Draft Bees Lakes Habitat Restoration Plan

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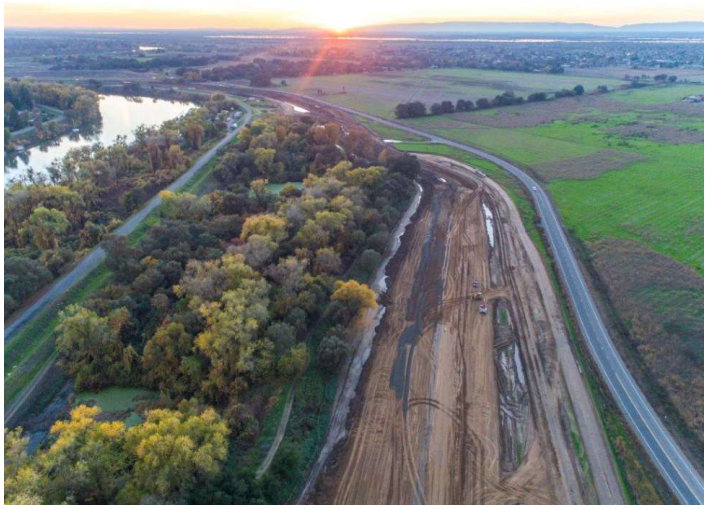
Bees Lakes Habitat Restoration Plan



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March 30, 2020

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1 INTRODUCTION

1.1 OVERVIEW

The City of West Sacramento (City) applied for and received a grant from the Sacramento/San Joaquin Delta Conservancy (Delta Conservancy) in 2019 to prepare the Bees Lakes Habitat Restoration Plan. The grant was provided through the Ecosystem Restoration and Water Quality Grant Program, which was developed in response to the Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Proposition 1). Proposition 1 authorized the California Legislature to appropriate funds to the Delta Conservancy to fund multi-benefit ecosystem, watershed protection and restoration projects that benefit the Delta.

The City competitively selected a project team to conduct the scope of work included in the grant agreement. This project team includes Douglas Environmental, HDR Engineering, cbec ecoengineering, and GEI Consultants. This Habitat Restoration Plan was prepared by the project team for the City consistent with the requirements of the grant agreement.

1.2 HABITAT RESTORATION PLAN GOAL AND OBJECTIVES

The goal of this grant-funded planning effort is to prepare a habitat restoration plan for the Bees Lakes area that restores historic physical and ecological processes to optimize habitat function, enhances the existing habitat to better meet listed species needs, improves pond water quality, removes potential contaminants, and improves public access management.

To achieve this goal, the planning effort incorporated several objectives including developing a range of habitat restoration alternatives based on the best available science and stakeholder input, selecting a stakeholder-supported habitat restoration plan that enhances physical and ecological processes, identifying improvements that will enhance the public's recreational and educational use of the site while discouraging unwanted uses and limiting the disturbance of sensitive natural areas, completing California Environmental Quality Act (CEQA) compliance, and preparing 65% design plans with sufficient detail to qualify for an implementation project grant.

Consistent with these objectives, the first task of this effort included preparing an Environmental Baseline Report to identify the existing environmental conditions within the Bees Lakes area (Douglas Environmental 2019). The Environmental Baseline Report formed the basis for developing the preliminary habitat restoration concepts that are presented in this Habitat Restoration Plan.

1.3 PROJECT LOCATION

The Bees Lakes project site is located along the west bank of the Sacramento River in the City of West Sacramento, Yolo County, California (Figure 1). The West Sacramento Area Flood Control Agency (WSAFCA) completed construction of 5.5 miles of levee improvements in 2018 as part of the Southport Sacramento River Early Implementation Project (Southport EIP), including constructing a setback levee along the northwestern edge of the Bees Lakes project site. The Southport EIP created two new floodplain restoration areas connected to the Sacramento River, immediately upstream and downstream of the Bees Lakes project site. Cross levees between the Bees Lakes project site and the two floodplain restoration sites were built to preserve access to the Sacramento Yacht Club and the Sherwood Harbor Marina, which are located at the north and south ends of the Bees Lakes

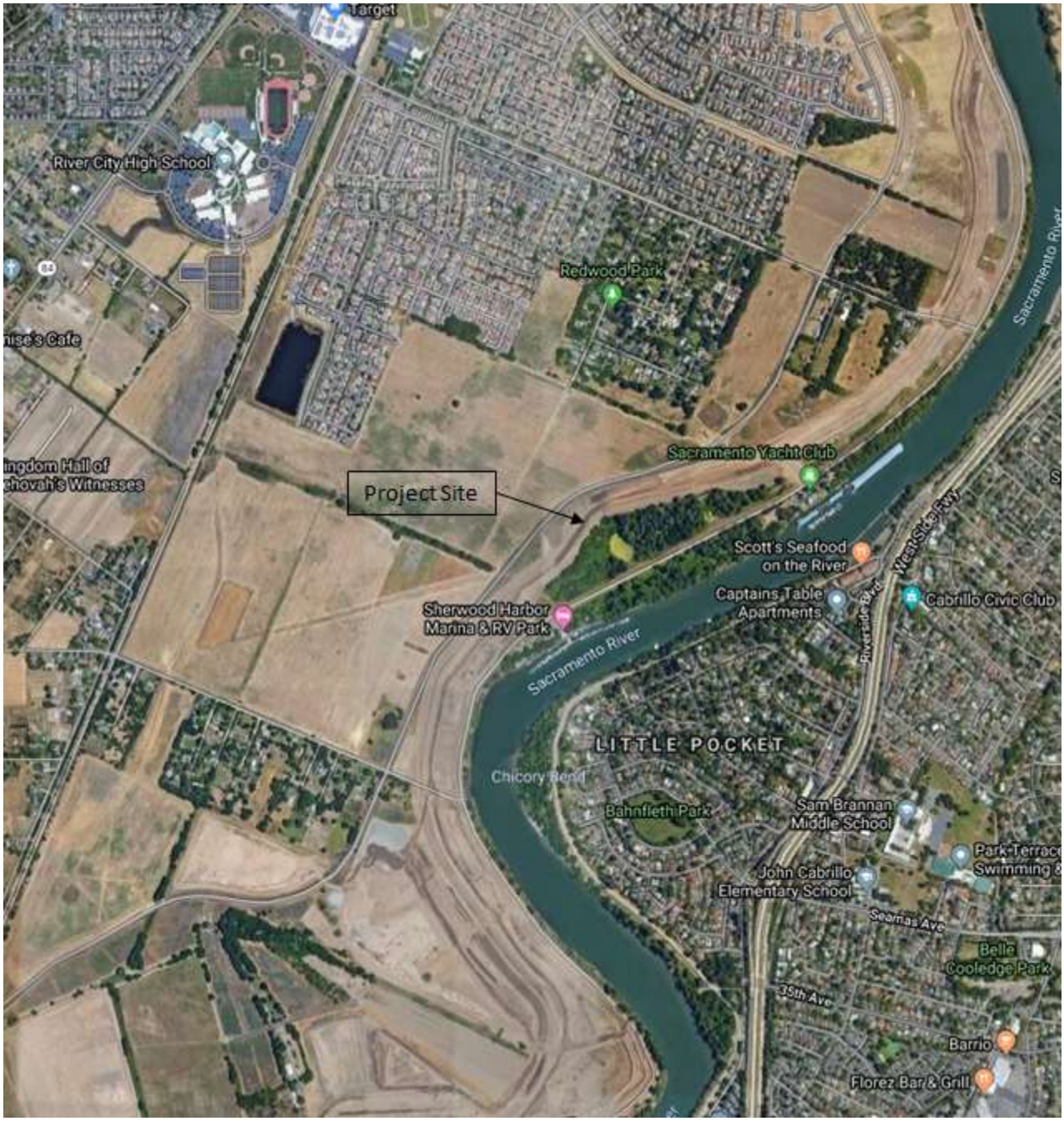


Figure 1. Project Site Aerial

project site, respectively. The remaining segment of the unmaintained levee along South River Road runs through the Bees Lakes project site, with the portion southeast of the levee encompassing the Sacramento river bank and associated riverside riparian habitat. The road built on the cross levees and the remaining section of South River Road is now referred to as the Chicory Loop.

The Bees Lakes project site is bounded by the Reclamation District (RD) 900 Operations and Maintenance (O&M) waterside toe road on the northwest edge, the Sacramento River on the southeast edge, and the property boundaries of the Sacramento Yacht Club and the Sherwood Harbor Marina southeast of the old levee along South River Road. Within the project site boundary, the Bees Lakes area consists of two ponds surrounded by

dense vegetation and wooded areas. The project planning area for analysis of potential hydrologic effects additionally includes areas to the waterside crest of the new flood control levees surrounding the site.

The Bees Lakes property is owned by the WSAFCA. The portion of the site located southeast of South River Road adjacent to the Sacramento River also includes a State Lands Commission public trust easement for commerce, navigation and fisheries. The purpose of the easement is to preserve, enhance or create wetlands, riparian habitat, and open space. The State Lands Commission considers the public trust easement a significant benefit to the public trust because it permanently protects the parcel from commercial and/or residential development, creates new public recreational opportunities, and preserves wetlands, riparian habitat and open space (State Lands Commission 2012).

Regional access to the project area is provided by Interstate 80 via the Interstate 80/Jefferson Boulevard interchange. To access the site from this interchange, vehicles travel south on Jefferson Boulevard then east onto Lake Washington Boulevard, Linden Road or Davis Road to Village Parkway, which connects to the Chicory Loop.

The nearest residences to the project site are located approximately 600 feet to the southeast across the Sacramento River within the Little Pocket neighborhood of the City of Sacramento. Within the City of West Sacramento, the nearest residences are located approximately 850 feet to the north along Tamarack Road within the City's Southport community.

1.4 SITE HISTORY

Review of available historical topographic maps (including maps from 1907, 1916, 1948, 1954, 1967, 1992, 2012, and 2018; USGS 2019) and historical aerial photographs (dating from 1947, 1957, 1964, 1966, 1993, and 1994-2018; www.historicaerials.com and Google Earth®) of the Bees Lakes project site reveal some temporal context helpful to understanding current site conditions. The South River Road levee has been in place in the current-day alignment since before 1907 (which is the date of the earliest detailed USGS topographic map available for the area). The existing foot trail that runs on the high ground along the northern edge of the landside woodland appeared to be a dead-end dirt road coming from the South River Road levee in 1948. The two ponds are not mapped on the earliest detailed USGS maps (from 1907 and 1916), but do show up on the 1948 map, indicating they probably formed at some point between 1916 and 1948. Based on their location adjacent to and landside of the levee, and their configuration and depth, these ponds likely formed as scour holes caused by erosion during a levee overtopping and/or breaching event during that time frame. The size and extent of the two ponds are similar from 1948 to present-day, except that the smallest pond appears slightly smaller in extent on the most recent maps, which is also evident from review of historical aerial photographs.

Review of historical aerial photographs reveals that the entirety of the riverside portion of the site has been densely wooded since the earliest photograph in 1947, but that California grape (*Vitis californica*) only became clearly dominant in portions of the riverside forest starting around 2005. On the landside portion of the site, the outer boundaries of the landside wooded areas have been consistent through the decades, having been directly adjacent to (and constrained by) active agricultural uses from 1947 (or earlier), until the new flood control levee was constructed starting in 2017. Early aerial photographs from 1947 through 1966 show significantly less woody vegetation within the interior of the landside portion of the site than in the present day, with evidence of ongoing site disturbance and larger extents of open grassland vegetation and bare ground. The dirt road around the

backside of the woodland appears to have extended further west/southwest of the large pond at one point, to a clearing adjacent to the pecan (*Carya illinoinsensis*) grove. The large pecan trees in that grove first become apparent on aerial photographs starting in 1957. There is a wide gap in available aerial photography between 1966 and 1993; the 1993 aerial photographs and beyond show the entirety of the landside area of the project site being densely wooded, similar to current conditions.

Long-term observations by local birders (Leo Edson and Michael Perrone, *pers. comm*.), who have been frequenting the site since the early 1990s, indicate that a number of mature Fremont cottonwood (*Populus fremontii*) and black willow (*Salix gooddingii*) trees have died in recent decades on the landside portion of the site, and the prevalence of young valley oaks (*Quercus lobata*) in the landside woodland canopy has increased. Increased abundances of California grape (*Vitis californica*) and various nonnative invasive species have also been observed over recent decades (Leo Edson, *pers. comm*.). Site users have additionally noticed increased trash dumping on the site in recent years, particularly since the new developments and the new flood control levee were built.

2 ALTERNATIVES DEVELOPMENT PROCESS

2.1 PLANNING CONTEXT

The Bees Lakes area is an unmanaged green space that has historically been utilized by locals for walking and hiking, biking, bird watching, horse riding, fishing, and even paintball activities. The Bees Lakes ponds historically provided fishing opportunities, although they no longer do so. Currently within the project area, two unauthorized, yet developed and intricate BMX bike courses have been developed by bicycle enthusiasts. While impressive in their own right, these facilities represent a liability for the City; especially as the area around the project becomes developed and access to the site becomes more common. A narrow and steep footpath provides access for fishing to the waterside beach area along the Sacramento River.

The Bees Lakes area is located directly adjacent to areas that are slated for future residential development, which will bring increased interest and use of the site. The City's General Plan land use designation for the site is Open Space (OS) and the zoning designation is Public Open Space (POS). The land use designations directly northwest and west of the project site include Rural Residential, Low-Density Residential, High-Density Residential, Commercial, and Recreation and Parks (City of West Sacramento 2016).

The West Sacramento General Plan Policy Document identifies that the Sacramento Riverfront will be a well-known regional destination and attraction that will be a gathering point for people of the Sacramento region and beyond with both active social points of activities and quiet, natural opportunities. The Recreation and Cultural Resources Element of the General Plan commits the City to ensuring continuous public access to the Sacramento River for its full length within West Sacramento, and calls for access to the Sacramento River to be linked to the City's overall system of parks, recreational pathways, and open space.

A major goal of the Urban Structure and Design element of the General Plan is to enhance the relationship between the City and the Sacramento River. Specific policies call for development of a continuous pedestrian and bicycle path along the river, development of visual and scenic areas along the riverfront, and development of pedestrian links between the river and public schools, parks, and other major open space areas. The Transportation and Circulation element of the General Plan specifies that bicycle and pedestrian pathways be included adjacent to waterways, to the extent practical.

The City's Parks Master Plan, which is currently being updated, identifies goals that include improving water access and increasing the number and variety of facilities, recreational corridors/trails, and fishing and water access. The Parks Master Plan identifies the following strategies to meet the community demand for recreation opportunities:

- Acquire and develop recreation corridors located along watercourses and railroad right-of-ways to link the park system and provide additional recreation opportunities.
- Locate new parks to take advantage of the city's natural resources, including the river and other watercourses.
- Provide improved river access for boating and fishing.

- Develop open space areas to protect significant wetlands and riparian forests, and to provide passive recreation opportunities.

The City sees the Sacramento River as central to the identity of West Sacramento. However, the Parks Master Plan points out those opportunities to enjoy the river are hampered by the lack of developed public access. It identifies "providing convenient and safe public river access that is also sensitive to the natural environment" as a key recreational opportunity. The Parks Master Plan lists underutilized assets, including the Sacramento River and Bees Lakes area, and identifies these as key opportunities for recreation development and protection.

2.2 BASELINE ENVIRONMENTAL CONDITIONS

The identification of the existing environmental conditions within the Bees Lakes area was conducted to understand the planning area's habitat restoration opportunities and constraints. The site's existing environmental conditions are identified in the Bees Lakes Habitat Restoration Plan Environmental Baseline Report (Douglas Environmental 2019). The Environmental Baseline Report formed the basis for developing the preliminary habitat restoration concepts described in this document. The following provides a summary of the site's environmental conditions.

The majority of the Bees Lakes project site is vegetated with mature, dense riparian forest/woodland and riparian scrub vegetation. The areas around the periphery of the site and along the South River Road levee primarily support herbaceous nonnative annual grassland and/or ruderal plant communities, due to past agricultural uses and ongoing disturbance associated with levee construction, and operations and maintenance (O&M) activities.

RIPARIAN WOODLAND/FOREST VEGETATION

The tree canopy layer in riparian woodland/forest vegetation types of the site is dominated largely by Fremont cottonwood and valley oak, with black willow and boxelder (*Acer negundo*) also prevalent. Defined as Fremont cottonwood forest, this habitat type is dominated on the project site by Fremont cottonwood, with box elder (*Acer negundo*), Northern California black walnut (*Juglans hindsii*), valley oak, Oregon ash (*Fraxinus latifolia*), and black willow (*Salix gooddingii*) as co-dominants. The shrub layer is dense to intermittent and is dominated by California grape, which is currently highly dominant in the understory of the riverside portion of the site, growing with and over lower tree and scrub-shrub species and well into the cottonwood forest tree canopy, creating curtains of wild grape on many of the mature trees. In recent years, increasing mortality of mature cottonwood and willow trees with little to no new recruitment of young cottonwoods or willows has been observed on the landside portion of the project site, while young valley oaks have become more prevalent (Leo Edson, *pers. comm.*). These trends towards increasing valley oak cover are likely due to the lack of riverine or other canopy opening disturbances occurring on the interior of the site in recent decades, which would be needed to sustain continual recruitment of early seral species such as willow and cottonwood that require bare mineral soil and open canopy conditions for seedling growth.

The Valley oak woodland habitat type on the project site is dominated by valley oak, with box elder, white alder, Oregon ash, Northern California black walnut, interior live oak, and black willow regularly co-occurring in the tree canopy. Valley oak woodland stands are found at varying elevations and hydrologic conditions on the project site but only on the landside portion of the site, except on higher ground along the old levee. There are many large, mature oak trees on the project site, particularly along the northwest edge of the wooded area.

The black willow woodland habitat type shares similar community composition to Fremont cottonwood forest and valley oak woodland, except that black willow is dominant in the tree canopy. Boxelder and northern California black walnut are co-dominant in the tree canopy, and the shrub layer is primarily buttonbush and sandbar willow.

The Boxelder forest habitat type is characterized by boxelder being dominant or co-dominant in the tree canopy, with generally less than 5% cover by taller trees such as Fremont cottonwood, valley oak and black oak.

RIPARIAN SCRUB VEGETATION

Riparian scrub vegetation is generally defined by being lower-stature than riparian woodland/forest vegetation types, and are dominated by shorter tree or shrub species. Specific riparian scrub vegetation alliances present on site include: California Blackberry, Himalayan blackberry shrublands, buttonbush thickets and edible fig riparian scrub. California blackberry thickets are prevalent within the project site understory and in tree canopy openings. California blackberry regularly co-occurs with California grape, which grows within and on top of the blackberry shrubs. Himalayan blackberry is an invasive species, and both native and nonnative blackberry species repress recruitment by riparian tree species. Buttonwillow occurs in the riparian forest understory in various locations on the project site, primarily around the margin of the larger Bees Lakes pond where taller tree canopy was generally absent. Edible fig riparian scrub occurs in one low-lying riverside portion of the project site, where fig is the dominant large shrub species.

OTHER VEGETATION TYPES

A small grove of large pecan trees occurs at the northeast edge of the wooded portion of the site. These trees may be remnants of historical plantings for ornamental value or nut production, as pecan trees are not generally widely naturalized in the region. The Bees Lakes ponds are mapped as open water/duckweed blooms. Duckweed blooms are dominated by small, floating aquatic herbs in the Arum family, including duckweed (*Lemna* sp.), which can provide an important food source for wood ducks and other aquatic wildlife. The most widespread vegetation type on the project site is annual grassland/ruderal herbaceous vegetation. This is due in significant part to the riparian forests and scrub vegetation types being split into multiple vegetation alliances based on species dominance patterns. The slope of the new levee was seeded with native grasses following construction; these grasses are in an early phase of growth.

INVASIVE PLANT SPECIES

The most commonly observed woody invasive plants on the project site include Himalayan blackberry, which occurs in large patches in portions of the riparian forest understory and in some open canopy sites, and edible fig, which is scattered throughout the site but primarily in the riverside portion, both of these species are rated invasive by the California Invasive Plant Council (CalIPC 2020). This rating is important in identifying plant species that may limit habitat biodiversity. Additional plants present on the project site rated invasive by CalIPC include English ivy (*Hedera helix*), giant reed (*Arundo donax*), Russian olive (*Elaeagnus angustifolia*), and glossy privet (*Ligustrum lucidum*). Nonnative trees present in low numbers within the interior woodlands of the site that are not rated invasive by CalIPC include a small grove of mature pecan trees and scattered pecan saplings, and occasional Chinese pistache (*Pistacia chinensis*) and almond (*Prunus dulcis*) trees. Other species rated as invasive

by CalIPC on the site include nonnative annual grasses (wild oats, Italian rye grass, foxtail barley, ripgut brome, bermuda grass), Johnsongrass, yellow starthistle, Italian thistle, yellow sweetclover, burclover, hairy vetch, and milk thistle (CalIPC 2019). Scattered poison hemlock (*Conium maculatum*) plants were also observed within the project site.

WILDLIFE

The project site provides high quality habitat for an abundance of birds and other wildlife. Large trees within the riparian woodlands provide nesting and roosting habitat for raptors, songbirds, herons, and egrets, while dense and diverse understory riparian vegetation and the Bees Lakes ponds provide quality habitat for various songbirds, amphibians, reptiles and mammals. The annual grasslands surrounding the periphery of the site provide an additional element of habitat diversity for terrestrial wildlife.

FISH

The project site is adjacent to the Sacramento River, which supports a diversity of native and nonnative fish species. During high river flows, the riverside wooded portion of the project site becomes shallowly inundated and provides flooded riparian habitat for fishes, as well as foodweb benefits to the riverine ecosystem via the flushing of organic matter and insects from the forests/woodlands into the riverine ecosystem. The riparian forest vegetation along the river's edge also provides shaded riverine aquatic habitat for fishes and other aquatic species in the Sacramento River channel. Multiple special-status fish species also occur in the Sacramento River adjacent to the project area, including anadromous fish such as salmonids, lamprey, and sturgeon, and migratory fish species that may spawn along within the study area along shallow river margins.

It is unknown whether the Bees Lakes ponds currently support any fish species. Intraoffice correspondence memos by California Department of Fish and Game staff dating from 1956 indicate that the ponds at that time were popular with local anglers. At that time, the ponds were owned by the West Sacramento Land Company and were managed by the West Sacramento Rod and Gun Club (Kelley 1956).

SITE GEOLOGY AND SOILS

The project area is located in the southern portion of the Sacramento Valley within the northern portion of California's Great Valley Geomorphic Province. The Great Valley, also called the Central Valley, is a nearly flat alluvial plain that lies between the Sierra Nevada on the east and the Coast Ranges on the west.

The Sacramento Valley contains thousands of feet of accumulated fluvial, overbank, and fan deposits resulting from erosion of these surrounding ranges (Hackel 1966). The Sacramento River is the main drainage of the northern Sacramento Valley, flowing generally south from the Klamath Mountains to its discharge point into the Suisun Bay in the San Francisco Bay Area. In the Sacramento area, the Sacramento and American Rivers have been confined by human-made levees since the turn of the nineteenth century. In the project area, these levees generally were constructed on Holocene age (less than 11,000 years old) alluvial and fluvial deposits deposited by the current and historic Sacramento River and its tributaries (Kleinfelder 2007).

The surface and subsurface distributions of sandy and clayey deposits are a function of former river positions on the landscape and present-day geomorphic processes adjacent to the river channel (i.e., flooding and deposition)

(William Lettis & Associates 2009). Helley and Harwood (1985) compiled previous regional studies of the quaternary geology of the Sacramento Valley, which, in the project area, classified the surficial deposits as Quaternary stream alluvium (Qa) near to the modern river channel and undifferentiated Quaternary basin (Qb) deposits away from the modern river channel. Subsequent mapping by William Lettis & Associates (2009) indicates that the Bees Lakes area is underlain by historical channel deposits and historical alluvial deposits.

For the most part, the soil units encountered by the borings in the area (Blackburn Consulting 2011) coincide with the geological units described in the geomorphological mapping of the area (William Lettis & Associates 2009). The subsurface stratigraphy of the area primarily includes silty sand layers with interbedded sand and silt layers with some gravel. The borings in the area indicate presence of a clay layer approximately 90 feet below ground surface (Blackburn Consulting 2011).

REGIONAL HYDROLOGY

The Bees Lakes area is located along the Sacramento River between river mile (RM) 55.8 and RM 55.1. It sits between the two Offset Floodplain Areas that were created as part of the Southport EIP. The remnant levee on which South River Road is located separates the Sacramento River from the Bees Lakes ponds. The ponds are hydraulically connected to the Sacramento River and the shallow groundwater table through seepage, which causes the pond water levels to rise and fall along with the stage in the river and aquifer depth. The remaining portion of South River Road connects the Sacramento Yacht Club to the Sherwood Harbor Marina. The Southport EIP setback levee runs along the northwest side of the project site. Two access embankment levees provide access to the yacht club and the marina from Village Parkway. The setback levee, two embankment levees, and the remnant levee form a ring around the two ponds with a total volume of approximately 650 acre-feet at the levee crown elevation (cbec 2015).

The section of the Sacramento River adjacent to the project site collects water from most of the Sacramento River Basin including the Feather, Yuba, and American Rivers. Flows in the Sacramento River are influenced by reservoir releases at Shasta, Oroville, Englebright, and Folsom Dams. During high flood events, the Fremont Weir and Sacramento Weir divert water away from the City of Sacramento into the Yolo Bypass upstream of the confluence with the American River. Both banks of the Sacramento River have been reinforced with levees first mapped in 1895. Construction of levees through the mid to late 20th century reduced the amount of river widening but increased the amount of bed incision and exacerbated the pressure on the levees protecting the urban development on the east side of the river (cbec 2011). The Southport EIP included levee improvements, construction of a setback levee and offset area, and erosion repairs to bring levees on the West Sacramento side of the river up to current engineering standards for flood protection.

PREDICTED SEA LEVEL RISE

The Cal-Adapt website (https://cal-adapt.org) was reviewed for information regarding sea level rise. Cal-Adapt is an online resource to help visualize the effect of climate change on the local level. The CalFloD-3D tool displays local impacts of a 100-year storm event coupled with various levels of projected sea-level rise (SLR). This tool forecasts that sea levels will increase from 0 to 1.41 meters (0-4.62 ft) above current sea level. This prediction is based on the 2017 assessment of the vulnerability of Bay Area natural gas pipelines to the effects of climate change commissioned by the California Energy Commission (CEC 2017). In compiling the CalFloD-3D tool,

researchers used a high-resolution digital elevation surface in a 3-dimensional hydraulic model that simulated 100-year storm surges coupled with SLR (CEC 2017).

The closest modeled location relevant to the Bees Lakes site is the north end of the Deep Water Ship Channel. The Deep Water Ship Channel meets the Sacramento River at RM 57.9. at this location, the maximum predicted change in water depth during a 100-year flood and a projected SLR of +1.41 meters was between 8.2 and 9.8 feet. Translated directly to the peak stage of the 100-year flood event at RM 55.5 on the Sacramento River, this would raise the river stage from 30.2 ft to the range of 38.4 to 40 feet.

WATER QUALITY

The two ponds within the Bees Lakes area are surrounded by a ring of levees yet they are hydraulically connected to the Sacramento River and the shallow groundwater table through seepage. The hydraulic connectivity leads to water levels rising and falling along with the stage in the river and aquifer, but the ponds are expected to have a very high residency time. This lack of flushing leads to stagnant water within the ponds, which promotes a substantial growth of algae and provides ideal mosquito habitat. Additionally, an abandoned boat and a large amount of trash have been observed in the ponds and are suspected to be degrading their water quality. Investigations into water quality are limited but based on visual observations and inferences about the land use practices in this area, other unknown water contaminants may exist in the Bees Lakes study area.

The understanding of the groundwater quality in the Bees Lakes area is based on studies of local wells at the two adjacent marinas and private domestic water wells. The closest drinking water wells to the Bees Lakes area are the small water system wells at Sherwood Harbor Marina and the Sacramento Yacht Club. The California Department of Public Health conducted tests on these wells in 2001 for Sulfate and Nitrate. Neither of these wells exceeded the Maximum Contaminant level as established by the State of California Drinking Water Standards (LSCE 2015).

2.3 INITIAL CONCEPTUAL RESTORATION ALTERNATIVES

In developing initial conceptual restoration alternatives, the project team focused on the grant's goal of restoring physical and ecological processes within the Bees Lakes area to optimize habitat function, enhance the existing habitat to better meet listed species needs, improve pond water quality, remove potential contaminants, and improve public access management. The information gathered in preparing the Bees Lakes Habitat Restoration Plan Environmental Baseline Report (Douglas Environmental 2019) provided baseline information regarding the site's habitat conditions and potential restoration opportunities. Four preliminary habitat restoration concepts were initially developed that ranged from limited disturbance of the existing habitat resources to a substantial alteration of the site's hydrology. All four concepts focused on enhancing the site's ecological processes, which would require a range of physical changes to the site.

The alternative with the least physical changes included removing invasive plants, and enhancing and expanding the site's riparian woodland habitat. A second alternative focused on improving the pond water quality by installing pipes under South River Road that would connect the ponds to the Sacramento River. The purpose of these pipes was to provide a direct connection between the Sacramento River and the ponds, which would substantially enhance pond water quality. These pipes were proposed to be screened to prevent fish stranding in the ponds. Expanding on this concept, a third alternative was identified that would directly connect the

Sacramento River to the ponds by excavating two large culverts under South River Road. These culverts would be of sufficient size and depth to allow regular exchange of water between the ponds and the Sacramento River. The intent of this alternative was to provide off-channel habitat for migrating salmon while also improving pond water quality. Some filling of the ponds would be necessary to ensure fish stranding would not occur. The final alternative included constructing a riverside terrace or bench along the Sacramento River by lowering the west bank's existing topography to provide off-channel fish habitat.

2.4 STAKEHOLDER ENGAGEMENT

The project team briefed the City's Parks, Recreation and Intergenerational Services Commission on August 6, 2019 on the grant objectives, the Habitat Restoration Plan development process, and on the four initial conceptual restoration alternatives. During this briefing, City staff discussed the development of a stakeholder advisory group and received input from the Commission on potential membership of the group. The City subsequently established a stakeholder advisory group when the initial conceptual restoration alternatives were still in their formative stage. The group was established at that time to allow for early input into the development of the conceptual alternatives. The City also worked with WSAFCA staff to identify potential advisory group members including local landowners, RD 900 representatives, marina owners/operators, environmental organization representatives, site users, developer representatives, equestrian advocates, cyclists, academics, and wildlife viewers.

The first stakeholder meeting was held on November 5, 2019 at City Hall from 6:00 to 8:00 pm during which an overview of the grant goals and objectives was provided to the group. The four preliminary habitat restoration concepts, as described above, were presented to the group for their input. The stakeholders provided detailed input on the concepts and suggested several concept modifications. The stakeholders raised concerns regarding the extensive illegal dumping that occurs at the site. One suggested solution included installing fencing around the entire perimeter of the site.

For the recreational opportunities, a stakeholder requested that equestrian uses be listed as a recreational component. In addition, educational components were suggested. It was suggested that the project alternatives could be implemented in phases through a strategy of preparing a combination of project and programmatic environmental documentation. The first phase of project implementation could be evaluated at a project level while later larger phases, such as connecting the Bees Lakes ponds to the Sacramento River, could be evaluated programmatically.

The stakeholders suggested that the City make implementable changes now, such as installing no dumping signs, rather than waiting to complete a larger project. The stakeholders also suggested evaluating the feasibility of closing South River Road through the use of locking gates that could be accessed by emergency personnel. Concerns were raised about fire and emergency vehicle access and the ability of Sherwood Harbor Marina to have two access routes. The City's trail ranger program was mentioned as a means to patrol and maintain the site and one stakeholder mentioned using voluntary horse patrols.

Stakeholders generally did not support the more expansive alternatives that would connect the ponds to the river to provide salmon habitat. Concerns were raised regarding the implementability of a river connection and the long-term maintenance requirements. Stakeholders were concerned about the perception of breaching the remnant levee for habitat benefits since this is the former levee. The stakeholders suggested focusing on a

restoration project that would be more likely to be funded and built. The stakeholders agreed that restoration enhancements are definitely needed within the area and that a project with less physical disturbance would likely be more acceptable.

For recreational access, boardwalks were identified as an important component due to the frequent inundation of the existing trails within the Bees Lakes area.

The stakeholders discussed the existing BMX facilities that have been built within the ponds area including the benefits provided by these facilities and potential liabilities for the City. The Sheephill BMX facility in the Huntington Beach area was identified as a good example of how a BMX facility could be maintained on public lands and how liability could be minimized for public agencies.

A second stakeholder meeting was held on January 27, 2020 at City Hall from 6:00 to 8:00 pm where three refined conceptual alternatives, as described below, were presented. The project team summarized the process used to compare and analyze the conceptual alternatives including the development of habitat, recreation and water quality evaluation criteria. Comparative evaluation matrices were presented and the scoring and results were discussed by the project team and stakeholders. The project team discussed the cost considerations and implementation feasibility for each alternative. Stakeholders provided input on the evaluation criteria and cost considerations/implementability.

In addition to these group stakeholder meetings, several individual meetings were held with interested stakeholders to gather input on the conceptual alternatives. A public site tour was also conducted with the Sacramento-San Joaquin Delta Conservancy Board on July 24, 2019 to provide the Board members an opportunity to understand the site's restoration opportunities. In addition, the project team conducted a meeting and site visit with Jim Starr with the California Department of Fish and Wildlife on August 20, 2019 to gather information regarding restoration opportunities and habitat mitigation requirements that may be required for the different conceptual alternatives.

2.5 REFINED CONCEPTUAL RESTORATION ALTERNATIVES

The City is required by the grant for this planning effort to conduct a detailed evaluation of three restoration alternatives. To determine the three alternatives that would move forward to the detailed evaluation phase, the City relied on the direct input of the stakeholder group and on a high-level evaluation by the project team of the potential benefits of the four initial conceptual restoration alternatives. Based on this input and evaluation, the City determined that the alternative focused on improving the pond water quality by installing pipes under South River Road would be eliminated. The City determined that this alternative would have relatively few habitat and water quality benefits while requiring a significant cost to construct and maintain over the long term. The complexity of construction and level of habitat disturbance necessary to install the pipes also contributed to the City's decision. The following sections describe the three conceptual alternatives the City proposed to evaluate in detail.

ALTERNATIVE 1 – MINIMAL GRADING

Alternative 1 is identified as the Minimal Grading alternative because it does not include constructing a connection to the Sacramento River or excavating the river's west bank. It has the least grading and site

disturbance of the three alternatives evaluated. This alternative includes removing invasive plants, and enhancing and expanding the site's riparian woodland habitat (Figure 2). Potential recreational amenities include marked foot trails, elevated boardwalks, Americans with Disabilities Act (ADA) access ramps, an equestrian trail, way-finding signage and information kiosks. This alternative would also include the removal of potential contaminants from the ponds and the collection and disposal of any trash on the site.

ALTERNATIVE 2 – FULL FLOODPLAIN CONNECTION

This alternative would include the same components as identified for Alternative 1 but would add a full connection to the Sacramento River by excavating a single channel that would extend from the Sacramento River to the larger of the two ponds (Figure 3). This connection would be achieved by installing an arched culvert under South River Road. An existing channel that connects the two ponds during high water events would be further excavated to allow a more regular exchange of water between the two ponds.

ALTERNATIVE 3 – RIVERSIDE TERRACE

This alternative would include the same components as identified for Alternative 1 but would add a floodplain terrace along the west bank of the Sacramento River (Figure 4). The purpose of this floodplain terrace would be to provide inundated floodplain and shaded riverine aquatic habitat for salmonids and other fish species within the river.

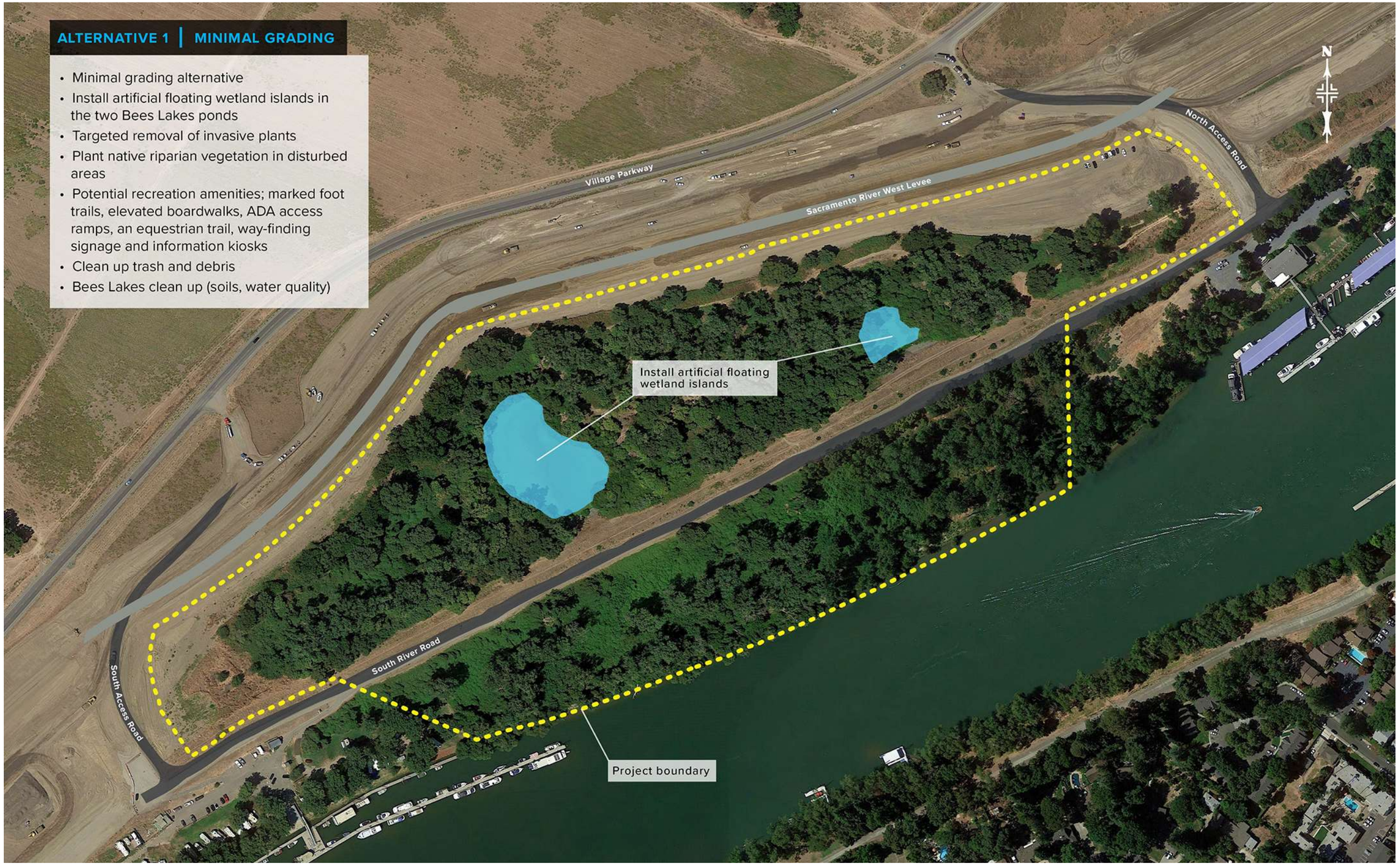


Figure 2. Alternative 1 – Minimal Grading

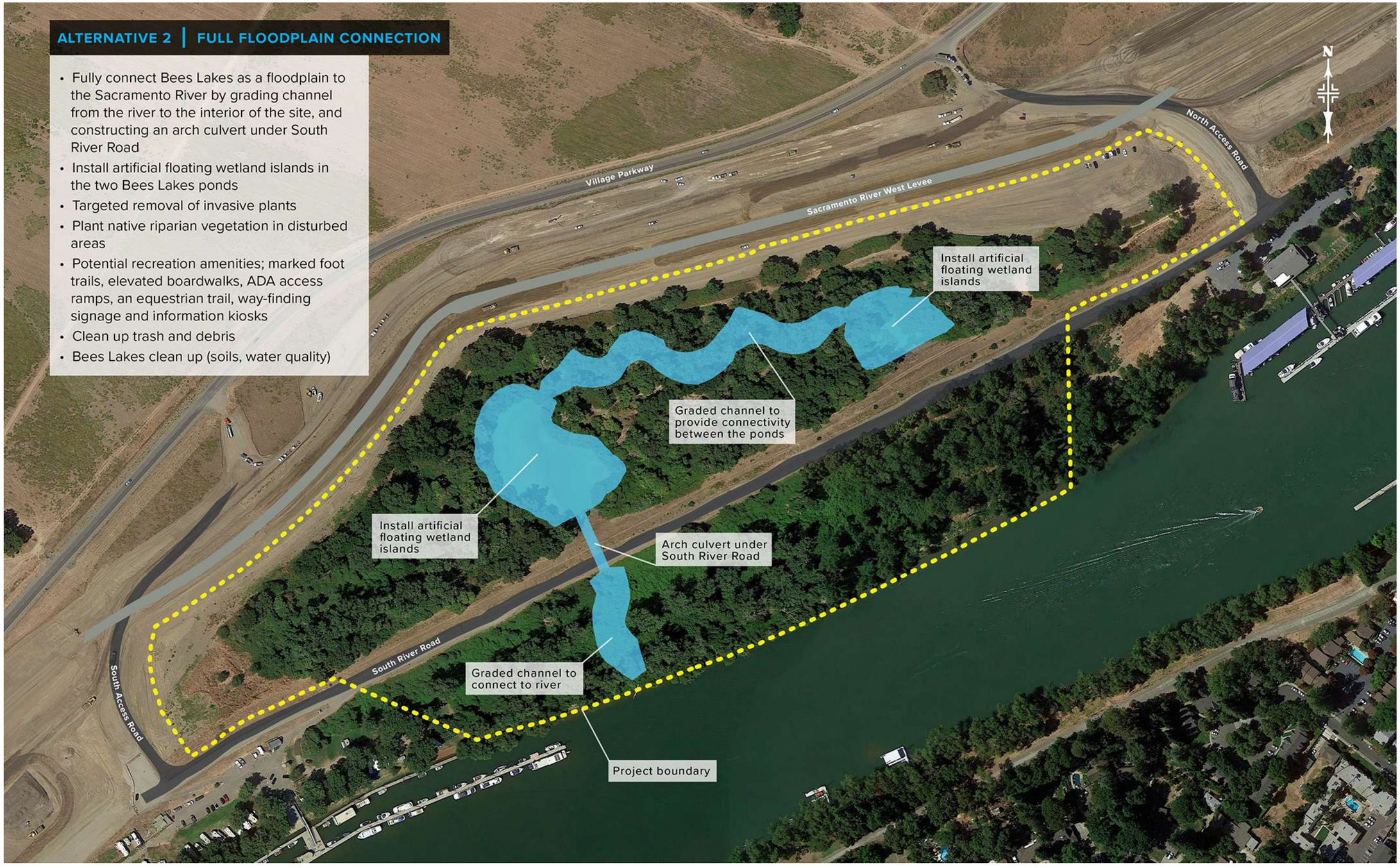


Figure 3. Alternative 2 – Full Floodplain Connection

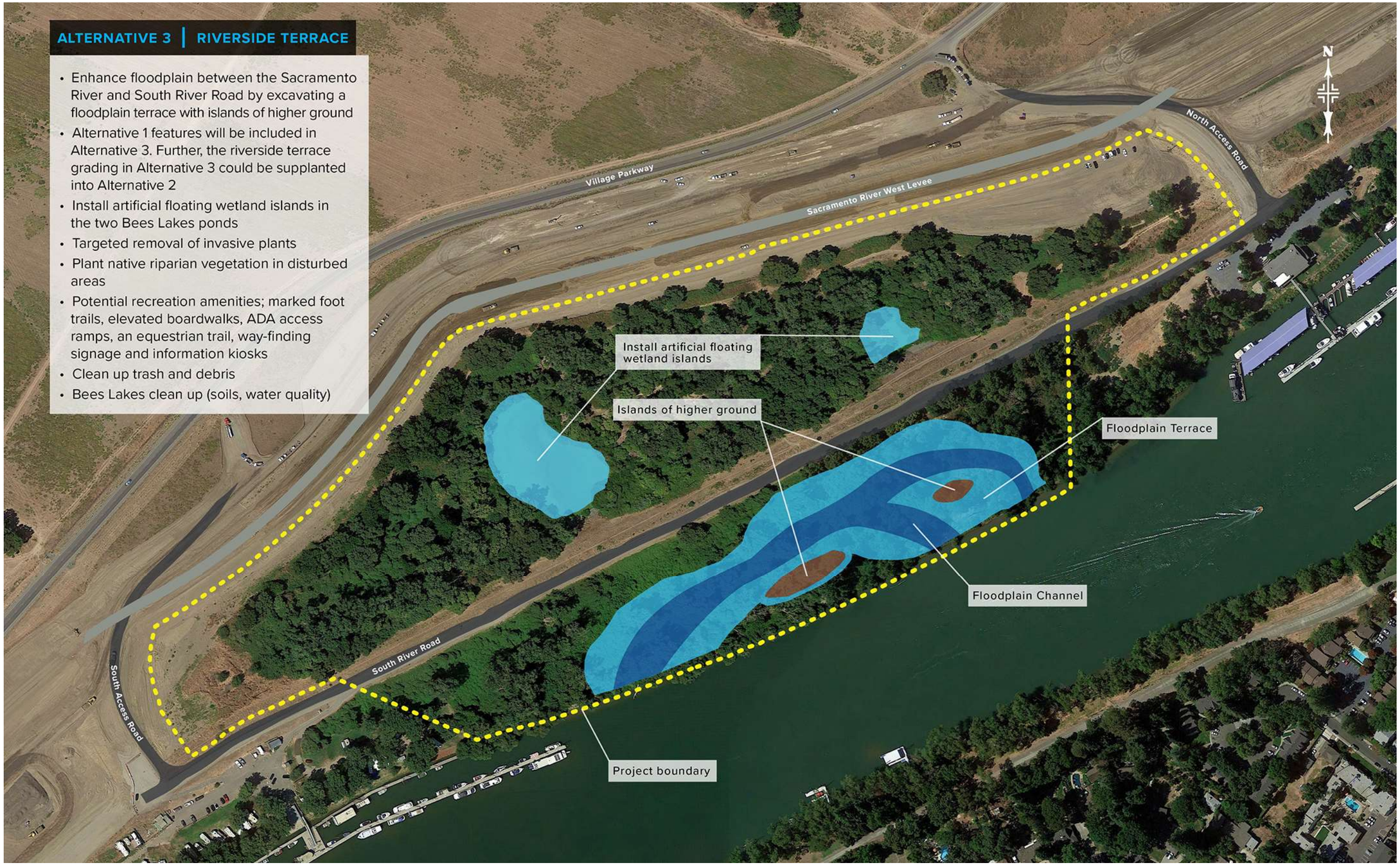


Figure 4. Alternative 3 – Riverside Terrace

3 CONCEPTUAL ALTERNATIVES – ANALYSIS AND EVALUATION PROCESS

3.1 EVALUATION CRITERIA DEVELOPMENT

The project team identified six categories of evaluation criteria, based on the objectives of the grant and the goals of the City, to comparatively assess the three refined conceptual restoration alternatives. These six categories include habitat, recreation, water quality, constructability, construction costs, and long-term operations and maintenance costs. Within these categories, several of the evaluation criteria were further refined to more precisely identify the comparative benefits of the conceptual alternatives. Evaluation criteria were either subjective, based on project team experience and conversations with stakeholders, or quantitative, based on currently available data. The evaluation criteria are described by category below.

HABITAT CRITERIA

Habitat criteria were developed to determine the relative ecological benefits of the three alternatives to multiple species guilds. For each habitat criterion, the benefits of each alternative over existing baseline conditions and relative to other alternatives were assessed. Habitat benefits were scored based on best professional judgment regarding anticipated habitat quality and quantity under each alternative, as well as on hydrodynamic modeling predictions of expected suitable habitat acreages where simulated data could provide the basis for such a determination. Habitat criteria scoring also included consideration of temporary habitat losses and permanent project impacts.

Salmonids - Rearing juvenile salmonid habitat has been identified as a limiting factor in the success of Chinook Salmon and Steelhead, two endangered species in the project area. Project alternative benefits to salmonids were evaluated based on modeled acreage of suitable rearing salmonid habitat generated by each alternative. Suitable juvenile salmonid rearing habitat was assessed according to habitat suitability curves for flow depth and velocity. Hydrodynamic modeling results for each alternative in project eco-flow conditions were analyzed for adherence to habitat suitability curves to provide the basis for determining acres of suitable habitat. Alternatives were scored relative to existing conditions and each other.

The eco-flow used to evaluate juvenile rearing salmonid habitat was developed in a statistical analysis of long-term (1980 to 2015) river flow data for the Sacramento River. Using the U.S. Army Corps of Engineers (USACE) Hydrologic Engineering Center Ecosystem Functions Model (HEC-EFM), the minimum flow required to stimulate floodplain foodweb development was determined based on the timing, duration, and frequency of inundation associated with juvenile rearing salmonid habitat needs. Juvenile Chinook Salmon (fall-run) and Steelhead typically emigrate from December to June looking to feed on floodplains as they head downriver. Floodplain inundation for a period of at least 2 weeks stimulates growth of biota that feed the juvenile fish. If floodplain inundation occurs between December and June for at least 2 weeks in 2 out of every 3 years, it can have a meaningful contribution to emigrating salmonid growth and potentially toward increasing salmonid populations. The eco-flow is the minimum flow required to satisfy these conditions for timing, duration and

frequency of inundation. The eco-flow was used to evaluate juvenile salmonid rearing and also as a proxy for frequent low-flow events that may inundate the site.

Riparian Birds - Habitat benefits for native riparian birds were evaluated based on each alternative's anticipated enhancements to and conservation of riparian vegetation. Temporary and permanent habitat conversion project impacts were taken into account, as were the expected positive effects of reintroducing a riverine floodplain connection to the interior of the site on sustained riparian forest diversity and structural heterogeneity under Alternative 2. Alternatives scored higher if they promoted natural recruitment, stand diversity, and structural heterogeneity in the long term and scored lower for loss of habitat by conversion to other types (e.g., open water). Habitat conversion impacts were estimated by reviewing inundation and depth maps of the alternatives from simulations of the 2-year flow and eco-flow.

Waterbirds - Habitat benefits for waterbirds were assessed based both on shallow-water habitat availability (up to 1 foot inundation, supporting dabblers and waders) and deep-water habitat availability (3 to 9 feet deep, supporting diving birds). Hydrodynamic modeling formed the basis for evaluating available waterbird habitat, using project eco-flow conditions as a proxy for frequently occurring winter-spring inundation conditions. Model results were analyzed in GIS to estimate the relative seasonally available habitat acreages of waterbird habitat, and alternatives with greater seasonal inundation extents for waterbirds received higher scores.

Native Terrestrial Wildlife - Habitat benefits of project alternatives on native terrestrial wildlife were primarily evaluated based on terrestrial wildlife habitat availability and accessibility under modeled winter-spring site inundation extents. Project temporary and permanent impacts and enhancements to extant habitats were also taken into account.

Native Fishes and Aquatic Foodweb - Habitat benefits to native fishes and the regional aquatic foodweb were evaluated based on site connectivity with the Sacramento River and area of additional fish habitat generated under each alternative. Increasing hydrologic connectivity of the site interior or riverside terrace to the river provides additional floodplain habitat for fish, and provides inputs to the regional aquatic foodweb in the form of allochthonous organic matter flushed out of the inundated riparian forests as well as on-site productivity of phytoplankton and zooplankton. Available native fish habitat and expected foodweb benefits were assessed by reviewing inundation from simulations of the eco-flow compared to existing conditions and between alternatives. Alternatives scored higher based on increased connectivity to the Sacramento River and greater areas of inundation in the eco-flow scenario.

Valley Elderberry Longhorn Beetle (VELB) - The VELB requires mature elderberry shrubs with stems of at least one inch in diameter to complete its life cycle, and elderberry shrubs are common on the project site. All alternatives would provide some benefit to VELB in that they all enhance and conserve riparian habitats that support elderberries; alternatives scored differently relative to each other based on temporary and permanent impacts to riparian habitat and anticipated impacts to elderberry shrubs. Habitat conversion was estimated by reviewing inundation and depth maps of the alternatives from simulations of the 2-year flow and eco-flow and compared to the existing condition.

Swainson's Hawk - Swainson's Hawk (SWHA) nests in large trees, such as valley oak and cottonwood, and has been observed nesting on the project site. While enhancement and conservation of riparian habitats generally benefit SWHA, this species is likely to become significantly less frequent at the Bees Lakes project site under any

alternative, due to the extent of planned surrounding housing developments that will remove available foraging habitat for SWHA. Thus, all alternatives scored equally (very low) for this habitat criterion.

Regional Ecological Resilience - This habitat criterion was scored based on professional judgment as to how each alternative would contribute to sustainability of existing habitats, resilience to sea level rise, or if it included features that support species' resilience or habitat diversity. Reconnecting the interior of the site to a riverine flood regime was scored as having the largest contribution to regional ecological resilience, due to promoting sustained riparian recruitment and stand diversity and potential for riparian habitat expansion with sea level rise, as well as increasing aquatic habitat availability for fishes and aquatic foodweb productivity. Alternatives were scored relative to existing conditions and each other.

RECREATION CRITERIA

The implementation of recreational components is intended to enhance the public's recreational and educational value and use of the site while discouraging unwanted uses and limiting the disturbance of sensitive natural areas. The team evaluated the potential effects each alternative would have on recreational opportunities. Because the recreational components are similar among the alternatives, this analysis focused on potential limitations to site access due to inundation. Specifically, the project team evaluated inundation duration and the spatial extent of the eco-flow and 2-year inundation events. Alternatives received higher scores if site access was maintained during frequent flood flow events.

River/Fishing Access - Alternatives were evaluated based on the river access and fishing opportunities they would provide. Fishing access was quantified by additional shoreline created and its proximity to the river. Alternatives were ranked relative to the existing condition and to each other.

Hiking/Birdwatching Access - Alternatives were evaluated based on the ability of site users to continue to access the site during frequently recurring flood events. The 2-year event inundation maps were evaluated to assess loss of access during frequently recurring floods. Alternatives were ranked relative to the existing condition and to each other.

Accessible Recreation Opportunities - Similar to hiking and birdwatching access, alternatives were evaluated based on their ability to provide ADA access and for maintaining access to the site during frequently recurring flood events. The 2-year event inundation maps were evaluated to assess loss of access during frequently recurring floods. Alternatives were ranked relative to the existing condition and to each other.

WATER QUALITY CRITERIA

The relative water quality benefits were assessed based on the ability of each alternative to enhance the degraded water quality within the Bees Lakes ponds. Although all of the alternatives would be expected to have some water quality benefits for the ponds due to the proposed draining and contaminated material removal that is common across the alternatives, the regular exchange and flushing of pond water with the Sacramento River associated with Alternative 2 would generate the greatest water quality benefits for the ponds.

CONSTRUCTABILITY CRITERIA

The constructability criteria focused on the level of difficulty in constructing an alternative, the eligibility of the alternative for grant funding, and the ease of permitted. The assessment of these criteria is subjective and generally assumes that a more complex project design would be more difficult to permit and construct. However, the more complex alternatives were identified as having higher eligibility for grant funding due to the greater habitat benefits they were estimated to produce.

Project Constructability - The constructability criterion accounted for the level of effort it would take to construct each alternative. Project constructability was regarded as more complex and alternatives scored lower if they required specialized equipment, unconventional or non-standard methods, if the work areas were not easily accessible, or if the working conditions were exceptionally difficult. For example, work on the riverside of the remnant levee would require specialized equipment such as sheet-pile drivers to allow grading below river stage. Construction of access roads to mobilize heavy grading equipment was viewed as an impediment to constructability of an alternative.

Project Eligibility for Grants - Alternatives were evaluated based on whether they include components that are typically funded through grants. Grant funding opportunities tends to be greatest for habitat restoration projects, particularly those that provide habitat for salmonids such as through the Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Proposition 1). However, funding opportunities are also available for recreational projects such as through the Parks, Environment, and Water Bond of 2018 (Proposition 68). Because all three alternatives would have similar recreational features, for this criterion, alternatives that achieved the greatest ecosystem benefits were ranked the highest.

Ease of Permitting – This criterion reflects the level of effort and number of permits that would be necessary to implement the alternative. Generally, alternatives that remove large areas of riparian habitat to construct project features or that include a connection to the Sacramento River would be expected to require substantially more effort to secure necessary permits than a more limited alternative. However, all of the alternatives considered would likely require an encroachment permit from the Central Valley Flood Protection Board and a Clean Water Act Section 404 permit for wetland fill.

LONG-TERM OPERATIONS AND MAINTENANCE CRITERIA

For this criterion, the alternatives were evaluated based on the level of operations and maintenance that would be required to maintain the alternative over the long term. All three alternatives have costs associated with patrolling, signage, trash collection and trail maintenance. Features that would increase operations and maintenance costs include pump inspections, inspection and maintenance of culverts, and adaptive management actions such as sediment and vegetation maintenance associated with floodplain connections. The operations and maintenance required for all of the alternatives would have the potential to impact the City's General Fund. However, the alternatives that require more physical infrastructure and that result in greater changes in the site hydrology are assumed to have substantially higher long-term maintenance and operational requirements that could add significantly to the long-term project costs. For this criterion, the alternative estimated to have the lowest long-term operations and maintenance costs was ranked highest while the alternative estimated to have the highest long-term operations and maintenance costs was ranked lowest.

COST/BENEFIT CRITERIA

A more qualitative analysis was conducted to estimate the relative benefits of each alternative compared to their relative costs. The cost estimates are preliminary and will require refinement once the 65-percent site designs are completed. However, these preliminary estimates reflect the level of construction required for each alternative, particularly the required level of soil excavation and grading needed. Because soil movement would likely be the largest cost associated with the alternatives, these preliminary cost estimates provide a reasonable projection for comparison purposes. The benefits were estimated based on how effectively each alternative would achieve the grant objectives, taking into consideration the alternatives likelihood of being constructed.

3.2 HYDROLOGIC MODELING AND ANALYSIS

HYDRAULIC MODELING

The project team used USACE's HEC River Analysis System (HEC-RAS) two dimensional (2D) hydrodynamic model of the Sacramento River to evaluate hydraulic conditions for alternatives that include riverbank (Alternative 2) and floodplain (Alternative 3) grading. The hydrodynamic model domain used to analyze the alternatives is a subset of a larger HEC-RAS 2D model developed for the Sacramento River. Upstream and downstream boundary conditions, including water surface elevations (WSEs) and input flows, for the model were derived from separate hydrodynamic model that was prepared for and vetted during the Southport Early Implementation Project.

The project conditions for alternatives 2 and 3 were input to the 2D model and simulated for the 2-year return interval and eco-flows. Alternative 1 was not simulated using a hydrodynamic model because it has no connection to the river. Existing conditions were also modeled to provide a basis for comparison for each alternative.

Alternative 3, which involves grading adjacent to the river, was evaluated to provide depth and velocity predictions to inform salmonid habitat evaluations. Alternative 2 does not include riverside grading but its connection to the river causes the ponds to inundate with the rise of the river and the model was used to predict areas and depths of inundation under this scenario. WSEs in the Sacramento River from simulations of Alternatives 2 and 3 were used to estimate pond WSEs within the interior areas of the site for Alternatives 1 and 3 based on groundwater – river stage relationships derived from local piezometer data.

Hydraulic modeling results were used as the basis for evaluating several of the ecological parameters. Depth and velocity values were used to predict salmonid habitat suitability and extent. Inundation depth and area maps helped inform habitat evaluations of waterbirds, riparian birds, terrestrial wildlife, native fishes (and aquatic foodweb contributions), VELB, and SWHA. Model results were also used to predict shear stress to assess the potential for erosion, sediment deposition, and sustainability of the designs during concept development. The methods of evaluation are described in more detail in Ecological Analysis and Evaluation discussion below.

HYDROLOGIC EVALUATION

A study of the site's existing hydrologic conditions was conducted during preparation of the Bees Lakes Habitat Restoration Plan Environmental Baseline Report (Douglas Environmental 2019) to determine how water levels within the two ponds vary by season. This information is necessary to design restoration planting and to inform

the layout of paths, boardwalks and interpretive features. Available piezometer data in the area surrounding the site was analyzed, specifically monitoring well 7 (MW-7) and MW-15. These two monitoring wells, which were installed during the assessment period of the Southport Levee Improvement Project (LSCE 2015), are located 0.2 miles west of the site and 0.7 miles northeast of the site, respectively. The groundwater elevation was compared to river stage at these piezometers and proximity of the sites to the river was considered. Through percolation, the groundwater at each piezometer rose and fell with changing river stage. MW-7 showed a muted response to changing river stage and MW-15 displayed a much greater degree of hydrologic connectivity. To approximate the potential WSE in the Bees Lakes ponds, both hydrographs from MW-7 and MW-15 were considered, averaging the groundwater levels during the wet (December-May) and dry (June-November) seasons. The average WSE in the ponds was calculated as 5.9 feet above the North American Vertical Datum of 1988 (NAVD 88) during the wet season and 4.9 feet NAVD 88 during the dry season. Further study and water level monitoring is recommended during the design phase to augment this limited data set to support development of the planting plan and layout of access and interpretive features.

3.3 ECOLOGICAL ANALYSIS AND EVALUATION

Data from hydraulic and hydrologic modeling were used to evaluate the alternatives according to the defined habitat evaluation criteria. Hydraulic modeling simulations included the 2-year return interval flow and the eco-flow. The eco-flow, described above, is relevant to habitat for rearing juvenile salmonids, but it also served as a proxy for frequently occurring flow events. The 2-year flow represents the upper end of frequently occurring flows and it inundates the existing floodplain on the waterside of the remnant levee, which enabled comparison to inundated area in the existing condition. Review of model results for both flow events provided a basis for evaluating changes in various types of habitat during frequent flood events.

Model output including inundation extent, inundation depth, and flow velocity were processed using GIS to understand spatial differences in inundation and depth patterns between alternatives and the existing condition and to help develop a qualitative understanding of effects on habitat. Inundation maps (Appendix A: Figures 1 through 6) indicated broadly the changes in wetted extent that could be expected on the site while inundation depth maps (Appendix A: Figures 7 through 12) more clearly defined the implications of wetted area. Inundation depth patterns were spatially analyzed to identify different depth ranges suitable for different bird habitats and depth and velocity results were processed to determine the weighted usable area for rearing juvenile salmonids.

SALMONID HABITAT ANALYSIS

Salmonid habitat was quantified according to the weighted usable area (WUA) method to provide an estimate of suitable habitat for rearing juvenile salmonids for Alternatives 2 and 3 that connect to the river. WUA was evaluated for the eco-flow and for the 2-year flow, which provided a basis for comparison to existing conditions, as the existing overbank between the remnant levee and river becomes inundated at the river stage associated with this event.

The WUA score is an indicator of habitat quality. The WUA method applies a factor (a fraction roughly equivalent to a percentage) to area designed as habitat to reflect the degree to which a species is predicted to utilize it. For example, 1 acre of WUA could represent 1 acre of exceptional habitat (with a habitat index score of 1, for ideal) or it could represent 10 acres of marginal habitat (with a habitat index score of 0.1). A species utility of habitat is determined according to habitat suitability indices. Habitat suitability for rearing juvenile salmonids

was defined according to published habitat suitability indices (HSI) for flow depth and velocity, represented as curves along which ideal habitat achieves a score of "1" and unsuitable habitat scores a "0." HSI values for depth and velocity for juvenile Chinook Salmon and Steelhead were assumed to be the same and were developed for the California Department of Fish and Wildlife (CDFW) Voluntary Agreement (VA) process by compiling observational data from multiple river systems, including the lower Yuba River, lower American River, Klamath River, Trinity River, and Sacramento River. Based on habitat suitability index curves for flow depth and velocity, rearing juvenile salmonids prefer flow depths of 0.9 to 4 feet and flow velocities below 0.8 foot per second. Deeper or shallower water or faster flow velocities score less than 1.

Model output for depth and velocity were converted to raster format and each raster cell was multiplied by the composite HSI to produce the weighted usable area for that raster cell. The composite (or global) habitat suitability index (gHSI) and the total WUA within the site were calculated using the following equations:

$$gHSI_{cell} = VHSI \times DHSI \quad \text{(Equation 1)}$$

$$WUA = \sum(gHSI_{cell} \times Area_{cell}) \quad \text{(Equation 2)}$$

Where VHSI, and DHSI are velocity and depth habitat suitability indices, respectively, taken from habitat suitability index curves for juvenile Chinook Salmon and Steelhead. The gHSI is a product of VHSI and DHSI (Equation 1) and represents hydraulic habitat suitability. To calculate WUA, the value of each cell in the gHSI raster was multiplied by the cell area and summed across all the cells in the model domain to calculate the total WUA (Equation 2). WUA results were evaluated relative to existing conditions and each other to assess relative improvements in rearing juvenile salmonid habitat. Consideration was also given for habitat availability, and higher scoring was given to Alternative 3 as the graded terrace is more directly accessed from the river than the interior ponds area in Alternative 2.

WATERBIRD HABITAT ANALYSIS

Hydraulic model output inundation depth data were evaluated to assess improvements to waterbird habitat among the alternatives. Waterbirds common to the area are divided into two categories: shallow and deep waterbirds. Shallow waterbirds include dabblers and waders and deep waterbirds consist of diving birds. Shallow waterbirds prefer inundated areas up to 1 foot in depth while deep waterbirds prefer inundated areas 3 to 9 feet deep. Hydraulic model depth plots for the eco-flow and 2-year flow were evaluated to estimate available habitat during frequent flow events common in the winter-spring timeframe. Hydraulic model depth results were processed in GIS to identify preferred depth ranges for deep and shallow waterbirds and areas of respective habitat were tabulated. Alternatives that produced greater acreages of suitable habitat were scored higher.

ANALYSIS OF OTHER HABITAT COMPONENTS

Remaining habitat criteria by which alternatives were evaluated include those for riparian birds, native terrestrial wildlife, native fishes and aquatic foodweb, VELB, SWHA and regional ecological resilience. Hydraulic model output data and mapping for wetted area (Appendix A: Figures 1 through 6) and water depth (Appendix A: Figures 7 through 12) during the 2-year and eco-flows were used to analyze benefits to these habitat criteria. Maps of wetted area and depth were utilized to assess:

- Temporary and permanent impacts to habitat;
    - Enhancements such as improved forest diversity or sustainability and natural recruitment when evaluating for riparian birds, native fishes and aquatic birds, VELB, and regional ecological resilience; and
    - Detractions such as conversion to another habitat type (e.g., open water) or loss of mature trees when evaluating for riparian birds, native terrestrial wildlife, VELB and SWHA.
- Whether access to a species' habitat is improved or limited by inundation in the cases of native terrestrial wildlife and native fishes and regional ecological resilience;
- Extent of connectivity to the Sacramento River as it affects potential to create additional off-channel habitat, stimulate foodweb production, or provide stability and habitat expansion with sea level rise; and
- Impacts of construction using area of newly inundated areas as a proxy in all cases.

Best professional judgment was used to rank the alternatives based on visual assessments of the wetted area and water depth maps as they pertained to the individual habitat criteria. Alternatives were ranked based on their benefits or impacts to habitat, relative to the existing condition and each other.

3.4 DECISION MATRICES

The evaluation criteria and ecological analyses described above were used to assess the potential benefits of implementing each alternative. Decision matrices were developed for each alternative to facilitate an objective assessment that would assign a numerical score for both project benefit and constructability aspects. The benefit decision matrices contained habitat, recreation and water quality categories with eight criteria in the habitat category, three criteria for recreation, and one criterion for water quality. The constructability decision matrices contained constructability, long-term operations and maintenance, and cost/benefit criteria with three criteria for the constructability category, one criterion for long-term operations and maintenance, and one criterion for the costs/benefit assessment.

While ecological analyses generated quantitative information to facilitate an objective assessment of evaluation criteria, scoring was assigned on a qualitative scale, appropriate to a conceptual-level evaluation. Qualitative ratings used to describe the benefits the alternative contributed toward each of the evaluation criteria included very low, low, medium, high and very high value. These ratings were associated with scores of 1 through 5 with a very high value being assigned a 5. If an alternative presented no benefit toward an evaluation criterion, a score of 0 was assigned. Total scores were tallied at the bottom of the matrices and were then averaged based on the number of criteria assessed. The evaluation matrices are included as Appendix B of this report.

3.5 PRELIMINARY COST ESTIMATES

Conceptual level opinions of probable cost were prepared for the three alternatives to facilitate alternative rankings in the decision matrix. Construction costs were based on the major components envisioned for each alternative at the conceptual design level. Unit costs were based on bids and costs estimates prepared for similar

construction on recent projects. Past unit costs were escalated at 3% annual inflation to account for an anticipated implementation date of summer 2022. Opinions of probable construction cost for the three alternatives are shown in Table 1.

Table 1. Preliminary Construction Cost Estimates

	Alternative 1	Alternative 2	Alternative 3
Construction Cost Estimate	$3.25 million	$5.5 million	$8.5 million

3.6 ANALYSIS RESULTS

To compare the alternatives across the benefit and constructability categories included in the decision matrices, the scoring was consolidated into a single table (Table 2). The average score for each decision matrix category was identified for each alternative by dividing the total score by the number of criteria included in the individual decision matrices. For example, for the habitat matrices, the total score for each alternative was divided by eight (the total number of criteria for this matrix) to determine the average score. The average scores were then converted to rankings of either Low = 1, Medium = 2, or High = 3. A final tally is provided in the right-hand column of Table 2 for each alternative. Of the three alternatives, Alternative 1 – Minimal Grading achieved the highest score of 15 followed by Alternative 2 – Full Floodplain Connection with a score of 12, and Alternative 3 – Riverside Terrace with a score of 10.

Table 2. Benefits and Constructability Analysis Results

Alternatives	Habitat Restoration	Recreation	Water Quality	Construct-ability	Long-Term O & M	Cost/ Benefit	Total
1 - Minimal Grading	1	3	2	3	3	3	**15**
2 - Full Floodplain Connection	2	2	3	2	1	2	**12**
3 - Riverside Terrace	2	3	2	1	1	1	**10**

NOTE: *The numbers represent how each alternative was ranked according to the matrices analysis for each category. The rankings are identified as Low = 1, Medium = 2, and High = 3 with the alternative with the highest total score having the best combination of benefits and constructability.

The Benefits and Constructability Analysis of the alternatives reflected in Table 2 identified that the alternatives with more extensive construction components (Alternatives 2 and 3) would result in greater habitat benefits than Alternative 1. Of the three alternatives, Alternative 2 would achieve the highest water quality benefits for the ponds due to the proposed connection to the Sacramento River. Alternative 3 was identified as providing the highest recreational amenities primarily because access to the ponds would not be limited by inundation during frequent flood events as anticipated with Alternative 2 and additional fishing opportunities along the Sacramento River would be created with construction of the riverside terrace.

Alternative 1 was identified as being relatively easy to permit, construct, and maintain, particularly when compared to the other two alternatives. Although Alternative 2 would provide connectivity between the ponds and the river and would increase the usable area for salmonid habitat, it would also require complex and expensive construction, increased long-term maintenance, and relatively complex permitting. Alternative 3 would provide

greater habitat benefits than Alternative 1 with the introduction of the riverside terrace but would also be very expensive to construct, would increase long-term maintenance, and would require complex permitting associated with constructing within the Sacramento River floodplain.

3.7 PREFERRED ALTERNATIVE SELECTION

As discussed in Chapter 2 above, the three refined conceptual alternatives, the evaluation criteria, and the evaluation matrices were presented to stakeholders during the second stakeholder meeting held on January 27, 2020. Stakeholders provided input on the evaluation criteria and implementability of the refined conceptual alternatives. The stakeholders reached general consensus during the meeting that Alternative 1 – Minimal Grading should be identified as the preferred alternative.

The project team briefed the City's Parks, Recreation and Intergenerational Services Commission on February 4, 2020 on the Habitat Restoration Plan development process and on the refined conceptual alternatives developed through the stakeholder engagement process. Based on stakeholder input and the results of the conceptual alternative evaluation process described above, City staff recommended Alternative 1 – Minimal Grading as the preferred alternative and requested feedback from the Commission on this recommendation. The Commission supported the recommendation. The Commission further supported consideration of Alternative 2 and/or Alternative 3 as future phases of project implementation.

4 PREFERRED ALTERNATIVE DESCRIPTION

Alternative 1 – Minimal Grading has been identified by the City, with support from stakeholders and the Parks, Recreation and Intergenerational Services Commission, as the preferred alternative. This alternative includes ecosystem, water quality, and recreation components that are described in detail below. The long-term operations and maintenance requirements and construction cost estimates are also described below.

4.1 ECOSYSTEM COMPONENTS

INVASIVE PLANT REMOVAL

Project site restoration implementation will include focused removal and control of target invasive species at the project site (Table 3). The goal of the invasive plant removal is to significantly decrease abundance of target invasive species and increase abundance of native understory species to improve and sustain native plant community health and diversity. The impact of completely eradicating target species would likely outweigh the benefit. As such, complete eradication is not being proposed.

The most prevalent target invasive species are: Himalayan blackberry, which occurs in large patches in portions of the riparian forest understory and in some monoculture patches; and edible fig (*Ficus carica*), which is scattered throughout the site, primarily on the riverside portion. Both of these species are rated invasive by the California Invasive Plant Council (Cal-IPC 2020). Native California blackberry is also prevalent on site; care will be taken to avoid native blackberry thickets. Additional invasive plants present on the project site that are rated invasive by Cal-IPC and will be targeted for removal include English ivy (*Hedera helix*), giant reed (*Arundo donax*), Russian olive (*Elaeagnus angustifolia*), and glossy privet (*Ligustrum lucidum*). Additional invasive species that have potential to occur on the project site and would be targeted for removal if present include tree-of-heaven (*Ailanthus altissima*), black locust (*Robinia pseudoacacia*), perennial pepperweed (*Lepidium latifolium*), and red sesbania (*Sesbania punicea*).

Some nonnative tree species are present in low numbers within the interior woodlands of the site that are not rated invasive by Cal-IPC but may also be targeted for removal, including a few individual Chinese pistache (*Pistacia chinensis*) and almond (*Prunus dulcis*) trees, and a small grove of mature pecan trees (*Carya illinoinensis*) occurring at the northeast edge of the wooded portion of the site. Generally, pecan trees are not widely naturalized in the region and it is assumed they were likely planted for ornamental value or nut productions). Pecan seedlings and saplings have been observed recruiting in other portions of the project site in recent decades (Leo Edson, *pers. comm.*). Any pecan tree removal would be undertaken with care not to remove Northern California black walnut (*Juglans hindsii*) trees or saplings, which appear very similar to pecan when fruits are not evident.

Herbaceous invasive species present in the open grassland areas of the project site that would be targeted for removal and management include Johnsongrass (*Sorghum halepense*), yellow starthistle (*Centaurea solstitialis*), Italian thistle (*Carduus pycnocephalus*), milk thistle (*Silybum marianum*), and poison hemlock (*Conium maculatum*).

Table 3. Target Invasive Plant Species

Common Name	Scientific Name	Cal-IPC Invasive Plant Inventory Rating
giant reed	*Arundo donax*	High
English ivy	*Hedera helix*	High
red sesbania	*Sesbania punicea*	High
yellow starthistle	*Centaurea solstitialis*	High
perennial pepperweed	*Lepidium latifolium*	High
Himalayan blackberry	*Rubus armeniacus*	High
tree-of-heaven	*Ailanthus altissima*	Moderate
poison hemlock	*Conium maculatum*	Moderate
Russian olive	*Elaeagnus angustifolia*	Moderate
edible fig	*Ficus carica*	Moderate
Italian thistle	*Carduus pycnocephalus*	Moderate
glossy privet	*Ligustrum lucidum*	Limited
black locust	*Robinia pseudoacacia*	Limited
milk thistle	*Silybum marianum*	Limited
pecan	*Carya illinoinensis*	Not rated
Chinese pistache	*Pistacia chinensis*	Not rated
almond	*Prunus dulcis*	Not rated
Johnsongrass	*Sorghum halepense*	Not rated

Rating Source: Cal-IPC 2020.

INVASIVE PLANT REMOVAL METHODS

Invasive plant removal will be conducted over two seasons in a targeted manner to minimize impacts to native vegetation. An ecologist/biologist retained by the City will direct and oversee all invasive plant removal work. All herbicide treatments will be conducted by a licensed applicator in accordance with herbicide label specifications under the direction of a Pest Control Advisor (PCA) licensed in the State of California.

Invasive woody plant removal in the first season will consist of targeted work by hand crews to either hand pull invasive plants (e.g. with a weed wrench), or cut and remove invasive plant material. Where appropriate, the cut surface of stumps or large stems will be painted with herbicide to kill woody plant root systems and prevent and/or reduce crown resprouting. Cut invasive woody plant materials will be removed from the site and disposed of legally offsite.

All locations where invasive woody plants are removed and treated in the first season will be marked, mapped, and tracked over the following growing season to locate and retreat any resprouts; more than one retreatment may be necessary. After woody plant removal sites have been revisited in the second season following treatment with little to no evidence of regrowth of target invasive plants, any significant bare ground areas (100 square feet in

size or larger) will be raked to scarify the soil surface and subsequently broadcast seeded with the riparian seed mix (Table 4) in the subsequent fall to winter. Seeded sites will be regularly revisited (i.e., monthly) during the growing season to ensure native vegetation is establishing and that further adaptive management actions are not indicated.

Table 4. Seed Mix Type 1 – Riparian Woodland

Common Name	Scientific Name	Seeding Rate (PLS* lbs/acre)
yarrow	*Achillea millefolium*	0.2
spike bentgrass	*Agrostis exarata*	0.1
California mugwort	*Artemisia douglasiana*	0.8
narrow-leaved milkweed	*Asclepias fascicularis*	1.0
showy milkweed	*Asclepias speciosa*	1.0
Fort Miller clarkia	*Clarkia williamsonii*	0.3
blue wildrye	*Elymus glaucus*	5.0
slender wheatgrass	*Elymus trachycaulus ssp. trachycaulus*	4.0
creeping wildrye	*Elymus triticoides*	3.5
California poppy	*Eschscholzia californica*	0.5
common gumplant	*Grindelia camporum*	0.5
meadow barley	*Hordeum brachyantherum*	5.0
miniature lupine	*Lupinus bicolor*	1.0
Hooker's evening primrose	*Oenothera elata*	0.4
Tansy leafed phacelia	*Phacelia tanacetifolia*	0.4
Canada goldenrod	*Solidago canadensis*	0.3
purple needlegrass	*Stipa pulchra*	3.0
Application Rate		27.0

*PLS = Pure Live Seed; seeding rates shown for native grasses and large-seeded forbs assume drill seeding application; seeding rates would be increased for broadcast or hydroseeding applications.

Control of target invasive herbaceous species will be achieved either via mechanical methods, including targeted hand pulling or timed mowing/string trimming of invasive plants before seedset, and/or spot spraying target invasive plants with a backpack sprayer using an appropriate herbicide and marker dye. No herbicides will be sprayed on days when wind speeds are high enough to potentially cause herbicide drift, and no herbicide spraying will be conducted within any elderberry shrub driplines. If spot treatments of herbaceous invasive plants result in any significant areas of bare ground (100 square feet or greater), those areas would be raked and broadcast seeded with the grassland seed mix (Table 5) in the fall or winter after treatment.

Table 5. Seed Mix Type 2 – Grassland

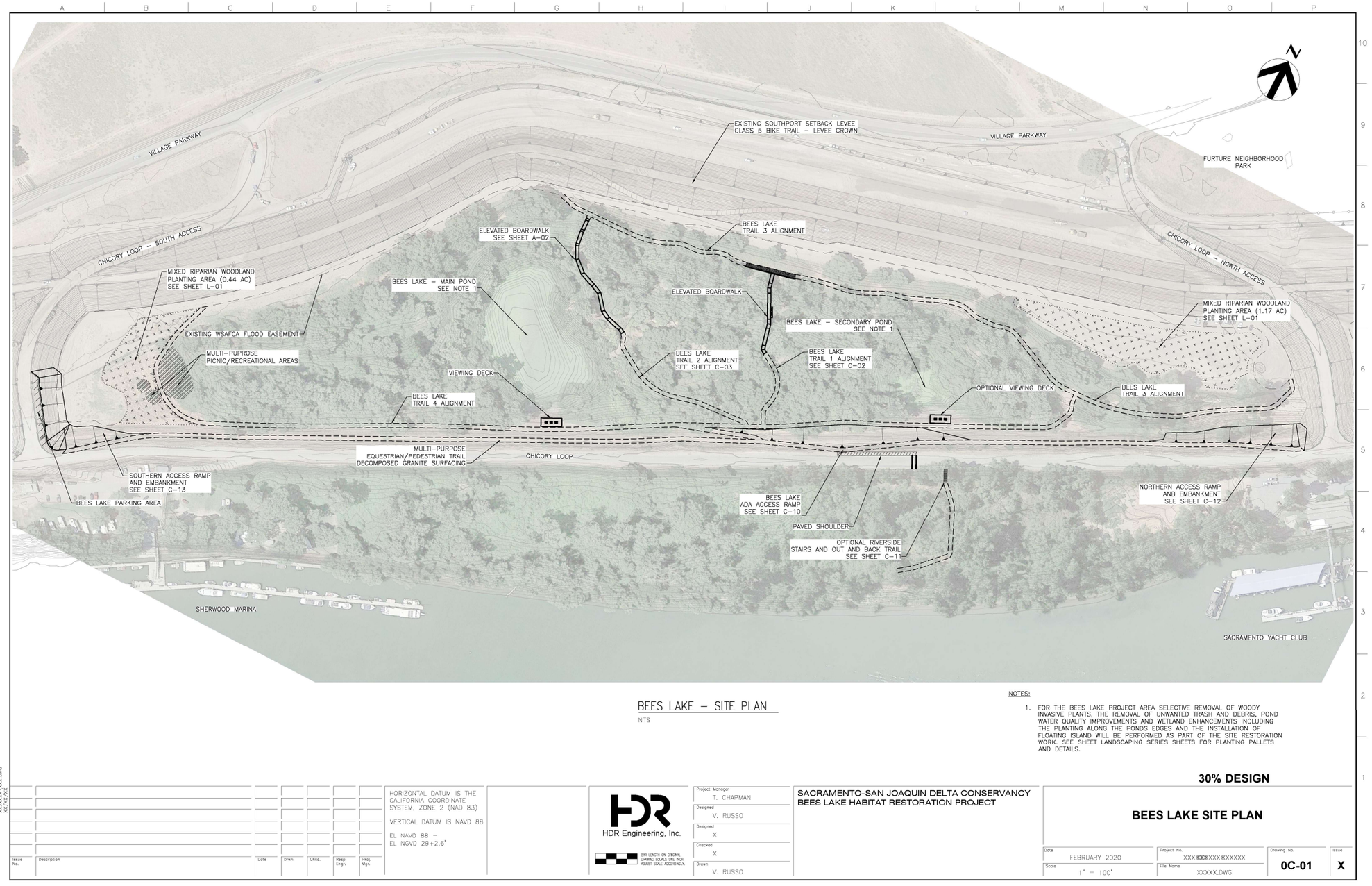
Common Name	Scientific Name	Seeding Rate (PLS* lbs/acre)
yarrow	*Achillea millefolium*	0.2
small flowered fiddleneck	*Amsinckia menziesii*	0.2
California brome	*Bromus carinatus*	1.0
Fort Miller clarkia	*Clarkia williamsonii*	0.3
blue wildrye	*Elymus glaucus*	5.0
slender wheatgrass	*Elymus trachycaulus ssp. trachycaulus*	4.0
California poppy	*Eschscholzia californica*	0.5
common gumplant	*Grindelia camporum*	0.5
California barley	*Hordeum brachyantherum ssp. californicum*	4.0
California goldfields	*Lasthenia californica*	0.5
miniature lupine	*Lupinus bicolor*	1.0
Tansy leafed phacelia	*Phacelia tanacetifolia*	0.2
one-sided bluegrass	*Poa secunda ssp. secunda*	0.5
Canada goldenrod	*Solidago canadensis*	0.3
purple needlegrass	*Stipa pulchra*	4.0
Pacific aster	*Symphyotrichum chilense*	0.5
Application Rate		*22.7*

*PLS = Pure Live Seed; seeding rates shown for native grasses and large-seeded forbs assume drillseeding application; seeding rates would be increased for broadcast or hydroseeding applications.

MIXED RIPARIAN WOODLAND ESTABLISHMENT

To enhance and expand riparian woodland habitat at the Bees Lakes project site, approximately 1.6 acres of mixed riparian woodland dominated by Fremont cottonwood (*Populus fremontii*) will be planted at two locations on the northeast and southwest ends of the landside portion of the project site (Figure 5). Historically, human disturbance prevented the establishment of woody vegetation in these areas.

The gradual succession to a community dominated by valley oak is expected in the absence of regular flooding disturbance. However, mature cottonwoods provide important nesting habitat for many riparian bird species regularly observed at the project site, including: cavity-nesting birds such as wood duck (*Aix sponsa*), downy woodpecker (*Picoides pubescens*), Nuttall's woodpecker (*Picoides nuttallii*), ash-throated flycatcher (*Myiarchus cinerascens*), and tree swallow (*Tachycineta bicolor*); and for raptors including: red-shouldered hawk (*Buteo lineatus*), red-tailed hawk (*Buteo jamaicensis*), and Swainson's hawk (*Buteo swainsoni*). To increase and maintain future nesting habitat for cavity-nesting species in particular, the riparian woodland planting areas will be planted with mixed riparian woodland dominated by Fremont cottonwood. The planting palette for the mixed riparian woodland planting areas are provided in Tables 4 and 6.



BEES LAKE – SITE PLAN

NTS

NOTES:

1. FOR THE BEES LAKE PROJECT AREA SELECTIVE REMOVAL OF WOODY INVASIVE PLANTS, THE REMOVAL OF UNWANTED TRASH AND DEBRIS, POND WATER QUALITY IMPROVEMENTS AND WETLAND ENHANCEMENTS INCLUDING THE PLANTING ALONG THE PONDS EDGES AND THE INSTALLATION OF FLOATING ISLAND WILL BE PERFORMED AS PART OF THE SITE RESTORATION WORK. SEE SHEET LANDSCAPING SERIES SHEETS FOR PLANTING PALLETS AND DETAILS.

30% DESIGN

HORIZONTAL DATUM IS THE CALIFORNIA COORDINATE SYSTEM, ZONE 2 (NAD 83)

VERTICAL DATUM IS NAVD 88

EL NAVD 88 –
EL NGVD 29+2.6'

HDR Engineering, Inc.

BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY.

Project Manager: T. CHAPMAN
Designed: V. RUSSO
Designed: X
Checked: X
Drawn: V. RUSSO

SACRAMENTO-SAN JOAQUIN DELTA CONSERVANCY
BEES LAKE HABITAT RESTORATION PROJECT

BEES LAKE SITE PLAN

Date: FEBRUARY 2020
Project No.: XXXXXXXXXXXXXX
Drawing No.: 0C-01
Issue: X
Scale: 1" = 100'
File Name: XXXXX.DWG

Figure 5. Project Site Plan

Container plants and cuttings will be installed in the fall, between October 15 and December 1. After planting container plants (Table 6) in sinuous rows, the riparian woodland seed mix (Type 1 Seed Mix; Table 4) would be drill seeded between planted trees and shrubs. Planted trees and shrubs will receive supplemental irrigation using a temporary system (water source to be determined) over a three-year establishment period, after which the plant roots will have accessed the relatively shallow water table and no supplemental irrigation would be needed for plant survival. Plants will be deeply watered during each irrigation event (1-2 inches of water applied during each event) to promote deep rooting, and irrigation frequency will decrease during the establishment period.

Table 6. Riparian Woodland Planting Palette

Common Name	Scientific Name	Plant Size	Quantity per Acre
Overstory Species			
boxelder	*Acer negundo*	Treepot 4 or 1 Gal	9
Oregon ash	*Fraxinus latifolia*	Treepot 4 or 1 Gal	18
California sycamore	*Platanus racemosa*	Treepot 4 or Cutting	46
Fremont cottonwood	*Populus fremontii*	Treepot 4 or Cutting	73
black willow	*Salix gooddingii*	Treepot 4 or Cutting	18
Arroyo willow	*Salix lasiolepis*	Treepot 4 or Cutting	18
Understory Species			
coyote brush	*Baccharis pilularis*	Treepot 4	9
mulefat	*Baccharis salicifolia*	Treepot 4 or 1 Gal	27
California coffeeberry	*Frangula californica*	Treepot 4	27
toyon	*Heteromeles arbutifolia*	Treepot 4 or 1 Gal	9
California rose	*Rosa californica*	Tree Band or Treepot 4	55
California blackberry	*Rubus ursinus*	Tree Band or Treepot 4	55
Showy milkweed	*Asclepias speciosa*	Plug/rhizome	100
Narrow leaf milkweed	*Asclepias fascicularis*	Plug/rhizome	100
Total Plants per Acre – Overstory and Understory			**364**

NOTE: Understory species to alternate with overstory species within planting rows; California rose and California blackberry to be planted adjacent to Fremont cottonwood and willow plantings. Planting rows will be spaced 16 feet apart on center; overstory species will be planted 20 feet on center and understory species will alternate with overstory species (10 feet on center) within rows. California rose and California blackberry to be planted adjacent to Fremont cottonwood and willow plantings. Showy milkweed and narrow leaf milkweed to be planted in outer rows between tree and shrub plantings to provide monarch butterfly and additional pollinator habitat benefits.

Beaver exclusion caging or fencing is not planned, and not expected to be necessary, but the planting strategy includes installing California rose and California blackberry in association with tree species that are most susceptible to beaver damage (*e.g.*, willows and cottonwoods) to provide a natural thorny barrier to beaver herbivory. Cages around riparian trees may be installed as an adaptive management measure if beavers are observed to be causing greater than anticipated tree damage or mortality. Because there will be continued public access to the project site, it may be appropriate to install some temporary exclusion fencing and signage during the establishment period, around the planting areas to protect plants and irrigation systems.

RESEED TEMPORARY IMPACT AREAS

The planned project will minimize grading and impacts to vegetation and soils. Most temporary disturbance areas would be associated with providing ADA site access and improvements of existing foot trails to allow for multiple uses. Additionally, focused removal of target invasive species would result in some temporary, small scale impacts. Areas where temporary soil disturbance or vegetation removal occurs within riparian scrub or woodland due to project implementation will be seeded with the riparian seedmix (Table 4), and monitored for establishment success. It is expected that any temporarily disturbed areas will be rapidly colonized through natural recruitment and regrowth of native species from the surrounding dense native vegetation. Due to the isolated nature of temporary disturbance areas, and dense native vegetation surrounding them, it is expected that seeding, combined with natural recruitment would be sufficient to rapidly restore native plant cover. However, if seeding and natural recruitment are not successful in revegetating disturbed areas, remedial adaptive management actions, such as reseeding or planting container plants and cuttings with Cocoon™ individual plant watering systems, or watering tubes with starch-based hydrogel applications or similar, may be taken.

All areas within existing grasslands and uplands that are disturbed by trails improvement work or for the construction of the north and south trail access ramps will be seeded with the native grassland seed mix (Table 5) which includes a mix of native grasses and forbs.

4.2 WATER QUALITY COMPONENTS

The Bees Lakes larger pond is relatively deep and steep sided, while the smaller pond is shallower and occasionally dries up completely during extended dry periods. During investigations conducted for the Southport Early Implementation Project, analysis of water quality in the Bees Lakes ponds revealed slightly elevated levels of arsenic and oil and grease (ICF International 2014). Further testing and evaluation are planned; based on investigation results, pond enhancements may include some soil removal and disposal, or potential treatment of pond water, if appropriate. Additionally, an abandoned boat and a large amount of refuse observed in the ponds are suspected to be negatively affecting water quality. At minimum, project implementation would include drawing down pond water levels temporarily to extract large trash and debris.

Because the ponds are hydraulically connected to the Sacramento River and the shallow groundwater table through seepage and not stream flow, the ponds have a high residence time and do not experience any flushing. This leads to stagnant water conditions, growth of algae, and likely low dissolved oxygen concentration in the water column. Installing a submerged or floating aeration diffusion device is being considered as a potential project element to increase pond aeration and water circulation within the ponds, decrease algae growth, and increase habitat suitability for fishes and other aquatic life (including mosquito fish).

An additional habitat enhancement that may be implemented at one or both ponds includes installing one or more artificial floating wetland islands. These low impact and low cost enhancements are typically constructed from a polymer-fiber platform that wetland plants are planted into, with plant roots penetrating the fiber matrix to hang below into the water column, essentially growing hydroponically in the pond water. The islands are built to be sufficiently buoyant to float and hold soil mix (during plant establishment), robust wetland vegetation, and wildlife. Floating islands would thus provide nesting, basking, cover, foraging, and fishing habitat for multiple bird species and western pond turtles and would have the added benefit of providing habitat refugia for birds and turtles from terrestrial predators such as raccoons and feral cats. The plant roots growing through the floating

island and shade provided by the island would be expected to improve habitat quality for native and/or nonnative pond fish (which in turn should provide food for many wildlife species and provide mosquito larvae control). Floating wetland islands, like emergent wetlands, have additionally been demonstrated to improve water quality by taking up excess nutrients (nitrogen, phosphorus, etc.) that may be present in the water column. Since floating islands track the pond WSE, vegetation on these islands should additionally persist whether widely fluctuating pond water levels remain very high or low for prolonged periods of time.

4.3 RECREATION COMPONENTS

Alternative 1 includes several recreational components that are intended to improve access management at the site and to provide improved recreational opportunities for site users. Potential recreational amenities include marked foot trails, elevated boardwalks, ADA access ramps, an equestrian trail, way-finding signage and information kiosks. Marked foot trails will improve hiking and birdwatching access through the site. Some of the paths will be newly constructed, paved with decomposed granite, and others will expand existing paths by clearing brush. Boardwalks will be built to span low elevation locations along the paths. The foot trail between the South River Road Levee and the river is proposed to be improved to facilitate river and fishing access. The decomposed granite paths will also improve site accessibility including ADA access. Equestrian use of the project area west of South River Road is proposed to be accommodated through the development of shared pedestrian/equestrian use trails. Interpretive signage will be placed along the paths to enrich the user experience by improving the public's understanding of the site's environmental value. Also, post-and-cable fencing will be selectively installed to restrict access to sensitive habitat areas on the site.

4.4 LONG-TERM OPERATIONS AND MAINTENANCE REQUIREMENTS

INSPECTION AND MAINTENANCE DURING RESTORATION ESTABLISHMENT PHASE

During habitat restoration project implementation and the three- to five-year vegetation establishment period for all planted areas, regular monthly to quarterly site inspections (as deemed appropriate) would be conducted by an ecologist retained by the City. During these inspections, the ecologist would record observations on plant establishment success, including trends and patterns in plant survival and health, new native vegetation recruitment, observable beaver or human disturbance damage, any site erosion problems, trash dumping or vandalism, visit and track all invasive species removal sites, temporary disturbance reseeding sites, and map target invasive plant populations for treatment. Field visit observations and associated maintenance recommendations would be summarized and shared with the City and the restoration contractor. As necessary, planted container plants that die within the first three years after planting would be replaced with suitable replacement plants. Replacements may be of the same or a different species if the ecologist's review of plant health and survival patterns indicates that species substitutions may be appropriate.

Maintenance actions conducted during the three to five year establishment phase will include vegetation management and invasive species control (as described above), minor erosion repairs or additional erosion protective measures if needed, addition of beaver exclusion measures (e.g. plant caging) if needed, and/or supplemental seedings and plantings as deemed appropriate in areas with poor vegetation establishment.

OPERATIONS AND MAINTENANCE OF WATER QUALITY AND RECREATION COMPONENTS

Regular operations and maintenance of the water quality and recreational components will be necessary over the life of the project. The water quality components consist primarily of installing artificial floating wetland islands to increase wetland habitat, which can increase water quality through improved water filtration. However, Alternative 1 may also include the installation of aeration diffusion devices within the ponds. The aeration diffusion devices would require regular monitoring to ensure they are properly functioning and are replaced if they fail. Although the floating wetlands are assumed to require little maintenance, they may need to be replaced if they become damaged or fail for some other reason.

Although the site is intended to provide passive recreational opportunities, it would include recreational infrastructure features and access management components that will require maintenance and replacement once they meet their useful life. The boardwalk trails may be regularly inundated as pond water levels rise in relation to water levels in the Sacramento River. This inundation would be expected to result in sediment and vegetative debris being deposited on the boardwalk trails. This material would need to be removed by maintenance personnel using shovels and/or brooms, depending upon the volume of material deposited. Regular boardwalk repairs would also likely be necessary including replacing individual boards or replacing whole boardwalk segments. Other walking trails would require regular maintenance to ensure tripping or falling hazards are not being created. This would likely require the regular application of decomposed granite or some other similar material in trail areas that are degrading. Regular vegetation clearing of the walking trails would be necessary to ensure access is not restricted. Also, because some of the trails on the site are expected to be used by equestrian riders, additional overhead vegetation clearing may be necessary to ensure adequate head clearance is provided. To ensure sensitive vegetation or listed-species habitat areas are not disturbed, any post-and-cable fencing installed on the site will need to be regularly maintained. Regular pickup and maintenance of trash receptacles will be necessary to ensure they do not become a nuisance. Also, wayfinding signage will need to be regularly repaired and replaced.

DEVELOPMENT OF OPERATIONS AND MAINTENANCE PLAN

The project team recommends the development of a comprehensive Bees Lakes Operations and Maintenance Plan (O&M Plan) to ensure the habitat, water quality and recreational objectives of Alternative 1 are maintained over the long term. The O&M Plan should identify anticipated operation and maintenance activities, maintenance standards, operating procedures, maintenance responsibilities, emergency/weather response operations, vehicle and equipment access restrictions, opening and closing procedures, safety requirements, burglary and vandalism procedures, illegal dumping procedures, volunteer programs (e.g., trailrider patrols), group use of the site, and flood patrol requirements.

5 PLAN IMPLEMENTATION

5.1 DESIGN PROCESS

The design process for the preferred alternative includes the initial preparation of 30 percent design plans. These 30 percent design plans have been developed concurrent with the preparation of this Habitat Restoration Plan. The 30 percent design plans are intended to identify the primary components of the preferred alternatives but will not include all of the design details that would be necessary to implement the preferred alternative. Following City review of these initial design plans, the next design step will include the preparation of 65 percent design plans. Once the 65 percent design plans are completed, the City will be able to better define the costs and long-term management requirements associated with implementing the preferred alternative.

The Delta Conservancy grant that funded the development of this Habitat Restoration Plan provides sufficient funding to prepare the 30 and 65 percent design plans. However, additional grant funding will be necessary to complete the 100 percent design plans and to implement the preferred alternative.

5.2 CALIFORNIA ENVIRONMENTAL QUALITY ACT COMPLIANCE

Implementation of the preferred alternative will require compliance with the California Environmental Quality Act (CEQA). This compliance is anticipated to be completed through City adoption of an Initial Study and Mitigated Negative Declaration. The City has initiated preparation of an Initial Study for the preferred alternative and anticipates public release of a draft Initial Study in July 2020. The Initial Study will include a detailed description of the preferred alternative and will describe the environmental impacts associated with project implementation. Mitigation measures will be identified, if necessary, for any potentially significant impacts. Following a 30-day public review period, the City will consider any comments received on the document and will decide whether to adopt the Initial Study and associated Negative Declaration or Mitigated Negative Declaration.

5.3 NATIONAL ENVIRONMENTAL POLICY ACT COMPLIANCE

Compliance with the National Environmental Policy Act (NEPA) will be required if the preferred alternative requires any federal approvals. As described below, the preferred alternative is anticipated to require permits from the U.S. Army Corps of Engineers. NEPA requires federal agencies to disclose the environmental impacts associated with their permitting decisions, to identify mitigation measures when impacts are anticipated to occur, and to evaluate project alternatives. Compliance with NEPA would be expected to be achieved through the preparation of an Environmental Assessment and adoption of a Finding of No Significant Impact (FONSI). Close coordination with USACE will be required during the permitting portion of project implementation to clarify the permitting requirements and appropriate NEPA compliance documentation.

5.4 PERMITTING

The preferred alternative includes recreational improvements along the west bank of the Sacramento River. The implementation of these improvements will require issuance of a Lake and Streambed Alteration Agreement and potentially an Incidental Take Permit from the California Department of Fish and Wildlife. The California State

Lands Commission will also need to approve any project components that occur within their easement east of South River Road along the Sacramento River. Because the preferred alternative is located within the designated floodway of the Sacramento River and is protected by State Plan of Flood Control levees, implementation will require an encroachment permit from the Central Valley Flood Protection Board and likely a Rivers and Harbors Act Section 408 authorization from the USACE. The placement of fill within the ponds and within any wetlands on the site will require a Clean Water Act Section 404 permit from USACE.

For USACE to issue either a 408 or a 404 permit, they will be required to consult with the U.S. Fish and Wildlife Service and National Marine Fisheries Service through Section 7 of the federal Endangered Species Act. In addition, USACE will be required to comply with Section 106 of the National Historic Preservation Act. Lastly, the project will require a Construction Activities Storm Water General permit from the State Water Resources Control Board, a 401 Water Quality Certification from the Central Valley Regional Water Quality Control Board, a Delta Plan Covered Action Certification from the Delta Stewardship Council, a grading permit from the City of West Sacramento, and a land owner agreement between the City and WSAFCA (the property owner). These permits are summarized in Table 7 below.

Table 7. Potential Applicable Permits

Permitting Agency	Required Permits
Federal Agencies	
USACE	Clean Water Act Section 404 Permit
USACE	Section 408 of the Rivers and Harbors Act of 1899
USFWS	Section 7 Endangered Species Act
NMFS	Section 7 Endangered Species Act
State Agencies	
SLC	Easement Consistency Approval
SHPO	Section 106 National Historic Preservation Act
CDFW	Section 1600 Lake or Streambed Alteration Agreement
CDFW	California Endangered Species Act Incidental Take Permit or Consistency Determination
RWQCB	Section 401 General Water Quality Certification for Small Habitat Restoration Projects
SWRCB	Construction Activities Storm Water General Permit
DSC	Delta Plan Covered Action Certification
CVFPB	Permission to Encroach on Waterways within Designated Floodways
Local and Regional Planning Agencies	
City	Grading Permit
City/WSAFCA	Landowner Agreement

Abbreviations used: USACE = U.S. Army Corps of Engineers; USFWS = U.S. Fish and Wildlife Service; NMFS = National Marine Fisheries; SLC = State Lands Commission; SHPO = State Historic Preservation Officer; CDFW = California Department of Fish and Wildlife; SWRCB = State Water Resources Control Board; RWQCB = Regional Water Quality Control Board; CVFPB = Central Valley Flood Protection DSC = Delta Stewardship Council; WSAFCA = West Sacramento Area Flood Control Agency

5.5 COST ESTIMATE REFINEMENT

The preliminary cost estimates developed for the conceptual alternatives were prepared at a planning level to allow the City to take into consideration the comparative construction and long-term operations and maintenance costs of the conceptual alternatives when selecting a preferred alternative. However, for the City to pursue implementation grant funding, the cost estimate for the preferred alternative will require additional refinement. This cost refinement effort is being conducted concurrent with the development of the 65% design plans. Once the costs of the preferred alternative components are better defined and the City is able to determine what grant funding may be available for implementation, the City may need to refine or remove preferred alternative components to meet the available grant funding opportunity.

5.6 FUTURE GRANT FUNDING OPPORTUNITIES

The Proposition 1 grant received from the Delta Conservancy for development of this Habitat Restoration Plan is solely for the planning phase of the project. The City does not currently have a funding source allocated to project implementation. Therefore, the City's ability to implement this Habitat Restoration Plan will likely be dependent upon the availability of additional grant funding. A Proposition 1 implementation grant could be a source for this funding. The Delta Conservancy has Proposition 1 funding available for habitat restoration planning and implementation projects within the Delta. The California Department of Fish and Wildlife and the California Department of Water Resources also have Proposition 1 funding available for the implementation of multi-benefit projects in the Delta. In addition, the Delta Conservancy has $12 million available in Proposition 68 funding that is being awarded on a first-come, first-serve basis. Proposition 68 funding is available for the implementation of recreational projects within the Delta. Once the cost estimate refinement process is completed, the City will consider these and any other potential funding opportunities that could be used for project implementation.

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Appendix A: Hydraulic Modeling Inundation Extents and Depths

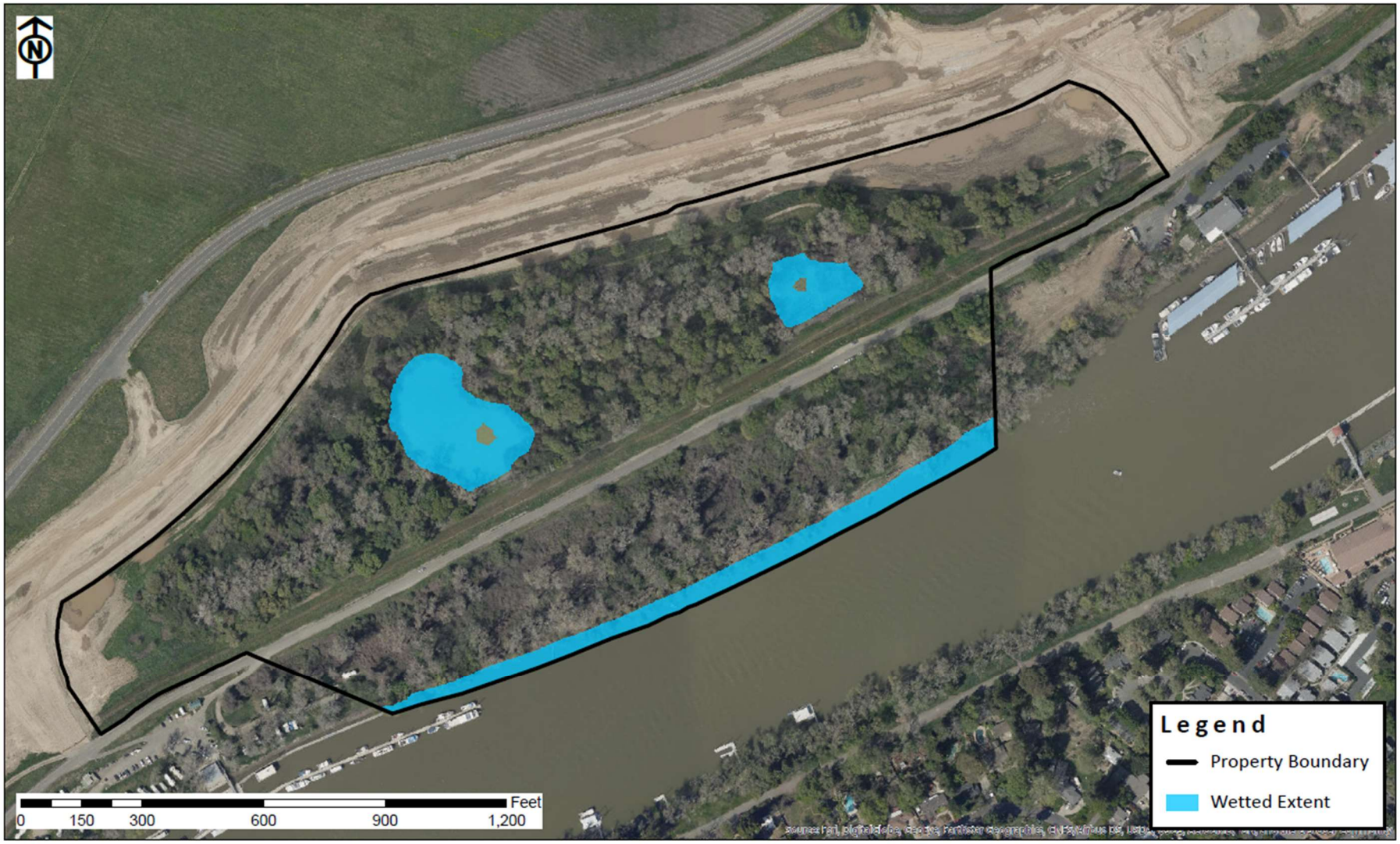

Figure A-1: Alternative 1, Eco-Flow Wetted Extent

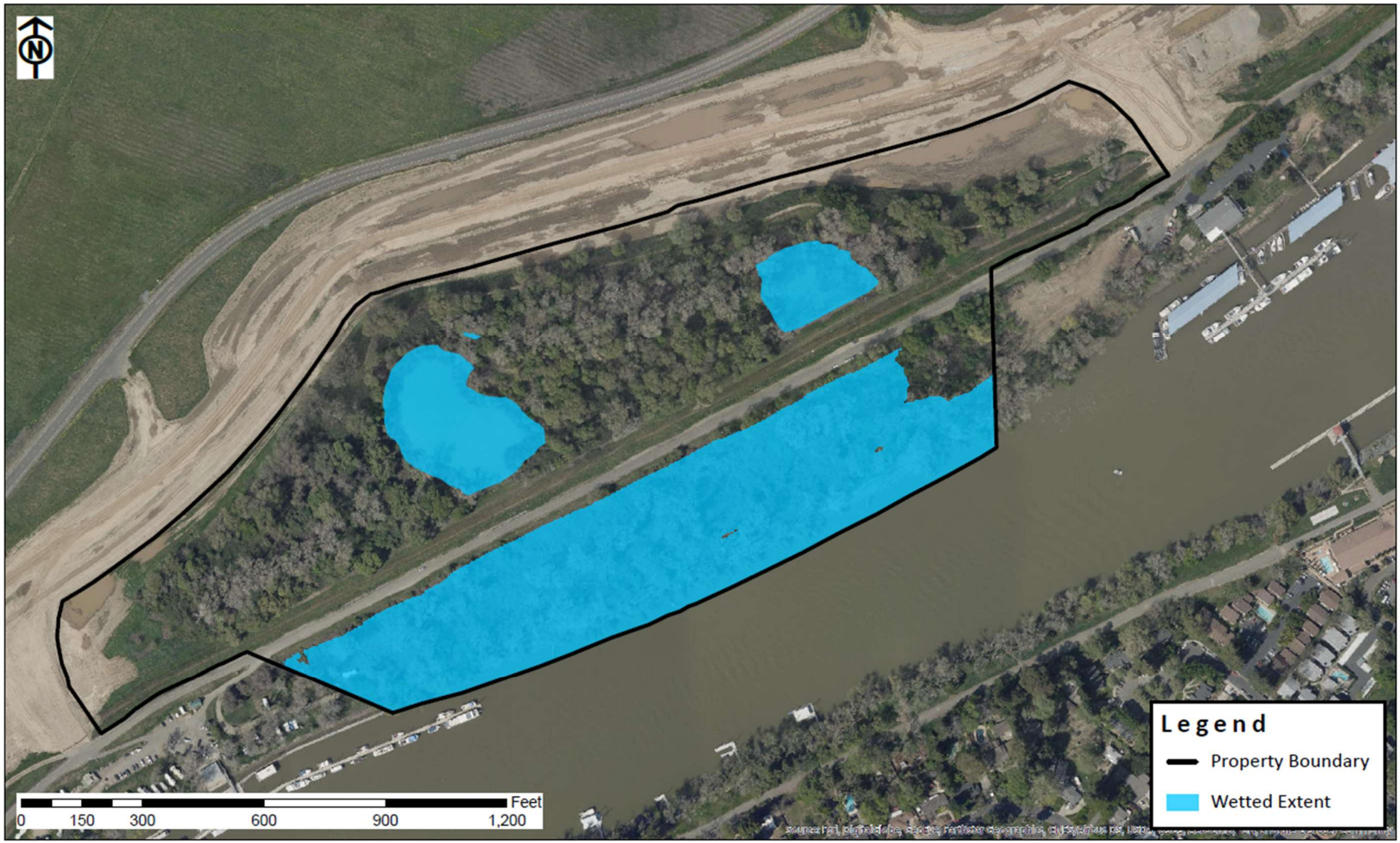

Figure A-2: Alternative 1, 2-year Flow Wetted Extent

Figure A-3: Alternative 2, Eco-Flow Wetted Extent

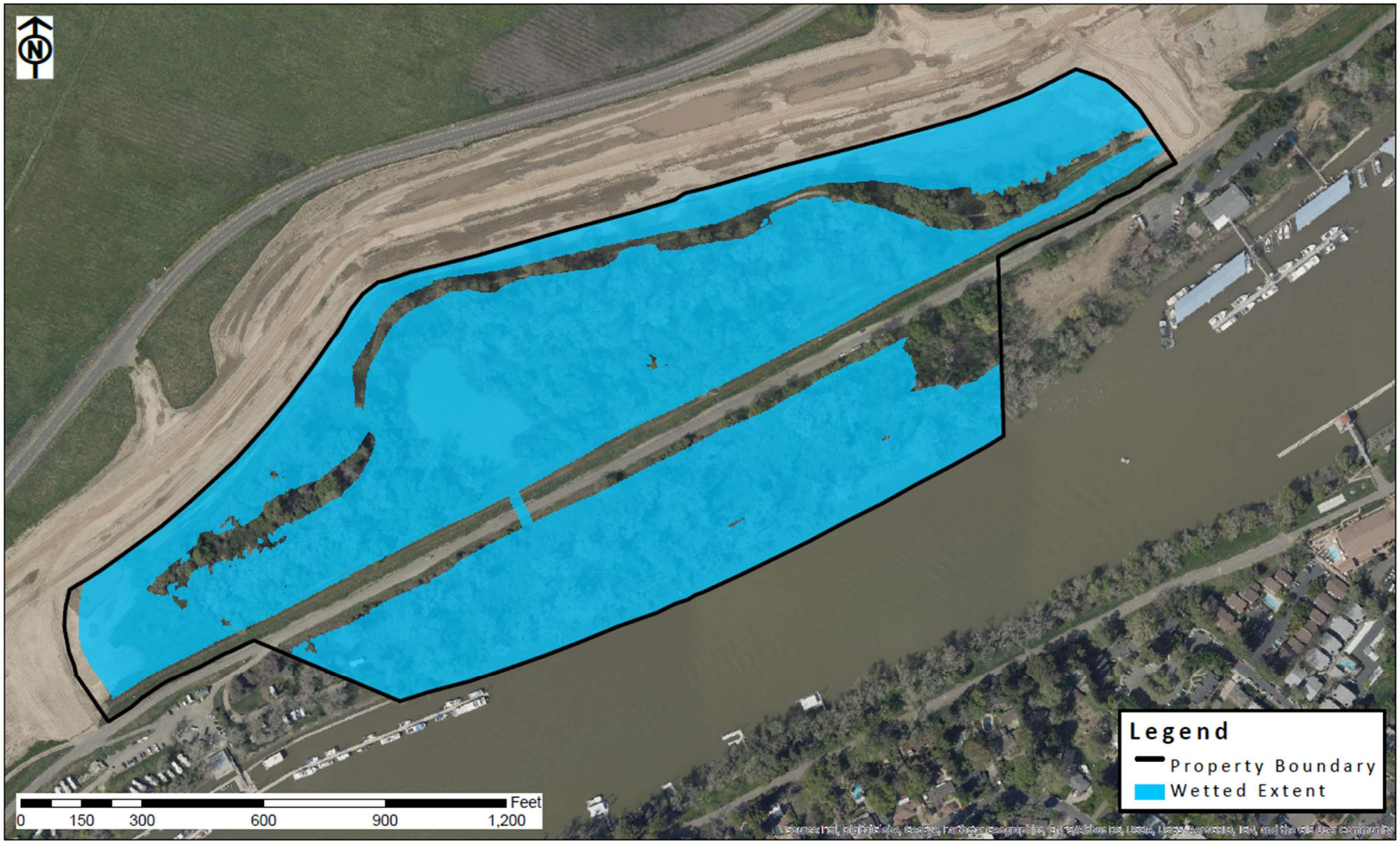

Figure A-4: Alternative 2, 2-year Flow Wetted Extent

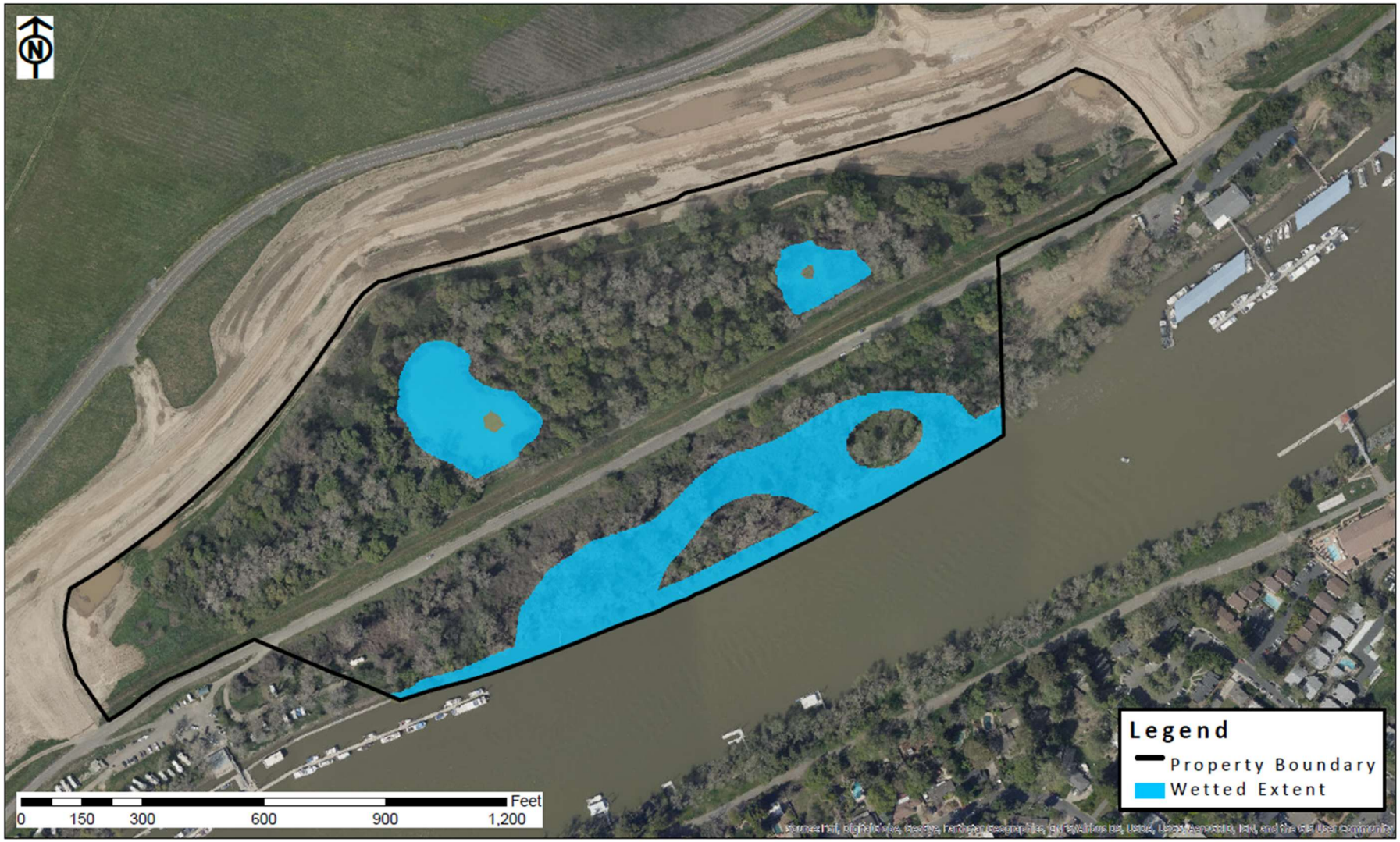

Figure A-5: Alternative 3, Eco-Flow Wetted Extent

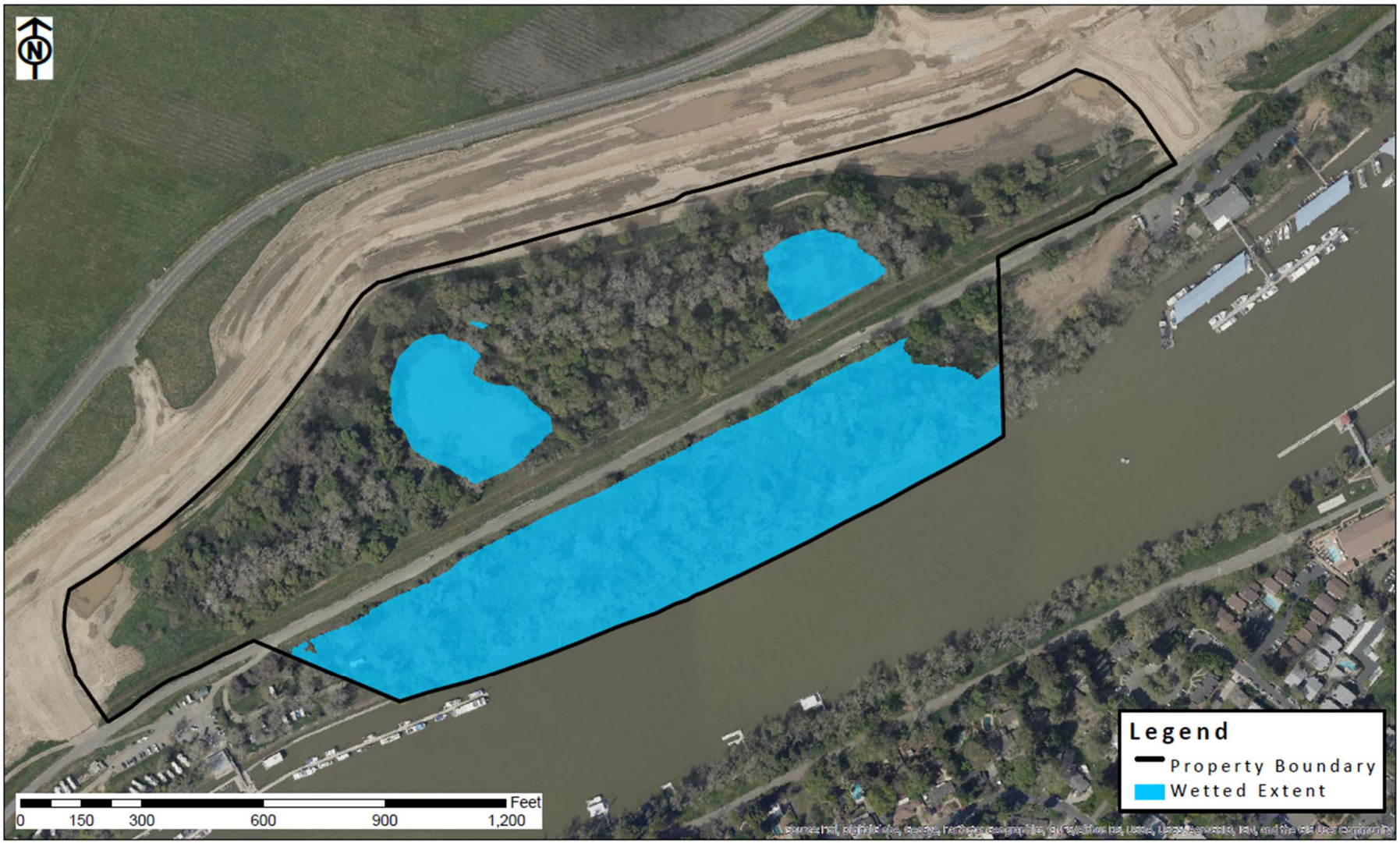

Figure A-6: Alternative 3, 2-year Flow Wetted Extent

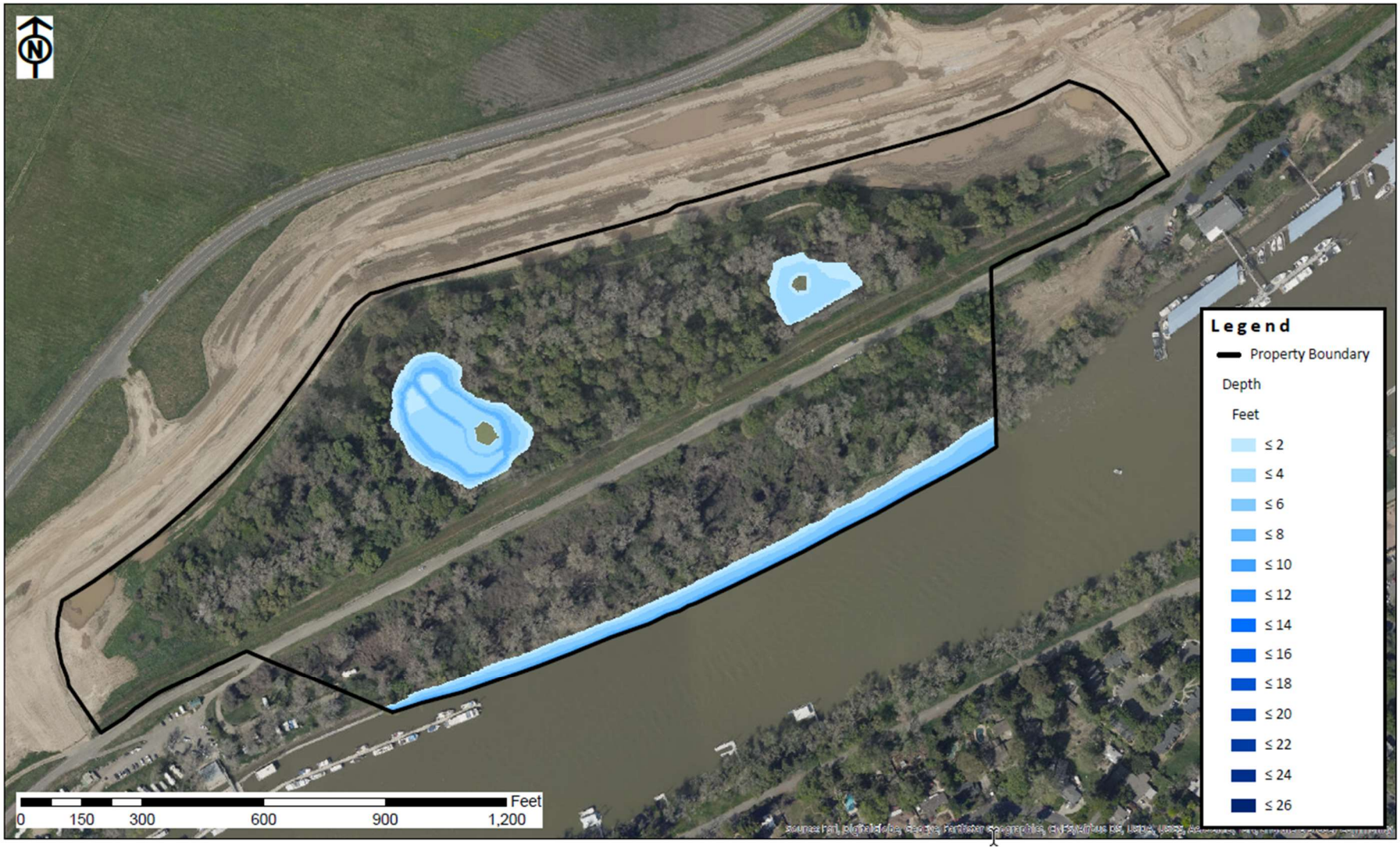

Figure A-7: Alternative 1, Eco-Flow Depth

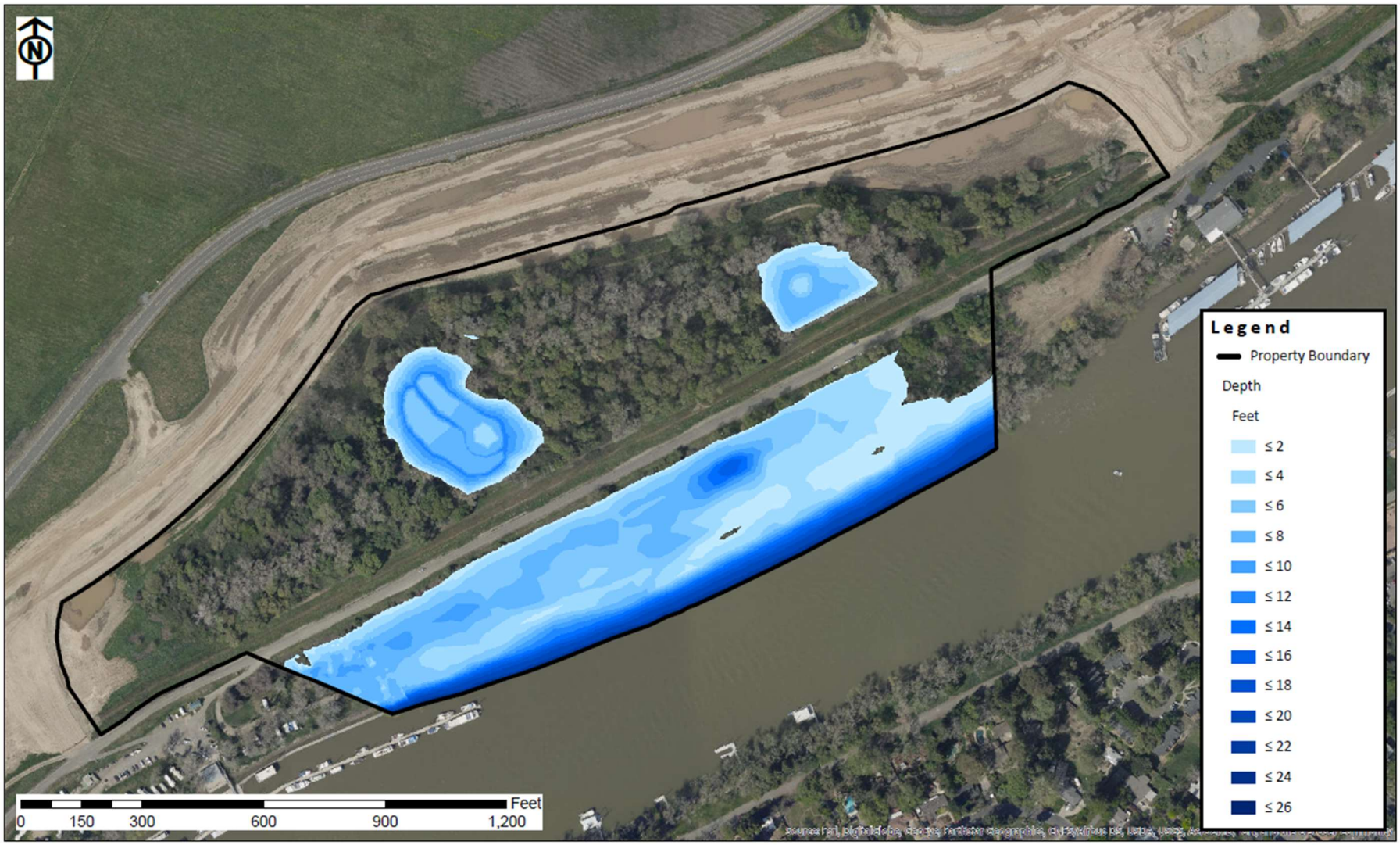

Figure A-8: Alternative 1, 2-year Flow Depth

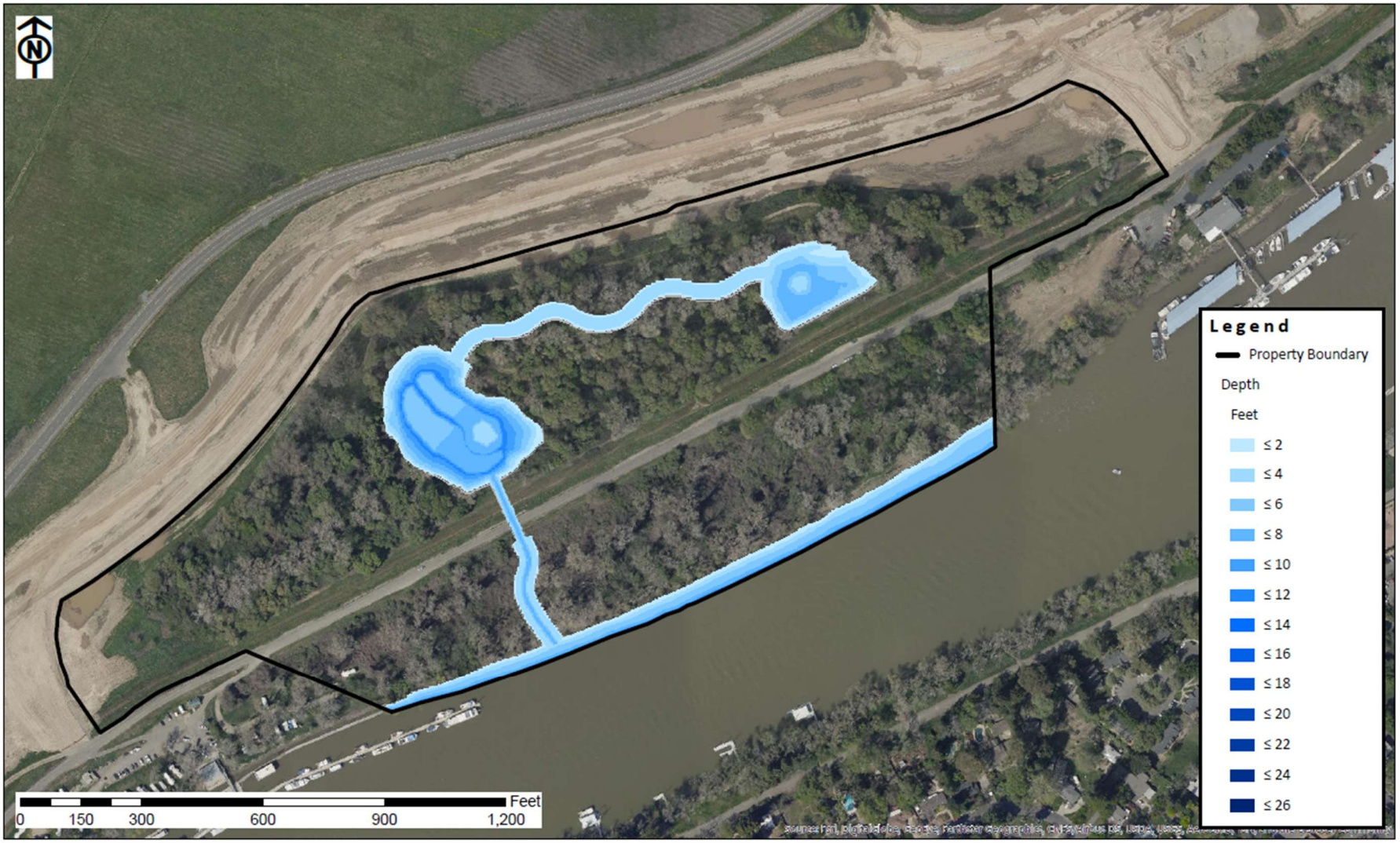

Figure A-9: Alternative 2, Eco-Flow Depth

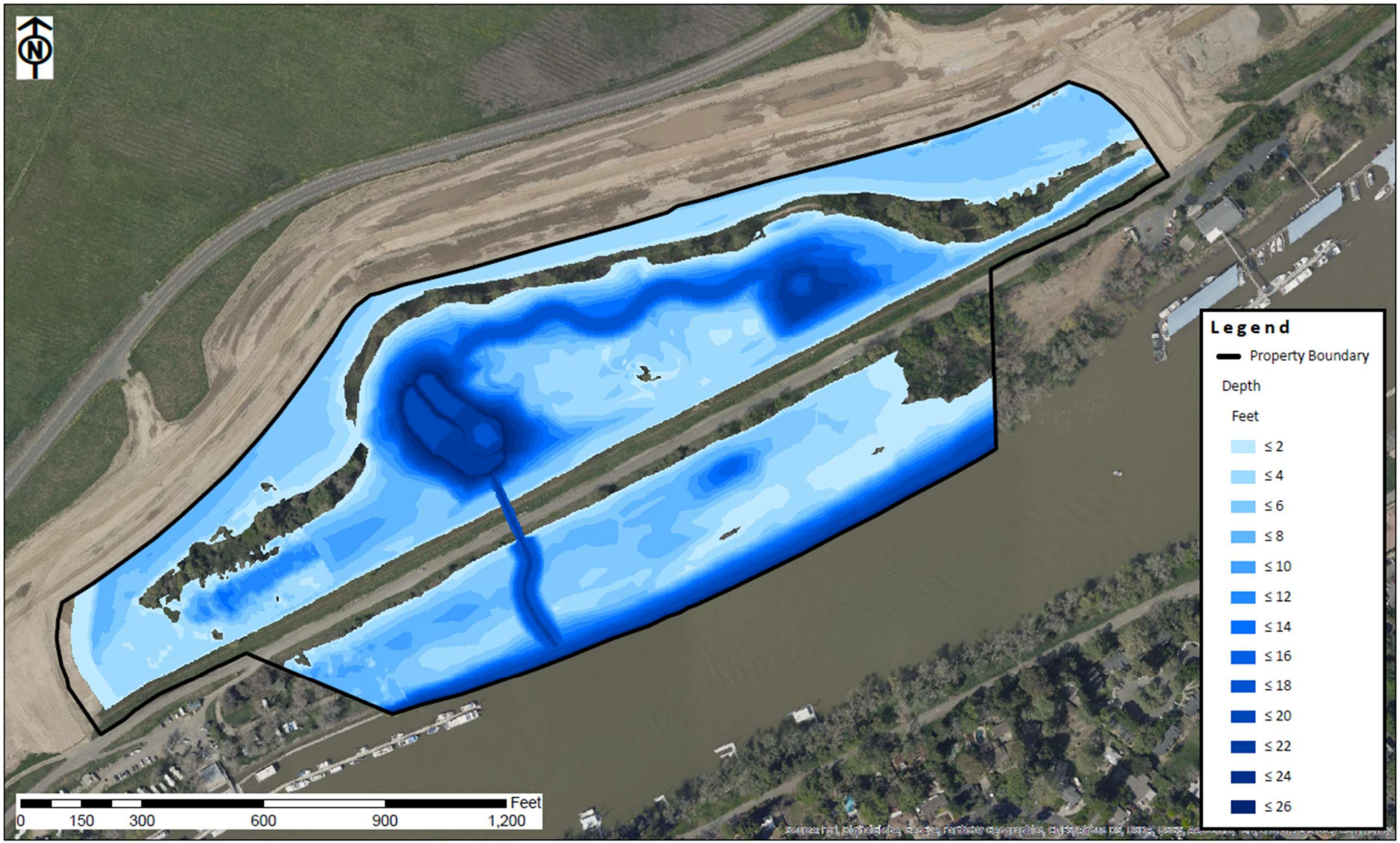

Figure A-10: Alternative 2, 2-year Flow Depth

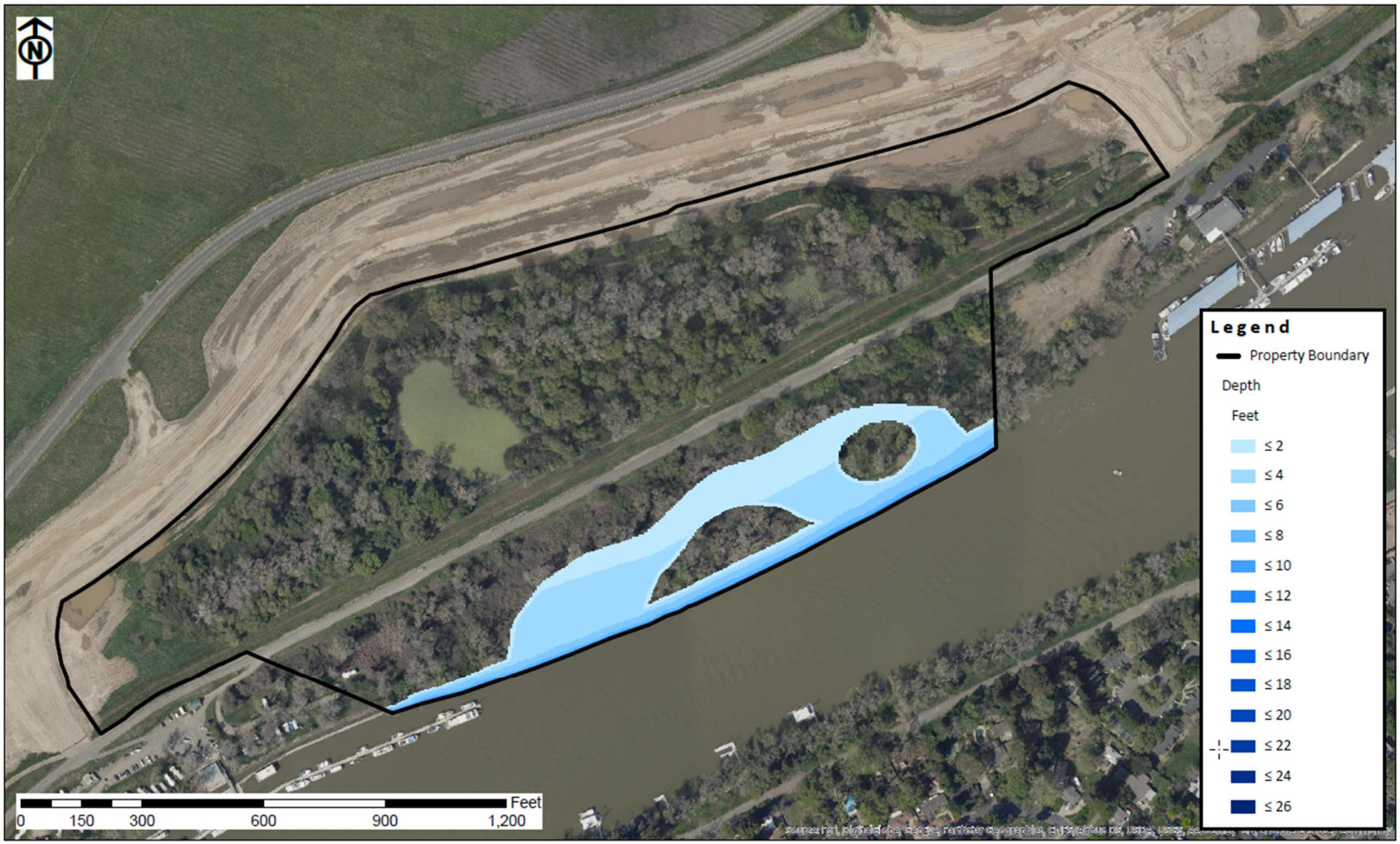

Figure A-11: Alternative 3, Eco-Flow Depth

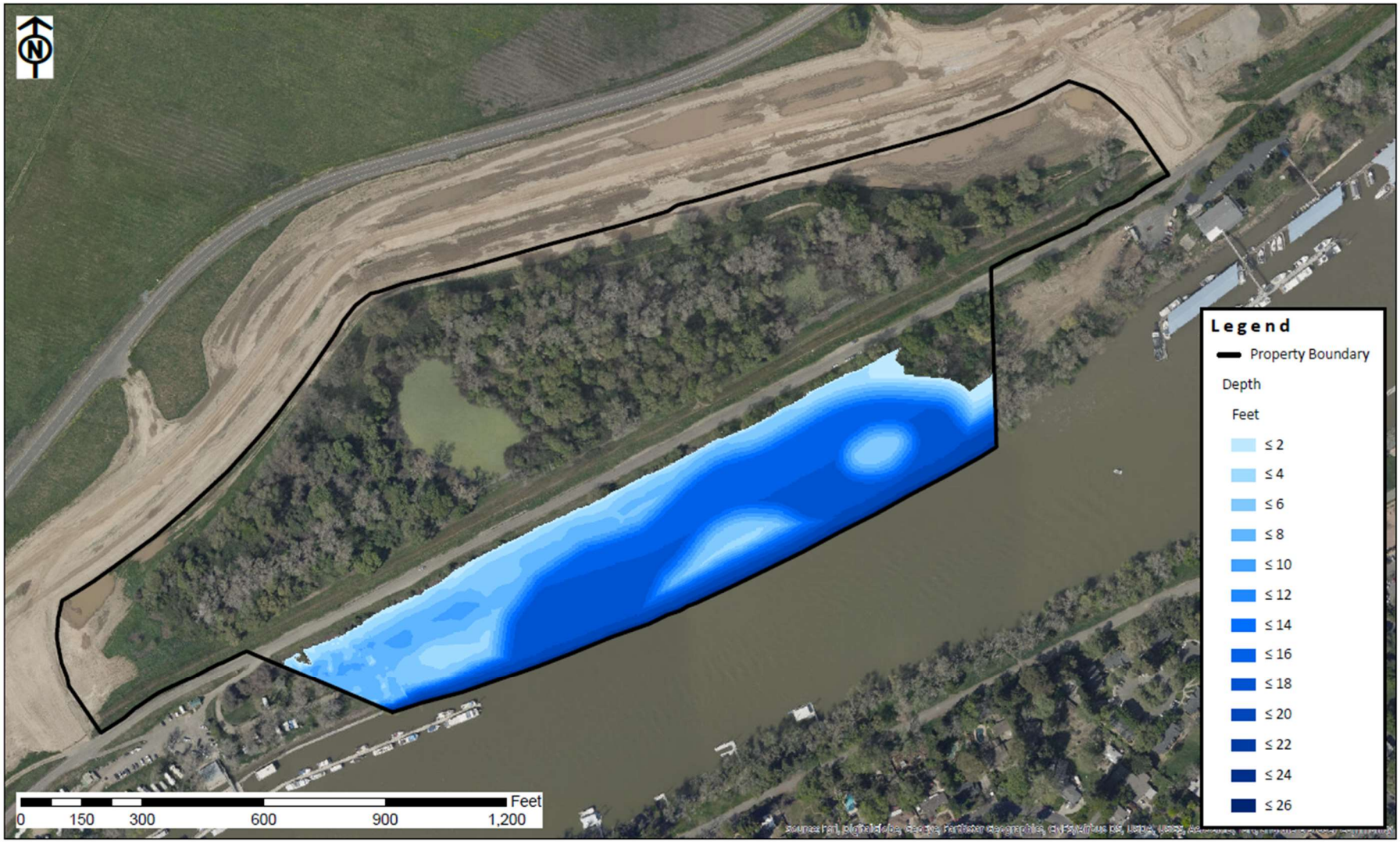

Figure A-12: Alternative 3, 2-year Flow Depth

Appendix B: Alternative Evaluation Tables

Table B-1. HABITAT Category Alternative 1: Minimal Grading

Project Metric	No	Yes					Comments
		Very Low	Low	Med	High	Very High	
Habitat Benefit for Native Riparian Birds				X			Enhancement and conservation of riparian habitats with minimal impacts.
Habitat Benefit for Native Waterbirds				X			Some enhancement of existing habitat for waterbirds (floating wetland islands, invasive species removal).
Habitat Benefit for Other Native Terrestrial Wildlife				X			Enhancement and conservation of riparian habitats with minimal impacts.
Habitat Benefit for Native Fishes and Aquatic Foodweb	X						No effect on riverine ecosystem.
Habitat Benefit for Valley Elderberry Longhorn Beetle				X			Enhancement and conservation of riparian habitats with minimal impacts to elderberries.
Habitat Benefit for Swainson's Hawk		X					Enhancement and conservation of riparian habitats benefits Swainson's hawk. Swainson's hawk uses the site for nesting but this species is likely to become less frequent due to surrounding developments removing foraging habitats, regardless of the alternative selected.
Habitat Benefit for Salmonids	X						No effect on riverine ecosystem. Benefits determined by analysis of Alternatives' benefit to rearing juvenile salmonids.
Improvements to Regional Ecological Resilience		X					No significant effect on regional ecological resilience - flooding disturbance regime, sustainability of existing habitats, and resilience to sea level rise will not be affected. Site restoration and management actions will contribute to site resilience and thus minimally contribute to regional resilience.
Tally	**2**	**2**	**0**	**4**	**0**	**0**	
Score (No=0, Very Low=1, Low=2, Medium=3, High=4, Very High=5)	**0**	**2**	**0**	**12**	**0**	**0**	**Total Score = 14 Average Score = 1.75 (Low)**

*Average score is determined by dividing the total score by the number of individual categories. Low, Medium and High designations are then assigned according to the following scoring: Low = 1 – 2.5, Medium = 2.51 – 3.5, High = 3.51 – 5.

Table B-2. HABITAT Category Alternative 2: Full Floodplain Connection

Project Metric	No	Yes					Comments
		Very Low	Low	Med	High	Very High	
Habitat Benefit for Native Riparian Birds					X		Enhancement and conservation of riparian habitats occurs in all alternatives, but Alternative 2 has the greatest temporary impacts to riparian habitat and some conversion impacts to emergent marsh and open water, and habitat quality for riparian birds during periods that the site is flooded may be slightly reduced. However, reintroducing a natural flood regime into the interior of the site would allow for continued natural recruitment of willows and cottonwoods and other riparian plants, improving stand diversity and structural heterogeneity and sustaining mixed riparian woodland vegetation, and thus in the long-term should improve and better sustain long-term habitat quality for many riparian birds.
Habitat Benefit for Native Waterbirds					X		Additional flooding on the interior of the site under this Alternative would provide additional habitat for waterbirds during wet season.
Habitat Benefit for Other Native Terrestrial Wildlife			X				Prolonged flooding of interior of site would reduce accessibility of portions of the site to terrestrial wildlife during the wet season, but flood regime will improve riparian forest habitat quality during remainder of year.
Habitat Benefit for Native Fishes and Aquatic Foodweb				X			Reconnecting the Bees Lakes site as a floodplain to the Sacramento River would provide additional habitat and aquatic food web benefits for native fishes.
Habitat Benefit for Valley Elderberry Longhorn Beetle			X				Alternative 2 has the greatest temporary impacts to riparian habitat and some conversion impacts to emergent marsh and open water. Elderberry shrubs would be avoided to extent possible, but some may be affected. Flooding of the interior of the site may also result in mortality or reduced vigor of any elderberry shrubs that are at lower elevations on the site, but most shrubs observed on site are at high enough elevations and are expected to survive and thrive.
Habitat Benefit for Swainson's Hawk		X					Enhancement and conservation of riparian habitats benefits Swainson's hawk. Swainson's hawk uses the site for nesting but this species is likely to become less frequent due to surrounding developments removing foraging habitats, regardless of the alternative selected.

Project Metric	No	Yes					Comments
		Very Low	Low	Med	High	Very High	
Habitat Benefit for Salmonids			X				Reconnecting the Bees Lakes site as a floodplain to the Sacramento River would provide additional floodplain habitat and aquatic food web benefits for salmonids. This alternative would increase salmonid rearing habitat by 1.9 acres (weighted usable area) assuming a 2-week eco-flow period (2 weeks inundation from December to June in 2 out of 3 years).
Improvements to Regional Ecological Resilience					X		Reintroducing a natural riverine flood regime into the interior of site would allow for continued natural recruitment of willows and cottonwoods and other riparian plants, improving stand diversity and structural heterogeneity and sustaining mixed riparian woodland vegetation in perpetuity. Additionally, the site would provide floodplain habitat for native fishes, and would continue to provide riparian floodplain habitat with sea level rise.
Tally		**1**	**3**	**1**	**3**	**0**	
Score (No=0, Very Low=1, Low=2, Medium=3, High=4, Very High=5)		**1**	**6**	**3**	**12**	**0**	**Total Score = 22** **Average Score = 2.75 (Medium)**

*Average score is determined by dividing the total score by the number of individual categories. Low, Medium and High designations are then assigned according to the following scoring: Low = 1 – 2.5, Medium = 2.51 – 3.5, High = 3.51 – 5.

Table B-3. HABITAT Category Alternative 3: Riverside Terrace

Project Metric	No	Yes					Comments
		Very Low	Low	Med	High	Very High	
Habitat Benefit for Native Riparian Birds				X			Enhancement and conservation of riparian habitats occurs in all alternatives; Alternative 3 has temporary impacts to riparian habitat and some conversion impacts to emergent marsh and open water. No reintroduction of a natural flooding regime to interior of site would be included with this alternative.
Habitat Benefit for Native Waterbirds				X			Some enhancement of existing habitat for waterbirds (floating wetland islands, invasive species removal). Additional flooding of portions of riverside portion of site at lower flows under this Alternative may provide additional habitat for waterbirds during wet season.
Habitat Benefit for Other Native Terrestrial Wildlife			X				Habitat enhancement and conservation benefits terrestrial wildlife. Prolonged flooding of more of riverside portion of site would slightly reduce accessibility of some riverside habitats to terrestrial wildlife during the wet season.
Habitat Benefit for Native Fishes and Aquatic Foodweb				X			Lowering portions of the riverside terrace would result in more aquatic and fish habitat accessible during frequent flood events, providing some floodplain habitat and aquatic food web benefits for native fishes.
Habitat Benefit for Valley Elderberry Longhorn Beetle				X			Enhancement and conservation of riparian habitats benefits valley elderberry longhorn beetle. Alternative 3 has some temporary impacts to riparian habitat and some minimal conversion impacts to emergent marsh and open water; though elderberry shrubs would be avoided to extent possible, a few may be affected.
Habitat Benefit for Swainson's Hawk			X				Enhancement and conservation of riparian habitats benefits Swainson's hawk. Swainson's hawk uses the site for nesting but this species is likely to become less frequent due to surrounding developments removing foraging habitats, regardless of the alternative selected.

Project Metric	No	Yes					Comments
		Very Low	Low	Med	High	Very High	
Habitat Benefit for Salmonids				X			Lowering portions of the riverside terrace would provide more salmonid floodplain habitat that is more frequently accessible, providing some floodplain habitat and aquatic food web benefits for salmonids. This alternative would increase salmonid rearing habitat by 3.3 acres (weighted usable area) assuming a 2-week eco-flow period (2 weeks inundation from December to June in 2 out of 3 years)
Improvements to Regional Ecological Resilience			X				No significant effect on regional ecological resilience - flooding disturbance regime, sustainability of existing habitats, and resilience to sea level rise will not be affected, but lowered riparian terrace could contribute to resilience of salmonid populations by increasing local floodplain habitat availability.
Tally		**0**	**3**	**5**	**0**	**0**	
Score (No=0, Very Low=1, Low=2, Medium=3, High=4, Very High=5)		**0**	**6**	**15**	**0**	**0**	**Total Score = 21** **Average Score = 2.63 (Medium)**

*Average score is determined by dividing the total score by the number of individual categories. Low, Medium and High designations are then assigned according to the following scoring: Low = 1 – 2.5, Medium = 2.51 – 3.5, High = 3.51 – 5.

Table B-4. RECREATION Category Alternative 1: Minimal Grading

Project Metric	No	Yes					Comments
		Very Low	Low	Med	High	Very High	
Recreation Benefits – Improved River/Fishing Access				X			Additional riverine fishing access would be provided by a trail extension to the Sacramento River.
Recreation Benefits – Improved Hiking/Birdwatching Access					X		Recreational access options considered would improve hiking and birdwatching access, cycling and equestrian use for most of the season because access would not be restricted during periods of high river flows.
Accessible Recreation Opportunities					X		Depending on recreation options selected, recreational access options considered would improve site accessibility (including ADA access), and site will be accessible for most of season because access would not be restricted during periods of high river flows.
Tally		**0**	**0**	**1**	**2**	**0**	
Score (No=0, Very Low=1, Low=2, Medium=3, High=4, Very High=5)		**0**	**0**	**3**	**8**	**0**	**Total Score = 11** **Average Score = 3.67 (High)**
*Average score is determined by dividing the total score by the number of individual categories. Low, Medium and High designations are then assigned according to the following scoring: Low = 1 – 2.5, Medium = 2.51 – 3.5, High = 3.51 – 5.							

Table B-5. RECREATION Category Alternative 2: Full Floodplain Connection

Project Metric	No	Yes					Comments
		Very Low	Low	Med	High	Very High	
Recreation Benefits – Improved River/Fishing Access					X		Additional riverine fishing access provided by a trail extension to the Sacramento River. Also, potential additional riverine floodplain edge created for water/fishing access within interior of site or along river terrace channels.
Recreation Benefits – Improved Hiking/Birdwatching Access				X			Recreational access for hiking, cycling, equestrian and bird watching activities may be more limited during wet season or periods of high river flows because trails on interior of site would be inundated. However, planned recreational access improvements that apply to all alternatives would improve access when the site is not flooded.
Accessible Recreation Opportunities				X			Depending on recreation options selected, recreational access options considered would improve site accessibility (including ADA access). Site would be less accessible during wet season than under other alternatives.
Tally		**0**	**0**	**2**	**1**	**0**	
Score (No=0, Very Low=1, Low=2, Medium=3, High=4, Very High=5)		**0**	**0**	**6**	**4**	**0**	**Total Score = 10** **Average Score = 3.33 (Medium)**
*Average score is determined by dividing the total score by the number of individual categories. Low, Medium and High designations are then assigned according to the following scoring: Low = 1 – 2.5, Medium = 2.51 – 3.5, High = 3.51 – 5.							

Table B-6. RECREATION Category Alternative 3: Riverside Terrace

Project Metric	No	Yes					Comments
		Very Low	Low	Med	High	Very High	
Recreation Benefits – Improved River/Fishing Access					X		Additional riverine fishing access provided by a trail extension to the Sacramento River. Also, potential additional riverine floodplain edge created for water/fishing access along river terrace channels.
Recreation Benefits – Improved Hiking/Birdwatching Access					X		Recreational access for hiking, cycling, equestrian, and bird watching activities may be slightly more limited during wet season or periods of high river flows for portion of riverside terrace isolated from South River Road. However, planned recreational access improvements that apply to all alternatives would improve access when the site is not flooded.
Accessible Recreation Opportunities				X			Depending on recreation options selected, recreational access options considered would improve site accessibility (including ADA access). Riverside portion of site would be less accessible during wet season.
Tally		**0**	**0**	**1**	**2**	**0**	
Score (No=0, Very Low=1, Low=2, Medium=3, High=4, Very High=5)		**0**	**0**	**3**	**8**	**0**	**Total Score = 11** **Average Score = 3.67 (High)**
*Average score is determined by dividing the total score by the number of individual categories. Low, Medium and High designations are then assigned according to the following scoring: Low = 1 – 2.5, Medium = 2.51 – 3.5, High = 3.51 – 5.							

Table B-7. WATER QUALITY Category Alternative 1: Minimal Grading

Project Metric	No	Yes					Comments
		Very Low	Low	Med	High	Very High	
Water Quality Benefits				X			This alternative includes pond dredging and the installation of floating wetland islands, both of which will enhancement water quality.
Tally	**0**	**0**	**0**	**1**	**0**	**0**	
Score (No=0, Very Low=1, Low=2, Medium=3, High=4, Very High=5)	**0**	**0**	**0**	**3**	**0**	**0**	**Total Score = 3** **Average Score = 3 (Medium)**
*Average score is determined by dividing the total score by the number of individual categories. Low, Medium and High designations are then assigned according to the following scoring: Low = 1 – 2.5, Medium = 2.51 – 3.5, High = 3.51 – 5.							

Table B-8. WATER QUALITY Category Alternative 2: Full Floodplain Connection

Project Metric	No	Yes					Comments
		Very Low	Low	Med	High	Very High	
Water Quality Benefits						X	This alternative includes pond dredging and the installation of floating wetland islands, both of which will enhancement water quality. In addition, this alternative connects the ponds to the Sacramento River, which will result in a regular exchange of water between the ponds and the river. This regular exchange and flushing of the ponds will substantially improve pond water quality.
Tally		**0**	**0**	**0**	**0**	**1**	
Score (No=0, Very Low=1, Low=2, Medium=3, High=4, Very High=5)		**0**	**0**	**0**	**0**	**5**	**Total Score = 5** **Average Score = 5 (High)**

*Average score is determined by dividing the total score by the number of individual categories. Low, Medium and High designations are then assigned according to the following scoring: Low = 1 – 2.5, Medium = 2.51 – 3.5, High = 3.51 – 5.

Table B-9. WATER QUALITY Category Alternative 3: Riverside Terrace

Project Metric	No	Yes					Comments
		Very Low	Low	Med	High	Very High	
Water Quality Benefits				X			This alternative includes pond dredging and the installation of floating wetland islands, both of which will enhancement water quality.
Tally		**0**	**0**	**1**	**0**	**0**	
Score (No=0, Very Low=1, Low=2, Medium=3, High=4, Very High=5)		**0**	**0**	**3**	**0**	**0**	**Total Score = 3** **Average Score = 3 (Medium)**
*Average score is determined by dividing the total score by the number of individual categories. Low, Medium and High designations are then assigned according to the following scoring: Low = 1 – 2.5, Medium = 2.51 – 3.5, High = 3.51 – 5.							

Table B-10. CONSTRUCTABILITY Category Alternative 1: Minimal Grading

Project Metric	No	Yes					Comments
		Very Low	Low	Med	High	Very High	
Project Constructability						X	This alternative would require minimal grading and habitat mitigation, and only limited planting and invasive species removal. Site cleanup and construction could be completed using industry-standard methods and the anticipated infrastructure components would not represent logistical or technical challenges.
Project Eligibility for Grants			X				This alternative could be eligible for habitat restoration and public recreational access improvement grants. However, because this alternative would have fewer habitat benefits than Alternatives 2 and 3, it was ranked lower than those alternatives for grant eligibility.
Ease of Permitting						X	The permitting for this alternative would be relatively easy compared to Alternatives 2 and 3 due to the limited habitat impacts and lack of alteration to the flood system.
Tally	**0**	**0**	**1**	**0**	**0**	**2**	
Score (No=0, Very Low=1, Low=2, Medium=3, High=4, Very High=5)	**0**	**0**	**2**	**0**	**0**	**10**	**Total Score = 12** **Average Score = 4 (High)**

*Average score is determined by dividing the total score by the number of individual categories. Low, Medium and High designations are then assigned according to the following scoring: Low = 1 – 2.5, Medium = 2.51 – 3.5, High = 3.51 – 5.

Table B-11. CONSTRUCTABILITY Category Alternative 2: Full Floodplain Connection

Project Metric	No	Yes					Comments
		Very Low	Low	Med	High	Very High	
Project Constructability			X				This alternative would require significant grading and substantial engineering effort to construct the river connection and install the arched culvert bridge. Significant habitat impacts would be anticipated due to the grading efforts, which would require extensive mitigation. Construction would include logistical and technical challenges associated with excavating a river connection within a dense riparian area.
Project Eligibility for Grants					X		This alternative could be eligible for habitat restoration and public recreational access improvement grants. Because this alternative would include the restoration of aquatic habitat that could support listed species, it could be eligible for a variety of habitat restoration grants.
Ease of Permitting			X				Temporary and permanent impacts to riparian habitats would be expected with this alternative that would require on-site mitigation. Additionally, any work affecting the river channel would result in significant additional permitting and regulatory requirements when compared to Alternative 1.
Tally	**0**	**0**	**2**	**0**	**1**	**0**	
Score (No=0, Very Low=1, Low=2, Medium=3, High=4, Very High=5)	**0**	**0**	**4**	**0**	**4**	**0**	**Total Score = 8** **Average Score = 2.67 (Medium)**

*Average score is determined by dividing the total score by the number of individual categories. Low, Medium and High designations are then assigned according to the following scoring: Low = 1 – 2.5, Medium = 2.51 – 3.5, High = 3.51 – 5.

Table B-12. CONSTRUCTABILITY Category Alternative 3: Riverside Terrace

Project Metric	No	Yes					Comments
		Very Low	Low	Med	High	Very High	
Project Constructability		X					This alternative would require significant grading and substantial engineering effort to construct the riverside terrace. Significant habitat impacts would be anticipated due to the grading efforts, which would require extensive mitigation. Construction would include logistical and technical challenges associated with excavating a terrace along a densely vegetated river bank.
Project Eligibility for Grants					X		This alternative could be eligible for habitat restoration and public recreational access improvement grants. Because this alternative would include the restoration of aquatic habitat that could support listed species, it could be eligible for a variety of habitat restoration grants.
Ease of Permitting			X				Temporary and permanent impacts to riparian habitats would be expected with this alternative that would require on-site mitigation. Additionally, any work affecting the river channel would result in significant additional permitting and regulatory requirements when compared to Alternative 1.
Tally	**0**	**1**	**1**	**0**	**1**	**0**	
Score (No=0, Very Low=1, Low=2, Medium=3, High=4, Very High=5)	**0**	**1**	**2**	**0**	**4**	**0**	**Total Score = 7** **Average Score = 2.33 (Low)**

*Average score is determined by dividing the total score by the number of individual categories. Low, Medium and High designations are then assigned according to the following scoring: Low = 1 – 2.5, Medium = 2.51 – 3.5, High = 3.51 – 5.

Table B-13. OPERATIONS AND MAINTENANCE Category Alternative 1: Minimal Grading

Project Metric	No	Yes					Comments
		Very Low	Low	Med	High	Very High	
Long-Term Operation and Maintenance Costs *Low cost = high rating					X		Long-term operation and maintenance costs would be driven primarily by increased recreational access issues, increased patrolling and signage, trash collection, pond water circulation system maintenance, and trail and boardwalk maintenance. Some long-term habitat management would be necessary but would be similar among the alternatives.
Tally	**0**	**0**	**0**	**0**	**1**	**0**	
Score (No=0, Very Low=1, Low=2, Medium=3, High=4, Very High=5)	**0**	**0**	**0**	**0**	**4**	**0**	**Total Score = 4** **Average Score = 4 (High)**

*Average score is determined by dividing the total score by the number of individual categories. Low, Medium and High designations are then assigned according to the following scoring: Low = 1 – 2.5, Medium = 2.51 – 3.5, High = 3.51 – 5.

Table B-14. OPERATIONS AND MAINTENANCE Category Alternative 2: Full Floodplain Connection

Project Metric	No	Yes					Comments
		Very Low	Low	Med	High	Very High	
Long-Term Operation and Maintenance Costs *Low cost = high rating		X					In addition to the long-term operation and maintenance costs associated with Alternative 1, this alternative would also require the inspection and removal of accumulated debris from the arch culvert bridge and potential additional adaptive management actions associated with the floodplain connection.
Tally	**0**	**1**	**0**	**0**	**0**	**0**	
Score (No=0, Very Low=1, Low=2, Medium=3, High=4, Very High=5)	**0**	**1**	**0**	**0**	**0**	**0**	**Total Score = 1** **Average Score = 1 (Low)**

*Average score is determined by dividing the total score by the number of individual categories. Low, Medium and High designations are then assigned according to the following scoring: Low = 1 – 2.5, Medium = 2.51 – 3.5, High = 3.51 – 5.

Table B-15. OPERATIONS AND MAINTENANCE Category Alternative 3: Riverside Terrace

Project Metric	No	Yes					Comments
		Very Low	Low	Med	High	Very High	
Long-Term Operation and Maintenance Costs *Low cost = high rating			X				In addition to the long-term operation and maintenance costs associated with Alternative 1, this alternative would also require the long-term maintenance of the floodplain terrace.
Tally	**0**	**0**	**1**	**0**	**0**	**0**	
Score (No=0, Very Low=1, Low=2, Medium=3, High=4, Very High=5)	**0**	**0**	**2**	**0**	**0**	**0**	**Total Score = 2** **Average Score = 2 (Low)**

*Average score is determined by dividing the total score by the number of individual categories. Low, Medium and High designations are then assigned according to the following scoring: Low = 1 – 2.5, Medium = 2.51 – 3.5, High = 3.51 – 5.

Table B-16. COSTS/BENEFITS Category Alternative 3: Minimal Grading

Project Metric	No	Yes					Comments
		Very Low	Low	Med	High	Very High	
Construction Costs Compared to Benefits *Lower cost = higher rating *Higher benefit = higher rating					X		Total construction costs are estimated to be $3.25 million. This is the lowest cost alternative. Because this alternative could largely achieve many of the benefits of the other two alternatives but at a substantially lower cost, it was ranked high.
Tally	**0**	**0**	**0**	**0**	**1**	**0**	
Score (No=0, Very Low=1, Low=2, Medium=3, High=4, Very High=5)	**0**	**0**	**0**	**0**	**4**	**0**	**Total Score = 4** **Average Score = 4 (High)**

*Average score is determined by dividing the total score by the number of individual categories. Low, Medium and High designations are then assigned according to the following scoring: Low = 1 – 2.5, Medium = 2.51 – 3.5, High = 3.51 – 5.

Table B-17. COSTS/BENEFITS Category Alternative 2: Full Floodplain Connection

Project Metric	No	Yes					Comments
		Very Low	Low	Med	High	Very High	
Construction Costs Compared to Benefits *Lower cost = higher rating *Higher benefit = higher rating				X			Total construction costs are estimated to be $5.5 million. This cost is substantially higher than Alternative 1 but not as high as Alternative 3. This alternative could achieve slightly better habitat and water quality benefits than Alternative 1 but would be more difficult to permit and construct. Also, it would cost more than Alternative 1 to maintain over the long-term. Therefore, it was ranked medium.
Tally	**0**	**0**	**0**	**1**	**0**	**0**	
Score (No=0, Very Low=1, Low=2, Medium=3, High=4, Very High=5)	**0**	**0**	**0**	**3**	**0**	**0**	**Total Score = 3** **Average Score = 3 (Medium)**
*Average score is determined by dividing the total score by the number of individual categories. Low, Medium and High designations are then assigned according to the following scoring: Low = 1 – 2.5, Medium = 2.51 – 3.5, High = 3.51 – 5.							

Table B-18. COSTS/BENEFITS Category Alternative 3: Riverside Terrace

Project Metric	No	Yes					Comments
		Very Low	Low	Med	High	Very High	
Construction Costs Compared to Benefits *Lower cost = higher rating *Higher benefit = higher rating			X				Total construction costs are estimated to be $8.5 million. This represents the highest cost alternative. This alternative could achieve slightly better habitat benefits but would be more difficult to permit and construct. Also, it would cost substantially more than Alternative 1 to maintain over the long-term. Therefore, it was ranked low.
Tally	**0**	**0**	**1**	**0**	**0**	**0**	
Score (No=0, Very Low=1, Low=2, Medium=3, High=4, Very High=5)	**0**	**0**	**2**	**0**	**0**	**0**	**Total Score = 2** **Average Score = 2 (Low)**

*Average score is determined by dividing the total score by the number of individual categories. Low, Medium and High designations are then assigned according to the following scoring: Low = 1 – 2.5, Medium = 2.51 – 3.5, High = 3.51 – 5.