

Attachment
SMMC Item 12
November 4, 2013

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.

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).



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

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, Downstream 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).

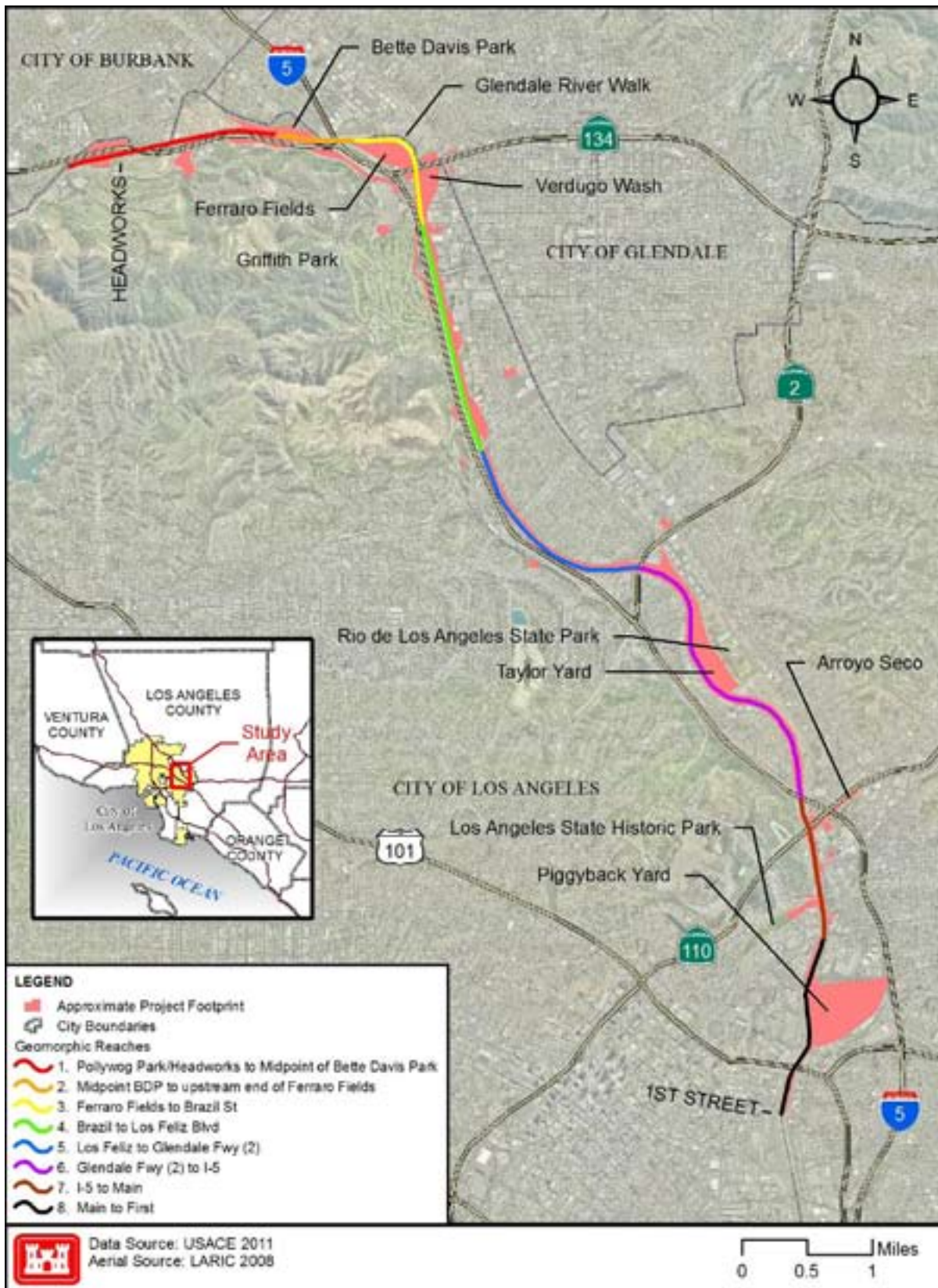


Figure ES-3 Study Area, the ARBOR Reach

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 Angeles 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, 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 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	same as 10	same as 10	same as 10
Output (HU)	866			
Acres	82			
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	same as 10	same as 10	$\Delta = \$37,500,000$
Output (HU)	392			$\Delta = 55$
Acres	39			$\Delta = 20$
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	$\Delta = \$22,400,000$	same as 13	$\Delta = \$179,000,000$
Output (HU)	40	$\Delta = 160$		$\Delta = 130$
Acres	33	$\Delta = 17$		$\Delta = 30$
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	same as 10	same as 10	same as 10
Output (HU)	492			
Acres	59			
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	same as 10	$\Delta = \$135,000,000$	same as 16
Output (HU)	87		$\Delta = 265$	
Acres	41		$\Delta = 27$	
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	same as 13	same as 13
Output (HU)	1,256	Δ = 191		
Acres	138	Δ = 21		
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	same as 13	Δ = \$61,600,000
Output (HU)	29	Δ = 230		Δ = 88
Acres	27	Δ = 22		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	same as 10	Δ = \$180,000,000	same as 16
Output (HU)	2,159		Δ = 342	
Acres	109		Δ = 44	
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
<i>Note: Errors due to rounding may be present.</i>				

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.

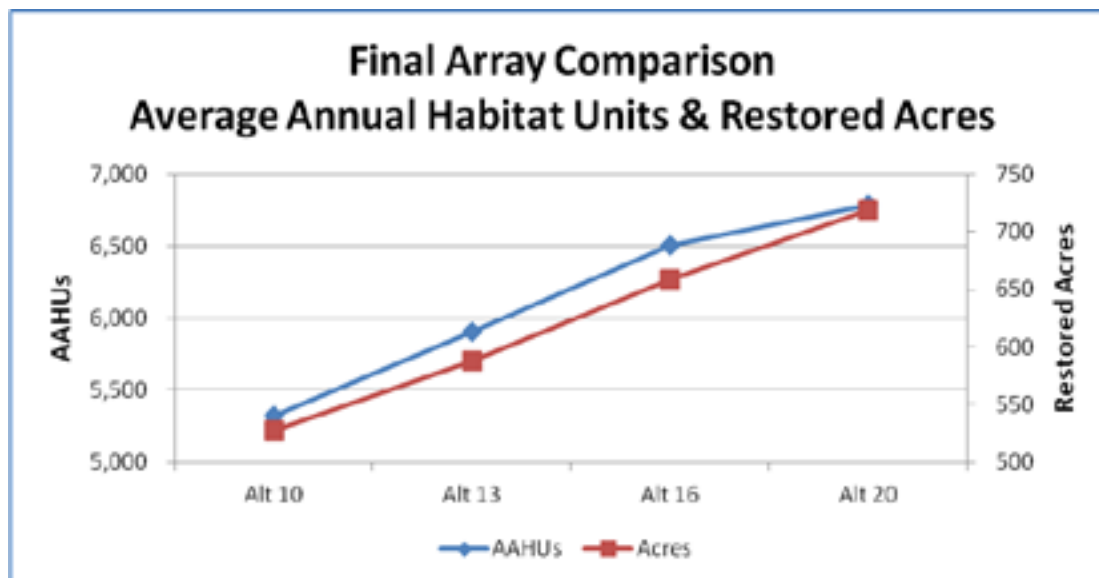


Figure ES-4 Final Array Comparison-AAHUs and Restored Acres

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	0	5,321	5,902	6,509	6,782
a. Net gain in AAHU					
b. Incremental Cost/AAHU					
c. % increase in AAHU versus no action		\$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.