alternative, when calculated using the amortized method.

AQ-7 Results in emissions of lead of greater than 25 tons/year.

SCAQMD has developed quantitative thresholds based on the criteria listed above and on technical evaluations of air pollutant emissions and dispersion. Specifically, daily regional mass emission and localized significance thresholds were used to determine significance under CEQA. The general conformity de minimis applicability thresholds developed by EPA under the Clean Air Act were used to determine significance under NEPA, and are shown in Table 5-2.

Table 5-2 General Conformity De Minimis Thresholds

Pollutant	Attainment Status	De Minimis Threshold (tpy)
VOC	Nonattainment, extreme	10
CO	Maintenance	100
NO2	Maintenance	10
SO2	Attainment	100
PM10	Nonattainment, Serious	70
PM2.5	Nonattainment	100
Pb	Nonattainment	25

Regional Significance Thresholds

AQ-2 was assessed using SCAQMD-developed Regional Significance Thresholds (RSTs) for mass daily emission rates of criteria pollutants for both construction and operational sources. RSTs represent the maximum emissions from a project that are not expected to cause or contribute to an exceedance of the most stringent applicable federal or state ambient air quality standard in the SCAB. RSTs are presented in pounds per day. Thresholds for construction impacts are based on the maximum or peak daily emissions during the construction period, which provides a "worst-case" analysis of the construction emissions, Similarly, significance determinations for operational emissions are based on the maximum or peak daily allowable emissions during the operational phase. Table 5-3 summarizes the RSTs.

Table 5-3 Air Quality Significance Thresholds

Mass Daily Thresholds [a]		
Pollutant	Construction[b]	Operation[c]
Nitrogen Oxide (NOx)	100 lbs/day	55 lbs/day
Reactive Organic Gas (ROG)	75 lbs/day	55 lbs/day
Particle Pollution (PM_{10})	150 lbs/day	150 lbs/day
Particle Pollution ($PM_{2.5}$)	55 lbs/day	55 lbs/day
Sulfur Oxides (SOx)	150 lbs/day	150 lbs/day
Carbon Monoxide (CO)	550 lbs/day	550 lbs/day
Lead	3 lbs/day	3 lbs/day
Toxic Air Contaminants (TACs), Odor, and Greenhouse Gas (GHG) Thresholds		
TACs (including carcinogens and non-carcinogens)	Maximum Incremental Cancer Risk > 10 in 1 million Chronic and Acute Hazard Index > 1.0 (project increment) Cancer Burden > 0.5 excess cancer cases (in areas > 1 in 1 million)	
Odor	Project creates an odor nuisance pursuant to SCAQMD Rule 402	
GHG	10,000 MT/yr Carbon Dioxide (CO_2) eq for industrial facilities	

Mass Daily Thresholds [a]		
Ambient Air Quality for Criteria Pollutants[d]		
NOx1-hour average annual average	In attainment; significant if project causes or contributes to an exceedance of any standard: 0.18 ppm (state) 0.03 ppm (state) and 0.0534 ppm (federal)	
PM_{10}, 24-hour annual average	10.4 μg/m^3 (construction)[e] and 2.5 μg/m^3 (operation) 1.0 μg/m^3	
$PM_{2.5}$, 24-hour average	10.4 μg/m^3 (construction)[e] and 2.5 μg/m^3 (operation)	
$SO_{2.}$1-hour average 24-hour average	0.255 ppm (state) and 0.075 ppm federal - 99th percentile) 0.04 ppm (state)	
Sulfate 24-hour average	25 μg/m^3 (state)	
CO, 1-hour average 8-hour average	In attainment; significant if project causes or contributes to an exceedance of any standard: 20 ppm (state) and 35 ppm (federal) 9.0 ppm (state/federal)	
Lead 30-day average Rolling 3-month average Quarterly average	1.5 μg/m^3 (state) 0.15 μg/m^3 (federal) 1.5 μg/m^3 (federal)	

a) Source: SCAQMD CEQA Handbook (SCAQMD, 1993)
b) Construction thresholds apply to both the South Coast Air Basin (SCAB) and Coachella Valley (Salton Sea and Mojave Desert Air Basin)
c) For Coachella Valley; the mass daily thresholds for operation are the same as the construction thresholds.
d) Ambient air quality thresholds for criteria pollutants based on SCAQMD Rule 1303. Table A-2 unless otherwise stated.
e) Ambient air quality threshold based on SCAQMD Rule 403.

KEY: ppm = parts per million; μg/m^3 = microgram per cubic meter; lbs/day = pounds per day; MT/yr C02eq = metric tons per year of CO_2 equivalents.

Cumulative Impacts

AQ-3 was assessed using RSTs. The SCAQMD has typically considers projects that exceed the RSTs to be cumulatively considerable. Conversely, projects that do not exceed the thresholds are generally not considered to be cumulatively significant. This approach will be applied to impacts under CEQA and NEPA. This project will not have long-term air quality impacts because it does not install a facility (structure or building) that generates direct or indirect emissions once construction is completed. Therefore, the project will not have any long-term cumulative impacts.

Localized Significance Thresholds

AQ-4 was assess using SCAQMD-developed localized significant thresholds (LSTs) that identify daily emissions levels at a project construction site that could cause or contribute to adverse localized air quality impacts to the nearest sensitive receptors.

LST thresholds are based on size (acres) of the disturbed construction area, the ambient air quality around the facility or construction site, and the distance to offsite human receptor. For purposes of a CEQA analysis, the SCAQMD considers a sensitive receptor to be a receptor such as a residence, hospital, prison, and convalescent facility where it is possible that an individual could remain for 24 hours. Schools are also considered sensitive receptors. Commercial and industrial facilities are not considered sensitive receptors because employees do not typically remain on site for a full 24 hours.

The LST methodology requires that PM10 and PM2.5 emissions be evaluated at sensitive receptors because the averaging period for the state standard is 24 hours and because, per SCAQMD's definition, an individual could remain at a sensitive receptor location for the full 24 hours. The LST methodology also requires that for pollutants with standards based on shorter averaging periods, such as NO2 and CO, emissions be evaluated at industrial and commercial receptors because it is reasonable to assume that a worker at these sites could be present for periods of 1 to 8 hours. VOC does not have an ambient air quality standard and is, therefore, not addressed in the LST methodology. Offsite mobile emissions are not included in the LST evaluation, per LST methodology. The LSTs for the proposed Los Angeles River Restoration alternatives are summarized in Table 5-4.

Table 5-4 Localized Significance Thresholds

Alternative	Localized Significant Emissions Thresholds, lbs/day			
	NOx.	CO	PM10	PM2.5
10	46	231	4	3
13	46	231	4	3
16	46	231	4	3
20	46	231	4	3

Odors

To assess AQ-5, the SCAQMD CEQA Air Quality Handbook indicates that land uses likely to result in odor nuisance complaints include: agriculture, wastewater treatment plants, food processing plants, chemical plants, composting, refineries, landfills, dairies, and fiberglass molding. Since the project would not result in construction of the facilities listed above, it is assumed that odor impacts would be less than significant under both CEQA and NEPA. Brief, qualitative discussions of control orders associated with the alternative are included in Section 5.2.3.

Global Climate Change Significance Thresholds

CEQA Greenhouse Gas Thresholds

The CEQA Guidelines were amended in 2010 to require the evaluation of greenhouse gas (GHG) emissions in environmental documents. Impacts from a project would be significant if it would do one of the following:

- Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment; or

- Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.

Although the SCAQMD adopted a quantitative significance threshold for industrial (stationary source) projects, they did not adopt thresholds for restoration projects like the one described in this study. The SCAQMD recommends that the total construction emissions be amortized over the lifetime of the project and then added to annual operational emissions. If the lifetime of a project is not known, then a 30-year lifetime is assumed. AQ-6 is assessed pursuant to this method.

NEPA Greenhouse Gas Statement

There are currently no Federal GHG emission thresholds. Therefore, the USACE will not utilize the SCAQMD quantitative CEQA significance threshold for industrial projects, propose a new GHG threshold, or make a NEPA significance impact determination for GHG emissions anticipated to result from any of the alternatives. Rather, in compliance with NEPA implementing regulations, the anticipated emissions will be disclosed for each alternative without expressing a judgment as to their significance.

On February 18, 2010, the Council on Environmental Quality (CEQ) released Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions (CEQ, 2010). This guidance states that if a proposed action would be reasonably anticipated to cause direct emissions of 25,000 metric tons or more of CO2 equivalent (MTCO2e) on an annual basis, agencies should consider this an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public. Although it was assumed that the alternatives would not exceed 25,000 MTCO2e, a quantitative assessment was conducted for this EIS/EIR, as stated above. It is important to note that CEQ does not propose this emissions reference point as an indicator of a threshold of significant effects.

5.2.4 Environmental Impacts

No Action Alternative

Construction Impacts

There would be no construction related air emissions under the No Action Alternative since no construction would occur.

Operational Impacts

There would be no operational related air emissions under the No Action Alternative since no construction would occur.

Alternative 10

Construction Impacts

- AQ-1: As shown in Table 5-5, unmitigated NOx and CO emissions would exceed the significance criteria under NEPA. As a result, unmitigated construction activities associated with this alternative would result in significant NOx and CO air quality impacts. Emissions from this alternative would be less than significant values for VOC, PM 25 and PM10. Calculations regarding lead emissions are pending; however, construction equipment operating on unleaded fuel is expected to emit only minor amounts of lead, therefore emissions are expected be below thresholds.

- AQ-2 and AQ-4: As shown in Table 5-5 construction emissions are expected to exceed the following thresholds: (1) the RSTs for ROG and NOx; and (2) the LSTs for NOx, PM10, and PM2.5. These constitute temporary significant unmitigated impacts during construction due to emissions of ROG, NOx, PM10, and PM2.5. Environmental Commitments in Section 5.2.4 would reduce PM10, and PM2.5 levels but PM10, and PM2.5 would still exceed LST thresholds.

- AQ-3: The population in Los Angeles County is expected to increase in the future. Increases in population and housing could increase traffic, utility demands, and construction projects, which would all result in increased air pollution. Additionally, air pollutant emissions associated with past and present development and activities have contributed to local and regional air pollution. Several development projects in Los Angeles County could occur in the vicinity of the proposed project and alternatives during the same period and would contribute to cumulative effects. Construction activities associated with this alternative would result in individually significant air quality impacts for NOx and ROG emissions under CEQA and NEPA.

- AQ-5: Potential sources that may emit odors during construction activities would include diesel emissions from on- and off-road equipment. However, construction would be limited to relatively small footprints interspersed throughout the project area, and the number of diesel powered equipment would be limited to those indicated in Table 2.2 of Appendix F. Furthermore, not all diesel equipment are expected to be operating simultaneously. Therefore, construction emissions would be transient and would result in less than significant impact to odors.

Table 5-5 Air Emissions from Construction of Alternative 10

Criteria	Criteria Pollutant Emissions					
	ROG	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2
Regional Construction Emissions	98 lbs/day 17.9 tons/ Year	513 lbs/day 93.7 tons/ Year	813 lbs/day 148.3 tons/ Year	62 lbs/day 11.2 tons/ Year	47 lbs/day 8.6 tons/ year	1 lbs/day 0.2 tons/ year
SCAQMD Project Construction Regional Thresholds	75 lbs/ Day	550 lbs/ Day	100 lbs/ day	150 lbs/ Day	55 lbs/ day	150 lbs/ day
Exceeds SCAQMD Construction Regional Threshold	Yes	No	Yes	No	No	No
Localized Construction Emissions	49 lbs/ Day	230 lbs/day	366 lbs/ day	18 lbs/ Day	18 lbs/ day	< 1 lbs/ day
SCAQMD Project Construction Localized Thresholds	-	231 lbs/day	46 lbs/day	4 lbs/day	3 lbs/day	-
Exceeds SCAQMD Construction Localized Threshold	-	No	Yes	Yes	Yes	-
Federal Conformity Rule Thresholds for NEPA	50 ton/ Year	50 tons/ year	50 ton/ Year	50 tons/ year	50 tons/ year	50 tons/ year
Exceed NEPA Thresholds (based on regional emissions)	No	Yes	Yes	No	No	No

ROG: reactive organic gases; NOx: nitrogen oxides; CO: carbon monoxide; CO_2: carbon dioxide; PM_{10}: particulate matter less than 10 microns; PM2.5: particulate matter less than 2.5 microns. See Appendix F for additional details regarding construction emissions and thresholds data.

- AQ-6 (GHG): The CalEEMod model was used to estimate GHG emissions during the construction phases of the proposed project. For this project, the major source of GHG is the combustion of fuel in construction equipment, in vehicles used to haul materials, and in vehicles used by workers commuting to/from the site. Based on the construction schedule, types and quantities of construction equipment, and number of haul trucks, etc., the maximum CO2e emissions were estimated. The expected life of the proposed project is considered at least 30 years. Table 5-11 compares the GHGs emissions from the project construction activities with the SCAQMD's GHG emissions threshold. As shown, the GHG emissions from the project construction activities results in less than significant impacts under CEQA.

- AQ-7: Estimated total lead emissions for all alternatives are shown in Table 5-6, below, therefore this section pertains to all alternatives and will not be repeated below. Relative to other alternatives, Alternative 13 would emit the least amount of lead per year; in contrast, and Alternative 20 would emit the most amount of lead per year. Alternatives 10 and 16 would emit equal amount of lead per year.

Relative to the General Conformity Rule de minimis threshold, lead emissions associated with all alternatives are substantially below the threshold.

Table 5-6 Estimated Total Lead Emissions by Alternative

Alternative	Total Lead Emissions (Tons/Year)	General Conformity de Minimus Threshold (Tons/Year)
10	0.0054	25
13	0.0044	25
16	0.0054	25
20	0.0064	25

Because this is a rough estimation, the accuracy of these calculations is limited. To compensate for this inaccuracy, estimates of numbers of pieces of equipment and hours of use were kept very high. Therefore, it is likely that lead emission estimates for all alternatives are smaller than the results reported above.

Operational Impacts

Operational emissions would include general maintenance activities that would utilize one or two light duty trucks as needed. Emissions would also include increased traffic near the project area due to additional visitors. However, operational emissions are expected to be transient.

Alternative 13

Construction Impacts

- AQ-1: As shown in Table 5-7, unmitigated NOx and CO emissions would exceed the significance criteria under NEPA. As a result, unmitigated construction activities associated with this alternative would result in significant NOx and CO air quality impacts. Emissions from this alternative would be less than significant values for VOC, PM 25 and PM10. Calculations regarding lead emissions are pending; however, construction equipment operating on unleaded fuel is expected to emit only minor amounts of lead, therefore emissions are expected be below thresholds.

- AQ-2 and AQ-4: As shown in Table 5-7 construction emissions are expected to exceed the following thresholds: (1) the RSTs for ROG, CO and NOx; and (2) the LSTs for CO, NOx, PM10, and PM2.5. These constitute temporary significant unmitigated impacts during construction due to emissions of ROG, CO, NOx, PM10, and PM2.5. Environmental Commitments in Section 5.2.4 would reduce PM10, and PM2.5 levels but PM10, and PM2.5 would still exceed LST thresholds.

- AQ-3: The population in Los Angeles County is expected to increase in the future. Increases in population and housing could increase traffic, utility demands, and construction projects, which would all result in increased air pollution. Additionally, air pollutant emissions associated with past and present development and activities have contributed to local and regional air pollution. Several development projects in Los Angeles County could occur in the vicinity of the proposed project and alternatives during the same period and would contribute to cumulative effects. Construction activities associated with this alternative would result in individually significant air quality impacts for ROG, CO and NOx emissions under CEQA and NEPA.

- AQ-5: Potential sources that may emit odors during construction activities would include diesel emissions from on- and off-road equipment. However, construction would be limited to relatively small footprints interspersed throughout the project area, and the number of diesel powered equipment would be limited to those indicated in Table 2.2 of Appendix F. Furthermore, not all diesel equipment are expected to be operating simultaneously. Therefore, construction emissions would be transient and would result in less than significant impact to odors.

- GHG: The CalEEMod model was used to estimate GHG emissions during the construction phases of the proposed project. For this project, the major source of GHG is the combustion of fuel in construction equipment, in vehicles used to haul materials, and in vehicles used by workers commuting to/from the site. Based on the construction schedule, types and quantities of construction equipment, and number of haul trucks, etc., the maximum CO2e emissions were estimated. The expected life of the proposed project is considered at least 30 years. Table 5-11 compares the GHGs emissions from the project construction activities with the SCAQMD's GHG emissions threshold. As shown, the GHG emissions from the project construction activities results in less than significant impacts under CEQA.

Operational Impacts

Operational emissions would include general maintenance activities that would utilize one or two light duty trucks as needed. Emissions would also include increased traffic near the project area due to additional visitors. However, operational emissions are expected to be transient.

Table 5-7 Air Emissions from Construction of Alternative 13

Criteria	Criteria Pollutant Emissions					
	ROG	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2
Regional Construction Emissions	131 lbs/day 23.9 tons/ Year	704 lbs/day 128.5 tons/ year	1026 lbs/day 187.2 tons/ Year	47 lbs/day 8.6 tons/ Year	47 lbs/day 8.6 tons/ year	1 lbs/day 0.2 tons/ year
SCAQMD Project Construction Regional Thresholds	75 lbs/ Day	550 lbs/ day	100 lbs/ day	150 lbs/ Day	55 lbs/ day	150 lbs/ day
Exceeds SCAQMD Construction Regional Threshold	Yes	Yes	Yes	No	No	No
Localized Construction Emissions	140 lbs/ Day	762 lbs/ day	1,099 lbs/ Day	52 lbs/ Day	52 lbs/ day	2 lbs/ Day
SCAQMD Project Construction Localized Thresholds	-	231 lbs/ day	46 lbs/ Day	4 lbs/ Day	3 lbs/ day	-

Criteria	Criteria Pollutant Emissions					
	ROG	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2
Exceeds SCAQMD Construction Localized Threshold	-	Yes	Yes	Yes	Yes	-
Federal Conformity Rule Thresholds for NEPA	50 ton/ Year	50 tons/ year	50 ton/ Year	50 tons/ year	50 tons/ year	50 tons/ year
Exceed NEPA Thresholds (based on regional emissions)	No	Yes	Yes	No	No	No

ROG: reactive organic gases; NOx: nitrogen oxides; CO: carbon monoxide; CO_2: carbon dioxide; PM_{10}: particulate matter less than 10 microns; PM2.5: particulate matter less than 2.5 microns. See Appendix F for additional details regarding construction emissions and thresholds data.

Alternative 16

Construction Impacts

- AQ-1: As shown in Table 5-8, unmitigated ROG, NOx and CO emissions would exceed the significance criteria under NEPA. As a result, unmitigated construction activities associated with this alternative would result in significant ROG, NOx and CO air quality impacts. Emissions from this alternative would be less than significant values for VOC, PM 25 and PM10. Calculations regarding lead emissions are pending; however, construction equipment operating on unleaded fuel is expected to emit only minor amounts of lead, therefore emissions are expected be below thresholds.

- AQ-2 and AQ-4: As shown in Table 5-8 construction emissions are expected to exceed the following thresholds: (1) the RSTs for ROG, CO and NOx; and (2) the LSTs for CO, NOx, PM10, and PM2.5. These constitute temporary significant unmitigated impacts during construction due to emissions of ROG, CO, NOx, PM10, and PM2.5. Environmental Commitments in Section 5.2.4 would reduce PM10, and PM2.5 levels but PM10, and PM2.5 would still exceed LST thresholds.

- AQ-3: The population in Los Angeles County is expected to increase in the future. Increases in population and housing could increase traffic, utility demands, and construction projects, which would all result in increased air pollution. Additionally, air pollutant emissions associated with past and present development and activities have contributed to local and regional air pollution. Several development projects in Los Angeles County could occur in the vicinity of the proposed project and alternatives during the same period and would contribute to cumulative effects. Construction activities associated with this alternative would result in individually significant air quality impacts for ROG, CO and NOx emissions under CEQA and NEPA.

- AQ-5: Potential sources that may emit odors during construction activities would include diesel emissions from on- and off-road equipment. However, construction would be limited to relatively small footprints interspersed throughout the project area, and the number of diesel powered equipment would be limited to those indicated in Table 2.2 of Appendix F. Furthermore, not all diesel equipment is expected to be operating simultaneously. Therefore, construction emissions would be transient and would result in less than significant impact to odors.

- GHG: The CalEEMod model was used to estimate GHG emissions during the construction phases of the proposed project. For this project, the major source of GHG is the combustion of fuel in construction equipment, in vehicles used to haul materials, and in vehicles used by workers commuting to/from the site. Based on the construction schedule, types and quantities of construction equipment, and number of haul trucks, etc., the maximum CO2e emissions were estimated. The expected life of the proposed project is considered at least 30 years. Table 5-11 compares the GHGs emissions from the project construction activities with the SCAQMD's GHG emissions threshold. As shown, the GHG emissions from the project construction activities results in less than significant impacts under CEQA.

Operational Impacts

Operational emissions would include general maintenance activities that would utilize one or two light duty trucks as needed. Emissions would also include increased traffic near the project area due to additional visitors. However, operational emissions are expected to be transient.

Table 5-8 Air Emissions from Construction of Alternative 16

Criteria	Criteria Pollutant Emissions					
	ROG	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2
Regional Construction Emissions	347 lbs/day 63.3 tons/ Year	1,840 lbs/day 335.7 tons/ year	2,584 lbs/day 471.5 tons/ Year	140 lbs/day 25.5 tons/ Year	136 lbs/day 24.9 tons/ year	3 lbs/day 0.58 tons/ Year
SCAQMD Project Construction Regional Thresholds	75 lbs/ Day	550 lbs/ day	100 lbs/ day	150 lbs/ Day	55 lbs/ day	150 lbs/ Day
Exceeds SCAQMD Construction Regional Threshold	Yes	Yes	Yes	No	Yes	No
Localized Construction Emissions	312 lbs/ Day	1,611 lbs/ day	2,224 lbs/ day	118 lbs/ Day	118 lbs/ day	3 lbs/day
SCAQMD Project Construction Localized Thresholds	-	231 lbs/ day	46 lbs/ day	4 lbs/ Day	3 lbs/ day	-
Exceeds SCAQMD Construction Localized Threshold	-	Yes	Yes	Yes	Yes	-
Federal Conformity Rule Thresholds for NEPA	50 ton/ Year	50 tons/ year	50 ton/ Year	50 tons/ year	50 tons/ year	50 tons/ year
Exceed NEPA Thresholds (based on regional emissions)	Yes	Yes	Yes	No	No	No

ROG: reactive organic gases; NOx: nitrogen oxides; CO: carbon monoxide; CO_2: carbon dioxide; PM_{10}: particulate matter less than 10 microns; PM2.5: particulate matter less than 2.5 microns. See Appendix F for additional details regarding construction emissions and thresholds data.

Alternative 20

Construction Impacts

- AQ-1: As shown in Table 5-9, unmitigated ROG, NOx and CO emissions would exceed the significance criteria under NEPA. As a result, unmitigated construction activities associated with this alternative would result in significant ROG, NOx and CO air quality impacts. Emissions from this alternative would be less than significant values for VOC, PM 25 and PM10. Calculations regarding lead emissions are pending; however, construction equipment operating on unleaded fuel is expected to emit only minor amounts of lead, therefore emissions are expected be below thresholds.

- AQ-2 and AQ-4: As shown in Table 5-9 construction emissions are expected to exceed the following thresholds: (1) the RSTs for ROG, CO, NOx, and PM2.5; and (2) the LSTs for CO, NOx, PM10, and PM2.5. These constitute temporary significant unmitigated impacts during construction due to emissions of ROG, CO, NOx, PM10, and PM2.5. Environmental Commitments in Section 5.2.4 would reduce PM10, and PM2.5 levels but PM10, and PM2.5 would still exceed LST thresholds.

- AQ-3: The population in Los Angeles County is expected to increase in the future. Increases in population and housing could increase traffic, utility demands, and construction projects, which would all result in increased air pollution. Additionally, air pollutant emissions associated with past and present development and activities have contributed to local and regional air pollution. Several development projects in Los Angeles County could occur in the vicinity of the proposed project and alternatives during the same period and would contribute to cumulative effects. Construction activities associated with this alternative would result in individually significant air quality impacts for ROG, CO, NOx, and PM2.5 emissions under CEQA and NEPA.

- AQ-5: Potential sources that may emit odors during construction activities would include diesel emissions from on- and off-road equipment. However, construction would be limited to relatively small footprints interspersed throughout the project area, and the number of diesel powered equipment would be limited to those indicated in Table 2.2 of Appendix F. Furthermore, not all diesel equipment is expected to be operating simultaneously. Therefore, construction emissions would be transient and would result in less than significant impact to odors.

- GHG: The CalEEMod model was used to estimate GHG emissions during the construction phases of the proposed project. For this project, the major source of GHG is the combustion of fuel in construction equipment, in vehicles used to haul materials, and in vehicles used by workers commuting to/from the site. Based on the construction schedule, types and quantities of construction equipment, and number of haul trucks, etc., the maximum CO2e emissions were estimated. The expected life of the proposed project is considered at least 30 years. Table 5-11 compares the GHGs emissions from the project construction activities with the SCAQMD's GHG emissions threshold. As shown, the GHG emissions from the project construction activities results in less than significant impacts under CEQA.

Operational Impacts

Operational emissions would include general maintenance activities that would utilize one or two light duty trucks as needed. Emissions would also include increased traffic near the project area due to additional visitors. However, operational emissions are expected to be transient.

Table 5-9 Air Emissions from Construction of Alternative 20

Criteria	Criteria Pollutant Emissions					
	ROG	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2
Regional Construction Emissions	311 lbs/day 56.9 tons/ Year	1,769 lbs/day 332.9 tons/ year	2,264 lbs/day 413.2 tons/ Year	130 lbs/day 23.7 tons/ Year	126 lbs/day 23.0 tons/ year	3 lbs/day 0.56 tons/ year
SCAQMD Project Construction Regional Thresholds	75 lbs/ Day	550 lbs/ day	100 lbs/ Day	150 lbs/ Day	55 lbs/ day	150 lbs/ Day
Exceeds SCAQMD Construction Regional Threshold	Yes	Yes	Yes	No	Yes	No
Localized Construction Emissions	267 lbs/day	1,497 lbs/ day	1,837 lbs/ Day	103 lbs/ Day	103 lbs/ day	3 lbs/day
SCAQMD Project Construction Localized Thresholds	-	231 lbs/ day	46 lbs/ Day	4 lbs/ Day	3 lbs/ day	-
Exceeds SCAQMD Construction Localized Threshold	-	Yes	Yes	Yes	Yes	-
Federal Conformity Rule Thresholds for NEPA	50 ton/ Year	50 tons/ year	50 ton/ Year	50 tons/ year	50 tons/ year	50 tons/ year
Exceed NEPA Thresholds (based on regional emissions)	Yes	Yes	Yes	No	No	No

ROG: reactive organic gases; NOx: nitrogen oxides; CO: carbon monoxide; CO_2: carbon dioxide; PM_{10}: particulate matter less than 10 microns; PM2.5: particulate matter less than 2.5 microns. See Appendix F for additional details regarding construction emissions and thresholds data.

Table 5-10 Summary of Daily Air Emissions – All Alternatives

Emissions, lbs/day	Alternative			
	10	13	16	20
ROG	98	131	347	312
CO	513	704	1,840	1,769
NOx	813	1026	2,584	2,264
PM_{10}	62	47	140	130
$PM_{2.5}$	47	47	136	126
SO_2	1	1	3	3

5.2.5 Mitigation Measures

Implementation of the mitigation measures provided below would reduce, to the extent feasible, the construction-related air quality impacts associated with all alternatives (except for the no action alternative). No mitigation is required for the No Action alternative. Although impacts can be reduced with implementation of best management practices (BMPs), some temporary exceedance of significance thresholds will be unavoidable due to the magnitude of changes proposed. BMPs for controlling fugitive dust and pollutant emissions include the following techniques:

- Water active construction sites to reduce fugitive dust, including locations where grading is to occur;
- All trucks hauling dirt, sand, soil, or other loose materials are to be covered or should maintain at least two feet of freeboard, according to the requirements of California Vehicle Code (CVC) Section 23114;
- During construction, the off-road equipment, vehicles, and trucks shall not idle more than five minutes in any one hour;
- The off-road construction equipment drivers shall have proper training in operating the equipment efficiently, taking into account ways to reduce the hours of equipment operation and/or operating the equipment at a lower load factor;
- Pave construction access roads at least 100 feet onto the site from main road; and
- Reduce construction traffic speeds to 15 mph or less on unpaved surfaces.

These mitigation measures can reduce PM_{10} and $PM_{2.5}$ emissions up to 50 percent.

5.2.6 Greenhouse Gas Emissions and Climate Change

Significance Criteria

Under CEQA, a significant adverse impact would result if greater than 3,000 MT per year of greenhouse gas emissions resulted from the construction or operation of the selected alternative, when calculated using the amortized method.

The Corps' position under NEPA is that there are no science-based GHG significance thresholds, nor has the federal government adopted any by regulation. In the absence of an adopted or science-based GHG significance standard, the Corps will not propose a new GHG significance standard, or make a NEPA impact determination for GHG emissions anticipated to result from the proposed project or any of the alternatives. Rather, in compliance with NEPA implementing regulations, the anticipated GHG emissions will be disclosed for the proposed project and each alternative without the Corps expressing judgment as to the significance of such emissions.

Environmental Impacts

No Action Alternative

Under the No Action Alternative, no construction activities would occur. As a result, there would be no additional GHGs generated from the construction activities associated with the proposed project, including motorized equipment and vehicles. Climate change would be influenced by emissions due to local and regional emissions from vehicles and local commercial and industrial land uses.

Construction Impacts from Action Alternatives

The CalEEMod model was used to estimate GHG emissions during the construction phases of the proposed project. For this project, the major source of GHG is the combustion of fuel in construction equipment, in vehicles used to haul materials, and in vehicles used by workers commuting to/from the site. Based on the construction schedule, types and quantities of construction equipment, and number of haul trucks, etc., the maximum CO_2e emissions were estimated. The expected life of the proposed project is considered at least 30 years. Table 5-11 compares the GHGs emissions from the project construction activities with the SCAQMD's GHG emissions threshold. As shown, the GHG emissions from the project construction activities results in less than significant impacts under CEQA.

Table 5-11 Greenhouse Gas Emissions

Alternative	10	13	16	20
Total CO_{2e} (MT/year)	3,475	9,588	22,072	31,879
Amortized to 30 year (MT/year)	116	320	736	1,062
SCAQMD Threshold (MT/year)	3,000	3,000	3,000	3,000
Exceeds Threshold	No	No	No	No

Operation Impacts

Long-term operation of the project would generate minor emissions of GHGs due to engine exhausts from maintenance vehicles and also from increased traffic to the study area due to increased visitation.

Establishing more green vegetation in the river channel could have long-term beneficial improvements on ambient air quality. Many of these measures include enhanced pedestrian access, which could help reduce vehicle emissions. Also, increasing the amount of green open space could help reduce levels of greenhouse gases, such as carbon dioxide (CO_2), and reduce greenhouse gas emissions as required by the state's Global Warming Solutions Act of 2006.

5.2.7 Comparison of Significant Impacts and Mitigation for All Alternatives

A summary of significant impacts on air quality resulting from the construction of project alternatives is provided in Table 5-12. Impacts are compared by alternative. Proposed mitigation, where feasible, and the significance of the impact following mitigation under CEQA and NEPA are also listed in the table.

Table 5-12 Comparison of Significant Impacts and Mitigation for Air Quality for all Alternatives

Impacts During Construction under CEQA			
Alternative	**Significant Impact Before Mitigation**	**Mitigation**	**Residual Impact After Mitigation**
10	ROG, NOx, PM_{10}, $PM_{2.5}$.	Compliance with Rule 403 Implementation of measures listed in Section 5.2.4*	ROG, NOx, PM_{10}, $PM_{2.5}$.
13	ROG, NOx, CO, PM_{10}, $PM_{2.5}$.	Compliance with Rule 403 Implementation of measures listed in Section 5.2.4*	ROG, NOx, CO, PM_{10}, $PM_{2.5}$.
16	ROG, NOx, CO, PM_{10}, $PM_{2.5}$.	Compliance with Rule 403 Implementation of measures listed in Section 5.2.4*	ROG, NOx, CO, PM_{10}, $PM_{2.5}$.
20	ROG, NOx, CO, PM_{10}, $PM_{2.5}$	Compliance with Rule 403 Implementation of measures listed in Section 5.2.4*	ROG, NOx, CO, PM_{10}, $PM_{2.5}$
Impacts During Construction under NEPA			
Alternative	**Significant Impact Before Mitigation**	**Mitigation**	**Residual Impact After Mitigation**
10	CO, NOx	Compliance with Rule 403. Implementation of measures listed in Section 5.2.4*	CO, NOx
13	CO, NOx	Compliance with Rule 403. Implementation of measures listed in Section 5.2.4*	CO, NOx

Impacts During Construction under NEPA			
16	ROG, NOx, CO,	Compliance with Rule 403. Implementation of measures listed in Section 5.2.4*	ROG, NOx, CO,
20	ROG, NOx, CO	Compliance with Rule 403. Implementation of measures listed in Section 5.2.4*	ROG, NOx, CO

*These mitigation measures may reduce PM_{10} and $PM_{2.5}$ emissions up to 50 percent.

5.3 LAND USE

5.3.1 Regulatory Framework

Land use in the study area is managed according to Federal, state, regional, and local policies. Because these policies create land use patterns in the study area, they are described in detail in the Affected Environment section (Section 3.3).

The Cities of Los Angeles and Glendale adopted the State of California CEQA Guidelines (Title 14, California Code of Regulations, Sec. 15000 et seq.) as the CEQA Guidelines for their cities in 2002, and 2003, respectively (City of Los Angeles 2002, City of Glendale 2003). The significance criteria provide the thresholds to identify the impacts of land use actions, land use consistency, and land use compatibility. These criteria are identified in the environmental checklist from the CEQA Guidelines. Although the City of Burbank has not formally adopted the state CEQA Guidelines, it has used the significance criteria from the state in recent CEQA analyses, including the EIR for the updated General Plan 2035 (City of Burbank 2012a). These criteria are applicable when determining the potential impacts of implementing any of the proposed project alternatives.

5.3.2 Significance Criteria

A significant adverse impact would be considered to occur if the following resulted per the CEQA guidelines:

- Permanent inconsistencies with the adopted land use/density designation in the General Plan, Community Plan, LA-RIO district, redevelopment plan, specific plan for the site, or adopted habitat conservation plan or natural community conservation plan, or
- The introduction of permanent features that would physically divide an existing neighborhood or community.

5.3.3 Environmental Impacts

No Action Alternative

Construction Impacts

Under the No Action Alternative, no construction efforts would be undertaken and there would be no impacts to land use. Future land use would be controlled through existing regulatory, community, and master planning efforts.

Operation Impacts

Under the No Action Alternative, land use would continue to be regulated and guided via Federal, state, regional, and local guidance, general plans, master planning, ordinances, and land use zoning plans. Land use zoning is expected to remain the same without implementation of restoration. Industrial, commercial, and residential areas would continue to occupy their current extent, or changes in zoning would be controlled via jurisdictional guidance. Continued deterioration of land use conditions could occur if parcels not utilized for restoration, such as abandoned buildings, vacant lots, and undeveloped parcels along the River, are not rehabilitated or restored independently.

Land uses within the study area under future without-project conditions would be similar to existing conditions in areas where the land uses in the vicinity of the River are primarily zoned for single-family residential, parks and open space, and specific planned commercial uses; these include large areas of Reaches 1-3 in Los Angeles and Burbank, and areas of Reaches 4-6 within and adjacent to Griffith and Elysian Parks.

The Hollywood Community Plan was updated in June 2012, but no significant land use changes were proposed within the study area; therefore, land uses would remain relatively stable. The City of Burbank General Plan is currently being updated; however, the proposed updates do not include significant changes in land uses within the study area. The City of Glendale is continuing several master planning efforts within the study area; these include the Bicycle Transportation Plan that contains areas within Reaches 1-3. These improvements, designed to address non-motorized transportation, are applicable to the entire city as well as the study area; these planning efforts would occur with or without the proposed project.

Open space, parks, and recreation would continue to be limited in the study area. Non-Federal actions to introduce parks or conduct small scale restoration would incrementally increase recreational land use value to the area, but would occur slowly, incurring only minimal benefits to land use.

Alternative 10

Construction

General plans, and community and specific plans, may include policies concerning the short term impacts of noise, traffic, air quality, and other resource areas that result from construction and related temporary project implementation activities. However, land use objectives, goals, and policies typically concern the permanent use of the land; the general plans and applicable community plans within Reaches 1-8 do not address land use impacts from construction activities. Establishment of staging sites for construction may alter land uses within the reaches temporarily, but these impacts would be short term, and any adverse land use impacts related to construction activities would be less than significant.

Operational

<u>Reaches 1-3</u>

The Hollywood Community Plan is the largest community plan of those that encompass the River channel. This plan contains Open Space and Public Facilities land use designations within Reaches 1-3, and was updated in June 2012. The Open Space designation allows for park and recreational uses, and includes Griffith Park and lands adjacent to and within the river channel. The Public Facilities designation reflects the public ownership, access and operation of infrastructure and primarily includes existing freeway right-of-way areas but also includes lands adjoining the channel that are subject to riparian and channel restoration and improvement measures. The measures implemented within Reaches 1-3 in this Alternative would be consistent with these land use designations. In addition, they would be consistent with policies in the Hollywood Community Plan for public improvements, including Public Improvements Policy 2 supporting the creation of a Los Angeles River Greenbelt to be integrated with existing and proposed parks, trails, and scenic routes. Further, the side channel diversion in Reach 3 would not conflict with the existing recreational uses at the Los Angeles Zoo or Ferraro Soccer Complex within Griffith Park since it would occur primarily between those uses and adjacent the Route 134 freeway corridor. Therefore, no land use impacts from implementation of the measures within Reaches 1-3 would occur (City of Los Angeles 2012).

The City of Glendale borders portions of Reaches 2 and 3. Restoration measures in this Alternative would not extend beyond the River channel within this city. No impacts would occur from the measures in this alternative to the Single Family Residential and Industrial land use designations along these reaches. In addition, no impacts would occur to the goals and objectives in the Bicycle Transportation Plan since the proposed Class I bicycle trail would occur on the opposite side of the River channel from the restoration measures (City of Glendale 2012).

Reaches 4-6

Restoration measures would be consistent with the Open Space and Public Facilities land use designations in the Northeast Los Angeles and Silver Lake-Echo Park-Elysian Valley Community Plans where they would occur, and no land use impacts would result.

Measures in Reach 4 would include river diversion into the Los Feliz Golf Course. The land area to be affected by implementation of these measures is designated for Open Space and Public Facilities; although the measures could potentially impact operations at the golf course, the land affected at the golf course is located in one section near the River and would not significantly disrupt or preclude normal golf course operations. Therefore, potential adverse land use impacts would be less than significant.

Restoration measures in Reach 6 would include increasing riparian habitat by at least 80 acres in the channel, at the Bowtie site and at the Taylor Yard parcel. Although much of the Taylor Yard site has been converted into the Rio de Los Angeles State Park, a narrow band of industrial land remains between the western boundary of the park and the River channel. Although the land has been traditionally used for industrial purposes, it currently has a land use designation of Open Space and Public Facilities in the Northeast Los Angeles Community Plan. Conversion of this industrial land for channel improvements and riparian restoration measures would be consistent with these Open Space and Public Facilities land use designations since these measures would enhance the recreational uses of the River while preserving its function for flood risk management purposes. In addition, the Northeast Los Angeles Community Plan includes specific goals and policies, including Open Space Policy 4-2.1 and Recreation and Park Facilities Policy 5-2.1, to promote open space and recreation uses and increase public access along the River. Further, implementation of the measures would still allow for the operation of the active rail operations located between Reach 6 and the state park. Therefore, land use impacts would be less than significant (City of Los Angeles 2007).

The western side of the River channel in Reach 6 is within the Silver Lake-Echo Park-Elysian Valley Community Plan Area, on lands designated as Industrial, Open Space, Public Facilities, and Single-Family and Multiple Family Residential. The measures in Alternative 10 would occur within the non-industrial and non-residential land use designations, and would not conflict with these designations. Therefore, no impacts to land use would occur.

Reaches 7 -8

Restoration measures would include plantings built into channel walls and riparian corridors up the Arroyo Seco tributary. This would occur within the Northeast Los Angeles, Central City North, and Silver Lake-Echo Park-Elysian Valley Community Plan Areas on lands with Open Space, Public Facilities, and Industrial land use designations. This would conflict with the Industrial land use designation. However, given the location of these measures within and adjacent to the River corridor, the isolation of the site and lack of current industrial operations, impacts would be less than significant.

Part of the area affected is utilized by a maintenance road, parking, and utilities; these could be adjusted with the measures to continue their operation, further ensuring that any adverse impacts would be less-than significant.

Within Reach 8, the Piggyback Yard site would be converted to 113 acres of riparian habitat. This site is located within the Lincoln Heights Community Plan Area. According to this Plan, the land use designation within the site is Industrial, reflecting the current use of the site as a container transfer facility and rail yard. Conversion of the site to riparian habitat would conflict with the Industrial land use designation, as well as specific goals and policies concerning industrial land uses in the Plan. These include Industrial Objectives 1 and 2, which aim to preserve industrial lands for industrial uses to preserve employment and tax-base revenue, and Policy 4 which calls for industrial areas north of the I-10 and west of I-5 to be maintained and improved as a means of providing revenue for the City and employment opportunities for its residents (City of Los Angeles 2007).

Should the restoration measures be implemented, the existing container transfer facility would be impacted and possibly compelled to relocate. In addition, potential adverse indirect impacts could occur should new industrial uses not desire to locate to an area with decreasing availability and viability for industrial operations. Further, indirect impacts could result from the decreasing availability of industrial land in the Los Angeles area; this could decrease the viability of industrial and manufacturing businesses from remaining in the area if their operations are limited to increasingly small and potentially isolated parcels of land surrounded by restored riparian and wetland habitat and recreational areas. Therefore, implementation of restoration measures within Reach 8 would result in a significant adverse impact.

Implementation of any of the measures in Alternative 10 would result in changes to the environment, and, as discussed above, would adversely impact existing land uses where they would cause their relocation or affect their continued viability. Operational impacts would occur if the measures resulted in conflicts with the continued operation of existing land uses. Operation of the measures in Reaches 1-3 would occur adjacent to or in the immediate vicinity of existing recreational and open space land uses, such as the Ferraro Sports Complex and the Los Angeles Zoo; however, the measures would not result in conflicts with these land uses nor affect their viability. Existing land uses within Reaches 4-6, including the rail operations at Taylor Yard, would also not be adversely impacted by operation of the measures in a manner that would render them obsolete. Therefore, operational impacts would be less than significant.

Alternative 13

Construction Impacts

Land use impacts are the same as for Alternative 10. Though a larger footprint of construction will occur than Alternative 10, for the same reasons as for Alternative 10, there are no land use impacts anticipated to result from construction of Alternative 13.

Operational Impacts

In Reaches 1 and 2, operational impacts would be the same as under Alternative 10.Under this alternative additional measures including side channel creation and riparian habitat creation would occur in Reach 3. No potentially significant impacts would occur from adding these measures because they would be consistent with the Single Family Residential and Industrial land use designations in the City of Glendale. Measures implemented in Reaches 4 and 5 would be the same as those under Alternative 10, therefore the impacts would be the same. Relative to Alternative 10, this alternative would add reconfiguration and widening of the channel into the westernmost portion of Taylor Yard in Reach 6. However, similar to Alternative 10, potential land use impacts would be less than significant since these lands are designated for Open Space and Public Facilities uses and would not disrupt the railroad operations between the Taylor Yard and the state park.

Restoration measures within Reach 7 would be more extensive than under Alternative 10, and would add the actions of creating riparian habitat corridors, restructuring channel walls to support vines and other vegetation, and widening and/or terracing back the channel walls to overbank levels. These additional actions would occur on lands designated for Open Space and Public Facilities within the Northeast Los Angeles, Central City North, and Silver-Lake-Echo Park-Elysian Valley Community Plan Areas, with one isolated parcel designated for Industrial that is not currently in use for industrial purposes and has limited viability for future industrial uses. Therefore, adverse land use impacts would be less than significant in Reach 7. In the Piggyback Yard area within Reach 8, Alternative 13 measures would be the same as those under Alternative 10, resulting in the conversion of industrial land to uses not consistent with the Boyle Heights Community Plan, and significant adverse land use impacts would occur.

Alternative 16

Construction Impacts

Land use impacts are the same as for Alternative 10, although restoration measures occur over a larger area. Though a larger footprint of construction will occur than Alternatives 10 and 13, for the same reasons as for Alternative 10, there are no land use impacts anticipated to result from construction of Alternative 16.

Operational Impacts

Restoration measures in Reaches 1-4, 6 and 7 would be the same as Alternative 13, therefore impacts would be the same.

Measures in Reach 5 would include additional channel widening and terracing. These measures would not affect land uses differently than Alternatives 10 and 13, and would be consistent with the respective community plans applicable to those reaches, because widening of Reach 5 occurs within the existing channel right of way, with only channel geometry changed. Therefore, potential adverse land use impacts would be less than significant. In Reach 8, the measures would be more extensive than Alternatives 10 and 13, and would include the reconfiguration and widening of the main channel, including increasing the channel invert width up to 500 feet and construction of a 1000-foot wide bench into the Piggyback Yard. Conversion from industrial uses to open space is inconsistent with community plans and reflects a significant adverse impact on land use.

Alternative 20

Construction Impacts

Land use impacts are the same as for Alternative 10. Though a larger footprint of construction will occur than Alternatives 10, 13 and 16, for the same reasons as for previously described alternatives, there are no land use impacts anticipated to result from construction of Alternative 20.

Operational Impacts

Restoration measures in Reaches 1-2 and 5-6 would be the same as Alternative 16; therefore, land use impacts in these reaches would be less than significant.

Restoration measures on the left bank of the River along the lower part of Reach 3, and in Reach 4 , would be more extensive than those in Alternatives 10, 13, and 16, and would impact lands designated as Industrial in the Verdugo Wash area of the Northeast Los Angeles Community Plan. Restoration measures in Reaches 3 and 4 in this alternative would result in the permanent conversion of industrial uses to a non-industrial use. This would conflict with the designated Industrial use definition for this site. In addition, active industrial uses are currently in operation within the proposed conversion area; these uses would likely not be able to continue to exist at the site with the restoration measures included in this alternative, and might require relocation. Indirect impacts could occur from the reduction in viable industrial operations adjacent to and in the vicinity of the site. Unlike Alternatives 10, 13, and 16, the measures in this alternative could result in a potentially significant adverse impact to land use in Reaches 3 and 4.

Reaches 7-8

In Reach 7, restoration measures up the Arroyo Seco tributary and adjacent the Cornfields site on lands designated Industrial would be more intensive than Alternative 16 but would still allow current industrial uses to operate; therefore, potential adverse land use impacts would be less than significant. Additionally, three streams would be daylighted outside of the river channel and a pool and riffle system would be added within the channel. These measures would be consistent with current land uses and community plans, and impacts would be less than significant.

Measures occurring within Reach 8 would be the same as those in Alternative 16 and greater than Alternatives 10 and 13 with respect to potential land use impacts at the Piggyback Yard resulting from the widening and reconfiguration of the channel. Adverse land use impacts would be the same as Alternative 16, and would be significant.

5.3.4 Best Management Practices and Impact Avoidance Measures

BMPs for protection of land use may be provided through the application of community plans. Local communities will have the opportunity to evaluate land uses and this may assist in identifying the best measures for avoiding impacts to land use.

In Reaches 3-4 under Alternative 20, the conversion of lands in the Verdugo Wash area for River restoration measures could displace existing industrial operations on land designated for industrial purposes, per the Northeast Los Angeles Community Plan. The Northeast Los Angeles Community Plan is the effective Land Use Element for the Northeast CPA. The City of Los Angeles, as part of its efforts to address changing land uses in the area, may conduct an analysis of the Industrial land designations adjacent to, and in the vicinity of, the River. This analysis would examine the continued viability of industrial land uses near the River corridor, and suggest modifications of land use designations, goals, and policies, in the Northeast Los Angeles Community Plan where appropriate. This analysis would include potential impacts on current industrial land uses and suggest modifications of land use policies to ensure that these uses can continue as River restoration measures are implemented.

In Reach 8 under all the Alternatives, the proposed River restoration measures occurring at Piggyback Yard would affect and potentially displace the existing industrial container rail operations, thus reducing their viability and potentially reducing the viability of other industrial uses within the Boyle Heights and Lincoln Heights communities. The Boyle Heights Community Plan is currently being updated, and the community has dual goals of preserving industrial uses and jobs while increasing parks, recreation and open space options in the community. The Boyle Heights Community Plan is the effective Land Use Element for Boyle Heights in the City of Los Angeles General Plan.

5.4 WATER RESOURCES

5.4.1 Regulatory Framework

Clean Water Act

The CWA is the principal law governing pollution control and water quality of the nation's waterways. The objective of the CWA is to restore and maintain the chemical, physical, and biological integrity of U.S. waters (33 USC 1251). It provides standards and enforcement, a number of regulatory programs with permits and licenses, grants, and revolving funds, as well as general provisions and provisions for research and related programs. Relevant sections are Sections 401, 402, and 404.

National Flood Insurance Act

This act established the Federal flood insurance program, prior to which, affordable private flood insurance was generally not available. Under the National Flood Insurance Program, Federally subsidized flood insurance is made available to owners of flood-prone property in participating communities. Administered by the Federal Insurance Administration of the Federal Emergency Management Agency (FEMA), participating communities are required to adopt certain minimum floodplain management standards, including restrictions on development in designated floodways, a requirement that new structures in the 100-year flood zone be elevated to or above the 100-year flood level (known as base flood elevation), and a requirement that subdivisions are designed to minimize exposure to flood hazards (NOAA 2006). Any work that may affect the flood elevations would be coordinated with FEMA.

Executive Orders

EO 11988, Floodplain Management, was issued on May 24, 1977, to avoid to the extent possible the long- and short-term adverse impacts of occupying and modifying floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative.

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act established the State Water Resources Control Board, which has the ultimate authority over state water rights and water quality policy. It also established nine regional boards to oversee water quality on a day-to-day basis at the local or regional level. The regional boards develop and update their respective basin plans, which are used to address beneficial uses, water quality standards for both surface water and groundwater, and measures necessary to control point and nonpoint sources. The regional boards regulate all pollutant or nuisance discharges that may affect either surface water or groundwater. Under the auspices of the USEPA, the Water Resources Control Board grants NPDES permits (CERES 2006). The Porter-Cologne Act also applies to nonpoint as well as point source discharges. It establishes an administrative permitting authority, in the form of waste discharge requirements, waiver of these requirements, or basin plan prohibitions, to be used to control nonpoint source discharges (California Regional Water Quality Control Board 2004). Within the study area, stormwater management plans and authorizations are coordinated with the Los Angeles Regional Water Quality Control Board, along with the City and Los Angeles County.

Regional Water Quality Control Board 401 Permit Process

Section 401 of the Clean Water Act grants each state the right to ensure that the state's interests are protected on any Federally permitted or funded activity occurring in or adjacent to Waters of the State. In California, the Regional Water Quality Control Boards are the agencies mandated to ensure protection of the California waters. If a proposed project requires Section 404 compliance, falls under other Federal jurisdiction, or has the potential to affect Waters of the State, the Regional Water Quality Control Board would regulate the project and associated activities through a water quality certification. The purpose of the certification is to verify that the project activities comply with state water quality standards. A Section 401 water quality certification would most likely be required for in-water work associated with the restoration measures.

Local Regulations

In December 2001, the Los Angeles Regional Water Quality Control Board issued a Municipal Stormwater NPDES Permit (No. CAS004001) that requires new development and redevelopment projects to incorporate stormwater mitigation measures. Depending on the type of project, either a standard urban stormwater mitigation plan or a site-specific mitigation plan is required to reduce the quantity and improve the quality of rainfall runoff that leaves a project site. Stormwater pollution control plans would be coordinated with the City and Los Angeles County.

5.4.2 Significance Criteria

The following thresholds of significance are based on CEQA guidelines. A project would be considered to have a significant impact if it would cause the following to occur:

- Violation of any water quality standard or waste discharge requirements,
- Substantial depletion of groundwater supplies or substantial interference with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted),
- Substantial change to the existing drainage pattern of the study area, including the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site,
- Creation or contribution to runoff that exceeded the capacity of existing or planned stormwater drainage systems or introduced substantial additional sources of polluted runoff,
- Located housing within a 100-year flood hazard area as mapped on a Federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map,
- Located structures where they would impede or redirect flood flows,
- Resulted in greater exposure of people or structures to a significant risk of loss, injury or death involving flooding including flooding as a result of the failure of a levee or dam,
- Increased the risk of inundation of the study area by seiche, tsunami or mudflow,
- Increase in the water surface elevation of peak flows in the River,
- Substantial changes to the amount of surface water in the River, including both diminished or increased flow,
- Resulted in a permanent, adverse change to the movement of surface water sufficient to produce a substantial change in the current or direction of water flow,
- Created pollution, contamination, or nuisance, as defined in Section 13050 of the California Water Code,
- Caused regulatory standards to be violated, as defined in the applicable NPDES stormwater permit or water quality control plan for the receiving water body,
- Change potable water levels sufficiently to reduce the ability of a water utility to use the groundwater basin for public water supplies, conjunctive use purposes, imported water storage, summer/winter peaking, or to respond to emergencies and drought,
- Reduction in yields of adjacent wells or well fields (public or private),
- Adversely altered the rate or direction of flow of groundwater, or
- Resulted in demonstrable and sustained reduction of groundwater recharge capacity.

5.4.3 Environmental Impacts

No Action Alternative

Construction Impacts

No impacts to water resources would occur from construction under this alternative because construction would not occur.

Operational Impacts

Hydrology, water quality, and groundwater conditions within the study area will continue changing based on population pressures, new and continuing regulations, and future climate conditions. Hydrology in the study area will continue to be characteristic of urban environments with high peak flows and short durations, with resultant peaks in pollutants that quickly dissipate to normal levels. Increased population density and impervious areas within the watershed, upstream of and on tributaries within the study area, could potentially increase these conditions. New regulations that serve to implement development and redevelopment requirements for hydro-modification/low-impact development practices, which are designed to capture on-site runoff primarily through infiltration and diversions, could decrease future impacts due to urbanization. Current climate change studies have indicated a likely increase in the frequency of extreme weather conditions in the future. These extreme weather events could compound and increase watershed peak flows.

Water quality impairments within the watershed are primarily being addressed through the TMDL process. TMDL implementation plans, which serve to identify best management practices (BMPs) to reduce water quality impairments and meet watershed beneficial uses have been developed for several reaches of the study area. Watershed water quality conditions have undergone extensive scrutiny and analysis in the past few decades due to public awareness and the participation of watershed stakeholder groups. Though increased urbanization within the watershed has been correlated with degraded water quality conditions, watershed stakeholders have helped to develop current regulations to improve these conditions. Newly required hydro-modification and low-impact development regulations are also contributing to the reduction of watershed contaminants through the containment and treatment of urban runoff.

Groundwater conditions within the watershed are impaired due to historic land use contaminants that have persisted in the water table. Treatment facilities have been established to treat groundwater contamination, which will improve conditions over time. Like surface water quality, public awareness and watershed stakeholder groups have helped develop regulations to protect groundwater from further degradation. If improperly managed, population growth within the study area has the potential to create higher demands for water use in the region and further degrade the basin's ability to naturally recharge water.

Watershed peak flows would remain characteristic of an urban environment, with high peak flows of short durations. Surface water quality pollution in the River channel and tributaries would be expected to continue to improve due to ongoing efforts to meet required regulatory pollutant reductions. Groundwater areas contaminated by persistent contaminants from historic land use activities would also continue to slowly improve over time due to implemented groundwater treatment BMPs. The majority of groundwater supply in the study area would continue to come from the Upper Los Angeles River Area groundwater basin. Groundwater basins would continue to be recharged and managed to support future water resource uses. Surface and groundwater water quality improvements due to management activities would continue to improve to the extent feasible under the No Action Alternative, or as water quality program funding permits. However, the Los Angeles River is a highly urbanized and degraded system. Due to pollution impacts traced to highly urbanized and industrial land use activities located in the watershed, water quality problems will likely persist at measurable levels.
Under the No Action Alternative, restoration measures would not be constructed; therefore, the potential for operation impacts would be non-existent.

Alternative 10 (ART)

Potential impacts to water resources may occur from construction efforts or from the operation of the completed project. Overall, temporary impacts incurred during the construction phase could be adverse (although not significant), while greater beneficial impacts are anticipated once the project is complete. Potential impacts are described below for construction and operation of the project.

Construction Impacts

Construction efforts affecting water resources are regulated and guided through permitting, certification, and plan development in order to minimize adverse impacts. The project would comply with state-adopted, USEPA-approved water quality standards as contained in the RWQCB's Basin Plan, which was designed to preserve and enhance water quality and protect the beneficial uses for all regional waters (SWRCB 1994). These plans were described above in relation to the components that address erosion control.

Clean Water Act Section 401 water quality certification and a SWPPP would be required to be obtained by the construction contractor. A SWPPP would be developed in accordance with the guidelines of the State of California's NPDES General Construction Permit. The SWPPP would contain a visual monitoring program, and a water quality monitoring program for non-visible pollutants to determine construction site BMP effectiveness. The SWPPP would list all BMPs to be implemented during construction activities for the control of erosion, siltation, and any other pollutants that could potentially enter stormwater or surface water of the River and tributaries.

Impacts to surface water quality could be caused by temporary ground-disturbing activities during construction, many of them near local drainages and waterways that could become contaminated by erosion, construction substances, and resuspension of sediment during rain events. Ground-disturbing activities that may occur during construction of Alternative 10 include the following:

- Demolition of concrete and excavation of earthen material to create geomorphological changes,
- Demolition of concrete paved and/or grouted rock channel bed and side slope protection,
- Widening of channel bed and top of banks via excavation and grading of earthen material,
- Use of heavy equipment for hauling away concrete debris and excavated material, and
- Excavation for topsoil fill and vegetation establishment on side slopes of maintenance roads and channel.

Hydrologic features would not be significantly affected by measures under Alternative 10. Restoration measures would be designed to not impair flood risk management functions in any portion of the study area or areas downstream. It is assumed that instream construction and modification of the project reaches would be conducted in dry weather months (April 15 - October 31) to avoid wet weather storm flows, or that work areas would be adequately protected and not affect flood conveyance. In areas where instream construction would occur, diversions would be implemented to bypass dry weather flows downstream. Base flows supportive of beneficial uses, which protect aquatic life and human uses, may be temporarily affected in the immediate construction zone, but would not be affected upstream or downstream of the study area (SWRCB 1994).

Implementation of BMPs, including erosion control measures, would avoid or minimize any adverse effects from soil erosion and surface water runoff. Soil erosion during possible storm events also has the potential to temporarily increase turbidity and sedimentation in the River and tributary confluences. These potential impacts would be addressed in a SWPPP, which would be prepared by the construction contractor, and would be expected to keep impacts to less than significant.

Due to the shallow depth of groundwater in the study area, much of the River channel bed between Reaches 4 and 6 has not been hardened; during the original design and construction of the channel, hardening was avoided out of concern that the shallowness of groundwater in these reaches would cause concrete slab failures over time. Though restoration measures would decrease impervious areas and increase infiltration rates of surface to groundwater, impacts to groundwater from polluted surface water should be minimal, as a strong hydrologic connection between surface and groundwater already exists in the study area and accidental spills would be avoided or minimized through the implementation of a Spill Prevention and Response Plan.

Operational Impacts

It is anticipated that current channel operations and maintenance activities would not be significantly affected under the proposed alternative's restoration measures. The City would be responsible for maintenance of restoration features, while the USACE would continue to maintain the LACDA project within the study area, with modifications for compatibility with the restoration project consistent with the flood risk management function. Potential additional maintenance of restoration features would be as follows:

- Maintenance of daylighted storm drains and associated overbank wetland areas to remove accumulated trash and sediment deposition, which could pose a threat to water quality if dispersed to the main channel, and
- Maintenance of riparian restoration areas targeted for revegetation; if topsoil is eroded before vegetation is established, in-stream sediment pollution could occur.

To prevent additional impacts during maintenance, maintenance crews would need to follow existing BMP plans, or develop new BMP plans while working in restoration areas.

Operational impacts to River hydrology under Alternative 10 would be beneficial and are expected to include:

- Widening of the channel bed,
- Expansion of overbank areas on both sides of the river,
- Restoration of riparian habitat corridors on channel side slopes and overbank areas, which will provide shading,
- Reconnection of main channel flows to the historic floodplain using connectors through impervious barriers,
- Constructing grade control structures for hydraulic diversity, and
- Creating geomorphologic variation and backwater areas.

Incidental benefits to water quality due to operations would occur in all reaches of the study area; these benefits would be realized in the short term due to the removal of impervious surfaces in the River and riparian overbank areas, but would not be fully realized until riverine habitat was established.

Water quality pollutant removal mechanisms incidental to the implementation of restoration measures include physical and biological. Physical removal includes the removal of pollutants through adsorption, absorption, filtration, and ultraviolet disinfection. Adsorption allows for a pollutant to bind to another substance through adhesion and thereby be removed from the environment (ammonia, copper, cyanide, indicator bacteria, lead, nutrients, oil, and selenium). Absorption allows for uptake of a pollutant, when it is incorporated into vegetation (nutrients). Filtration is the removal of a pollutant by mechanical or physical means (trash). Ultraviolet disinfection occurs when ultraviolet rays are used to kill microorganisms (indicator bacteria).

Biological removal includes phytoremediation and bioremediation. Phytoremediation is the process of using plants to remove, transfer, stabilize, and destroy environmental contaminants (ammonia, copper, cyanide, indicator bacteria, lead, nutrients, oil, and selenium). Bioremediation is the process of using biologic organisms to remove, transfer, stabilize, and destroy environmental contaminants (ammonia, copper, cyanide, indicator bacteria, lead, nutrients, oil, and selenium).

The restored habitat could provide benefits by helping to provide biological and chemical removal of constituents that contribute to the River's 303(d) listing, including ammonia, copper, cyanide, indicator bacteria, lead, nutrients (algae), oil, selenium, and trash (SWRCB 2010).

Groundwater benefits to operation would include increased groundwater infiltration and recharge for future water uses, though these benefits would likely not be significant.

Alternative 13 (ACE)

Construction Impacts

Restoration measures and associated construction and beneficial impacts to project area water resources under Alternative 13 would be similar in scope to those under Alternative 10, but would be implemented over a larger portion of the study area to include the Arroyo Seco confluence and increased widening at Taylor Yard. Additional measures under Alternative 13 include the demolition and excavation of channel walls to construct planter boxes.

As discussed under Alternative 10, protective management and BMP measures during construction activities to address impacts to River hydrology, groundwater, or water quality would ensure construction impacts are less than significant. Beneficial impacts under Alternative 13 would also be similar to Alternative 10, but would increase because of the slightly larger area of implementation.

Operational Impacts

Operation impacts and benefits under Alternative 13 would not significantly affect hydrologic features, water quality, and groundwater resources and would be the same to those found under Alternative 10, but over a slightly larger area, thus providing an incremental increase in benefits.

Alternative 16 (AND)

Construction Impacts

In comparison to Alternative 10 and 13, Alternative 16 proposes additional significant restoration measures over a larger area of implementation within the project area, with a larger footprint of disturbance at Piggyback Yard. The additional measures include:

- Demolition and excavation of channel walls to create terraced banks in Reaches 5and 8,
- Demolition and excavation to deepen channel bed in Reach 5, and
- Demolition and excavation of old railroad features and construction of trestles for relocation of the railroad above the restoration area in Reach 8.

Hydrologic features, water quality, and groundwater resources would not be significantly affected by restoration measures under Alternative 16. In comparison to Alternatives 10 and 13, Alternative 16 would be implemented over a larger area, increasing the potential for construction impacts; however, as addressed in Alternative 10, BMPs would help prevent potential construction impacts.

Operational Impacts

Beneficial impacts would be similar to those found under Alternative 10 and 13, but would also include increased riverine and riparian habitat supportive of reducing flows and increasing channel capacity, increasing the interaction of surface to groundwater by softening the channel bottom, and increasing the natural "polishing" and removal of pollutants from surface water.

Alternative 20 (RIVER)

Construction Impacts

In comparison to Alternatives 10, 13, and 16, Alternative 20 proposes restoration measures over the largest area (see Table 5-1). Restoration measures under Alternative 20 would be similar to Alternative 16, but would also include the widening of Verdugo Wash in Reaches 3 and 4 and channel reshaping/widening restoration measures in Reach 2. Construction impacts under Alternative 20, both adverse and beneficial, would be similar to Alternative 16, but would be more extensive due to the increased area over which the measures would be applied.

Operational Impacts

Operations under Alternative 20 would not significantly affect hydrologic features, water quality, and groundwater resources, and would be the same as those under Alternative 16, but would occur over a larger area, again providing an incremental increase in overall benefits.

5.4.4 Best Management Practices and Impact Avoidance Measures

Implementation of BMPs would be guided through permitting, certification, and plan development, and through recommendations provided in the CEQA guidelines. The proposed erosion control measures, also listed under Section 5.1. BMPs, would include, but not be limited to, the following:

- Installing silt fences around construction areas to prevent silt and sediment from entering the river channel,
- Stabilizing and reseeding of disturbed areas with native plants,
- Implementing an Erosion and Sediment Control Plan consistent with RWQCB policy and guidelines,
- Conducting construction work in accordance with site-specific construction plans that minimize the potential for sediment to enter the stream,
- Identifying all areas that require clearing, grading, revegetation, or recontouring and enclosing within construction fencing,
- Minimizing the extent of areas to be cleared, graded, or recontoured,
- Grading spoil sites to minimize surface erosion and applying erosion control measures, as appropriate, to prevent sediment from entering water courses or the stream channel to the maximum extent feasible,
- Applying mulch to disturbed areas, as appropriate, and plant with appropriate plant species as soon as practical after disturbance,
- Designing and implementing a dewatering plan to avoid operating equipment in flowing water by using temporary cofferdams or some other suitable diversion to divert channel flow around the channel and bank construction area,
- Limiting most in-channel construction to the low-flow period between April 15 and October 31 to minimize soil erosion, and
- Complying with an established Spill Prevention and Response Plan, which would define requirements for storage, handling, and containment of hazardous materials.

5.5 BIOLOGICAL RESOURCES

5.5.1 Regulatory Framework

Federal Laws and Regulations

Clean Water Act (CWA) The CWA has provisions for protecting biological resources within the aquatic environment through identification of beneficial uses and prohibitions on fill of wetlands or other Waters of the U.S. (WoU.S.). The primary functions of the CWA in protecting biological resources in this instance are to ensure that any impacts to wetlands or WoU.S. are compensated for and to provide a framework for ensuring that water quality is maintained or improved.

Endangered Species Act (ESA) The Endangered Species Act (ESA) protects threatened and endangered species by prohibiting federal actions that would jeopardize continued existence of such species or result in destruction or adverse modification of any critical habitat of such species. If adverse impacts to listed species are anticipated, Section 7 of the Act requires consultation regarding protection of such species be conducted with the U.S. Fish and Wildlife Service (USFWS) and/or the National Marine Fisheries Service (NMFS) prior to project implementation. (16 USC 1531, 1536).

Fish And Wildlife Coordination Act (FWCA) The purposes of the FWCA include recognizing the contribution of wildlife resources to the nation, acknowledging the increasing public interest and awareness of wildlife resources, and ensuring that wildlife conservation receives due consideration in water resources development programs (16 USC 661).

Migratory Bird Treaty Act (MBTA) The MBTA implements various treaties and conventions between the U.S. and Canada, Japan, Mexico, and Russia for the protection of migratory birds. Under the act, taking, killing or possessing migratory birds is banned.

Several Executive Orders relating to biological resources would need to be complied with as future planning and implementation of any of the proposed restoration measures take place. Relevant EOs include the following:

- *Invasive Species*—EO 13112, issued on February 3, 1999, helps prevent the introduction of invasive species and provides for their control and minimizes the economic, ecological, and human health impacts that invasive species cause.
- *Protection of Wetlands*—EO 11990, issued on May 24, 1977, helps avoid the long-term and short-term adverse impacts associated with destroying or modifying wetlands and avoiding direct or indirect support of new construction in wetlands when there is a practicable alternative.
- *Migratory Birds*—EO 13186, issued on January 10, 2001, promotes the conservation of migratory birds and their habitats and directs Federal agencies to implement the Migratory Bird Treaty Act.
- *Protection and Enhancement of Environmental Quality*—EO 11514, issued on March 5, 1970, supports the purpose and policies of NEPA and directs Federal agencies to take measures to meet national environmental goals.

State Laws and Regulations

California Endangered Species Act, Sections 1600-1607
The California Endangered Species Act focuses on protecting all native species of fishes, amphibians, reptiles, birds, mammals, invertebrates, and plants, and their habitats threatened with extinction and those experiencing a significant decline which, if not halted, would lead to a threatened or endangered designation.

California Fish and Wildlife Code, Sections 1600-1607

Sections 1600 through 1607 which regulate work that would substantially divert, obstruct, or change the natural flow of a river, stream, or lake; that would substantially change the bed, channel, or bank of a river, stream, or lake; or that would use material from a streambed.

The Porter-Cologne Water Quality Control Act also applies to biological resource protections.

5.5.2 Significance Criteria

In evaluating the context and intensity of an environmental effect, a significance threshold provides a qualitative or quantitative benchmark for determining whether the impact is significant or less than significant. The thresholds for determining the significance of impacts for this analysis are based on the environmental checklist in Appendix G of the CEQA (2006) guidelines.

These thresholds also encompass the factors taken into account under NEPA to determine the significance of an action in terms of its context and the intensity of its impacts. The alternatives under consideration could result in a significant impact related to biological resources if they would:

- Have a substantial adverse effect, either directly or through habitat modification, on any species identified as endangered, threatened, candidate, rare, or of special concern in local or regional plans, policies, regulations, or on lists compiled by the CDFW, NOAA-Fisheries, or USFWS;
- Have a substantial adverse and unmitigated effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the CDFW, NOAA-Fisheries, or USFWS;
- Have a substantial adverse and unmitigated effect on Federal- and state-protected wetlands as defined by Section 404 of the CWA and as protected under the Porter-Cologne Water Quality Control Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means;
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species, or with established native fish or wildlife migratory or dispersal corridors, or impede the use of native wildlife or fish nursery sites;
- Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance; or
- Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan.

5.5.3 Environmental Impacts

Impacts to biological resources would result from temporary construction efforts and construction of new habitat features. Impacts may include those to vegetation, wildlife, or species of special concern. Proposed alternative impacts range from modifying existing sensitive habitat such as riparian and wetland communities, disturbing native species by construction activities such as air and noise pollution, and disrupting the use of fish and wildlife corridors and breeding or nesting habitats. These impacts could result from site preparation, grading, bank lowering, channel widening, daylighting of storm drains, removal of concrete, excavation of side channels, riverside plantings, removal or alteration of existing structures and water infrastructure, and construction of new connections to water sources. The magnitude of the disturbance would determine the significance of the impact to biological resources. However, the majority of the effects from the construction of the restoration measures proposed under the action alternatives would be highly beneficial to biological resources over the long term.

In this section, the significant beneficial impacts are qualitatively described for each alternative, while also providing the quantitative measure of restoration benefits in terms of Habitat Units (HUs). Additional details regarding the calculation of HUs are provided in Sections 4.9 and 4.11.

No Action Alternative

Construction Impacts

No construction impacts would occur under the No Action Alternative since there would be no construction.

Operational Impacts

Current operations would be expected to continue into the future without the implementation of the proposed project. Authorized maintenance includes clearing of all vegetation and scraping of the channel to maintain the purpose of flood risk management, which may be implemented in the future as funding allows. While funding has not allowed for this level of removal since the river's channelization, it remains an authorized maintenance activity. Due to the limited funding, recent maintenance of vegetation in the study area is limited to removal of non-natives within existing habitat in soft bottom reaches and removal of sediment and aquatic vegetation in concrete reaches. Without implementation of the proposed project, removal of all vegetation in the channel would remain an authorized maintenance activity. While non-natives are periodically removed when funding becomes available, this maintenance would not be consistent or widespread throughout the study area.

Under the No Action Alternative, poor water quality and quantity issues will continue to degrade the existing river ecosystem. The excessive trash that accumulates within existing habitat will not be removed, and will continue to degrade riparian and wetland habitats. Most dry season flow in the channel is due to wastewater releases from the upstream Tillman Treatment Plant or runoff from irrigation or industrial practices. If the climate of Southern California becomes drier, as some climate models predict, pressure on any available water supply will increase. Over time, this could result in greater water conservation measures as well as reuse of treated wastewater, which would reduce flows in the channel. Reduced flows could result in diminished wetland and riparian habitat as well as open water habitat. With degraded habitat conditions and invasion by non-natives, use of habitats by wildlife species is also expected decline.

Habitat connectivity within the study area would continue to be extremely limited, restricting movement of most wildlife to within the existing habitat corridor in the Glendale Narrows (Reaches 4-6) and in Reach 2. No restoration of habitat nodes would occur and there would be no improvement of local wildlife connectivity. The benefits of restoration of habitat nodes in the urban environment, including supporting source populations of wildlife and reduction of inbreeding depression, would not be attained. Opportunities for regional wildlife connectivity via tributary confluences to significant ecological areas such as the Santa Monica and San Gabriel Mountains could not be realized.

While limited habitat exists within the study area, supporting native plants and wildlife, under the No Action Alternative it is anticipated that non-native species will continue to invade and that native habitat and wildlife diversity will decline. Due to the extensive urbanization in the study area, the existing habitat and ecological functions are extremely degraded. These degraded conditions would persist with implementation of the No Action Alternative.

Without consistent maintenance, native plant and wildlife diversity would continue to decline while existing habitats would be increasingly infested by non-native species. Non-native species do not provide adequate habitat to support a diverse population of fish and wildlife. Mechanical or chemical treatment would continue to be necessary, both as a means of maintaining native vegetation and to maintain the flood capacity of the channel to convey high flows, as funding allows.

Alternative 10 (ART)

Construction Impacts

The impacts to biological resources from constructing the proposed restoration features could include disturbance and/or removal of existing native and non-native vegetation, temporary displacement of/disturbance to wildlife species, temporary air and noise pollution, temporary sediment runoff into the River, and temporary disturbance of wildlife movement pathways.

Vegetation

During construction, existing native vegetation within the river channel would be left in place, with removal of invasives throughout the soft bottom reaches in which restoration features are constructed to avoid proliferation of invasives into restored areas. Some of this existing vegetation may be disturbed during construction of features adjacent to the vegetated river channel, such as restructuring the channel walls and widening the channel

Other portions of the study area, outside the vegetated river channel, are predominantly vegetated with non-native invasive weeds and/or ornamental vegetation. These invasives may spread further where construction efforts disturb soils. Increased presence of invasive weed species reduces ecological diversity and minimizes habitat value. However, restoration designs specifically call for revegetation of disturbed areas with native habitat, including those areas disturbed during the construction period. Non-native infestations would be treated either mechanically or chemically after construction is complete. Construction of the restoration features and invasives control would remove weedy and ornamental vegetation and replace it with native riparian and wetland habitat, which would be a benefit to the river ecosystem.

With the implementation of restoration measures, installation of native habitat, and control of invasives, construction of the proposed project would not cause significant adverse impacts to vegetation. Any impacts would be minimal, localized, and short term, and would ultimately be beneficial after native habitats are restored.

Fish

Construction activities in the river channel may result in disturbance to fish through disturbance of habitat and invertebrate prey items, as well as through increased turbidity with potential sediment runoff into the river. Construction equipment working in close proximity to the river may introduce sediment or pollutants into the water

Fish may be exposed to suspended sediment concentrations during construction, which may cause clogging to gills of fish in the immediate vicinity. It is expected that most fish would avoid the immediate construction area due to increased noise levels, turbidity, and oxygen depletion resulting from increased sediment load in the river. The proposed project will be subject to water quality standards and BMPs during construction through the issuance of federal and state permits, which would protect water quality and minimize impacts to fish. Any construction related impacts to fish would be temporary and not significant.

Currently no native fish inhabit this portion of the river (LADWP 2004, FoLAR 2008). The proposed project would benefit native fish species by restoring river habitat and riffle/pool complexes. Restoration of wetlands would incidentally improve water quality, which would also benefit fish species.

Fish are expected to re-colonize the proposed construction areas after construction is complete. Native fish may require reintroduction into the study area, which may also require eradication of non-native fish species that feed on the native fish. Although native fish such as the Santa Ana Sucker, rainbow trout, and arroyo chub are currently extirpated from the site, reintroduction of these species could occur following restoration of appropriate habitat as these fish are supported on tributaries upstream.

Once suitable habitat conditions are restored, reintroductions of native fish species could be undertaken by other state or federal agencies, possibly in cooperation with non-profit organizations. The study area is large enough to support a self-sustaining, breeding population of historically occurring native fish. This would greatly benefit the overall population of these species by providing new breeding grounds (which are extremely limited within all of the southern California watersheds), and establishing refuge populations that would enable the species to survive any catastrophic events within existing territories. Santa Ana sucker and arroyo chub, in particular, have been extirpated from most of their historic ranges and are now found in only a handful of isolated areas.

Birds

Construction activities may temporarily remove vegetation, degrade water quality in the river, and increase ambient noise levels, which could cause disturbances to some birds causing them to vacate the construction area. Increased levels of activity may decrease birds' use of the study area for foraging, roosting, and nesting. Birds are expected to vacate the area and find alternate foraging, nesting, and roosting locations during construction activities. Construction would take place only in limited portions of the study area at any given time, and bird species would likely find similar habitat nearby in other portions of the vegetated channel or adjacent habitat areas. Birds are also expected to acclimate to construction noise, as noise levels in the study area are generally high due to the adjacent freeway and urban uses. Vegetation removal activities would take place outside the breeding season for birds to minimize impacts to nesting.

Birds would benefit from the proposed project via planting and expansion of native riparian and wetland habitats, which would improve opportunities for foraging, roosting, and nesting. Removal of trash and incidental improvement of water quality would also benefit bird species in the study area. With the implementation of restoration measures, adverse impacts to birds would be avoided and impacts would be considered less than significant, with an overall benefit to bird species in the study area.

Wildlife

Construction activities may temporarily disturb wildlife within the study area by removing vegetation and sediment, increasing noise levels, and increasing vibration levels. Wildlife is expected to vacate the area and find alternate habitat nearby during construction. Construction would take place in phases, and only be performed in limited portions of the study area at any given time. Much of the wildlife inhabiting the study area are urban adapted species that are acclimated to human presence, generally higher noise levels, and some level of disturbance. These species may adapt more readily to the type of disruptions that occur during construction. Wildlife is expected to re-colonize the construction areas after construction is complete. No significant adverse effects are expected to impact these commonly occurring wildlife species as a result of construction activities included in this alternative.

Overall, wildlife would benefit from the proposed alternative with restoration and expansion of native vegetation, which would provide additional and improved wildlife habitat.

Wildlife Movement

Wildlife movement within the study area may be disrupted during construction activities due to removal of vegetation, increased noise levels, and increased vibrations. Disturbance would be temporary and movement opportunities would be restored after construction is complete.

Wildlife movement would be marginally improved in this alternative. Restoration at Taylor Yard establishes a large node of historic riparian and marsh habitat adjacent to the river corridor. The habitat at Taylor Yard is then connected to other habitats currently existing within the river channel in the Glendale Narrows (Figure 6-2). Restoration at Taylor Yard also establishes a natural hydrologic connection between the River and the historic floodplain, which restores key ecological processes such as a more natural disturbance regime, scour and deposition of sediment and vegetation, nutrient cycling, biotic interactions, and colonization of new habitat areas (Stromberg et al 2007), as well as improved wildlife movement between the river and floodplain. Connectivity to other restored habitat in the Study area is more limited by the overbank locations (i.e. Ferraro Fields, Los Feliz golf course) and assisted hydrology in those areas. Restoration of habitat in Reaches 1, 2, and 3 provides opportunities for regional connections to Griffith Park, leading to the greater Santa Monica Mountains and the Pacific Ocean (Figure 6-3).

Impacts to wildlife movement would be temporary and not significant, and overall the project would be beneficial for wildlife species in the study area by restoring and expanding native habitat.

Wetlands

Wetland habitat has been observed in Reaches 4-6 and appears on NWI maps (USFWS 2012). For the purposes of this study, areas within the channel and at least 1/3 of the distance up the channels banks have been designated as Waters of the U.S. Similarly, any wetlands present are considered “jurisdictional” and may be temporarily affected during construction. The extent of the temporary impacts under all alternatives is being evaluated as part of a Section 404(b)(1) analysis, during which the “least environmentally damaging practicable alternative” will be identified. Since this project is an aquatic habitat restoration project with significant wetland benefits, no mitigation for wetland impacts is required or proposed.

Threatened and Endangered Species

The Federally endangered least Bell’s vireo (*Vireo bellii pusillus*) has been known to inhabit the study area and suitable habitat exists within the vegetated portions of the channel. Least Bell’s vireo were observed in the study area in 2009 and 2013 (USACE 2009, 2013). Other species of special concern, including Federal or State listed species, are not expected to occur in the study area. Impacts to least Bell’s vireo may occur with disturbance of existing riparian vegetation in the river channel and increased noise levels. With implementation of the proposed project, this riparian vegetation would be improved through removal of invasives. Riparian habitat would be further expanded through restoration of river adjacent areas, which would provide additional habitat for increased populations of vireo. Protocol level surveys for least Bell’s vireo would be performed prior to construction to identify presence within the study area. Any removal of vegetation would be limited to outside of the nesting season, and minimization measures such as noise barriers could be implemented to minimize impacts to any vireo that may be found near the study area.

With implementation of restoration and minimization measures, impacts to threatened and endangered species are not expected to be significant. Construction would be temporary, and overall would benefit endangered species by expanding native riparian and wetland habitat. The Corps would continue to coordinate with the U.S. Fish and Wildlife Service and the California Department of Wildlife to ensure impacts to threatened and endangered species are avoided and minimized.

Operational Impacts

Following completion of the construction phase, the operation of the project will begin, which will result in impacts that include (1) the maintenance necessary to ensure success of restored components, and (2) the long-term benefits of restoration that would support fish and wildlife. In addition, the LACDA operations and maintenance plan would be modified to complement the restoration project.

Riparian areas planted through restoration will be preserved on overbank areas, where they will not inhibit flood conveyance. Similarly, planter boxes or greening of the channel will also be designed in this way. Access to the river will be necessary for operation and maintenance activities following completion of the restoration project.

Trucks and other heavy equipment will access the channel via established routes that cause the least disturbance to soils or vegetation. Operation and maintenance activities will also be required to follow established protocols to ensure that any threatened or endangered species are adequately protected.

Following completion of restoration, the improved size and quality of habitat will be a significant beneficial impact to biological resources. This alternative will result in the restoration of 251 acres of valley foothill riparian habitat and will treat invasive plants on 338 acres. Restoration and expansion of native and structurally diverse riparian habitat will provide herbaceous, shrub, and tree layers needed to support existing wildlife species and provide habitat for threatened and endangered species that have the potential to inhabit the area, such as the least Bell's vireo.

Under this alternative, a total of 14 streams that currently connect to the river through culverts will be opened up and converted into wetland habitat. Beneficial impacts will result from the addition of wetland and riparian habitat, as well as an incidental improvement in water quality passing through wetlands (instead of culverts). Culverts to be replaced are concentrated in Reaches 3, 4, 5, and 7 under this alternative. The creation of additional riparian and wetland habitat in the overbank side channels will also provide benefits to fish and wildlife in the area by expanding habitat and allowing for increased populations of wildlife in restored areas.

Additional habitat will be created through installation of a high elevation side channel behind Ferraro Fields and along Griffith Park. Expanded in-channel habitat will be created where the main river channel is widened by 80 feet at Taylor Yard.

Restoration of riparian and wetland habitat in the study area will require continued maintenance to ensure the establishment and survival of planted vegetation. This includes the ongoing mechanical and/or chemical removal of non-native species that become established after restoration, as well as the irrigation and protection of native species. Restoration features would be maintained consistent with the operations and maintenance manual for the restoration project, which may include measures such as trimming or thinning of in-channel restoration features to avoid impacts to the flood risk management function. In addition, monitoring will be necessary to ensure that excessive scour or bank failures do not occur where natural channel features are restored. These maintenance activities may result in minimal impacts due to entry of restoration staff into vegetated areas to perform maintenance; however, these activities will ultimately be beneficial for persistence of the restored habitats and are expected to be minimal and not significant.

Due to enhanced habitat and additional recreational opportunities, human visitation to the study area is expected to increase. Indirect operational impacts would occur if this increased human visitation to the site led to increased disturbance of habitat. Designated trails, public use areas, and educational signage would be installed to minimize impacts from human intrusion into restored habitat areas. Although occasional adverse impacts of this nature are expected, they are expected to be minimal in comparison to the habitat benefits that would occur as a result of the project. Restoration features would be monitored and maintained to repair any damage that may occur from human visitation and recreation activities.

Overall, operation and maintenance efforts will be guided by best management and a mitigation and monitoring plan, and will not pose significant adverse impacts on the biological resources in the area. The restoration measures in this alternative have been designed specifically to improve the study area's biological resources and ecological functioning. This alternative is expected to provide significant beneficial impacts including the restoration of native habitat, expansion of habitats into overbank side channels and river adjacent areas, expansion of wildlife populations, and improved connectivity for local and regional wildlife movement. The total average annual HUs provided by this alternative are 5,321.

The normal LACDA operations and maintenance would also be affected by implementation of the restoration project. LACDA operation and maintenance include those measures that are intended to ensure proper flood conveyance through the channel, such as clearing or thinning of vegetation or removing sediment or debris if necessary, and that maintain access into the channel and environs. The LACDA OMRRR plan would be modified to accommodate the restoration features, with maintenance of those features a City responsibility under the restoration OMRRR plan. At the same time, the USACE would modify the LACDA OMRRR plan for the rest of the ARBOR reach to preserve flood risk management function while complementing the restoration project. These modifications would allow native vegetation to remain in the rest of the reach to the extent that design conveyance capacities would be met or would experience only minimal changes from the design conditions. Such OMRRR would be contingent on funding and would be anticipated to be phased in over time. These OMRRR modifications would be refined during design of the restoration project including detailed hydrologic and hydraulic analysis.

Alternative 13 (ACE)

Construction Impacts

The nature of construction impacts will be the same as for Alternative 10. Although the total area that will be affected by construction will increase for this alternative, these impacts will be temporary, and for each of the reasons noted above for Alternative 10, will not be significant to biological resources.

Operational Impacts

As with Alternative 10, impacts could potentially result from the day to day operation and maintenance of the Federal flood conveyance channel, as well as from maintaining the restoration elements. Beneficial impacts will result from the newly restored habitats. Typical operation and maintenance of the channel will be the same as in Alternative 10. However, because of the larger scale of restoration under this alternative, there will be increased maintenance efforts to ensure that restoration is successful. Protection of restored elements during maintenance will be ensured through proper use of best management practices and implementation of a management plan for the restored areas. Furthermore, the increased attraction of the site to the public will be managed through placement of signage and exclusion fences, as necessary, to protect restoration.
The benefits of the proposed alternative will be the same as for Alternative 10, with the exception of the expanded area of restoration and improved local and regional wildlife movement opportunities in Alternative 13.

Alternative 13 is designed to restore 273 acres of valley foothill riparian communities throughout the study area, including overbank areas in all reaches except 7 and within the expansive boundaries of Piggyback Yard. This is a total of 22 acres more than in Alternative 10. This alternative provides for the removal of invasives from 68 additional acres in comparison to Alternative 10, for a total treated area of 406 acres. Alternative 13 also provides for the removal of culverts from 11 streams entering the channel, where wetlands will be created, and also includes 26 acres of freshwater marsh habitat in additional locations. Side channel habitat will also be substantially increased from Alternative 10 with restoration of the confluence of Arroyo Seco, creation of side channel behind Ferraro Fields, and the expansion of the soft river bottom along Taylor Yard to a 300 foot width. This alternative is expected to provide significant beneficial impacts including increased area of restoration of native habitat, expansion of habitats into overbank side channels and river adjacent areas, expansion of wildlife populations, restoration of additional natural hydrologic connections, and further improved connectivity for local and regional wildlife movement. The total average annual HUs provided by this alternative are 5,902.

Wildlife movement would be further improved in Alternative 13 with the restoration of the Arroyo Seco confluence. The restored habitat at Arroyo Seco would improve local connectivity for wildlife by serving as a new habitat node, with a connection to Taylor Yard via the river channel as a vegetated corridor (Figure 6-5). Improved nodal habitat connectivity promotes wildlife movement within the study area and prevents inbreeding depression and local extinction of wildlife populations. The restoration of the Arroyo Seco confluence restores natural in-channel geomorphology in the currently channelized tributary. Restoration of this natural hydrologic connection between the River and tributary also benefits the River ecosystem by restoring key ecological processes in this area (Stromberg et al 2007).

On a regional scale, restoration at Arroyo Seco confluence provides future opportunities to restore habitat connectivity between the river at the Study area and the San Gabriel Mountains via the Arroyo Seco tributary (Figure 6-6). Additional opportunity for connection in this area exists via the Corps' on-going Arroyo Seco Ecosystem Restoration Study. Additional neighborhood habitat in the communities of San Rafael Hills, Mount Washington, and Montecito Heights could also be incorporated into the movement corridor as regional habitat nodes.

Alternative 16 (AND)

Construction Impacts

Construction types and impacts are similar to those described above for Alternatives 10 and 13. However, the scale of construction would continue to increase with each alternative, resulting in ever increasing earthwork requirements. Greater channel widening measures, additional side channels, and more extensive changes would result in a potentially longer construction period and would affect a larger area. However, for the same reasons described above, adverse impacts are not anticipated to be significant.

Operational Impacts

Operation of the project area following implementation of Alternative 16 would require the same maintenance and operations activities as those previously mentioned for Alternative 10 and 13. Because larger areas would be restored, truck and heavy equipment access, if needed, would be more limited. Designating access points during construction would reduce operation impacts. Additional restrictions to human usage may initially be desired to ensure successful establishment of restored elements.

The benefits of the proposed alternative will be the same as for Alternative 10 and 13, with the exception of the expanded areas of restoration, removal of concrete in the channel bed and restoration of a natural hydrologic connection at the Piggyback Yard site, and improved local wildlife movement within the study area via restoration of this connection. Though less valley foothill riparian habitat is established, greater areas of soft bottom channel, wetland, and side channels are created. Terraced areas are expanded, which provide for attenuation and habitat expansion. A total of 464 acres are targeted for invasive plant removal and treatment.

Local wildlife movement within the study area would be additionally improved by restoration of a natural hydrologic connection at Piggyback Yard, where concrete would be removed from the channel bank and the channel bed to reconnect the river to the historic floodplain. Due to the large size of the restored Piggyback Yard habitat (approximately 90 acres), the connection to the River in Alternative 16 would allow the site to serve as a source population for other restored habitat areas along the river and minimize the risk of local extinction in smaller areas. The restored channel bed at Piggyback Yard in Alternative 16 also provides a habitat corridor that connects to other habitat areas in the study area, which promotes wildlife movement and prevents inbreeding depression.). Opportunities for regional wildlife movement will be the same as in Alternative 13.

Significant benefits to biological resources will result from this alternative, including increased area of restoration of native habitat, expansion of habitats into overbank side channels and adjacent areas, removal of concrete from the channel bed, restoration of additional natural hydrologic connections, and further improved connectivity for local wildlife movement. The total average annual HUs provided by this alternative increase to 6,610.

Alternative 20 (RIVER)

Construction Impacts

Construction impacts for this alternative would generally be the same as those described for the same components that occur in Alternatives 10, 13, and 16 above. However, areas targeted for restoration increase under Alternative 20. This alternative provides the most expansive and transformative restoration alternative; construction impacts would be the most extensive in this alternative than in any other. However, for the same reasons described for other alternatives, impacts are not anticipated to be significant.

Operational Impacts

Potential temporary adverse impacts to biological resources that may result from operation and maintenance of Alternative 20 would not be substantially different than those described above for the other alternatives. However, once construction is complete, additional maintenance would be required to ensure that this most extensive riparian and wetland restoration alternative becomes successfully established and persists through the life of the project. Benefits are generally the same as for Alternative 10, 13, and 16, but more extensive due to the expanded areas of restoration, additional removal of concrete and restoration of natural hydrology at the Verdugo Wash tributary confluence, and improved local and regional habitat connectivity for wildlife within the study area via restoration of the Verdugo Wash confluence and Cornfields sites.

Alternative 20 would remove concrete and widen the confluence of the Verdugo Wash in order to support natural hydrology and habitat, and to reconnect the tributary to the historic floodplain. Restoration of the Verdugo Wash confluence would provide an additional 34 acre habitat area, which would connect to the wildlife corridor in the Glendale Narrows (Figure 6-11) and other habitat areas restored in the downstream reaches. Alternative 20 also adds restoration at the Cornfields site. This provides an additional 9 acres of riparian habitat that is hydrologically connected to the River, decreasing the distance between habitat areas in the resource-poor downtown area. Future opportunities for widespread regional connectivity would be created via restoration of the Verdugo Wash confluence, in addition to the connection at the Arroyo Seco tributary confluence (Figure 6-12).

Under this alternative, restoration measures would result in a total of 288 acres of valley foothill riparian habitat. A total of 46 acres of freshwater marsh would be created, in addition to the wetland swales created at daylighted streams. The area of soft river bottom would be expanded to its maximum potential along Reaches 5, 6, and 8, creating the most open water habitat of any alternative. Overall, restoration in this alternative provides the largest proposed area of aquatic, wetland, and riparian habitat of any alternative. Significant benefits to biological resources will result from this alternative including increased area of restoration of native habitat, expansion of habitats into overbank side channels and river adjacent areas, expansion of wildlife populations, additional removal of concrete from the channel bed, restoration of additional natural hydrologic connections, and further improved connectivity for local and regional wildlife movement. The total average annual HUs provided by this alternative are 6,883.

5.5.4 Best Management Practices and Impact Avoidance Measures

To avoid impacts to wildlife onsite, the following BMPs would be followed:

- Vegetation clearing activities would not occur during the breeding season, which generally runs from March 1-August 31.
- If vegetation removal must occur during the breeding season, a qualified biologist would perform nesting bird surveys following established protocol prior to construction. If nests are detected during these surveys, a 300-foot no construction buffer would be delineated around the nest (500-foot buffer for raptors).
- Construction would be monitored by a qualified biologist.
- Construction would be phased to minimize impacts to wildlife species, so that the entire study area would not be under construction at the same time.

Operational impacts may be offset by implementing the following measures:

- Maintenance for weed/invasives control or flood conveyance would be performed outside of the bird nesting season,
- Sensitive habitat types would be avoided to the maximum extent practicable during maintenance. Designated access points for maintenance vehicles would be created to reduce impacts to restored areas.

Informational signs would be installed to educate the public regarding the restored habitat, sensitive resources, and the impact that human intrusion may have.

5.6 CULTURAL RESOURCES

5.6.1 Regulatory Framework

The impacts of Federal undertakings on cultural resources are formally assessed through a process mandated by the National Historic Preservation Act (NHPA) of 1966, as amended (16 U.S.C. Section 470), and its implementing regulation, Protection of Historic Properties (36 CFR 800). Section 106 of the NHPA describes the process for identifying and evaluating historic properties, for assessing the effects of Federal actions on historic properties, and for consulting to avoid, reduce, or minimize adverse effects. Historic properties are cultural resources that are either "included in", or are eligible for inclusion in the National Register of Historic Places (NRHP). The Section 106 process does not require historic properties to be preserved but ensures that the decisions of Federal agencies concerning the treatment of these places result from meaningful consideration of cultural and historic values and the options available to protect the properties.

The NRHP criteria for evaluation (36 CFR 60.4) are the quality of significance in American history, architecture, archaeology, engineering, and culture in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and;

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

These criteria do not require historic properties to be preserved but ensure that the decisions of Federal agencies concerning the treatment of these places result from meaningful consideration of cultural and historic values and the options available to protect the properties.

In evaluating the context and intensity of an environmental effect, a significance threshold provides a qualitative or quantitative benchmark for determining whether the impact is significant or less than significant. The Section 106 compliance process provides the primary basis for determining whether an impact on cultural resources is significant in a NEPA analysis. The level and significance of impacts on cultural resources that may be associated with implementing the ecosystem alternative plans are based on applying the "criteria of adverse effect." The criteria of adverse effects are defined in 36 CFR 800.5a as follows:

> *"An adverse effect is found when an action may alter the characteristics of a historic property that qualify it for inclusion in NRHP in a manner that would diminish the integrity of the property's location, design, setting, workmanship, feeling, or association. Adverse effects may include reasonably foreseeable effects caused by the action that may occur later in time, be farther removed in distance, or be cumulative".*

For the purposes of this analysis, if the undertaking would result in an adverse effect on an historic property, there would be a significant impact under NEPA. The Section 106 process provides a means to resolve adverse effects and thus reduce impacts to a less than significant level. It should be noted that under NEPA impacts are considered either adverse or beneficial to cultural resources and a significant beneficial impact could result in rare cases such as the restoration and reuse of a deteriorating historic building. Under the NHPA, the analysis can result in a finding of adverse effects, no adverse effects, or no historic properties affected.

The criteria of adverse effect also provide a general framework for determining the context and intensity of potential impacts on traditional cultural properties. Assessment of impacts involving traditional cultural properties or effects on traditional practices or resources also requires focused consultation with the affected group or groups.

In general, CEQA requirements regarding cultural resources parallel Federal laws and processes. The potential impacts of a project on archaeological sites, historic properties, and Native American sacred places must be disclosed to the public. CEQA specifies that where "a project may cause a substantial change in the significance of [a] historic resource," the project "may have a significant effect on the environment" (Cal. Pub. Res. Code §21084.1). The state of California maintains the California Register of Historical Resources (CRHR), which includes resources listed on or formally determined to be eligible for listing on the NRHP, some California State Landmarks and Points of Historical Interest, and properties of local significance that have been designated under a local preservation ordinance.

5.6.2 Significance Criteria

For the purposes of this analysis, the NHPA "criteria of adverse effect" was identified as a significance threshold for NEPA. Application of the NHPA "criteria of adverse effect" as a significance threshold is inclusive of the City of Los Angeles CEQA significance thresholds because the criteria provides more specific guidance in defining and analyzing adverse changes in the qualities and characteristics that define historical resources.

An impact on cultural resources under CEQA is considered to be significant if it would result in any of the following:

- A substantial adverse change in the significance of a historical resource as defined in CEQA Guidelines Section 15064.5,

- A substantial adverse change in the significance of an archaeological resource pursuant to Section 15064.5, or
- Disturbance to any human remains, including those interred outside of formal cemeteries.

5.6.3 Environmental Impacts

The preliminary Area of Potential Effects (APE) for the purposes of compliance with the Section 106 process for this study is the footprint and disturbance areas specific to each alternative with a 50 meter (164 foot) buffer. The buffer is included as a preliminary estimate of areas that may be disturbed by construction equipment and access, as well as potential alterations to the visual setting. It is assumed for this analysis that ground disturbance could extend up to 50 feet below the ground surface in some areas, but less in most areas where excavation would be more limited.

Potential common sources of impacts on cultural resources associated with the construction of the proposed ecosystem restoration measures include ground disturbance, new construction, and structural alteration/removal of features.

Ground disturbance would result from site preparation, grading, bank lowering, channel widening, opening of storm drains, removal of concrete, excavation of side channels, riverside planting excavations, excavations for removal or alteration of existing structures and water infrastructure, and excavations for construction of new connections to water sources. If prehistoric or historic archaeological sites are present, ground disturbance can directly damage artifacts and features or alter the spatial relationship of artifacts, features, and other deposits and destroy their research potential. This can result in the permanent loss of information relevant to the site function, dates of use, plants and animals used, past environments, ethnicity and other important research questions. Ground disturbance can also damage unmarked burials or other sites that may be important to contemporary Native Americans as ancestral locations or for traditional cultural or religious purposes.

Proposed new construction may change the physical setting of historic buildings and structures. New construction for ecosystem restoration may also alter drainage patterns and channel morphology, exposing buried archaeological resources and causing impacts due to erosion.

The ecosystem restoration elements include the acquisition, removal or alteration of existing buildings and structures, including water control and conveyance infrastructure, and rail and other transportation facilities. Affected structures may be historic properties under the NHPA or historical resources under CEQA. If the proposed action of implementing the ecosystem restoration measures were to alter the characteristics of historic properties or historical resources that qualify them for inclusion on the NRHP or the CRHR, there could be an adverse effect.

A potential cultural resource impact applicable to all of the proposed ecosystem restoration measures and reaches is the alteration of the River facilities. Although not formally documented or evaluated for historic significance, the containment and flood risk management facilities on the River and its tributaries appear to be eligible for listing on the NRHP for their association with important events and possibly for their engineering innovation. The qualities of historic integrity that are typically considered for linear segments of water conveyance properties are integrity of location and the integrity of the facility or system function. Generally, modifications that maintain these qualities would not be seen as an adverse effect. Thus, modifications to facilities such as those proposed as ecosystem restoration measures involving removing portions of concrete structures, creating new structures and connections with the river and daylighting might not be considered an adverse effect on historic water conveyance facilities if the flood risk management function and location is maintained. Further evaluation and analysis during the next phase of the USACE planning process will clarify what features of the system contribute to its historic character and those qualities of integrity that are important to maintain. However, if integrity of design or other qualities are considered to contribute to the historic significance of the water conveyance facilities, there is potential for significant impacts on cultural resources under NEPA and CEQA and adverse effects under the NHPA at these locations that will need to be resolved through the Section 106 process.

No Action Alternative

Construction Impacts

Under the No Action Alternative, impacts on cultural resources associated with the ecosystem restoration project would not occur in the study area. There would be no impacts resulting from the ground disturbing activities and altering of historic infrastructure that may occur under the proposed action. However there would be no associated identification studies, monitoring, historic research, or other actions that would further define, afford protection to and increase the knowledge base, education and appreciation of the history associated with the River in Los Angeles, Burbank, and Glendale. Damage and loss of resources may occur from lack of knowledge or neglect. As infrastructure ages, many more building and structures may be considered historic and would need to be considered in future project planning. Cultural resource compliance actions would continue to be conducted for other projects that are Federal undertakings or that require NEPA or CEQA review. For these actions, surveys would be conducted, impacts would be assessed, and mitigations would be prescribed.

Operational Impacts

Under the No Action Alternative, there would be no change in potential impacts on cultural resources associated with the operations and maintenance of the containment and flood risk management facilities on the River and its tributaries. Ongoing O&M activities do not involve extensive ground disturbing activities or the removal or extensive alteration of existing structures including water control and conveyance infrastructure, and rail and other transportation facilities that may be historic. No significant impacts would be anticipated.

ALTERNATIVE 10 (ART)

Construction Impacts

Reaches 1-3

Impacts on cultural resources could occur from ground disturbance, new construction and structural alterations as a result of Alternative 10.

The immediate river corridor APE through Reaches 1, 2, and 3 has been minimally investigated for cultural resources. Pollywog Park and Bette Davis Park have not been inventoried. In Reaches 1 and 2 there have been small block surveys conducted that include portions of the approach to Pollywog Park at the River and a portion of the right bank between the Headworks Spreading Ground and Travel Town. Eligible NRHP and CRHR resources include the Riverside- Zoo Drive Bridge and portions of Griffith Park. No actions are proposed that would alter the setting or architectural qualities of the bridge that qualify it for inclusion in the NRHP. The small portions of Griffith Park in the APE have not been documented or evaluated and the current resource record focuses exclusively on historic structures elsewhere in the park. The Travel Town outdoor transportation museum, just outside the APE, is of historic age but has not been evaluated as a historic property. The containment and flood risk management facilities along the River and its tributaries are now of historic age, but have not been formally documented or evaluated for historic significance. Based on current information, modification of these structures to daylight storm drain outlets, create habitat corridors, restore open water habitat and construct River connections would likely impact historic structures, but impacts would probably not be significant because the integrity of function and location would be retained.

No specific past land uses other than open space, river channel and parkland are observed on historic quadrangle maps in the APE. There is a record of an adobe structure occupied in 1868 in the vicinity of the River at Polliwog Park, but the location is imprecise and no physical remains are visible. Given the proximity to the channelized river and the effects of freeway construction it is doubtful that any foundations or features could be located again for further investigation. Disturbance in this reach is extensive, the result of river channelization, freeway construction, utility installation and roadwork.

Based on the record search, no impacts resulting from the proposed restoration measures on cultural resources have been identified. However, identification and evaluation of cultural resources in the APE is incomplete.

While there is always the possibility of encountering buried cultural resources during ground disturbing activities, the potential for undiscovered intact buried resources that would meet the criteria for eligibility for NRHP or CRHR listing or other sensitive cultural resources appears to be low. Adverse effects are not anticipated.

Reaches 4-6

Impacts on cultural resources could occur from ground disturbance, new construction and structural alterations and removals in these reaches under Alternative 10.

The river corridor through Reaches 4, 5 and 6 has been minimally investigated for cultural resources and there are no surveys that are adjacent to and/or directly follow the River. Bridges across the River have been inventoried and evaluated for historic significance. The Glendale-Hyperion Viaduct, Riverside-Figueroa Street Bridge and Fletcher Drive Bridge, Arroyo Seco Parkway and portions of Griffith Park are eligible for listing on the NRHP and the CRHR for their architectural qualities and/or historic associations. There have been cultural resource surface surveys on adjacent parcels and along the edge of the Taylor Yard study area for this project, but there has been no inventory of the study area or subsurface excavation reported associated with other developments at Taylor Yard.

No actions are proposed that would alter architectural qualities of the historic bridges and the other properties or their settings that qualify them for inclusion in the NRHP and the CRHR. Daylighted storm drains and the narrow habitat corridors in Reaches 4 and 5 on the edge of the river channel would be developed on highly disturbed lands that are unlikely to contain or impact any intact cultural resources. Likewise, changes in channel morphology to provide habitat features are unlikely to encounter or impact intact cultural resources. Modification to the concrete channel for daylighting the storm drains and flow diversions would likely impact historic River structures, but impacts would probably not be significant because the integrity of function and location would be retained. The excavation of the side channels through the two golf courses could encounter buried cultural resources. The potential for archaeological resources and the level of past disturbance of these locations is unknown.

Extensive ground disturbance is proposed for the Bowtie/Taylor Yard site. Although it has not been inventoried for cultural resources, its history of past use as a rail facility dating back to 1925 would indicate a high likelihood for near surface and subsurface historic cultural resources including structural remains and foundations. Historic quadrangle maps show several structures, especially in the southern (Taylor Yard) part of the restoration site. Because of the extent and depth of excavation, there is also the potential for encountering intact archaeological sites predating 1925, including those that may have been encapsulated by floods on this terrace before the River was controlled. Based on the current plan, it is highly likely that historic properties could be encountered during construction and there is potential for impacts to historic archaeological resources associated with implementing this measure. However, by completing the required Section106 process and resolution of any adverse effects, significant impacts are not anticipated. Likewise extensive modifications to the river channel and river facilities at this location are proposed. Based on current information, modification of these structures would likely impact historic structures, but impacts would probably not be significant because the integrity of function and location would be retained.

Reaches 7-8

Impacts on cultural resources could occur from ground disturbance, new construction, and structural alterations and removals in these reaches under Alternative 10.

There have been previous cultural resource investigations at the Arroyo Seco confluence site, but no investigations of the Piggyback Yard study area. Bridges across the River have been inventoried and evaluated for historic significance. The First Street Viaduct, North Broadway Bridge (Buena Vista Viaduct), Cesar Chavez-Macy Street Bridge, North Main Street Bridge, North Spring Street Bridge are all eligible for listing on the NRHP and the CRHR for their architectural qualities and/or historic association.

No actions are proposed that would alter architectural qualities of the historic bridges or their settings that qualify them for inclusion in the NRHP and the CRHR. The Arroyo Seco Parkway (Pasadena Freeway), also eligible for listing on the NRHP and the CRHR, would not be impacted by the proposed restoration. Two other historic properties, the Department of Water and Power complex and the Mission Tower, would not be impacted under this alternative.

Daylighting storm drain outlets and constructing marsh habitat on the overbank areas of the channel would occur on highly disturbed lands that are unlikely to contain any intact cultural resources. Impacts are not anticipated. Modification of the concrete structures at the confluence would likely impact River and Arroyo Seco channel historic structures, but impacts would probably not be significant because the integrity of function and location would be retained.

The work on the Piggyback Yard would include the removal of standing structures, removal of pavement, grading and shallow excavation. The Piggyback Yard is on the site of a Union Pacific rail facility that was established in the early 1900s. Historic quadrangle maps show several structures in the APE including a roundhouse and turntable. There is a high likelihood of near surface and subsurface historic cultural resources including structural remains and foundations. Based on the current plan, it is highly likely that historic properties could be encountered during construction and there is potential for impacts to historic archaeological resources associated with implementing this alternative. There is potential for adverse effects on historic properties and significant impacts on cultural resources at these locations that will need to be resolved through the Section 106 process. Because there have been no cultural resource inventories, the age of the current structures that would be removed is unknown. The connection and confluence of the restored wash with the River would likely impact historic River structures, but impacts would probably not be significant because the integrity of function and location would be retained.

Operational Impacts

Under Alternative 10, minimal impacts on cultural resources would be anticipated associated with the operations and maintenance of the restoration project areas and the containment and flood risk management facilities on the River and its tributaries. In areas where concrete is removed, erosion may reveal buried undiscovered cultural resources. Ongoing O&M activities typically do not involve extensive ground disturbing activities or the removal or extensive alteration of existing structures including water control and conveyance infrastructure, and rail and other transportation facilities that may be historic. No significant impacts would be anticipated.

Overall, assuming successful completion of the Section 106 process, this alternative would not be anticipated to result in a substantial adverse change in the significance of a historic resource, a substantial adverse change in the significance of an archaeological resource, or disturbance to any human remains.

Alternative 13 (ACE)

Construction Impacts

Reaches 1-3

The ecosystem restoration measures proposed for Reaches 1 and 2 are the same as Alternative 10. Anticipated impacts on cultural resources would be the same as described for these reaches under Alternative 10. In Reach 3, Alternative 13 adds narrow riparian corridors along the upstream edge of Ferraro Fields and along Zoo Drive. A side channel cutting diagonally behind Ferraro Fields to a freshwater marsh and then to the River would be established by daylighting a stormwater culvert. Potential impacts on cultural resources could occur from ground disturbance, new construction and structural alterations as described above.

The APE adjacent to the channelized River and Zoo Drive has not been inventoried, but has been extensively disturbed. Ferraro Fields has been investigated for cultural resources. Although the athletic fields were built on a portion of an old airfield, no cultural resources have been recorded there. While there is always the possibility of encountering buried cultural resources during ground disturbing activities, the potential for undiscovered intact buried resources that would meet the criteria for eligibility for NRHP or CRHR listing or other sensitive cultural resources appears to be low. Adverse effects are not anticipated.

Reaches 4-6

The ecosystem restoration measures proposed for Reaches 4, 5 and 6 are similar to Alternative 10. Additional measures include more extensive work on channel geomorphology to support in-stream habitat in Reach 4, additional modification on both banks of the channel walls to support herbaceous riparian vegetation in Reaches 5 and 6, and the daylighting of a large storm drain at the Bowtie site in Reach 6 to create a freshwater marsh. Anticipated impacts on cultural resources would be the same as described for these reaches under Alternative 10 and would include the potential for impacts to historic archaeological properties at the Bowtie/Taylor Yard site associated with implementing the ecosystem restoration. There is potential for adverse effects on historic properties and significant impacts on cultural resources at these locations that will need to be resolved through the Section 106 process.

Reaches 7-8

Work in Reach 7 includes modifying the channel walls on both banks to support herbaceous riparian vegetation, removing concrete, reconfiguring the Arroyo Seco channel cross section, and planting to support riparian habitat restoration. No actions are proposed that would alter architectural and historic qualities or the settings of the NRHP- and the CRHR- eligible historic bridges, buildings or the Arroyo Seco Parkway. The narrow habitat corridors on the edge of the river channel and Arroyo Seco channel modifications would be developed on highly disturbed land that are unlikely to contain any intact cultural resources. Modification of the concrete structures at the confluence would likely impact River and Arroyo Seco channel historic infrastructure, but impacts would probably not be significant because the integrity of function and location would be retained.

Ecosystem restoration measures proposed for Reach 8 are the same as Alternative 10 with the exception that existing railroad tracks within the Piggyback Yard would be elevated. Anticipated impacts on cultural resources would be the same as described under Alternative 10 and would include the potential for impacts on historic archaeological properties associated with implementing measures at the Piggyback Yard. There is potential for adverse effects on historic properties and significant impacts on cultural resources at these locations that will need to be resolved through the Section 106 process.

Operational Impacts

Under Alternative 13, minimal impacts on cultural resources would be anticipated associated with the operations and maintenance of the restoration project areas and the containment and flood risk management facilities on the River and its tributaries. In areas where concrete is removed, erosion may reveal buried undiscovered cultural resources. Ongoing O&M activities typically do not involve extensive ground disturbing activities or the removal or extensive alteration of existing structures including water control and conveyance infrastructure, and rail and other transportation facilities that may be historic. No significant impacts would be anticipated.

Overall, assuming successful completion of the Section 106 process, this alternative would not be anticipated to result in a substantial adverse change in the significance of a historic resource, a substantial adverse change in the significance of an archaeological resource, or disturbance to any human remains.

Alternative 16 (AND)

Construction Impacts

The ecosystem restoration measures proposed for Reaches 1, 2, 3, 4, 6, and 7 are the same as Alternative 13. Anticipated impacts on cultural resources would be the same as described for these reaches under Alternative 13.

In addition to the restoration measures proposed for Reach 5 under Alternative 13, Alternative 16 adds reshaping of the right bank of the channel from trapezoidal to vertical configuration and widening the channel invert to provide additional in-stream habitat. A bioengineered notch along the top of right channel would be constructed for hanging vines. The left bank of the channel would be constructed to transition from trapezoidal to vegetated terraces. These changes would not alter architectural qualities of the historic bridges and the other properties or their settings that qualify them for inclusion in the NRHP and the CRHR. Modifications to the channel morphology are unlikely to encounter or impact intact buried archaeological resources, but modification to the concrete channel would likely impact historic River structures. Impacts would probably not be significant because the integrity of function and location would be retained.

Additional restoration measures proposed for Reach 8 include riparian planting and restoration of riparian habitat corridors outside of the channel along the Piggyback Yard area and channel alterations including terraces and widening provide habitat features supportive of in-stream biota. Modification to the concrete channels and channel wall would likely impact historic River structures, but impacts would probably not be significant because the integrity of function and location would be retained. There is a high likelihood of near surface and subsurface historic cultural resources including structural remains and foundations in the Piggyback Yard. Removing the channel wall and creating a bench would require more extensive excavation and the potential for deeper erosion than the other alternatives. This increases the likelihood of impacts by exposing archaeological sites from the historic railroad uses and perhaps earlier periods. It is highly likely that historic properties could be encountered during construction and there is potential for impacts on historic archaeological resources associated with implementing this measure. There is potential for adverse effects on historic properties and significant impacts on cultural resources at these locations that will need to be resolved through the Section 106 process.

Operational Impacts

Under Alternative 16, minimal impacts on cultural resources would be anticipated associated with the operations and maintenance of the restoration project areas and the containment and flood risk management facilities on the River and its tributaries. In areas where concrete is removed, erosion may reveal buried undiscovered cultural resources. Ongoing O&M activities typically do not involve extensive ground disturbing activities or the removal or extensive alteration of existing structures including water control and conveyance infrastructure, and rail and other transportation facilities that may be historic. No significant impacts would be anticipated.

Overall, assuming successful completion of the Section 106 process, this alternative would not be anticipated to result in a substantial adverse change in the significance of a historic resource, a substantial adverse change in the significance of an archaeological resource, or disturbance to any human remains.

Alternative 20 (RIVER)

Construction Impacts

The ecosystem restoration measures proposed for Reaches 1, 4, 5, 6, and 8 are the same as Alternative 16. Anticipated impacts on cultural resources would be the same as described for these reaches under Alternative 16.

The additional measure for Reach 2 of reshaping the right bank of the channel from a trapezoidal to vertical configuration and hanging vines from the top of the channel would likely impact historic River structures, but impacts would probably not be significant because the integrity of function and location would be retained.

The measures proposed for Reach 3 on the west side of the River for Ferraro Fields and along Zoo Drive would be the same as Alternatives 13 and 16 with the same anticipated impacts on cultural resources. On the east side of the River in Reach 3, the Verdugo Wash would be widened under the SR-134 Freeway and a soft bed riverbed would be configured to support an open water marsh through removal of the concrete bed. The downstream banks would be lowered and sloped adding riparian vegetation. Portions of the study area above the River and wash level have been inventoried and no cultural resources have been recorded. Reconfiguring the confluence and creating the sloped downstream banks would require the removal of at least ten structures. Most appear to be of recent construction but their age and historic status has not been verified. Deep excavations would be needed to lower the banks. In the immediate vicinity of the Verdugo Wash and freeway supports and in the channel the soil is likely to be highly disturbed, but the potential for intact buried archaeological resources is unknown in other areas proposed for lowering. Modification to the concrete channels would likely impact historic River structures, but impacts would probably not be significant because the integrity of function and location would be retained.

In addition to the restoration measures proposed for Reach 7 under Alternatives 13 and 16, under Alternative 20 three storm drains would be daylighted. Terraces on the right bank would be added adjacent to the Cornfields site and the western edge of the terrace would be sloped back up to the original ground elevation, creating a freshwater marsh. The daylighted storm drains are in disturbed areas where the potential for undiscovered intact buried resources would be low. Modification to the concrete channel for daylighting the storm drains and flow diversions would likely impact historic River structures, but impacts would probably not be significant because the integrity of function and location would be retained. The Cornfields site is the former location of the Southern Pacific River Station and freight yard. Archaeological excavations at the Cornfields have confirmed the presence of significant historical cultural resources on the site. Impacts to historic archaeological properties would be possible from ground disturbing activities associated with creating the freshwater marsh at this site and connecting it with the

River. There is potential for adverse effects on historic properties and significant impacts on cultural resources at these locations that will need to be resolved through the Section 106 process. No actions are proposed that would alter architectural and historic qualities or the settings of the NRHP- and the CRHR-eligible historic bridges and buildings.

Operational Impacts

Under Alternative 20, little change in potential impacts on cultural resources would be anticipated associated with the operations and maintenance of the restoration project areas and the containment and flood risk management facilities on the River and its tributaries. In areas where concrete is removed, erosion may reveal buried undiscovered cultural resources. Ongoing O&M activities typically do not involve extensive ground disturbing activities or the removal or extensive alteration of existing structures including water control and conveyance infrastructure, and rail and other transportation facilities that may be historic. No significant impacts would be anticipated.

Overall, assuming successful completion of the Section 106 process, this alternative would not be anticipated to result in a substantial adverse change in the significance of a historic resource, a substantial adverse change in the significance of an archaeological resource, or disturbance to any human remains.

5.6.4 Best Management Practices and Impact Avoidance Measures

Inventory, identification and evaluation of the cultural resources that may be encountered in the APE are incomplete and a fully-informed assessment of impacts on cultural resources is not possible. Based on the results of the record search it is highly likely that historic properties could be encountered during construction of the proposed ecosystem restoration measures at Bowtie/Taylor Yard and the Piggyback Yard under all of Alternatives and also at the Cornfields under Alternative 20. There is potential for adverse effects on historic properties and significant impacts on cultural resources at these locations that will need to be resolved through the Section 106 process. This does not preclude the possibility of adverse effects and significant impacts on cultural resources at other locations from the construction of ecosystem restoration actions

Completion of the Section 106 process for implementing these proposed restoration measures requires consultation with the California State Historic Preservation Officer (SHPO) and other parties defined in 36 CFR 800 (f). These may include local governments, Indian tribes, applicants for Federal assistance or permits and representatives of other organizations. The USACE effects determination for implementing this undertaking and for concurrence with the effects determination by the SHPO would require additional information such as research designs; further refinement of the APE for each action and location; site-specific inventory, identification and evaluation efforts; further research into past uses and depth of disturbance; and continued consultation. This supporting work will be conducted prior to initiation of construction. The USACE consulted with the SHPO staff by telephone in June of 2013 regarding the level of effort for the analysis in the IFR EIS/EIR. The SHPO concurs with the use of existing information from the records and literature search. The SHPO will review and may provide comments on the draft EIS. The SHPO understands that further compliance actions with Section 106 will occur in the next phase of the project, consistent with the USACE planning process (Dibble 2013). Resolution of identified adverse effects through completion of the Section106 process would reduce significant impacts on cultural resources. No adverse effects are anticipated from the long-term operation or maintenance of the ecosystem restoration projects, after resolution of construction-related adverse effects.

Development of a Programmatic Agreement (PA) is anticipated for addressing consultation, review, and compliance with Federal and state requirements regarding cultural resources because of the project complexity, lack of baseline information, long time-frame for implementation, and application of similar ecosystem restoration measures at multiple locations. The PA would establish a process through which the parties would meet their compliance responsibilities for these kinds of projects and their effects on particular types of cultural resources. The PA can set standards and expectations for consistently addressing cultural resource identification requirements and effect analyses for project implementation, avoid redundant consultation, simplify requirements for adapting to minor changes in project descriptions, and streamline compliance. The required signatories to the PA would include (1) the USACE; (2) the SHPO; and (3) the Advisory Council on Historic Preservation (ACHP) (if, after notified by letter, they choose to participate). Other required signatories include any person or organization agreeing to assume some sort of role or responsibility in the PA such as local governments. Concurring parties could include Tribes, local governments, groups or individuals with historical, cultural, economic or preservation interests in the River corridor. Signing a PA as a concurring party simply means that the group or individual concurs with the PA. Concurring parties do not have the authority in and of themselves to terminate or amend a PA.

Research, documentation, and evaluation will be undertaken of the containment and flood risk management facilities on the River and its tributaries for historic significance. It is of historic age and would appear to be eligible for listing on the NRHP minimally for its association with important events in the development of Southern California and possibly for engineering innovation. All of the restoration measures proposed for this project involve modification of River structures. The qualities of historic integrity that are typically considered for linear segments of water conveyance properties are integrity of location and the integrity of the facility or system function. This evaluation will clarify what features of the system contribute to its historic character and those qualities of integrity that are important to maintain.

Steps will be taken to ensure that cultural resource block inventories and evaluations are conducted of potential restoration sites and staging areas so that avoidance and impact minimization measures for cultural resources can be incorporated in project design and so that the Section 106 process can be completed in a timely manner.

A plan will be prepared outlining in detail procedures for monitoring construction and coordinating appropriate responses for discovery of unanticipated buried resources. An archeologist meeting the Secretary of the Interior's Qualification Standards shall monitor all construction activities in areas where there is a potential for buried resources. The monitor shall be empowered to temporarily stop construction in the area of any significant discovery. Should previously unknown historic or archaeological remains be discovered, the USACE would comply with 36 CFR 800.13. At the conclusion of monitoring activities, a detailed letter report shall be prepared. This report shall be submitted to the SHPO for review and comment.

5.7 TRAFFIC AND CIRCULATION

5.7.1 Regulatory Framework

Federal Regulations

Federal management of transportation facilities in the area is under the authority of the Federal Highway Administration and the Federal Transit Administration. Federal programs related to roads and highways, mass transit, and pedestrian and bicycle facilities include Metropolitan and Statewide Planning (49 USC Sections 5303, 5304, 5305), Large Urban Cities (49 USC Section 5307), Rail and Fixed Guideway Modernization (49 USC Section 5309), Bus and Bus Facilities (49 USC Sections 5309, 5318), the Surface Transportation Program, and Congestion Mitigation and Air Quality Improvement Program.

State Regulations

Coordination with Caltrans would be necessary where construction of restoration measures would involve highways, regulations, and standards under Caltrans jurisdiction. Where proposed projects would affect state highways and freeways, coordination with Caltrans would require developing traffic management plans and obtaining encroachment permits for work within state ROWs and permits to transport equipment or materials in oversized vehicles. Caltrans would also likely participate in decisions related to federal transportation agency involvement.

Local Regulations

Local jurisdictions, including the Cities of Los Angeles, Glendale, and Burbank, and Los Angeles County, have primary responsibility for managing the various roadways that make up the area street network. The Los Angeles County Metropolitan Transportation Authority is responsible for preparing the Congestion Management Program for Los Angeles County. This program addresses the impact of local growth on the regional transportation system and monitors the operations of the designated Congestion Management Plan roadway network.

City of Los Angeles regulations include significance levels of construction-related activities, designated truck routes and hours of operation, noise restrictions from construction and excavation activities, and construction clearance requirements. These regulations are discussed below.

LADOT considers construction-related traffic to be an adverse impact, but not significant. This is because such impacts, while they are often inconvenient to local roadway users, are short-term. However, LADOT requires implementation of worksite traffic control plans for construction projects in order to ensure that construction-related impacts are minimized to the extent possible.

The City of Los Angeles allows major and secondary arterials to be used as truck routes. However, some local streets have weight limitations or other restrictions that would limit truck traffic. Typically, trucks would not travel on those streets except to obtain access to a specific project site. The City of Los Angeles policy is to allow trucks to travel in a "reasonable fashion" to and from a project site. The City of Los Angeles reviews each haul route permit application on a project basis and may adjust its general guidelines as appropriate for particular situations.
The City of Los Angeles also restricts the speed limit to 25 mph in construction areas. The city has the following construction clearance requirements:

- Five-foot clearance between a traffic lane and the nearest vertical obstruction, which can be reduced to three feet in certain circumstances with the approval of LADOT;
- Two-foot clearance to a raised curb, which can be reduced to zero in certain situations with the approval of LADOT;
- A minimum of 10-foot-wide traffic lanes must be maintained through construction zones; and
- The minimum taper requirement for channeling traffic flow lanes ranges from 25:1 to 30:1 (length to horizontal distance).

5.7.2 Significance Criteria

The City of Los Angeles CEQA Guidelines (2002) traffic significance thresholds have been used to determine the level of impacts. The cities of Glendale and Burbank have not established CEQA significance criteria. For purposes of this project, the criteria above from the City of Los Angeles' CEQA Guidelines have been applied for the portions of the project in those cities.

The project would have a significant impact on traffic, transportation, and the circulation system if it would:

- Conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system,
- Conflict with an applicable congestion management program, including, but not limited to level of service (LOS) standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways,
- Substantially increase hazards due to a design feature (e.g. sharp curves or dangerous intersections) or incompatible uses (e.g. farm equipment),
- Result in inadequate emergency access,
- Result in an increased demand for public transit, beyond the current transit capacity,
- Provide less parking than was needed for the project, as determined through a project-specific analysis of parking demand, or
- Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities.

5.7.3 Environmental Impacts

No Action Alternative

Construction Impacts

No impacts to transportation would occur from construction under this alternative because construction would not occur.

Operational Impacts

Under the No Action Alternative, the project would not be implemented and no construction would occur; therefore, the existing transportation network and travel demand would not be altered and there would be no impacts.

Population, employment, and goods movement are all projected to increase under the future without-study conditions (Wilbur Smith Associates 2008). This would result in increased pressure on the transportation system, including increased numbers of vehicles and vehicle miles traveled on Federal and state highways and local streets, increased demand for freight and passenger rail capacity, increased public transit ridership, increased parking demand, and increased numbers of pedestrians and bicyclists. Many of these systems, especially the road and rail networks, are already operating near capacity and increased use would be expected to reduce operating efficiency and cause increased delays.

A high-speed rail network is planned that would have three routes passing through Union Station that would accommodate a projected 14,100 riders. The study is currently undergoing a phased study planning and environmental review to determine the best route alignment and station locations, and assess the environmental impacts. Construction in the Central Valley may begin in early 2013 and will take several years to complete. In the Los Angeles area, high-speed rail would provide a new transportation alternative that would divert trips from existing road, passenger rail, and bus routes and serve California's growing population (California High Speed Rail Authority 2012). High speed rail trains would pass through the study area.

Transportation stakeholders have developed plans to achieve an efficiently functioning transportation system such as the Transportation Element of the City of Los Angeles's General Plan (City of Los Angeles 1997) and the Multi-County Goods Movement Action Plan (Metrolink 2007). The stakeholders including governments, transportation planning agencies, and commercial businesses such as Union Pacific and BNSF would be expected to continue efforts to analyze the region's transportation needs and implement projects to address growing demand and evolving needs. However, issues such as funding and land use conflicts may prevent or cause delays in implementing major changes or upgrades to the transportation network.

Alternative 10 (ART)

Construction Impacts

The project would add additional traffic to area roads during construction, which would occur over 161 working days under this alternative. Trips would involve construction equipment and materials being delivered to and removed from the site and workers commuting to and from the site. Construction vehicles would be scheduled and routed to minimize conflicts with other traffic. However, workers commuting to and from the site would travel during peak morning and afternoon commute periods, adding traffic to areas roads when they are busiest. Table 5-13 contains estimates for the number of worker commute trips and haul truck trips that would be generated by the action alternatives; the numbers are estimates and actual numbers may vary.

Table 5-13 Construction and Demolition Debris Removal

Alternative	Daily Worker Round Trips (2 people per vehicle)	Daily Haul Truck Trips	Estimated Number of Work Days
10-ART	24	12 cubic yard truck: 73 16 cubic yard truck: 338 Total truck trips: 411	161
13-ACE	29	12 cubic yard truck: 88 16 cubic yard truck: 250 Total truck trips: 338	282
16-AND	90	12 cubic yard truck: 92 16 cubic yard truck: 332 Total truck trips: 424	624
20-RIVER	107	12 cubic yard truck: 80 16 cubic yard truck: 397 Total truck trips: 477	726

Construction activities could result in delays in traffic movements due to the presence of slow-moving construction trucks and vehicles delivering or removing equipment and supplies from construction sites, and from temporary closure of travel lanes or roads or from traffic detours. A construction traffic management plan would be prepared and submitted to LADOT for review and approval prior to project implementation to ensure that construction impacts are minimized. The plan would include:

- Designated routes and access points for construction vehicles and equipment,
- Any turning movement restrictions,
- Travel time restrictions to avoid peak travel periods on selected roadways, and
- Designated staging and parking areas for workers and equipment.

With implementation of a traffic management plan and traffic control plan, and the appropriate BMPs, additional construction traffic and temporary closures and diversions would have a minimal impact on effected roadways and intersections. LADOT considers temporary impacts to be less than significant.

If construction required temporary closures or partial closures of streets or traffic diversions to accommodate construction activities, public transit routes on the affected streets would also be temporarily disrupted. Transit vehicles could be routed, and riders could be delayed, resulting in short-term impacts. The construction traffic management plan and traffic control plan would describe impacts to public transit in detail and efforts would be made to minimize impacts. The project proponent would also coordinate with local transit providers prior to project implementation. In the unlikely event that a significant impact was identified, the project design or construction plan would be altered to reduce the impact to less than significant.

Construction would occur in railyards and near railroad lines in Reach 8. The construction traffic management plan and traffic control plan would describe impacts to railroads in detail and coordination with railroad operators would be essential to determine methods for minimizing impacts. Proper coordination will ensure that impacts would be less than significant.

During construction, staging areas would provide parking for construction equipment and construction workers, so parking demand on surrounding roads would not increase. If road or lane closures were necessary to accommodate construction activities, on-street parking spaces in those areas could also be temporarily closed. The construction traffic management plan and traffic control plan would describe impacts to parking in detail and efforts would be made to minimize impacts. This impact would be less than significant.

Construction could have short-term adverse impacts on the Los Angeles River Bike Path. Sections of the path may be temporarily closed or rerouted to accommodate construction activities. If construction required closures or partial closures of streets to accommodate construction activities, bike lanes and sidewalks on these streets would also be temporarily closed, resulting in short-term moderate adverse impacts. A construction traffic management plan would be prepared prior to project implementation. The plan would describe in detail any closures or rerouting of the bike path to accommodate construction activities. Efforts would be made to minimize any necessary closures. If closures were necessary, signs would be posted to alert users to the closure and fencing or other access restrictions would be used if necessary to ensure safety. This impact would be less than significant.

Operational Impacts

The project would not alter the roadway network. No existing roads, intersections, or bridges would be permanently closed and no new roadway features would be added. Because no new features would be added during maintenance, the project would not introduce hazards due to design features such as sharp curves or dangerous intersections or incompatible uses such as farm equipment and there would be no impact related to this significance criterion. There would also be no change in roadway capacity.

The project would not result in changes to emergency access. As previously stated, the project would not alter the roadway network, so existing emergency access routes would not be affected. Ramps constructed under this alternative would assist people in the River channel during operation to exit safely and easily and swiftwater rescue personnel to access the River.

The project would add vehicle trips to area roads because it would make portions of the River a recreational destination. However, these trips would likely occur during off-peak travel hours and therefore would not affect the performance of the roadway network when it is at its busiest. Therefore the project would not conflict with established measures of effectiveness for the performance of the roadway network and the area's adopted congestion management program and impacts would be less than significant.

Ridership on public transit routes with stops near portions of the study area where public access is enhanced would increase because people would use public transit to access the River. However, the restored River is not expected to be a public draw to the extent that it causes overcrowding on public transit resources.

This alternative calls for the removal of out-of-use railroad infrastructure in Reach 6 at Taylor Yard west of Rio de Los Angeles State Park to provide area for habitat corridors and riparian plantings. These lines are not in use and the nearby rail line that is in use would not be affected; therefore, there would be no impact on railroads at this location.

This alternative, like the other alternatives, calls for the redevelopment of the Los Angeles Transfer Container Facility, also known as Piggyback Yard. It is located in Reach 8, owned by Union Pacific, and used as a freight-forwarding area. The yard has multiple rail spurs running through it and rail lines on its north, west, and south perimeters. The passenger and freight rail lines along the west perimeter are owned by LA Metro and are referred to as the "East Bank" tracks. The tracks at the Yard's northern perimeter consist of the "Yuma Main Line", owned by Union Pacific, and one Amtrak track. The lines south of the Yard are Metrolink tracks owned by Metro, also known as the "San Gabriel Subdivision." All of these tracks would remain in place and continue to operate; however, the spur lines in the Yard's interior and the railyard storage capacity would be permanently removed. The reduction in railyard capacity would result in a long-term moderate adverse impact.

Long-term ridership on commuter rail lines with stops near portions of the study area where public access is enhanced would increase because people would use commuter rail to access the River. Additional riders would likely travel during off-peak travel times since they would primarily be accessing the River for recreational purposes. Since they would generally travel during off-peak times, the additional riders would not likely cause ridership to exceed peak ridership and would not add substantially to demand for commuter rail service; thus, existing capacity should be sufficient to accommodate the increase. Therefore, impacts would be less than significant.

The project would not alter the amount of available parking in the project vicinity; however, parking demand on roads near the River would increase because more people would be expected to access the River for recreational purposes. Thus, the existing parking in the study area, which is primarily on-street parking on residential roads, would be more heavily used and would see more use by persons not living or working in the area. A project would have a significant impact on parking if it were to provide less parking than was needed, as determined by a project-specific analysis of parking demand. A project-specific analysis of parking demand will be prepared prior to project implementation and the final design will reflect adequate parking, resulting in a less than significant adverse impact.

Because the River corridor would be enhanced aesthetically and new multi-use walking and biking paths would be constructed, and public access would increase, more people would be expected to use the River corridor for local and recreational trips. Travel on the existing Los Angeles River Bike Path would also increase. The capacity of the Los Angeles River Bike Path and the new multi-use paths that would be constructed as part of the project should be sufficient to accommodate demand.

Alternative 13 (ACE)

Construction Impacts

Construction activities would occur over 282 days, a longer time period compared to Alternative 10-ART, so the temporary effects of construction would last longer. As shown in Table 5-12, the number of daily worker commute trips would be slightly higher than under Alternative 10-ART but the number of round trip truck trips would be lower. Construction impacts would be less than significant since the inconvenience to vehicles and other types of traffic would be temporary.

Operational Impacts

Operational impacts on traffic and transportation would be similar to those described for Alternative 10-ART, but would be more extensive due to the larger footprint of the proposed project; however, impacts would still be less than significant. Under this alternative, existing railroad alignments would not be affected during construction or operation. Through coordination and implementation of BMPs, impacts are considered to remain less than significant for both construction and operation.

Alternative 16 (AND)

Construction Impacts

Construction activities would occur over 624 days, a longer time period compared to Alternatives 10-ART and 13-ACE, so the temporary effects of construction would last longer. As shown in Table 5-12, the number of daily worker commute trips would be approximately three times as many as Alternative 13-ACE. The number of round trip truck trips would also be higher; however, because the trucks would not travel the same routes, would not likely travel during peak commute hours, and would only last for the duration of construction, the additional trips would result in a less than significant impact. Most construction impacts to circulation and traffic would be less than significant since the inconvenience to vehicles and other types of traffic would be temporary.

Under this alternative existing railroad alignments would be kept at grade but placed onto trestles in Reach 8 on the left bank south of Main Street to Caesar Chavez Avenue through Piggyback Yard, with excavation below the existing grade. The railroad would be trestled to provide right-of-way for additional channel capacity and space to implement other restoration measures. This would require temporary closure of the affected portion of the railroad line and rerouting of traffic using this line, which would result in delays for the rerouted rail traffic and for rail traffic on the lines to which traffic is rerouted. This short-term impact to rail traffic would be significant, since it would be difficult to find sufficient capacity on other rail lines to reroute freight, passenger, and high-speed rail trains while the trestles are being constructed.

Operational Impacts

Operational impacts on traffic and transportation would be similar to those described for Alternatives 10 and 13, but would be more extensive due to the larger footprint of the proposed project; however, impacts would still be less than significant. Once construction was complete, road and rail operations could return to a before-project state; thus, there would be no long-term operational impact on railroads. Through coordination and implementation of BMPs, impacts are considered to remain less than significant for operation.

Alternative 20 (RIVER)

Construction Impacts

Construction activities would occur over 726 days, a longer time period compared to the other alternatives, so the temporary effects of construction would last longer. As shown in Table 5-12, the number of daily worker commute trips would be higher than the other alternatives. The number of round trip truck trips would also be higher; however, because the trucks would not travel the same routes, would not likely travel during peak commute hours, and would only last for the duration of construction, the additional trips would result in a less than significant impact. Construction impacts for vehicular commuting and traffic would be less than significant since the inconvenience to vehicles and other types of traffic would be temporary.

Like Alternative 16, under this alternative, existing railroad alignments would be kept at grade but put onto trestles in Reach 8 on the left bank south of Main Street to Cesar Chavez Avenue through Piggyback Yard, with excavation below the existing grade. The railroad would also be raised onto trestles on the right bank between North Spring Street and North Broadway. The railroad would be trestled to provide right-of-way for additional channel capacity and space to implement other restoration measures. This would require temporary closure of the affected portion of the railroad line and rerouting of traffic using this line, which would result in delays for the rerouted rail traffic and for rail traffic on the lines to which traffic is rerouted. This short-term impact would be significant, since it would be difficult to find sufficient capacity on other rail lines to reroute freight, passenger, and high-speed rail trains while the trestles are being constructed.

Operational Impacts

Operational impacts on traffic and transportation would be similar to those described for Alternatives 10 13, and 16 but would be more extensive due to the larger footprint of the proposed project; however, impacts would still be less than significant. Once construction was complete, road and rail operations could return to a before-project state; thus, there would be no long-term operational impact on railroads. Through coordination and implementation of BMPs, impacts are considered to remain less than significant for operation.

5.7.4 Best Management Practices and Impact Avoidance Measures

The following BMPs would be implemented to reduce transportation impacts:

- The location and duration of any lane or street closures, including impacts on public transit, railroads, bicycle lanes, sidewalks, and parking would be fully coordinated with local cities and nearby residents,
- Detour routes would be provided if needed (including detour routes for public transit, bicycles, and pedestrians when effected),
- Local traffic and emergency vehicle access would be maintained or accommodated,
- Traffic protective devices and control measures would be implemented such as barricades, cones, flaggers, lights, warning beacons, temporary turning restrictions, temporary traffic signals, and warning signs,
- Advance notice would be provided to affected residents, businesses, emergency services providers (police, fire, ambulance) and public transit providers,
- Temporary bus stops would be located within a reasonable walking distance of any displaced bus stops when public transit stops are affected,
- Safety improvements would be made to existing at-grade street-rail crossings where traffic increases would be expected, and
- The project would coordinate with railroad companies to ensure continuous operation and appropriate safety measures.

5.8 NOISE

5.8.1 Regulatory Setting

Federal

Federal law (Noise Control Act of 1972, 42 U.S.C. 4901 et seq., P.L. 92-574) legislates that each state provide for the protection of its citizens from noise. The following sections describe each of the regulations that have been developed at the state, county, and city level for noise control. Though each of the regulations described in the following sections applies to the proposed project, some regulations are stricter than others and would become the basis for significance criteria.

State of California

The State of California requires each local government to perform noise surveys and implement a noise element as part of its general plan as guided by the General Plan Guidelines (OPR 1998). The study area is located within the jurisdictions of the Los Angeles County, City of Los Angeles, City of Glendale, and City of Burbank, each of which have specific noise guidelines in place, as well as ordinances established as enforcement mechanisms for noise control.

Title 24 of the California Code of Regulations (CCR), Part 2, Chapter 12, Section 1208A.8.2 establishes the statewide regulations for allowable interior noise and states that interior noise levels attributable to exterior sources shall not exceed 45 decibels in any habitable room. This noise metric is to be measured as the day-night level (DNL) or the community noise equivalent level (CNEL), consistent with the Noise Element of the local General Plan. The CNEL is applicable for this analysis and adds a 5 dBA penalty to evening hours (7:00 p.m. to 10:00 p.m.) and a 10 dBA penalty to nighttime hours (10:00 p.m. to 7:00 a.m.).

Meaningful noise regulations come from average noise levels over the course of a 24-hour period referred to as the day-night average and denoted as DNL. These values are calculated from 24-hour averages in which nighttime values (10pm to 7am) are increased by 10 dB to account for the greater disturbance potential from nighttime noises. The community noise equivalent level (CNEL) is another measurement type that provides additional weighting for communities. It describes cumulative noise exposure over 24 hours, increased overnight by 10 dB to account for nighttime sensitivity, but also includes an additional increase by 5 dB for events between 7pm and 10pm.

Los Angeles County

The Los Angeles County Code (LACC) provides applicable noise regulations for exterior noises, specific guidelines for allowable noise in particular land use zones, allowable noise levels for construction activities and duration considerations for construction activities. The Los Angeles County General Plan reinforces the County Codes in its 2012 revised Noise Element. However, current ambient noise levels have not been updated in this document (Los Angeles County 2012). The LACC provides noise level regulations for exterior, interior, and construction noise.

Exterior Noise

LACC Section 12.08.390 regulates exterior noise levels for four noise zones based on noise sensitivity as shown in Table 5-14. Unless a variance is allowed, these exterior noise levels apply to all receptor properties within a designated noise zone.

Table 5-14 Los Angeles County Code Exterior Noise Limits

Noise Zone	Designated Noise Zone Land Use (Receptor property)	Time Interval	Exterior Noise Level (dB)
I	Noise-sensitive area	Anytime	45
II	Residential properties	10:00 pm to 7:00 am (nighttime)	45
		7:00 am to 10:00 pm (daytime)	50
III	Commercial properties	10:00 pm to 7:00 am (nighttime)	55
		7:00 am to 10:00 pm (daytime)	60
IV	Industrial properties	Anytime	70

Interior Noise

Table 5-15 lists the allowable noise levels for residential dwellings.

Table 5-15 Los Angeles County Code Interior Noise Limits

Designated Land Use	Time Interval	Allowable Interior Noise Level (dB)
Multifamily	10 pm—7 am	40
Residential	7 am—10 pm	45

Construction Zones

Section 12.08.440 of the LACC restricts construction activity, where construction disturbs a commercial or residential property, to the hours between 7:00 a.m. and 7:00 p.m. Monday through Saturday and prohibits construction activity at any time on Sundays, or national holidays. Section 12.08.440 includes noise level limits at residential properties for mobile and stationary construction equipment (Table 5-16). Section 12.08.440 limits construction noise at commercial properties to a maximum of 85 dBA any time.

Operating or causing the operation of any tools or equipment used in construction, drilling, repair, alteration or demolition work between weekday hours of 7:00 p.m. and 7:00 a.m., or at any time on Sundays or holidays, such that the sound therefrom creates a noise disturbance across a residential or commercial real-property line, except for emergency work of public service utilities or by variance issued by the health officer is prohibited.

Table 5-16 Los Angeles County Code Construction Limits

	Single-family Residential	Multi-family Residential	Semi Residential/ Commercial
Mobile Equipment. Maximum noise levels for nonscheduled, intermittent, short-term operation (less than 10 days) of mobile equipment:			
Daily, except Sundays and legal holidays, 7:00 a.m. to 8:00 p.m.	75dBA	80dBA	85dBA
Daily, 8:00 p.m. to 7:00 a.m. and all day Sunday and legal holidays	60dBA	64dBA	70dBA
Stationary Equipment. Maximum noise level for repetitively scheduled and relatively long-term operation (periods of 10 days or more) of stationary equipment:			
Daily, except Sundays and legal holidays, 7:00 a.m. to 8:00 p.m.	60dBA	65dBA	70dBA
Daily, 8:00 p.m. to 7:00 a.m. and all day Sunday and legal holidays	50dBA	55dBA	60dBA

In addition, the LACC states that all mobile or stationary internal-combustion-engine powered equipment or machinery shall be equipped with suitable exhaust and air-intake silencers in proper working order. In case of a conflict between this chapter and any other ordinance regulating construction activities, provisions of any specific ordinance regulating construction activities shall control. Variances from the requirements of this chapter may be granted by the health officer. Every applicant for a variance shall file with the health officer a written application on a form prescribed by the health officer. The application shall state the name and address of the applicant, the nature of the noise source involved, and such other information as the health officer may require.

City of Los Angeles

The City of Los Angeles Municipal Code (LAMC) provides its own set of regulations for exterior noise and construction (City of Los Angeles 2012).

Exterior Noise

The LAMC determines noise impacts based on the increase over the ambient noise level. Sections 112.01 and 112.02 indicate a noise ordinance violation would occur from most stationary sources when noise would exceed levels identified in Table 5-17 by 5 dBA or more.

Table 5-17 Presumed Ambient Noise Level by Zone within Los Angeles

Zone	Day (7:00 a.m.–10:00 p.m.)	Night (10:00 p.m.–7:00 a.m.)
Agricultural, Suburban, Residential including Single and Multiple Family Homes (A1, A2, RA, RE, RS, RD, RW1, RW2, R1, R2, R3, R4, and R5)	50 dBA	40 dBA
Parking Areas and Commercial (P, PB, CR, C1, C1.5, C2, C4, C5, and CM)	60 dBA	55 dBA
Limited and Restricted Light Industrial (M1, MR1, and MR2)	60 dBA	55 dBA
Light and Heavy Industrial (M2 and M3)	65 dBA	65 dBA

Source: City of Los Angeles 2012.

Construction Noise

Construction activity is regulated in Section 40.41 of the LAMC, which restricts construction activity to occur between the hours of 7:00 a.m. and 9:00 p.m. Section 40.41 further restricts construction activities within 500 feet of residential properties to between the hours of 8:00 a.m. and 6:00 p.m. on Saturdays, or national holidays and prohibits construction at any time on Sundays. Section 112.05 further restricts construction equipment operating within 500 feet of residential uses between the hours of 7:00 a.m. and 10:00 p.m. to 75 dBA DNL. Section 112.05 states that construction and industrial machinery shall not exceed a maximum of 75 dBA at a distance of 50 feet, except where compliance is technically infeasible.

As determined by the Executive Director of the Board, the provisions of Subsection (c) shall not apply to major public works construction by the City of Los Angeles and its proprietary Departments, including all structures and operations necessary to regulate or direct traffic due to construction activities. The Board, through its Executive Director, pursuant to Subsection (b) would grant a variance for this work and construction activities would be subject to all conditions of the variance as granted. Concurrent with the request for a variance, the City Department that would conduct the construction work would notify each affected Council district office and established Neighborhood Council of projects where proposed Sunday and/or Holiday work would occur.

City General Plans

Noise control objectives and guidelines have been prepared in the General Plan Noise Elements for each of the cities of Los Angeles, Burbank and Glendale. The most comprehensive noise planning is provided in the City of Los Angeles General Plan Noise Element; it provides noise and land use compatibility guidelines for exterior noise, reinforces the state and county regulations, provides an additional construction ordinance, and provides the basis for the Burbank and Glendale General Plan Noise Elements (City of Los Angeles 1998). No additional noise elements are found in the Burbank or Glendale General plans. City General Plans are required to indicate the extent of airport noise exposure, where those lands are subject to additional noise controls. The study area is not within an airport noise exposure contour of 65dB in any of the city jurisdictions.

Exterior Noise

The City of Los Angeles General Plan Noise Element guidance for noise and land use compatibility is provided in a matrix taken from the Governor's General Plan Guidelines (OPR 1998). Land use categories are similar to state and county land uses. A range of dBA measurements is shown for each land use for normally acceptable, conditionally acceptable, normally unacceptable, and clearly unacceptable noise levels (Table 5-18).

Table 5-18 City of Los Angeles Noise Element and Land Use Compatibility Matrix

Land Use Category	Normally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Residential – Low Density	50-60	60-70	70-75	75-85
Residential – Multiple Family	50-65	65-70	70-75	75-85
Transient Lodging – Motels, Hotels	50-65	65-70	70-80	80-85
Schools, Libraries, Churches, Hospitals, Nursing Homes	50-60	60-65	65-80	80-85
Auditoriums, Concert Halls, Amphitheaters	NA	50-70	NA	70-85
Sports Arenas, Outdoor Spectator Sports	NA	50-75	NA	75-85
Playgrounds, Neighborhood Parks	50-67.5	NA	67.5-75	75-85
Golf Courses, Riding Stables, Water Recreation, Cemeteries	50-70	NA	70-80	80-85
Office Buildings, Business Commercial and Professional	50-67.5	67.5-77.5	77.5-85	NA
Industrial, Manufacturing, Utilities, Agriculture	50-70	70-80	80-85	NA

Source: OPR 1998, City of Los Angeles 1998.

Construction Noise

There are no additional construction noise regulations provided in the City General Plans.

Wildlife

There are no established regulations for controlling noise for protection of noise sensitive wildlife. However, through the NEPA/CEQA agency consultation process, the USFWS service may provide noise control measures to protect sensitive wildlife during implementation of the selected project. Previous studies have established a 60 dB limit during the nesting season for protecting sensitive bird species such as the least Bell's vireo in relation to highway noise (AASHTO 2008).

5.8.2 Significance Criteria

Thresholds of significance for noise impacts are derived from state, county, and city regulations and ordinances described in Section 5.8.1. The most restrictive limitations are selected as threshold criteria in cases where there are conflicting state, county, or city regulations. Construction limits allow for some leeway in noise levels without a variance, and if a variance is obtained, some leeway for limits that are set. In the case where no variance is approved by a public health officer under permit, adverse noise effects would be considered significant if the following regulations are violated:

- Interior noise levels attributable to an exterior source exceeds 45 dB in any habitable room during the daytime from 7am to 10pm (Title 24), or exceeds 40 dB nighttime from 10pm to 7am (LACC),
- Exterior noise levels exceed those limits set by LACC for four noise zones shown in Table 5-16, or those set by the LAMC and shown in Table 5-17,
- An increase in noise levels by 3 decibels or more within the “normally unacceptable” or “clearly unacceptable” categories (see Table 5-18), or any increase of 5 decibels or more,
- A 5 dBA or greater increase over the monitored or assumed ambient noise level per CEQA, or
- Violation of any noise limits established by USFWS during consultation for sensitive wildlife species.
- Violation of LAMC restrictions on construction activity, which must only occur between the hours of 7:00 a.m. and 9:00 p.m., must not occur within 500 feet of residential properties and between the hours of 8:00 a.m. and 6:00 p.m. on Saturdays and national holidays, and must not occur anytime on Sundays (City of Los Angeles 2012),
- Violation of LAMC restrictions on construction equipment operating within 500 feet of residential uses to 75 dBA DNL (see Table 5-17),
- Violation of LACC restrictions on construction equipment noise for construction projects lasting 10 or more days (see Table 5-16), and
- Violation of LAMC requirements that construction and industrial machinery shall not exceed a maximum of 75 dBA at a distance of 50 feet, except where compliance is technically infeasible (see Table 5-17).

5.8.3 Environmental Impacts

Operational noise impacts are not anticipated to result from the project after it is completed. Operation and maintenance of the channel would continue to occur and generate a comparable noise environment to that already in place. Long-term effects would be limited to occasional noise generated during visits by maintenance vehicles, which would not be considered significant. Construction of the selected project would generate temporary increased noise levels, which can be a nuisance. In general, mobile (e.g. trucks) and stationary (e.g. cranes) construction activities would result in short term increases in noise.

Impacts on noise sensitive receptors, such as public school classrooms, which are active primarily during the daytime and evening hours, were determined by weighting the impact measurement to the potential interior noise level (or for exterior uses, e.g., outdoor theaters, to the exterior noise level) over the typical hours of use, instead of using a 24-hour measurement. Indoor noise levels are typically 10-20 dBA lower with windows closed, depending on the type of window (i.e., single pane, double pane, etc.).

No Action Alternative

Construction Impacts

No impacts to noise-sensitive receptors would occur from construction under this alternative because construction would not occur.

Operational Impacts

Noise conditions will continue to be regulated through Federal, state, and local laws and ordinances into the foreseeable future. Noise levels in the study area are not anticipated to change significantly under the without-project conditions. Much of the study area is either built-out or set aside as permanent open space; therefore, substantial new development that could generate sources of noise within the study area is unlikely. Nevertheless, ambient noise levels may increase over time as a result of population growth and infill, which could generate additional traffic on adjacent highways or increased use of local open spaces and thereby contribute incrementally to the acoustic environment.

Alternative 10 (ART)

Construction Impacts

Construction activities associated with this project would result in short-term increases in noise. Construction would occur over 161 days. Sensitive receptors that could be affected by construction noise include residents and wildlife. Construction equipment that would be used for this project is listed in Table 5-19. The L_{max} noise level is given for each piece of construction equipment and a calculated composite site noise level at various distances. The composite noise level assumes that all equipment would operate at a given usage load factor (FHWA 2006), over a standard eight-hour workday, which results in an average daytime L_{eq}. The load factor accounts for the fraction of time that the equipment is in use over the specified time period. The composite noise level from several pieces of equipment operating during the same phase is obtained from decibel addition of the L_{eq} of each individual unit. Noise sensitive receptors are generally located between 100 ft and 800 ft from the project. The closest noise sensitive receptors are anticipated to experience noise levels between 83 dBA L_{eq} at 100 feet during the "Place Storm and Drain Pipe" phase of construction and 72 dBA L_{eq} at 120 ft under the "Aggregate Base Course" phase of construction listed in Table 5-19. Sound levels at noise sensitive receptors located further from each phase of construction would be lower than those listed in Table 5-19. Construction activities associated with the project would be temporary in nature and related noise impacts would be short-term. Construction activity noise levels at and near the study area would fluctuate depending on the particular type, number, and duration of uses of various pieces of construction equipment.

Construction of the project would occur between the hours of 8 a.m. and 6 p.m. Monday thru Saturday. The noise associated with the construction activities would typically fall within the City of Los Angeles' construction exemption for noise, which also applies to work done within the Cities of Glendale or Burbank, as necessary. During that time, residents would be exposed to increased noise. Construction activities could increase noise levels at nearby sensitive receptors, but would be less than significant with the incorporation of avoidance measures and because of the relatively short duration of increased noise at any given location (less than 10 days).

Construction related material haul trips and construction workers commuting to the project site could raise ambient noise levels along haul routes and area roadways, depending on the number of haul trips made, types of vehicles used and utilized routes. A 3 dBA increase in traffic noise would occur if a doubling of sound energy resulted from the truck haul routes and/or construction workers accessing the study area. In other words, traffic would need to double because of the project on area roadways for a 3 dBA increase to result. Because truck haul traffic and commuting traffic of workers would result in only a slight increase in traffic on area roadways the increase in traffic noise is expected to be well below 3 dBA, and therefore less than significant.

Impacts to wildlife would not be likely to occur if construction activity was undertaken outside of the established breeding season for sensitive species. If breeding habitat for ESA-listed species is identified in the construction area, construction will be timed to avoid this habitat during the breeding season, thereby avoiding significant impacts.

Table 5-19 Alternative 10 (ART) Temporary Received Construction Noise Level

Construction Phase	Equipment Type	Equipment Spec. Sound Level (Lmax) at 50 feet	Distance to Nearest Residence	Composite Noise Level (Leq)	Applicable Reach(es)
Topsoil	Tractor Loader Water Truck Roller – Compactor	86 78 80 73	100 100 100 100	79	1
Place Storm Drain and Piping	Hydraulic Excavator Tractor Crane Grader Paver Compactor	85 86 85 85 85 80	100 100 100 100 100 100	83	3, 4, 5, 7
Excavation Grade Control	Hydraulic Excavator	85	100	79	4
Grouted Riprap	Hydraulic Excavator	85	100	79	4
Compacted Fill	Tractor Loader Water Truck Roller – Compactor	86 78 80 73	100 100 100 100	82	4
Excavation Embankment	Scraper	85	100	82	4, 6, 8
Riprap	Hydraulic Excavator	85	100	79	4, 8
Aggregate Base Course	Loader Grader Roller – Compactor	78 85 73	120 120 120	72	6
Asphalt Pavement	Paver	85	120	75	6

Source: FHWA 2006.

Operational Impacts

As discussed at the beginning of this section, operational impacts to noise-sensitive resources are not anticipated for this alternative.

Alternative 13 (ACE)

Construction Impacts

The types of short and long term effects and significance would be slightly different under Alternative 13 as compared to Alternative10 due to additional construction phases, a longer construction schedule, additional truck trips due to more culvert replacements, additional excavation work to create side channels, geomorphic modification at Taylor Yard, and larger scale modification of channels at Arroyo Seco. Construction would occur over 282 days, 121 days longer than Alternative 10. The closest noise sensitive receptors are anticipated to experience noise levels between 83 dBA L_{eq} at 100 feet during the "Place Storm and Drain Pipe" phase of construction and 54 dBA L_{eq} at 600 ft under the "Remove Spalls" phase of construction listed in Table 5-20. Sound levels at noise sensitive receptors located further from each phase of construction would be lower than those listed in Table 5-20. Because truck haul traffic and commuting traffic of workers would result in only a slight increase in traffic on area roadways the increase in traffic noise is expected to be well below 3 dBA, and therefore less than significant. Impacts to wildlife would be the same as under Alternative 10.

Table 5-20 Alternative 13 (ACE) Received Construction Noise Levels

Construction Phase	Equipment Type	Equipment Spec. Sound Level (Lmax)	Distance to Nearest Residence	Composite Noise Level (Leq)	Applicable Reach(es)
Topsoil	Tractor Loader Water Truck Roller – Compactor	86 78 80 73	100 100 100 100	79	1
Place Storm Drain and Piping	Hydraulic Excavator Tractor Crane Grader Paver Compactor	85 86 85 85 85 80	100 100 100 100 100 100	83	3, 4, 5
Excavation Grade Control	Hydraulic Excavator	85	100	79	4
Grouted Riprap	Hydraulic Excavator	85	100	79	4
Compacted Fill	Tractor Loader Water Truck Roller – Compactor	86 78 80 73	100 100 100 100	82	3, 4
Excavation Embankment	Scraper	85	100	82	3, 4, 6, 7, 8
Riprap	Hydraulic Excavator	85	100	79	4, 8
Aggregate Base Course	Loader Grader Roller – Compactor	78 85 73	120 120 120	72	6, 7
Asphalt Pavement	Paver	85	120	75	6, 7
Geotextile Turf Reinforcement	Loader	78	120	70	6
Rock at Geotextilet Tie-In	Loader Grader	78 85	120 120	72	6
Concrete Demolition	Loader Hydraulic Excavator	78 85	600 600	64	7
Remove Spalls	Hydraulic Excavator	85	600	54	7
Chain Link Fence Demolition	Loader	78	600	47	7
Utility Pole Relocation	Tractor Crane	86 85	600 600	64	7

Source: FHWA 2006.

Operational Impacts

Operational impacts to noise sensitive resources are not anticipated for this alternative.

Alternative 16 (AND)

Construction Impacts

The types of short and long term effects and significance would be different under Alternative 16 compared to Alternatives 10 and 13 due to additional construction phases, a longer construction schedule, additional truck trips due to more culvert replacements, additional excavation work to create side channels, geomorphic modification at Taylor Yard, and larger scale modification of channels at Arroyo Seco. Construction would occur over 624 days, 342 days longer than Alternative 13. The closest noise sensitive receptors are anticipated to experience noise levels between 83 dBA L_{eq} at 100 feet during the "Place Storm and Drain Pipe" and "Concrete Demolition" phases of construction to 53 dBA L_{eq} at 700 ft under the "Railroad Trestle" phase of construction listed in Table 5-21. Sound levels at noise sensitive receptors located further from each phase of construction would be lower than those listed in Table 5-21. Because truck haul traffic and commuting traffic of workers would result in only a slight increase in traffic on area roadways the increase in traffic noise is expected to be well below 3 dBA, and therefore less than significant. Impacts to wildlife would be the same as under Alternative 10.

Table 5-21 Alternative 16 (AND) Received Construction Noise Levels

Construction Phase	Equipment Type	Equipment Spec. Sound Level (Lmax)	Distance to Nearest Residence	Composite Noise Level (Leq)	Applicable Reach(es)
Topsoil	Tractor Loader Water Truck Roller – Compactor	86 78 80 73	50 50 50 50	79	1, 5, 6, 8
Place Storm Drain and Piping	Hydraulic Excavator Tractor Crane Grader Paver Compactor	85 86 85 85 85 80	100 100 100 100 100 100	83	3, 4, 5
Excavation Grade Control	Hydraulic Excavator	85	100	79	4, 8
Grouted Riprap	Hydraulic Excavator	85	100	79	4, 8
Compacted Fill	Tractor Loader Water Truck Roller – Compactor	86 78 80 73	100 100 100 100	82	3, 5, 8
Excavation Embankment	Scraper	85	100	82	3, 4, 5, 6, 7, 8
Riprap	Hydraulic Excavator	85	100	79	3, 5, 8
Aggregate Base Course	Loader Grader Roller – Compactor	78 85 73	100 100 100	74	5, 6, 7, 8
Asphalt Pavement	Paver	85	100	77	5, 6, 7, 8
Geotextile Turf Reinforcement	Loader	78	120	70	6
Rock at Geotextile Tie-In	Loader Grader	78 85	120 120	72	6
Concrete Demolition	Loader Hydraulic Excavator	78 85	100 100	83	5, 7, 8
Remove Spalls	Hydraulic Excavator	85	100	73	5, 7, 8
Chain Link Fence Demolition	Loader	78	100	66	5, 7, 8
Utility Pole Relocation	Tractor Crane	86 85	600 600	64	7, 8
Grouted Riprap Demolition	Loader	78	100	82	5

Construction Phase	Equipment Type	Equipment Spec. Sound Level (Lmax)	Distance to Nearest Residence	Composite Noise Level (Leq)	Applicable Reach(es)
	Hydraulic Excavator	85	100		
Riprap Demolition	Hydraulic Excavator	85	100	76	5
Sheet Pile Wall Demolition	Crane	85	100	81	5
Asphalt Demolition	Loader	78	100	77	5
Retaining Wall Gravel	Loader	78	100	74	5
Subdrain System	Loader	78	100	66	5
Railroad Trestle	Loader Crane	78 85	700 700	53	8

Source: FHWA 2006.

Operational Impacts

Operational impacts to noise sensitive resources are not anticipated to be significant under this alternative.

Alternative 20 (RIVER)

Construction Impacts

Compared to Alternative 16 the types of short and long term effects and significance would be slightly different under Alternative 20, mainly due to differences in construction phasing and more extensive restoration of the River. Construction would occur over 726 days, 102 days longer than Alternative 16. The closest noise sensitive receptors are anticipated to experience noise levels between 83 dBA L_{eq} at 100 feet during the “Place Storm and Drain Pipe” and “Concrete Demolition” phases of construction to 55 dBA L_{eq} at 600 ft under the “Railroad Trestle” phase of construction listed in Table 5-22. Sound levels at noise sensitive receptors located further from each phase of construction would be lower than those listed in Table 5.22. Because truck haul traffic and commuting traffic of workers would result in only a slight increase in traffic on area roadways the increase in traffic noise is expected to be well below 3 dBA, and therefore less than significant. Impacts to wildlife would be the same as under Alternative 10.

Table 5-22 Alternative 20 (RIVER) Received Construction Noise Levels

Construction Phase	Equipment Type	Equipment Spec. Sound Level (Lmax)	Distance to Nearest Residence	Composite Noise Level (Leq)	Applicable Reach(es)
Topsoil	Tractor Loader Water Truck Roller – Compactor	86 78 80 73	100 100 100 100	79	1, 2, 3, 5, 6, 8
Place Storm Drain and Piping	Hydraulic Excavator Tractor Crane Grader Paver Compactor	85 86 85 85 85 80	100 100 100 100 100 100	83	4, 5, 7
Excavation Grade Control	Hydraulic Excavator	85	100	79	4, 8
Grouted Riprap	Hydraulic Excavator	85	100	79	4, 8
Compacted Fill	Tractor Loader Water Truck Roller – Compactor	86 78 80 73	100 100 100 100	82	2, 3, 4, 5, 7, 8
Excavation Embankment	Scraper	85	100	82	3, 4, 5, 6, 8
Riprap	Hydraulic Excavator	85	100	79	2, 3, 5, 7, 8
Aggregate Base Course	Loader Grader Roller – Compactor	78 85 73	100 100 100	74	2, 3, 5, 6, 8
Asphalt Pavement	Paver	85	100	77	2, 3, 5, 6, 8
Geotextile Turf Reinforcement	Loader	78	120	70	2, 3, 6
Rock at GeotextileTie-In	Loader Grader	78 85	120 120	72	2, 3, 6
Concrete Demolition	Loader Hydraulic Excavator	78 85	100 100	83	2, 3, 5, 8
Remove Spalls	Hydraulic Excavator	85	100	73	2, 5, 8
Chain Link Fence Demolition	Loader	78	100	66	2, 3, 5, 8
Utility Pole Relocation	Tractor Crane	86 85	130 130	81	2, 8
Grouted Riprap Demolition	Loader Hydraulic Excavator	78 85	100 100	82	2, 5
Riprap Demolition	Hydraulic Excavator	85	100	76	2, 4, 5
Sheet Pile Wall Demolition	Crane	85	100	81	2, 5
Asphalt Demolition	Loader Hydraulic Excavator	78 85	100 100	80	2, 5
Retaining Wall Gravel	Loader	78	100	74	2, 5
Subdrain System	Loader	78	100	66	2, 3, 5
Railroad Trestle	Loader Crane	78 85	600 600	55	7, 8

Source: FHWA 2006.

Operational Impacts

Operational impacts to noise sensitive resources are not anticipated to be significant for this alternative as noted earlier in this section.

5.8.4 Best Management Practices and Impact Avoidance Measures

The following measures would be required to reduce the short-term adverse effects of noise to a less than significant level and would be implemented during construction:

- Require that potential noise impacts associated with project construction be minimized by such measures as designating haul routes, requiring less noisy equipment or using mufflers if needed to reduce noise, and increasing the distance from the noise source and the receptor by providing land use buffers, or enclosing or orienting noisy equipment away from noise sensitive uses,
- Impose construction hours that are more restrictive than those set forth in the LAMC if necessary and when practical,
- Require vehicle parking and deployment activities to be separated and buffered from sensitive uses,
- Limit haul truck or other vehicle speed on roads adjacent to residences and on unpaved roadways, and
- Notify residents about type and schedule of construction.

5.9 RECREATION

5.9.1 Regulatory Framework

Federal

The main Federal regulation that pertains to recreation is the Americans with Disabilities Act (ADA). ADA standards for accessible public facilities require that reasonable accommodation be made to allow disabled citizens access to recreational and other facilities.

State

Two state parks have been developed within the study area. These include the Rio De Los Angeles State Park in the Taylor Yard area (Reach 6) and the Los Angeles State Historic Park in the Cornfields area (Reach 7). General plans for these two parks provide guidelines for land use and recreational development.

The Quimby Act allows California municipalities to require that new residential subdivisions set aside parklands or to charge fees to developers in lieu of setting aside parklands. The City of Los Angeles has enacted ordinances that implement the Quimby Act, requiring that land be set aside for parks and establish fees for other types of permits and approvals.

Local

Within the City of Los Angeles, the Department of Recreation and Parks operates over 16,000 acres of parkland, made up of some 150 recreation centers and over 350 park sites citywide. Parks in Glendale are operated and maintained by the City of Glendale Department of Parks, Recreation & Community Services. Parks in Burbank are operated and maintained by the City of Burbank Park, Recreation & Community Services Department.

In 1978, the City of Los Angeles prepared the Griffith Park Master Plan, which is currently under revision. A draft version of the master plan was circulated in 2005 but was rejected. It is not known when the revised draft of the master plan would be prepared.

5.9.2 Significance Criteria

The proposed project alternatives under consideration would result in a significant impact related to recreation if they would (City of Los Angeles 2002):

- Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated,
- Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment,
- Substantially restrict or reduce the availability or quality of existing recreational opportunities in the project vicinity, or
- Implement operational or construction-related activities related to the placement of project facilities that would cause a substantial long-term disruption of any institutionally recognized recreational activities.

5.9.3 Environmental Impacts

No Action Alternative

Construction Impacts

No impacts to recreational resources would occur from construction under this alternative because construction would not occur.

Operational Impacts

Because the study area is largely developed, the potential for substantial conversion of land to recreational uses is limited. However, recreational features will continue to be pursued by state or local entities wishing to develop recreational park areas along the River corridor. Local groups, such as the Santa Monica Mountains Conservancy and Mountains Recreation Conservation Authority, are likely to continue working to enhance the Los Angeles River Greenway through improvements of existing facilities along the River and installation of new park features.

The Metropolitan Transportation Agency (MTA) and City of Los Angeles are actively planning a bridge across the river that will provide a safe and convenient bicycle and pedestrian link between the Los Angeles River Bikeway on the west bank and the Taylor Yard on the east bank of Reach 6. The proposed bikeway improvement will consist of a minimum 15-foot-wide bridge over the River, and a minimum 12-foot-wide connection to the Union Pacific's Taylor Yard property (LARRC 2011d). As part of the North Atwater Park Expansion Project, a multimodal bridge is proposed to provide a connection from North Atwater Park, across North Atwater Creek and up to the banks of the River in Reach 3. This bridge will provide pedestrians and bicyclists access to the River (LARRC 2011d).

Demand for recreation in the area is expected to increase proportionally to growth of population in the study area. Continued implementation of the Los Angeles River Revitalization Master Plan (City of Los Angeles 2007) could increase recreational opportunities significantly over the long term in the study area.

Alternative 10 (ART)

Construction Impacts

Alternative 10 would have no significant adverse effect on recreation and public access resources in the study area. During the construction period, the alternative may result in minor and temporary adverse recreation and public access effects, including:

- Temporary closure of trail systems, access points, bridges, or crossings along the River (Reaches 1-3),
- Temporary partial closure of Harding golf course (Reach 3)
- Temporary full closure of Los Feliz golf course (Reach 3)
- Realignment/relocation of trail, access points, bridges, or crossings (Reaches 2-3),
- Temporary increase in noise and air pollution in the vicinity of construction, which may degrade the recreation experience at adjacent facilities, and
- Temporary restrictions on activities such as walking/jogging, cycling, equestrian, and bird watching.

Temporary closure of Los Feliz Golf Course would constitute an adverse impact, but this impact is considered less than significant because the duration of closure is expected to be no longer than two months, and local and regional golfers have the option to use other courses in the vicinity, such as Roosevelt and Harding golf courses across the River in Griffith Park.

Operational Impacts

Alternative 10 would have no significant adverse effect on recreation and public access resources in the study area. The alternative would not decrease the quality or quantity of recreation and public access resources in the study area. In contrast, the alternative would benefit recreation and public access over the long term, in ways that are compatible with ecosystem restoration. Also, the addition of restoration features along Rio De Los Angeles State Park (Taylor Yard) and at Los Angeles State Historic Park (Cornfields) is consistent with the park's General Plan, and is expected to complement and expand upon existing resources. Benefits include:

- Improved aesthetic quality of the River,
- Increased public awareness of the recreation resources in the project reach,
- Increased visitation to recreation facilities in the project reach,
- Increased public health and safety from improved water quality along the River,
- Increased quality, quantity, and diversity of recreation resources along the River, such as trails, bike paths, benches, signage, River access points, maintenance ramps, etc., and
- Habitat quality improvements may have larger beneficial effects on specific recreation activities which are heavily dependent on the health of the river, such as bird watching.

Alternative 13 (ACE)

Construction Impacts

Alternative 13 would have no significant adverse effect on recreation and public access resources in the study area. Alternative 13 would result in minor and temporary adverse effects similar to those described for Alternative 10with the addition of temporary adverse effects on access to playing fields at Ferraro Fields, where some side channel features are included with Alternative 13. Access would not be fully restricted, but there may be occasions when the fields are not accessible by car due to construction closures.

Operational Impacts

Alternative 13 would have no significant adverse effect on recreation and public access resources in the study area. The alternative would not decrease the long-term quality or quantity of recreation and public access resources in the study area. In contrast, the alternative would benefit recreation and public access over the long term through increased quality, quantity, and access to parks and trails along the River, increasing public recreation resource opportunities for local and regional visitors.

Potential benefits to recreation may be slightly higher than for Alternative 10 due to the increased level of restoration under Alternative 13. In addition to the beneficial impacts mentioned for Alternative 10, the following beneficial impacts could occur under Alternative 13:

- Enhanced recreation resources along the river, such as new opportunities for outdoor education, or recreation-based businesses (recreation equipment rental, riding, or cycling trips, etc.), and
- Increased quantity of approved access points to the River, reducing use of unapproved access points.

Alternative 16 (AND)

Construction Impacts

Alternative 16 would have no significant adverse effect on recreation and public access resources in the study area. Minor and temporary adverse recreation and public access effects during the construction period would be the same as those described for Alternative 13.

Operational Impacts

Alternative 16 would have no significant adverse effect on recreation and public access resources in the study area. The alternative would not decrease the long-term quality or quantity of recreation and public access resources in the study area. In contrast, the alternative would benefit recreation and public access over the long term. Potential benefits to recreation may be slightly higher than for Alternative 13 due to the increased level of restoration under Alternative 16. In addition to the beneficial impacts mentioned for Alternative 13, the inclusion of channel bed deepening and terrace bank submeasures may further increase the aesthetic quality of the recreation resource and the quality of the recreation experience to visitors.

Alternative 20 (RIVER)

Construction Impacts

Alternative 20 would have no significant adverse effect on recreation and public access resources in the study area. During the construction period, the alternative may result in the same minor and temporary adverse recreation and public access effects as detailed for Alternative 16. In addition, temporary partial closure of Los Angeles State Historic Park for construction of marsh/wetland restoration features would be required.

Operational Impacts

Alternative 20 would have no significant adverse effect on recreation and public access resources in the study area. The alternative would not decrease the quality or quantity of recreation and public access resources in the study area. In contrast, the alternative would benefit recreation and public access over the long term. Potential benefits would be similar to those discussed under Alternative 16 above, but may be slightly higher for Alternative 20 due to the increased level of restoration. The addition of restoration features at Los Angeles State Historic Park is consistent with the park's General Plan and is expected to complement existing recreation and educational opportunities at the park.

5.9.4 Best Management Practices and Impact Avoidance Measures

No impact avoidance measures are required for recreation and public access resources since no significant adverse effects have been identified.

Any minor and temporary adverse effects from construction could be offset through a variety of public outreach and information measures in cooperation with local parks departments, business owners, and residents, such as:

- Public media/meetings to provide clear information on the types and durations of disruptions to the River and adjacent resources,
- Signed detour routes for affected roads as well as pedestrian, bicycle, and equestrian trails, and river access points, and
- Signage at construction areas with information relevant to recreation users (length of closure, alternative access points, etc.).
- Working with park representatives on timing of park and golf club closures to minimize effects on recreational access and use.

5.10 AESTHETICS

5.10.1 Regulatory Framework

The Conservation Element of the City of Los Angeles General Plan contains objectives, policies, and programs for the City's resources, which include land forms and scenic vistas. The conservation element contains the following land form and scenic vista objective and policy:

Objective: Protect and reinforce natural and scenic vistas as irreplaceable resources and for the aesthetic enjoyment of present and future generations.

Policy: Continue to encourage and/or require property owners to develop their properties in a manner that would, to the greatest extent practical, retain significant existing land forms (e.g., ridge lines, bluffs, unique geologic features) and unique scenic features (historic, ocean, mountains, unique natural features) and/or make possible public view or other access to unique features or scenic views.

The Los Angeles County General Plan (currently being updated) contains goals and policies pertaining to scenic resources (Los Angeles County 1993). One of the goals is to conserve aesthetic resources and protect the environment. General policies for this goal include the following:

Policy 15 - Protect areas that have significant natural resources and scenic values, including significant ecological areas, the coastal zone, and prime agricultural lands.

Policy 21 - Develop community parks, particularly in areas of the greatest deficiency, and take advantage of opportunities to preserve large natural and scenic areas.

Guidelines for maintaining aesthetic value are developed from a combination of criteria established for CEQA, and those put forth in applicable city, county, or state General Plans. For this project, applicable guidelines are derived from the City of Los Angeles CEQA guidelines, as well as the General Plans of the Burbank and Glendale.

5.10.2 Significance Criteria

The restoration measures would be considered to have a significant adverse effect if any of the following were to occur as a result of the project:

- Conflict with plans, policies, or regulations governing scenic resources,

- Permanent and substantial loss or degradation of a scenic vista or public viewshed,
- Permanent and substantial loss or degradation of components of scenic resources, such as natural features, parks, historic buildings, or architectural character,
- Creation of a new source of substantial light or glare that would adversely affect day or nighttime views in the area, or
- Obfuscation of existing light sources that result in reduced safety.

5.10.3 Environmental Impacts

No Action Alternative

Construction Impacts

No impacts to aesthetic resources would occur from construction under this alternative because construction would not occur.

Operational Impacts

Since channelization of the River, aesthetic conditions have declined. The natural setting of the River is gone and replaced with concrete that leads to the collection and proliferation of trash and graffiti. However, over time, substrate and debris deposits have amassed soils suitable for establishment of vegetation, thereby softening the look of the concrete channel and creating a more natural appearance.

Without restoration efforts, these trends are expected to continue. The area would continue to be vandalized and collect trash, and homeless encampments may increase with the growing population. Continued discharge of greywater and stormwater would contribute to unpleasant odors. Increased use of tertiary treated water for irrigation and other uses may reduce the amount of water flowing in the River during the dry months, further reducing the visual quality of the channel. Lighting conditions are not expected to change significantly under current city or county guidelines.

Although continued deposition of substrate and growth of vegetation is likely to occur under the No Action Alternative, attracting increasing numbers of shorebirds, waterfowl, and wading birds to the area, removal of this vegetation is likely to occur. Channel maintenance is an ever-present need to facilitate flood flows in the channel, and the removal of vegetation is anticipated to occur regularly.

Small and localized improvement projects for recreation or independent restoration efforts are anticipated to occur in the foreseeable future even if this larger study is not pursued; these projects would slowly improve the aesthetics of the River a small area at a time. For example, FoLAR organizes a river cleanup event each year, inviting citizens to assist in removing trash and debris from the River.

Alternative 10 (ART)

Construction Impacts

Impacts to aesthetic condition would occur during the construction phase of this alternative. The proposed restoration measures under this alternative require large equipment to be present, extensive earthwork be done, and mechanical or chemical removal of vegetation over expansive areas.

Many of the areas targeted for restoration are already in industrial use and therefore visually degraded. Furthermore, the River channel and staging areas are not generally located in areas that are readily visible from roadways, neighborhoods, or nearby parks and are not in areas that have special aesthetic value.

Riparian plantings would occur in all reaches under this alternative, as would non-native plant removal, trash removal, installation of linear strips for biofiltration, greening of River channel walls, and creation of buffer zones and planted swales. These components require little to no machinery, can be built or installed quickly, and would have less than significant impacts on aesthetic resources.

In areas regularly utilized for recreation, where aesthetic appeal is particularly desirable, construction efforts would be streamlined to occur quickly, to avoid interfering with recreational opportunities, and to affect as small an area as possible in order to minimize impacts. Staging areas would be located away from recreation sites as much as possible. A complete list of impact avoidance measures is provided below. Overall, due to the temporary nature of the impacts to visual resources, and the objective of creating dramatically improved visual conditions as a result of restoration, the adverse impacts are less than significant.

Operational Impacts

Adverse impacts of operation may result as measures are taken to ensure proper flood flow conveyance within the channel. This may require removal of vegetation, both native and non-native, if it is deemed necessary for flood risk management through the life of the project (50 years). However, this vegetation removal would only occur in areas not restored as a result of the implementation of the selected alternative under this IFR. Riparian areas planted through restoration will be preserved on overbank areas, where they will not inhibit flood conveyance. Similarly, planter boxes or greening of the channel will also be designed in this way.

Maintenance of the conveyance channel and the newly restored habitat will require presence of trucks, which could potentially compromise aesthetics. However, given their temporary presence and need to maintain visual conditions, their adverse impact is less than significant.

Aesthetics along the River will improve immediately following completion of the construction phase and will continue to improve over time, resulting in substantial and significant beneficial impacts that increase with each year. Riparian plantings along daylighted culverts, side channels, and overbank areas will mature and flourish, providing a greening and softening of the River channel. A total of 251 acres of valley foothill riparian community will be restored on overbank areas of the river, including those areas within the historic wash of Piggyback Yard in Reach 8. Those areas and more will be treated for invasive plant removal, addressing a total of 338 acres throughout all reaches. A total of 14 streams entering the river will be daylighted, or removed from culverts, creating visually appealing swales or wetlands in Reaches 3, 4, 5, and 7. Overbank terraces, creation of side channels, and widening of the channel will further create additional habitat, which contributes to improvements in visual quality in Reaches 2-8. Overall, the final restoration product will be a vast improvement over the current aesthetic condition, providing a greener corridor and better habitat for native wildlife, and thereby increasing enjoyment by human visitors. Impacts will be significant and beneficial.

Alternative 13 (ACE)

Construction Impacts

Construction under Alternative 13 will create temporary adverse impacts to the study area that are the same as Alternative 10 in nature, but would affect an incrementally larger area. Again, construction efforts would temporarily affect visual appeal, but would be less than significant as they will be minimized by construction management protocols and the existing degraded visual condition. Some proposed measures are anticipated to take longer to implement due to the expanded area covered by the alternative, therefore visual impacts would extend for an additional 121 work days compared to Alternative 10. Operation and maintenance activities would not interfere with visual appeal.

Operational Impacts

Once completed, beneficial impacts to visual condition will be significant and incrementally improved over Alternative 10. A larger area of invasive plants will be removed, a greater area of native riparian habitat will be established, and more side channels, wetlands, and open water habitat will be restored. Specifically, Alternative 13 provides the following improvements over Alternative 10; 22 additional riparian acres created throughout all reaches, three times greater soft river bottom habitat in Reach 6, 26 acres of freshwater marsh throughout all reaches, and adds vegetation to channel walls in Reaches 6 and 7. These additional habitats will further improve aesthetic value of the river.

Alternative 16 (AND)

Construction Impacts

Similar to Alternatives 10 and 13, construction efforts would temporarily affect the visual quality of all reaches within the study area. Some proposed measures are anticipated to take longer to implement due to the expanded area covered by the alternative, resulting in an additional 565 work days compared to Alternative 10. However, for the same reasons noted above, adverse impacts to visual condition will not be significant.

Operational Impacts

Once completed, beneficial impacts to visual condition will be significant and incrementally improved over Alternatives 10 and 13. Increasingly larger areas of invasive plants will be removed and more side channels, wetlands, and open water habitat will be restored. Specifically, Alternative 16 provides the following improvements over Alternative 13; creates an additional 500 feet of soft river bottom habitat in Reach 8, 12 additional acres of freshwater marsh, creates additional terraces in Reaches 5, 6, and 8, and adds side channels within the historic wash within Piggyback Yard in Reach 8. These additional habitats will further improve aesthetic value of the River.

Alternative 20 (RIVER)

Construction Impacts

Similar to Alternatives 10, 13 and 16, construction efforts would temporarily affect the visual quality of some areas within the study area. Some proposed measures are anticipated to take longer to implement due to the expanded area covered by this largest alternative, resulting in an additional 667 work days compared to Alternative 10. However, for the same reasons noted above, adverse impacts to visual conditions will not be significant.

Operational Impacts

Once completed, beneficial impacts to visual condition will be significant and incrementally improved over all other alternatives. The largest area of invasives removal will be targeted at 499 acres, additional channel improvements will be made at Verdugo Wash, and additional wetlands will be created at the Los Angeles River State Historic Park in Reach 7. This alternative provides the greatest potential for improved aesthetic value of the river.

5.11 PUBLIC HEALTH AND SAFETY, INCLUDING HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

5.11.1 Regulatory Framework

Federal

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) established prohibitions and requirements concerning closed and abandoned hazardous waste sites (USEPA 2006a). The law authorizes two kinds of response actions: short-term removal to address releases or threatened releases requiring prompt response, and long-term remedial responses that permanently and significantly reduce the dangers from releases or threats of releases of hazardous substances that are serious but not immediately life threatening. CERCLA was amended by the Superfund Amendments and Reauthorization Act (SARA). Title 40 CFR part 312 provides standards and practices for All Appropriate Inquiries.

The Resource Conservation and Recovery Act (RCRA) governs the disposal of solid and hazardous waste (USEPA 2006d). RCRA goals are to protect human health and the environment from the potential hazards of waste disposal, to conserve energy and natural resources, to reduce the amount of waste generated, and to ensure that wastes are managed in an environmentally sound manner. The solid waste program, under RCRA Subtitle D, encourages states to develop comprehensive plans to manage nonhazardous industrial solid waste and municipal solid waste. It also sets criteria for municipal solid waste landfills and other solid waste disposal facilities and prohibits the open dumping of solid waste. The hazardous waste program, under RCRA Subtitle C, establishes a system for controlling hazardous waste from the time it is generated until its ultimate disposal—in effect, from "cradle to grave." The underground storage tank program, under RCRA Subtitle I, regulates underground storage tanks containing hazardous substances and petroleum products.

Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Numerous EPA programs and regulations (such as RCRA and Superfund) are involved with the remediation of brownfields.

The Occupational Safety and Health (OSH) Act was enacted to ensure safe and healthful conditions for working men and women. The OSH Act created the Occupational Safety and Health Administration (OSHA) at the Federal level and provided that states could run their own safety and health programs as long as those programs were at least as effective as the Federal program.

The USACE's Engineering Regulation 1165-2-132, HTRW Guidance for Civil Works Projects, defines an HTRW project, the USACE's' methods for performing HTRW surveys, and the USACE's and sponsor's involvement at, and responsibility for, HTRW sites. USACE policy is to identify HTRW issues early in the project process and avoid construction within HTRW-contaminated areas or properties, where practicable. The USACE will share the costs of survey to identify the existence and extent of HTRW, but any response or remediation activities required, including studies to determine the appropriate response, are 100 percent non-project costs and the responsibility of the sponsor to undertake or ensure.

State

RCRA allows individual states to develop their own programs for regulating hazardous waste, provided that the state program is at least as stringent as RCRA (City of Los Angeles 2005). California has developed the California Hazardous Waste Control Law (Health and Safety Code sec. 25100 et seq; 22

CCR sec. 66260.1 et seq.), which is modeled closely on RCRA. These regulations identify standards for the classification, management, transportation, and disposal of hazardous waste.

California operates a complete state plan covering both the private sector and state and local government employees. California Code of Regulations, Title 8, contains California OSHA regulations. The California OSHA program is administered and enforced by the Division of Occupational Safety and Health, a unit of the California Department of Industrial Relations.

Section 2002(j) of the State Health and Safety Code, for the purposes of vector control and prevention, defines a public nuisance (City of Los Angeles 2005). Section 2060 enables the Greater Los Angeles County Vector Control District to abate a public nuisance pursuant to "the person … who controls the diversion, delivery, conveyance, or flow of water shall be responsible for the abatement of a public nuisance that is caused by, or as a result of, that property or the diversion, delivery, conveyance, or control of that water."

Local

Additional requirements pertaining to hazardous materials management are set forth in the City of Los Angeles Fire Code (City of Los Angeles 2005). The LAFC regulates the types, configuration, and quantities of hazardous materials that can be managed at a facility. Also, LAFC specifies design standards for the storage and management of hazardous materials. Citywide emergency response planning and emergency evacuation plans are coordinated by the Emergency Preparedness Department and the Emergency Operations Board of the City of Los Angeles. These plans are documented in the Emergency Operations Master Plan and Master Plan Procedures and Annexes of the City of Los Angeles. Operational units of the City of Los Angeles (e.g., departments) maintain emergency plans for their operations and facilities within the framework of the citywide plan. These plans are updated annually or when appropriate due to changed conditions.

In 2004, the City of Los Angeles approved Ordinance No. 175,790 amending Section 91.106.4.1 and Division 71 of Article 1, Chapter IX of the Los Angeles Municipal Code to establish citywide methane mitigation requirements and to include more current construction standards to control methane intrusion into buildings (City of Los Angeles 2005).

The City of Los Angeles Safety Element and Conservation Element address public health and safety with respect to hazardous materials, fires, methane, and brownfields (City of Los Angeles 2001). The safety element goals, objectives, policies, and programs (which are also applicable to conservation element issues) are broadly stated to reflect the comprehensive scope of the Emergency Operations Organization (EOO). The EOO is the only program that implements the safety element. The safety element's policies outline administrative considerations, which are addressed by EOO procedures, including its master plan, or which are observed in the carrying out of the plan. All City of Los Angeles agencies are part of the EOO, and all emergency preparedness, response, and recovery programs are integrated into EOO operations and are reviewed and revised continuously.

5.11.2 Significance Criteria

Potential public health and safety impacts, including HTRW impacts, are assessed based on changes to public health and safety from the restoration alternatives. A significant adverse impact would be considered to occur if the selected project resulted in any of the following:

- Creation of a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials,

- Creation of a significant hazard to the public or the environment through reasonably foreseeable release of hazardous materials into the environment,
- Utilizes hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school;
- Construction or ground disturbance on a site that is included on a list of hazardous materials sites compiled pursuant to California Government Code Section 65962.5 and, as a result, creates a significant hazard to the public or the environment,
- Impairs implementation of or physically interferes with an adopted emergency response plan or emergency evacuation plan,
- Exposes people or structures to a significant risk of loss, injury, or death involving fires, or
- Exposes people to a significant risk of water-related injury of death, or
- Exposes people to infectious diseases.

5.11.3 Environmental Impacts

No Action Alternative

Construction Impacts

No impacts to public health and safety would occur from construction under this alternative because construction would not occur.

Operational Impacts

The baseline conditions regarding risks to public health and safety in the study area would be similar to present conditions under the future without-study conditions. River safety risks would not be expected to change substantially, and much of the River would likely continue to be fenced to prevent public access. Sensitive receptors would continue to exist in the area, and health and safety risks to these receptors would not change if the study was not implemented. Wildfire hazard zones would likely stay the same because most of the undeveloped areas where vegetation is present are designated as parks and likely to remain as parks. Methane zones in general are naturally occurring deposits and thus would not be likely to change substantially. Vector-borne diseases would continue to be a risk, but would also continue to be controlled by GLACVCD and similar public health agencies.

The baseline conditions regarding releases of HTRW would likely improve under the future without-study conditions. Parties responsible for the release of HTRW to the environment are required by law to address these sites through investigation and monitoring, and by carrying out remediation when warranted. . Remediation has already reduced contaminant levels and is ongoing. Therefore, the trend over time would likely be toward remediation and natural attenuation (i.e., at the San Fernando Valley Superfund Site and Taylor Yard G2 site. Industrial remediation goals have been achieved at the Taylor Yard G1 site. Remediation and natural attenuation at some HTRW sites could occur within the life of the project; however, these activities may take longer to complete at some locations. For example, groundwater contamination associated with the San Fernando Valley Superfund Site is pervasive in the region and is not likely to be fully remediated over the next 50 years.

Alternative 10 (ART)

Construction Impacts

Los Angeles River Water Safety

Although construction activities would bring workers into contact with the River, OSHA and USACE safety standards will be diligently followed to avoid or minimize any dangers of water-related injuries. Construction would be suspended during any high flow events.

Wildfire

Construction equipment or activities could potentially cause an accidental fire in high fire hazard zones. Project activities would comply with all applicable Federal, state, and local laws, ordinances, and regulations related to fire prevention and fire safety. BMPs related to fire prevention would be implemented during and after construction to ensure that fires were not started and that if they did start, would be immediately extinguished, resulting in a less than significant impact.

Methane Zones

Construction would be done in accordance with regulations pertaining to development within methane zones and buffer zones; therefore, no adverse impacts from methane are expected.

HTRW

According to USACE policy, construction should be avoided in HTRW project areas where practicable. However, it would not be possible to implement any of the alternatives and still avoid the San Fernando Valley Superfund Site groundwater contamination, the Taylor Yard G1 and G2 sites, and Piggyback Yard. Investigation and remediation of the identified HTRW sites in the study area would be conducted before construction activities are undertaken at affected sites. For contaminated groundwater that cannot be addressed prior to construction activities, such as the San Fernando Valley Superfund Site, the sponsor would be responsible at 100% non-project cost for addressing treatment and disposal of contaminated groundwater during dewatering activities.

The USACE would share the cost of investigations for HTRW contamination but would not contribute funds for preparing response plans and conducting remediation activities. The City would be responsible for conducting remediation or ensuring remediation by responsible parties at contaminated sites to support the project with the oversight of the appropriate regulatory agencies in accordance with all applicable laws, regulations, and ordinances, as described in the HTRW appendix for this IFR. In addition, it is possible that undocumented soil or groundwater contamination is present in the study area and could be identified after completion of this feasibility study. The risk of encountering unknown contamination during design or construction would be minimized through review of the existing ASTM type Phase I and Phase II Environmental Site Assessments, and also by the sponsor undertaking industry-standard inquiries according to ASTM standards that are consistent with the CERCLA brownfields amendments and the All Appropriate Inquiries Rule prior to land acquisition and providing lands to the project.

Soil and water quality in the River would be tested at locations where contamination is suspected. Sampling locations and procedures would be coordinated with the Los Angeles Regional Water Quality Control Board, Department of Toxic Substances Control, USEPA, and the Los Angeles, Glendale, or Burbank environmental departments, as applicable. Any contamination found would be addressed in accordance with all applicable laws, regulations, and ordinances in a manner that would be protective of human and ecological health, so no adverse HTRW impacts are expected. Furthermore, BMPs will be in place, including standard procedures for addressing any contaminants uncovered or inadvertently released during construction, including containment, handling, disposal and reporting requirements.

Approach to HTRW Impacted Soil

The City would conduct remediation activities prior to construction at the affected sites. Beneficial impacts are expected as contaminated sites would be remediated to cleaner states than would be expected without the project. For groundwater contamination that is infeasible to remediate prior to construction, the sponsor would be responsible for costs of addressing treatment and disposal of such contamination during construction. In the event that unknown contamination was to be discovered during construction despite making all appropriate inquiries, the approach to such contamination as relates to the project will be governed by the Project Partnership Agreement.

All HTRW impacted soil within the project footprint must be remediated to the requirements of the local environmental regulatory agencies and be compatible with the future land uses for and needs of the restoration project. At this time, those areas with HTRW impacted soil to be addressed by the Sponsor are anticipated to be the Taylor Yard G1 and G2 sites and the Piggyback Yard. The methodologies utilized to remediate HTRW impacted soils, regardless of the nature and extent of contamination must be compatible with the planned ecosystem restoration features and must be protective of human health and the environment. To preclude the adverse impact of contaminated soil leaching downward and further contaminating the shallow groundwater system, contaminated soil should be removed from areas that are planned as wetlands, areas that will be irrigated and areas that will be subject to erosion and infiltration of surface water runoff. Within areas where contaminated soil is remediated by removal and off-site disposal, the resulting excavations should not be filled with clean soil beyond the level of the planned ecosystem restoration grades. The Sponsor must complete remediation that is acceptable to the environmental regulatory agencies and appropriate for the land use for the project selected prior to restoration project construction at those sites.

Approach to HTRW Impacted Groundwater

Remediation of contaminated groundwater within the limits of the SFVSS site is on-going and is expected to continue for the foreseeable future. Localized groundwater contamination from remnant contamination at some of the adjacent sites may also be encountered during dewatering activities. Contaminated groundwater encountered in excavations during construction and during dewatering operations must be treated and disposed of in accordance with the requirements of the local regulatory agencies. The persistent and shallow nature of the groundwater beneath the proposed restoration features, the widespread nature of the groundwater contamination, and potential impacts associated with local soil contamination make total remediation of the groundwater prior to construction of the restoration features infeasible. As a result, it is anticipated that regulator-supervised (USEPA) responsible-party remediation of contaminated groundwater will be ongoing during construction of the ecosystem restoration features. Therefore the Sponsor will design, implement, coordinate and fully fund all treatment and disposal of contaminated groundwater during construction, with regulator concurrence and any necessary permits. Dewatering and treatment operations should be designed so that they do not adversely impact the ongoing pump and treatment operations for the SFVSS at the nearby Pollock Well Field.

Construction of the project would involve the routine transport, use, and disposal of common hazardous materials, such as fuels (gasoline and diesel), oils and lubricants, and cleaners (e.g., solvents, corrosives, soaps, detergents). The project would not require the use of unusual or acutely hazardous materials. Accidental spills could occur; however, minor spills are not likely to have significant effects. BMPs would be implemented to minimize potential for the public to come into contact with or be exposed to hazardous materials during the routine transport, use, or disposal of hazardous materials or as a result of an accidental release.

Operational Impacts

Los Angeles River Water Safety

Implementation of the project would increase opportunities for the public to interact with the River, therefore long-term potential for water-related injuries and accidental drownings could increase, especially during and following storms when the water level and flow velocity increases. The potential for the public to enter the river channel during flooding would be greater than under current conditions, where much of the River is fenced and public access is impeded.

Although the project would increase opportunities for the public to be near and potentially to access the River, the project would be designed so as to not expose the general public to unexpected dangers associated with proximity to the River that could result in accidental drowning or water-related injuries. River channel designs would include features that would allow people to vacate the River channel quickly and ensure that swift water rescues could be performed with the maximum possible safety. As a result, impacts are anticipated to be less than significant.

Wildfire

Potential impacts from wildfire during maintenance activities associated with operation are the same as those from construction, and would be less than significant assuming implementation of BMPs.

Vector-Borne Diseases

The project would increase the amount of surface water in the River corridor, increase the amount of riparian habitat and wetlands, and alter drainage patterns and water flow. As such, there is concern that breeding grounds such as standing water for disease vectors such as mosquitoes would increase under the project, potentially resulting in an increase in the incidence of infectious diseases. Although the extent of surface water is expected to increase under the proposed measures, the suitability of habitat for vectors will depend on microhabitat features that are subject to change with each large flow event. As in any natural system, pools and backwater areas may be formed or abandoned as new flow paths emerge. Once the project is constructed, the City of Los Angeles will continue to monitor and coordinate with vector control agencies as needed to provide treatment.

HTRW

Physical maintenance is typically limited to activities such as removing invasive species from restored areas. Physical maintenance and adaptive management activities would not involve dewatering or other activities requiring direct human interaction with the groundwater.

Currently, contaminated groundwater does not result in contaminant levels in the river in non-concrete bottom areas requiring treatment. That condition would be anticipated to remain the same after restoration project construction. The volume of contaminants from current and known sites entering groundwater will likely not change, the restoration project would not contribute contaminants to groundwater, and the remediation underway for the SFVSS, as managed by EPA, will continue to occur. The low or de minimis levels of contamination in the portion of the river in the study area directly interacting with groundwater do not currently impact ecological performance for existing vegetation in the river, and no different effect would be expected on the restored areas. Widening the river into restored areas at Taylor Yard with additional surface water from the river infiltrating to groundwater could have some minor beneficial effects on the groundwater plume.

Potential impacts from HTRW exposure during maintenance activities during operation would be less than significant assuming implementation of BMPs and remediation of contaminated areas prior to construction.

Methane Zones

Maintenance activities during operation would not include subsurface activities that would have impacts on methane zones and buffer zones; therefore, there would be no adverse impacts.

Alternative 13 (ACE)

The larger project footprint for this alternative is not anticipated to result in significant adverse impacts during construction or operation. . As with other alternatives, the sponsor would remediate or ensure remediation of contaminated sites prior to construction at those sites to provide sites compatible with the necessary land use for the project, and would address contaminated groundwater during dewatering activities. As with the other alternatives, BMPs would reduce potential impacts to less than significant.

Alternative 16 (AND)

The larger project footprint for this alternative is not anticipated to result in significant adverse impacts during construction or operation. As with other alternatives, the sponsor would remediate or ensure remediation of contaminated sites prior to construction at those sites to provide sites compatible with the necessary land use for the project, and would address contaminated groundwater during dewatering activities. As with the other alternatives, BMPs would reduce potential impacts to less than significant.

Alternative 20 (RIVER)

The larger project footprint for this alternative is not anticipated to result in significant adverse impacts during construction or operation. .As with other alternatives, the sponsor would remediate or ensure remediation of contaminated sites prior to construction at those sites to provide sites compatible with the necessary land use for the project, and would address contaminated groundwater during dewatering activities. As with the other alternatives, BMPs would reduce potential impacts to less than significant.

5.11.4 Best Management Practices and Impact Avoidance Measures

The types of BMPs that would reduce dangers associated with water safety, wildfire, methane, vector-borne diseases, and HTRW include the following:

- City will request increased police presence along the River, particularly during episodes of increased water levels and flow velocities,
- Fire extinguishers or other firefighting equipment (such as drums of water) would be close at hand during construction, regularly inspected, and maintained in proper working condition,
- Equipment with internal combustion engines would be placed so that exhaust is not near combustible materials,
- Combustible or flammable materials would be properly stored and proper clearance around these materials would be maintained,
- City will coordinate as needed with Vector Control agencies after project completion,
- A rigorous review of the HTRW sites identified as those with potential impacts on the project would be conducted. The review would include obtaining and reviewing regulatory files, site visits, and discussions with regulators and others about the severity of the contamination. Following this review, Phase I or II environmental site assessments would be conducted as necessary. In areas where existing information is limited, environmental investigations shall follow industry approved protocols for conducting Phase I and Phase II investigations as needed.

The sponsor shall not provide lands for project construction without first ensuring that it has undertaken adequate investigation and determined there is no contamination of concern for the relevant parcel or, where contamination is identified, has remediated or ensured remediation of the parcel to the standards necessary to support the restoration project, as agreed by the relevant regulatory agency and USACE.Coordination and consultation with the appropriate regulatory agencies, including the USEPA and California lead agency (usually the LARWQCB or the DTSC), and responsible parties, as necessary, would begin as early as possible regarding investigation and remediation at the San Fernando Valley Superfund Site and Taylor Yard G1 and G2 sites, as well as the Piggyback Yard site as needed. The City would conduct remediation at contaminated sites prior to construction of restoration features at those sites.

- A new ecological risk assessment would be performed for the Taylor Yards G1 and G2 properties. The risk assessment would include risk calculations and analyses for recreational human health standards.
- Prior to the start of construction, the USACE will develop engineering specifications and plans that will include a written environmental protection plan. This plan will include a written pollution prevention plan that outlines the actions needed to respond spill or release of hazardous materials during construction or maintenance activities. The environmental protection plan would describe hazardous materials management and spill prevention and response methods. The plan would be reviewed with all site workers.
- A site-specific health and safety plan would be prepared and reviewed with all workers detailing methods of compliance with occupational health and safety regulations, emergency response actions, and include the route to the nearest emergency medical facility,
- Relevant paperwork such as material safety data sheets and chain-of-custody documents recording the transport and disposal of hazardous materials and waste would be maintained and available for inspection,
- All hazardous materials would be removed from the site when construction or maintenance activities were completed if not before, and
- Construction sites would be fenced to prevent unauthorized access.

5.12 UTILITIES AND PUBLIC SERVICES

5.12.1 Regulatory Framework

No Federal agencies or regulations are applicable to utilities and service systems associated with the array of restoration measures proposed for this project. Applicable California regulations include the Solid Waste Reuse and Recycling Access Act and the Integrated Waste Management Act. The Board of Public Works is the Bureau of Sanitation’s oversight agency. Oversight for energy-related utilities at the state level is under the California Public Utilities Commission and the California Energy Commission. The California Public Utilities Commission and the Federal Energy Regulatory Commission both regulate Southern California Gas operations.

5.12.2 Significance Criteria

An alternative would have a significant impact if it:

- Resulted in the need for new systems or supplies, or if it substantially altered power, natural gas, communications, local or regional water treatment or distribution facilities, sewer or septic tanks, stormwater drainage, solid waste disposal, or local or regional water supplies,
- Resulted in relocation of a utility to greater than 10 miles in any direction,
- Would use or take up the remaining capacity or capability of systems or eliminate the ability for facilities to accommodate new inputs,

- Exceeded wastewater treatment requirements of the applicable RWQCB,
- Required or resulted in the construction of new water or wastewater facilities or expansion of existing facilities to serve the project's projected demand, the construction of which could cause significant environmental affects,
- Required or resulted in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects,
- Resulted in insufficient water supplies available to serve the project from existing entitlements and resources, or would require new or expanded entitlements,
- Resulted in a determination by the wastewater treatment provider which serves or may serve the project that it has inadequate capacity to serve the project's projected demand in addition to the provider's existing commitments,
- Was served by a landfill with insufficient permitted capacity to accommodate the project's solid waste disposal needs,
- Failed to comply with Federal, state, and local statues and regulations related to solid waste, or
- Created a need for additional government services related to police, fire protection, schools, parks, libraries, or other public facilities.

5.12.3 Environmental Impacts

No Action Alternative

Construction Impacts

No impacts to utilities would occur from construction under this alternative because construction would not occur.

Operational Impacts

Although conservation efforts and energy-efficient technology are helping to slow growth in demand for some utilities, continued population growth in the Los Angeles area would generally continue to result in increased energy demand under the future without-project conditions. The possible exception is natural gas, which may experience a slight decline in demand. In the study area, the owners and operators of the major utility systems (electric, natural gas, sewer, water, and storm systems) would be expected to maintain, repair, update, and augment these systems on an ongoing basis in order to protect supply and provide reliable service to customers. Infrastructure planning documents would continue to be developed, implemented, and updated and would forecast demand, analyze demand relative to capacity, and make plans to alter infrastructure so that capacity is sufficient to meet forecasted demand. Some capital improvements would be expected to occur, resulting in increased capacity; however, funding for and completion of major improvements may lag behind demand. The market for telecommunications and solid waste management is characterized by multiple private service providers, which increases competition for customers. Due to this competition, these utilities would be expected to respond readily to customers' needs and keep pace with demand.

Alternative 10 (ART)

Construction Impacts

Where utilities overlap the study area, it is possible that these utilities could be affected by construction activities. LADPW power lines occur in the study area within Reaches 6 and 7, and up to 8 towers supporting them in Reach 6 and 10 towers in Reach 7 may require relocation. This impact would be less than significant as the power lines would be relocated less than 10 miles away. No other relocations have been identified at this time.

A utility management plan would be prepared prior to the start of construction and would describe in detail:

- Procedures for marking utilities prior to construction,
- Any utilities that would be temporarily rendered inoperable during construction,
- Any utilities that would have to be permanently relocated a distance of greater than 10 miles from their current location, and the plan for their relocation,
- Practices for working safely around utilities, particularly overhead transmission lines,
- Response procedures if a utility line were accidentally breached or impacted,
- Procedures for coordinating construction activities with utility owners, and
- Any permanent impacts to utility infrastructure and capacity.

California Government Code Section 4216 requires anyone planning an excavation in Los Angeles to call Underground Service Alert of Southern California, also known as DigAlert or Call Before You Dig, at least two working days before starting excavation to ensure that underground utilities are marked so they would not be damaged. Underground Service Alert would be called to mark utilities prior to construction. If necessary, a private utility locator would also be contracted to supplement the utility locations provided by Underground Service Alert. Relocation of segments of utility easements or corridors of less than 10 miles would be less than significant.

Alternative 10 would involve daylighting selected stormwater outfalls in Reaches 3, 4, 5, and 7. During construction, stormwater flow would have to be redirected to other stormwater outfalls, temporarily reducing overall stormwater system capacity, resulting in a short-term impact. The reduction in capacity would be less than significant and capacity would be restored when construction was complete.

Concrete and soils removed during construction would contribute to the debris that requires disposal. However, as much as possible, concrete and soils would be reused in other study areas or recycled. The amount of construction and demolition debris that would be generated by the project is shown in Table 5--23. The estimates provided in the table are based on the total debris generated by the project being divided by the number of days of construction to generate a daily amount of debris. The assumption then is that the daily amount that would be disposed in a landfill. Finally, based on reported recycling rates for similar materials throughout Los Angeles, it is assumed that 60% of the debris is reused or recycled rather than disposed in a landfill (Los Angeles Bureau of Sanitation 2007).

Table 5-23 Construction and Demolition Debris

Material	Total Debris Generated by Project (tons)	Debris Generated by Project Per Day (tons per day)	Debris Disposed at Landfill Assuming 60% is Reused or Recycled (tons per day)
Alternative 10 (ART)			
Excavated Material	837,650	5,203	2,081
Alternative 13 (ACE)			
Excavated Material	995,718	3,531	1,412
Concrete Demolition	33,681	119	48
Spalls Removal	26,626	94	38
Total	1,056,026	3,745	1,498
Alternative 16 (AND)			
Excavated Material	2,839,552	4,551	1,820
Concrete Demolition	113,146	181	73
Spalls Removal	107,691	173	69
Grouted Riprap Demolition	78,643	126	50
Riprap Demolition	12,192	20	8
Asphalt Removal	3,502	6	2
Total	3,154,725	5,056	2,022
Alternative 20 (RIVER)			
Excavated Material	4,044,573	5,571	2,228
Concrete Demolition	87,302	120	48
Spalls Removal	92,125	127	51
Grouted Riprap Demolition	70,563	97	39
Riprap Demolition	24,938	34	14
Asphalt Demolition	5,030	7	3
Total	4,324,531	5,957	2,383

Debris would likely be disposed of at the Sunshine Canyon Landfill. This landfill is projected to reach capacity and close in 2037 (Browning Ferris Industries of California, Inc. 2008). Alternative 10 is scheduled to be completed in 2017, so the landfill would be operational throughout construction of the project. The landfill is permitted to receive up to 12,100 tons of solid waste per day and is currently receiving approximately 9,000 tons of solid waste per day (Browning Ferris Industries of California, Inc. 2008; Republic Services 2012).

Alternative 10 would generate 2,081 additional tons of debris per day, which would result in a total daily disposal of 11,081 tons of debris at the Sunshine Canyon Landfill. This would not exceed the landfill's capacity. In addition, there are additional landfills in the area that could accommodate debris, if necessary.

Because construction personnel would follow safe construction practices and comply with health and safety requirements, accidents during construction are not likely and thus would not have an adverse impact on local police, fire, and emergency medical personnel. Police, fire, or emergency medical would respond if accidents or incidents occur during construction. Construction would not impact schools or libraries.

Operational Impacts

The project would enhance stormwater management by creating more pervious surfaces in multiple Reaches, which would increase potential for stormwater to infiltrate into the ground.

The project may require irrigation water to support landscaping, at least temporarily (until plants fully establish). The side channel proposed in Reach 3, and the freshwater marsh proposed in Reach 7 may also require pumps and electricity supply. Drought-tolerant native plants would be used; however, the project may result in a long-term increased demand for water and electricity, resulting in a minor impact.

Operation of the project would not likely alter the amount of solid waste generated in the study area or alter demand for natural gas or telecommunications infrastructure; therefore, there would be no impact on these utilities.

Increased public access would result in more people in the study area. Minor modifications or increases in police, fire, and emergency medical personnel, equipment, or facilities could be required in order to maintain an acceptable level of service and response time in the study area. The cities in the project area will request increased presence if necessary. The USACE would incorporate design measures to promote public safety and reduce incidences requiring police, fire, or emergency medical response such as adequate public lighting, signage stating rules and public access hours, and flood warning devices. Adverse impacts to public services would be less than significant.

Operation of the project would provide beneficial impacts to outdoor education opportunities for local schools. Operation of the project would have no effect on libraries.

Alternative 13 (ACE)

Construction Impacts

The project footprint for this alternative is the same as Alternative 10 except in Reaches 3, 6, and 7; therefore, the types of effects and significance in Reaches 1, 2, 4, 5, and 8 would be the same as Alternative 10. In Reaches 3, 6, and 7, a different design would be implemented and different specific utilities may be affected; however, there would be no unique impacts on utilities. The types of utilities effects would be the same as those described for Alternative 10. Fewer stormwater outfalls would be daylighted than under Alternative 10, therefore impacts associated with that measure would be less than under Alternative 10. All impacts would be less than significant.

As shown in Table 5-23, Alternative 13 would generate 1,498 tons of debris per day that would require landfill disposal, the least amount of any alternative. This would result in a total daily disposal rate of 10,498 tons of debris at the Sunshine Canyon Landfill. This would not exceed the landfill's capacity, so the project would be served by a landfill with sufficient permitted capacity and there would be no adverse impact. In addition, there are additional landfills in the area that could accommodate debris, if necessary.

Construction activities would occur over a longer time period compared to Alternative 10, so the temporary effects of construction would last longer.

Operational Impacts

Impacts to public services during operation would be similar as those described for Alternative 10 but would be slightly more extensive due to the larger project footprint. Impacts would be less than significant.

Alternative 16 (AND)

Construction Impacts

The project footprint for this alternative is the same as Alternative 10 in Reaches 1, 2, and 4 and the same as Alternative 13 in Reaches 3 and 6. The types of effects and significance in those Reaches would be the same as described for those alternatives. In Reaches 5, 7, and 8, a different project design would be implemented and different specific utilities may be affected; however, there would be no unique impacts on utilities. The types of utility effects would be the same as those described for Alternative 10-ART. All impacts would be less than significant.

Alternative 16 would involve daylighting the same stormwater outfalls as Alternative 13, therefore impacts from this measure would be the same as Alternative 13.

As shown in Table 5-23, Alternative 16 would generate 2,022 tons of debris per day that would require landfill disposal, which is less than Alternative 10 but more than Alternative 13. This would result in a total daily disposal of 11,022 tons of debris at the Sunshine Canyon Landfill. This would not exceed the landfill's capacity, so the project would be served by a landfill with sufficient permitted capacity and there would be no adverse impact. In addition, there are additional landfills in the area that could accommodate debris, if necessary.

Construction activities would occur over a longer time period compared to Alternatives 10 and 13, so the temporary effects of construction would last longer.

Operational Impacts

Impacts to public services during operation would be similar as those described for Alternatives 10 and 13 but would be slightly more extensive due to the larger project footprint. Impacts would be less than significant.

Alternative 20 (RIVER)

Construction Impacts

The project footprint for this alternative is the same as a previously described alternative in Reaches 1, 4, 5, 6 and 8. The types of effects and significance in those Reaches would be the same as described for those alternatives. In Reaches 2, 3, and 7, a different project design would be implemented and different specific utilities may be affected; however, there would be no unique impacts on utilities. The types of utility effects in these reaches would be the same as those described for Alternative 10. All impacts would be less than significant.

Alternative 20 would involve daylighting the same stormwater outfalls as Alternatives 13 and 16, and one additional one in Reach 7, therefore impacts from this measure would be slightly greater than the previous alternatives.

As shown in Table 5-23, Alternative 20 would generate 2,383 tons of debris per day that would require landfill disposal, which is the most of any alternative. This would result in a total daily disposal of 11,383 tons of debris at the Sunshine Canyon Landfill. This would not exceed the landfill's capacity, so the project would be served by a landfill with sufficient permitted capacity and there would be no adverse impact. In addition, there are additional landfills in the area that could accommodate debris, if necessary.

Construction activities would occur over a longer time period compared to the other alternatives, so the temporary effects of construction would last longer.

Operational Impacts

Impacts to public services during operation would be similar as those described for the previous alternatives but would be slightly more extensive due to the larger project footprint. Impacts would be less than significant.

5.12.4 Best Management Practices and Impact Avoidance Measures

Measures that would be implemented and would provide BMPs for reducing impacts include:

- Development of a utility management plan
- Obtaining a Private Solid Waste Hauler Permit from the City's Bureau of Sanitation prior to collecting, hauling and transporting waste,
- Recycling/reuse of construction debris to the extent possible;
- Disposing of excess debris to City certified waste processing facility, and
- Staggering construction of daylighting outfalls in order to minimize reduction in capacity of the stormwater system.

5.13 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

5.13.1 Regulatory Framework

Federal

Federal Executive Order 12898 was signed by President Bill Clinton on February 11, 1994, to focus Federal attention on the environmental and human health conditions of minority and low-income populations with the goal of achieving environmental protection for all communities. The Order directed Federal agencies to develop environmental justice strategies to aid Federal agencies identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. Environmental justice concerns may arise from impacts on the natural and physical environment, such as human health or ecological impacts on minority populations, low-income populations, and Indian tribes, or from related social or economic impacts.

State

In addition to its prioritization by the Federal government, California was one of the first states in the Nation to pass legislation to codify environmental justice in state statute, defining "environmental justice" as "The fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations and policies." (Government Code Section 65040.12)

Local

The City of Los Angeles General Plan, Housing Element includes the City's policies in regards to housing issues (City of Los Angeles 2001), Policy 2.3.2 states that the City will "…allow for the provision of sufficient public infrastructure and services to support the projected needs of the population and businesses of the City within the patterns of use established in the community plans."

5.13.2 Significance Criteria

The proposed project alternatives could cause significant impacts related to population, socioeconomics, and environmental justice if they would be inconsistent with the City of Los Angeles' General Plan, Housing Element in the following ways (City of Los Angeles 2002):

- Induce substantial population growth in an area, either directly (e.g., by proposing new homes and businesses) or indirectly (e.g., through extension of roads or other infrastructure),
- Cause growth (e.g., new housing or employment generators) or accelerate development in an undeveloped area that exceeds projected/planned levels for the year(s) of project occupancy/buildout, or
- Cause a substantial number of residents, businesses, or employees to be displaced (includes displacement of affordable housing), necessitating the construction of replacement housing elsewhere.

Additionally, alternatives would cause significant impacts under NEPA if they would:

- Have disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and, or low-income populations. The CEQ guidance identifies three factors to be considered to the extent practicable when determining whether environmental effects are disproportionately high and adverse (CEQ, 1997):
- Whether there is or would be an impact on the natural or physical environment that significantly (as the term is employed by NEPA) and adversely affects a minority population, low-income population, or Indian tribe. Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment;
- Whether the environmental effects are significant (as the term is employed by NEPA) and are or may be having an adverse impact on minority populations, low-income populations, or Indian tribes that appreciably exceeds or is likely to appreciably exceed those on the general population or other appropriate comparison group; and
- Whether the environmental effects occur or would occur in a minority population, low income population or Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards.

5.13.3 Environmental Impacts

No Action Alternative

Construction Impacts

No impacts to socioeconomics would occur from construction under this alternative because construction would not occur.

Operational Impacts

The socioeconomic assessment area consists of a predominantly residential and densely populated area in Los Angeles County. Due to the existing dense level of development, it is unlikely that changes in the local or regional economy will result in drastic changes in land use, population, or demographics in the assessment area. Other factors such as gentrification, poverty rates, and local businesses can affect the local economy and land uses, but no clear trends have emerged at the time of this assessment. Any changes that do occur in the period of analysis would likely be coincident with larger regional trends and would not materially alter the conditions in which an ecosystem restoration study would be constructed.

Environmental justice considerations would not likely be altered substantially. Income and poverty in the assessment area appear to reflect national and regional trends of slow but increasing recovery from the recent recession. Unemployment in the assessment area is below that of the City or the County. The demographics of the assessment area may shift slowly in proportion to larger regional trends, but there is no indication for large shifts in demographics over the period of analysis.

Alternative 10 (ART)

Construction Impacts

Temporary closure of recreational facilities such as bike lanes and horseback riding areas or reduction in access or availability of recreational features during the construction period would occur. However, adverse effects associated with any temporary closures of trail systems, access points, or crossings along the River would be temporary and less than significant. Effects would include temporarily reduced access to the River as well as diminished walking, biking, and golfing opportunities at specific locations during the construction period. Los Feliz golf course may require temporary full closure, and Harding golf course will likely require partial closure and remain open. All construction areas where employment and facility operation would be disrupted would be prioritized and expedited as much as possible. No net employment effects are expected at Los Feliz golf course. Because construction at Los Feliz is expected to take no longer than two months, employees could be temporarily reassigned with the Los Angeles Department of Parks and Recreation to reduce impacts. Because the Los Feliz golf course is a City of Los Angeles Department of Recreation & Parks facility, this temporary closure would not fall under the Uniform Relocation Assistance Act. Affected golfers would be likely to visit another course during construction, possibly substituting for the nearby Roosevelt course in Griffith Park.

Proposed staging areas are typically open lots near the River. Staging areas may result in temporary minor nuisances on adjacent businesses (traffic congestion, noise, etc.) but these effects would be managed by implementing BMPs, such that the effects remain less than significant. Proposed staging areas do not require business relocations. A phased construction approach that prioritizes areas with potential for temporary adverse socioeconomic effects would limit the quantity of closures at any one time and result in less than significant impacts.

As detailed in the draft Economic Appendix (see Appendix B), the infusion of construction funds into the regional economy will generate beneficial economic effects such as increased sales, additional jobs, increased labor income, and increased gross regional product during the construction period. The top three industries affected include construction, food and drink services, and engineering services. See Appendix B for detailed results of economic analysis.

This alternative is not expected to significantly affect environmental justice populations during construction, other than through a temporary but significant reduction in air quality that would equally affect all residents within the immediate construction area. Air quality impacts are further discussed in Section 5.2. The alternative may result in other minor and temporary adverse effects, such as increased noise or dust around the construction area, which would affect adjacent populations. However, these effects would be managed by implementing BMPs and staying within noise limits and construction periods specified in city and county plans. All populations adjacent to the construction area would be affected equally, rather than environmental justice populations being disproportionately affected. It is likely that all communities adjacent to the river would experience similar levels of temporary adverse effects mentioned above. However, the nature of this restoration project is such that project location is entirely driven by the location of the River, and cannot be located elsewhere. Moreover, adverse effects are temporary in nature.

Operational Impacts

Throughout most of the study area, Alternative 10 would have no significant effect on the socioeconomic characteristics of the study area. The alternative does not require relocation or removal of existing residences, indicating that population and housing would not be directly affected. However, commercial infrastructure at Piggyback Yard would be partially replaced with riparian and wetland habitat. It is assumed that the functions that occur at Piggyback Yard (predominantly intermodal freight transportation) would be replaced at a similar facility within the region. Information indicates that approximately 100-200 workers are employed at Piggyback Yard. For all private-sector relocations, the sponsor would provide relocation assistance for the affected business per the Uniform Relocation Act of 1970, as amended. Thus it is expected that business owners would have the opportunity to relocate to a suitable location in the region and socioeconomic impacts would therefore be less than significant. The conversion of Piggyback Yard is assumed to be a long term goal of the proposed project, and it may be a number of years before this takes place, providing ample time to address potential socioeconomic impacts

Furthermore, this alternative may also result in minor beneficial impacts to socioeconomic conditions in the study area. Improved aesthetic quality of the River, improved habitat value, improved quality and quantity of recreation resources along the River, and improved River accessibility would be the catalyst for these minor beneficial effects, which may include the following:

- Improvement in quality and quantity of recreation resources along the River may result in indirect economic benefits to businesses near or reliant upon the River, such as recreation equipment rentals, educational activities, restaurants and food service, etc.,
- Any improvements in environmental quality (such as water quality) in the region as a result of a cleaner, active River system would benefit all populations in the study area, and
- Potential long term urban renewal/redevelopment benefits such as increased local economic output, job growth, and labor income following completion of the restoration project (see Appendix B for further discussion of redevelopment impacts).

Alternative 10 is likely to yield beneficial effects to adjacent communities over the long term. These beneficial impacts include enhanced visual aesthetics, reconnection of communities divided by the river with pedestrian bridges, increased environmental education opportunities, and new, enhanced recreational opportunities. However, conversion of Piggyback Yard from its current industrial use into green space may result in disproportionately adverse effects to low-income or minority communities in the immediate area. While most of the study area demographics reflect a similar percentage of low-income and minority populations as the rest of the City of Los Angeles, communities in the census tracts immediately surrounding Piggyback Yard include minority and low-income populations, with less than 20% white residents on average, and with approximately 31% of residents living in poverty, which is 11% higher than the City of Los Angeles on the whole. Though rail and freight operations will likely be relocated to another location within the Los Angeles region, it is unlikely that the operations will be relocated near the communities in and around the ARBOR reach due to lack of a suitable alternative location and commuting to the new location may no longer be feasible for local residents. Working class jobs at Piggyback Yard may be transferred elsewhere in the Los Angeles regional economy; while not a net economic loss regionally, this may disproportionately affect the low-income and minority populations in and around the ARBOR reach study area if employees are from the communities in and around the current location and do not or are not able to retain their positions after the relocation of the facility to another location in the region. Indirect impacts may also occur to other businesses in the area that rely on clientele from the Piggyback Yard workforce. Based on the analyses presented in the Economics Appendix (Appendix B), any job growth predicted from urban renewal/redevelopment may not directly offset any initial job losses from closure of Piggyback Yard, as redevelopment will be a long term process, and the specific skilled labor jobs at Piggyback Yard are not likely to be replaced in kind either during construction or over the long term.

Alternative 13 (ACE)

Construction Impacts

Impacts for Alternative 13 would be similar to those for Alternative 10 in nature, though they may be slightly increased in duration due to the increase in overall level of restoration associated with the inclusion of channel reshaping in Reaches 6 and 7 and additional side channel work at Ferraro Fields in Reach 3.

Operational Impacts

Alternative 13 expands upon the features in Alternative 10 and adds additional measures. Impacts at Piggyback Yard would be the same as those described under Alternative 10. The current project footprint does not necessitate removal/relocating of any buildings, although some parking lots or open areas adjacent to the channel which are currently used for equipment storage may be reduced in size to accommodate channel reshaping. Additional analysis would occur after preparation of a real estate assessment by the USACE and during later stages of design. Should any acquisitions or condemnations be required, the sponsor would provide necessary assistance per the Uniform Relocation Act. Socioeconomic impacts, therefore, would be less than significant.

Alternative 13 may also result in beneficial impacts in the study area. These beneficial impacts would be same as for Alternative 10, with the possibility of slightly greater impact due the increased level of restoration for Alternative 13. Potential environmental justice effects would be the same as those described for Alternative 10.

Alternative 16 (AND)

Construction Impacts

Impacts for Alternative 16 would be to the same as those for Alternative 13 in nature, though they may be increased in extent and duration due to the increase in overall level of restoration associated with the addition of channel deepening in Reach 5 and bank terracing submeasures in Reaches 5 and 8.

Operational Impacts

Impacts for Alternative 16 would be the same as those for Alternatives 10 and 13.

Alternative 16 may also result in beneficial impacts in the study area. These beneficial impacts would be same as for Alternatives 10 and 13, with the possibility of slightly greater impact due to the increased level of restoration for Alternative 16. Potential environmental justice effects would be the same as those described for Alternatives 10 and 13.

Alternative 20 (RIVER)

Construction Impacts

The footprint for Alternative 20 is largest of the alternatives, including additional areas of restoration at Verdugo Wash, Los Angeles State Historic Park, and additional in-channel work, compared to Alternative 16. As with previous alternatives, it is assumed than any minor adverse effects from construction would be managed using BMPs such that they remain less than significant. Alternative 20 would require temporary partial closure of Los Angeles State Historic Park for construction of marsh/wetland restoration features; a less than significant impact due to the temporary nature of the closure and the availability of substitute recreation areas in the vicinity. At the Verdugo Wash confluence, a number of commercial/industrial parcels which fall within the project footprint would need to be acquired. Based on preliminary analysis, approximately 10 businesses would require relocation at Verdugo Wash. These businesses include warehousing, manufacturing, and industrial uses. Based on current design at Los Angeles State Historic Park, two parcels zoned for warehouses would be affected and structures found there would need to be relocated. Acquisition and displacement of businesses is a significant socioeconomic effect if it presents an economic hardship to a substantial number of local businesses or results in the permanent loss of jobs. However, for all relocations, the sponsor would provide relocation assistance per the Uniform Relocation Act of 1970, as amended. Thus it is expected that business owners would have the opportunity to relocate to a suitable location and socioeconomic impacts would therefore be less than significant.

Operational Impacts

Impacts would be similar to Alternatives 10, 13, and 16, with the following additions due to the more expansive restoration associated with Alternative 20.

The alternative may also result in beneficial impacts to the study area. These beneficial impacts would be same as for Alternatives 10, 13, and 16, with the possibility of greater beneficial impact due the increased level of restoration for Alternative 20.

Like Alternatives 10, 13, and 15, Alternative 20 does not require relocation or removal of existing residences, and as such would not displace any low-income or minority populations. Overall, it is expected that low-income and minority populations in the study area would experience some long-term beneficial effects from the alternative. However, as described Alternatives 10, 13, and 16, there is potential for significant adverse environmental justice effects from the conversion of Piggyback Yard.

5.13.4 Best Management Practices and Impact Avoidance Measures

As currently described, implementation of all four alternatives would require conversion of the Piggyback Yard property, and Alternatives 13 and 20 would require acquisition of businesses at the confluence with Verdugo Wash. Under CEQA, economic and social effects are not considered significant (CEQA Article 5 Section 15064(e)). While impacts to these properties do not constitute a CEQA significant impact, the effects on these displaced businesses would be significant under NEPA if no compensatory action were taken. Acquisition and compensation would be carried out in accordance with the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended, Pub. L. 91-646, 42 U.S.C. 4601. As a component of the acquisition, businesses would have the opportunity to participate in the relocation assistance program. As such, it is expected that no net adverse effect would be experienced, and the impact would remain below the threshold of significance. The project proponents would actively participate in relocation of these businesses to ensure fair and equitable compensation.

5.14 CUMULATIVE IMPACTS

The CEQA guidelines and the regulations implementing NEPA require that the cumulative effect of a proposed action be assessed (14 CCR Section 15130; 40 CFR Parts 1500-1508). A cumulative effect is an "impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions" (40 CFR § 1508.7). In addition, they are defined as "two or more individual effects, which, when considered together, are considerable or which compound or increase other environmental impacts" (CEQA Guidelines Sec. 15355). Cumulative effects can result from individually minor but collectively significant actions taking place over time (40 CFR § 1508.7). CEQ's guidance for considering cumulative effects states that NEPA documents "should compare the cumulative effects of multiple actions with appropriate national, regional, state, or community goals to determine whether the total effect is significant" (CEQA 2010). The following sections discuss local and regional growth trends and projects that may result in cumulative effects when combined with effects from the actions discussed above.

In general, past, present, and reasonably foreseeable future projects are assessed by resource area. Cumulative effects may arise from single or multiple actions and may result in additive or interactive effects. Interactive effects may be countervailing, where the adverse cumulative effect is less than the sum of the individual effects, or synergistic, where the net adverse cumulative effect is greater than the sum of the individual effects (CEQA 2010). The factors considered in determining the significance of cumulative effects are similar to those presented for each resource earlier in Chapter 5.

An integral part of the cumulative effects analysis involves determining whether effects from the project would contribute to ongoing or foreseeable resource trends. Where effects from the project contribute to regional resource trends, there is a potential for a cumulative effect. The cumulative effects analysis does not assess all expected environmental impacts from regional projects but only those resulting from the project and other past, present, and reasonably foreseeable future actions.

The timeframe for analysis of cumulative effects can be described as the reasonable and foreseeable estimate for implementation of cumulative projects, in addition to the proposed action. For purpose of this analysis and discussion of existing, ongoing, or planned projects, this timeframe would extend from the present to approximately 2035. This timeframe is based on the recent and pending adoption of various general, community, and resource plans proposing land use and resource projects incrementally being developed through that year, in addition to site-specific projects. Implementation of the restoration measures proposed in the Alternatives is also likely to be a long-term project that would coincide with the development schedule of the projects discussed below.

5.14.1 Existing, Ongoing or Planned Projects

This section is a discussion of projects that could contribute to cumulative effects, in addition to the project assessed in this FSR. Because of the large geographic region affected by the proposed project, the cumulative analysis primarily focuses on regional plans and planning documents in growth and development in addition to specific projects when identifying past, present, and reasonably foreseeable future actions for the effects analysis.

Analysis of cumulative effects considers past, present and reasonably foreseeable projects in addition to the proposed project. These projects include those potentially effecting environmental resource areas including land use, utilities, services, hydrology, parks and recreation, biological and cultural resources, and other issue areas.

The following are projects and plans that could potentially contribute to or address cumulative effects associated with implementation of the ARBOR alternatives. These include local and regional plans as well as public and private projects either recently adopted or in preparation by Los Angeles, Glendale, Burbank, utility and power agencies as well as regional planning agencies that could result in cumulative effects.

Hollywood Community Plan

In the City of Los Angeles, the Hollywood Community Plan encompasses portions of Reaches 1-6. This Plan has recently undergone a comprehensive update, and was adopted by the Los Angeles City Council in June 2012 (City of Los Angeles 2012). The major highlights of the Plan are the increased land use density and residential height limits for the central section of Hollywood, including sections of Hollywood Boulevard and Vine Avenue. No significant changes in zoning or land use designations affecting the portion of the Plan within Reaches 1-6 were adopted (City of Los Angeles, 2012).

Boyle Heights Community Plan

In the City of Los Angeles, the Boyle Heights Community Plan, which includes portions of Reaches 7 and 8, has been undergoing a comprehensive update since 2006 (City of Los Angeles, 2012). This Plan update is focusing on the various challenges facing the Boyle Heights community, including promoting new businesses, preserving existing industrial uses, preserving and creating affordable housing, and promoting new and expanded park and recreational opportunities. It is unknown when this update would be finalized and adopted by the City.

Los Angeles State Historic Park

The Los Angeles State Historic Park, located on the former 32-acre Cornfields site in Reach 7, opened in September 2006. The park is under development, and operates a number of amenities, including a natural amphitheater, a multiuse plaza, approximately four acres of open turf area for informal recreation and events, temporary classroom structures, interpretive panels, and walking trails (California Department of Parks and Recreation, 2012).

Rio de Los Angeles State Park

The Rio de Los Angeles State Park is located on a portion of the Taylor Yard site in Reach 6. Jointly managed by the California State Parks Department and the Los Angeles Department of Recreation and Parks, park construction began in 2005 upon adoption of a general plan for the site. Facilities include an amphitheater, soccer fields, tennis courts, baseball fields, trails, play areas, natural areas, and picnic areas (California Department of Parks and Recreation, 2012).

Los Angeles and San Gabriel Rivers Watershed Projects

A series of ongoing flood risk management and water quality projects and studies have been underway in coordination with the USACE and the Los Angeles County Department of Public Works (LACDPW) since 2000. The objective is to develop a framework for an integrated basin management plan in the Los Angeles County drainage area. The USACE and LACDPW are investigating solutions to flood risk management problems, while addressing environmental issues and impacts. These efforts are ongoing (LACDPW, 2012).

Arroyo Seco Watershed Management and Restoration Plan

Prepared for the State Water Resources Control Board in 2006, this Plan developed policies to manage and restore water quality and habitat in the Arroyo Seco watershed. The Plan focused on water quality and habitat, and included a series of recommended projects to enhance water quality and habitat improvement, including restoration of riparian areas with native plants (North East Trees 2006).

Green Visions Plan

The Green Visions Plan is a joint venture between the University of Southern California and the region's land conservancies, including the Rivers and Mountains Conservancy, Santa Monica Mountains Conservancy, Coastal Conservancy, and Baldwin Hills Conservancy. The mission of the Green Visions Plan for 21st Century Southern California is to provide a guide to habitat conservation, watershed health, and recreational open space for the Los Angeles metropolitan region and to design planning and decision support tools to nurture green land use patterns in southern California. Their goals are to protect and restore natural areas, to restore natural hydrological function, to promote equitable access to open space, and to maximize support via multiuse facilities (University of Southern California, 2012).

2005 Los Angeles Urban Water Management Plan

The Urban Water Management Plan serves as the City's master plan for water supply and resources management. The Plan describes how the City would address the following:

- Pursue cost-effective water conservation and recycling projects to increase supply reliability and offset increases in water demand due to growth and environmental enhancements;
- Protect groundwater supplies from contamination and provide treatment to optimize their use;
- Ensure access to reliable and affordable supplemental water supplies through active and effective representation at the Metropolitan Water District of Southern California;
- Maintain the operational integrity of the Los Angeles Aqueduct and the City's water distribution system; and
- Secure needed funds, including outside funding, to develop more efficient use of existing supplies, such as by conservation and recycling projects, and resource management programs.

Los Angeles Integrated Resources Plan

This Plan describes the wastewater, recycled water, and runoff systems in Los Angeles, identifies system inadequacies based on the needs projected for 2020, and provides recommended alternatives to address the future needs of the systems. Los Angeles owns and operates four wastewater treatment plants and water reclamation plants that manage the wastewater generated in the City and other areas in neighboring jurisdictions. Future population increases in Los Angeles and its service areas would result in increased wastewater flows that must be managed safely. This Plan addresses the alternatives to manage the facilities effectively and ensure a continued supply of water for the City (City of Los Angeles 2012).

Integrated Regional Water Management Plan

The LACDPW adopted an *Integrated Regional Water Management Plan* in 2006 to define a clear vision and direction for the sustainable management of water resources in the Greater Los Angeles County Region. The Plan presents analysis and information regarding possible solutions and the costs and benefits of addressing water quality and quantity needs for the region (LACDPW 2006, 2012).

Water Quality Compliance Master Plan

In 2009, Los Angeles adopted the *Water Quality Compliance Master Plan (WQCMP)*, a 20-year strategy for clean stormwater and urban runoff to reduce the pollution flowing into local rivers, creeks, lakes and beaches. By promoting green infrastructure, the WQCMP seeks a broad watershed-based perspective using green and natural solutions to improve water quality and maintain Los Angeles' compliance with current and emerging water quality regulations. The master plan describes the existing status of urban runoff management in Los Angeles and watershed management efforts by Los Angeles and other organizations, identifies key issues for the future of urban runoff management, provides strategic guidelines for improving the quality of Los Angeles' rivers, creeks, lakes and ocean, identifies opportunities for collaboration among City departments and with non-governmental organizations, and describes how rainwater can be used beneficially to augment the water supply (City of Los Angeles 2009).

Multi-County Goods Movement Action Plan

Various local and regional transportation agencies and private rail operators have been addressing long-term needs to ensure the continued viability of freight rail operations throughout the Los Angeles region and southern California. Metrolink has sponsored the *Multi-County Goods Movement Action Plan* to work with various transportation providers, community groups, and private rail companies to study intermodal transportation means of moving goods throughout the region. The Plan, prepared in 2008, provides guidelines for various agencies and recommends planning efforts to ensure that key freight corridors remain viable while addressing environmental concerns, economic benefits, and community needs (Metrolink 2008).

Johnny Carson Park

Johnny Carson Park is a 17.6-acre park in the City of Burbank. The amenities offered at this park include: a picnic area; an outdoor exercise course; a playground; two pedestrian bridges; a small performance stage; an abundant amount of mature trees; and vast areas of shaded green passive open parkland. The park's topography and potential for streambed restoration provide some very exciting opportunities for sustainability-driven improvements. The City has recently received grant funding to enhance the existing loop trail with interpretative signage, performing Americans with Disability Act (ADA) improvements to two existing bridges, providing new par course exercise equipment and creating a secondary trail system complete with benches.

Glendale Narrows Riverwalk

The City of Glendale, in association with various state and federal agencies, is developing the Glendale Narrows Riverwalk. This park and open space feature will provide a half mile of landscaped recreational trail along the north bank of the Los Angeles River across from Griffith Park. It will include a small entry park that will serve as a staging area for hikers and bicyclists, a separate staging area for equestrians using local trails, another small park area for walking and picnicking, enhancement of wildlife habitat in the river channel, and educational and interpretive exhibits. The project is funded by grants from the California River Parkways program and the Los Angeles County Regional Park and Open Space District. Most of Phase II of the project has been built as part of the Fairmont Avenue flyover extension off the 134 Freeway that is now nearing completion. Master Planning efforts for the remainder of Phase II and all of Phase III are now under way as the result of a Community-Based Planning grant from Caltrans. This effort will include linking Phases I and II, as well as exploring the potential for a bridge across the Verdugo Wash. Phase III will explore the prospect for what may become the signature element of the project – a multi-user bridge across the Los Angeles River from the Riverwalk to the Los Angeles Bike Path and on to Griffith Park, specifically for non-motorized travel between these recreational facilities.

Headworks Ecosystem Restoration Feasibility Study

The Headworks Ecosystem Restoration Feasibility Study will evaluate ecosystem restoration through the development of riparian habitat and wetlands, creating a multi-objective project that also include water quality improvement and passive recreation opportunities. Currently, four different alternatives are undergoing analysis, including habitat evaluation via the Combined Habitat Assessment Protocol methodology. Three of the four alternatives involve the redirection of water from the main LA River channel to the overbank (Headworks site) to help encourage ecosystem restoration in the region. One of the alternatives involves the capture and redirection of surface water runoff and overland flow to the Headworks site to encourage ecosystem restoration. Construction of the selected alternative is not anticipated until at least 2018, pending construction of a reservoir on the site. The project is located in the southeastern portion of the San Fernando Valley off Forest Lawn Drive at the Los Angeles River, adjacent to Griffith Park.

Sennett Creek Park

The proposed Sennett Creek Park would create a park along the south bank of the LA River on a narrow strip between the River and Forest Lawn Drive in the City of Los Angeles. The park would connect Griffith Park and the Warner Bros. studio complex and would be adjacent to the Forest Lawn Memorial Park complex. The non-profit Friends of the LA River (FoLAR) and North East Trees are working with the City of Los Angeles, the USACE and major stakeholders, including Forest Lawn and Warner Bros., to implement a vision for this park and secure funding sources for its development. Proposed features of this park would include a river bicycle and pedestrian path, picnic areas, riparian restoration, and connectivity to wildlife corridors and nearby trails, including Sennett Creek.

Griffith Park Trail Planning

The City of Los Angeles, working with other agencies and non-profit groups, are proposing new trails or improvements to existing trails throughout Griffith Park. These improved or new trails are designed to enhance the visitor experience to Griffith Park as well as highlight the parks natural resources and connections with its historic past. These activities include developing a concept plan for Anza National Trail enhancement and management through the Griffith Park-L.A. River corridor promoting community connectivity, native habitat restoration, increased awareness of the trail, improved maintenance, and an enhanced user experience.

Griffith Park on the East Bank

The City of Los Angeles and various local non-profits are working on plans to transform a 28-acre portion of Griffith Park now being used as a service yard into usable parklands. The site is located next to the LA River, the existing North Atwater Park, and the City of Glendale water reclamation plant, and is near the Chevy Chase Recreation Center. Current plans call for a combination of playgrounds and picnic areas, athletic fields and recreation areas, and bicycle and pedestrian trails.

Senate Bill No. 1201

This law, adopted in 2012, amends the Los Angeles County Flood Control Act to include a provision that provides for public use of navigable waterways under the district’s control suitable for recreational and educational purposes. This provision codified that the river was subject to Section 4 of Article X of the California Constitution, which guarantees the public a right of access to navigable waters of the state. The LA River must be held in trust for the public and the state and its local governments are directed to manage it for public use and access when compatible with flood risk management.

Dreamworks Animation Campus

This entertainment media project in Glendale would create a 495,000 square foot entertainment production campus and employ approximately 1400 people at full build-out. The project would be constructed in two phases and would eventually encompass seven buildings with a distinct Mediterranean theme. The project would combine the studios design and production staff into an integrated setting for the creation and production of animated films and related media (City of Glendale 2006, 2008).

Cornfield-Arroyo Seco Specific Plan

The Cornfield-Arroyo Seco Specific Plan will guide the future development of the Arroyo Seco area within and adjacent to Reach 7 by creating a series of mixed-use zoning districts that allow private, public, and nonprofit sector developers to combine retail, residential, commercial, civic, and industrial uses while ensuring that this development contributes to an engaging, human-scale urban fabric. The plan would create four new zoning districts that would result from implementation of the Specific Plan, including the following: Greenways, Urban Village, Urban Innovation, and Urban Center. Two existing, primarily residential zoning districts will remain. The specific plan area would encompass the River channel for several miles (City of Los Angeles 2010, 2012).

Albion Dairy Park Project

This project, located in Reach 7, would transform the Los Angeles River adjacent to the old Swiss Dairy site into a river greenway park. The 6-acre site is located next to Downey Park in the community of Lincoln Heights in the City of Los Angeles. The site would undergo a redevelopment and revitalization process which would incorporate multi-functional and multi-benefit design features that would serve as an amenity for the community while improving stormwater quality in the city. The Mitigated Negative Declaration for the project was approved in April 2011 (City of Los Angeles 2011).

Atwater Bridge

This project, headed by the Los Angeles River Revitalization Corp., is located in the Atwater areas of the study area and would construct a pedestrian, equestrian, and bicycle bridge across the Los Angeles River to connect Atwater Village with Griffith Park and the Los Angeles River bikeway. This project is in the approval process with the City of Los Angeles and the USACE.

Burbank2035 General Plan

The City of Burbank is currently updating its General Plan. Named *Burbank2035*, its goals and policies affect a wide range of issues including housing, traffic circulation and mobility, parks and recreation, resource conservation, and public safety. Although parts of the City's General Plan have been revised through the years, the Plan has not been comprehensively updated since the mid-1960s. In that time, both the City and the surrounding influences of southern California have experience massive growth and environmental, physical, economic, social, and demographic changes. Due to the changing times, some community priorities have also shifted and evolved. A Draft EIR for Burbank2035 has been released as of summer 2012 (City of Burbank 2012).

5.14.2 Cumulative Impact Analysis

This section discusses the impacts of the alternatives when considered cumulatively with impacts of other past, present, and reasonably foreseeable future actions. The geographic scope for each resource is provided as part of the discussion.

Geology, Soils, and Seismic Hazards

The study area for cumulative impacts for this resource type includes the watershed of the River and its tributaries. The potential for cumulative impacts related to geology, soils, and seismic hazards is minimal under both the action alternatives and the No Action Alternative, since no significant issues related to these resources or hazards were identified for this project. Although most of the area within Reaches 1-8 is in a liquefaction zone, and the Raymond Fault is located within portions of Reach 5, the proposed project would not affect these features, and would not contribute to cumulative impacts related to past, present, or reasonably foreseeable future projects.

Soil erosion could occur due to the extensive amount of ground clearing and earthwork involved with construction of the project. However, the proposed channel restoration measures in Alternatives 10, 13, 16 and 20 would be required to meet modern construction criteria including stormwater pollution prevention, These criteria would also apply to cumulative projects in the study area; therefore, cumulative impacts would be considered less than significant.

Implementation of any of the alternatives would result in negligible impacts on sand and gravel deposits and underground oil and gas fields, so there would be no cumulative impacts on mineral resources expected with the project.

Air Quality

Cumulative air quality and greenhouse gas impacts can occur when multiple emission sources affect the same geographic area simultaneously or when sequential projects extend the duration of air quality impacts on a given area over a long period. Potential sources of fugitive dust (contributing to local PM_{10} levels) include construction, vehicle traffic on unpaved roads or off-road areas, and wind erosion from areas with exposed soils. Vehicles associated with short-term construction and potential increased traffic in the long term would contribute to NOx, ROG, CO_2, and PM_{10} emissions. Construction of River restoration measures would not contribute to CO_2 impacts that would present a cumulatively significant impact to greenhouse gas emissions.

The study area for cumulative air quality effects is generally along the LA River corridor, but also including the greater Los Angeles/Burbank/Glendale area for regional effects. There are present or reasonably foreseeable construction projects occurring with or in proximity to future River restoration projects as they are implemented in near-term and long-term planning periods. These include the construction of Albion Dairy Park, Glendale Narrows Riverwalk, Sennett Creek Park, and Griffith Park on the East Bank.

Short-term and potentially significant cumulative air quality impacts from construction-related fugitive dust are possible if River restoration projects were to occur simultaneously with other reasonably foreseeable construction projects or with ongoing emission sources in proximity of the project. The South Coast Air Basin is classified as a nonattainment area for Federal and state PM_{10} standards. , Emissions from other projects considered here would affect the local study area and vicinity. Cumulative impacts due to emissions from other past, present, and reasonably foreseeable future projects would be reduced to the degree possible through use of BMPs (such as dust abatement).   Projects considered cumulatively with this one would result in a significant cumulative impact, as they would only add to the amount of emissions, which already exceed thresholds. Anticipated long-term cumulative increases in vehicular traffic that may accompany implementation of some restoration measures in combination with other projects identified here would have an overall incremental adverse effect on air quality and greenhouse gases in the region. Cumulative impacts under the No Action Alternative would still be considered significant, assuming exceedance of air quality thresholds from other projects.

Land Use

The study area includes the applicable community plan areas within the jurisdiction of the City of Los Angeles proposed for restoration measures, as well as the Cities of Glendale and Burbank. These cities include policies generally supporting the restoration of the River in their General Plans and applicable community plans. The implementation of any of the alternatives would be consistent with the applicable general plans and community specific plans of these cities, with the exception of industrial land uses on several key sites. These general plans, as well as the land use plans by county and regional planning agencies such as the Southern California Association of Governments (SCAG), are addressing the River as an asset for the region along with its long-term and recognized importance for flood risk management, water quality, and fish and wildlife habitat. The City of Burbank is preparing a comprehensive update of its General Plan, which would address the impacts of cumulative projects, including this one, on transportation, utility, and public service expansions through the year 2035; therefore, none of the alternatives would contribute significantly to cumulative impacts in Burbank (City of Burbank 2012a, City of Glendale 2012e).

There would be no significant cumulative land use impacts with the No Action Alternative, since present land uses would continue in conformance with adopted community and general plans. Implementing the restoration measures within the Reaches would result in significant impacts from converting industrial land uses to non-industrial uses. The degree of impact is most significant with Alternative 20, since the industrial land area affected is greatest, though impacts in Alternatives 10, 13 and 16 would be significant as well. Impacts on industrial land use are a focused issue within Los Angeles and the applicable Community Plan updates as well. The viability of continued industrial uses in the vicinity of the study area is also an issue due to the age of some of these uses. Their continued operation may be subject to other factors independent of any change in land uses due to the proposed project or any other similar efforts in the area. Encroachment of other uses, including the Rio de Los Angeles State Park, poses the greatest challenge to the continued viability of adjacent and nearby industrial uses in this area. This could impact the City's efforts to maintain areas that provide an economic base for long-term employment and fiscal health, and would contribute to significant adverse cumulative land use impacts (City of Los Angeles, 2012).

Hydrology, Floodplains, and Water Quality

The study area for hydrology, floodplains, and hydrology includes the watershed of the River and its tributaries. Cumulative impacts to hydrology, floodplains, and water quality are expected to be beneficial under both the No Action Alternative and the restoration Alternatives. In addition to the various restoration measures in Alternatives 10, 13, 16 and 20, other past, present, or reasonably foreseeable future projects include various master planning efforts by the Los Angeles County Department of Public Works and other local and regional agencies to develop comprehensive plans addressing hydrology, floodplains, and water quality from a regional perspective. These plans address hydrology and water quality issues throughout Los Angeles County and in particular the various water courses and tributaries that eventually flow into the River. These collectively influence flood risk management and water quality issues within the River channel. Cumulative impacts related to floodplains would be beneficial since the implementation of these comprehensive plans favorably address floodplain and associated water release issues from various major and minor tributaries in addition to the main River channel.

Another beneficial cumulative impact would result from the various measures within the alternatives that would increase the riparian and native habitats. These measures would reduce the amount of impermeable surface area in the River channel, and vegetation features would help improve hydrology and water quality for cumulative projects located within and in the vicinity of the reaches, including the Rio de Los Angeles State Park, Griffith Park on the East Bank, Glendale Narrows Riverwalk, and the Albion Dairy Park (City of Los Angeles 2012; Los Angeles County 2006, 2012).

Biological Resources

The study area for biological resources includes the watershed of the River and its tributaries. The restoration measures in Alternatives 10, 13, 16, and 20 would contribute to beneficial cumulative impacts to biological resources. These impacts would increase the amount of fish and wildlife habitat; provide greater ecological/biological benefits; aid in linking isolated habitats; help increase the amount of open space; help expand species diversity; and reduce the amount of impermeable surface area in the study area. These impacts would be beneficial from a regional perspective since they would benefit fish and wildlife species that may migrate outside of the study area. These benefits would also accrue to past, present, and reasonably foreseeable projects including the Albion Dairy Park, Griffith Park on the East Bank, Sennett Creek Park, and the Rio de Los Angeles State Parks that are located along or in the vicinity of the River. These projects would be developed under the No Action Alternative as well, so cumulative impacts would continue to be beneficial.

Construction activities would require excavation of surface and sub-surface materials and the subsequent disposal of these materials. However, any cumulative adverse impacts to biological resources as a result of construction activities would be addressed through the implementation of BMPs and stormwater requirements of local and state agencies as well as the USACE. These measures would be implemented as part of any other planned or reasonably foreseeable developments within the study area, including the development of Taylor Yard, the Cornfields site, and the Albion Dairy Park. In conjunction with other habitat restoration efforts proposed or being planned in the area, including significant restoration efforts on Arroyo Seco and other projects under consideration by watershed groups and local agencies, these measures would have a significant, beneficial cumulative impact (City of Los Angeles, California Department of Parks and Recreation, 2012).

Cultural Resources

The study area for cultural resources includes the area within and in the vicinity of the River channel as well as the areas proposed for development of cumulative projects identified above. Implementing the proposed restoration measures, combined with other past, present, and reasonably foreseeable projects in the vicinity, would result in the potential for both beneficial and adverse impacts on cultural and paleontological resources in the study area. Adverse impacts would be mitigated through adherence to Federal and state guidelines and provisions for protection of cultural and paleontological artifacts, including the potential discovery of human remains; therefore, impacts would not be significant.

Past developments in the study area have resulted in the loss or destruction of the spatial integrity of prehistoric and historic archaeological resources through ground-disturbing activities. Paleontological resources may have been lost through excavation as well. Historic buildings and structures have been lost or impacted due to demolition, substantial alteration, neglect, or incompatible construction. The impacts of current and future cumulative actions in the study area that are not subject to extensive cultural or historic resource review or result from neglect or vandalism would continue whether the proposed restoration measures were implemented or not. Restoration measures may stimulate the adaptive reuse, rehabilitation, or restoration of adjacent historic buildings and structures, but associated economic development may encourage removal of historic buildings and structures or incompatible construction. However, much of the current and future development would be subject to Federal, state, and local reviews that include some level of consideration and protection for cultural and paleontological resources.

The restoration measures, combined with cumulative developments in, and in the vicinity of, the study area would be conducted in the context of environmental and cultural resource compliance review as proscribed by Los Angeles, Glendale, and Burbank ordinance provisions as well as state and Federal guidelines and regulations for the identification, handling, and preservation of cultural resources. Development of cumulative projects, including Rio de Los Angeles State Park, and Los Angeles State Historic Park, has already been subject to these multi-jurisdictional provisions. Cumulative developments in the planning stage within and in the vicinity of the study area, including Albion Dairy Park, Sennett Creek Park, and Griffith Park on the East Bank, would be subject to these provisions as these parklands are developed. These provisions are designed to identify cultural and paleontological resources, assess impacts, and avoid adverse effects. When combined with other past, present, or future impacts, the cumulative impacts resulting from either the proposed restoration measures or the No Action Alternative would be less than significant.

Traffic and Transportation

The study area for traffic and transportation includes the highways, streets, railways, and transit corridors in Los Angeles County that serve both the project vicinity as well as the greater southern California region and beyond. Many elements of the current transportation network (past projects) are operating near or at their capacity. Current projects, including the expansion of I-5 in Burbank and Glendale, are addressing capacity and utilization requirements; however, long-term capacity is likely to lag behind projected population growth of the region and the lack of adequate space and facilities to expand the network. Other current or reasonably foreseeable future projects in the study areas include a TEA-21 project to upgrade the southern terminus of SR-2 and Glendale Boulevard, and the $898 million Metro Gold Line Eastside Extension project. The added capacity of these transportation elements will help to offset temporary increases in construction-related traffic.

The restoration measures in the various alternatives, together with these past, present, and reasonably foreseeable future projects, would expand open space and parkland opportunities primarily serving a local population, and would not likely result in a significant cumulative impact to the regional transportation system (Metrolink, 2012).

The restoration measures, combined with cumulative developments within the study area, could result in cumulative impacts to current and planned rail operations. Various commuter and passenger rail projects, such as the Metrolink's Metro Gold Line extension and the State-sponsored high-speed rail, include routes that overlap several project reaches. In addition, both Union Pacific and BNSF maintain both active rail lines and storage tracks along both sides of the River. These cumulative project efforts would occur either with the restoration measures or the No Action Alternative; therefore, cumulative impacts would be similar. These projects would be coordinated with Metrolink, SCAG, and other local and regional transportation agencies and private rail operators through the *Multi-County Goods Movement Action Plan* and similar regional planning efforts to ensure that any cumulative impacts would be less than significant.

Noise

Cumulative noise impacts typically occur when multiple projects affect the same geographic areas simultaneously or when sequential projects extend the duration of noise impacts on a given area over a longer period. Noise impacts are primarily localized because sound levels decrease relatively quickly with increasing distance from the source; therefore, the cumulative noise setting would be limited to the area subject to audible increase in noise levels with construction and development of cumulative projects. Cumulative noise impacts from implementing the proposed project, together with other reasonably foreseeable development activities in the study area, would result primarily from temporary construction activities. These construction activities would include several parks and recreation areas in the vicinity of the study area, including the Glendale Narrows Riverwalk, Sennett Creek Park, and the Albion Dairy Park. However, given the planned facilities for these parks and recreation areas, including trails, pathways, and small structures, construction activities would likely not necessitate use of heavy equipment for most activities. The potentially highest levels of cumulative noise impacts would take place if several development projects were to take place at the same time and be in fairly close proximity. However, these increases would be due to construction activities and would be temporary, and would be subject to local noise ordinance provisions from the Cities of Los Angeles, Glendale and Burbank. These ordinance provisions would be applicable to the cumulative projects under the No Action Alternative as well. Therefore, no significant cumulative adverse noise impacts would occur.

Recreation

The study area for recreation comprises the community plan areas of Los Angeles proposed for restoration measures, as well as the Cities of Glendale and Burbank. Implementation of any of the alternatives would contribute to cumulative beneficial recreation impacts for the residents of the study area. The restoration measures would increase riparian habitats that could present a recreation resource through attractive and aesthetic features both within and along the River channel. All communities in the study area have documented the need for more parks and open space in general plans and in various community plans. These planning efforts, including the development of the Rio de Los Angeles State park and the Los Angeles State Historic Park, have introduced new parklands along and adjacent to the River channel. Although these new parklands would continue to be developed under the No Action Alternative, the impact would be less beneficial without the comprehensive river parkland measures under the restoration measures. Additional planning efforts, including the *Boyle Heights Community Plan* update currently in progress, are addressing that neighborhood's need for additional parks and recreational opportunities along Reaches 7 and 8, where there is currently little land available for parks and recreation spaces or amenities. The restoration measures would occur in areas that could connect with reasonably foreseeable parklands that could be identified through the update of this Plan as well as future community plan updates (City of Los Angeles, 2012). In addition, recreation and open space amenities are identified within the vicinity of the River in the updated *Burbank 2035 General Plan* currently in progress, and cumulative impacts of the restoration measures within Reach 1 in Burbank would result in beneficial cumulative impacts as well (City of Burbank, 2012).

Aesthetics

Implementation of any of the alternatives, combined with cumulative projects in Los Angeles, Glendale, and Burbank would result in cumulative beneficial impacts for aesthetic resources. These reasonably foreseeable future projects would result primarily in the conversion of older industrial and industrial-serving uses to open space uses within the study area comprising the community plan areas of Los Angeles and areas of Glendale and Burbank with River frontage proposed for restoration. These projects include the Rio de Los Angeles State Park, Los Angles State Historic Park, and improvements in the Glendale Bicycle Transportation Plan, and would result in new parklands, River access, bicycle and pedestrian paths, and landscaping features. Under the No Action Alternative, these projects would provide a beneficial cumulative impact to aesthetic resources. Combined with the LA River project, these projects would result in greater improvement to the aesthetic appearance of the study area and surrounding areas in the cumulative setting. In addition, the proposed project in itself and when combined with cumulative projects would not likely result in new sources of significant light or glare that would result in potential impacts. Therefore, the overall cumulative aesthetic impacts would be beneficial.

Public Health and Safety, Including Hazardous, Toxic or Radiological Waste

The study area for public health and safety includes the River channel, and the immediate vicinity providing nearby or direct River access. Implementation of River restoration measures could result in less-than-significant potential cumulative impacts involving school safety, HTRW, methane zones, and infectious diseases associated with the project. However, because implementation of the River revitalization measures and other reasonably foreseeable future parkland and recreation projects would increase the opportunities for the public to interact with the River, the cumulative risk of water-related injury could increase. This cumulative risk would be greatest with the development of parks and recreational activities with direct or nearby River access, such as Griffith Park on the East Bank, Sennett Creek Park, and the Glendale Narrows Riverwalk. Since these parks would be developed regardless of whether the restoration measures are implemented, the cumulative risks would be similar under a No Action Alternative. This risk would be greatest during and following seasonal flooding events. However, existing public health and safety agencies in the Cities of Los Angeles, Glendale, and Burbank, including police, fire and other emergency services would be utilized to address any cumulative impacts to public health and safety.

It is assumed that other large-scale projects in the region will need to remediate HTRW prior to construction. In combination with remediation that would occur prior to construction for this project, significant beneficial impacts on the overall environment through less HTRW could occur.

Utilities and Public Services

The continued population and economic growth of Los Angeles, Glendale, Burbank, and the surrounding region requires commensurate growth in infrastructure and utility capacity. The study area, including the River channel and surrounding lands within the reach areas would continue to be used as a utility corridor and as a conduit for stormwater treatment and discharge. The increase in demand for power and telecommunications would likely result in the need for replacing, upgrading, and installing new transmission lines. Some of these replacements, upgrades, and installations would take place within the study reaches and would be in addition to, or parallel with, the movement of any lines required by expanding the river channel. These upgrades would occur under either the No Action Alternative or any of the restoration measures, and cumulative impacts would be similar. Implementation of any of the proposed alternatives would occur within areas primarily designated for open space and public facilities, and would not conflict with these upgrades or potential new facilities. Cumulative impacts would be addressed through various plans currently adopted or in progress, including the Greater Los Angeles County Integrated Water Resources Management Plan, Integrated Regional Water Management Plan, 2005 Urban Water Management Plan, Solid Waste Integrated Resources Plan, and related projects address long-term infrastructure and utility needs. These planning efforts would ensure that cumulative impacts associated with the restoration measures, and cumulative utility projects within the Reaches and vicinity, are less than significant.

Socioeconomics and Environmental Justice

Under the No Action Alternative, no displacement of housing or industrial uses would occur and no significant impacts to socioeconomic and environmental justice would result. Implementation of any of the alternatives would not result in the displacement of housing; however, all would result in the conversion of industrial land uses to open space and recreational land uses, resulting in a potential loss of jobs and employment centers within the study area and vicinity. The study area comprises the community plan areas of Los Angeles including the applicable River reaches as well as the Cities of Glendale and Burbank. This conversion would be greatest with Alternative 20, due to the amount of industrial land at the Piggyback Yard and Verdugo Wash sites identified for River restoration measures. However, it would occur with Alternatives 10, 13, and 16 as well due to the impacts at the Piggyback Yard site. This, combined with present and reasonably foreseeable future projects including the Rio de Los Angeles State Park at the Taylor Yard site and the Los Angeles State Historic Park, would not result in significant cumulative socioeconomic impacts; however, because these effects would occur on a sub-regional level but are assumed to primarily effect low-income communities in the downstream reaches of the project area, this would constitute a potentially significant cumulative environmental justice impact. These impacts would primarily be in Los Angeles due to the preponderance of the study area within this jurisdiction and the relative availability of convertible (industrial) land uses as compared to the more limited study areas within the cities of Glendale and Burbank. The relocation of the container transfer facility at the Piggyback Yard would result in the loss of jobs and industrial uses at the site; in addition, adjoining and nearby industrial land uses dependent on the viability of operations at the Piggyback Yard, would be impacted. With the decrease in available industrial land, the viability of continued industrial operations in the vicinity of the study area would be diminished, resulting in the potential loss of still further jobs and employment centers. These impacts could be addressed through community planning efforts, including those underway in Boyle Heights, but would not guarantee the continued viability of industrial employment within the study area or nearby vicinity.

Cumulative impacts to children's health and safety are not anticipated to be significant. The restoration measures, combined with current and foreseeable recreation and rehabilitation projects by the Cities of Los Angeles, Glendale and Burbank, would enhance the River and its vicinity as a recreational resource for the surrounding community; this would have a net positive affect on minority and low-income populations as well as children's health and safety. Increased access to the River and enhanced recreational opportunities would also be consistent with recommendations from several groups that advocate River enhancement measures as a means to unite various groups and populations and ameliorate environmental justice issues including minimal opportunities to access parks and other recreational facilities in neighborhoods dominated by minority and low-income populations, many of which are found along reaches in the study area. Present and reasonably foreseeable future projects in the study area, including the proposed project, could result in air quality and noise impacts due to the potential conversion of older industrial uses to open space uses. However, these impacts would primarily be due to construction, and would therefore be temporary. In addition, construction measures to address potential air quality and noise concerns, such as dust controls and adherence to local noise ordinances, would reduce any potential cumulative impact on environmental justice populations to a less than significant level. Furthermore, the same areas that would be affected during construction will receive a long-term benefit with the increased recreational amenities.

5.15 GROWTH-INDUCING IMPACTS

All of the proposed alternatives include efforts to provide additional environmental restoration. These are likely to decrease potential growth, rather than induce growth, since these lands would be converted to open space. The conversion of lands from high density uses to open space may have the effect of decreasing the potential for growth. Many restoration submeasures in are within marginal lands at the edge of the River or existing open space that can easily be converted to native habitat. Where larger-scale restoration measures are suggested such as at Piggyback Yard, these measures would convert industrial and rail facilities into restored habitat and remove them from the potential of being developed into higher density commercial or industrial uses or converted into housing developments. Conversely, it is possible that large scale restoration would attract a greater number of residents to the surrounding areas, particularly as a result of the area becoming a desirable place to live due to its proximity to restored open space.

5.16 UNAVOIDABLE ADVERSE IMPACTS

Table 5-24 Unavoidable Adverse Impacts

Resource	Alternative 10 (ART)	Alternative 13 (ACE)	Alternative 16 (AND)	Alternative 20 (RIVER)
AIR QUALITY	The construction phase of the proposed project is expected to exceed the following thresholds: (1) the CEQA regional significance thresholds for ROG and NOx; (2) the CEQA localized significance thresholds for NOx, PM10, and PM2.5; and (3) the NEPA significance thresholds for NOx and CO.	Air quality impacts the same as Alt 10, as well as additional exceedances of the CEQA regional significance thresholds for CO and the CEQA localized significance thresholds for CO.	Air quality impacts are the same as Alt 13, as well as additional exceedances of the CEQA regional significance thresholds for PM2.5 and the NEPA significance thresholds for ROG.	Same as Alt 16.
LAND USE	Restoration of Piggyback Yard would conflict with the Industrial land use designation, and potential adverse indirect impacts could also occur should new industrial uses not desire to relocate. This results in a significant adverse impact.	Same as Alt 10.	Same as Alt 10.	Same as Alt 10, additional impacts in Reach 3 at Verdugo Wash.
TRAFFIC AND CIRCULATION	Restoration of Piggyback Yard would result in temporary removal of rail lines. Permanent removal of spur lines in Piggyback Yard would remove rail capacity.	Same as Alt 10.	Same as Alt 10.	Same as Alt 10.
SOCIO-ECONOMICS AND ENVIRONMENTAL JUSTICE	Working class jobs at Piggyback Yard that may be transferred elsewhere may disproportionately affect the low-income and minority populations.	Same as Alt 10.	Same as Alt 10.	Same as Alt 10.

5.17 RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The National Environmental Policy Act (NEPA) (40 CFR 1502.16) requires that an EIS consider the relationship between short-term uses of the environment and the impacts that such uses may have on the maintenance and enhancement of long-term productivity of the affected environment. This section compares the short and long term environmental effects of the proposed restoration action. Overall, the proposed restoration project would provide minor and temporary short-term losses, while resulting in significant beneficial impacts to the long-term productivity of the affected area.

The period of construction of the proposed project represents the cause of short-term impacts. These temporary and minor impacts or losses are considered non-significant and will include increases in noise, disruption to traffic and recreation in the area, demolition of existing features, removal of materials, reduction in air, water, and aesthetic quality, and disturbance to biological resources. Significant adverse impacts that will occur during construction include the exceedance of air quality thresholds. Long-term adverse impacts will also result from the project, once the construction period is complete. These impacts will result entirely from the proposed transformation of Piggyback Yard from its current industrial use condition to a restored historic wash condition. The long-term adverse impacts include the permanent loss of industrial land uses at Piggyback Yard, the permanent closure of railroads and the resulting loss of rail capacity at Piggyback Yard, and the loss of working class employment within the Piggyback Yard neighborhood where minority and low-income populations will be disproportionately affected by that loss.

Long-term beneficial impacts will result from the restoration of the aquatic, wetland, and riparian habitats within the Los Angeles River. Additional in water habitat will provide greater habitat for fish and wildlife in the area, as well as provide other cumulative benefits, such as water attenuation for flood abatement, and aesthetic improvements. Daylighting streams will create new wetland habitat and removing non-native vegetation and replacing it with native plants will further increase fish and wildlife habitat. Secondary long-term benefits of restoration efforts will include improvements to aesthetic quality, air quality, water quality, recreation access and availability, and to those populations that do not have equal availability of recreational opportunities. Ecological restoration will provide a significant and long-term improvement in the condition of the River for the native wildlife populations that once occurred, and in doing so, will enhance the well-being of the human population that surrounds the River. These long-term benefits have been envisioned and designed to outweigh the short-term adverse impacts that are necessary to achieve the restoration goals.

5.18 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The irreversible environmental changes that would result from implementation of the proposed projects involve the consumption of material resources, energy resources, and human resources that affect the sustainability of resource use in future generations. The use of these resources is considered to be permanent because the use or destruction of the resource cannot be replaced within a reasonable timeframe.

Overall, the proposed action would result in the use of materials, energy, and human resources that would be irreversible and irretrievably lost. Losses would include those from materials demolished, fill material removed, vegetation uprooted, energy resources utilized, and labor hours spent. Levels of significance of these losses, both adverse and beneficial, are described in further detail in subsequent paragraphs.

For all of the alternatives proposed, a variety of materials in place within the study area would be demolished, removed, or altered in a way that would result in their irretrievable loss. This loss would be offset in part by the reuse of materials where possible. For example, it may be feasible to utilize demolished concrete as bank protection where new channel or side channel features are implemented. Transfer of non-reusable materials for disposal will also create irretrievable losses as landfill capacity is occupied. Alternatives increase in footprint with increasing number (10, 13, 16, 20) and consequently, a greater amount of materials will be removed for each alternative. See Appendix C for a complete description of material volume to be removed or demolished for each alternative.

Materials used for construction would also be irretrievably lost, as they would no longer be available for other projects. This includes all materials noted in Appendix C, again with increasing commitments with each alternative. In addition, use of water for dust abatement will be irretrievable. These needed materials are not in short supply and would not limit other unrelated construction activities. The land itself will be committed to the selected restoration alternative and unavailable for use in future project. However, the River channel is already committed as a Federal project for flood reduction and management and cannot be otherwise apportioned.

Energy resources used would include fuels and electricity, which would be utilized during construction and continue to be used during operation of the channel and maintenance of restoration elements. These uses would constitute an irretrievable loss of energy. However, consumption of energy would not place a significant demand on energy in the region.

Use of human resources during construction would be an irreversible loss of labor supply for other projects. However, labor opportunities are desired in the study area and this use of human resources represents beneficial employment opportunities. Transfer of industrial land uses into recreational land uses represents an irreversible loss of employment opportunities in the downtown industrial area of Los Angeles for all alternatives, while Alternative 20 represents an additional loss of industrial land uses and opportunities within the Verdugo Wash vicinity.

Vegetation that would be altered would be irretrievably lost, though this is a designated objective of the restoration project in many portions of the study area. The irretrievable loss of non-native and invasive vegetation is a preferred outcome. In other areas, loss of vegetation due to construction will be remedied with revegetation efforts. Biological resources will be protected from irretrievable loss through construction management BMPs and site surveys conducted prior to groundbreaking.

Construction and operation of the selected alternative would require protection of cultural resources under the NHPA and would not result in the irretrievable loss of archeological or historic finds. Unidentifiable cultural resources would be irretrievably lost during construction.

6 COMPARISON OF ALTERNATIVE PLANS

This section provides a comparison of the final array of alternatives that were described in Chapter 4. The final array consists of the "No Action" alternative and the 4 action alternatives described in Section 4.14.

As noted in Chapter 4, there is a significant cost difference among the alternatives in the final array. The results of the CE/ICA for the final array of alternatives also show significant increases in the incremental cost per habitat unit among alternatives. The environmental outputs and the CE/ICA are one measure of the merits of the alternatives that must be weighed against other evaluation criteria. As part of the 6-step planning process, alternatives are compared against the No Action Alternative as well as each other. This section describes how the Tentatively Selected Plan was identified and the additional analysis to confirm or change that selection. The details of each alternative were independently described in previous chapters and will be evaluated in this step. In each evaluation step, the significant contributions or effects of each individual plan are quantified and judged. The further comparison and evaluation of alternatives considers each plan's effects on:

- Project Objectives
- Project Constraints
- Policy Issues
- National Objectives and the Four Accounts
  - National Ecosystem Restoration
  - Environmental Quality
  - National Economic Development
  - Regional Economic Development
  - Other Social Effects
- Principles and Guidelines Criteria
  - Completeness
  - Efficiency
  - Effectiveness
  - Acceptability

6.1 FINAL ARRAY COST ESTIMATES

Following identification of the final array of alternatives refinements were made to the cost estimates. An abbreviated cost risk analysis was also conducted. In a risk analysis, both risks and uncertainties pertaining to design and implementation of the project are considered and possible risks of future cost escalation considered. This risk analysis is included in Appendix C Cost Estimating, and applicable contingencies have been applied to the costs shown below in Table 6-1. In addition refinements to the LERRDs estimates are included. Refinements to the costs for the final array resulted in minor changes to the total first costs and average annual costs. Economic evaluation confirmed that these impacts would not have had a material impact on the alternative comparison described in Chapter 4, or the selection of the final array of alternatives.

Table 6-1 Final Array Cost Information Ecosystem Restoration

	Alt 10	Alt 13	Alt 16	Alt 20
Construction	$37,160,342	$82,287,850	$265,844,810	$365,214,471
Mobilization (7.5%)	$2,787,026	$6,171,589	$19,938,361	$27,391,085
Construction First Cost	$39,947,368	$88,459,438	$261,753,170	$363,575,556
Construction Contingency	38.83%	36.01%	37.89%	39.38%
Total Construction Cost	**$55,456,944**	**$120,312,641**	**$360,927,221**	**$506,743,287**
PED/EDC (11%)	$4,394,210	$9,730,538	$31,436,149	$43,186,611
PED/EDC Contingency	24.40%	24.40%	24.40%	24.40%
Total PED/EDC	**$5,466,398**	**$12,104,790**	**$39,106,569**	**$53,724,144**
S&A (6.5%)	$2,596,579	$5,749,864	$18,575,906	$25,519,361
S&A Contingency	26.25%	26.25%	26.25%	26.25%
Total S&A	**$3,278,181**	**$7,259,203**	**$23,452,081**	**$32,218,193**
Lands & Damages	$247,425,237	$250,048,826	$278,031,210	$352,858,303
Lands & Damages Contingency	20.00%	20.00%	20.00%	20.00%
Relocations	$11,392,360	$11,392,360	$35,422,360	$49,072,002
Relocations Contingency	20.00%	20.00%	32.14%	31.46%
Total LERRDs	**$310,581,116**	**$313,729,423**	**$380,442,863**	**$487,941,715**
TOTAL FIRST COST	**$374,782,639**	**$453,406,057**	**$803,928,734**	**$1,080,627,339**
Interest During Construction	$1,323,438	$2,808,572	$19,580,381	$23,889,483
Tot Investment Cost	$376,106,077	$456,214,629	$823,509,115	$1,104,516,822
Annualized Investment Cost	$16,764,634	$20,335,411	$36,707,275	$49,232,974
Annualized O&M	$579,141	$872,445	$2,257,215	$2,515,390
Total Annual Cost	$17,343,775	$21,207,856	$38,964,490	$51,748,364
AAHU	5,321	5,902	6,509	6,782

6.2 FINAL ARRAY COMPARISON BY PROJECT OBJECTIVE

All of the alternatives meet objectives for restoration to some degree. How well the alternatives met the restoration planning objectives was primarily addressed by the habitat analysis (CHAP) discussed in Section 4.9. However, the attainment of restored hydrologic and hydraulic function under Objective 1 and habitat connectivity under Objective 2 received further comparison as discussed in Section 6.3 below. The summary tables 6.2 and 6.3 provide a comparison of how each alternative meets criteria for objectives. Each is ranked from 1 to 4 with 4 being the highest. A zero is given if there is no value added for that objective target.

6.2.1 Planning Objectives Summary

The planning objectives for this study are described in detail in Section 4 and summarized below. Table 6-2 and Table 6-3 below include information pertaining to objectives performance criteria for the two objectives related to ecosystem restoration and describe how each meets the criteria. The third objective related to recreation is described in the recreation plan analysis in Section 4.15, and is met by this plan.

1. ***Restore Valley Foothill Riparian Strand and Freshwater Marsh Habitat:*** Restore Valley Foothill Riparian wildlife habitat types, aquatic freshwater marsh communities, and native fish habitat within the ARBOR reach throughout the period of analysis, including restoration of supporting ecological processes and biological diversity, and a more natural hydrologic and hydraulic regime that reconnects the river to historic floodplains and tributaries, reduces velocities, increases infiltration, and improves natural sediment processes.

2. ***Increase Habitat Connectivity:*** Increase habitat connectivity between the river and the historic floodplain, and increase nodal connectivity for wildlife between restored habitat patches and nearby significant ecological zones such as the Santa Monica Mountains, Verdugo Hills, Elysian Hills, and San Gabriel Mountains within the ARBOR reach throughout the period of analysis.

3. ***Increase passive recreation:*** Include recreation that is compatible with the restored environment in the ARBOR reach throughout the period of analysis.

Table 6-2 Objectives Performance Criteria Analysis of Final Array for Objective 1

OBJECTIVE 1: RESTORE VALLEY FOOTHILL RIPARIAN AND FRESHWATER MARSH HABITAT				
Target Objective	**Analysis of Target Objective by Alternative[1]**			
	Alt 10 (ART)	**Alt 13 (ACE)**	**Alt 16 (AND)**	**Alt 20 (RIVER)**
Removal and management of invasives to less than 10 percent within 5 to 7 years post-construction of each feature. Includes both proposed restoration features and existing habitat in soft bottom reaches during construction and adaptive management.	1-Provides invasives management in 528 acres	2-Provides invasives management in 588 acres	3-Provides invasives management in 659 acres	4-Provides invasives management in 719 acres
For Valley Foothill Riparian Habitat:				
Restore structurally diverse riparian habitat consisting of herbaceous (e.g. herbaceous vine cover), shrub (e.g. shrubby willow thicket), and tree (e.g. mature cottonwood-willow trees) layers in a minimum of five reaches resulting in 3 contiguous reaches. Restore riparian habitats with a varying number of structural layers (one, two, and three layers) to support survival and reproductive requirements for riparian obligate and transient wildlife species, including food, water, shelter, breeding, migration, and dispersal (Krueper, 1995).	1-Restores eight contiguous reaches, 528 acres providing a net increase of 93% in habitat or 5321 habitat units	2-Restores eight contiguous reaches, 588 acres providing a net increase of 104% in habitat or 5902 habitat units	3-Restores eight contiguous reaches, 659 acres providing a net increase of 114% in habitat or 6509 habitat units	4-Restores eight contiguous reaches, 719 acres providing a net increase of 119% in habitat or 6782 habitat units
Restore a minimum of 2 aquatic habitat nodes with a natural hydrologic connection to the river and riparian communities with a minimum distance of 150 meters from the water's edge to create areas capable of functioning as core habitat and refuge for native reptiles and amphibians (Semlitsch and Bodie 2003) and to minimize the risk of localized extinction due to natural disasters (IE flood, fire, drought) (Schippers et al. 1996; Dunning et al 1995).	1- Restores 1 aquatic habitat node with natural hydrologic connection and width of 150 meters in reaches 6	2- Restores 2 aquatic habitat node with natural connection and width of 150 meters in reaches 6 and 7 (Arroyo Seco) providing 300% more nodal connections than Alternative 10.	3-Restores 3 aquatic habitat nodes with natural hydrologic connections and a width of 150 meters in reach 6, 7 and 8 providing 85% more nodal connections than Alternative 13	4- Restores 3 aquatic habitat nodes with natural hydrologic connections and a width of 150 meters in reach 3. 6, 7 and 8 providing 120% more in nodal connections that Alternative 16
Within 5-10 years of construction, restore and maintain dense, structurally diverse riparian habitat sufficient to maintain survival and reproductive needs of wildlife. Restore a minimum of one habitat node with a minimum width of 250 meters (820 feet) to support high frequencies of the Federally endangered least Bell's vireo (Kus 2002).	3-Restores one reach with strand widths of at least 250 meters (820 feet)	3-Restores one reach with strand widths of at least 250 meters (820 feet)	3-Restores one reach with strand widths of at least 250 meters (820 feet)	4-Restores two reaches with strand widths of at least 250 meters (820 feet)
For Freshwater Marsh and Fish Habitat:				
Restore functioning freshwater marsh habitat consisting of emergent herbaceous vegetation (i.e., cattails, rushes, sedges) adapted to saturated soil conditions.	1-Fifteen acres restored in 15 daylighted streams and in widened area of Taylor Yard	2-Twelve acres restored in 12 daylighted streams and 21 additional acres in Reach 6 to Taylor Yard	3-Twelve acres restored in 12 daylighted streams, 27 acres added in Reach 5, 21 additional acres in Reach 6 to Taylor Yard, 44 acres in Piggyback Yard	4-Twelve acres restored in 12 daylighted streams,20 acres in reach 27 acres added in Reach 2, 10 acres in reach 3, Reach 5, 21 additional acres in Reach 6 to Taylor Yard, 10 acres in Reach 7, 44 acres in Piggyback Yard
Restore aquatic habitat to support survival and reproductive requirements for fish and wildlife species, including food, water, shelter, breeding, migration, and dispersal.	1-Minimal main stem restoration of aquatic habitat in Reach 6, 138 acres	2-Increase in main stem aquatic habitat in Reach 6, 17 acres	3-Increase in main stem channel aquatic habitat in Reaches 5, 6 and 8 – 27, 38, and 44 acres respectively	4-Increase in channel aquatic habitat in Reaches 2, 5, 6 and 8 – 17, 27, 38, and 44 acres respectively*Reach 2 did not count entire area between Victory and Freeway, not as much restoration*
For a More Natural Hydrologic and Hydraulic Regime:				
Expansion of River hydrology into at least one large, contiguous river adjacent area within the study area that promotes hydrologic connections to the floodplain and overbank areas.	1-Minimal restored hydrologic connection Reach 4 Griffith Park & Los Feliz side channels, Reach 6 to Taylor Yard	2-Increased restored hydrologic connection in Reach 6 to Taylor Yard and Reach 3 side channel, in addition to Alt 10 connections	3-Increased restored hydrologic connection in Reach 8 to Piggyback Yard in addition to Alt 13 connections	4-Increased restored hydrologic connection in Reach 3 Verdugo Wash, Reach 7 LA River State Historic Park addition to Alt 16 connections
Widen channel to accommodate meandering of the River in at least one reach	1-Widens channel by approximately 24 feet in Reach 6	2-Widens channel to approximately 544 feet in Reach 6, modification of Arroyo Seco confluence in Reach 7	3-Reach 5 is widened approximately 24 feet x 1.6 miles by modification of channel walls from trap to vertical and terracing of left bank, and Reach 8 includes terracing on the right and left banks upstream and downstream of Piggyback Yard and channel widening in channel 500 feet and on a bench in Piggyback Yard of 1,000 ft in addition to Alt 13	4-Reach 2 is widened approximately 24 feet by converting right bank from trapezoidal to vertical, in addition to Alt 16 changes
Connect river hydrologically (assisted or naturally) to overbank with at least one such connection per reach	1-Daylights 13 small tributary streams and adds two side channels, adds a minimal amount of restored natural riverbed in Reach 6 with some terracing, historical wash in Reach 8	2-Daylights 11 small tributary streams, terraces and widens significantly in Reach 6, in addition to Alt 10	3-Daylights 11 small tributary streams, Reaches 8, widens minimally in Reach 5, terraces in Reaches 5, and 8, and adds 3 side channels historical wash in Reach 8 in addition to changes in Alt 13	4-Daylights 12 small tributary streams, Verdugo Wash confluences, widens minimally in Reach 2, , adds terracing in LA River State Historic Park in Reach 7 in addition to changes in Alt 16

OBJECTIVE 1: RESTORE VALLEY FOOTHILL RIPARIAN AND FRESHWATER MARSH HABITAT				
Within the main stem of the river, when increasing vegetation, target velocity should be less than 12 ft/s and ideally 8 ft/s	3-No adverse effect in Reaches 1-5, 7, and 8. Some adverse effect in Reach 6 at downstream transition – velocity >12ft/s can be mitigated	2-No adverse effect in Reaches 1-5, and 8. Some adverse effect in Reach 6 at downstream transition – velocity >12ft/s, can be mitigated, some adverse effect due to vegetation on channel walls	2-No adverse effect in Reaches 1-4, and 8. Some adverse effect in Reach 5 at upstream transition, in Reach 6 at downstream transition – velocity >12ft/s, can be mitigated, in Reach 7 some adverse effect due to vegetation on channel walls	4-No adverse effect in Reaches 1-4, and 8. Some adverse effect in Reach 5 at upstream transition, in Reach 6 at downstream transition – velocity >12ft/s can be mitigated
Restore seasonal overbank flooding to river adjacent areas for sustainability of habitat and natural ecological, hydrologic processes	2-Minimal seasonal overbank flooding on terracing in Reach 6	2-Minimal seasonal overbank flooding on terracing in Reach 6	3-Increasing overbank flows in greater area in Reach 6 and on terracing in Reaches 5, and 6	4-Increasing overbank flows in greater area in Reach 6 and 8, and on terracing in Reaches 2, 5, 6, and 8

1 Rating from 1 to 4, with 4 being highest. A zero is given if there is no value added for that objective target.

Table 6-3 Objectives Performance Criteria Analysis of Final Array for Objective 2

OBJECTIVE 2: INCREASE HABITAT CONNECTIVITY				
	Analysis of Target Objective by Alternative[1]			
Target Objective	**Alt 10 (ART)**	**Alt 13 (ACE)**	**Alt 16 (AND)**	**Alt 20 (RIVER)**
Restoration of riparian and wetland aquatic wildlife habitat at tributary confluences to create connectivity to similar upstream habitats on the tributaries with ultimate nodal connection to the aquatic habitats in the San Gabriel and Verdugo Mountains (at least one major tributary connection should be restored.)	0-No connection	3-Reconnection hydrologically with Arroyo Seco	3-Reconnection hydrologically with Arroyo Seco	4-Reconnection hydrologically with Arroyo Seco and Verdugo Wash
Restore habitat corridors between large nodes in the ARBOR area to maximize connectivity for wildlife movement and dispersal on the local scale and minimize the risk of habitat sinks in an urban environment (Hilty et al 2006, Hanski & Thomas 1994, Rudd 2002, Noss 1983), and to provide opportunities for regional wildlife movement	0-no habitat corridors created between nodes	2-connection created between Taylor Yard (Reach 6) and Arroyo Seco (Reach 7)	3-connections created between Taylor Yard (Reach 6), Arroyo Seco (Reach 7), and Piggyback Yard (Reach 8)	4- connections created between Verdugo Wash (Reach 3), Taylor Yard (Reach 6), Arroyo Seco (Reach 7), and Piggyback Yard (Reach 8)
Restoration of wildlife habitat on channel banks	1-Restores 12 acres of habitat on channel banks	2-Restores 54 acres of habitat on channel banks	3-Restores 95 acres of habitat on channel banks	4-Restores 102 acres of habitat on channel banks
Improved aquatic-habitat connectivity within the ARBOR area through restoration of habitat nodes with wetland and riparian habitat that are naturally hydrologically connected to the river corridor upstream and downstream of the Glendale Narrows. (Rudd et al 2002)	0-No Nodal Connectivity upstream or downstream of the Glendale Narrows	2-Increased Nodal Connectivity of 309% over Alt 10	3- Increased Nodal Connectivity of 85 % over Alt 13	4- Increased Nodal Connectivity of 120 % over Alt 16
Lengthen the extent of contiguous vegetated pathways for reptile and small/medium mammal movement (currently limited to Reaches 4 to 6, to achieve upstream and/or downstream connections to at least one additional tributary or open space area that is currently isolated from the soft-bottom reach. This may be achieved by either in-channel or side-channel vegetated corridors.	Reaches 1-6	Reaches 1-8	Reaches 1-8	Reaches 1-8

OBJECTIVE 2: INCREASE HABITAT CONNECTIVITY				
	Analysis of Target Objective by Alternative[1]			
Target Objective	**Alt 10 (ART)**	**Alt 13 (ACE)**	**Alt 16 (AND)**	**Alt 20 (RIVER)**
Reconnect hydrologically with at least one main tributary- Confluence restoration provides an improved hydraulic connection to the LA River. Widening or laying back the side slopes adds capacity. Removal of concrete sides slopes and/or inverts allow establishment of vegetation which reduces velocities, increases infiltration, and improves the natural sediment processes.	0-No connection	3-Reconnection hydrologically with Arroyo Seco	3-Reconnection hydrologically with Arroyo Seco	4-Reconnection hydrologically with Arroyo Seco and Verdugo Wash
Ideally, the alternatives will also achieve the following:				
Expansion of riparian and wetland wildlife habitat into large, contiguous river adjacent lands within the study area to support higher abundance of wildlife and more significant nodal connections to nearby ecological zones. Connections to Santa Monica Mountains created through Headworks, Ferraro Fields, and side channels.	1-Restores 202 acres of habitat on in river adjacent and contiguous areas	2-Restores 207 acres of habitat on in river adjacent and contiguous areas	3-Restores 234 acres of habitat on in river adjacent and contiguous areas	4-Restores 234 acres of habitat on in river adjacent and contiguous areas
Include Reach 7 to provide nodal connections to San Gabriel Mountains via Arroyo Seco confluence and/or other smaller tributaries and to provide potential for future direct connections to the mountains via other projects upstream on Arroyo Seco.	0-Does not include Arroyo Seco watershed connections	4-Includes Arroyo Seco confluence restoration	4-Includes Arroyo Seco confluence restoration	4-Includes Arroyo Seco confluence restoration

1 Rating from 1 to 4, with 4 being highest. A zero is given if there is no value added for that objective target.

6.3 Objectives Comparison of Alternative Plans

USACE Guidance on the objective of Civil Works ecosystem restoration (ER 1105-2-100) states "Restored ecosystems should mimic, as closely as possible, conditions which would occur in the area in the absence of human changes to the landscape and hydrology. Indicators of success would include … the ability of the restored area to continue to function and produce the desired outputs with a minimum of continuing human intervention." Guidance goes on to state "Restoration projects should be conceived in a systems context … in order to improve the potential for long-term survival as self-regulating, functioning systems. This system view will be applied both in examination of the problems and the development of alternative means for their solution. Consideration should be given to the interconnectedness and dynamics of natural systems…" (USACE 2000).

The habitat model (CHAP) outputs as described in Section 4.9 and CE/ICA analysis as described in Section 4.11were utilized to compare the ecosystem benefits of the alternatives under consideration. Results of the incremental analysis must be synthesized with other decision-making criteria. IWR Report 95-R-1, *Evaluation of Environmental Investments Procedures Manual* describes that "*In some cases, the economic and environmental models used to estimate the effects of environmental restoration plans are not capable of capturing the full range of such effects. The models may be incapable of accounting for all considerations that impact upon the decision process. For example, concerns about endangered species, support by a local sponsor or other interest group, cost sharing arrangements, and other factors may lead to the continuing consideration and selection of solutions that may not be the most cost effective, or that may incur substantial incremental costs.*"

CHAP was the primary tool used to assess habitat value restored by the study alternatives. The HU output for this study measured habitat value as described in Section 4.9, but did not distinguish the value of in-channel habitat and natural hydrologic connectivity equal weight was given to in channel habitat and out of channel habitat. In-channel habitat and natural hydrologic connections support sediment and nutrient exchange with floodplain habitats, and in-channel restoration is only possible by providing additional area for the river to naturally meander and widen. Widening of the river channel does not just seek to restore habitat and hydrologic connectivity along the river but to: "restore significant structure, function and dynamic processes that have been degraded" (EP 1165-2-501) and to partially "reestablish the attributes of a naturalistic, functioning, and self-regulating system" (EP 1165-2-502). Restoration of natural hydrology and connections between the river and historic floodplain also removes barriers (such as concrete or high overbank elevations) which supports wildlife movement for a greater variety of species. The HU output also did not fully capture habitat nodal connectivity within the study area and regionally. Restoration of habitat patches and vegetated corridors to link them improves connectivity for the movement of wildlife within the study area and to nearby ecological areas by reducing habitat fragmentation, restoring corridors, and removing barriers.

6.3.1 Objectives Comparison of Restoration of Natural Hydrological Function and Habitat Connectivity

Therefore, comparison was performed for the final array of alternatives to assess their responsiveness to the hydrologic restoration component of Objective 1 and habitat connectivity in Objective 2. This provides a comparison of the factors not captured by the CE/ICA results necessary to support NER plan selection. The Objectives summary table above contains the results of the CHAP analysis and the additional comparison described below.

A comparison of restoration habitat connectedness was performed based on the sizes of habitat nodes in the study area and the minimum distance of vegetated corridors between nodes (Rudd et al 2002).

"Connectedness" was calculated using equations found in Rudd et al 2002, which was measured based on the size of habitat nodes with natural hydrologic connections to the river and the length of natural habitat corridors between them. This is based on the knowledge that in order for wildlife to move through a landscape they need large patches of habitat to support resources for survival (foraging, resting, breeding, "live-in" habitat) and accessible vegetated corridors to allow for movement between the habitat patches. Restoration of large nodes that are close together, connected by natural habitat corridors, increase the level of "connectedness".

The direct natural hydrologic connections between the river and historic floodplain would occur in the final array at Taylor Yard in all four alternatives (with less acres of habitat in Alternative 10), Piggyback Yard (Alt 16, 20), Arroyo Seco (Alt 13, 16, 20), and at Verdugo Wash (Alt 20). These direct hydrologic connections, where the river/tributary can spread and naturally meander into the adjacent floodplain and establish riparian and wetland habitat, provide the most natural habitat connections and the best opportunities for wildlife movement between the river and the historic floodplain. Assisted hydrologic connections, where water is fed to the historic floodplain sites via culverts (i.e. Ferarro Field, Griffith Park, Pollywog Park, Los Feliz Golf Course, Piggyback Yard (Alt 13)), can support riparian and wetland habitat and create habitat connectivity by increasing the amount and availability of resources (food, shelter, nesting habitat) within the historic floodplain, where it is currently extremely limited to "soft-bottom" portions of the channelized river. This habitat would attract and could support higher populations of wildlife that are now limited to the scarce riparian habitat in the river channel. However, movement to and from these floodplain sites with assisted hydrology would be more limited to birds and other small wildlife that would not be hindered by using culverts or climbing channel walls to reach the river adjacent habitat.

The comparison of local and regional habitat connectivity and the nature of hydrology (natural vs. assisted) to support ecosystem functioning and wildlife movement is discussed for the final array of alternatives below. It includes a comparison of restoration of a more natural hydrologic and hydraulic regime with increased connectivity to the floodplain as well as evaluation of local habitat connectivity within the study area and opportunities for connectivity over longer distances to regional significant ecological zones.

The two comparisons for hydrologic and habitat connectivity are provided together as they are closely linked.

Alternative 10

Alternative 10 consists of a corridor of 528 acres along the approximately 11-mile stretch proposed for restoration on the LA River. The plan consists of restoring valley foothill riparian wildlife habitat, freshwater marsh aquatic habitat, and native fish habitat (though currently native fish no longer exist in the Study area). Alternative 10 has the least cost of the four proposed plans in the final array and partially meets planning objectives.

Alternative 10 – Connectivity

Alternative 10 (Figure 6-1) restores a natural hydrologic connection between the River and the historic floodplain at the Taylor Yard Site in reach 6, which re-establishes lost functions and supports more sustainable habitat in that area. This restoration at Taylor Yard establishes a large node of historic valley foothill riparian and marsh habitat adjacent to the River corridor. The habitat at Taylor Yard is then connected to other habitats currently existing within the river channel in the Glendale Narrows (Figure 6-2). Connectivity to other restored habitat in the Study area is more limited by the overbank locations (i.e. Ferraro Fields, Los Feliz golf course) and assisted hydrology in those areas.

Restoration of habitat in reaches 1, 2, and 3 provides regional habitat connections to Griffith Park, leading to the greater Santa Monica Mountains and the Pacific Ocean (Figure 6-3). Additional opportunity for connection in this area may exist via the Corps' on-going Headworks Ecosystem Restoration Study.

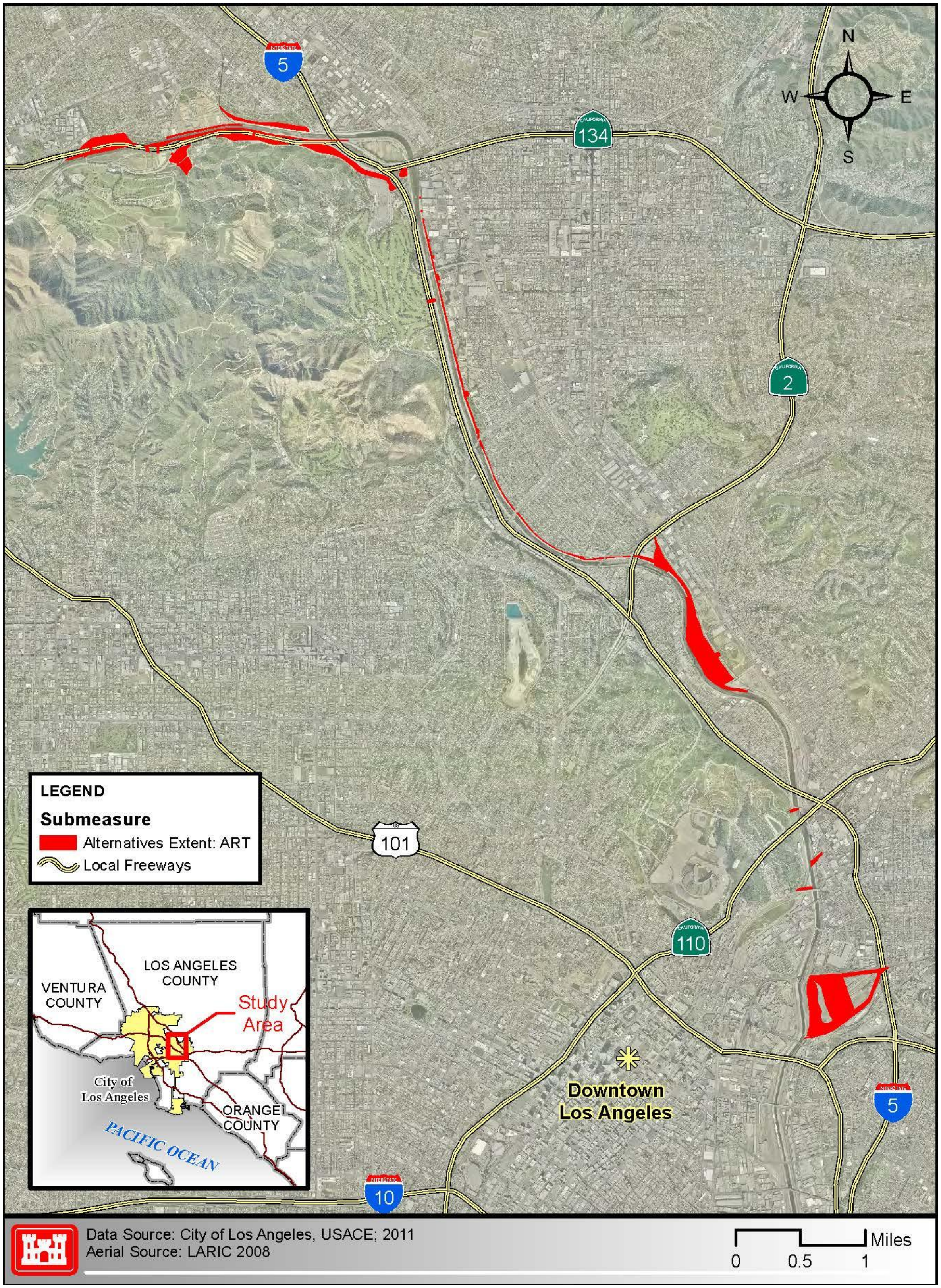


Figure 6-1 Alternative 10 Footprint Map

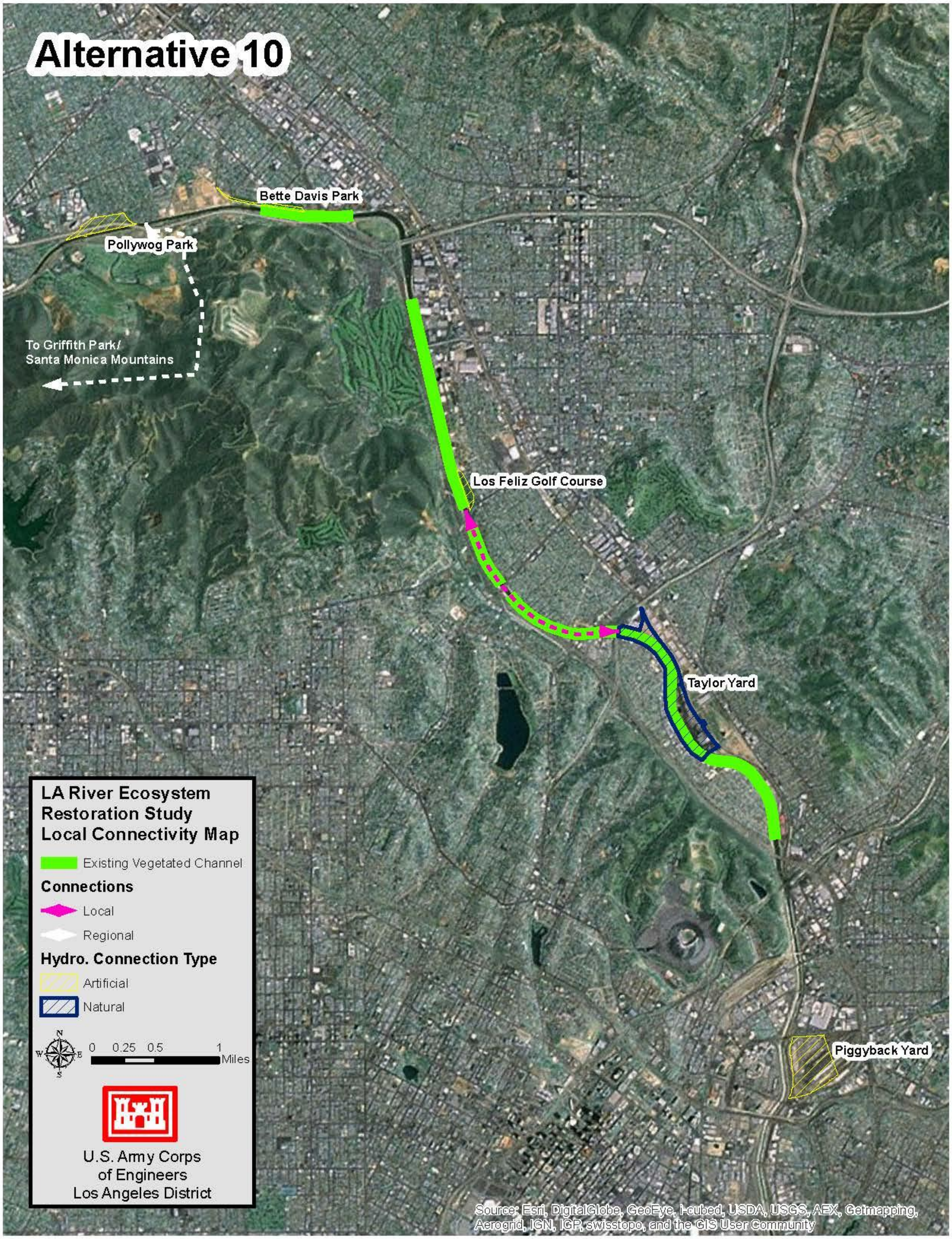


Figure 6-2 Alternative 10 Local Habitat and Hydrologic Connectivity

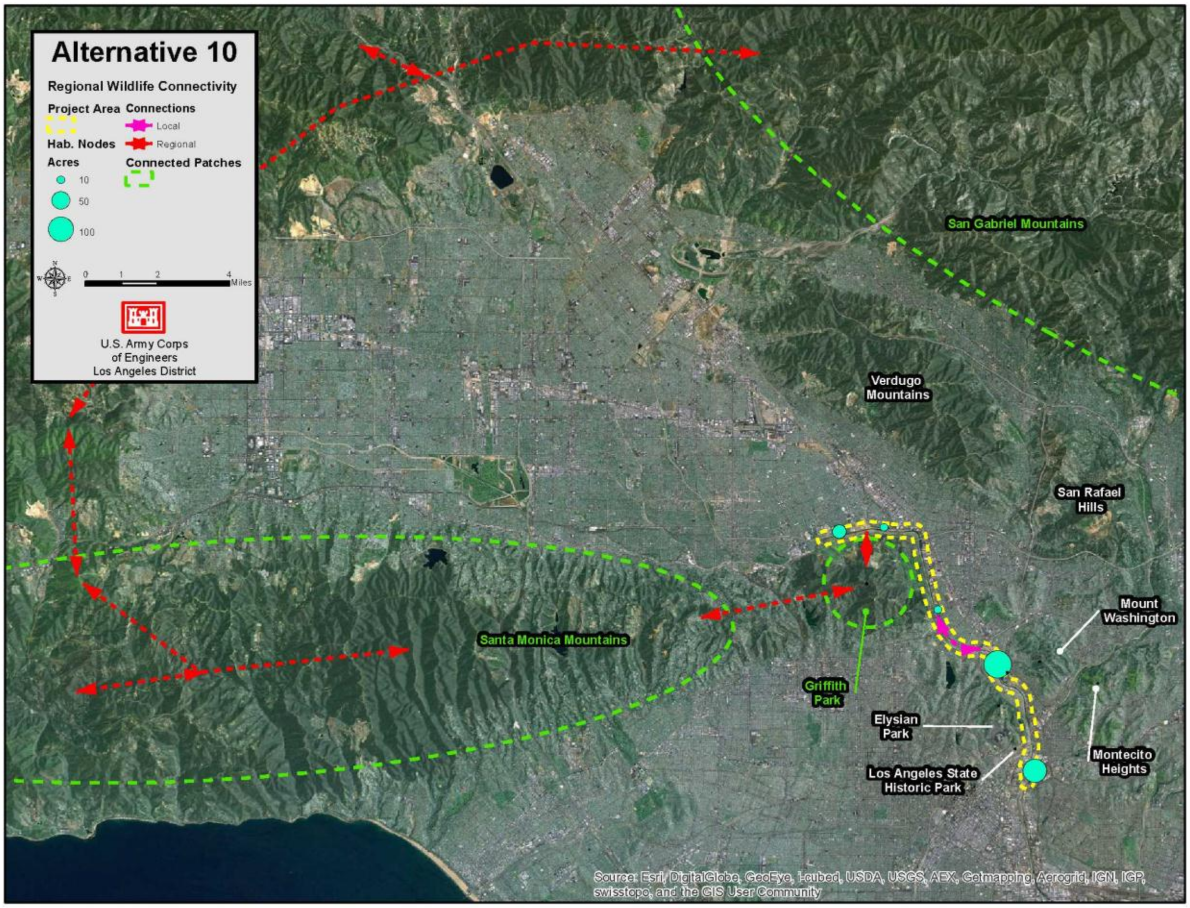


Figure 6-3 Alternative 10 Regional Habitat Connectivity Illustrated by Red Lines

Alternative 13

Alternative 13 restores 588 acres along the 11 mile study area. Below is a map (Figure 6-4) showing the footprint of Alternative 13 ACE. While the footprint is very similar to that of Alternative 10, the added measures in reaches 3, 6 and 7 provide additional connectivity benefits, including natural hydrologic and hydraulic connectivity between the river, floodplain, and overbank areas, and habitat connectivity for wildlife movement. Natural hydrologic connectivity supports additional ecological processes such as natural disturbance, nutrient cycling, biotic interactions, and population dynamics which improve the sustainability of the restored ecosystem pursuant to the definition of connectivity found in planning guidance.

It adds additional increments of restoration that contribute to the planning objectives by:

Objective 1: Restore Valley Foothill Riparian Strand and Freshwater Marsh Habitat

- Reach 3 provides 17 additional acres of riparian and marsh habitat and reach 6 provides 21 acres of additional marsh. Arroyo Seco restoration in reach 7 adds 22 acres of additional riparian habitat.
- A more natural hydrologic and hydraulic regime is incrementally increased with the widening in reach 6 of over 200 additional feet of river bed and naturalization of the major tributary

confluence on the Arroyo Seco. Assisted hydrologic connections are made at the overbank side channel in Ferraro Fields, Griffith Park Golf Course, and Los Feliz Golf Course.

Objective 2: Increase Habitat Connectivity

- This alternative provides 309% more connectedness (Rudd et al 2002) within the Study Area over Alternative 10 via the restored nodal connections between Taylor Yard and Arroyo Seco (Figure 6-5). In Alternative 13, by adding the natural hydrologic connection at Arroyo Seco, which is very close in proximity to Taylor Yard, the level of connectedness is substantially increased from Alternative 10, where there is very limited connectivity (assisted hydrology). Increased channel bed restoration in reach 6 and in Arroyo Seco in reach 7 allow for creation of riffle/pool complexes which supports habitat for and movement of native fish species.
- Increased regional habitat connectivity through Arroyo Seco confluence to the San Gabriel Mountains.

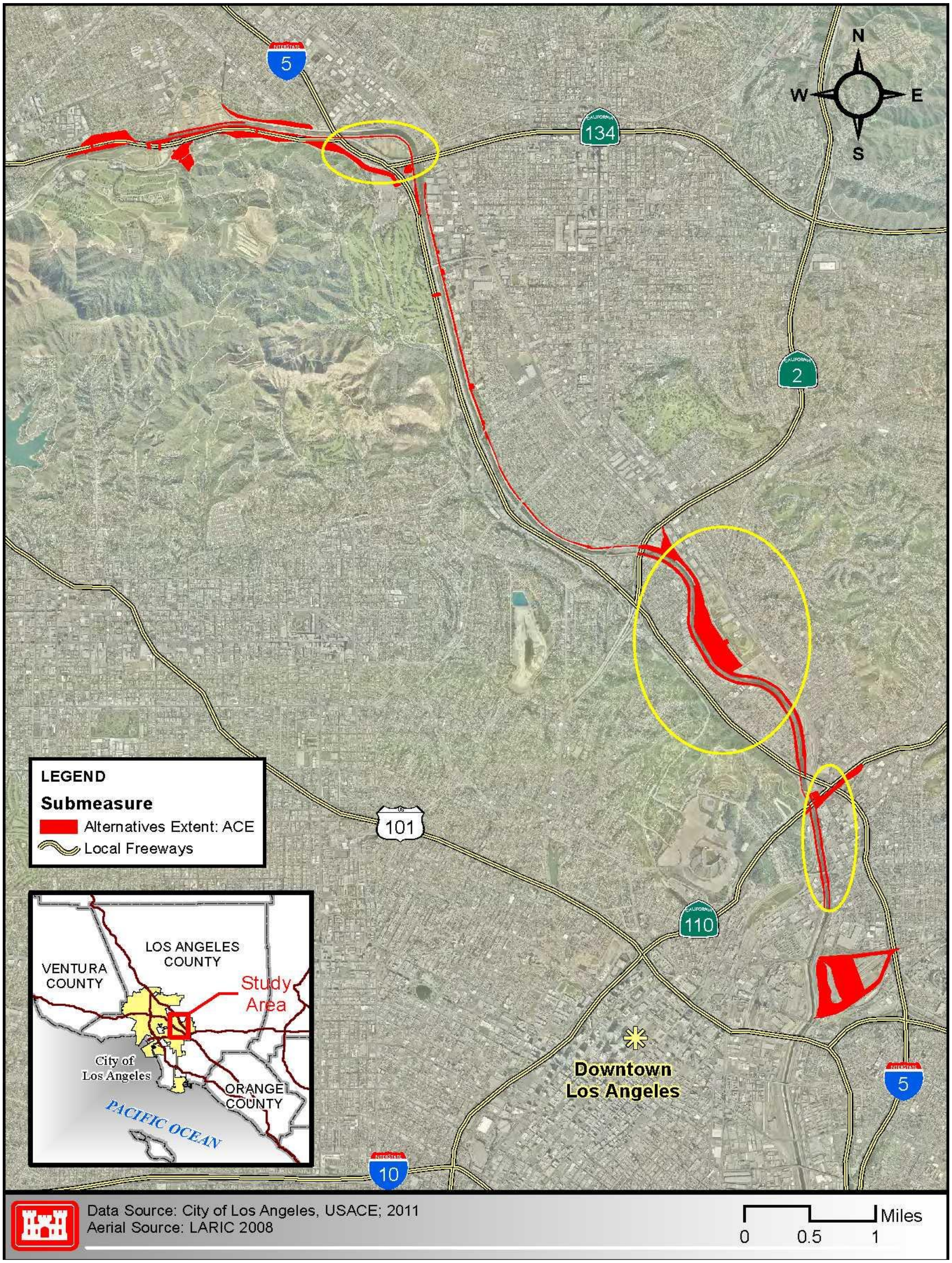


Figure 6-4 Alternative 13 ACE Footprint with Yellow Highlight Areas Showing Additions over Alternative 10

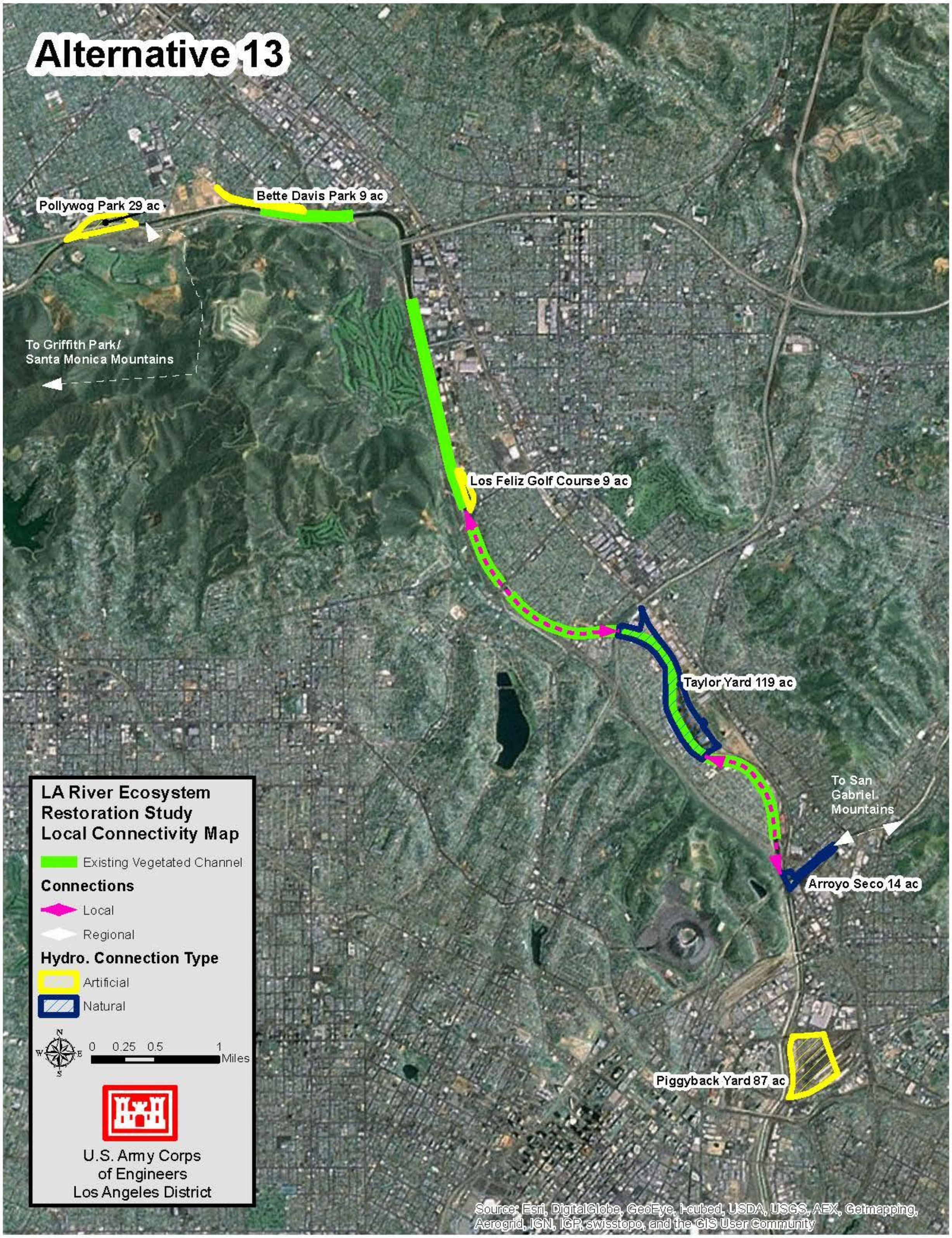


Figure 6-5 Alternative 13 Local Habitat and Hydrologic Connectivity

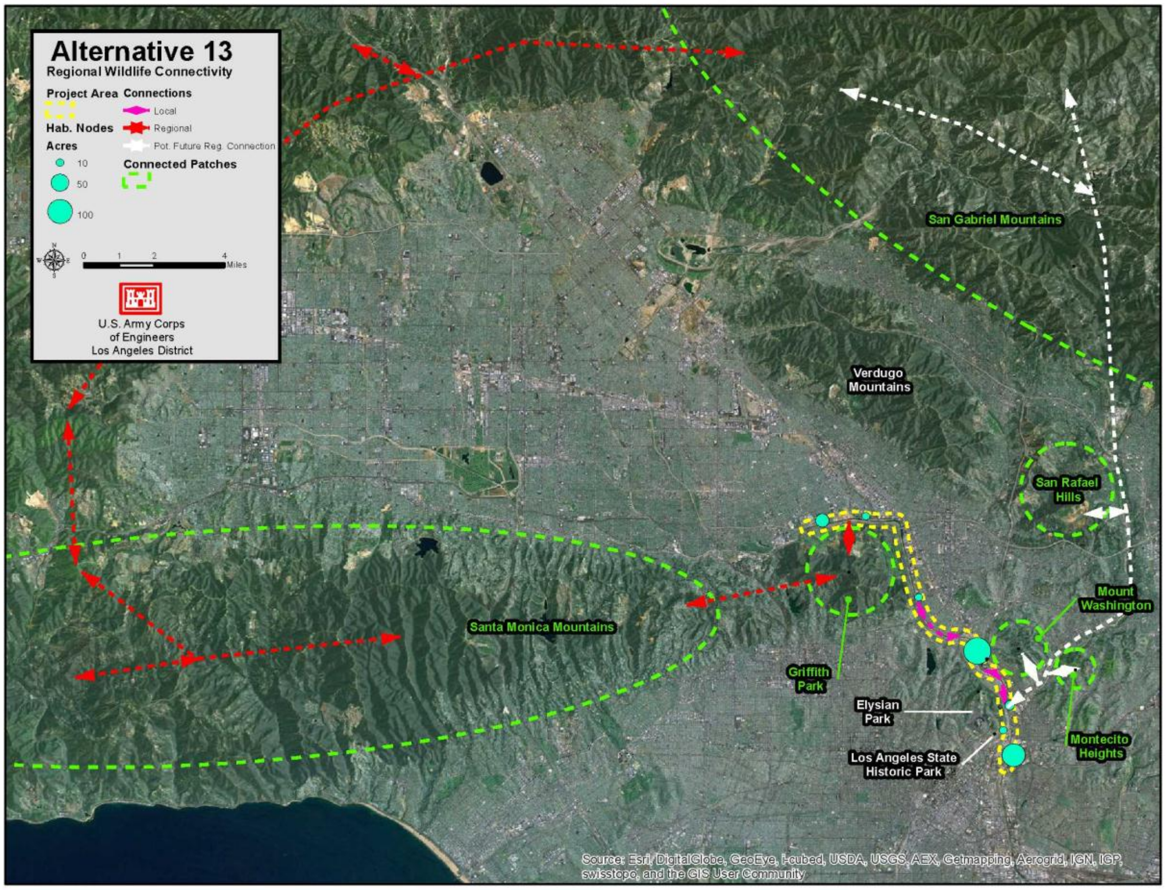


Figure 6-6 Alternative 13 Regional Habitat Connectivity Illustrated by Red Lines

Alternative 13 adds to the regional connection through Griffith Park to the Santa Monica Mountains with addition of a side channel at Ferraro Fields, and restores a natural hydrologic connection between the river and historic floodplain at the Arroyo Seco confluence, which restores natural ecosystem processes as well as improved nodal and regional habitat connectivity. In addition, the increased widening in Reach 6 and modified bank allow for more habitat and hydrologic connectivity in this reach.

Alternative 13 would remove the bank and widen the river channel bed at the Taylor Yard site more substantially than in Alternative 10. This alternative restores a natural hydrologic and habitat connection between the river and the site. This would allow for natural in-channel geomorphology and habitat to establish and for the currently confined river to spread into its historic floodplain. This natural hydrologic connection between the river and the floodplain restores key processes that exist in a native river ecosystem such as a more natural disturbance regime, scour and deposition of sediment and vegetation, nutrient cycling, biotic interactions, and colonization of new habitat areas (Stromberg et al 2007).

The restoration of the Arroyo Seco confluence restores natural in-channel geomorphology and riparian and aquatic habitat in the currently channelized tributary at the confluence with the river. This natural hydrologic connection between the river and tributary also restores key ecosystem processes that normally exist in a native river ecosystem. The restored habitat at Arroyo Seco would also improve local connectivity for wildlife by serving as a new habitat node, with a connection to Taylor Yard via the river channel as a vegetated corridor (Figure 6-5). Improved nodal connectivity promotes wildlife movement within the study area and prevents inbreeding depression and local extinction of wildlife populations.

Nodal habitat connectivity would increase 309% within the study area over Alternative 10, through restoration of natural hydrology and habitat at the Arroyo Seco confluence and its extremely close proximity to habitat at Taylor Yard.

On a regional scale, restoration at Arroyo Seco confluence provides future opportunities to restore aquatic habitat connectivity between the river at the Study area and the San Gabriel Mountains via the Arroyo Seco tributary (Figure 6-6). Additional opportunity for connection in this area exists via the Corps' on-going Arroyo Seco Ecosystem Restoration Study. Urbanization has eliminated the historic habitat corridor that once existed on the Arroyo Seco tributary, and without restoration of the confluence reconnection of the river to the San Gabriel Mountains could not be realized in the future. Additional neighborhood habitat in the communities of San Rafael Hills, Mount Washington, and Montecito Heights could eventually be incorporated into the movement corridor as regional habitat nodes.

Alternative 16

Alternative 16 restores 659 acres of habitat along the 11 mile study area. Below is a map (Figure 6-7) showing the footprint of Alternative 16. Alternative 16 adds the following benefits and incremental increase in objectives criteria as follows:

Objective 1: Restore Valley Foothill Riparian Strand and Freshwater Marsh Habitat

- Reach 5 provides an added 17 acres of in channel riverine habitat via channel widening from a trapezoidal to vertical configuration
- Reach 8 provides an added 21 acres of in channel riverine habitat via removal of the concrete channel bed
- Reach 8 restores a natural hydrologic connection between the river and Piggyback Yard via removal of the concrete bank between the river and the site
- Reach 8 provides an additional 17 acres in wetland marsh habitat via restoration of a large side channel in Piggyback Yard.

Objective 2: Increase Habitat Connectivity

- 85% more connectedness (Rudd et al 2002) within the Study Area over Alternative 13 via the restored nodal connections between the larger nodes at Piggyback Yard and Taylor Yard and satellite nodes. (Figure 6-8)
- Reach 8 modifies 0.75-miles of concrete channel to natural river bed, which restores the geomorphology and habitat in approximately 30 acres of river channel and supports a new wildlife movement corridor.
- Reach 8 removes the concrete bank at Piggyback Yard to directly connect restored in-channel habitat to approximately 90 acres of floodplain habitat.
- Reach 8 daylights two tributary streams at Piggyback Yard with 1.6 miles of tributary restoration.
- Reach 8 modifies channel banks upstream and downstream of Piggyback Yard with planted terraces which connect the naturalized river bed with overbank areas (increasing regional habitat connectivity).
- Reach 5 widens 1.6 miles of channel which supports a wider vegetated movement corridor for wildlife.
- Channel bed restoration in reaches 5 and 8 allow for creation of riffle/pool complexes which supports habitat for and movement of native fish species.

While the footprint is very similar to that of Alternative 13, the added measures in reaches 5 and 8 provide incremental increases in benefits, connectivity benefits, including natural hydrologic and hydraulic functioning which reconnects the river, floodplain, and overbank areas, and improved local habitat connectivity for wildlife movement.

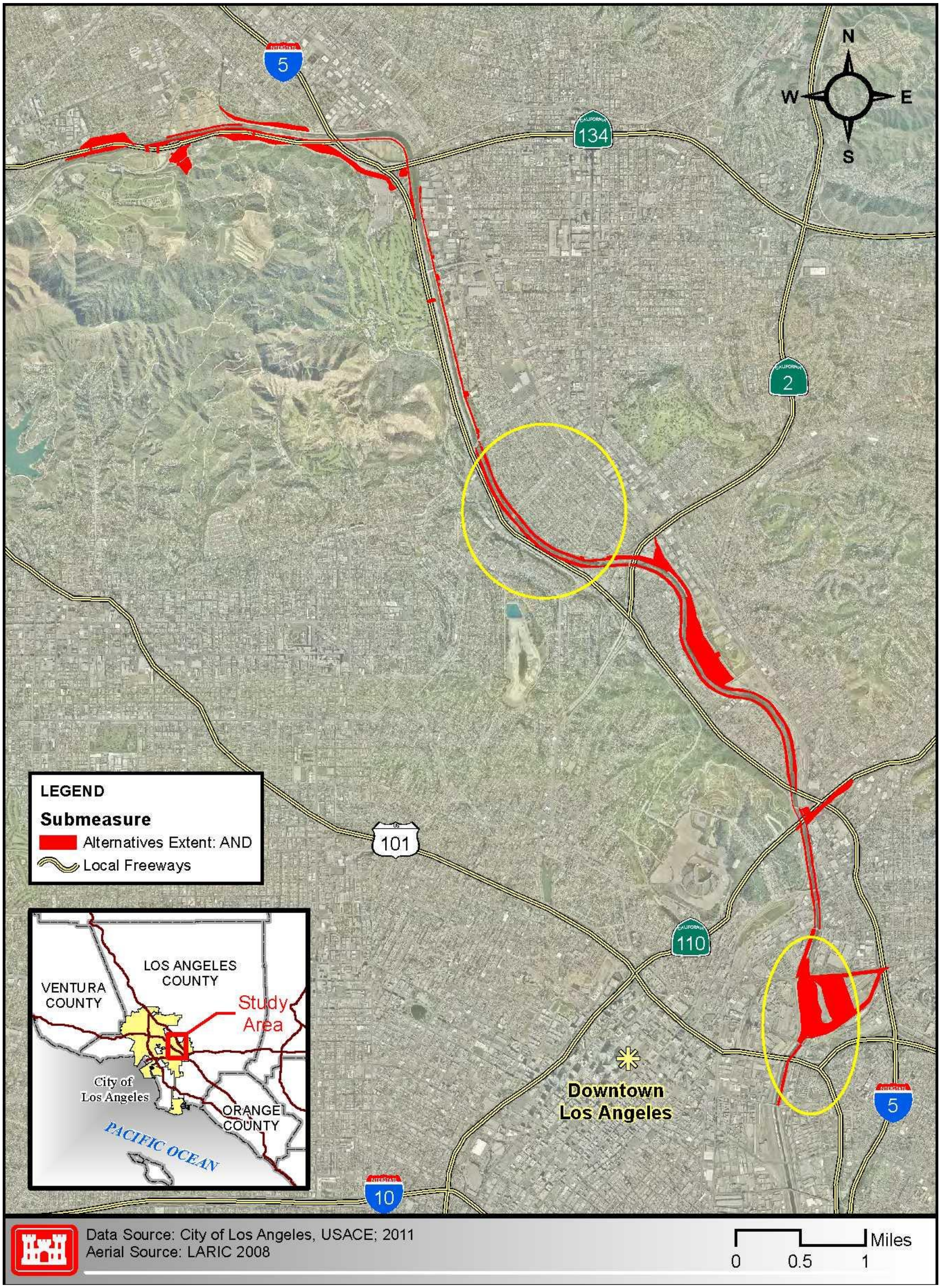


Figure 6-7 Alternative 16 AND footprint – Areas with Changes from Alternative 13 Circled in Yellow

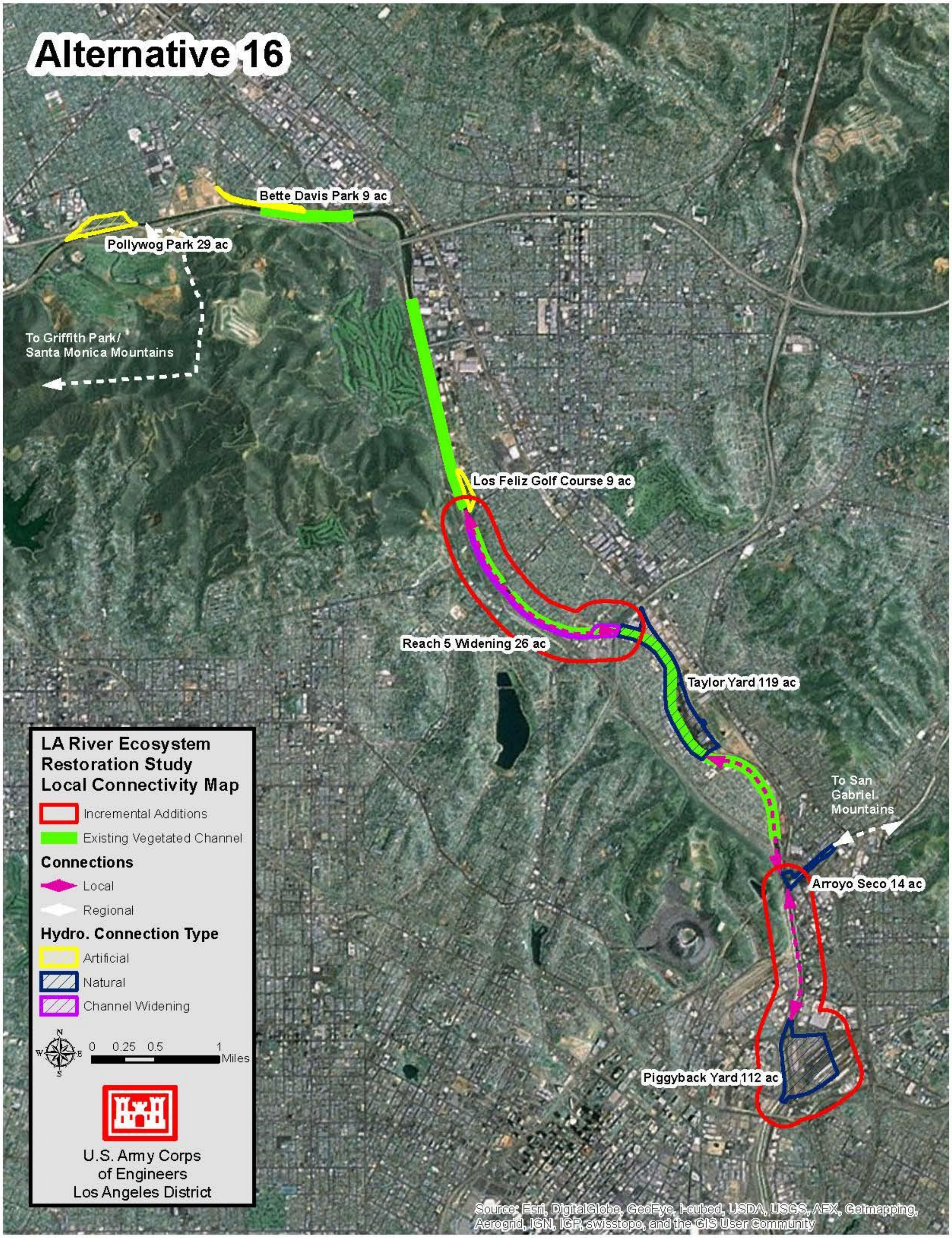


Figure 6-8 Alternative 16 Local Habitat and Hydrologic Connectivity

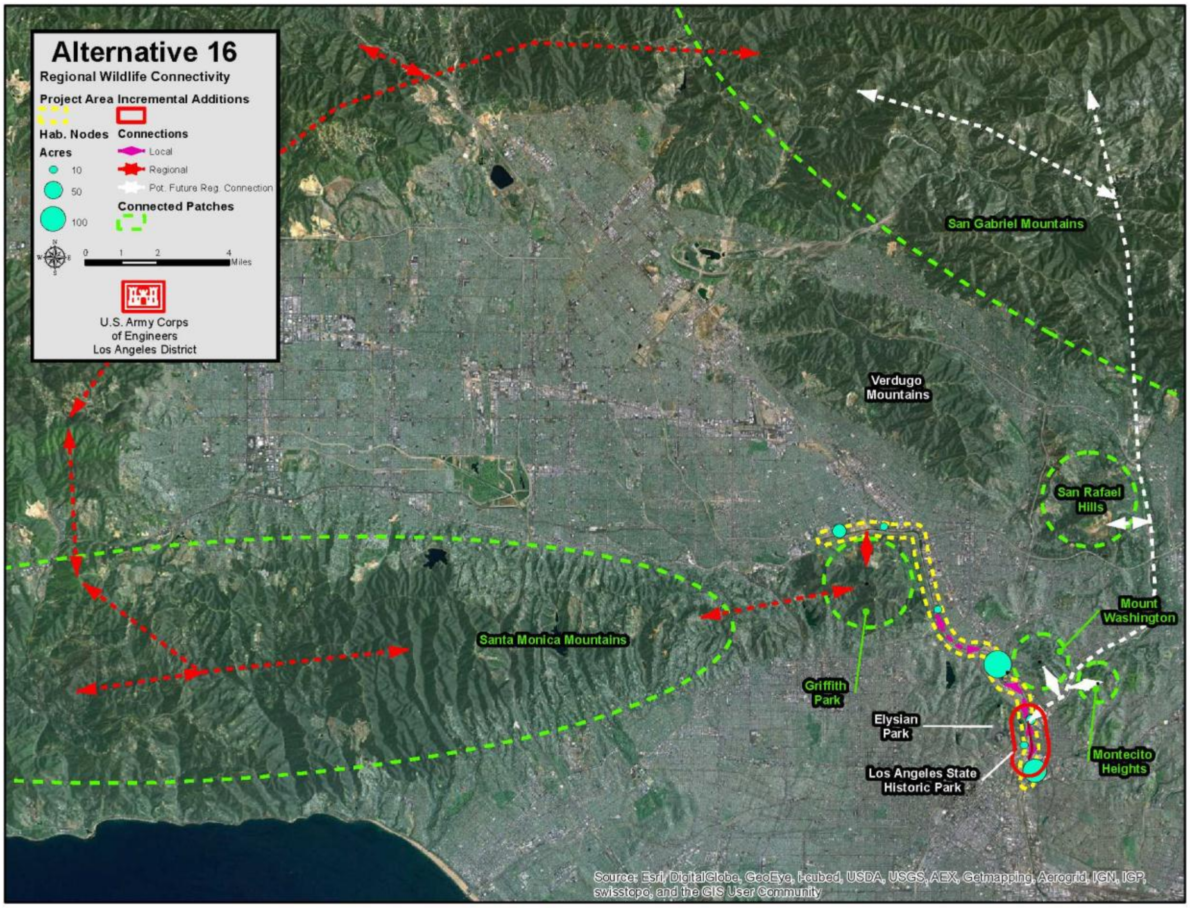


Figure 6-9 Alternative 16 Regional Habitat Connectivity Increases from Alternative 13 – Represented by Red Circled Area at the Downstream End of the Project

Alternative 16 increases natural hydrologic connectivity and local habitat connectivity but does not significantly increase regional connectivity over Alternative 13. Alternative 16 would remove a concrete wall and concrete in the channel bed at the Piggyback yard site. Direct natural hydrologic connection would allow for interaction between the river and historic floodplain. Concrete removal and expanded width for natural physical processes are directly linked. Restoring the hydrologic interaction between the river and the Piggyback Yard site allows for removal of concrete in the bed of this reach that would otherwise be unacceptable from a flood risk standpoint. The interaction between the river and historic floodplain would increase sustainability and diversity within this resource scarce reach. With this removal of concrete, a natural hydrologic connection between the river and the site would be restored. The incremental modifications at Piggyback Yard included in Alternative 16 would allow the site to function as a natural wetland area with a flow off channel, providing an area of low velocity. Lower velocity areas would allow for development of more structurally diverse habitat while maintaining a direct connection with the river. Restoration of the channel bed at Piggyback Yard would provide an additional 41 acres of native fish habitat via establishment of natural channel geomorphology and freshwater marsh.

The restored floodplain connection to the river in Alternative 16 would allow the 108 acre habitat node to support high populations of wildlife in Reach 8, which is currently complete built out and resource poor. The Piggyback Yard habitat node would then serve as a source population for other nodes along the river and minimize the risk of local extinction in smaller nodes. The restored channel bed at Piggyback Yard in also provides a habitat corridor that connects to other nodes in the study area. Wildlife could travel in and out of this node to other habitat nodes in the project area.

Alternative 16 additionally widens the river for a length of 1.6 miles in Reach 5. This widening allows for expansion of in-channel river habitat, which supports wildlife movement corridors. Restoration of in-channel geomorphology, including riffle/pool complexes, would also support 25 acres of increased habitat for native fish.

In Alternative 16, local habitat connectivity would increase 85% within the study area over Alternative 13, through restoration of natural hydrology and habitat at the Piggyback Yard site and its connection to Arroyo Seco via restored in-channel and channel bank habitat.

Alternative 20

Alternative 20 restores 719 acres of habitat along the 11 mile study reach. Below is a map showing the footprint of Alternative 20 (Figure 6-10). Alternative 20 adds the following benefits and incrementally meets objectives criteria above the level provided by Alternative 16 as follows:

Objective 1: Restore Valley Foothill Riparian Strand and Freshwater Marsh Habitat

- Reach 2 provides an added 10 acres of in channel riverine habitat via channel widening from a trapezoidal to vertical configuration (Freshwater marsh biological diversity objective 1a)
- Reach 3 provides an added 35 acres of in channel riverine habitat via removal of the concrete channel bed and bank in the tributary confluence of Verdugo Wash
- Reach7 restores a natural hydrologic connection between the river and the LA River State Historic Park via removal of the concrete bank between the river and the site.

Objective 2: Increase Habitat Connectivity

- 120% more connectedness (Rudd et al 2002) within the Study Area over Alternative 16via the restored nodal connections at Verdugo Wash and LA River State Historic Park (Figure 6-11).
- Increased regional habitat connectivity through Verdugo Wash to the Verdugo Hills and the San Gabriel Mountains
- Increased regional connectivity through the LA River State Historic Park to the Elysian Hills and upstream to Griffith Park and the Santa Monica Mountains (Figure 6-12)
- Reach 2 widens .6 miles of channel which supports a wider vegetated movement corridor for wildlife
- Channel bed restoration in reaches 2 and 3 allow for creation of riffle/pool complexes which supports habitat and refugia for and movement of native fish species.

The added measures in reaches 2, 3 and 7 provide additional connectivity benefits, including natural hydrologic and hydraulic connectivity between the river, floodplain, and overbank areas, and habitat connectivity for wildlife movement locally within the river system and to regional areas.

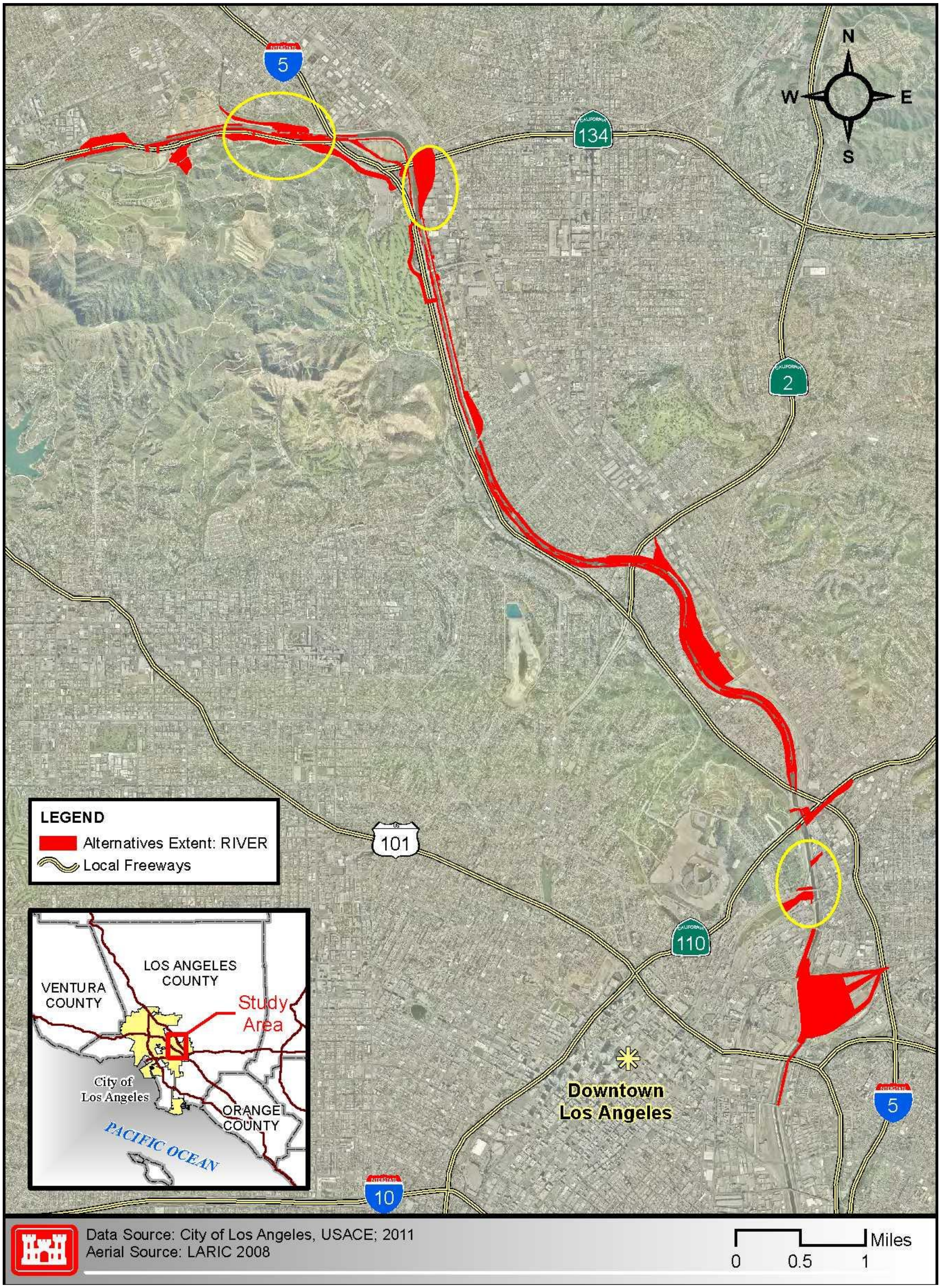


Figure 6-10 Alternative 20 Footprint Show Areas with Changes from Alternative 16 in Yellow Circles

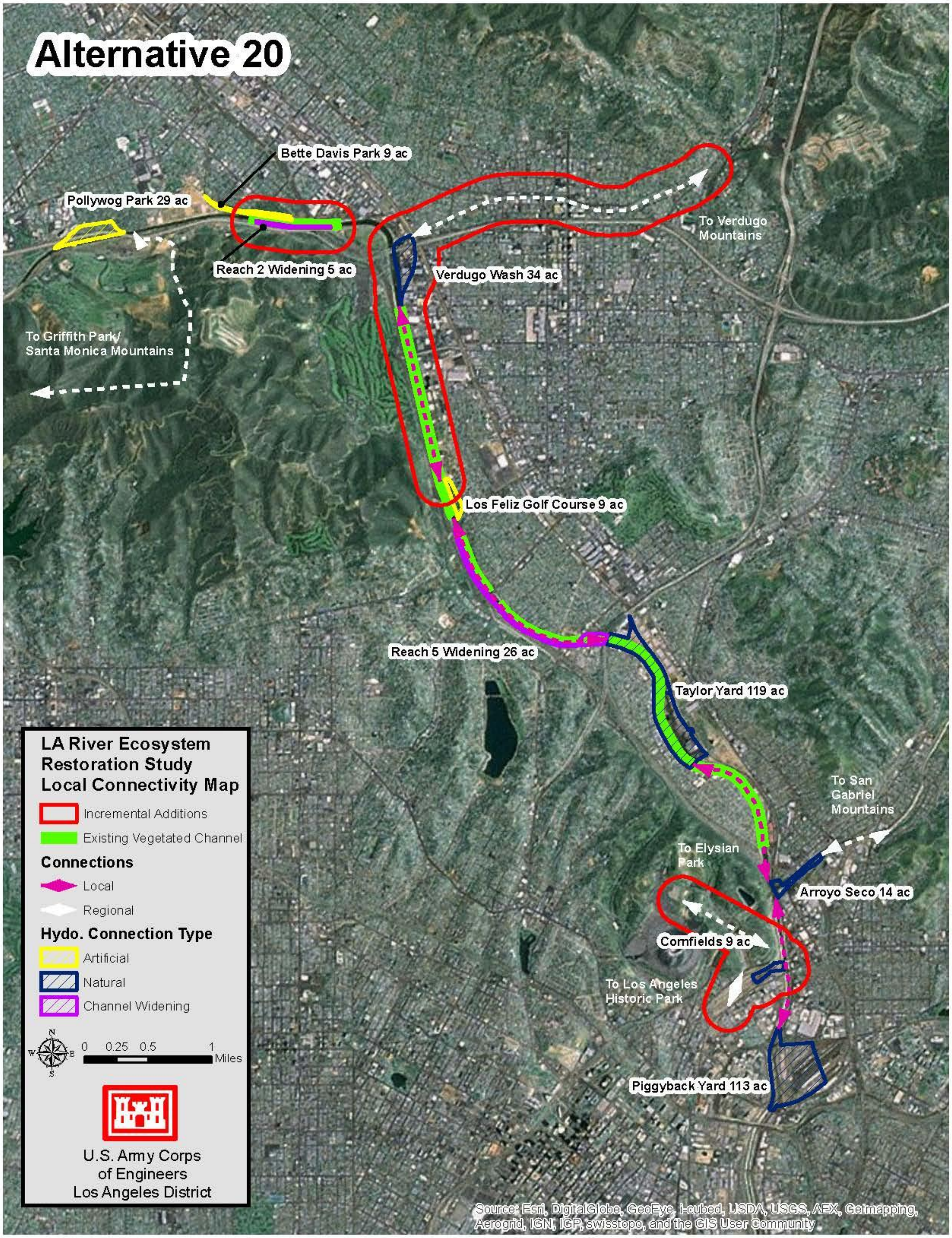


Figure 6-11 Alternative 20 Local Habitat and Hydrologic Connectivity Increase in Red Polygons

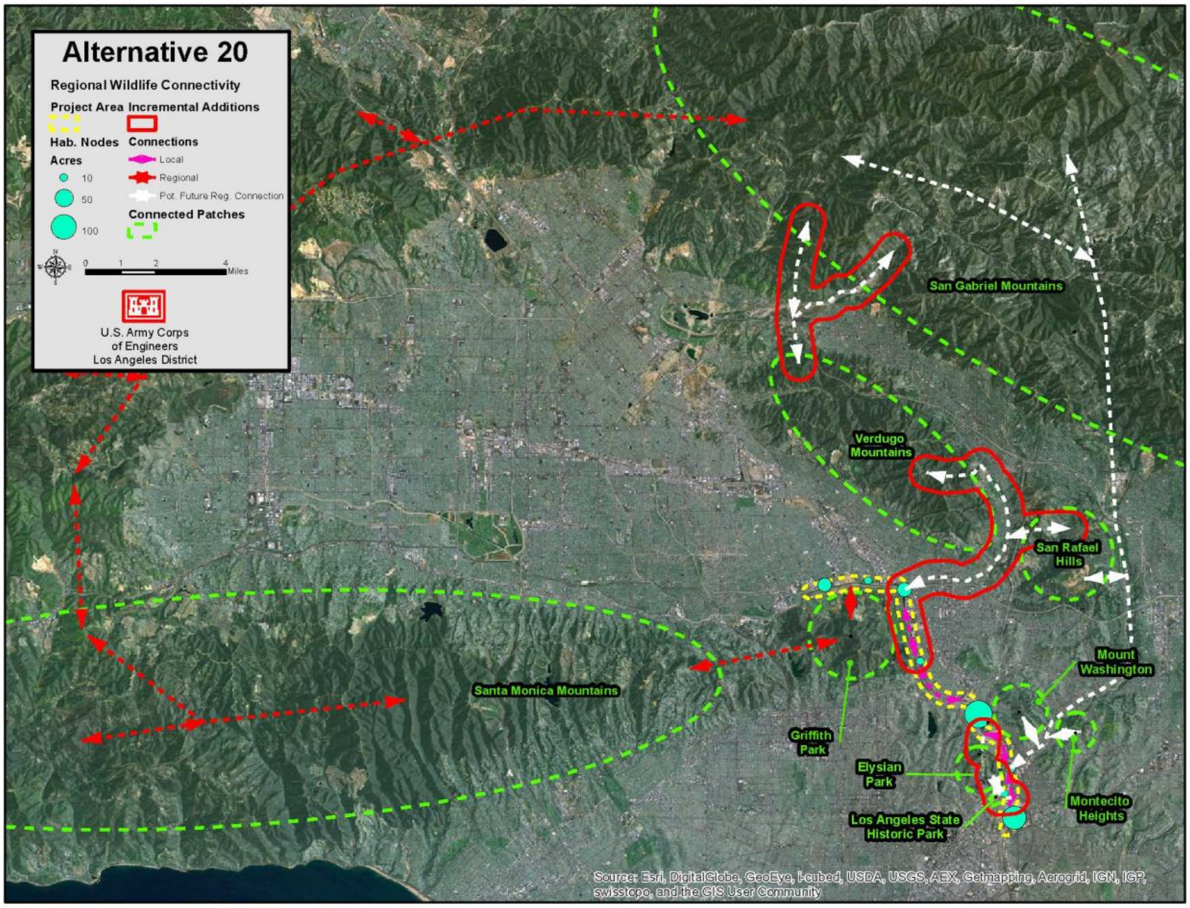


Figure 6-12 Alternative 20 Potential Regional Habitat Connectivity with Increase from 16 Shown by the Polygons

In addition to the features in Alternative 16, Alternative 20 restores a natural hydrologic connection between the river and the historic floodplain at the Verdugo Wash tributary, which increases local habitat connectivity within the study area as well as opportunities for widespread regional habitat connectivity. This alternative also restores a hydrologic connection to the LA River State Historic Park (Cornfields) site, which provides additional opportunity for regional habitat connectivity, and widens the natural channel bed in Reach 2, which provides additional in-channel marsh and riparian habitat.

Alternative 20 would remove concrete and widen the confluence of the Verdugo Wash in Reach 3 to support natural hydrology and reconnection of the tributary to the historic floodplain. Alternative 20 creates a third reach of the river with a large natural connection to the floodplain and restores a direct geomorphic connection between the River and the bed and banks of the Verdugo Wash. This reach is currently very constrained hydraulically. Opening up the confluence at this location provides a wide natural river channel bed and confluence with potentially slower velocities providing an opportunity in the reach for nutrient recycling and refugia for fish as they move up and down the river system.

Additionally, restoration of the channel bank at the LA River State Historic Park (Cornfields) provides an additional hydrologic connection within reach 7. Terracing the bank of the river at this location provides a hydrologic connection on the west bank of the river. Alternative 20 also widens the river for a length of

0.5 miles in Reach 2. This widening allows for expansion of in-channel river habitat and geomorphology, including riffle/pool complexes, which would support 5 acres of increased habitat for native fish.

Restoration of the Verdugo Wash confluence would also provide 34 acre habitat node in the Study Area, with connectivity to the Los Feliz Golf Course via existing habitat in the Glendale Narrows (Figure 6-11) and connectivity through the downstream reaches. The added restoration at the Cornfields site in Reach 7 provides a 9 acre riparian habitat node that decreases the distance between habitat nodes in the resource poor downtown area (Figure 6-11). In Alternative 20, local habitat connectivity would increase 120% within the study area over Alternative 16, through restoration of natural hydrology and habitat at the Verdugo Wash site and its connection to Taylor Yard via existing in-channel habitat in the Glendale Narrows, as well as through restoration of hydrology and habitat at the Cornfields site, which adds a habitat node and decreases distance between nodes in the resource poor downtown area.

Alternative 20, in addition to the regional connectivity in Alternative 13, adds the Verdugo Wash tributary, which provides a future connection between the LA River and the Verdugo Mountains, a connection that also historically supported a habitat corridor for movement of wildlife. Urbanization has eliminated this habitat corridor, and without restoration of the confluence at Verdugo Wash reconnection of the river to the Verdugo Mountains could not be realized. Restoration at the Verdugo Wash confluence would restore opportunity for passage to the Verdugo Mountains, a 26 square mile area serving as a stepping stone to the western San Gabriel Mountains (Figure 6-12). Additional habitat in the community of San Rafael Hills could also be incorporated into the movement corridor as a regional habitat node. Regional habitat connectivity is further improved by restoring connections between the river and the 575-acre habitat node at Elysian Park via restoration of the Cornfields site.

6.3.2 Plan Recognition

While not a Federal plan, the Los Angeles River Revitalization Master Plan gathered the input of Federal, state, regional and local agencies and stakeholders. It was adopted by the Los Angeles City Council in 2007.The Corps was directed by WRDA 2007, as part of this study, to develop plans consistent with the goals of the Los Angeles River Revitalization Master Plan. Four of its major recommendations for ecosystem improvement are:

4.13) Create a continuous functional riparian corridor that provides habitat for birds, mammals, amphibians, reptiles, invertebrates, and fish within the channel bottom

4.14) Connect this corridor to other significant habitat and migration routes along the tributaries and into the mountains

4.15) Improve water quality and provide… [features and habitat] that would support desirable fish species…

4.16) Bio-engineer [or naturalize] the River's edge where feasible...

The study alternatives vary in their degree of responsiveness to the Plan. All alternatives include some restoration in all reaches of the river in the study area, supporting the establishing of a continuous river corridor. However, they vary in their responsiveness to connecting this corridor to other significant habitat and migration routes along the tributaries and into the mountains, providing aquatic habitat necessary to sustain fish, and naturalizing the river's edge.

6.3.3 Comparison by Objectives Conclusion

The primary NER objectives include restoring Valley Foothill Riparian strand and freshwater marsh habitat and increasing habitat connectivity. Figure 6-13 depicts the degree to which the final array of alternatives meets planning objectives for habitat restoration based on the CHAP analysis. Alternative 10 minimally meets the planning objectives while the larger alternatives provide incremental increases in NER outputs toward this objective. Table 6-4 compares nodal and regional habitat connectivity for each alternative. Alternative 13 provides the greatest percent incremental increase in habitat connectivity. Alternatives 16 and 20 provide additional increases in habitat connectivity.

A recreation plan was also formulated to specifically meet the objective of providing passive recreation compatible with the proposed environmental restoration features in the ARBOR reach.

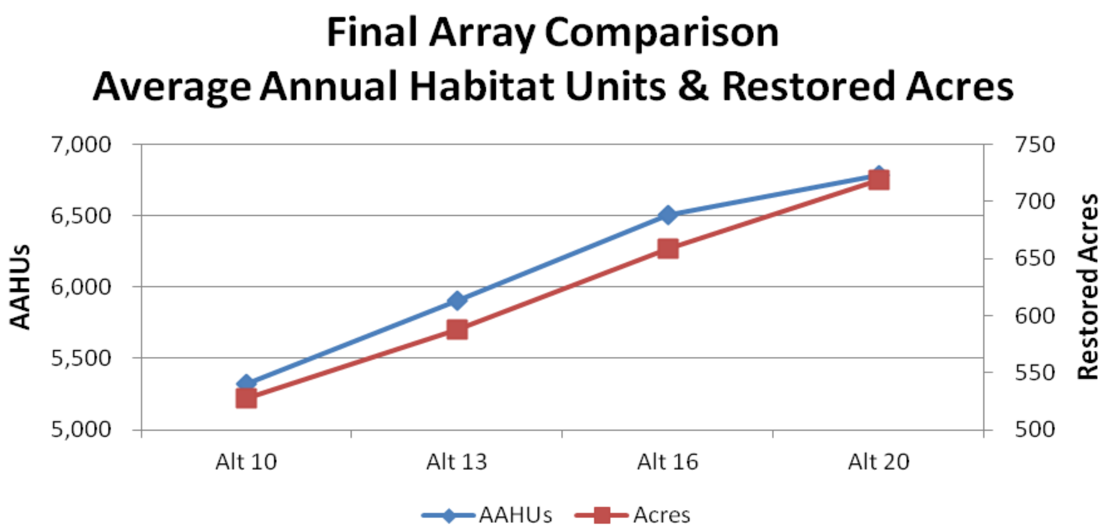


Figure 6-13 Final Array Comparison – AAHU's and restored acres

Table 6-4 Final Array Comparison by Objectives-Habitat Connections

Habitat Connections	Alternative 10	Alternative 13	Alternative 16	Alternative 20
Incremental nodal increase between alternatives	Minor improvement	309%	85%	120%
Added Regional Connections	Santa Monica Mtns	Santa Monica & San Gabriel Mtns	Santa Monica & San Gabriel Mtns	Verdugo & Elysian Hills, Santa Monica & San Gabriel Mtns

6.4 FINAL ARRAY POLICY ISSUES, RISKS, AND CONSTRAINTS COMPARISON

During plan formulation, each measure and alternative was formulated to avoid constraints and minimize risk as much as was possible. Alternatives comparison by major project constraints for the final array is displayed in Table 6-5. Levee vegetation regulations will be followed either by request for variance or limitation. Where levee modifications occur, they will maintain existing levels of protection. Alternative 10 has the least amount of construction activity and modification of current conditions, which accounts for its having the fewest changes to current levee conditions. Alternatives 13, 16, and 20 have relatively more changes due to the increasing levels of habitat restoration. Percentages of real estate reflect the differences in construction activities relative to land area, with Alternative 20 having the lowest percentage and Alternative 10 having the highest.

Table 6-5 Final Array Comparison by Key Constraint

Alternative	Hazardous, Toxic, and Waste	Potential Levee Area (LAR#) Changes, and Variance Areas in Compliance with Levee Regulations	Percentage of Lands Relative to Project Cost
10 - ART	Sponsor response/remediation required at G1 and G2, potential remediation at Piggyback Yard, and for San Fernando Valley groundwater plume	Reaches 4 and 5	83%
13 - ACE	Sponsor response/remediation required at G1 and G2, Piggyback Yard, and for San Fernando Valley groundwater plume	Reaches 3, 4,5,6	69%
16 - AND	Remediation similar to Alternative 10	Reaches 3, 4, 5, 6, 7, 8	47%
20 - RIVER	Remediation similar to Alternative 10	Reaches 2 3, 4, 5, 6, 8	46%

6.4.1 Flood Risk Management

A key constraint of the study was that existing levels of flood risk management should be maintained. Appendix E, Hydrology and Hydraulics, describes the hydraulic analysis conducted on the final array of alternatives. That analysis focused on changes to maximum water surface elevations and maximum velocity. It noted that reaches where there is an increase in water surface elevations with project are in transition areas of the channel. Characteristics of transition areas are either geometric (trapezoidal to rectangular or from a widened section to a narrow section) or construction material (soft-bottom or concrete). Several areas exhibit average velocities in excess of 12 ft/s. In those areas, planting of additional vegetation is not recommended and for those areas with velocities greater than 8 ft/s, supplemental protection will be required. The initial analysis concludes that most of the impacts of the proposed features can be mitigated by preventing vegetation establishment in transition areas. The potential impact to existing flood risk management benefits as well as to habitat outputs should be minimal.

The addition of Taylor Yard, LA River State Historic Park (Cornfields), Verdugo Wash, Arroyo Seco, and Piggyback Yard do not provide substantial flood risk reduction for the larger design type floods, but would have a significant effect on the small to moderate size events. Unlike conventional hydraulics for the larger events where discharge is the dominant channel-forming parameter, vegetation dictates the channel forms during the small to moderate size events. Vegetation influences flow patterns and sediment settling on floodplains (Darby 1999, Larsen et al 2007) as well as bedform changes, largely due to its effect on velocity.

During the design phase 2D unsteady flow numeric models and possibly physical modeling will be required to more accurately simulate the flow hydraulics for the project. This may result in adjustments to plan features, but should not change the overall habitat benefits.

6.4.2 Levees

The National Levee Database (NLD) indicates that there are five levees within the ARBOR reach. The listing was made based on as-built documents and may not be reflective of current conditions. Site visits were made to the levees within the study area in October 2012 and current conditions were documented. Findings of that site inspection are found in Appendix D (Geotechnical). Maps and descriptions of each are also found in that appendix. Based on visual observations, portions of the existing levee configuration no longer appear to meet the criteria of a levee condition and may be removed from the NLD at a future date. These areas will need to be accurately delineated in location and extent and ultimately approved as a non- levee condition by the Levee Safety Officer. Portions that are listed and observed as levee have been noted as part of this effort. Those portions of levee, if modified by ecosystem restoration activities, must be done in accordance with current design practices and guidance pertaining to design and construction of levees.

- **Alternative 10**: Reaches 4 and 5 riparian corridors –left bank for riparian vegetation on berm and crown or use perennial riparian grasses – LAR #6

- **Alternative 13**: Reach 3 riparian corridor –consider re-designation of Ferraro Fields from leveed to unleveed (LAR #3), and Reaches 4 & 5 riparian corridors – left bank for riparian vegetation on berm and crown or use perennial riparian grasses (LAR #6), Reach 6 right bank, vegetation on levee banks may require interruption in vegetation at levee-like storm drain confluences or variance to allow overhanging vegetation

- **Alternative 16**: Reach 3 riparian corridor – consider re-designation of Ferraro Fields from leveed to unleveed (LAR #3), Reaches 4 & 5 riparian corridors – left bank for riparian vegetation on berm and crown or use perennial riparian grasses (LAR #6), Reach 5 planted terracing on the left bank (with concrete erosion control) and overhanging vegetation on vertical wall on right bank (LAR#6), Reach 6 right bank, vegetation on levee banks may require interruption in vegetation at levee-like storm drain confluences or variance to allow overhanging vegetation, Reach 7 may require variance for overhanging vegetation in leveed areas for LAR 2 and 5, Reach 8 may require variance or redesignation of LAR 2 to allow for planted terracing on the right bank.

- **Alternative 20**: Reach 2 overhanging vegetation on the left bank at Bette Davis Park LAR #7, Reach 3 riparian corridor – consider re-designation of Ferraro Fields from leveed to unleveed (LAR #3), Reaches 4 & 5 riparian corridors – left bank for riparian vegetation on berm and crown or use perennial riparian grasses(LAR #6), Reach 5 planted terracing on the left bank (with concrete erosion control) and overhanging vegetation on vertical wall on right bank (LAR#6), Reach 6 right bank, vegetation on levee banks may require interruption in vegetation at levee-like storm drain confluences or variance to allow overhanging vegetation Reach 8 may require variance or redesignation of LAR #2 to allow for planted terracing on the right bank.

The riparian forbs on the levees are expected to occur in a relatively narrow band and be surrounded by more structurally diverse riparian vegetation in adjacent areas. Wildlife is still expected to use the levee plantings as a movement corridor between the more diverse riparian habitat areas, which will provide habitat for small mammals, reptiles, and birds. By replacing riparian vegetation with riparian forbs on the levees, CHAP values in the final array would decrease slightly for those areas. However the overall CHAP values and the ranking of the final array and the selection of the TSP would not be significantly impacted as the decrease would be relative across all alternatives in the final array.

6.4.3 HTRW

A study constraint was to avoid sites contaminated with HTRW to the extent practicable. If sites cannot be avoided, the Corps will cost share related HTRW required activities involving studies or investigations but the non-federal sponsor is 100 percent responsible for all costs associated with remediation of any known or unknown HTRW. As described in this report and Appendix K HTRW Survey Report

Appendix, there are known contaminated sites within the study area that cannot be avoided by the project. These include the San Fernando Valley Superfund Site, and Taylor Yard G1 and G2, which are considered high impact sites. In addition, contamination is possible at the Piggyback Yard site based on historical uses, posing a potentially high impact to the project since the extent of this potential contamination is unknown. Localized groundwater contamination may also be encountered during construction. Under all alternatives the non-Federal sponsor would remediate or ensure the remediation of soil contamination to the standard required for the restoration project prior to construction of restoration features at the affected sites. Because it is infeasible to remediate groundwater contamination prior to construction, the sponsor would be responsible at 100 percent non-project cost for addressing contaminated groundwater including treatment and disposal during dewatering activities. The sponsor understands its responsibility and has directly committed to undertaking or ensuring the necessary HTRW remediation to facilitate the project, including providing sites to be cleaned to be compatible with the restoration land use necessary and addressing groundwater contamination during dewatering activities.

6.4.4 Real Estate

Under Corps policy land acquisition for ecosystem restoration project should be kept to a minimum and a target of 25% has been establishes as a maximum percentage. Since the project is in an urban area and real estate and relocation costs are known to be exceptionally high in Los Angeles, real estate costs would be high for any alternative. The percentage of real estate costs to total cost is high for the entire final array of alternatives ranging from 45 to 83%. The City has waived reimbursement for LERRD costs exceeding its share of total ecosystem restoration costs. Additional discussion of real estate costs and cost share is presented in Chapter 7.

6.5 COMPARISON BY NATIONAL OBJECTIVES AND THE FOUR ACCOUNTS

In the 1970 Flood Control Act, Congress identified four equal national accounts for use in water resources development planning. They are national economic development (NED); regional economic development (RED); environmental quality (EQ); and social well-being (OSE, other social effects). Policy in the 1970s regarded making contributions to only two of these, NED and EQ, as national objectives. Now only contributing to NED remains a national objective, as stated in the Principles and Guidelines.

> *The Federal objective of water and related land resources planning is to contribute to national economic development consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements.*

However, all four of these planning categories remain important considerations of water resource projects and the USACE is considering revising this in new guidelines. The four categories, known as the System of Accounts as suggested by the U.S. Water Resources Council, address long-term impacts and are defined in such a manner that each proposed plan can be easily compared to the No Action plan and other alternatives. Collectively, the four accounts are required to include all significant effects of a plan on the human environment.

Contributions to NED are increases in the net value of the national output of goods and services, expressed in monetary units. They are the direct net benefits that accrue in the planning area and the rest of the nation. Recommended ecosystem restoration measures do not need to exhibit net NED benefits, but will be based on non-monetary outputs compatible with the Principles and Guidelines selection criteria. Although alternatives may produce incidental NED benefits, for this study, the NED account addresses the recreation benefits with the national ecosystem restoration (NER) account providing the primary basis for comparison for the project purpose. Ecosystem restoration has become one of the primary missions of the Civil Works program. The NER plan is the option with the greatest net ecosystem restoration benefits. The NER objective is to contribute to the nation's ecosystems through restoration, with contributions measured by changes in the amounts and values of habitat. The four accounts used to compare the alternative plans have been modified to include the NER account, and the EQ, RED, and OSE accounts.

6.5.1 National Ecosystem Restoration

The NER account displays the monetary costs and the non-monetary benefits related to each alternative plan. The NER plan is identified by examining the average annual HUs for each alternative versus the average annual costs for the alternative. Determination of the NER plan is typically the primary decision-making factor for identification of the recommended plan. The incremental cost analysis indicates that alternatives in the final array are incrementally cost effective and efficient.

There are some distinct differences between these four alternatives. First, there is the consideration of cost versus benefits. Each alternative is progressively more beneficial as it becomes more costly. Table 6-6 below includes a summary of the NER benefits and costs. The table includes the ecosystem restoration alternatives and displays costs and benefits as total and annualized values.

Table 6-6 NER and NED Benefits Summary

Criteria	No Action	10 (ART)	13 (ACE)	16 (AND)	20 (RIVER)
Plan Description	**No Action**	**ARBOR Riparian Transitions**	**ARBOR Corridor Extension**	**ARBOR Narrows to Downtown**	**ARBOR Riparian Integration via Varied Ecological Reintroduction**
ASSESSMENT					
National Ecosystem Restoration (NER)					
1) Total First Cost	*$0*	$375 Million	$453 Million	$804 Million	$1.08 Billion
2) Total Investment Cost	$0	$376 Million	$456 Million	$824 Million	$1.10 Billion
3) Annualized Cost	*$0*	$17 Million	$20 Million	$37 Million	$49 Million
4) Annualized O&M	*$0*	$579 Thousand	$872 Thousand	$2.3 Million	$2.5 Million
5) Real Estate Percentage of Cost	*$0*	83%	69%	47%	46%
6) Benefits a. Net gain in AAHU	*0*	5,321	5,902	6,509	6,782
b. Incremental Cost/AAHU c. % increase in AAHU versus no action	*0*	$3,259 93%	$6,651 104%	$29,253 114%	$46,827 119%

The recreation plan described in Chapter 4 was developed to be compatible with the NER Plan. The first cost of the recreation plan is $6.1 million, and annual cost $318,000. Annual benefits are estimated at $2.4 Million, with a benefit to costs ratio of 7.51. Additional recreation measures and benefits could be achieved with Alternatives 16 or 20.

6.5.2 Environmental Quality

The Planning Manual describes environmental quality as "favorable changes in the ecological, aesthetic, and cultural attributes of natural and cultural resources." Adverse effects within these categories can also be included in this assessment. Resource and use types that were assessed in this document (Chapter 5) include the following:

- Geology, Soils, Seismic Hazards, or Mineral Resources
- Air Quality
- Land Use
- Water Resources
- Biological Resources
- Cultural Resources
- Traffic and Circulation
- Noise
- Recreation and Public Access
- Aesthetics
- Public Health and Safety, including HTRW
- Utilities and Public Services
- Socioeconomics and Environmental Justice

Table 6-7 below summarizes the comparison of environmental quality between No Action and the final array of alternatives.

Table 6-7 EQ Evaluation and Comparison Summary

Resource Area	No Action	10 (ART) ARBOR Riparian Transitions	13 (ACE) ARBOR Corridor Extension	16 (AND) ARBOR Narrows to Downtown	20 (RIVER) ARBOR Riparian Integration via Varied Ecological Reintroduction
Geology, Seismology, Soils, and Minerals	No change.	Temporary, insignificant adverse impacts due to construction. Long term beneficial due to stabilization of soils from increased wetland and riparian vegetation over 251 acres.	Temporary, insignificant adverse impacts due to construction. Long term beneficial due to stabilization of soils from increased wetland and riparian vegetation over 273 acres.	Temporary, insignificant adverse impacts due to construction. Long term beneficial due to stabilization of soils from increased wetland and riparian vegetation over 270 acres.	Temporary, insignificant adverse impacts due to construction. Long term beneficial due to stabilization of soils from increased wetland and riparian vegetation over 288 acres.
Air Quality	No change.	Temporary, significant adverse impacts from air quality threshold exceedances during construction. No long-term effects. Potential long-term benefits from additional vegetation and removal of industrial yard.	Temporary, significant adverse impacts, with additional exceedances to air quality thresholds. No long-term effects. Potential long-term benefits from additional vegetation and removal of industrial yard.	Temporary, significant adverse impacts, with additional exceedances to air quality thresholds. No long-term effects. Potential long-term benefits from additional vegetation and removal of industrial yard.	Temporary, significant adverse impacts same as Alt 16. No long-term effects. Potential long-term benefits from additional vegetation and removal of industrial yard.
Land Use	No change.	Permanent, significant adverse impacts through loss of Piggyback Yard industrial land uses.	Permanent, significant adverse impacts through loss of Piggyback Yard industrial land uses.	Permanent, significant adverse impacts through loss of Piggyback Yard industrial land uses.	Permanent, significant adverse impacts through loss of Piggyback Yard industrial land uses.
Water Resources	Continued degradation.	Temporary, insignificant adverse impacts to water quality due to erosion. Long term beneficial impacts resulting from increase in riparian vegetation (251 acres) and wetland creation (16 acres).	Temporary, insignificant adverse impacts to water quality due to erosion. Long term beneficial impacts resulting from increase in riparian vegetation (271 acres) and wetland creation (39 acres).	Temporary, insignificant adverse impacts to water quality due to erosion. Long term beneficial impacts resulting from increase in riparian vegetation (270 acres) and wetland creation (49 acres).	Temporary, insignificant adverse impacts to water quality due to erosion. Long term beneficial impacts resulting from increase in riparian vegetation (288 acres) and wetland creation (58 acres).
Biological Resources	Continued degradation.	Long term beneficial effects from creation of riparian vegetation (251), wetland creation (16), creation of one new side channel, and additional open water habitat (80 foot expansion).	Long term beneficial effects from creation of riparian vegetation (271), wetland creation (39), creation of 2 new side channels, and additional open water habitat (300 foot expansion).	Long term beneficial effects from creation of riparian vegetation (270), wetland creation (49), creation of 3 new side channels, additional open water habitat (500 foot expansion), and restoration of Arroyo Seco confluence.	Long term beneficial effects from creation of riparian vegetation (288), wetland creation (58), creation of 3 new side channels, additional open water habitat (500), restoration of Arroyo Seco and Verdugo Wash confluences, and connection to LASHP.

Resource Area	No Action	10 (ART) ARBOR Riparian Transitions	13 (ACE) ARBOR Corridor Extension	16 (AND) ARBOR Narrows to Downtown	20 (RIVER) ARBOR Riparian Integration via Varied Ecological Reintroduction
Cultural Resources	No change.	Section 106 protocol will ensure no long-term significant adverse effects.	Section 106 protocol will ensure no long-term significant adverse effects.	Section 106 protocol will ensure no long-term significant adverse effects.	Section 106 protocol will ensure no long-term significant adverse effects.
Traffic and Circulation	No change, continued degradation with population growth.	Temporary adverse impacts from traffic congestion during construction over 161 days. Long-term adverse effects resulting from reduction in rail line capacity through Piggyback Yard.	Temporary adverse impacts from traffic congestion during construction over 282 days. Long-term adverse effects resulting from reduction in rail line capacity through Piggyback Yard.	Temporary adverse impacts from traffic congestion during construction over 624 days. Short-term significant impact to rail traffic due to temporary closures. Long-term adverse effects resulting from reduction in rail line capacity through Piggyback Yard.	Temporary adverse impacts from traffic congestion during construction over 161 days. Short-term significant impact to rail traffic due to temporary closures. Long-term adverse effects resulting from reduction in rail line capacity through Piggyback Yard.
Noise	No change, continued degradation with population growth.	Temporary increase during construction. Long-term benefits to noise reduction in Piggyback Yard.	Temporary increase during construction. Long-term benefits to noise reduction in Piggyback Yard.	Temporary increase during construction. Long-term benefits to noise reduction in Piggyback Yard.	Temporary increase during construction. Long-term benefits to noise reduction in Piggyback Yard and Verdugo Wash industrial area.
Recreation	No change	Minor and temporary adverse effects due to closures during construction. Long-term beneficial effects resulting from greater access and improved recreation features.	Minor and temporary adverse effects due to closures during construction. Long-term beneficial effects resulting from greater access and improved recreation features.	Minor and temporary adverse effects due to closures during construction. Long-term beneficial effects resulting from greater access and improved recreation features.	Minor and temporary adverse effects due to closures during construction. Long-term beneficial effects resulting from greater access and improved recreation features.
Aesthetics	Continued degraded condition	Minor and temporary effects from construction. Long-term beneficial effects from riparian revegetation, creation of native habitat, removal of invasive plants (338 acres), and removal of Piggyback Yard.	Minor and temporary effects from construction. Long-term beneficial effects from riparian revegetation, removal of invasive plants (406 acres), creation of native habitat, and removal of Piggyback Yard.	Minor and temporary effects from construction. Long-term beneficial effects from riparian revegetation, creation of native habitat, removal of invasive plants (464), and removal of Piggyback Yard.	Minor and temporary effects from construction. Long-term beneficial effects from riparian revegetation, creation of native habitat, removal of invasive plants (499 acres), removal of Piggyback Yard, and removal of Verdugo Wash industrial area.
Public Health and Safety, Including Hazardous, Toxic and Radioactive Waste	No change.	No short- or long- term impacts would occur.	No short- or long- term impacts would occur.	No short- or long- term impacts would occur.	No short- or long- term impacts would occur.
Utilities and Public Services	No change.	No short- or long- term impacts would occur.	No short- or long- term impacts would occur.	No short- or long- term impacts would occur.	No short- or long- term impacts would occur.

Resource Area	No Action	10 (ART) ARBOR Riparian Transitions	13 (ACE) ARBOR Corridor Extension	16 (AND) ARBOR Narrows to Downtown	20 (RIVER) ARBOR Riparian Integration via Varied Ecological Reintroduction
Socioeconomics and Environmental Justice	No change.	Potential minor temporary adverse effects from recreation closures. Temporary benefit to employment during construction. Long-term potentially significant adverse effects on low-income/minority populations from loss of employment at Piggyback Yard. Long-term beneficial effects to low-income and minority populations from improved ecological condition, water quality, recreation access, aesthetics.	Potential minor temporary adverse effects from recreation closures. Temporary benefit to employment during construction. Long-term potentially significant adverse effects on low-income/minority populations from loss of employment at Piggyback Yard. Long-term beneficial effects to low-income and minority populations from improved ecological condition, water quality, recreation access, aesthetics.	Potential minor temporary adverse effects from recreation closures. Temporary benefit to employment during construction. Long-term potentially significant adverse effects on low-income/minority populations from loss of employment at Piggyback Yard. Long-term beneficial effects to low-income and minority populations from improved ecological condition, water quality, recreation access, aesthetics.	Potential minor temporary adverse effects from recreation closures. Temporary benefit to employment during construction. Long-term potentially significant adverse effects on low-income/minority populations from loss of employment at Piggyback Yard industrial area. Long-term beneficial effects to low-income and minority populations from improved ecological condition, water quality, recreation access, aesthetics.

For most of the resource or use categories listed above, environmental effects arising from this project would be beneficial. However, significant, unavoidable adverse impacts have been identified under some resource categories. A summary of effects by alternative is as follows:

Alternative 10 (ART)

Long-term, beneficial impacts to water resources, biological resources, aesthetics, and recreation would occur under this alternative. In general, these beneficial effects would occur during operation and maintenance of the restored habitat, and are associated with increased wetland and riparian function, a higher ratio of plants to hardscape compared to existing conditions, and increased opportunities for bird watching and outdoor education.

Short-term, minimal to moderate adverse impacts to water resources, biological resources, aesthetics, recreation, transportation and circulation, and socioeconomics would occur under this alternative. These impacts are all associated with disruptions occurring during construction, and would not occur once construction was completed.

Significant, unavoidable adverse impacts to air quality, environmental justice, and land use would occur under this alternative. Significant air quality impacts are associated with emissions from construction machinery during construction, which would exceed state and federal thresholds for criteria pollutants. These impacts would not occur under long-term operation of the restored area. Significant land use impacts are associated with converting industrial lands at Piggyback Yard to other land uses, and would occur during both the construction and operations phases. Significant adverse impacts to environmental justice associated with the closure of Piggyback Yard and associated loss of blue-collar jobs in the environmental justice community that surrounds Piggyback Yard would occur under this alternative during both construction and operations.

Alternative 13 (ACE)

Impacts under this alternative, both beneficial and adverse, would include those identified under Alternative 10. These impacts may be more extensive compared to Alternative 10 due to more extensive implementation of proposed restoration measures under this alternative. In addition to the impacts identified under Alternative 10, significant impacts to transportation and circulation would occur under this alternative.

Alternative 16 (AND)

Impacts under this alternative, both beneficial and adverse, would include those identified under Alternatives 10 and 13. These impacts may be more extensive compared to Alternative 10 due to more extensive implementation of proposed restoration measures under this alternative. Short-term, significant impacts to transportation and circulation would occur as a result of having to temporarily close railroad lines that pass through Piggyback Yard to allow them to be placed onto trestles. Performing this action would require that passenger and freight trains to be rerouted during the construction phase, leading to delays in rail service and disruption of delivery schedules.

Alternative 20 (RIVER)

Impacts under this alternative, both beneficial and adverse, would include those identified under the previous alternatives. There are additional relocations in Reach 3 associated with restoration at Verdugo Wash. These impacts would likely be most extensive under this alternative since it would involve the most extensive implementation of proposed restoration measures.

6.5.3 Regional Economic Development

RED impacts include, principally, changes in income and employment. There may be some overlap with the other accounts. Indirect and induced impacts are the focus of the RED account, and differences between it and NED are considered transfers from the rest of the nation. The study area for RED is the Los Angeles metropolitan area, which is home to 15.4 million people with the largest population and largest area in the United States. If this area were a country, it would have the 15th largest economy in the world just below Australia and just above the Netherlands, Turkey, Sweden, Belgium, and Indonesia.

The following summarizes the RED assessment. These results were developed by the study team as reasonable factors, based upon available information, for developing a general estimate of potential redevelopment RED benefits associated with project alternatives. This is discussed in more detail in the Appendix B, Economics, and ranked for each alternative in Table 6-6. Ranking is in terms of employment, Gross Regional Product, and tax revenues. Additional detail pertaining to the RED is found in Appendix B Economics.

Table 6-8 provides the RED in three levels. Level 1 is impacts of construction of the project (both by the ecosystem restoration and the recreation components), Level 2 is impacts of redevelopment construction, and Level 3 shows impacts of long-term redevelopment.

Table 6-8 Assessment of Impacts from Construction

Regional Economic Development From Construction					
Criteria	No Action	10 (ART)	13 (ACE)	16 (AND)	20 (RIVER)
Plan Description		ARBOR Riparian Transitions	ARBOR Corridor Extension	ARBOR Narrows to Downtown	ARBOR Riparian Integration via Varied Ecological Reintroduction
Ecosystem Construction Cumulative Impacts					
Jobs	0	913	1,986	6,491	9,001
Labor Income	$0	$52,560,000	$114,350,000	$373,823,000	$518,341,000
Sales	$0	$125,936,000	$273,986,000	$895,690,000	$1,241,959,000
GRP	$0	$73,445,000	$159,785,000	$522,357,000	$724,297,000
Recreation Construction Cumulative Impacts					
Jobs	0	74	74	74	74
Labor Income	$0	$4,998,000	$4,998,000	$4,998,000	$4,998,000
Value	$0	$12,958,000	$12,958,000	$12,958,000	$12,958,000
Output	$0	$7,265,000	$7,265,000	$7,265,000	$7,265,000
Redevelopment Construction Cumulative Impacts					
Jobs	0	1,226	1,281	1,281	5,087
Labor Income	$0	$80,981,000	$84,665,000	$84,665,000	$336,278,000
Value	$0	$111,132,000	$115,791,000	$115,791,000	$460,153,000
Output	$0	$185,630,000	$193,002,000	$193,002,000	$767,247,000
Redevelopment Long-term Economic Activity Cumulative Impacts					
Jobs	0	628	675	675	2,671
Labor Income	$0	$897,646,000	$964,851,000	$964,851,000	$3,815,989,000
Taxes - Local	$0	$5,386,000	$5,789,000	$5,789,000	$22,896,000

The alternatives are estimated to create 2,200 to 14,100 construction related jobs over the period of analysis. Employment is anticipated to generate labor income ranging from $138 million to $860 million. Regional economic activity from construction is expected to increase by $260 million to nearly $1.5 billion with ecosystem restoration, recreation and redevelopment construction.

The long-term economic impacts of redevelopment are estimated to eventually create permanent employment of 630 to 2,700 jobs. This employment will have a greater impact to the region as these employment opportunities exist throughout the period of analysis. Total labor income from these employment opportunities is estimated to range from nearly $900 million to just under $4 billion depending upon alternative.

The cumulative effects of the construction/redevelopment components over the period of analysis will create between 2,800 to 16,800 jobs with incomes from over $1 billion to nearly $5 billion.

6.5.4 Other Social Effects Assessment

The OSE account describes the potential effects of project alternatives in areas that are not dealt with explicitly in the NER and RED accounts. The Principles and Guidelines state that the OSE, when included in USACE documents, should "display plan effects on social aspects such as community impacts, health and safety, displacement, energy conservation and others."

Social effects in a general sense refer to a concern for how the constituents of life that influence personal and group definitions of satisfaction, well-being, and happiness are affected by some condition or proposed intervention. Well-being is an ensemble concept composed of multiple dimensions. While economic factors are very important in characterizing well-being, there are many more factors which come into play. In particular the distribution of resources; the character and richness of personal and community associations; the social vulnerability and resilience of individuals, groups, and communities; and the ability to participate in systems of governance are all elements that help define well-being.

This OSE analysis describes the potential social effects of the alternatives under consideration. The OSE account explores the following categories of effects from the implementation of the alternatives considered; this is described in Appendix B, Economics, and summarized in the Table 6-7 below. In most cases it is not possible to differentiate between the social effects of the restoration alternatives. Appendix B Economics presents the OSE effects in much more detail.

- Displacement/Impacts to Population
- Public Health and Safety
- Displacement/Impacts to Minorities and Special Interest Groups
- Displacement/Impacts to Businesses
- Displacement/Impacts to Agriculture
- Displacement/Impacts to Recreational Areas
- Community Growth
- Project Impacts and Connectivity of the Community
- Community Well-being
- Environmental Health

Table 6-9 Other Social Effects Assessment

Criteria	No Action	10 (ART)	13 (ACE)	16 (AND)	20 (RIVER)
Plan Description	**No Action**	**ARBOR Riparian Transitions**	**ARBOR Corridor Extension**	**ARBOR Narrows to Downtown**	**ARBOR Riparian Integration via Varied Ecological Reintroduction**
Displacement/Impacts to Population	No effects	No displacement to population	No displacement to population	No displacement to population	No displacement to population
Public Health and Safety	Same as existing condition	Improved community health through restored river and open space/recreation opportunities	Improved community health through restored river and open space/recreation opportunities	Improved community health through restored river and open space/recreation opportunities	Improved community health through restored river and open space/recreation opportunities
Displacement/Impacts to Minorities and Special Interest Groups	Same as existing condition	No displacements or relocations. Improved linkages to trails and neighborhood parks, increasing property values	No displacements or relocations. Improved linkages to trails and neighborhood parks, increasing property values	No displacements or relocations. Improved linkages to trails and neighborhood parks, increasing property values	No displacements or relocations. Improved linkages to trails and neighborhood parks, increasing property values
Displacement/Impacts to Businesses	No impacts	Business relocations in Reach 8	Business relocations in Reach 8	Business relocations in Reach 8	Business relocations in Reaches 3 and 8
Displacement/Impacts to Recreational Areas	No impacts	Temporary restriction to existing recreation areas during construction	Temporary restriction to existing recreation areas during construction	Temporary restriction to existing recreation areas during construction	Temporary restriction to existing recreation areas during construction
Community Growth	Continued as in the existing conditions	Ecosystem restoration measures are projected to revitalize commercial, industrial, and residential development in several areas	Ecosystem restoration measures are projected to revitalize commercial, industrial, and residential development in several areas	Ecosystem restoration measures are projected to revitalize commercial, industrial, and residential development in several areas	Ecosystem restoration measures are projected to revitalize commercial, industrial, and residential development in several areas
Project Impacts and Connectivity to the community	River would not be restored and not result in any improvement to existing conditions	Promote connectivity of the community by providing a common place for residents to recreate and interact and create a sense of community and	Promote connectivity of the community by providing a common place for residents to recreate and interact and create a sense of community and belonging	Promote connectivity of the community by providing a common place for residents to recreate and interact and create a sense of community and	Promote connectivity of the community by providing a common place for residents to recreate and interact and create a sense of community and

Criteria	No Action	10 (ART)	13 (ACE)	16 (AND)	20 (RIVER)
Plan Description	**No Action**	**ARBOR Riparian Transitions**	**ARBOR Corridor Extension**	**ARBOR Narrows to Downtown**	**ARBOR Riparian Integration via Varied Ecological Reintroduction**
		belonging		belonging	belonging
Community Well Being	No changes	Restored River with recreation opportunities promotes well-being and livability of the community.	Restored River with recreation opportunities promotes well-being and livability of the community.	Restored River with recreation opportunities promotes well-being and livability of the community.	Restored River with recreation opportunities promotes well-being and livability of the community.
Environmental Health; aesthetics, stormwater runoff, energy savings, air quality	No changes	$4,216,800	$4,586,400	$4,536,000	$4,838,400

6.5.5 Principles and Guidelines

The Principles and Guidelines (U.S. Water Resources Council 1983) and the USACE Institute for Water Resources (IWR) Planning Manual (USACE 1996) present decision criteria for evaluation, comparison, and selection of measures. These are effectiveness, completeness, efficiency, and acceptability, as defined in Chapter 4.

Alt 10 ART

- *Effectiveness.* Alt 10 ART is judged to be minimally effective, in that while it meets the planning objectives overall, it fails to meet the key target objective of reconnection to tributaries, and thereby does not realize those potential habitat benefits, nor does it provide key nodal connections to tributaries along the ARBOR reach.
- *Completeness.* Alt 10 ART is considered complete, though it is considered the less resilient than alternatives 16 AND or 20 RIVER and therefore is subject to higher risk of failure to realize the estimated habitat benefits over the period of analysis.
- *Efficiency.* Alt 10 ART is efficient. All components of the plan were judged to be cost effective and best buys in the CE/ICA.
- *Acceptability.* Alt 10 ART complies with applicable laws, regulations, and public policies, and any adverse effects would be mitigated per discussion provided in Chapter 5.

Alt 13 ACE

- *Effectiveness.* Alt 13 ACE is judged to be effective; it meets the planning objectives overall, including the target objectives related to tributaries which Alt 10 ART did not address. .
- *Completeness.* Alt 13 ACE is considered complete and is more resilient that Alternative 10
- *Efficiency.* Alt 13 ACE is efficient. All components of the plan were judged to be cost effective and best buys in the CE/ICA.
- *Acceptability.* Alt 13 ACE complies with applicable laws, regulations, and public policies and any adverse effects would be mitigated per discussion provided in Chapter 5.

Alt 16 AND

- *Effectiveness.* Alt 16 AND is judged to be effective. It meets the planning objectives, especially in terms of contiguous restoration within and across reaches, and the extent of restoration at tributary confluences and side channel/floodplain areas which contribute to key nodal connections regionally.
- *Completeness.* Alt 16 AND is considered complete, more resilient than Alt 10 ART or Alt 13 ACE.
- *Efficiency.* Alt 16 AND is efficient. All components of the plan were judged to be cost effective any best buys in the CE/ICA. However, Alt 16 AND is substantially less efficient than Alt 13 ACE due to a significant increase in incremental cost per gain in output (HUs) compared to Alt 13 ACE.
- *Acceptability.* Alt 16 AND complies with applicable laws, regulations, and public policies, and any adverse effects would be mitigated per discussion provided in Chapter 5.

Alt 20 RIVER

- *Effectiveness.* Alt 20 RIVER is judged to be the most effective of the four final alternatives. It maximizes contribution toward achievement of the planning objectives, including key nodal connections for wildlife and habitat. It also maximizes the potential for near and long term RED and OSE benefits.

- *Completeness.* Alt 20 RIVER is considered complete. It would be resilient, and likely to achieve the estimated habitat benefits over the period of analysis.
- *Efficiency.* Alt 20 RIVER is efficient. All components of the plan were judged to be cost effective any best buys in the CE/ICA. It is the most expensive of the four final alternatives and is substantially less efficient than Alt 13 ACE due to a significantly higher incremental cost per gain in output (HUs).
- *Acceptability*. Alt 20 RIVER complies with applicable laws, regulations, and public policies and any adverse effects would be mitigated per discussion provided in Chapter 5.

6.6 CONCLUSION

The final array of action alternatives provides a range of approaches for the project, from Alt 10 ART which minimizes cost but does not fully meet all target objectives, to Alt 20 RIVER, which provides the most extensive restoration actions to maximize NER, RED, and OSE benefits at higher costs. Comparisons of alternatives for impacts in chapter 5 and benefits in chapter 6 provide the following support for selection of a TSP and designation of the NER plan.

6.6.1 Cost Effectiveness and Incremental Cost Analysis

The CE/ICA strongly supports the identification of Alternative 13 as the NER Plan. The following table summarizes the key cost and output metrics for the CE/ICA.

As shown below, Alternative 10 provides 5,321 AAHUs at a total cost of $374 million and an annual cost of about $17 million. The AAC/AAHU is $3,259. Relative to Alternative 10, Alternative 13 provides an 11% increase in output at an incremental first cost of $79 million and an incremental average annual cost of $3.9 million (a 22% increase). The incremental AAC/AAHU is $6,651, which is about double the incremental AAC/AAHU for Alternative 10.

Table 6-10 Final Array CE/ICA Comparison Table

	Alt 10	Alt 13	Alt 16	Alt 20
Total First Cost	$ 374,782,639	$ 453,406,057	$ 803,928,734	$ 1,080,627,338
Incremental First Cost	$ 374,782,639	$ 78,623,418	$ 350,522,677	$ 276,698,604
Incremental First Cost %		21%	77%	34%
AAHU	5,321	5,902	6,509	6,782
Incremental AAHU		581	607	273
Incremental AAHU %		11%	10%	4%
Total Cost/AAHU	$ 70,435	$ 76,822	$ 123,510	$ 159,338
Total Cost/AAHU % Increase		9%	61%	29%
Total First Cost/Restored Acre	$ 709,816	$ 771,099	$ 1,219,922	$ 1,502,959
TFC/Acre % Increase		9%	58%	23%
Total Annual Cost	$ 17,343,775	$ 21,207,856	$ 38,964,490	$ 51,748,364
Incremental Annual Cost	$ 17,343,775	$ 3,864,080	$ 17,756,635	$ 12,783,874
Incremental Annual Cost %		22%	84%	33%
AAC/AAHU	$ 3,259	$ 3,593	$ 5,986	$ 7,630
AAC/AAAHU % Increase		10%	67%	27%
AAC/Acre	$ 32,848	$ 36,068	$ 59,127	$ 71,973
AAC/Acre % Increase		10%	64%	22%
Incremental AAC/AAHU	$ 3,259	$ 6,651	$ 29,253	$ 46,827
Incremental AAC/AAHU %		104%	340%	60%
Incremental AAC/AAHU vs. Alt 13	49%	100%	440%	704%
Multiple	0.5	1.0	4.4	7.0

There is a substantial increase in cost (both in total cost and percent increase in cost) associated with Alternative 16 relative to Alternative 13. While the percent increase in output for Alternative 16 of 10% is approximately the same as under Alternative 13 (relative to Alternative 10), the percent increase in costs are approximately 80 percent (vs. about 20% for Alternative 13). Therefore, the incremental AAC/AAHU for Alternative 16 is over four times higher than for Alternative 13. Similarly, Alternative 20 requires a significant increase in cost relative to output compared to Alternative 13. The incremental AAC/AAHU for Alternative is about seven times higher than Alternative 13. The following two graphs display the substantial increases in cost and cost per output for Alternatives 16 and 20 relative to Alternative 13.

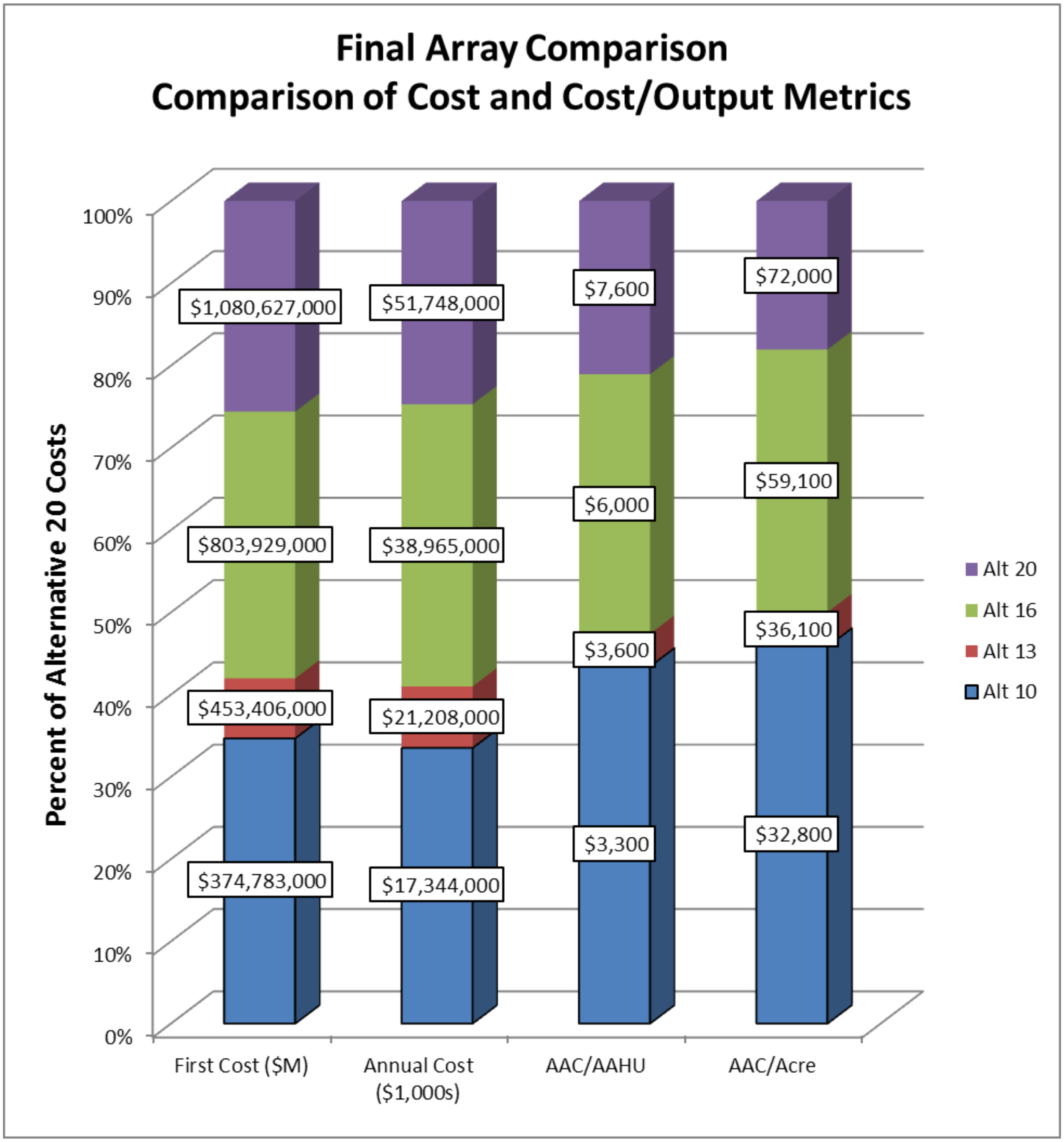


Figure 6-14 Final Array Comparison Cost and Cost/Output Metrics

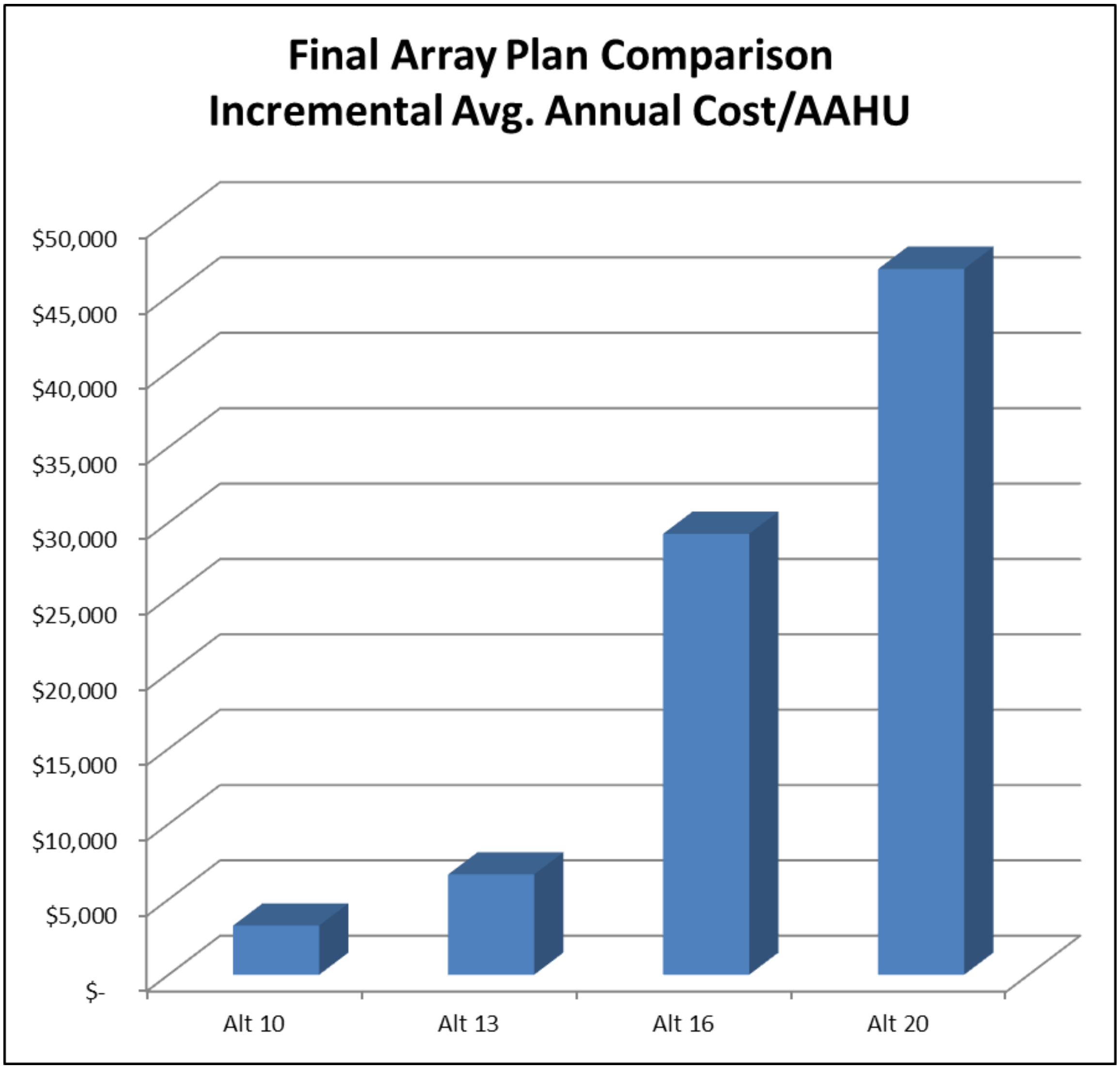


Figure 6-15 Final Array Plan Comparison Incremental Average Annual Cost/AAHU

Based upon these CE/ICA results, Alternative 13 is identified as the NER Plan. The following sections describe considerations other than the CE/ICA analysis considered in the selection of the tentatively selected plan, including completeness, effectiveness and acceptability, as well as the other Principles and Guidelines accounts.

6.6.2 Completeness, Effectiveness and Acceptability Criteria Comparison

Alternative 10 is complete, but less resilient than other alternatives, and only minimally effective as it does not provide key nodal connections to large tributary watersheds. Alternative 13 is incrementally more effective, and complete, as it is more resilient than Alternative 10. Alternative 16 is incrementally more complete and effective as it is more resilient than Alternatives 10 and 13. Alternative 20 is also incrementally more complete, and effective. All four alternatives are acceptable as they comply with applicable laws, regulations and public policies except as mitigated per the discussion in Chapter 5.

6.6.3 Completeness: Objective Analysis Summary

The alternatives were qualitatively analyzed for their ability to meet objectives, which is an important component of completeness. Alternative 10 minimally met the objectives with the incremental differences in 13, 16 and 20 increasing each larger alternative's capacity to meet each objective. For example, in restoring nodal habitat connectivity, Alternative 10 restores minimal connectivity within the reach where none existed before. Compared to Alternative 10, Alternative 13 significantly increases nodal connectivity by 309% reinforcing its selection as the NER plan. Increases in nodal connectivity for Alternatives 16 and 20 are incrementally smaller (85% for 16 and 120% for 20) Alternative 13 adds restoration of a major tributary confluence and Alternative 20 adds a second major tributary. Each alternative adds increasing levels of naturalization of the riverbed and banks with Alternative 13 the first to add significant channel restoration in the centrally located Taylor Yard and Alternative 16 adding the naturalizing of the concrete bed (Reach 8).

6.6.4 Analysis using the Four Accounts

The final array alternatives were also compared using the four accounts of National Ecosystem Restoration (NER), Environmental Quality (EQ), Regional Economic Development (RED), and Other Social Effects (OSE). NER and EQ analysis shows similar results to that seen in the habitat evaluation with the highest incremental increases in benefits realized with Alternative 13. Benefits increase incrementally as the size of the alternative area increases. There are significant temporary adverse effects to environmental quality however, benefits increase after construction. RED benefits are significantly increased for each alternative. However, the largest increase in RED benefits occurs with the incremental change from Alternative 16 to Alternative 20. OSE benefits are similar and increasing with relative area.

6.6.5 Analysis by Constraints

There were 4 key constraints considered in plan formulation: (1) levee policy, (2) HTRW contaminated sites, (3) flood risk management, and (4) real estate costs, Alternatives 10 and 13 have the least interaction with the levee system. All alternatives include similar requirements for use of sites currently known or suspected of having HTRW contamination with the inclusion of two Taylor Yard sites in Reach 6 and Piggyback Yard in Reach 8. Percentages for real estate costs are significantly higher for Alternatives 10 and 13 at 83 and 69percent respectively. Real estate costs in Alternatives 16 and 20 at nearly 50percent are still higher than the policy target of 25percent. Existing conditions flood risk management is maintained with each proposed plan. It was not practicable to avoid any of the constraints of the study and each will include responses for policy compliance. Relocations are necessary in all alternatives with added relocations in Alternative 20.

6.6.6 Impact Analysis

The comparison of the benefits and impacts of each alternative shows that all alternatives will have similar environmental impacts in nearly all categories, with an increase in impacts as the alternatives increase in areal extent from Alternative 10 to 20. Each alternative has temporary impacts due to construction in all categories and similar beneficial cumulative impacts over the long-term. Alternative 20 would have more significant land use changes in reach 3 adjacent to Verdugo Wash and in reach 7 adjacent to the Los Angeles River State Historic Park. The impact analysis supports the choice of any of the four alternatives, however, the larger the alternative the higher the impacts, but with higher beneficial impacts in the long-term.

6.6.7 NER and TSP

While Alternative 10 includes restoration measures in each reach, the subsequent alternatives provide a greater extent of restoration. This can be seen in the following comparisons:

- Habitat Values: Compared to Alternative 10, Alternative 13 and 16 provide an incremental increase of about 600 habitat units each, while Alternative 20 increases HU by just 273 units.
- Acres: Each incremental increase in acres is approximately the same.
- Nodal Habitat Connectivity: Alternative 13 has the highest increase in nodal habitat connectivity in comparison to the other alternatives in the final array at 309%.
- Regional Habitat Connectivity: Alternative 10 connects with the Santa Monica Mountains while Alternative 13 adds the Arroyo Seco connection to the San Gabriels, Alternative 16 has no added regional connections, and Alternative 20 adds a connection to the Verdugo Hills and the Elysian Hills.
- Hydrologic and Hydraulic Connectivity: Natural hydrology and hydraulics are restored and Alternative 13 adds major tributary restoration with inclusion of one half mile of the Arroyo Seco, and Alternative 20 adds another large tributary confluence with restoration of the Verdugo Wash confluence for about one quarter mile. This is also restored in Alternative 10 which has some channel widening in reach 6, but the increased widening of Reach 6 in Alternative 13 is much more significant. Alternatives 16 and 20 include in channel restoration by naturalizing the bed and bank in Reach 8, channel widening in Reaches 5 and 8. Alternative 20 adds widening in reach 2 and a wetland and connection to the river through the Los Angeles River State Historic Park.

When considering whether the increase in benefit justifies the added cost, comparison of costs shows that the smallest incremental increase in cost is only $79 million for Alternative 13 over Alternative 10, Alternatives 16 and 20 each increase costs by $350 and $276 million respectively.

The increased benefits for habitat value, nodal and regional habitat, hydrologic connectivity, and aquatic ecosystem restoration provided by alternatives 16 and 20, including the increase in RED benefits attained by these two larger alternatives make them reasonably acceptable and supportable alternatives. However, these added benefits also come at a higher relative increase in costs. Comparing cost to relative benefits gained, for a much smaller increase in costs over Alternative 10, Alternative 13 includes all the features of 10 and adds significant hydrologic connectivity in Reach 3 with addition of side channel, additional natural river bed in Reach 6, a natural channel confluence in Reach 7 with riparian vegetation lining channel walls, and a significant increase in nodal and regional connectivity of 309%. This alternative provides the greatest increase in net benefits within the final array for the least increase in cost while reasonably meeting the objectives. In addition, Alternative 13 meets all of the Principles and Guidelines criteria as an effective, efficient, complete, and acceptable plan.

After consideration of the materials presented, taking into account the Principles and Guidelines accounts as well as other habitat information, Alternative 13 has been identified as the Tentatively Selected Plan, as it reasonably maximizes net NER benefits.

7 DETAILS OF THE TENTATIVELY SELECTED PLAN

Alternative 13 (ACE) is the Tentatively Selected Plan. Features that make up the ecosystem restoration and recreation components of the TSP are described in Section 7.1. Section 7.2 includes description of plan implementation including apportionment of costs between the Federal government and non-Federal sponsor and allocation of costs among project purposes. It also describes Federal and non-Federal responsibilities for implementation.

7.1 Ecosystem Restoration Features

The TSP, Alternative 13 (ACE) restores 588 acres of habitat throughout the 11 miles of study area, Table 7-1 includes the total approximate acres restored by reach. These acreages reflect newly restored acres as well as existing habitat and open water that will be improved. Acres in the reach descriptions below are newly restored acreages. This includes restoration of valley foothill riparian and freshwater marsh habitat, daylighting of 11 streams (storm drains), creation of side channels in three locations, and restoration at the downsteam end of Arroyo Seco. Restoration measures were described in Chapter 4 Plan Formulation the alternative is depicted on a map at the end of this chapter (Figure 7-7).

Table 7-1 Approximate Acres Restored By Reach

Reach	Acres
1	82
2	39
3	50
4	59
5	41
6	159
7	49
8	109

7.1.1 Reach 1 Pollywog Park Area of Griffith Park

Approximately 60 acres of riparian habitat corridors would be restored along the overbanks of both sides of the river. Overbanks are those areas adjacent to the river where overland flow in flood events could occur in a natural river environment. Areas of restoration include Pollywog Park, the bank between Headworks and the River with a connection under SR-134 to Headworks, the open area directly downstream of Headworks with a connection under Forest Lawn Drive on the same side of SR-134 with Headworks, and on the left bank of Burbank Western Channel.

Figure 7-1 Graphic Depiction of the Restoration in Pollywog Park

This would involve planting a riparian community of cottonwood/willow, sycamore, mugwort, mulefat, and scarlet monkeyflower with a buffer of sagebrush, buckwheat, and native herbaceous plants. It would include irrigation for establishment and water harvesting features to sustain plants, including micro-grading and/or swales to capture and infiltrate water. Water sources could include reclaimed water, harvesting of stormwater and street runoff (with small wetland features at the end of adjacent streets), and/or highway runoff. Where stormwater or street runoff is excessive during storm events, a connection to the River at the downsteam edge of the park would allow it to overflow into the channel, creating a hydrologic connection. Figure 7-1 includes a graphic depiction of the restoration at the downsteam end of Pollywog Park with restoration. Soil amendments would be required. Establishment and drought management for this vegetation would utilize irrigation, either through flood irrigation (simulating a natural riparian regime) or drip irrigation, dependent upon the availability of water. There are no channel modifications within this reach. While there is a levee at the downstream end of this reach, any planting in that area will comply with all levee regulations. This set of measures in this reach subplan was the most incrementally cost effective and beneficial plan for all alternatives in the final array.

7.1.2 Reach 2 Bette Davis Park Area of Griffith Park

Implementation of the habitat corridors/riparian planting measure would result in restoration of approximately 26 acres of riparian habitat corridors along the overbanks of both sides of the River as described for Reach 1. This includes restoration of riparian habitat in the Bette Davis Park area of Griffith Park on the left bank and the area between Zoo Drive and SR-134, with connections under the highway to a restored linear riparian planting along the River extending into Reach 3. There are no channel modifications within this reach. Modifications to vegetation on or adjacent to levees will comply with levee regulations. The existing riparian vegetation in the channel would be maintained and restored through management of invasive species.

7.1.3 Reach 3 Ferraro Fields/Verdugo Wash area of Griffith Park

In this reach a side channel diverts water into a constructed side channel flowing on the west side of Ferraro Fields and daylights a stream currently confined in a large culvert just downstream of Ferraro Fields on the right bank in the Zoo Drive area. The side channel will periodically carry overflows from the main river channel and support a riparian fringe, and open water and freshwater marsh will be located in the daylighted tributary

Figure 7-2 Graphic Rendering of the Ferraro Fields Area

area at the downsteam end of this side channel and rejoin the river. Two additional smaller streams will be daylighted on the left bank. These will include a riparian fringe with freshwater marsh at the confluence with the LA River. Riparian areas are located on the right or west bank along Zoo Drive, on the River's edge of Ferraro Fields, and between the daylighted streams on the left bank. There are no modifications to the channel itself. Levee protection will remain and levee vegetation policy will be followed.   A graphic illustration of the side channel outlet is shown in Figure 7-2.

7.1.4 Reach 4 Griffith Park

Restoration in Reach 4 includes construction of a side channel at the edge of the Griffith Park Golf Course on the west of the Los Feliz Golf Course on the east bank, and a riparian habitat corridor) would include approximately 30 acres of restored riparian and wetland habitat. This is accomplished through a diversion of river flow into a side channel up to 10 feet deep with a riparian fringe through Griffith Park on the right bank, lining the left river bank with a riparian corridor within levee regulation requirements, and day lighting approximately seven small streams.

The side channel through Griffith Park would enter the park from the River under the I-5 Freeway through an existing tunnel (or farther upstream if necessary to facilitate diversion of flows) and exit the park to reenter the River downstream under I-5 through existing tunnels. A riparian fringe of trees and marsh vegetation would line the channel. The Los Feliz Golf Course would be lowered, rebuilt, and allowed to flood (with no changes to the River channel levee walls) in order to establish a riparian habitat interspersed with the golf course greens. Any necessary flood mitigation protection on the outer edge of the golf course will be included in the redesign and rebuilding of the golf course. A graphic depiction of restoration at Los Feliz Golf Course is shown in

Seven storm drains would be opened and naturalized as tributaries as far upstream as possible (at a minimum opening up the stream within the river right-of-way). Depending on the length of the daylighted channel, it would be planted with riparian vegetation and end at the confluence with the River in a small freshwater marsh. If it is not possible to design an efficient confluence, the connection to the river would remain gated. Freshwater marsh vegetation would include clustered field sedge, fragrant flatsedge, Parish's spikerush and common rush, scarlet monkey flower, California bulrush, narrow leaved cattail, and common cattail.

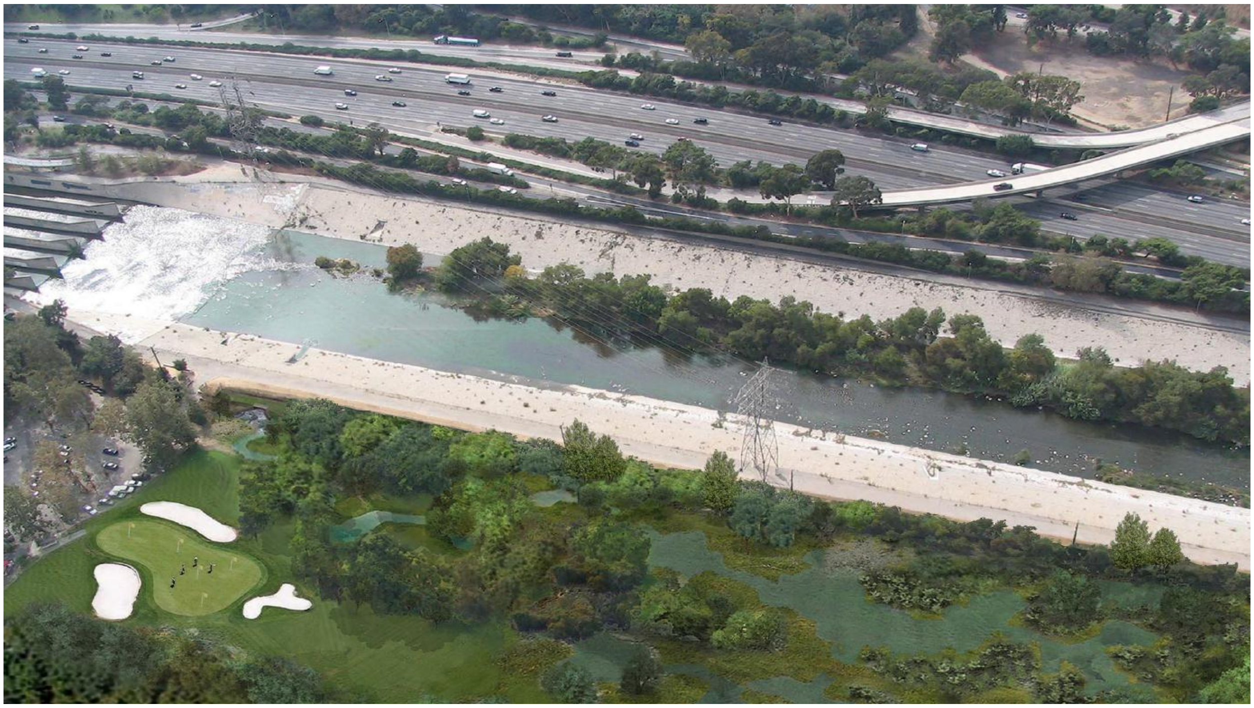


Figure 7-3 Graphic Depiction of Restoration at Los Feliz Golf Course

The riparian corridor would involve planting a riparian strip of mugwort and scarlet monkeyflower with a buffer of and native herbaceous plants which comply with levee vegetation policies. It would include irrigation for establishment and water harvesting features to sustain plants, including micro-grading and/or swales to capture and infiltrate water. Water sources could include reclaimed water, harvesting of stormwater and street runoff (with small wetland features at the end of adjacent streets), and/or highway runoff. Where stormwater or street runoff is excessive during storm events, a connection to the river would allow it to overflow into the channel, creating a hydrologic connection. Soil amendments would be required. Establishment and drought management for this vegetation would utilize irrigation, which would be either through flood irrigation (simulating a natural riparian regime) or drip irrigation, dependent upon the availability of water. This will be implemented as continuously as possible within the requirements of levee regulations. Vegetation in the channel will be restored through invasives removal and management. There are no channel modifications within this reach.

7.1.5 Reach 5 Riverside Drive

This reach will continue implementation of the habitat corridor restoration in a narrow strip along the east bank to avoid interference with the existing levee system (within current guidance for vegetation on levees), and restoration of one daylighted stream area with a riparian fringe and freshwater marsh at the downstream end of this reach on the east bank. The storm drain would be opened and naturalized as a tributary as far upstream as possible (at a minimum, this would open up a confluence within the River right-of-way). Depending on the length of the daylighted channel, it would be planted with riparian vegetation and end at the confluence with the river in a small freshwater marsh of approximately 1 acre. If it is not possible to design an efficient confluence due to the levee, the connection to the river would remain gated.

Freshwater marsh vegetation would include clustered field sedge, fragrant flatsedge, Parish's spikerush and common rush, scarlet monkey flower, California bulrush, narrow leaved cattail, and common cattail.

Existing in-channel riparian and wetland areas would be maintained and restored through management of invasive vegetation.

7.1.6 Reach 6 Taylor Yard

Reach 6 in this alternative includes riparian corridors and widening of the soft bottom river bed by approximately 300 feet and gradual riparian slope to the overbank elevation along the reach length approximately 1,000 feet. At the upstream end of the reach, a back water wetland is developed on a setback bench and there is a small terraced area at the downstream end of the Bowtie parcel. Freshwater marsh dominates the new river bed. The banks of the river downstream of Taylor Yard and on the west bank are restructured to support overhanging vines and other riparian vegetation. Where west banks present a levee conditions around stormwater culverts, vegetation will comply with levee vegetation policies. Existing in-channel riparian and wetland areas would be maintained and restored through management of invasive vegetation. There are LADWP power lines that may require relocation in this reach. A graphic depiction of the restored area is included in Figure 7-4.

Figure 7-4 Graphic Depiction Restored Reach 6 including Taylor Yard

7.1.7 Reach 7 Arroyo Seco/Los Angeles River State Historic Park

In Reach 7, the Arroyo Seco tributary will be restored with riparian habitat. This ephemeral stream will have its banks and bed softened for approximately half a mile upstream and will be stabilized with erosion control elements to maintain the existing protection. At the confluence on the upstream edge of the River, a riparian wetland will be established. Within the River channel itself, the banks will be restructured to support vegetation on the banks. Figure 7-5 includes a graphic rendering depicting the restored section of the Arroyo Seco. There are LADWP power lines adjacent the channel that may require relocation.

Figure 7-5 Graphic Depiction of the Restored Arroyo Seco

7.1.8 Reach 8 Piggyback Yard

In Reach 8, the Piggyback Yard site would be restored with approximately 113 acres of riparian habitat. Micro-grading would slope the site to restore the historical wash that once ran through this area. The restored historical wash would meander through the property and would be connected to the existing river channel through a wide culvert or designed confluence, if possible. The wash location will be determined by the USACE's hydrology and hydraulic analysis and would be located in the most appropriate place during more detailed design.

The riparian corridor measure would involve planting riparian communities of cottonwood/willow, sycamore, mugwort, mulefat, and scarlet monkeyflower with a buffer of sagebrush, buckwheat, and native herbaceous plants. It would include irrigation for establishment and water harvesting features to sustain plants, including micro-grading and/or swales to capture and infiltrate water. Water sources could include overflows from the restored historical wash, reclaimed water, harvesting of stormwater and street runoff (with small wetland features at the end of adjacent streets), and/or highway runoff. Soil amendments would be required. Establishment and drought management for this vegetation would utilize irrigation, which would be either through flood irrigation (simulating a natural riparian regime) or drip irrigation, dependent upon the availability of water. There are no channel modifications within this reach as water entering the River from the historical wash would be routed through existing storm drains in the channel wall.

7.1.9 Recreation Features

The objective of the recreation plan is to maintain and improve the quality and quantity of recreation amenities that complement the ecosystem restoration, especially in regard to promoting access and connectivity between both banks of the river and throughout the length of the reach. The recreation features will be designed to avoid any negative impacts to the restoration areas.

The recreation plan includes the modification, upgrade, or creation of multi-use trails and related basic amenities (access points, wildlife viewpoints, parking lots, restrooms, signage). The plan also includes non-motorized multi-use bridges across the LA River and smaller pedestrian bridges across tributaries or within large restored areas. Specifically, the plan calls for:

- 4.04 miles of new unpaved non-motorized multi-use trail
- 1 bridge spanning Arroyo Seco
- 2 small to medium bridges/crossings within Taylor Yard and Piggyback Yard
- 2 parking lots, one at Taylor Yard and one at Piggyback Yard
- 3 restrooms, one at Bette Davis Park, one at Taylor Yard, and one at Piggyback Yard
- 1 pedestrian tunnel beneath the railroad track on the east side of Taylor Yard
- 19 trail access points throughout the study area
- 5 wildlife viewing points throughout the study area

Recreation features are displayed on a series of maps at the end of this chapter (Figure 7-8). Table 1, below, summarizes the six proposed bridges. Table 7-2, below, summarizes the proposed changes in trails. As shown in the table, the plan would result in 7% of existing trails being upgraded, and a 36% increase in total accessible trails and multi-use paths along the river (when including multi-use paths created by the ecosystem restoration plan).

Table 7-2 Proposed Bridges

Length (ft)	Location	Description
150	Taylor Yard	Elevated crossing of railroad tracks to provide access to/from Taylor Yard for pedestrians
250	Arroyo Seco	Spans Arroyo Seco just before confluence with LA River to connect the downstream side of the Arroyo Seco confluence to an existing bridge across the LA River and the trails being added just upstream on the opposite bank
25	Piggyback Yard	Small pedestrian bridge over restoration area within Piggyback Yard
100	Piggyback Yard	Medium pedestrian bridge over restoration area within Piggyback Yard
250	Piggyback Yard	Medium pedestrian bridge over restoration area within Piggyback Yard
30	Piggyback Yard	Small pedestrian bridge over restoration area within Piggyback Yard

As shown in Table 7-3 below, 20.61 miles of existing trail would not be modified by the recreation plan. However, there would be 1.95 miles of existing length that would be upgraded to a fully-developed multi-use trail. There would also be 4.04 miles of new trail added in the study area, and 5.23 miles of newly accessible multi-use pathway created by the ecosystem restoration plan. At the current level of design, trails are assumed to be multiple-use, twelve feet wide, using a decomposed granite surface. Safety ramps will be part of project design and will be multi-use for maintenance, safety exits, and potential access by kayakers and canoeists.

Table 7-3 Proposed Trail Changes

Trail Type	Miles	% of Total With Project Miles
Existing Trail	20.61	69%
Upgraded road/Trail by Recreation Plan *	1.95	7%
New Trail	4.04	14%
Multi-Use Pathway created by Restoration Plan	5.23	25%
TOTAL	**29.88**	100%
** Upgraded trail does not contribute to the sum of total miles or % of total miles*		

7.1.10 Maintenance Considerations

Operation, maintenance, repair, replacement, and rehabilitation activities (OMRR&R) would occur after the project is constructed in order to keep project features functioning as designed. The OMRR&R costs are currently estimated at $872,000/yr for restoration and $42,000 for recreation. These costs assume annual inspection and maintenance, periodic repair and/or replacement of project features, management of invasives, and provision of irrigation during drought. Costs are based on a percentage of the initial construction cost of items anticipated to require maintenance over the life of the project, and listed in Appendix C Cost. A more detailed Operation and Maintenance Plan will be developed during implementation and will be coordinated with the current O&M plan for the existing flood risk management project.

USACE identified that a modification to the LACDA OMRRR plan would be needed to avoid contradictory maintenance requirements for the areas of restoration features. The LACDA OMRRR plan would thus be modified to accommodate the restoration features, with maintenance of those features a City responsibility under the restoration OMRRR plan.

At the same time, the USACE would modify the LACDA OMRRR plan for the rest of the ARBOR reach to preserve flood risk management function while complementing the restoration project. These modifications would allow some native vegetation to remain in the rest of the reach to the extent that design conveyance capacities would be met or would experience only minimal changes from the Design Conditions. Such OMRRR would be contingent on funding and would be anticipated to be phased in over time. These OMRRR modifications would be refined during design of the restoration project.

7.1.11 Hazardous, Toxic, and Radioactive Waste

As described in this report and Appendix K HTRW Survey Report, there are known and suspected contaminated sites within the study area that cannot be avoided by the project. These include the San Fernando Valley Superfund Site, and Taylor Yard G1 and G2 parcels, and Piggyback Yard. Per ER 1105-2-100, and ER 1165-2-132 if sites cannot be avoided the Corps will cost share related HTRW required activities involving studies or investigations but the non-federal sponsor has responsibility at 100 percent non-project cost for undertaking or ensuring remediation of any known or unknown HTRW to provide sites compatible with the land use necessary for the restoration project. The City would undertake all appropriate inquiries prior to land acquisition and would adequately investigate City-owned lands. The City is responsible for ensuring that all lands provided for the project are remediated to the standards required for the uses of the ecosystem restoration project as determined by the local regulator and with input from USACE. The City may undertake the remediation or ensure the remediation is undertaken prior to providing such lands for construction of project features. Prior to providing a parcel for project construction, the City must ensure that it is either shown to be free of contamination through adequate site investigation or that it has been remediated to regulator and USACE satisfaction to the standards necessary to support the ecosystem restoration project. Additionally, the non-federal sponsor will undertake necessary dewatering activities including treatment and disposal, at 100 percent non-project cost in areas with contaminated groundwater. The City of Los Angeles is aware of these requirements, and has accepted responsibility for delivering lands suitable for ecosystem restoration and addressing groundwater contamination during dewatering.

7.1.12 Construction Phasing

Currently there are anticipated to be four phases to project construction. The four phases are as follows:

- **Phase 1**: Arroyo Seco and daylight channels (Reach 7 to 8) -City cleans Taylor Yard/Bowtie while this phase is in construction
- **Phase 2**: Taylor Yard/Bowtie and vegetated banks (Reach 6)
- **Phase 3**: Daylight channels Reaches 3 to 5, side channels Ferraro, Griffith and Los Feliz-City cleans PBY
- **Phase 4**: PBY and remaining habitat corridors

In an effort to reduce construction costs, sequencing of the earthwork operations for the HTRW remediation and grading to project design grades should be performed to eliminate double handling of soils and materials. This sequencing is proposed as follows and depicted in the conceptual and not to scale figure below. Sequencing is further discussed in Section 9 of the HTRW Appendix: City responsibility:

1. Dewatering and subsequent contamination remediation prior to earthwork activities and prior to construction of the project would be needed to be performed. Continuation of dewatering would likely continue throughout construction of the project and monitoring and treatment would need to be performed by the non-federal sponsor.
2. City responsibility: Removal of HTRW impacted soils would be performed by the non-federal sponsor to the depth and grade required for restoration standards leaving in place the river channel and/or existing levee. If contaminants extend into channel or levee right of way, additional coordination with USACE would be needed to avoid flood risk management impacts during remediation.
3. City responsibility: The resulting excavation should not be filled beyond the design grades for the project landward of the channel.
4. Restoration Project construction: Modification of the channel and/or removal of the existing levee would be performed.
5. Restoration Project construction: Placement of fill to meet the desired grades at the channel would be made.
6. Restoration Project construction: Any planting and habitat efforts would be made.

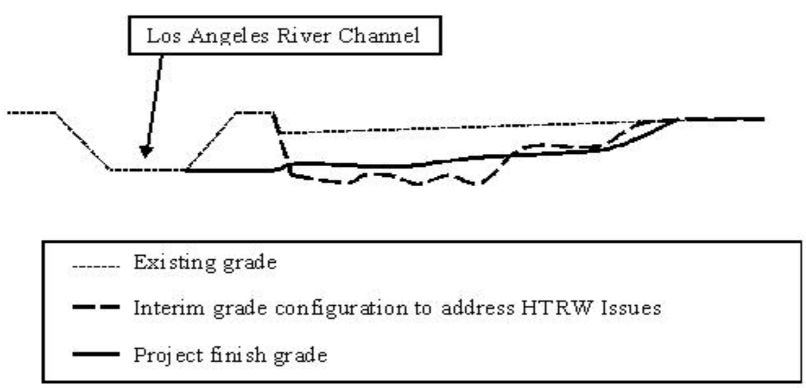


Figure 7-6 Conceptual earthwork sequencing

7.1.13 Monitoring and Adaptive management

Monitoring and adaptive management consists of the examination of terrestrial and aquatic plantings for a period 5 years following construction to ensure survival of all plants needed in the restoration effort. Plants that expire within this period would be replaced in-kind. Areas that exhibit high rates of die-off may be evaluated and adaptive measures undertaken to reestablish either more appropriate plant types, or to modify features of the project, such as irrigation rates or locations, to achieve appropriate and maximum habitat value for that area of the project. It is expected that monitoring, and potential modification of vegetation types and locations may be required to ultimately achieve maximum habitat value, structure, and potential diversity.

Monitoring and adaptive management plan for this project will be developed per the guidance resulting from Section 2039 of WRDA 2007 and implementation guidance dated August 31, 2009. A more detailed plan describing monitoring and adaptive management activities will be included in the final report and based upon the recommended plan. That plan will include cost shared monitoring for the first 10 years after project construction and will be developed in detail during PED.

7.1.14 Cost Summary

Table 7-4 below summarizes the costs of the tentatively selected plan. Data for this estimate is provided in the Cost Appendix. Following public review of the Draft Report and selection of the Recommended Plan a more detailed cost estimate will be developed using the Corps MCACES version Mii software. A Total Project Cost Summary with refined contingency costs based upon a detailed cost and schedule risk analysis will also be developed for the Recommended Plan.

Table 7-4 Cost Summary Table of the Tentatively Selected Plan, Alternative 13

Los Angeles River Ecosytem Restoration Program Year 2013	
Construction Item	Cost ($1,000)
Lands and Damages	300,059
Relocations	13,671
Channels	120,213
Recreation Facilities	6,134
Preconstruction Engineering and Design (PED)	12,105
Construction Management (S&A)	7,259
Total First Cost	**459,837**

7.2 Plan Implementation

This section presents the Federal and non-Federal responsibilities for implementing the tentatively selected plan. This includes Federal and non-Federal project cost sharing requirements and the division of responsibilities between the Federal government and the Non-Federal Sponsor, the City of Los Angeles. It also lists the steps toward project approval, and a schedule of the major milestones for the design and construction of the tentatively recommended plan.

7.2.1 Cost Apportionment for the Tentatively Selected Plan

Table 7-5 below represents the total costs for the tentatively selected plan for the ecosystem restoration and recreation features.

The non-Federal share of ecosystem restoration project implementation costs (pre-construction engineering and design, and construction) is 35 percent. The non-Federal sponsor shall provide all lands, easements, rights-of-way and dredged or excavated material disposal areas required for the ecosystem restoration features and perform all necessary relocations, what together are known as LERRD. In addition to LERRD, the non-Federal sponsor's obligations for total ecosystem restoration costs generally includes the costs of the sponsor's participation in the Project Coordination Team, the costs of audits performed by the sponsor, the costs of investigations for hazardous substances performed by the sponsor, as well as any additional funds needed to make its total contribution for ecosystem restoration costs equal to 35 percent.

The Non-Federal Sponsor has waived reimbursement for, and the Government shall not credit the Non-Federal Sponsor for, the value of lands, easements, rights-of-way, relocations, and improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material that exceeds 35 percent of total ecosystem restoration costs. The Assistant Secretary of the Army (Civil Works) granted the Non-Federal Sponsor's request to waiver reimbursement for provision and performance of LERRD that exceeds its share of total ecosystem restoration costs on August 8, 2013.

The total project cost to be authorized by Congress may be adjusted to reflect the waiver of reimbursement for LERRD that exceeds the Non-Federal Sponsor's share of total ecosystem restoration costs. The LERRD value for which the sponsor is waiving reimbursement will be shown in the Final IFR. The difference between the total costs of the project as shown below and the total project cost to be authorized by Congress will be shown in the Final IFR and the Chief of Engineers' Report.

Due to the high LERRD cost identified for the project, the sponsor's share of cost-shared ecosystem restoration costs is anticipated to be satisfied through provision of LERRD if all crediting processes and restrictions are followed. The Non-Federal Sponsor has not waived reimbursement for the costs of other project obligations. If a Design Agreement is entered into by the Department of the Army and the sponsor to undertake design of the project, prior to entering a Project Partnership Agreement, and therefore prior to provision, performance and crediting of any LERRD required for the project, the sponsor would be required to provide 35 percent of the costs of design under that agreement. However, because design costs are part of construction, the costs of design for ecosystem restoration that exceed the sponsor's share of cost shared costs would be eligible for reimbursement, subject to availability of funds, at the final accounting of the project. The non-Federal sponsor's costs of participation in the Project Coordination Team, costs of audits performed by the sponsor, and costs of investigations for hazardous substances performed by the sponsor, may also be eligible for reimbursement, subject to the availability of funds and the specific provisions of the Project Partnership Agreement.

The non-Federal sponsor is also responsible for 50 percent of recreation costs as shown below.

The non-Federal sponsor will pay 100 percent of the costs for operation, maintenance, repair, rehabilitation, and replacement (OMRRR) for the project. The non-Federal sponsor will also pay 100 percent of the costs of remediation for CERCLA hazardous substances, not part of total project costs.

Table 7-5 Federal and Non-Federal Apportionment of Initial Costs of the Tentatively Selected Plan

(Note: the total project cost to be authorized may differ from the display of initial costs below, to reflect the waiver of reimbursement for LERRD exceeding the sponsor's share of total ecosystem restoration costs and exclusion of such LERRD from total project cost.)

Item	Costs ($K)		
	Federal	**Non-Federal**	**Total**
Construction of Ecosystem Restoration Features*	$139,676,634	$0	$139,676,634
LERRDs***	$0	$313,729,423	
Total First Cost of Ecosystem Restoration including LERRD for which reimbursement is waived		$313,729,423	$453,406,057
Total Cost Share for Ecosystem Restoration to be shown in the FINAL IFR			
Total Cost-Shared Costs for Recreation	$3,066,851	$3,066,851	$6,133,701
Percentage of Total Cost-Shared Amount – Recreation	50%	50%	100%
TOTAL FIRST COSTS			**$459,539,758**

**Construction, S&A, PED/EDC and Contingency, does not include IDC or OMRR&R*
***Monitoring and Adaptive Management is assumed to be 5% of the ecosystem restoration construction cost.*
****Lands, easements, rights of way, relocations, and disposal areas*

Table 7-6 presents the allocation of costs and benefits by project purpose and summarizes the benefits analysis results for the ecosystem restoration primary purpose and the recreation secondary purpose.

Table 7-6 Allocation of Initial Costs by Purpose for the Tentatively Selected Plan

Item	Ecosystem Restoration		Recreation		Total	
	Allocated Costs ($K)	Benefits (AAHUs)	Allocated Costs ($K)	Benefits ($K)	Cost	Benefits
Investment Cost						
First Cost	$453,406		$6,134		$459,540	
IDC	$2,809		$57		$2,866	
Total	$456,215		$6,191		$462,406	
Annual Cost						
Interest & Amortization	$20,355		$276		$20,611	
OMRR&R	$872		$42		$915	
Subtotal	$21,208		$318		$21,526	
Annual Benefits						
Monetary				$2,390	$21,526	$2,390
Non-Monetary		5,902				5,902 *AAHU's*
Benefit-to-Cost Ratio		N/A		7.51		
Based on FY2013 price levels, 3.75% discount rate, and 50 year period of analysis.						

7.2.2 Division of Plan Responsibilities

The Water Resources Development Act (WRDA) of 1986 (Public Law 99-662) and various administrative policies have established the basis for the division of Federal and non-Federal responsibilities in the construction, maintenance, and operation of Federal water resource projects accomplished under the direction of the Corps. Anticipated Federal and non-Federal responsibilities are described in this section. The final division of specific responsibilities will be formalized in the project partnership agreement (PPA).

Federal Responsibilities

The estimated Federal share of the total first cost of the project is 65 percent of first costs related to ecosystem restoration and 50 percent of first costs related to recreation. First costs are typically all costs to implement the project inclusive of LERRD but do not include OMRR&R costs or remediation of hazardous substances regulated by CERCLA. The Federal Government's responsibilities are anticipated to be:

a. Sharing a percentage of the costs for Preconstruction, Engineering and Design (PED), including preparation of the Plans and Specifications, which is cost shared at the same percentage that applies to construction of the project.

b. Sharing a percentage of construction costs for the project.

c. Administering contracts for construction and supervision of the project after authorization funding and receipt of non-Federal assurances.

Non-Federal Responsibilities

Federal implementation of the recommended project would be subject to the non-Federal sponsor agreeing to comply with applicable Federal laws and policies, including but not limited to:

a. Provide 35 percent of total ecosystem restoration costs as further specified below:
   1. Provide 35 percent of design costs allocated by the Government to ecosystem restoration in accordance with the terms of a design agreement entered into prior to commencement of design work for the ecosystem restoration features;
   2. Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material all as determined by the Government to be required or to be necessary for the construction, operation, and maintenance of the ecosystem restoration features, but no credit shall be afforded, and no reimbursement shall be provided to the Non-Federal Sponsor, for any value of lands, easements, rights-of-way, relocations, or improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material that exceeds 35 percent of total ecosystem restoration costs;
   3. Provide, during construction, any additional funds necessary to make its total contribution for ecosystem restoration equal to 35 percent of total ecosystem restoration costs;

b. Provide 50 percent of total recreation costs as further specified below:
   1. Provide 35 percent of design costs allocated by the Government to recreation in accordance with the terms of a design agreement entered into prior to commencement of design work for the recreation features;
   2. Provide, during the first year of construction, any additional funds necessary to pay the full non-Federal share of design costs allocated by the Government to recreation;
   3. Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material all as determined by the Government to be required or to be necessary for the construction, operation, and maintenance of the recreation features;
   4. Provide, during construction, any additional funds necessary to make its total contribution for recreation equal to 50 percent of total recreation costs;

c. Provide, during construction, 100 percent of the total recreation costs that exceed an amount equal to 10 percent of the Federal share of total ecosystem restoration costs;

d. Shall not use funds from other Federal programs, including any non-Federal contribution required as a matching share therefor, to meet any of the non-Federal obligations for the project unless the Federal agency providing the Federal portion of such funds verifies in writing that expenditure of such funds for such purpose is authorized;

e. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements, and rights-of-way or the addition of facilities which might reduce the outputs produced by the ecosystem restoration features, hinder operation and maintenance of the project, or interfere with the project's proper function;

f. Shall not use the ecosystem restoration features or lands, easements, and rights-of-way required for such features as a wetlands bank or mitigation credit for any other project;

g. Keep the recreation features, and access roads, parking areas, and other associated public use facilities, open and available to all on equal terms;

h. Comply with all applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended (42 U.S.C. 4601-4655), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way required for construction, operation, and maintenance of the project, including those necessary for relocations, the borrowing of materials, or the disposal of dredged or excavated material; and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;

i. For so long as the project remains authorized, operate, maintain, repair, rehabilitate, and replace the project, or functional portions of the project, including any mitigation features, at no cost to the Federal Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government;

j. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the project for the purpose of completing, inspecting, operating, maintaining, repairing, rehabilitating, or replacing the project;

k. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, rehabilitation, and replacement of the project and any betterments, except for damages due to the fault or negligence of the United States or its contractors;

l. Keep and maintain books, records, documents, or other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, or other evidence are required, to the extent and in such detail as will properly reflect total project costs, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 Code of Federal Regulations (CFR) Section 33.20;

m. Comply with all applicable Federal and State laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"; and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141- 3148 and 40 U.S.C. 3701 – 3708 (revising, codifying and enacting without substantial change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a et seq.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 et seq.), and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c et seq.);

n. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 96-510, as amended (42 U.S.C. 9601-9675), that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction, operation, and maintenance of the project. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the non-Federal sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigations in accordance with such written direction;

o. Assume, as between the Federal Government and the non-Federal sponsor, complete financial responsibility for all necessary remediation and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction, operation, and maintenance of the project;

p. Agree, as between the Federal Government and the non-Federal sponsor, that the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, repair, rehabilitate, and replace the project in a manner that will not cause liability to arise under CERCLA; and

q. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 U.S.C. 1962d-5b), and Section 103(j) of the Water Resources Development Act of 1986, Public Law 99-662, as amended (33 U.S.C. 2213(j)), which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until each non-Federal interest has entered into a written agreement to furnish its required cooperation for the project or separable element.

7.2.3 Non-Federal Sponsors Financial Capability

The non-Federal sponsor has committed to provide its share of total project costs, as well as all LERRD required for the project including LERRD that is excluded from reimbursement. The non-Federal sponsor has also made a commitment to undertake all necessary response and remediation for CERCLA contaminants required for the Project, including providing lands free of soil contamination prior to construction of the Project features on those lands and handling groundwater contamination during construction activities.

7.2.4 Project Partnership Agreement

Prior to advertisement for the first construction contract, a Project Partnership Agreement will be required to be signed by the Federal Government and the City of Los Angeles, requiring formal assurances of local cooperation from the City. This agreement will be prepared and negotiated during the Plans and Specifications Phase.

7.2.5 Approval and Implementation

The necessary reviews and activities leading to approval and implementation of the tentatively recommended plan are listed below:

a. Environmental Impact Statement Filing – the Final IFR will be circulated to State and Federal Agencies as direct by HQUSACE for the 30-Day State and Agency review. The District will concurrently distribute the Final IFR to parties not included on the HQUSACE mailing list. The District will then file the decision document and Final IFR together with the proposed report of the Chief of Engineers with EPA.

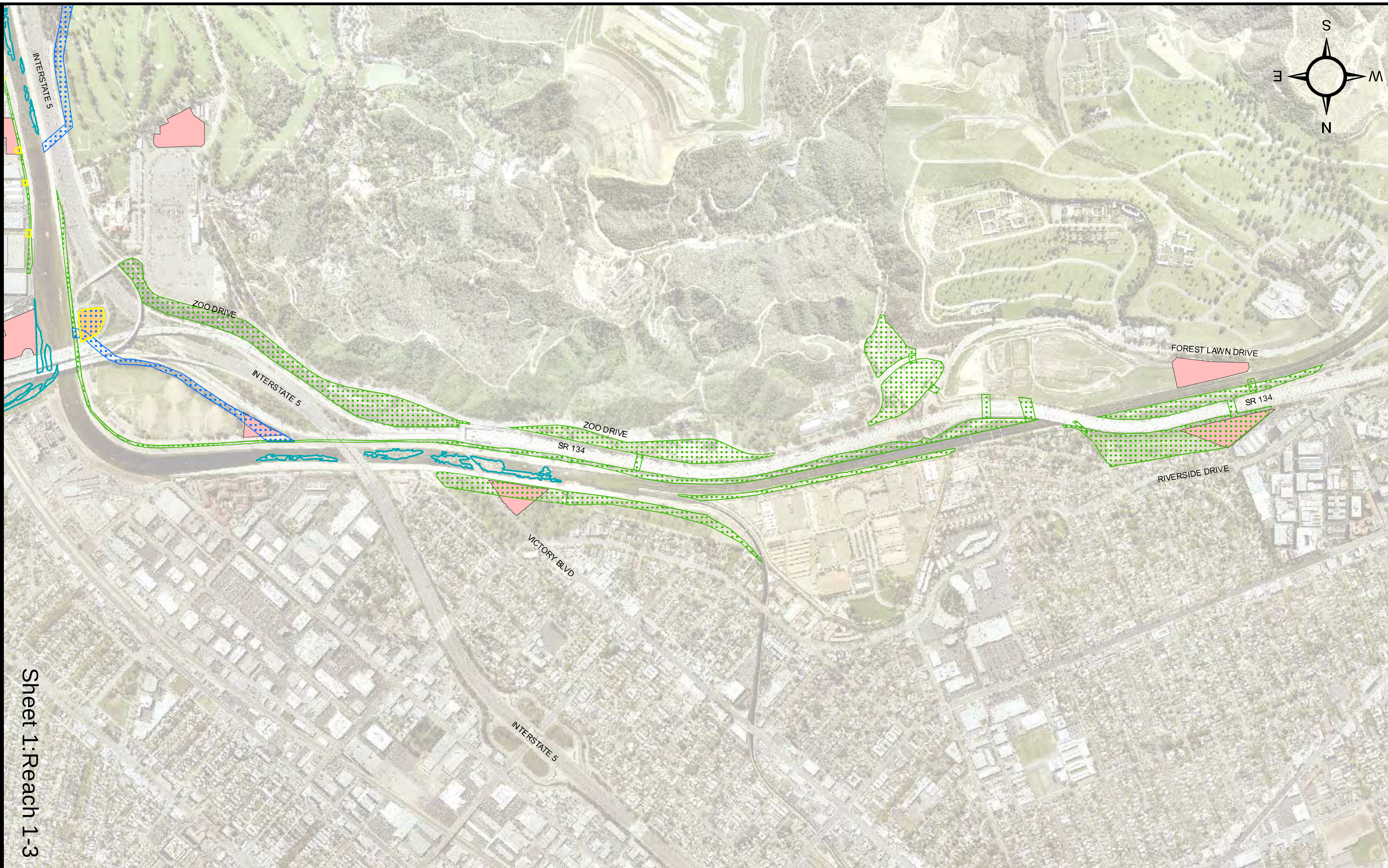
b. Chief of Engineers Approval – Chief of Engineer signs the report signifying approval of the project recommendation and submits the following to ASA (CW): the Chief of Engineers Report, the Final IFR, and the unsigned ROD.

c. ASA (CW) Approval – The Assistant Secretary of the Army for Civil Works will review the documents to determine the level of administration support for the Chief of Engineers recommendation. The ASA (CW) will formally submit the report to the Office of Management and Budget (OMB). OMB will review the recommendation to determine its relationship to the program of the President. OMB may clear the release of the report to Congress.

d. Project requires congressional approval for construction.

e. Funds could be provided, when appropriated in the budget, for preconstruction, engineering and design (PED), upon issuance of the Division Commander’s public notice announcing the completion of the final report and pending project authorization for construction. Surveys, model studies, and detailed engineering and design for PED studies will be accomplished first and then plans and specifications will be completed, upon receipt of funds

f. Construction would be performed with Federal and non-Federal funds, once the construction project was advertised and awarded.



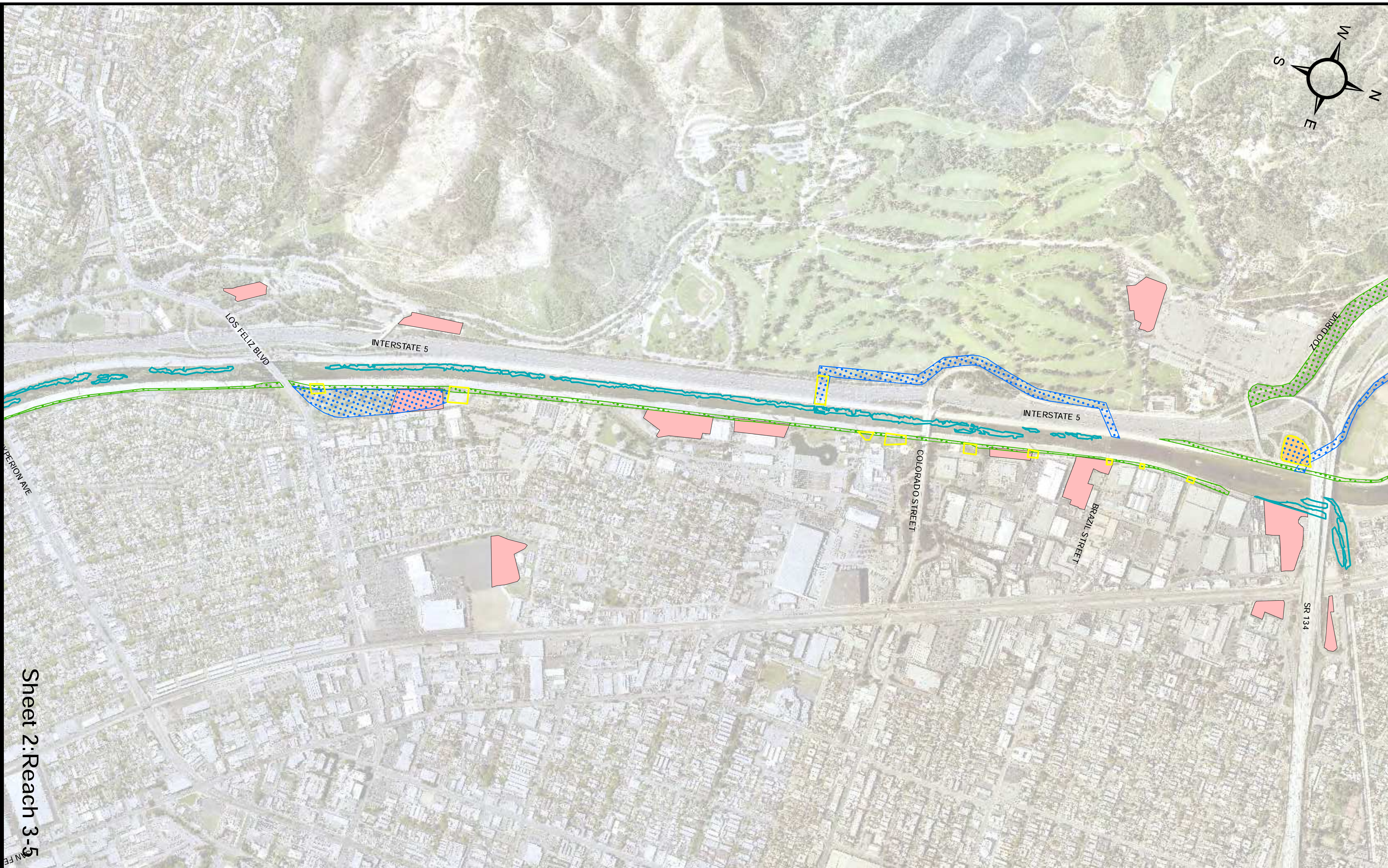
LEGEND
Sub-Measures

- 2. Expose stormdrain outlets; convert to natural stream confluence
- 3/5. Create geomorphology and plant for freshwater marsh
- 10. Divert tributary & river flow into side channels
- 17. Habitat corridors/riparian planting on banks
- 29. Invasive management
- Potential Temporary Construction Staging Areas

Data Source: USACE, 2011
City of Los Angeles, 2011
Aerial Source: LARIC 2008

Alternative 13, ARBOR Corridor Extension (ACE)
Los Angeles River Ecosystem Restoration (Feb, 2013)

0 0.2 0.4 Miles



Sheet 2:Reach 3-5

LEGEND
Sub-Measures

- 2. Expose stormdrain outlets; convert to natural stream confluence
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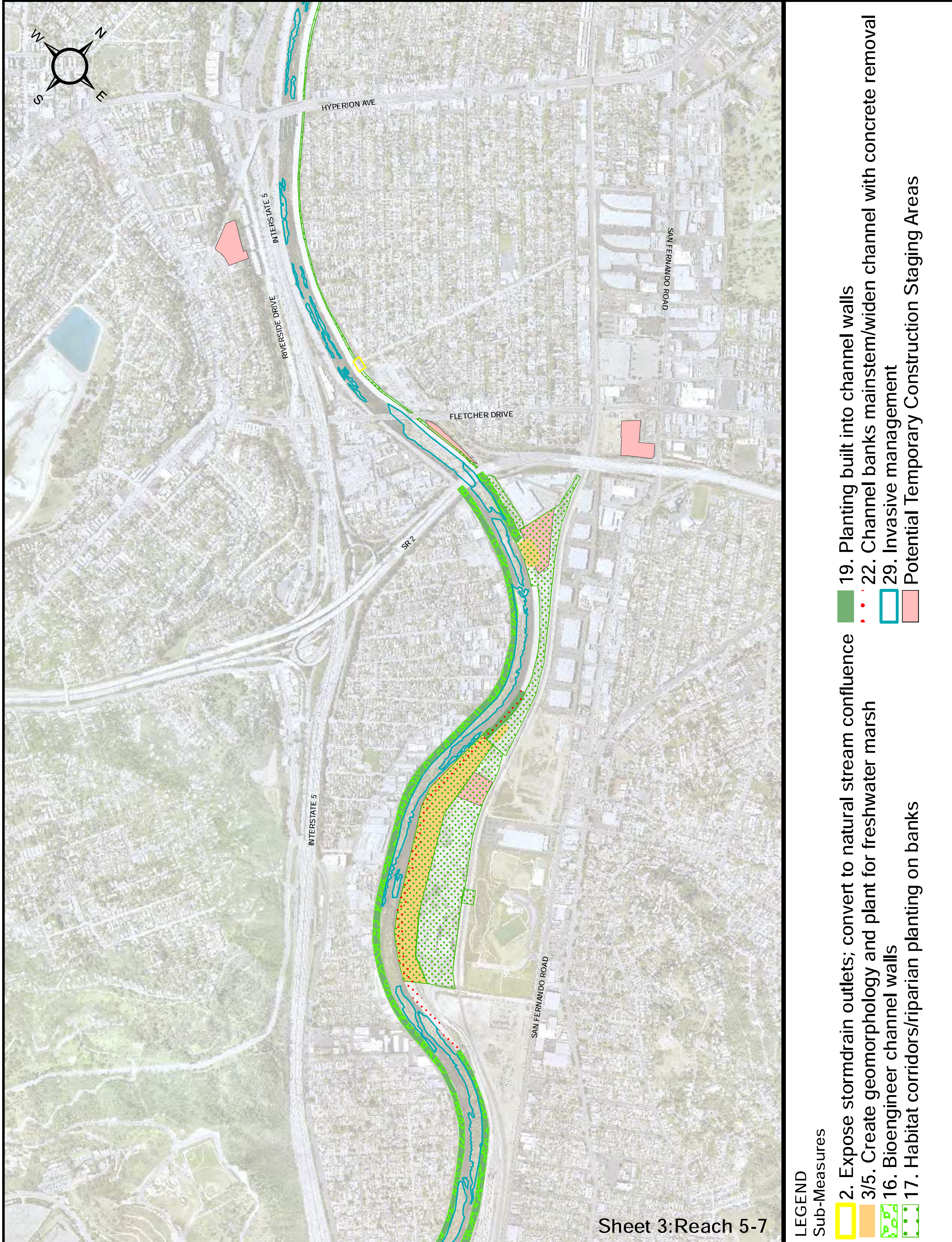

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City of Los Angeles, 2011
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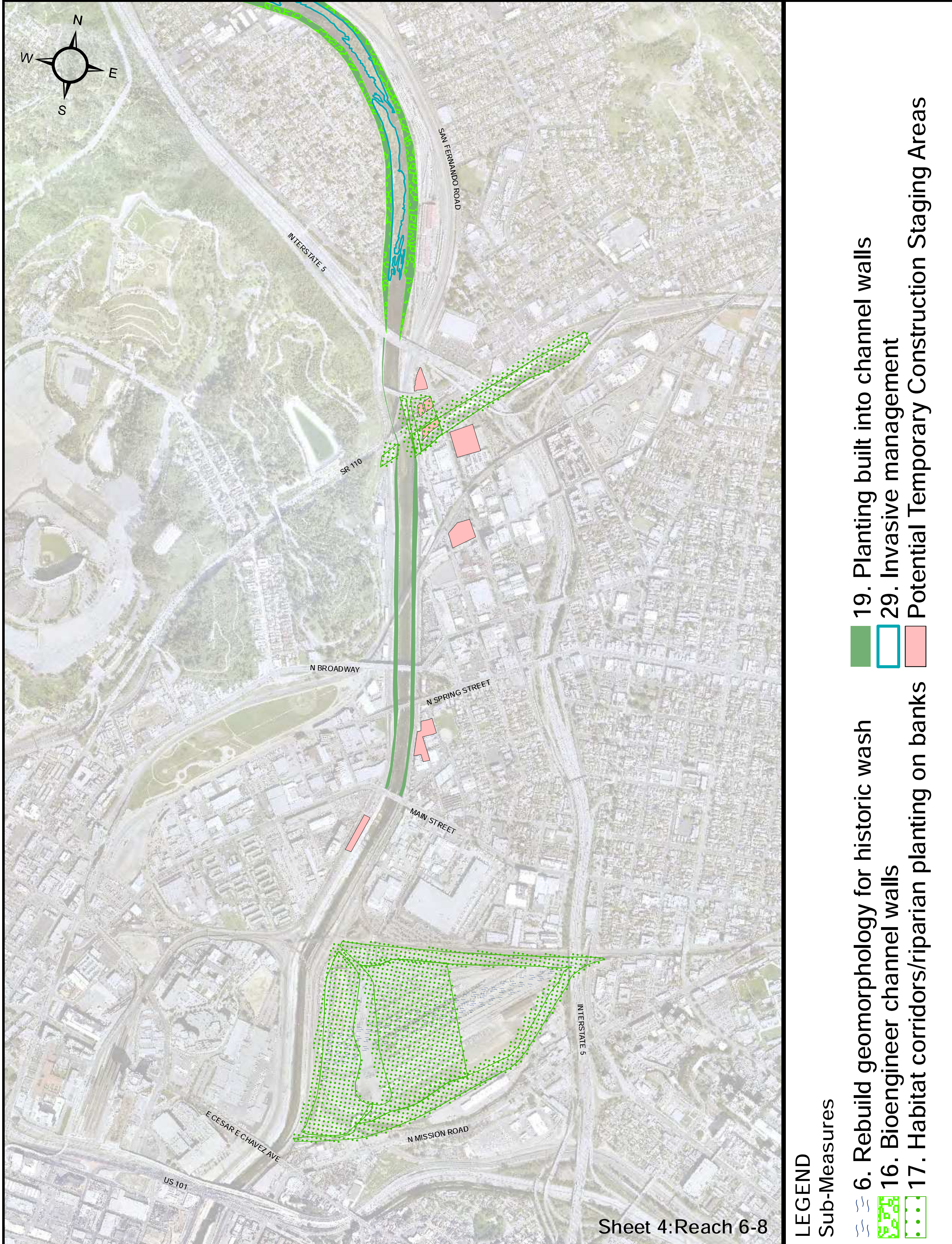
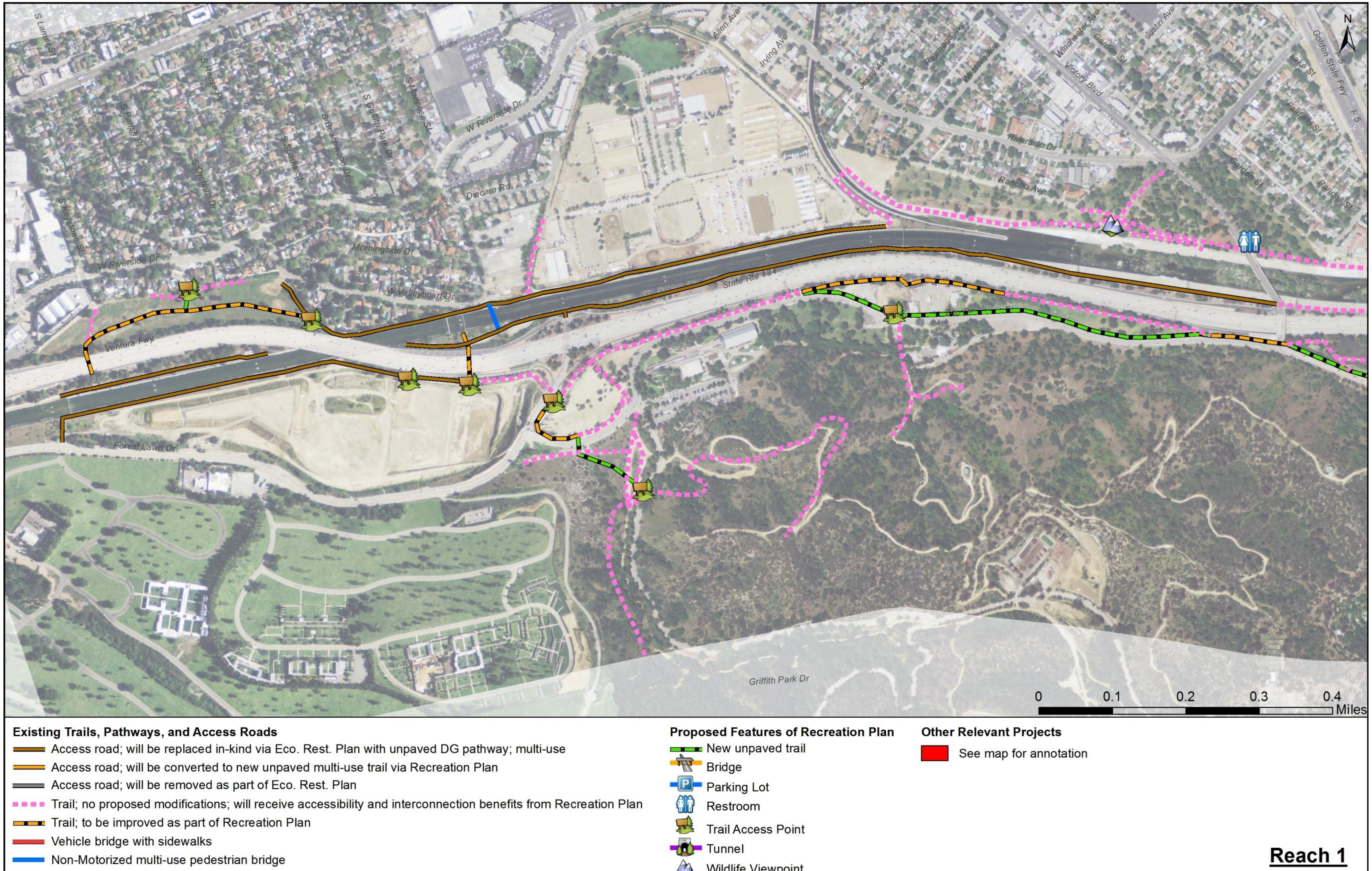


Data Source: USACE, 2011
City of Los Angeles, 2011
Aerial Source: LARIC 2008

Alternative 13, ARBOR Corridor Extension (ACE)
Los Angeles River Ecosystem Restoration (Feb, 2013)

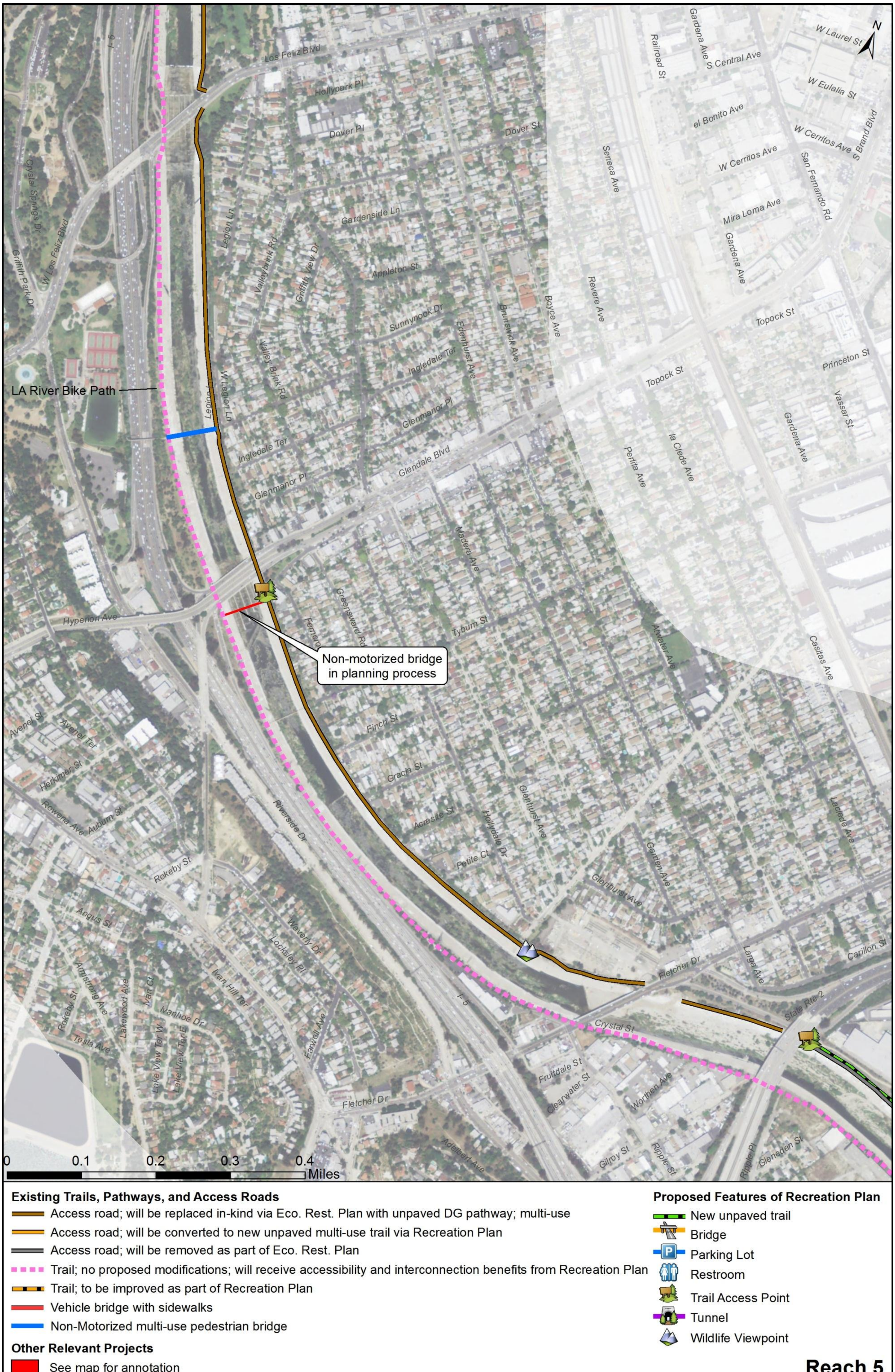
0 0.2 0.4 Miles



Recreation Plan Reach 1

Recreation Plan Reaches 2 and 3

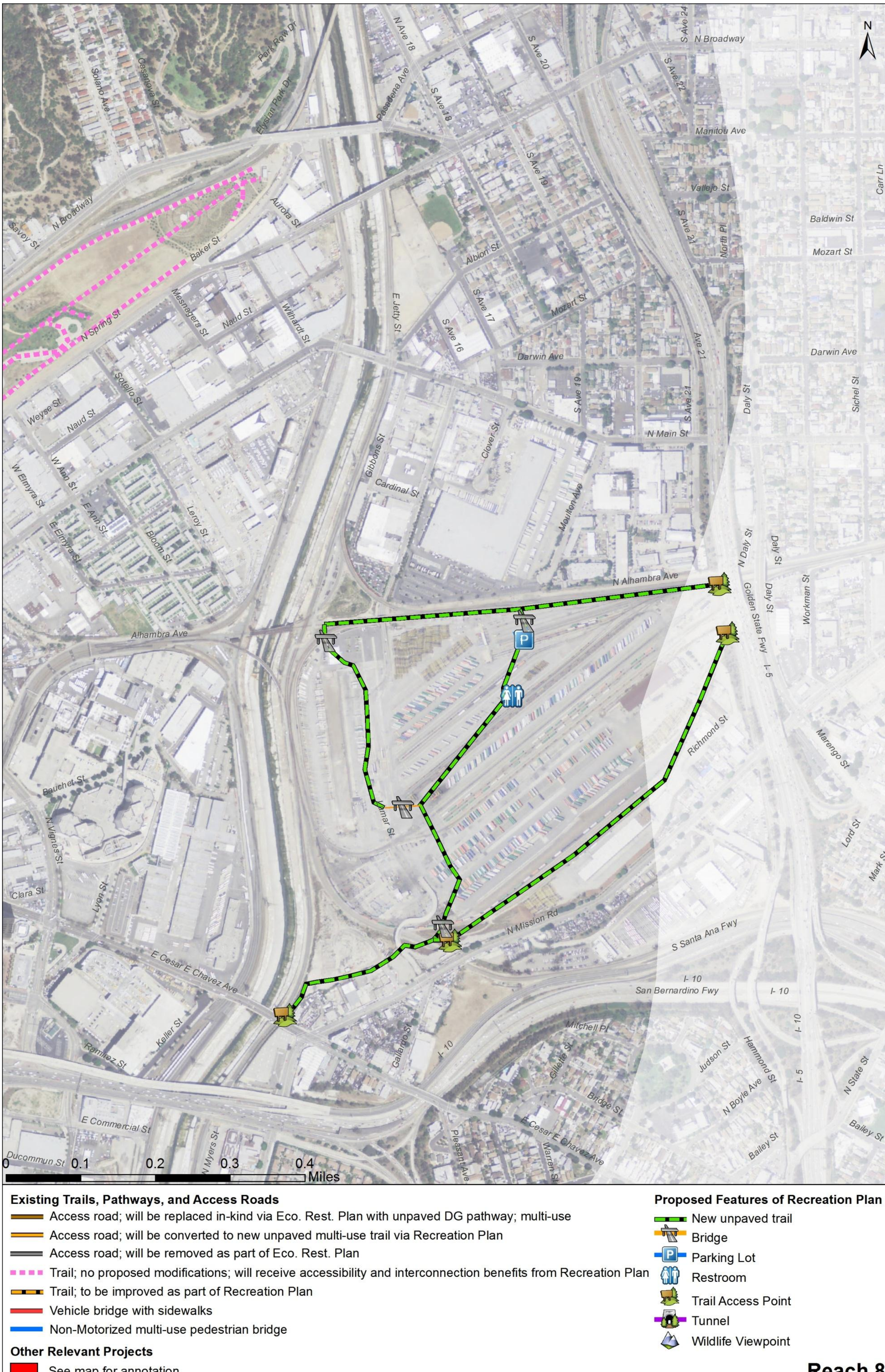
Recreation Plan Reach 4



Recreation Plan Reach 5

Recreation Plan Reach 6

Recreation Plan Reach 7



Recreation Plan Reach 8

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8 PUBLIC INVOLVEMENT

8.1 Overview and History of Public Involvement

The development of the proposed restoration efforts has resulted from a systematic process of evaluating the River's existing conditions and any associated problems and opportunities, then identifying objectives to help solve the problems and measures for realizing those opportunities. Throughout this process, public involvement has been an essential and invaluable ingredient. Beginning with the development of the LARRMP in 2005, the public has been invited to engage in the decision-making process at each step, including review of the Programmatic EIS/EIR for the LARRMP, and development and review of this IFR. An overview of public involvement throughout this process is included in Table 8-1. Additional details regarding each of the steps of this process are provided in the sections below.

Table 8-1 History of Public Involvement

Document	Timeframe	Public Involvement
Los Angeles River Revitalization Master Plan	2005-2007	During a 20-month period, a total of six sets of workshops were held to introduce the public to the LARRMP process and to solicit input for its development. A total of 17 workshops were held from San Fernando Valley to downtown Los Angeles. In addition, public briefings for professional organizations, briefings for Neighborhood Councils, press conferences, briefings for Congressional representatives, and a youth summit for several hundred high school students have taken place.
LARRMP Programmatic EIS/EIR	February 2007	The final series of public involvement workshops for the LARRMP were dedicated to updating the public about the Draft document and providing public hearings regarding the Programmatic EIS/EIR. Three workshops/public hearings were conducted in River-adjacent communities.
Los Angeles River Ecosystem Restoration Feasibility Study	2009-2012	A 3-day planning charette was held in December of 2009 to introduce the Los Angeles River Restoration IFR and solicit feedback on the study area's problems and opportunities, objectives to address them, and measures that could be used to meet the objectives. Participants included staff from the USACE, County, City, resource and municipal agencies, and non-governmental organizations, as well as local community members and consultants. Meetings with agencies on the Habitat Evaluation Team, and meetings with the Urban Watershed group, the Light Rail group, and other agencies.
Los Angeles River Ecosystem Restoration Feasibility Report and Integrated EIS/EIR	2013	A 45-day review period will be available to the public following completion of the Draft IFR.
River Update Meetings	2005-2013	Since 2007, a total of six meetings have been held for public information and to solicit public input. The meetings have provided status updates on the LARRMP as well as discussion on the development of the IFR.

8.2 Los Angeles River Revitalization Master Plan

The community outreach process for the Los Angeles River Revitalization Master Plan needed to address a considerable geographic coverage area. In addition, it had to meet the challenge of attracting and involving potential new stakeholders, non-English-speaking stakeholders, and stakeholders who had not participated in or were not familiar with public involvement processes. Importantly, the outreach process sought to recognize past contributions and concerns from a broad range of existing leaders, community groups, and residents, thereby ensuring their ongoing participation and maximizing the continuity and historical framework of previous involvement.

The following objectives helped focus the outreach effort:

- Empower residents, businesses, and community leaders to participate in River-related decision- and policy-making processes that impact their lives and their livelihoods.
- Utilize an inclusive outreach strategy that maximizes input opportunities from existing project stakeholders while simultaneously working to identify and motivate new participants.
- Reinforce that community members are included in the decision-making process, and that their input is valued and incorporated.
- Create multiple opportunities for the generation of ideas and alternatives.
- Build trust in, and ultimately consensus around, the project by ensuring that stakeholders feel vested in the decision-making process.

The outreach strategy for this project was predicated on three critical factors:

- Increasing public awareness through an aggressive campaign that included a proactive outreach to both known and new stakeholders,
- A strong and creative media component, and
- Creating an atmosphere of celebration, uniqueness, and relevance at each of the community events.

The outreach effort employed a mix of tools that included development of the project's identity, database development, stakeholder interviews, targeted/local impact outreach, community workshops, media strategy, and development of project-related collateral material and website. The website was integral to building participation among new stakeholders, encouraging their repeated participation, and harnessing the existing hard work and enthusiasm of established groups. Most importantly, outreach was conducted with awareness of multi-lingual needs and cultural sensitivities.

As public input was collected, a consistent pattern of interest emerged that revealed a clear, primary concern for how the surrounding communities and general public will safely use the River for recreation and enjoyment. In particular, interest was expressed for improving public access, creating more open/green space, dedicating space for athletics, beautifying the River with landscaping, retuning the River to its natural state, preserving existing neighborhoods, finding socially conscious solutions to homelessness issues, and keeping the River and its environs clean and safe. Additionally, areas of interest such as arts/public art, community involvement/education, water quality, flood risk management, habitat, land use, and River management received significant feedback and comment.

Methods used to communicate the planning efforts to the public included press conferences and coverage in the local, national, and global media as well as newsletters and other community notifications distributed on a regular basis.

In addition to the public outreach conducted as part of this IFR, outreach was conducted by the Alianza de los Pueblos del Rio, a collaborative organization funded by the Packard Foundation to concentrate outreach efforts in the Latino community. The Alianza hosted three public workshops in August 2006, and involved organizations such as the Mujeres de la Tierra, the William C. Velasquez Institute, the Anahuak Youth Soccer Association, and the Center for Law in the Public Interest.

8.2.1 LARRMP Workshops

SERIES #1, Meetings 1 & 2

- Saturday, October 15, 2005; 10 a.m. – 12:30 p.m.

North Weddington Recreation Center, North Hollywood

- Saturday, October 22; 10 a.m. – 2 p.m.

Goodwill Work Source Center, Cypress Park

SERIES #2, Meetings 3, 4, & 5

- Saturday, January 21, 2006; 10 a.m. – 12:30 p.m.

Reseda High School, 18230 Kittredge Street, Reseda

- Tuesday, January 24, 2006; 6 p.m. – 8:30 p.m.

Exposition Park Intergenerational Community Center, 3890 S. Menlo Avenue, Los Angeles

- Saturday, January 28, 2006; 10 a.m. – 12:30 p.m.

Chevy Chase Recreation Center, 4165 Chevy Chase Drive, Los Angeles

SERIES #3, Meetings 6, 7, & 8

- Saturday, March 25; 10 a.m. – 12:30 p.m.

Birmingham High School in Van Nuys

- Tuesday, March 28; 6 p.m. – 8:30 p.m.

Glassell Park Elementary School in Los Angeles

- Wednesday, March 29; 6 p.m. – 8:30 p.m.

International Institute of Los Angeles

SERIES #4, Meetings 9, 10, & 11

- Saturday, June 24; 10 a.m. – 12:30 p.m.

Goodwill Work Source Center, 342 N. Fernando Road, Los Angeles

- Tuesday, June 27; 6 p.m. – 8:30 p.m.

Oakwood School, 11600 Magnolia Boulevard, North Hollywood

- Wednesday, June 28; 6 p.m. – 8:30 p.m.

Evergreen Recreation Center, 2839 E. 4th Street, Boyle Heights

SERIES #5, Meetings 12, 13, & 14

- Tuesday, September 26; 6 p.m. – 8:30 p.m.

The New Academy – Gymnasium, 21425 Cohassett Street, Canoga Park

- Wednesday, September 27; 6 p.m. – 8:30 p.m.

LADWP Headquarters – Auditorium, 111 N. Hope Street, Los Angeles

- Saturday, September 30; 10 a.m. – 12:30 p.m.

Chevy Chase Recreation Center, 4165 Chevy Chase Drive, Atwater Village

SERIES #6, Meetings 15, 16, 17, 18, 19, & 20
(Each location and date below included a separate Public Hearing on the Draft Programmatic EIS/EIR)

- Saturday, February 24, 2007; 10 am – 12:30 p.m.

Hollenbeck Middle School Auditorium, 2510 East 6th Street, Boyle Heights

- Tuesday, February 27, 2007; 6:30 – 9 p.m.

Canoga Park High School Auditorium, 6850 Topanga Canyon Boulevard, Canoga Park

- Wednesday, February 28, 2007; 6:30 - 9 p.m.

Metropolitan Water District Board Room, 700 N. Alameda Street, Los Angeles

8.3 LARRMP Programmatic EIS/EIR

Three public workshops/public hearings were held in February 2007 for the Los Angeles River Revitalization Master Plan. This was the sixth and final series of meetings in the 20-month planning process. These meetings combined the presentation of the Los Angeles River Revitalization Draft Master Plan and Public Hearings with the Draft Programmatic EIS/EIR.

SERIES #6, Meetings 15, 16, 17, 18, 19, & 20
(Each location and date below included a separate Public Hearing on the Draft Programmatic EIS/EIR)

- Saturday, February 24, 2007; 10 am – 12:30 p.m.

Hollenbeck Middle School Auditorium, 2510 East 6th Street, Boyle Heights

- Tuesday, February 27, 2007; 6:30 – 9 p.m.

Canoga Park High School Auditorium, 6850 Topanga Canyon Boulevard, Canoga Park

- Wednesday, February 28, 2007; 6:30 - 9 p.m.

Metropolitan Water District Board Room, 700 N. Alameda Street, Los Angeles

8.4 Los Angeles River Restoration Feasibility Study

In order to fully integrate the input of the public and stakeholders for the Los Angeles River, it was necessary to design a workshop process that would best provide adequate background about the project and allow participants to effectively produce feasible restoration options. In this spirit, a 3-day charette workshop was conducted in December 2009. A charette is a focused process by which stakeholders engage in a collaborative brainstorming process to expedite the development of plans, alternatives, and/or management measures that address specific objectives. The purpose of the 3-day workshop was to receive input for the formulation of plans to restore ecosystem function to the highest level possible within the Los Angeles River, with an emphasis on ecosystem restoration for development of the NER plan. Specifically, the workshop sought to bring stakeholders together to:

- Identify new measures.
- Help validate study objectives for ecosystem restoration.
- Aid in the development of a list of alternatives to meet ecosystem restoration objectives.
- Provide conceptual representation of alternatives on maps.

The workshop series differed from previous workshops that were held during and subsequent to development of the LARRMP because it:

- Concentrated on an 11+- mile length of the River.
- Included a 6-hour field outing to critical locations within the study area during which specific problems and opportunities were discussed.
- Focused on ecosystem and habitat restoration as opposed to also emphasizing flood risk management, recreation, and/or adjacent development opportunities.
- Engaged the participants in organized brainstorming that developed long lists of problems and measures as well as personal vision statements.
- Grouped teams of experts in the disciplines of economics, biology, engineering, hydraulics, landscape architecture, geotechnical/soils engineering, planning, and recreation. These teams were able to apply their expertise, along with the information gathered from the public and other stakeholders during the LARRMP outreach efforts, to the focused charette process.

The charette workshop consisted of presentations about the history and condition of the River to the attendees. The problems occurring within the study area, the opportunities existing for restoration, identification of study objectives, planning constraints and considerations, and the methodology for evaluating and selecting the final restoration plan were all presented to attendees. Participants were also taken on a field trip through the focused study area.

Participants included representatives from USACE, the City of Los Angeles as the non-Federal Sponsor, the USFWS, LADPW, the California Coastal Conservancy and the Mountains Recreation and Conservation Authority, Audubon, California State Parks, the City of Glendale, non-governmental agencies such as FoLAR, The River Project, the Los Angeles and San Gabriel Rivers Watershed Council, and other stakeholders and experts having interest and knowledge about the Los Angeles River. A total of 68 participants attended the workshop for one or more of the 3 days.

Once the participants were familiarized with the project, the goals, and the constraints, they were divided into teams and given the task of identifying a variety of restoration measures that fulfilled the goals of the project. Teams were asked to brainstorm restoration alternatives, to imagine what the sites would ideally look like in 50 years, and to collate their ideas. A matrix was ultimately prepared that encompassed each of the distinct restoration alternatives. A series of weightings and rankings were applied to the matrix to identify the alternatives that were most feasible. Pairwise weighting provided the first culling, as pairs of alternatives were compared and one was selected over the other. This allowed for a reduction in alternatives that weren't substantially different from each other. Finally, the remaining alternatives were then ranked according to their completeness, effectiveness, efficiency, and acceptability.

Through this intensive charette process, participants were able to accomplish the following:

- Identify study area problems related to ecosystem restoration.
- Validate study objectives to solve these problems.
- Aid in development of an alternatives matrix to meet ecosystem restoration objectives.
- Provide conceptual representation of alternatives on maps.

The highest ranked/scored alternatives were then combined into groups of alternatives, and these alternatives were the initial alternatives that were utilized for plan formulation, as described above in Chapter 3. The final array of alternatives presented in this IFR was directly taken from the charette process, and final selections were the result of the CHAP and CE/ICA process.

8.5 Los Angeles River Restoration Feasibility Study and Integrated Environmental Impact Statement/Report

This IFR will be made available for public review prior to finalization. Public and agency input will be collected, analyzed, and summarized in the Final IFR.

8.6 River Update Meetings

River Update Meetings (RUMs) are public workshops to discuss the status of activities and implementation of features related to the LARRMP. At RUM workshops, City and USACE staff also provide progress reports and hear public feedback on the IFR. This has provided valuable input during the study's plan formulation efforts.

Overall topics include the following:

- The Los Angeles River Improvement Overlay District

- The Los Angeles River Memorandum of Understanding with the Los Angeles County Flood Control District, which establishes a joint City-County River Cooperation Committee
- The Los Angeles River Revitalization Corporation
- The Los Angeles River Foundation
- The status of River projects, grant applications, and achievements/awards

Since 2007, there have been a total of six RUM meetings. The meetings are summarized online and include minutes and presentation materials for the following meeting dates:

- October 30, 2007
- April 30, 2008
- December 4, 2008
- July 28, 2009
- June 24, 2010
- February 10, 2011

8.7 Agency and Stakeholder Involvement

Information regarding agency and stakeholder involvement, including any permitting completed, agreements reached, and restrictions that will apply during construction and/or operation, will be included prior to finalization of this IFR.

The Corps consulted with the California State Historic Preservation Officer (SHPO) by telephone in June of 2013 regarding the level of effort for the EIS. They are satisfied with the use of existing information and a records and literature search. The SHPO will review, and comment on the draft EIS and may provide comments. They also understand that compliance with Section 106 of the National Historic Preservation (36 CFR 800) will not occur as part of the NEPA process, but will occur in the next phase of the project.

The Los Angeles District Ecosystem Planning Section has been coordinating with the U.S. Fish and Wildlife Service (USFWS) regarding the Los Angeles River Ecosystem Restoration Study since the Planning Charettes that took place in December 2009. Mr. Peter Beck of USFWS attended the Charettes and provided input on project measures through that forum. Mr. Beck also contributed to the weighting of objectives during the early Plan Formulation process by providing input to an objectives comparison matrix. Mr. Beck has been participating on the CHAP (Combined Habitat Assessment Protocols) Habitat Evaluation Team since January 2010. The Habitat Team meetings solicited input on existing conditions, future without project conditions, and project alternatives. The input provided focused on existing species and habitat value, factors that degrade habitat value on the River, the viability of the measures and alternatives, and the habitat value that would be derived from these measures and alternatives. The Corps presented the preliminary final array of alternatives to resource agency contacts in September 2012.

The Corps will continue to coordinate with USFWS on the final array of alternatives in order to support completion of the Final Fish and Wildlife Coordination Act Report.

9 REMAINING REVIEWS, APPROVALS, IMPLEMENTATION, AND SCHEDULE

Section 7.2.5 describes the remaining reviews and approvals required. The following major milestones are currently scheduled.

Environmental Impact Statement Filing -	September 2013
Public Review Period (45 days) -	20 September – 05 November 2013
Public Meeting LA River Center	17 October 2013
Final Integrated Feasibility Report -	April 2014
Civil Works Review Board (CWRB) -	May 2014
ROD and CEQA Notice of Determination	April 2015
Final Report State and Agency Review -	August 2014
Final Chief's Report	October 2014

10 ENVIRONMENTAL COMPLIANCE

The status of the approach channel project's compliance with applicable Federal, State, and local environmental requirements is summarized below. Prior to initiation of construction, the project would be in compliance with all applicable laws, regulations, and Executive Orders.

10.1 Federal Laws, Regulations, and Policies

Clean Air Act of 1972, as amended (42 U.S.C. 7401, et seq.)
Section 5.2 of this EIS/EIR discusses the effects of the project on local and regional air quality. The section discusses the issues relative to the project's compliance with the EPA's adopted de minimus thresholds in its general conformity rule. Since the construction phase of the project would have significant adverse effects on air quality, a conformity determination will be prepared.

Clean Water Act of 1972, as amended (33 U.S.C. 1251, et seq.)
The potential effects of the proposed project on water quality have been evaluated and are discussed in Section 5.4. Those sections of the CWA most relevant to this project are described as follows:

Section 401 (33 USC 1341) requires certification from the state water control agencies that a proposed water resource project is in compliance with established effluent limitations and water quality standards. A Section 401 State Water Quality Certification will be requested from the Los Angeles Regional Water Quality Control Board.

Section 402 (33 USC 1342) establishes conditions and permitting for discharges of pollutants under the National Pollutant Discharge Elimination System (NPDES). Point source discharge of pollutants into navigable water is regulated through the NPDES. Stormwater permits are issued by the states if they have an authorized NPDES stormwater permit program or by the USEPA for areas not covered by an authorized state program. Prior to construction, the construction contractor will prepare and implement a Stormwater Pollution Protection Plan (SWPPP). The SWPPP will help identify the sources of sediment and other pollutants, and establish best management practices for storm water and non-storm water source control and pollutant control.

Section 404 of the CWA regulates the discharge of dredged or fill material into waters of the United States. The Corps does not issue permits to itself but conducts an internal assessment to ensure that all requirements of Section 404 are met. A 404(b)(1) Evaluation will be prepared to document impacts to Waters of the U.S. This Evaluation will be included in the Final IFR.

Endangered Species Act of 1973, as amended (16 U.S.C. 1531, et seq.)
A list of threatened and endangered species that have the potential to occur in the study area was obtained from USFWS on April 29, 2012. Based on the analysis contained in this document, the Corps has determined that the project would have no effect on Federally listed threatened or endangered species, and therefore no further consultation is required with USFWS or NMFS. The project is in compliance with the Endangered Species Act.

Executive Order 11988, Floodplain Management
The objective of this Executive Order is the avoidance, to the extent possible, of long-and short-term adverse effects associated with the occupancy and modification of the base floodplain (1 in 100 annual event) and the avoidance of direct and indirect support of development in the base floodplain wherever there is a practicable alternative. The proposed project does not contribute to increased development in the floodplain and is in compliance with the executive order.

Executive Order 11990, Protection of Wetlands

This Executive Order directs Federal agencies, in carrying out their responsibilities, to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. Wetland vegetation within the study area would be disturbed during construction but much more wetland habitat would be established as a result of the proposed project, therefore the project is in compliance with the executive order.

Executive Order 12989, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

This Executive Order states that Federal agencies are responsible for conducting their programs, policies, and activities that substantially affect human health of the environment in a manner that ensures that such programs, policies, and activities do not have the effect of excluding persons from participation in, denying persons the benefits of, or subjecting persons to discrimination under such programs, policies, and activities because of their race, color, or national origin. The required analysis has been conducted, and impacts have been avoided to the extent possible. Although the proposed construction project is located near minority and/or low income communities, this is unavoidable because the location of the Los Angeles River cannot be changed. In most reaches of the study area, benefits of the project would extend equally to all residences in the area; therefore it would not provide disproportionate benefits or effects to minority or low income populations and is in compliance with this Executive Order. Relocation of rail facilities at Piggyback Yard in Reach 8 may disproportionately affect the surrounding community which includes low-income neighborhoods in the immediate area. These neighborhoods, and the general study area, would also benefit from the proposed restoration. As Piggyback Yard is one of the few large, river-adjacent open space areas where substantial restoration could occur, these impacts are not avoidable.

Farmland Protection Policy Act (7 U.S.C. 4201, et seq.)

There are no designated prime or unique farmlands within the study area; therefore there would be no adverse effects to farmland and the project is in compliance with this Act.

Fish and Wildlife Coordination Act of 1958, as amended (16 U.S.C. 661, et seq.)

Federal agencies undertaking water projects are required to fully consider recommendations made by the USFWS in the provided Coordination Act Report (CAR) or Planning Aid Letter associated with the project. USFWS and CDFW have had full participation in planning and evaluating the proposed project, and USFWS has been funded to prepare a CAR. Inclusion of the CAR in the Final IFR/EIS/EIR and continued consideration of USFWS recommendations would accomplish full compliance with this law. Coordination with the USFWS and CDFW is ongoing and will be completed prior to completion of the final EIS/EIR.

Migratory Bird Treaty Act of 1936, as amended (16 U.S.C. 703, et seq.)

The Migratory Bird Treaty Act implements various treaties and conventions between the United States, Canada, Japan, Mexico, and Russia, providing protection for migratory birds as defined in 16 U.S.C. 715j. The proposed action is located primarily in a highly developed area, although some nesting habitat persists within the study area. To ensure that the project does not affect migratory birds, any clearing of vegetation will occur outside of the nesting season.

National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321, et seq.)

NEPA applies to all Federal agencies and most of the activities they manage, regulate, or fund that affect the environment. This act requires full disclosure of the environmental effects, alternatives, potential mitigation, and environmental compliance procedures of proposed actions. NEPA requires the preparation of an appropriate document to ensure that Federal agencies accomplish the law's purposes. This draft EIS/EIR constitutes partial compliance with NEPA. Full compliance will be achieved when the final EIS/EIR is filed with USEPA and the Corps issues a Record of Decision.

CEQ Regulations for Implementing the Procedural Provision of NEPA (40 CFR Part 1500 et seq.) The Council on Environmental Quality has prepared regulations for implementing NEPA, including those pertinent to NEPA and agency planning, preparation and distribution of an EIS, procedures for the open comment period, resolution of environmentally unsatisfactory actions, agency responsibilities, and other requirements of NEPA. This document has been prepared in compliance with these regulations.

U.S. Army Corps of Engineers' Procedures for Implementing NEPA (33 C.F.R., part 230, ER 200-2-2)

This regulation provides guidance for implementation of the procedural provisions of the National Environmental Policy Act (NEPA) for the Civil Works Program of the U.S. Army Corps of Engineers. It supplements Council on Environmental Quality (CEQ) regulations 40 CFR 1500-1508, in accordance with 40 CFR 1507.3, and is intended to be used in conjunction with the CEQ regulations. This regulation is applicable to all HQUSACE elements and all Field Operating Activities (FOAs) having responsibility for preparing and processing environmental documents in support of Civil Works functions. This IFR has been prepared in compliance with ER 200-2-2.

National Historic Preservation Act of 1966, as amended (16 U.S.C. 470)

The impacts of Federal undertakings on cultural resources are formally assessed through a separate process mandated by the National Historic Preservation Act (NHPA) of 1966, as amended (16 U.S.C. Section 470), and its implementing regulation, Protection of Historic Properties (36 CFR 800). Section 106 of the NHPA describes the process for identifying and evaluating historic properties, for assessing the effects of Federal actions on historic properties, and for consulting to avoid, reduce, or minimize adverse effects. Historic properties are cultural resources that are either "included in", or are eligible for inclusion in the National Register of Historic Places (NRHP). The Section 106 process does not require historic properties to be preserved but ensures that the decisions of Federal agencies concerning the treatment of these places result from meaningful consideration of cultural and historic values and the options available to protect the properties.

The USACE consulted with the SHPO staff by telephone in June of 2013 regarding the level of effort for the analysis in the IFR EIS/EIR. The SHPO has concurred with the use of existing information from the records and literature search. The SHPO will review and may provide comments on the draft EIS. The SHPO understands that further compliance actions with Section 106 will occur in the next phase of the project, consistent with the USACE planning process (Dibble 2013).

Executive Order 13112 Invasive Species

This EO states that each Federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law, use relevant programs and authorities to: (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them. This project includes removal of invasive species and establishment of native habitat, and is therefore in compliance with this Executive Order.

10.2 State of California Laws, Regulations, and Policies

California Clean Air Act

Section 5.2 of this document discusses the effects of the proposed project on the local and regional air quality. SCAQMD determines whether project emissions sources and emissions levels significantly affect air quality based on Federal Standards established by the U.S. EPA and State standards set by the California Air Resource Board. Since the construction phase of the project would have significant adverse effects on air quality, a conformity determination will be prepared after selection of the Tentatively Selected Plan.

California Endangered Species Act

This EIS/EIR has considered the potential effects to State-listed species and has determined that the project would have no effect on State-listed species. As a result, this project is in compliance with the California Endangered Species Act.

Porter-Cologne Water Quality Control Act

The potential effects of the proposed project on water quality have been evaluated and are discussed in Section 5.2. This project expects to achieve full compliance with the Water Quality Control Act by achieving compliance with RWQCB certification mandates for Section 401.

California Fish and Game Codes 1600-1607

The California Department of Fish and Wildlife, under California Fish and Game Code Sections 1600 through 1607, regulates work that would substantially divert, obstruct, or change the natural flow of a river, stream, or lake; that would substantially change the bed, channel, or bank of a river, stream, or lake; or that would use material from a streambed. Under Section 1602, the City will enter into a Streambed Alteration Agreement (SAA) with the CDFW that will include conditions to ensure impacts on fish and wildlife or habitat are avoided, minimized, or mitigated.

11 RECOMMENDATIONS

This will be included in the Final Report.

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