Appendix A. Public Notices

NOTICE OF INTENT
TO ADOPT A MITIGATED NEGATIVE DECLARATION

NOTICE IS HEREBY GIVEN that the City of Sacramento (City) and the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) have prepared an Environmental Assessment/Initial Study/proposed Mitigated Negative Declaration (EA/IS/MND) in accordance with the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) evaluating the potential environmental effects of the proposed Lower American River Anadromous Fish Habitat Restoration Project (proposed project). The project, which is located along the Lower American River (LAR) between Nimbus Dam and Riverbend Park in Sacramento County, is proposed to improve conditions for anadromous fish in the American River.
The City (a) has concluded that the proposed project would not have a significant effect on the environment; (b) has prepared a proposed Mitigated Negative Declaration (MND) and (c) anticipates recommending to the City Council that it approve the MND.

The City, in association with Reclamation and the Sacramento Water Forum (Water Forum), would borrow gravel material from Sailor and Mississippi Bars, and place up to 30,000 tons of gravel per year at up to three sites within the American River channel within 10 broadly defined areas. The project also includes floodplain and side channel creation/enhancement, and instream habitat structure placement in the LAR as part of ongoing Central Valley Project Improvement Act (CVPIA), Section 3406(b)(13) improvement requirements.

The EA/IS/MND identifies potentially significant impacts related to the proposed project. All potentially significant impacts are reduced to less-than-significant levels with implementation of mitigation measures identified in the Initial Study. The project site is not included on the Hazardous Waste and Substances Sites (Cortese) List.

The 30-day public review period begins June 20, 2019 and ends July 19, 2019. A copy of the EA/IS/proposed MND is available for public review at the Water Forum, 1330 21st Street, Sacramento, CA 95811 or online at https://www.cityofsacramento.org/Community-Development/Planning/Environmental.

Submit comments to: Lilly Allen, Water Forum, 1330 21st St., Sacramento, CA 95811
lallen@cityofsacramento.org. For e-mailed comments, include the project title in the subject line, attach comments in MS Word format, and include the commenter's name and U.S. Postal Service mailing address. All written comments must be received by 5 p.m. on July 19, 2019.

Appendix B. CEQA Environmental Checklist

Project Information

1. Project title:	Lower American River Anadromous Fish Habitat Restoration Project
2. Lead agency name and address:	City of Sacramento 915 I Street Sacramento, CA 95814
3. Contact person and phone number:	Lilly Allen, (916) 808-1993
4. Project location:	Sacramento County, California
5. Project sponsor's name and address:	U.S. Department of the Interior, Bureau of Reclamation, Mid-Pacific Region 2800 Cottage Way Sacramento, CA 95825 Sacramento Water Forum 1330 21st Street Sacramento, CA 95811
6. General plan designation:	Natural Preserve, Recreation
7. Zoning:	PC Parkway Corridor
8. Description of project: (Describe the whole action involved, including but not limited to later phases of the project, and any secondary, support, or off-site features necessary for its implementation. Attach additional sheets if necessary.)	The project includes a continuation of spawning gravel augmentation, floodplain and side channel creation/enhancement, and instream habitat structure placement at up to 10 sites repeatedly in the Lower American River between RM 23 and RM 13 that was initiated in 2008 and would be implemented between 2019 and 2034 to comply with the Central Valley Project Improvement Act and related Biological Opinions. Several but not all sites would be restored each year although restoration would not occur in years when funding is unavailable. Biological and physical monitoring are key components of the project.
9. Surrounding land uses and setting: Briefly describe the project's surroundings:	The project is located in the American River Parkway in an area designated for recreation and natural preserve. The Parkway is surrounded by suburban and urban residential areas to the north and south.
10. Other public agencies whose approval is required (e.g., permits, financing approval, or participation agreement.)	U.S. Department of the Interior, Bureau of Reclamation; U.S. Army Corps of Engineers; Central Valley Flood Protection Board; California Department of Fish and Wildlife; Central Valley Regional Water Quality Control Board, Sacramento Area Flood Control Agency
11. Have California Native American tribes traditionally and culturally affiliated with the project area requested consultation pursuant to Public Resources Code (PRC) Section 21080.3.1? If so, is there a plan for consultation that includes, for example, the determination of significance of impacts to tribal cultural resources, procedures regarding confidentiality, etc.?	The City is consulting with tribes which have requested consultation and notification pursuant to PRC Section 21080.3.1.

Environmental Factors Potentially Affected

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages.

☐	Aesthetics	☐	Agriculture and Forestry Resources	☐	Air Quality
☐	Biological Resources	☐	Cultural Resources	☐	Energy
☐	Geology and Soils	☐	Greenhouse Gas Emissions	☐	Hazards and Hazardous Materials
☐	Hydrology and Water Quality	☐	Land Use and Planning	☐	Mineral Resources
☐	Noise	☐	Population and Housing	☐	Public Services
☐	Recreation	☐	Transportation	☐	Tribal Cultural Resources
☐	Utilities and Service Systems	☐	Wildfire	☐	Mandatory Findings of Significance
				☒	None with Mitigation

Determination (To be completed by the Lead Agency)

On the basis of this initial evaluation:

☐ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☒ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☐ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

Signature: [signature] Date: 6-14-19

Print Name: Thomas R. Gohring Title: Executive Director

Agency: Sacramento City / County Office of Metropolitan Water Planning

Evaluation of Environmental Impacts

1) A brief explanation is required for all answers except "No Impact" answers that are adequately supported by the information sources a lead agency cites in the parentheses following each question. A "No Impact" answer is adequately supported if the referenced information sources show that the impact simply does not apply to projects like the one involved (e.g., the project falls outside a fault rupture zone). A "No Impact" answer should be explained where it is based on project-specific factors as well as general standards (e.g., the project will not expose sensitive receptors to pollutants, based on a project-specific screening analysis).

2) All answers must take account of the whole action involved, including off-site as well as on-site, cumulative as well as project-level, indirect as well as direct, and construction as well as operational impacts. Operations and maintenance impacts of the proposed project are routine, minimal, and essentially the same as current operations and maintenance of the American River Parkway (Parkway). There is no potential for a significant impact to any resource category from project operations and maintenance of the existing and proposed facilities.

3) Once the lead agency has determined that a particular physical impact may occur, then the checklist answers must indicate whether the impact is potentially significant, less than significant with mitigation, or less than significant. "Potentially Significant Impact" is appropriate if there is substantial evidence that an effect may be significant. If there are one or more "Potentially Significant Impact" entries when the determination is made, an EIR is required. “Beneficial impact” is also identified where appropriate to provide full disclosure of any benefits from implementing the proposed project.

4) "Less-than-Significant Impact with Mitigation Incorporated" applies where the incorporation of mitigation measures has reduced an effect from "Potentially Significant Impact" to a "Less-than-Significant Impact." The lead agency must describe the mitigation measures, and briefly explain how they reduce the effect to a less-than-significant level (mitigation measures from "Earlier Analyses," as described in (5) below, may be cross-referenced).

5) Earlier analyses may be used where, pursuant to the tiering, program EIR, or other CEQA process, an effect has been adequately analyzed in an earlier EIR or negative declaration (Section 15063[c][3][D]). In this case, a brief discussion should identify the following:

   a) Earlier Analysis Used. Identify and state where they are available for review.

   b) Impacts Adequately Addressed. Identify which effects from the above checklist were within the scope of and adequately analyzed in an earlier document pursuant to applicable legal standards, and state whether such effects were addressed by mitigation measures based on the earlier analysis.

   c) Mitigation Measures. For effects that are a "Less-than-Significant Impact with Mitigation Measures Incorporated," describe the mitigation measures which were incorporated or refined from the earlier document and the extent to which they address site-specific conditions for the project.

   In the case of the proposed project, the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) has previously completed several Environmental Assessments and Supplemental Environmental Assessments in compliance with the National Environmental Policy Act (NEPA). Where appropriate, this analysis is incorporated by reference, summarized, and used to support conclusions on project impacts under CEQA.

6) Lead agencies are encouraged to incorporate into the checklist references to information sources for potential impacts (e.g., general plans, zoning ordinances). Reference to a previously prepared or outside document should, where appropriate, include a reference to the page or pages where the statement is substantiated.

7) Supporting Information Sources: A source list should be attached, and other sources used or individuals contacted should be cited in the discussion.

8) This is only a suggested form, and lead agencies are free to use different formats; however, lead agencies should normally address the questions from this checklist that are relevant to a project's environmental effects in whatever format is selected.

9) The explanation of each issue should identify:

   a) the significance criteria or threshold, if any, used to evaluate each question; and

   b) the mitigation measure identified, if any, to reduce the impact to less than significance.

   Significance thresholds are identified for certain resources, but others are not explicitly identified because there is clearly no impact or the checklist question itself serves as the significance threshold.

1.1 Aesthetics

Environmental Issue	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Beneficial Impact
AESTHETICS.					
Except as provided in PRC Section 21099, **would the project:**					
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☐	☒	☐
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a State scenic highway?	☐	☐	☐	☒	☐
c) In non-urbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings? (Public views are those that are experienced from a publicly accessible vantage point.) If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality?	☐	☐	☒	☐	☐
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☐	☐	☒	☐

1.1.1 Environmental Setting

The American River Parkway (Parkway) is an open space greenbelt which extends from Nimbus Dam to the American River's confluence with the Sacramento River. Many areas along the north and south sides of the river have been affected by past gold mining and/or gravel borrow activities and these areas exhibit extensive dredge piles of gravel and cobble-sized material with riparian, wetland, woodland, and upland vegetation of various densities occupying floodplain, bank, and instream gravel bar areas. Topography in the Parkway varies from steep banks to wide, more broadly-sloping or flat meander areas.

The Parkway's open spaces and natural resources provide visitors with a highly-valued natural setting in the midst of a developed urban area. The American River Parkway Plan (Parkway Plan) (Sacramento County 2008) specifies management for many uses, including: viewing the clean, transparent waters of the American River at various flow levels; fish, wildlife and associated habitat; river recreation such as rafting, fishing, hiking, and biking; viewing geology and landforms; and many other uses with minimal urban or ambient noise and light. The land uses in the Parkway are defined in the Parkway Plan.

The goal of the Parkway Plan is to provide, protect, and enhance a continuous open space greenbelt along the Lower American River (LAR) for public use. Human developments and facilities are prohibited in the "Open Space Preserve Areas," except as necessary to protect the public health, safety, and welfare, or for the purposes of habitat restoration.

The LAR is designated as a "Recreational" river by the Secretary of the Interior under the National Wild and Scenic Rivers Act (designated 1981) and is given the same designation by the State under the California Wild and Scenic Rivers Act (designated 1972).

1.1.2 Discussion

a) Have a substantial adverse effect on a scenic vista?

No Impact. There are no designated scenic vistas in the project area. Therefore, there would be no impact.

b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a State scenic highway?

No Impact. There are no State scenic highways in the project vicinity. There would be no impact.

c) In non-urbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings? (Public views are those that are experienced from publicly accessible vantage point.) If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality?

Less-than-Significant Impact. The entire project area is zoned as PC – Parkway Corridor Zoned Area by Sacramento County (Sacramento County 2019). This zone is combined with the basic zone in areas on which uses may affect the aesthetics of the Parkway; these include zones for recreation and natural preserve. This combining zone has been established to limit uses that visually impact the Parkway and contains special development standards for structures and buildings, as well as use permit requirements. Project construction would be periodic and temporary (up to 6 weeks at any one site in any given year) and therefore compatible with the zoning regulations.

In-river spawning gravel placement, side channel excavation, and habitat structure placement would require the use of large construction equipment within and adjacent to the river but would be limited to a maximum of three restoration sites per year which represent a small portion of the total Parkway area. Furthermore, construction and equipment use would be only 4-6 weeks at each location. After work is completed at the various restoration sites, the visual character of these reaches would be consistent with existing conditions along the Parkway and LAR, where visitors see a meandering main channel, side channels, gravel bars, vegetated and unvegetated banks, upland and riparian vegetation at various life stages (including downed logs and rootwads), and the fish and wildlife species that use the Parkway and LAR as habitat. At borrow sites, the visual character would be similar before and after removal of material; the visual environment in these locations is characterized by large piles or mounds of gravel, and vegetation typical of disturbed areas.

As described on page 23 in the 2008 Environmental Assessment (2008 EA) prepared by the Bureau of Reclamation (Reclamation 2008) and in Appendix C, "National Park Service Wild and Scenic Rivers Evaluation," to the 2008 EA (National Park Service [NPS] 2008), and incorporated by reference, the NPS has concurred that the project conducted in 2008 through 2013 would not have a direct and adverse effect on the values for which the river was designated as a Wild and Scenic River. In 2018, NPS again concurred that the project described in the 2008 EA would not have a direct and adverse effect (NPS 2018). A similar concurrence is expected for the proposed action for 2019 through 2032 since the proposed action is very similar to the previous LAR restoration efforts. This impact would be less than significant.

d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?

No Impact. None of the project activities would include construction of temporary or permanent buildings or other facilities that would require permanent lighting, and therefore no new long-term sources of light or glare would be created by the project. Furthermore, all construction work would be conducted during the hours specified in the City of Sacramento (City) and County of Sacramento (County) ordinances, and therefore nighttime lighting for construction activities would not be required. Thus, there would be no impact.

1.2 Agriculture and Forestry Resources

Environmental Issue	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Beneficial Impact
AGRICULTURE AND FORESTRY RESOURCES. In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997, as updated) prepared by the California Department of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the State's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board. **Would the project:**					
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒	☐
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☒	☐
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in PRC Section 12220(g)), timberland (as defined by PRC Section 4526), or timberland zoned Timberland Production (as defined by Government Code Section 51104(g))?	☐	☐	☐	☒	☐
d) Result in the loss of forest land or conversion of forest land to non-forest use?	☐	☐	☒	☐	☐
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?	☐	☐	☒	☐	☐

1.2.1 Environmental Setting

As discussed and analyzed in the 2008 EA (page 22), and incorporated by reference, the proposed project borrow and restoration sites are located in land use areas designated for recreation and natural preserve by the Sacramento County General Plan (Sacramento County 2011), and the Folsom Lake State

Recreation Area & Folsom Powerhouse State Historic Park General Plan/Resource Management Plan (2010).

1.2.2 Discussion

a-c) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use; conflict with existing zoning for agricultural use, or a Williamson Act contract; or conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code Section 12220(g)), timberland (as defined by PRC Section 4526), or timberland zoned Timberland Production (as defined by Government Code Section 51104(g))?

No Impact. There are no lands designated as Prime, Unique, or Farmland of Statewide Importance nor are there any Williamson Act contracted lands within the project area (California Department of Conservation 2015, 2019). The entire project area is zoned as PC – Parkway Corridor Zoned Area by Sacramento County (Sacramento County 2019). There would be no impact.

d, e) Result in the loss of forest land or conversion of forest land to non-forest use or involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?

Less-than-Significant Impact. No agricultural or production uses exist in the project vicinity. There would be no conversion or loss of agricultural lands as a result of the project.

However, portions of the Parkway and project site may qualify as forestlands under Public Resources Code (PRC), Section 12220 since these areas may "support 10-percent native tree cover of any species, including hardwoods, under natural conditions, and that allows for management of one or more forest resources, including timber, aesthetics, fish and wildlife, biodiversity, water quality, recreation, and other public benefits." During construction of the side channels, up to 20 trees per site may need to be removed although all trees would be avoided to the extent feasible. The Parkway is a dynamic riverine environment, and continual recruitment and disposition of riparian and floodplain trees and other vegetation is a part of the natural cycle as the river meanders throughout the Parkway. The removal of up to 20 trees per site over the 15 years of the project would not convert forest land to a non-forest use and would be a less-than-significant impact.

1.3 Air Quality

Environmental Issue	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Beneficial Impact
AIR QUALITY.					
Where available, the significance criteria established by the applicable air quality management district or air pollution control district may be relied on to make the following determinations. **Would the project:**					
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☒	☐	☐
b) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable Federal or State ambient air quality standard?	☐	☐	☒	☐	☐
c) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☒	☐	☐
d) Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?	☐	☐	☐	☒	☐

1.3.1 Environmental Setting

The project site is located within the Sacramento Valley Air Basin (SVAB). The project site is located in Sacramento County, under the jurisdiction of the Sacramento Metropolitan Air Quality Management District (SMAQMD).

As required by the Federal Clean Air Act (FCAA) passed in 1970, the U.S. Environmental Protection Agency (EPA) has identified six criteria air pollutants that are pervasive in urban environments and for which state and national health-based ambient air quality standards have been established. EPA calls these pollutants "criteria air pollutants" because the agency has regulated them by developing specific public health- and welfare-based criteria as the basis for setting permissible levels. Ozone, carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM), and lead are the six criteria air pollutants. Notably, PM is measured in two size ranges: PM_{10} for particles less than 10 microns in diameter, and $PM_{2.5}$ for particles less than 2.5 microns in diameter. SVAB is currently designated as nonattainment for the State and Federal ambient air quality standards for ground-level ozone (O_3), as well as for the Federal standards for $PM_{2.5}$ (SMAQMD 2019a, 2019b).

1.3.2 Discussion

a) Conflict with or obstruct implementation of the applicable air quality plan?

Less-than-Significant Impact. This impact is determined based on whether the proposed project would conflict with or obstruct implementation of an applicable air quality action plan and/or applicable portions of the State Implementation Plan, which would lead to increases in the frequency or severity of existing air quality violations. SMAQMD is responsible for establishing and enforcing local air quality rules and regulations that address the requirements of Federal and State air quality laws in Sacramento County. SMAQMD is also responsible for implementing strategies for air quality improvement and recommending mitigation measures for new growth and development. SMAQMD has identified specific criteria pollutant thresholds to assist lead agencies in determining air quality impacts for projects located in Sacramento County. These thresholds are shown in **Table 1.3-1**.

Table 1.3-1 Air Quality Thresholds of Significance

	O_3 Precursor Emissions		
Emission Type	**NO_X**	**PM_{10}**	**$PM_{2.5}$**
Construction	85 pounds per day	Fugitive dust BACT/BMPs and 80 pounds per day, 14.6 tons per year	Fugitive dust BACT/BMPs and 82 pounds per day, 15 tons per year

Notes: O_3 = ozone, NOx = nitrogen oxide, PM_{10} = particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter.
Source: Sacramento Metropolitan Air Quality Management District 2015

The proposed project includes only construction-phase emissions associated with placing gravel at augmentation sites and the side channel improvements, including borrow of gravel material and transport of this material to the gravel augmentation sites. As specified by the description of the Proposed Action, all construction equipment would use Best Available Control Technology (BACT) and implement dust control Best Management Practices (BMPs) in accordance with current SMAQMD guidance. As discussed under item b) below and summarized in **Table 1.3-2**, project emissions would be below SMAQMD thresholds of significance without any mitigation. This impact would be less than significant.

b) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable Federal or State ambient air quality standard?

Less-than-Significant Impact. Construction emissions are considered short-term and temporary, but they have the potential to represent a significant impact with respect to air quality. Construction of the proposed project would temporarily generate emissions of reactive organic gases (ROG), NO_X, CO, PM_{10}, and $PM_{2.5}$. Emissions of ozone precursors (e.g., ROG and NO_X) are generated primarily by on-road mobile sources (i.e., delivery vehicles, haul trucks, construction worker vehicles) and off-road construction equipment. The level of emissions generated varies as a function of vehicle trips per day for worker commute trips and haul truck trips, and the types and number of heavy-duty, off-road equipment used and their respective intensity and frequency of operation.

Fugitive PM dust is one of the pollutants of greatest concern with respect to construction activities. Construction-related fugitive PM dust emissions can vary greatly depending on the level of activity, the specific operations taking place, the number and types of equipment operated, vehicle speeds, local soil conditions, weather conditions, and the amount of earth disturbance. Soil excavation and swale grading activities would be the primary source of fugitive PM dust emissions from construction activities. Movement of off-road construction equipment and work trucks on unpaved roads can also generate fugitive PM dust emissions.

Construction-related exhaust emissions were modeled using the California Emissions Estimator Model (CalEEMod), Version 2016.3.2, which was the most currently available version at the time of this analysis. CalEEMod allows the user to enter project-specific construction information, such as the types, number, and horsepower of construction equipment, and the number and length of off-site motor vehicle trips. Construction-related emissions for the proposed project were estimated for construction worker commutes, haul trucks, and the use of off-road equipment. **Table 1.3-2** shows the unmitigated emissions associated with construction activities.

Table 1.3-2 Proposed Action Construction Emissions

Construction Year(s)	Emissions					
	pounds/day (unmitigated)				tons/year (unmitigated)	
	ROG	NO_X	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
2019-2023	7.86	84.77	22.46	8.39	0.63	0.24
2024-2028	5.11	51.02	20.61	6.69	0.58	0.19
2029-2033	4.76	46.74	20.37	6.47	0.57	0.18
2034	4.87	26.69	19.30	5.53	0.54	0.16
SMAQMD Threshold of Significance	--	85	82	80	14.6	15
Exceeds Project Threshold?	--	No	No	No	No	No

Source: GEI Consultants, Inc. 2019
Notes: ROG = reactive organic gases; NO_X = nitrogen oxides; PM_{10} = particulate matter with aerodynamic diameter less than 10 micrometers; $PM_{2.5}$ = particulate matter with aerodynamic diameter less than 2.5 micrometers
Source: Emissions modeled by GEI Consultants, Inc., in 2019 (Model results in Appendix F)

SVAB is currently designated as nonattainment for the Federal and State ambient air quality standards for ground-level O_3, as well as for the Federal standards for $PM_{2.5}$. The air basin's nonattainment status is attributed to the region's development history. Past, present, and future development projects contribute to the region's adverse air quality impacts on a cumulative basis. By its nature, air pollution is largely a cumulative impact. SMAQMD's approach to thresholds of significance is used to determine whether a project's individual emissions would result in a cumulative considerable adverse contribution to SVAB's existing air quality conditions. If a project's emissions would be less than these levels, the project would not be expected to result in a cumulatively considerable contribution to the significant cumulative impact. The proposed project would not exceed SMAQMD's daily or annual emissions thresholds. This impact would be less than significant.

c) Expose sensitive receptors to substantial pollutant concentrations?

Less-than-Significant Impact. Some members of the population are especially sensitive to emissions of air pollutants and should be given special consideration during the evaluation of the project's air quality impacts. These people include children, older adults, any person with pre-existing respiratory or cardiovascular illness, and athletes and others who engage in frequent exercise. Sensitive receptors include residences, schools, playgrounds, child care centers, athletic facilities, long-term health care facilities, rehabilitation centers, convalescent centers, and retirement homes. While residences and recreational facilities, including the American River Bike Trail, are located adjacent to portions of the project site, the proposed project is not expected to result in the exposure of sensitive receptors to substantial pollutant concentrations, given the short-term nature of these construction emissions and the distance of residences and active recreation facilities to the construction sites. This impact is considered less than significant.

d) Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?

No Impact. Human response to odors is subjective, and sensitivity to odors varies greatly. Typically, odors are regarded as an annoyance rather than a health hazard. However, manifestations of a person's reaction to foul odors can range from psychological (e.g., irritation, anger, anxiety) to physiological (e.g., circulatory and respiratory reactions, nausea, vomiting, headaches). The proposed project would not create new objectionable odors. There would be no impact.

1.4 Biological Resources

Environmental Issue	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Beneficial Impact
BIOLOGICAL RESOURCES.					
Would the project:					
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	☐	☒	☐	☐	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	☐	☐	☒	☐	☐
c) Have a substantial adverse effect on State or Federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☒	☐	☐	☐
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☒	☐	☐	☐
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☐	☒	☐
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or State habitat conservation plan?	☐	☐	☐	☒	☐

This section summarizes the more detailed biological resources discussion provided in the Biological Resources Technical Report included as **Appendix G**.

1.4.1 Environmental Setting

The project study area is located in the riverine, riparian, and woodland corridor of the LAR. Elevation of the study area ranges from approximately 50 feet above mean sea level at the downstream end of the River Bend restoration site to approximately 200 feet at the upstream end of the Mississippi Bar borrow site. Water depth in this portion of the river fluctuates during summer because it is downstream of Nimbus Dam and subject to regulated flows. Vegetation on the restoration sites includes valley oak woodland, mixed riparian forest, and willow scrub (Reclamation 2015). The borrow sites are primarily barren and composed of dredge tailings, though seasonal wetlands are present in concave portions of the tailings (Water Forum 2008). These habitats have potential to support one special-status plant and several special-status wildlife species. The LAR also supports a variety of native and nonnative fishes, including game fish and special-status species. The study area includes designated critical habitat for two Federally listed species and Essential Fish Habitat (EFH) for Chinook salmon (*Oncorhynchus tshawytscha*).

1.4.2 Discussion

a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or the U.S. Fish and Wildlife Service?

Plants

Less-than-Significant Impact. Sanford's arrowhead (*Sagittaria sanfordii*) is the only special-status plant (California Rare Plant Rank 1B.2) that has potential to occur on the restoration sites. This plant has three occurrences mapped along the American River, including one occurrence in a concrete-lined drainage channel, near the restoration site approximately 0.8 mile downstream of the Rossmoor Drive access point. The other nearby occurrences are along the river, within 3 miles of restoration sites. Ground disturbance at the restoration sites would primarily occur below the ordinary high-water mark (OHWM) in areas where waters are generally fast moving and well oxygenated. Because Sanford's arrowhead occurs in slow-moving waters, it is very unlikely to occur in areas of project-related disturbance, and unlikely to be adversely affected by project implementation. Therefore, this impact would be less than significant.

Fisheries

Three Federally and State-listed fish species could occur at the restoration sites: California Central Valley steelhead (*O. mykiss*) (Federally threatened), Sacramento River winter-run Chinook salmon (*O. tshawytscha*) (Federally and State endangered), and Central Valley spring-run Chinook salmon (Federally and State threatened). In addition, Central Valley fall-run Chinook salmon, river lamprey (*Lampetra fluviatilis*), and hardhead (*Mylopharodon conocephalus*), all of which are California species of special concern, could occur at the restoration sites. The entire LAR from the confluence with the Sacramento River to Nimbus Dam is designated as critical habitat for Central Valley steelhead and EFH for Chinook salmon.

Habitat Conditions

Beneficial. The proposed project includes a suite of habitat modification/restoration activities with the expressed intent to improve conditions for anadromous salmonids in the LAR. Activities to augment spawning gravel, enhance floodplain and side channel habitats, and place instream habitat structures are expected to improve aquatic habitats and increase spawning and rearing success. Monitoring of past gravel placement indicates new spawning habitat for salmonids has been created and used successfully. Therefore, impacts associated with changes in habitat conditions would be beneficial.

Hazardous Materials

Less-than-Significant Impact with Mitigation Incorporated. Operation of construction equipment in or adjacent to the river presents the risk of a spill of hazardous materials into the river (e.g., construction equipment leaking fluids). Additionally, on-site refueling of construction equipment can result in minor fuel and oil spills. Without rapid containment and clean up, these materials could have deleterious effects on special-status fish within the exposure area. Although juvenile salmonids are highly mobile and thus have the ability to avoid potentially hazardous materials, exposure to such materials could result in mortality of large numbers of special-status fishes and have a substantial adverse effect on local populations. Therefore, this potential impact from project-related increases in pollutant discharge on special-status fish would be **potentially significant**. The following mitigation measure has been identified to address this impact:

> **Mitigation Measure GEO-1: Prepare and Implement a Storm Water Pollution Prevention Plan and Best Management Practices.**
>
> Please refer to Mitigation Measure GEO-1 in Section 1.7, "Geology and Soils," for the full text of this mitigation measure.

Implementing Mitigation Measure GEO-1 would reduce the potentially significant impact of pollutant discharge on special-status fish from accidental spill of or exposure to hazardous materials to a less-than-significant level, because a storm water pollution prevention plan (SWPPP) would be prepared and implemented, when required. The SWPPP would include a spill prevention, control, and countermeasure plan, and would identify the types of materials used for equipment operation, along with measures to prevent and materials available to clean up hazardous material and waste spills. The SWPPP would also identify emergency procedures for responding to spills. This impact would be less than significant with mitigation incorporated.

Suspended Sediments and Turbidity

Less-than-Significant Impact with Mitigation Incorporated. Project activities could result in short-term increases in suspended sediment and turbidity levels and impact fish populations through reduced food availability and feeding efficiency. At high levels, suspended solids can adversely affect the physiology and behavior of aquatic organisms and suppress photosynthetic activity at the base of food webs, affecting aquatic organisms either directly or indirectly (Alabaster and Lloyd 1980). Fish responses to increased turbidity and suspended sediment can range from behavioral changes (alarm reactions, abandonment of cover, and avoidance) to sublethal effects (e.g., reduced feeding rate), and, at high suspended sediment concentrations for prolonged periods, lethal effects (Newcombe and Jensen 1996). If this occurs while embryos are incubating, injury or mortality to incubating eggs or alevins could occur through the infiltration of fine sediment into salmonid redds with a reduction of intra-gravel water circulation and, in severe cases, entombment of salmonid eggs. Deposition of fine sediments in food-producing riffles also could reduce the abundance and availability of aquatic insects on which fish feed and result in loss of cover.

Riffle supplementation and floodplain and side channel creation/enhancement require applying the gravel directly to the streambed and/or grading it, thereby disturbing silt and sand on the river bottom and increasing potential for adverse effects. The amount of sediment that may be re-suspended by project activities is not anticipated to be substantial, and any re-suspension and re-deposition of instream sediments is expected to be localized and temporary. In addition, project activities would primarily occur within the middle of the active channel, where fewer juvenile salmonids are expected to rear. Previous studies indicate that juvenile salmonids tend to be found within 10-20 feet of river banks (Allen 2000, FISHBIO and Normandeau Associates 2012, Palmer and Hellmair 2012). Although some rearing and migrating juveniles may be found farther from the banks, the area disturbed by project activities and associated turbidity at any given time is expected to affect less than 40 percent of the river width and to be most concentrated within about 200 feet downstream of the restoration site. Therefore, juvenile salmonids will have opportunities to move to other portions of the channel where they can avoid potential impacts from turbidity increases. In addition, in-work work windows would prevent the siltation of steelhead redds and eggs. However, project-related increases in suspended sediment and turbidity have potential to cause adverse behavioral responses and sublethal and lethal effects, potentially resulting in a substantial adverse effect on local populations of juvenile salmonids and other special-status fish. Therefore, this impact would be potentially significant. The following mitigation measure has been identified to address this impact:

Mitigation Measure GEO-1: Prepare and Implement a Storm Water Pollution Prevention Plan and Best Management Practices.

Please refer to Mitigation Measure GEO-1 in Section 1.7, "Geology and Soils," for the full text of this mitigation measure.

Implementing Mitigation Measures GEO-1 would reduce the potentially significant impact associated with increases in suspended sediment and turbidity on special-status fish to a **less-than-significant** level because a SWPPP would be prepared and implemented, when required, measures would be implemented to minimize turbidity during in-water construction activities, and construction activities at any one site and collectively during the year are limited to a short duration. This impact would be less than significant with mitigation incorporated.

Physical Disturbance

Less-than-Significant Impact with Mitigation Incorporated. Gravel placement and grading activities for riffle supplementation, excavation activities for floodplain and side channel enhancement, and instream placement of habitat structures have potential to affect special-status fishes through displacement, disruption of normal behaviors, and direct injury or mortality. Rearing habitat for juvenile salmonids is generally well-distributed, allowing for juvenile movement to other areas to avoid the physical disturbance of construction activities. However, fish would not be able to use portions of the river where equipment is actively working or the associated turbidity plume occurs, and displacement may temporarily expose juvenile fish to a greater risk of predation. Although juvenile salmonids are generally expected to avoid areas where equipment is actively placing or excavating gravel, an undetermined number of special-status fishes may attempt to find shelter in the substrate and could be injured or killed by equipment. Placing material in the active channel would generally occur along non-vegetated channel margins where juvenile salmonid presence is expected to be minimal due to the lack of vegetation cover and the timing of in-river construction. However, using heavy equipment in areas that are accessible by fish and/or installing temporary water crossings could result in injury or mortality and have a substantial adverse effect on local populations. Therefore, this potential impact from direct injury or mortality of special-status fish would be potentially significant. The following mitigation measure has been identified to address this impact:

Mitigation Measure BIO-1: Minimize Injury and Mortality of Special-Status Fish Species.

The City/Water Forum and its construction contractor(s) shall implement the following measures to avoid and minimize direct injury and mortality of special-status fish:

- In-water work shall be restricted to July 1 through September 30, with consideration of the spatial and temporal distribution of spawning and incubating steelhead and fall-run Chinook salmon. Work past September 30 would be with approval from the national Marine Fisheries Service.

- Construction may be conducted year-round in areas, such as floodplains and side channels, when flowing water is absent due to separation from the main channel by gravel berms that are either naturally present or artificially created.

- In-water work in floodplains and side channels shall be limited to inlet/outlet areas during the last stage of reconnection to the main channel. if working outside of the instream work timing window.

- Instream habitat structures shall be placed when fish do not have access to the affected areas, or within timing windows, as described above.

- Measures such as slow, deliberate equipment operation and tapping the water surface before entering the channel shall be implemented during in-water work to alert fish to equipment operation in the channel before gravel is placed.

- Before project activities begin, worker Environmental Awareness Training shall be provided to inform agency staff and contractors of the need to avoid and minimize potential impacts on special-status fish and the possible penalties for not complying with these requirements. The training shall include, at a minimum, species identification, habitat requirements, and required practices for fish avoidance and protection. A designated enforcement lead shall be identified to employees and contractors to ensure that questions regarding avoidance and protection measures are addressed in a timely manner.

- A designated enforcement lead shall monitor in-water construction activities to confirm proper implementation of conservation measures and water quality protection measures.

Timing: Before and during ground-disturbing activities.

Responsibility: City/Water Forum and Construction Contractor(s).

Implementing Mitigation Measure BIO-1 would reduce the potentially significant impact associated with project-related injury or mortality of special-status fish to a less-than-significant level, because restrictions related to in-water work would be implemented, agency staff and contractors would receive training, and biological monitoring would be conducted. This impact would be less than significant with mitigation incorporated.

Invertebrates

Vernal Pool Fairy Shrimp

Less-than-Significant Impact with Mitigation Incorporated. Vernal pool fairy shrimp (*Branchinecta lynchi*) is known to occur within 3 miles of the restoration and borrow sites, including one occurrence near the Sailor Bar borrow site. This occurrence is from seasonal wetland habitat on the high floodplain terrace (CDFW 2019), outside the area of dredge tailings that would be used as borrow material. Vernal pool tadpole shrimp (*Lepidurus packardi*) has not been documented in this wetland, but it also could occur if habitat conditions are suitable. Vernal pool fairy shrimp is Federally listed as threatened, and vernal pool tadpole shrimp is Federally listed as endangered. Based on review of aerial photography and past wetland delineation reports (Water Forum 2008, Reclamation 2015), up to 0.24 acre of seasonal wetland habitat is present on the Sailor Bar and Mississippi borrow sites combined. Seasonal wetlands in tailings on the borrow sites are less likely to be suitable for vernal pool fairy shrimp and vernal pool tadpole shrimp than wetlands on the high floodplain and are not expected to sustain ponded water long enough for either species to complete its lifecycle. However, potential for these species to occur on the borrow sites cannot be entirely excluded. Because project activities would remove material from dredge tailings, seasonal wetland habitat potentially occupied by vernal pool fairy shrimp and vernal pool tadpole shrimp could be removed. This could have a substantial adverse effect on the local populations, depending on the amount of occupied habitat that is affected. Therefore, this potential impact on vernal pool fairy shrimp and vernal pool tadpole shrimp from potential modification of occupied habitat would be potentially significant. The following mitigation measures have been identified to address this impact:

Mitigation Measure GEO-1: Prepare and Implement a Storm Water Pollution Prevention Plan and Best Management Practices.

Please refer to Mitigation Measure GEO-1 in Section 1.7, "Geology and Soils," for the full text of this mitigation measure.

Mitigation Measure BIO-2: Avoid and Minimize Impacts on Waters of the United States and Waters of the State.

The City/Water Forum and its construction contractor(s) shall implement the following measures to avoid and minimize direct fill of waters of the United States and waters of the State in the Lower American River and minimize impacts on seasonal wetland habitats at the borrow sites.

- Ground disturbance shall be limited to gravel augmentation restoration sites and borrow sites. Existing access routes shall be used to obtain access to restoration and borrow sites. The total area of the project activity shall be limited to the minimum necessary. Borrow extraction areas and staging areas shall be placed to avoid and limit disturbance to the Lower American River and seasonal wetland habitats and shall provide a 250-foot setback from seasonal wetland habitats, to the extent feasible.

- Before the commencement of construction activities, high-visibility fencing shall be erected to protect areas of the Lower American River at gravel augmentation sites and identified seasonal wetland habitats at borrow sites that are located adjacent to disturbance areas but can be avoided from encroachment of personnel and equipment. The fencing shall be inspected before the start of each work day and shall be removed only when the construction within a given area is completed. Limits of waters of the United States and wetlands shall be incorporated into project bid specifications, along with a requirement for contractors to avoid these areas.

- A designated enforcement lead shall monitor all construction activities in waters of the United States to ensure that avoidance and minimization measures are being properly implemented and no unauthorized activities occur. The designated enforcement lead shall be empowered to stop construction activities that threaten to cause unanticipated and/or unauthorized significant adverse project impacts to allow resolution of these potential impacts by the City/Water Forum and U.S. Bureau of Reclamation. Project activity shall not resume until the conflict has been resolved.

- Authorization for direct fill of jurisdictional habitat in the American River and modification of seasonal wetlands at the borrow sites shall be obtained, as required, from the U.S. Army Corps of Engineers (Corps), Central Valley Regional Water Quality Control Board (RWQCB), and CDFW.

- **Clean Water Act (CWA) Section 404:** Before any ground-disturbing project activities begin in areas containing wetlands or waters, a qualified biologist shall conduct a formal delineation of waters of the United States for CWA Section 404 permitting. The findings shall be documented in a detailed report as part of the formal Section 404 wetland delineation process. Authorization for fill of jurisdictional waters of the United States shall be secured from the Corps via the Section 404 permitting process before project construction. Any mitigation measures determined necessary during the 404 permitting process shall be implemented during project construction.

- **CWA Section 401:** Prior to conducting work under a Section 404 Permit, Reclamation must obtain a Section 401 Water Quality Certification from the Central Valley RWQCB. This declaration states that any discharge complies with all applicable effluent limitations and water quality standards. Reclamation will submit an application to the Central Valley RWQCB for sites not included in the 2019 permit.
- **Fish and Game Code (FGC) Section 1602 or similar agreement:** A CDFW lake and streambed alteration agreement or similar approval from CDFW shall be obtained by the City for all activities that will substantially divert or obstruct the natural flow of water; substantially change or use any material from the bed, channel or bank of any river, stream, or lake; or deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it may pass into any river, stream, or lake. Any conditions of issuance of the lake and streambed alteration agreement, including avoidance, minimization, and compensation measures, shall be implemented as part of project implementation.

Timing: Before and during ground-disturbing activities.

Responsibility: City/Water Forum.

Implementing Mitigation Measures GEO-1 and BIO-2 would reduce the potentially significant impact associated with direct and indirect disturbance of seasonal wetlands potentially occupied by vernal pool fairy shrimp and vernal pool tadpole shrimp to a less-than-significant level because a SWPPP would be prepared and implemented and measures would be implemented to avoid and minimize extracting borrow from and staging near seasonal wetlands. This impact would be less than significant with mitigation incorporated.

Valley Elderberry Longhorn Beetle

Less-than-Significant Impact with Mitigation Incorporated. Blue elderberry (*Sambucus nigra ssp. caerulea*) shrubs are widely distributed throughout the restoration and borrow sites. These shrubs are the host plant for larvae of Valley elderberry longhorn beetle (VELB) (*Desmocerus californicus dimorphus*), which is Federally listed as threatened. There are a number of known occurrences of VELB on or near the restoration and borrow sites, and two areas of designated critical habitat for the species are located on or adjacent to several of the restoration sites, between approximately river mile (RM) 18 and RM 19 and from RM 14.5 to RM 17. Project activities would not require removal or trimming of elderberry shrubs, but elderberry shrubs adjacent to the restoration and borrow sites could be indirectly affected. VELB typically emerge from elderberry shrubs in March to July. Because project activities would occur July–September, direct loss of individuals is unlikely to occur. However, indirect impacts on elderberry shrubs could affect habitat quality and larvae that may be present in the shrubs. Depending on the number of shrubs occupied by VELB that are affected, this could have a substantial adverse effect on the local population. Therefore, this potential impact from indirect effects on elderberry shrubs would be potentially significant. The following mitigation measure has been identified to address this impact:

Mitigation Measure BIO-3: Minimize Effects to Valley Elderberry Longhorn Beetle.

The City/Water Forum and its construction contractor(s) shall implement the following measures to avoid and minimize potential adverse effects on VELB during project implementation.

- Before project activities begin, worker Environmental Awareness Training shall be provided to inform agency staff and contractors of the need to avoid and minimize potential impacts on VELB and its host plant and the possible penalties for not complying with these requirements. The training shall include, at a minimum, species identification, habitat requirements, and required practices for their avoidance and protection. A designated enforcement lead shall be identified to employees and contractors to ensure that questions regarding avoidance and protection measures are addressed in a timely manner.
- All elderberry shrubs on or adjacent to work areas shall be temporarily fenced and designated as environmentally sensitive areas. These areas shall be avoided by all construction personnel. Fencing shall be placed at least 20 feet from the dripline of each shrub, unless otherwise approved by USFWS.
- Dirt roadways and disturbed areas within 100 feet of elderberry shrubs shall be watered at least twice a day to minimize dust emissions.

Timing: Before and during ground-disturbing activities.

Responsibility: City/Water Forum and Construction Contractor(s)

Implementing Mitigation Measure BIO-3 would reduce the potentially significant impact associated with project-related adverse effects to valley elderberry longhorn beetle to a less-than-significant level, because agency staff and contractors would receive training, and measures would be implemented to avoid and minimize potential disturbance of elderberry shrubs. This impact would be less than significant with mitigation incorporated.

Reptiles

Less-than-Significant Impact. Western pond turtle (*Emys marmorata*), a California species of special concern, is known to occur along the LAR and could be present on-site during project activities. Natural basking sites, such as partially submerged logs or rocks, vary in abundance along the river, including at the restoration sites. However, habitat on the restoration and borrow sites is unlikely to be used for nesting, due to unsuitable substrate conditions. Placing gravel in the river could reduce habitat suitability for western pond turtle but creating/enhancing floodplain and side channel habitat and placing in-stream woody material at restoration sites could improve habitat quality. If individual pond turtles are present on or adjacent to the restoration sites, they are likely to leave affected areas when project activities begin, and extensive areas of equally suitable habitat are present in immediately adjacent areas. Because project activities in a given year would be limited to a very small proportion of the overall project area and larger river corridor, the number of individuals potentially affected would be low and is unlikely to substantially affect the local population. Therefore, this impact would be less than significant.

Birds

Less-than-Significant Impact with Mitigation Incorporated. Eight special-status bird species—golden eagle (*Aquila chrysaetos*), bald eagle (*Haliaeetus leucocephalus*), western yellow-billed cuckoo (*Coccyzus americanus*), burrowing owl (*Athene cunicularia*), Swainson's hawk (*Buteo swainsoni*), white-tailed kite (*Elanus leucurus*), bank swallow (*Riparia riparia*), and purple martin (*Progne subis*)—have potential to occur on or adjacent to the restoration and/or borrow sites. Bald eagle, Swainson's hawk, and bank swallow are State-listed as threatened or endangered, and western yellow-billed cuckoo is Federally listed as threatened. The remaining species are California species of special concern. Because project activities in a given year would be limited to a very small proportion of the overall project area, and equally suitable habitat is relatively abundant in the project vicinity, any potential disruption of foraging activities would be very minor. Swainson's hawk, white-tailed kite, and bank swallow are known to nest on or near the restoration and borrow sites, but the sites support a relatively limited number of potential nest trees, and extensive areas of forest and woodland nesting habitat are present along the LAR. Bridges over the river and snags throughout the project area could provide suitable nest sites for purple martin, but this species is not known to nest along the river. Both eagle species nest in region but are unlikely to nest in the project area, and the project area is outside the current nesting range of western yellow-billed cuckoo. Suitable nesting habitat for burrowing owl and bank swallow may be present adjacent to restoration or borrow sites, but the sites themselves are unlikely to provide suitable burrow substrate for either species.

Project activities are anticipated to require limited tree removal where side-channels are created and the use of haul routes in the American River Parkway could require tree trimming to facilitate passage of large project vehicles and equipment. Tree removal is limited to areas where side-channels would be created and is not likely to result in the removal of large diameter trees, since these areas are subject to high-velocity flows during periods of flooding. If tree trimming is required, it would not reduce the overall amount of suitable nesting habitat available and is very unlikely to remove active nests of special-status birds. However, if active nests of special-status birds are present on or near the restoration or borrow sites, they could be disturbed by heavy equipment operation and construction personnel, potentially resulting in nest abandonment, reduced care of eggs or young, or premature fledging. Depending on the species and number of individuals that are affected, nest failure could have a substantial adverse effect on the local population. Therefore, this potential impact from failure of active nests of special-status birds would be potentially significant. The following mitigation measure has been identified to address this impact:

Mitigation Measure BIO-4: Minimize Effects on Special-status Species and Nesting Birds.

The City/Water Forum and its construction contractor(s) shall implement the following measures to avoid and minimize potential adverse effects on special-status species and nesting birds during project implementation:

- Before project activities begin, worker Environmental Awareness Training shall be provided to inform agency staff and contractors of the need to avoid and minimize potential impacts on special-status species and nesting birds and the possible penalties for not complying with these requirements. The training shall include, at a minimum, species identification, habitat requirements and required practices for their avoidance and protection. A designated enforcement lead shall be identified to employees and contractors to ensure that questions regarding avoidance and protection measures are addressed in a timely manner.

- If vegetation removal is required during the bird nesting season (February 1 through August 15), surveys for active bird nests shall be conducted by a qualified biologist in areas of suitable nesting vegetation designated for removal. A minimum of one survey shall be conducted no more than 7 days before vegetation removal occurs. If active nests are found, removal of vegetation in which the nests are located shall be delayed until a qualified biologist determines that the young have fledged or the nest site is otherwise no longer in use.

- Preconstruction surveys will be conducted by a certified arborist to identify the species of trees and any sensitive habitats (i.e., nesting, critical habitat designations, etc.), and an acceptable replacement ratio determined in coordination with CDFW.

- Preconstruction surveys for special-status plant species, including Sanford’s arrowhead, shall be conducted by a qualified biologist, and the City will coordinate with CDFW if the species is found within the project boundary subject to ground disturbance.

- Preconstruction surveys for special-status reptiles, including Western pond turtle, shall be conducted by a qualified biologist, and the City will coordinate with CDFW if the species is observed within the project boundary subject to ground disturbance. Preconstruction surveys for active nests of burrowing owl, Swainson's hawk, white-tailed kite, bank swallow, purple martin, and colonial nesting herons and egrets shall be conducted by a qualified biologist in all areas of suitable nesting habitat that could be disturbed by project activities. A minimum of two surveys shall be conducted within 14 days before project activities begin, including at least one survey no more than 7 days before activities begin.

- Appropriate buffers shall be established and maintained around active nest sites to avoid nest failure from project activities. The appropriate size and shape of the buffers shall be determined by a qualified biologist and may vary depending on the nest location, nest stage, construction activity, and existing disturbance levels. The buffers may be adjusted if a qualified biologist determines it would not be likely to adversely affect the nest. Monitoring shall be conducted to confirm that project activities are not resulting in detectable adverse effects on nesting birds or their young. No project activities shall occur within the buffer areas until a qualified biologist determines that the young have fledged or the nest site is otherwise no longer in use.

Timing: Before and during ground-disturbing activities.

Responsibility: City/Water Forum and Construction Contractor(s)

Implementing Mitigation Measure BIO-4 would reduce the potentially significant impact associated with project-related failure of active nests of special-status birds to a less-than-significant level, because agency staff and contractors would receive training and buffers would be implemented around active nests to minimize potential for nest failure. This impact would be less than significant with mitigation incorporated.

Mammals

Less-than-Significant Impact. Pallid bats (*Antrozous pallidus*) could forage over the restoration and borrow sites, but foraging activities are unlikely to be disturbed by construction activities. Forest and woodland habitat adjacent to the restoration and borrow sites and in bridges over the river may provide marginally suitable roost sites. However, these areas are not expected to support maternity roosts or other large numbers of roosting individuals, because pallid bats are very sensitive to disturbance of roost sites and may avoid existing disturbance from recreational use and adjacent residential areas. Because project activities would not remove roosting habitat, potential impacts are anticipated to be limited to disturbance of temporary roost sites for small numbers of individuals. American badger (*Taxidea taxus*) has low potential to occur in grassland and open woodland adjacent to the borrow sites. Although an individual was recently documented near Folsom Dam (CDFW 2019), this species typically avoids heavily populated areas and is unlikely to occur regularly along the LAR. Because project activities in a given year would be limited to a very small proportion of the overall project area, and badgers are unlikely to occur throughout most of the project area, the number of individuals potentially affected would be very low. Because very few, if any, pallid bats and American badgers would be impacted by project implementation, their populations would not be substantially adversely affected, and these potential impacts would be less than significant.

b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?

Riparian Habitat and Sensitive Natural Communities

Less-than-Significant Impact. The restoration sites support willow scrub and mixed riparian forest, and on-site valley oak woodland and riparian habitats are considered communities of special concern by CDFW. Selective removal of individual trees may be required to construct side-channels, but a very small number of trees would be removed (i.e., up to 20). The use of haul routes in the American River Parkway could require tree trimming to facilitate passage of large project vehicles and equipment. However, potential impacts of such selective removal and trimming are anticipated to be minor. In addition, a Certified Arborist would be consulted regarding appropriate trimming techniques. These minor impacts on riparian habitat and sensitive natural communities would not have a substantial adverse effect. Therefore, this impact would be less than significant.

Critical Habitat and Essential Fish Habitat

Less-than-Significant Impact. The proposed project is designed to improve conditions for anadromous salmonids in the LAR, and monitoring has indicated that past gravel placement has created new spawning habitat for salmonids. Therefore, although project activities would temporarily disturb designated critical habitat for Central Valley steelhead and EFH for Chinook salmon, the overall result would be beneficial, and critical habitat would not be adversely affected. In addition, although project activities have potential to indirectly affect individual elderberry shrubs on or adjacent to the restoration and borrow sites, they would not result in substantial adverse effects to the two areas of designated critical habitat for VELB. Therefore, these impacts would be less than significant.

c) Have a substantial adverse effect on State or Federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?

Less-than-Significant Impact with Mitigation Incorporated. The LAR is a water of the United States subject to regulation under CWA Sections 404 and 401 and FGC Section 1602. Implementing the proposed project would result in direct modification and placement of fill within the jurisdictional river channel but would not result in the loss of channel capacity. However, project activities could temporarily degrade water quality in the river. Seasonal wetlands are known to occur at the borrow sites and could be directly modified, if borrow material is removed from tailings that support wetlands. Degradation of river water quality and loss of seasonal wetlands that are considered sensitive aquatic sites could have a substantial adverse effect on State and Federally protected wetlands. Therefore, this impact would be potentially significant. The following mitigation measure has been identified to address this impact:

> **Mitigation Measure GEO-1: Prepare and Implement a Storm Water Pollution Prevention Plan and Best Management Practices.**
>
> Please refer to Mitigation Measure GEO-1 in Section 1.7, "Geology and Soils," for the full text of this mitigation measure.
>
> **Mitigation Measure BIO-2: Avoid and Minimize Impacts on Waters of the United States and Water of the State.**
>
> Please refer to Mitigation Measure BIO-2 above for the full text of this mitigation measure.

Implementing Mitigation Measures GEO-1 and BIO-2 would reduce the potentially significant impact associated with fill and modification of waters of the United States and waters of the State to a less-than-significant level because a SWPPP would be implemented, when required, to protect water quality, impacts to seasonal wetlands would be avoided to the extent feasible, and biological monitoring would be conducted. This impact would be less than significant with mitigation incorporated.

d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?

Fish and Wildlife Movement and Migration

Less-than-Significant Impact. The restoration and borrow sites are part of a much larger contiguous extent of woodland and riparian habitats along the LAR. The river system serves as a corridor and/or primary route for fish and wildlife migration movement. Project activities would not substantially interfere with the movement of native wildlife because activities would be limited to a very small proportion of the overall project area and larger river corridor in a given year, would occur over a relatively brief period of time each year, and would not completely impede upstream or downstream wildlife movement. The in-water construction work window is timed specifically to avoid all periods of migration for anadromous salmonids. Therefore, potential impacts on fish and wildlife movement and migration would be less than significant.

Nursery Sites

Less-than-Significant Impact with Mitigation Incorporated. The in-river construction work window would avoid the risk to spawning salmonid adults, incubating eggs and pre-emergent fry. However, significant impacts on rearing juvenile salmonids and spawning and rearing of other native fish could occur (as described above under item a). The LAR serves as a nursery site for colonial-nesting bird species. In addition to the potential for bank swallow and purple martin nest colonies in the project area (as described above), three great blue heron (*Ardea herodias*) and great egret (*Ardea alba*) nest colonies are known to occur near the restoration /borrow sites. If nest colonies on or near the restoration or borrow sites are active during project implementation, they could be disturbed by heavy equipment operation and construction personnel, potentially resulting in nest abandonment, reduced care of eggs or young, or premature fledging. Because such colony sites are typically used for many years, nest failure and potential long-term colony abandonment could have a substantial adverse effect on the local nesting populations. Potential impacts on rearing juvenile salmonids, spawning and rearing of other native fish, and active heron/egret nest colonies would be potentially significant. The following mitigation measures have been identified to address this impact:

> **Mitigation Measure GEO-1: Prepare and Implement a Storm Water Pollution Prevention Plan and Best Management Practices.**
>
> Please refer to Mitigation Measure GEO-1 in Section 1.7, "Geology and Soils," for the full text of this mitigation measure.
>
> **Mitigation Measure BIO-1: Minimize Injury and Mortality of Special-status Fish Species.**
>
> Please refer to Mitigation Measure BIO-1 above for the full text of this mitigation measure.
>
> **Mitigation Measure BIO-4: Minimize Effects on Special-status and Other Nesting Birds.**
>
> Please refer to Mitigation Measure BIO-4 above for the full text of this mitigation measure.

Implementing Mitigation Measures GEO-1, BIO-1, and BIO-4 would reduce the potentially significant impact associated with direct and indirect effects on rearing juvenile fish and colonial nesting birds to a less-than-significant level, because a SWPPP would be implemented, when required, to protect water quality, measures would be implemented to minimize turbidity during in-water activities and project-related injury or mortality of juvenile fish, and buffers would be implemented around active nest colonies to minimize potential for nest failure. This impact would be less than significant with mitigation incorporated.

e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?

No Impact. The restoration and borrow sites are located within the area addressed by the *American River Parkway Plan* (Parkway Plan) (Sacramento County 2008). The Parkway Plan identifies policies and standards for projects within the plan area. The proposed project supports goals to preserve and protect anadromous and resident fishes and meets policies and standards defined in the Parkway Plan. Specifically, it is consistent with the Aquatic Communities Policy 3.7 to preserve, protect, and/or restore riparian and in-channel habitat necessary for spawning and rearing of fish species. Sacramento County policies and ordinances (i.e., Sacramento County General Plan and the Sacramento County Tree Preservation and Protection Ordinance) protect native oak trees. However, the project would not require removal of protected native oak trees. Therefore, the proposed project would have no impact related to potential conflict with local policies or ordinances protecting biological resources.

f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or State habitat conservation plan?

No Impact. The restoration and borrow sites are not within an area covered by an adopted Habitat Conservation Plan or Natural Community Conservation Plan. Actions and goals of the proposed project are consistent with those identified in the NMFS Recovery Plan for Central Valley Steelhead and Spring-run Chinook Salmon. Additionally, the proposed project is designed to meet objectives of the Central Valley Project Improvement Act (CVPIA) to mitigate effects of the Central Valley Project (CVP) on native fishes. Therefore, the proposed project would have no impact related to potential conflict with any adopted conservation plan.

1.5 Cultural Resources

Environmental Issue	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Beneficial Impact
I. CULTURAL RESOURCES.					
Would the project:					
a) Cause a substantial adverse change in the significance of a historical resource pursuant to California Code of Regulations (CCR) Section 15064.5?	☐	☐	☐	☒	☐
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to CCR Section 15064.5?	☐	☐	☐	☒	☐
c) Disturb any human remains, including remains interred outside of dedicated cemeteries?	☐	☐	☐	☒	☐

1.5.1 Environmental Setting

Archaeologically, the prehistory of the project area can be divided into three broad periods. The first of these is the Paleo-Indian Period which spanned from 10,000 to 6,000 BC. Few sites dating to this period have been identified in the Sacramento Valley, but it is assumed the lack of finds is due to rapid sedimentation burying older sites. There is likewise little evidence for the Lower Archaic Period (6,000 to 3,000 BC). The Middle Archaic Period (3,000 to 1,000 BC) is much better represented. The Middle Archaic is thought to have seen a shift from foraging subsistence strategies focusing on high-energy return resources to a more diversified strategy where more, though lower quality, resources were gathered. The following Upper Archaic Period (1,000 BC to AD 500) saw increased social complexity as well as more developed and formalized exchange systems between groups and regions. The Emergent Period (AD 500 to 1,800) saw continued technological and social changes including the introduction of the bow and arrow, monetized clamshell disk beads, and increased social stratification.

Sacramento County was created in 1850 when California became a state. As early as 1839, Captain John A. Sutter arrived in the Central Valley and established the settlement of New Helvetia, later known as Sacramento, near the confluence of the American and Sacramento Rivers. After the Gold Rush of 1848, the City of Sacramento was chosen as the County seat. The City of Sacramento was incorporated in 1849 and served as an important gateway to California's gold fields during the Gold Rush years. The Central Pacific Railroad of California was formed in 1861 and had a tremendous impact on Sacramento as it enabled easier transport of materials and goods. Sacramento grew and prospered throughout the 19^{th} and 20th centuries. By 2010, Sacramento encompassed more than 92 square miles and had more than 466,000 residents (McGowan and Willis 1968: 59; U.S. Census Bureau 2017).

Mining along the American River dates back to the mid-1800s. During the Gold Rush, mining camps sprang up along the American River extending from the Sacramento Valley to the Sierra Foothills. Initially, mining was done on a small scale by individuals willing to work their claims with limited resources. In later years, large-scale mining operators who had the means to construct the vast water-conveyance systems necessary to dredge-mine effectively entered the region. The Natoma Water &

Mining Company created a vast ditch system in the area as early as 1853. By the late nineteenth century, dredge mining became the preferred method of mining in the region. Several dredge-mining companies functioned along the American River over the years. The Colorado-Pacific Gold Dredging Company, Ashburton Mining Company, American River Water and Mining Company, Natoma Water & Mining Company, and Capital Dredge Company established and operated mining operations in the project area for decades leaving behind miles of dredge tailings and associated refuse deposits along the river. In recent years, much of the dredged area has been removed through rock crushing and reclamation for development and agricultural purposes (EDAW 2009: 7, 24, 27). The proposed action is situated on modern sediments and sand bars within and adjacent to the American River.

1.5.2 Discussion

Reclamation conducted a cultural resources investigation in 2015 of the western portion of the project area (Reclamation 2015). The Reclamation investigation included a records search and a reconnaissance-level pedestrian survey; a reconnaissance-level survey was determined to be sufficient for Reclamation because of the project context, i.e., situated in the American River as well as on modern sediments and sand bars. The records search, conducted at the North Central Information Center (NCIC) of the California Historical Resources Information System, identified two resources on the project site. The two resources included P-34-000509 (the American River Levee) and P-34-000335 (CA-308H, Capital Dredge Company Diggings). Reclamation found that P-34-000509 was mis-plotted by the NCIC and does not lie on the project site. Likewise, even though plotted within Reclamation's study area, there was no evidence of P-34-000335 on the project site.

EDAW conducted a cultural resources investigation of the eastern portion of the project site in 2009 (EDAW 2009). The investigation included a records search conducted at the NCIC as well as a cultural resources pedestrian survey. The pedestrian survey of the eastern portion of the project site identified historic-era dredge tailings and other features at Sailor Bar and Mississippi Bar associated with resource P-34-000335; both were found eligible for listing in the CRHR and the National Register of Historic Places (NRHP). The project proposed at the time would not have caused any impacts to Mississippi Bar and a finding of no historical resources impacted was recommended. Sailor Bar could not be avoided and subsequently mitigation was proposed consisting of interpretive material in the form of exhibits to be placed at Sailor Bar (SHPO 2010).

a) Cause a substantial adverse change in the significance of a historical resource pursuant to in California Code of Regulations Section 15064.5?

No Impact. Both the Sailor Bar dredge tailings and Mississippi Bar dredge tailings have been determined eligible for listing in the NRHP as contributors to P-34-000335 (a historic mining district). In 2009, the State Historic Preservation Officer (SHPO) determined that other ongoing rock crushing and quarrying activities at Mississippi Bar had affected the integrity of the tailings at the site and therefore proposed gravel extraction and processing activities at Mississippi Bar would have no adverse effect to the contributing elements of the mining site (P-34-000335) (SHPO 2009). Based on analysis of the previous determination, the Mississippi Bar site has lost integrity and is no longer considered an historical resource for the purposes of NEPA and CEQA. There would be no impact.

In 2010, a Memorandum of Agreement (MOA) was executed between Reclamation and SHPO to resolve any adverse effects to Sailor Bar. The mitigation outlined in the MOA was concurred with by SHPO in 2012 (SHPO 2010; Reclamation 2015). Because SHPO determined Mississippi Bar dredge tailings have lost integrity and because consultation resulted in mitigation of impacts to Sailor Bar, there would be no impact.

b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to California Code of Regulations Section 15064.5?

No Impact. The proposed restoration areas have been previously adequately surveyed for the presence of cultural resources. The restoration areas comprise portions of the American River and modern sediments and sand bars. Because of the recently deposited material and dynamic environment along the river, these areas have extremely low archaeological sensitivity for prehistoric resources. Further, aerial photography of these two restoration sites do not show any features that might be associated with historic-era resources such as tailings piles.

No archaeological resources have been identified on the project site. Further, given the physical context of the site, modern sand bars and sediment in the river, archaeological sensitivity is extremely low. Therefore, there would be no impact.

c) Disturb any human remains, including remains interred outside of dedicated cemeteries?

No Impact. No burials including remains interred out of formal cemeteries were identified on the project site. The project site is situated in modern sediments, sand bars, and portions of the American River giving the area very low potential for human remains. Therefore, there would be no impact.

1.6 Energy

Environmental Issue	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Beneficial Impact
ENERGY.					
Would the project:					
a) Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?	☐	☐	☒	☐	☐
b) Conflict with or obstruct a State or local plan for renewable energy or energy efficiency?	☐	☐	☐	☒	☐

1.6.1 Discussion

a) Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?

Less-than-Significant Impact. The project would consume energy during the construction phase, largely due to the annual movement of up to 30,000 tons of gravel that would be washed, transported, and placed in the river, and to a lesser extent due to side channel excavation and in-stream habitat structure placement. However, most of this energy use would be through operation of construction equipment and vehicles rather than electric use and the need to operate the equipment is in support of Reclamation's environmental commitments regarding salmonid habitat restoration as required under the CVPIA. Equipment and vehicle use would occur as specified in Table 2-2 in Section 2, "Alternatives Including the Proposed Action," which is typical of similar earthmoving projects and would not be wasteful or inefficient. Once constructed, no operations and maintenance activities are proposed. Implementing the project would result in negligible use of electrical or natural gas energy, and impacts would be less than significant.

b) Conflict with or obstruct a State or local plan for renewable energy or energy efficiency?

No Impact. The proposed project would change flow dynamics of discrete reaches of the LAR and create and enhance spawning and rearing habitat for fall-run Chinook salmon and steelhead trout in the river. Because implementing the project would not result in any developed land uses that could conflict with State or local plans for renewable energy or efficiency, there would be no impact.

1.7 Geology and Soils

Environmental Issue	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Beneficial Impact
GEOLOGY AND SOILS.					
Would the project:					
a) Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:	☐	☐	☐	☒	☐
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? (Refer to California Geological Survey Special Publication 42.)	☐	☐	☐	☒	☐
ii) Strong seismic ground shaking?	☐	☐	☐	☒	☐
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☐	☒	☐
iv) Landslides?	☐	☐	☐	☒	☐
b) Result in substantial soil erosion or the loss of topsoil?	☐	☒	☐	☐	☐
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	☐	☐	☐	☒	☐
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994, as updated),), creating substantial direct or indirect risks to life or property?	☐	☐	☐	☒	☐
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☐	☒	☐
f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☒	☐	☐	☐

1.7.1 Environmental Setting

Geology

The project area lies within the Sacramento Valley, which is part of the Great Valley Geomorphic Province. In the project area, Holocene (i.e., 11,700 years B.P. [Present Day]) and Pleistocene (1.8 million–11,700 years B.P.]) alluvial deposits lie atop the thick sequence of sedimentary rock units that form the deeply buried bedrock units in the mid-basin areas of the valley. The youngest geomorphic features in the project area are low floodplains, which are found primarily along the Sacramento and American Rivers. These major drainage ways were originally confined within broad natural levees sloping away from the rivers or streams. The natural levees formed through the deposition of coarser materials that settled out of suspension nearest the rivers and streams, forming the natural levees and sand bars in the vicinity of the river channel. The finer material was carried in suspension farther from the rivers or streams and settled out in quiet water areas such as swales, abandoned meander channels, and lakes. However, because the streams have meandered and reworked the previously deposited sediments, extreme variations in material types may be found over a limited distance or depth.

As described in the 2008 EA, and incorporated by reference, within the Mississippi Bar and Sailor Bar borrow areas, the sites have been highly disturbed as a consequence of historic gold mining operations. A large portion of the project area outside of the borrow areas, extending as far downstream as the El Manto site, has been altered by mining activities. In these areas, dredger tailings are prevalent, and in some areas, they have been partially, or largely, removed to provide gravel for construction projects. Where gravel remains, it is poorly graded with sand, cobble, and boulders in upper portion of the dredge piles. Where gravel has been mined, silty sand or silty sand with gravel is present at the surface, which in turn lies atop sandy materials and a basal layer of fines deposited over bedrock or undredged deposits. In between windrows of dredge materials occasionally are parallel rows of slickens deposits, which are fined-grained materials (silts or clays) that settled out of standing water during the dredging process. Past gravel mining and associated excavation activities have created large deep areas within the riverbed at approximately RM 12-14. Modeling shows that this area catches sediment as it moves downstream (see discussion in Section 1.10, “Hydrology and Water Quality,” and Appendices D and E to the Environmental Assessment).

The local bedrock is the Mehrten Formation which is usually well indurated and slightly to well cemented silty sands or mud-stones. In some locations in the project area, the Mehrten Formation is exposed along the river bank (Sherer 2008). The main channel of the LAR and side channel areas are primarily gravel bars with some boulders and outcropping of the Mehrten Formation.

Seismicity and Other Hazards

The Sacramento Valley has experienced relatively low seismic activity in the past and does not contain any Alquist-Priolo Earthquake Fault Zones (California Geological Survey [CGS] 2019). Numerous earthquakes of magnitude (M) 5.0 or greater have occurred on regional faults in the Coast Ranges, approximately 38–55 miles west of downtown Sacramento. The nearest known active (Holocene or Historic) fault trace to the project area is the Dunnigan Hills fault, approximately 30 miles northwest of project site (Jennings and Bryant 2010).

According to the California Geological Survey, the project area is not mapped in an area where strong seismic ground shaking, liquefaction, landslides, or seiche are likely to occur (CGS 2019).

1.7.2 Discussion

a) Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:

i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist

for the area or based on other substantial evidence of a known fault? (Refer to California Geological Survey Special Publication 42.)

ii) Strong seismic ground shaking?

iii) Seismic-related ground failure, including liquefaction?

iv) Landslides?

No Impact. Because there are no active faults mapped in the project area by the CGS or the U.S. Geological Survey, and the area is not located within an Alquist-Priolo Earthquake Fault Zone, fault ground rupture and strong seismic ground shaking are unlikely. Additionally, as stated in the Environmental Setting, this area has not been mapped as a location where liquefaction, landslides, or other geologic hazards are likely to occur. Subsidence and settlement resulting from construction of the proposed project is unlikely since the project only involves borrowing and placing gravel, excavating side channels, and creating in-stream habitat, and does not involve constructing any buildings or other structures that could contribute to, or be subject to, settlement or subsidence. Finally, a seismic seiche (an earthquake-induced wave within an enclosed or restricted body of water) in the project area is unlikely given the low probability of strong seismic ground-shaking. Therefore, there would be no impact.

b) Result in substantial soil erosion or the loss of topsoil?

Less-than-Significant Impact with Mitigation Incorporated. Gravel placement, side channel excavation, and habitat structure placement would take place within the river and would thus not impact surface soil erosion or contribute to loss of topsoil. Gravel borrow and processing would occur in areas previously used for and disturbed by gravel borrow and past gold mining activities and all work would be conducted during the dry season. However, construction could result in the temporary and short-term disturbance of soil and could expose disturbed areas if a storm event were to occur during project implementation. Rainfall of sufficient intensity could dislodge soil particles from the soil surface. Once particles are dislodged and the storm is large enough to generate runoff, substantial localized erosion could occur. In addition, soil disturbance during summer could result in substantial loss of topsoil because of wind erosion. Therefore, these proposed project elements would have a potentially significant effect. The following mitigation measures have been identified to address this impact:

Mitigation Measure GEO-1: Prepare and Implement a Storm Water Pollution Prevention Plan and Associated Best Management Practices.

Pollution Prevention Plan and Associated Best Management Practices.

When required, the City/Water Forum shall prepare and implement the appropriate Stormwater Pollution Prevention Plan (SWPPP), or Stormwater Management Plan (SWMP), as needed, to prevent and control pollution and to minimize and control runoff and erosion in compliance with state and local laws. The SWPPP or SWMP shall identify the activities that may cause pollutant discharge (including sediment) during storms or strong wind events, techniques to control pollutant discharge, and an erosion control plan. Regardless of the need for a SWPPP or SWMP, construction techniques and BMPs will be identified and implemented, as appropriate to reduce the potential for runoff, exposure to hazardous materials, and manage turbidity. Construction techniques will include minimizing site disturbance, controlling water flow over the construction site, stabilizing bare soil, and ensuring proper site cleanup.

BMPs that specify erosion and sedimentation control measures to be implemented, may include silt fences, staked straw bales/wattles, silt/sediment basins and traps, geofabric, trench plugs, terraces, water bars, soil stabilizers re-seeding with native species and mulching to revegetate disturbed areas. If suitable vegetation cannot reasonably be expected to become established, non-erodible material will be used for such stabilization.

If required, the SWPPP or SWMP shall also include a spill prevention, control, and countermeasure plan, and applicable hazardous materials business plans, and shall identify the types of materials used for equipment operation (including fuel and hydraulic fluids), and measures to prevent and materials available to clean up hazardous material and waste spills. The SWPPP or SWMP shall also identify emergency procedures for responding to spills. The SWPPP shall also include dust control practices to prevent wind erosion, sediment tracking, and dust generation by construction equipment, including during gravel processing.

The BMPs presented in either document shall be clearly identified and maintained in good working condition throughout the construction process. The construction contractor shall retain a copy of the approved SWPPP or SWMP on the construction site and modify it as necessary to suit specific site conditions through amendments approved by the Central Valley RWQCB, if necessary.

The City and all contractors will abide by regulations governing hazardous materials transport are included in CCR Title 22, the California Vehicle Code (CCR Title 13), and the State Fire Marshal Regulations (CCR Title 19). Transport of hazardous materials can only be conducted under a registration issued by the California Department of Toxic Substances Control. Construction contractors would be required to use, store, and transport hazardous materials in compliance with federal, state, and local regulations during project construction.

Timing: Before and during construction.

Responsibility: City/Water Forum and Construction Contractor(s).

Implementing Mitigation Measure GEO-1 would reduce the potentially significant impact from construction-related erosion to a less-than-significant level because a SWPPP or SWMP would be prepared and implemented, when required, consistent with permit requirements that would prevent and control pollution and minimize and control runoff and erosion. This impact would be less than significant with mitigation incorporated.

c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?

No Impact. See response to Question a above.

d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994, as updated), creating substantial direct or indirect risks to life or property?

No Impact. Soils in the proposed project area are comprised of riverwash or dredge tailings and the remainder of the project area is within the wetted river channel (classified as "water" by the Natural Resources Conservation Service). Soils are deep and well-drained, low or completely lacking in clay content, and thus are not considered expansive (U.S. Department of Agriculture 2019). Therefore, there would be no risk to life or property due to expansive soils.

e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?

No Impact. Because the project would not involve the use of wastewater disposal systems of any kind, there would be no impact related to the ability of project area soils to support the use of septic systems.

f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

Less-than-Significant with Mitigation Incorporated. The project site lies in Quaternary-period stream channel and alluvial fan deposits from the Holocene epoch (CGS 1965). These recent sedimentary deposits are not known to be paleontologically-sensitive. Igneous rock formations generally are not paleontologically sensitive, with the notable exception of the Mehrten Formation (which is known to contain vertebrate fossils and is paleontologically sensitive) and is known to be exposed along banks within the project area (Sherer 2008). No unique geologic features occur in the project area (CGS 1965).

As analyzed in the 2008 EA, and incorporated by reference, gravel would be extracted in the borrow areas from above ground dredger tailings, and no below-ground excavation would take place. Spawning gravel placement, as well as side channel enhancement and habitat structure placement, would involve some redistribution of gravel within the LAR and shallow excavation along the LAR bank and existing gravel bars within the restoration reaches. These areas are subject to past and present erosion and periodic shifts during high-water events and the underlying stream channel and alluvial fan deposits and do not represent fossil-bearing geologic formations. The side channels would be excavated to 1.0 to 2.5 feet in depth in areas that are part of the historical meander belt, and these excavations could encounter outcroppings of the Mehrten Formation, potentially causing incidental damage to a paleontological resource. This would be a potentially significant impact.

Mitigation Measure GEO-2: Conduct Construction Personnel Education, Stop Work if Paleontological Resources are Discovered, Assess the Significance of the Find, and Prepare and Implement a Recovery Plan, as Required.

To minimize the potential for destruction of or damage to potentially unique, scientifically important paleontological resources during project-related earthmoving activities, the City/Water Forum shall require the measures listed below to be implemented to minimize accidental damage to or destruction of unique paleontological resources.

- Before the start of any earthmoving activities, all construction personnel involved with earthmoving activities, including the site superintendent, will be trained regarding the possibility of encountering fossils, the appearance and types of fossils likely to be seen during construction, and proper notification procedures should fossils be encountered.

- If paleontological resources are discovered during earthmoving activities, the construction crew shall notify the City/Water Forum and shall immediately cease work in the vicinity of the find. The City/Water Forum shall retain a qualified paleontologist to evaluate the resource and prepare a recovery plan in accordance with applicable guidelines (Society of Vertebrate Paleontology 1996). The recovery plan may include, but is not limited to, a field survey, construction monitoring, sampling and data recovery procedures, museum storage coordination for any specimen recovered, and a report of findings. Recommendations in the recovery plan that are determined by the Water Forum to be necessary and feasible shall be implemented before construction activities can resume at the site where the paleontological resources were discovered.

Significance after Mitigation: Implementing this mitigation measure would reduce potentially significant effects related to the inadvertent damage or destruction of unique paleontological resources to a **less-than-significant** level because construction workers would be alerted to the possibility of encountering paleontological resources and, in the event that resources were discovered, work would stop immediately and fossil specimens would be recovered and recorded and would undergo appropriate curation.

Timing:	During construction.
Responsibility:	City/Water Forum and Construction Contractor(s).

1.8 Greenhouse Gas Emissions

Environmental Issue	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Beneficial Impact
II. GREENHOUSE GAS EMISSIONS.					
Would the project:					
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☐	☒	☐	☐
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☒	☐	☐

1.8.1 Environmental Setting

Sacramento County's Climate Action Plan (Sacramento County 2011) does not include any actions or strategies relevant to implementing the project beyond those already required by other laws (i.e., diversion of construction and demolition waste).

1.8.2 Discussion

a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?

Less-than-Significant Impact. Implementing the proposed project would generate temporary construction-related greenhouse gas (GHG) emissions that would cease following construction of the proposed project. Construction emissions would be generated by vehicle engine exhaust from heavy-duty construction equipment, haul trips, and construction worker trips. Construction would be temporary and short-term and is expected to occur over the course of approximately 19 months. Construction-related GHG emissions were modeled using CalEEMod (see Appendix F, "Air Quality Modeling Results"). Modeling results show that the proposed project's total construction-related GHG emissions would be 279 metric tons in the maximum modeled year.

SMAQMD has adopted a CEQA threshold of 1,100 metric tons of carbon dioxide equivalent (CO_2e) per year for construction-related GHG emissions related to land development and construction, and stationary source construction and operation (SMAQMD 2015).

Because the total annual construction emissions would not exceed SMAQMD's threshold of significance, the proposed project would not generate GHG emissions, either directly or indirectly, that would have a significant impact on the physical environment. Furthermore, measures to reduce GHG emissions, such as reducing heavy equipment and truck idling time, using properly sized equipment, maintaining equipment (wheel alignment and properly inflated tires), and improving operator training (provide training during tailgate safety meetings to minimize excessive fuel consumption), have been incorporated into project construction. Therefore, this impact would be less than significant.

b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?

Less-than-Significant Impact. The proposed project would not conflict with plans, policies, or regulations prepared or established to reduce GHG emissions. The proposed project's incremental contribution to the cumulative impact of increasing atmospheric levels of GHGs would be less than cumulatively considerable. The impact would be less than significant.

1.9 Hazards and Hazardous Materials

Environmental Issue	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Beneficial Impact
HAZARDS AND HAZARDOUS MATERIALS.					
Would the project:					
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☒	☐	☐	☐
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☒	☐	☐	☐
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	☒	☐
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☒	☐
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard or excessive noise for people residing or working in the project area?	☐	☐	☐	☒	☐
f) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☒	☐
g) Expose people or structures, either directly or indirectly, to a significant risk of loss, injury, or death involving wildland fires?	☐	☐	☒	☐	☐

1.9.1 Environmental Setting

Known Hazardous Materials Sites

Table 1.9-1 presents database search results for the project vicinity and includes all data sources in the Cortese List (enumerated in PRC Section 65962.5). These sources include the GeoTracker database, a groundwater information management system that is maintained by the State Water Resources Control Board (SWRCB); the Hazardous Waste and Substances Site List (i.e., the EnviroStor database), maintained by the California Department of Toxic Substances Control (DTSC); and EPA's Superfund Site database. Two sites were identified within 0.25 mile of the project site:

Table 1.9-1 Cortese-Listed Sites

Site Name, Address, Description, Number	Contaminants	Media Affected	Status/Cleanup Actions
American River Fish Hatchery 2101 Nimbus Road Sacramento, CA 95670 SWRCB: T0606701086	Diesel	Soil	Cleanup completed, case closed as of 3/3/2005. Prior soil contamination from LUST.
Fair Oaks Wrecking 11350 Bridge Street Rancho Cordova, CA SWRCB: T0606700623	Gasoline	Soil	Cleanup completed, case closed as of 1/2/1997. Prior soil contamination from LUST.

Notes: SWRCB = State Water Resources Control Board; LUST = Leaking Underground Storage Tank
[1]Includes listings within 0.25 mile of project activity areas.
Sources: DTSC 2019 and SWRCB 2019

Schools

There are no schools within 0.25 mile of the borrow sites or any of the restoration sites. The Sacramento Waldorf School is located approximately 0.8 mile north of the El Manto restoration site.

1.9.2 Discussion

a, b) Create a significant hazard to the public or the environment through: the routine transport, use, or disposal of hazardous materials or through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?

Less-than-Significant with Mitigation Incorporated. Project activities at borrow areas and restoration sites would involve the incidental transport and use of common materials used for the operation and maintenance of construction vehicles and equipment such as oils, lubricants, and fuel. However, the project would not involve routine or long-term transport or disposal of such materials. None of the proposed project activities would involve the use of acutely hazardous materials. Construction contractors would be required to use, store, and transport hazardous materials in compliance with Federal, State, and local regulations during project construction. Additionally, as described in Section 2, “Alternatives Including the Proposed Action,” all gravel placement, side channel excavation, and habitat structure placement would be conducted using river-friendly construction equipment. River-friendly equipment is pressure washed and uses food-grade vegetable oil in lieu of traditional hydraulic fluid for protection of water quality during in-river work. However, accidental spills could still occur and therefore the project would have a potentially significant impact. The following mitigation measure has been identified to address this impact:

> **Mitigation Measure GEO-1: Prepare and Implement a Storm Water Pollution Prevention Plan and Best Management Practices.**
>
> Please refer to Mitigation Measure GEO-1 in Section 1.7, “Geology and Soils,” for the full text of this mitigation measure.

Implementing Mitigation Measure GEO-1 would reduce the potentially significant impact from accidental spill of or exposure to hazardous materials during routine use, transport, or disposal to a less-than-significant level because a SWPPP would be prepared and implemented, when required. The

SWPPP would include a spill prevention, control, and countermeasure plan, and would identify the types of materials used for equipment operation (including fuel and hydraulic fluids), along with measures to prevent and materials available to clean up hazardous material and waste spills. The SWPPP would also identify emergency procedures for responding to spills. This impact would be less than significant with mitigation incorporated.

c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?

No Impact. There are no schools within 0.25 mile of any of borrow or restoration sites. Therefore, there would be no impact.

d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?

No Impact. Based on search results of sites compiled pursuant to Government Code Section 65962.5, there are two hazardous sites located near the project area (within 0.25 mile); however, both sites have been remediated and the cases closed with SWRCB. Additionally, neither of these sites is located directly within borrow areas or restoration sites. Thus, there would be no impact.

e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard or excessive noise for people residing or working in the project area?

No Impact. The project site is not within the jurisdiction of an airport land use plan, or within 2 miles of any airport. There would be no impact.

f) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?

No Impact. Construction of the proposed project would result in short-term construction activities within the borrow areas and at a maximum of three restoration sites within a construction season and will not require closure or reduced access on any adjacent roads that would interfere with an adopted emergency response plan or evacuation plan. Additionally, none of the roads in the project vicinity are listed as evacuation routes by the Sacramento County Office of Emergency Services (Sacramento County 2018). There would be no impact.

g) Expose people or structures, either directly or indirectly, to a significant risk of loss, injury, or death involving wildland fires?

Less-than-Significant Impact. CAL FIRE (2007, 2008) has determined that the areas where project activities would occur are not within a State responsibility area nor a very high fire hazard severity zone. The project would not include changes to the project site which would increase the risk of wildfire, and construction activities would not expose people or structures to a significant risk of loss, injury, or death involving wildland fires. Existing Sacramento County Parks Fire Fuel Reduction Action Plan activities along the Parkway would continue as would fuels and vegetation management in compliance with County Code (Sacramento County 2018). This impact would be less than significant.

1.10 Hydrology and Water Quality

Environmental Issue	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Beneficial Impact
HYDROLOGY AND WATER QUALITY.					
Would the project:					
a) Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality?	☐	☒	☐	☐	☐
b) Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?	☐	☐	☐	☒	☐
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:	☐	☐	☒	☐	☐
i) result in substantial erosion or siltation on- or off-site;	☐	☐	☒	☐	☐
ii) substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or offsite;	☐	☒	☐	☐	☐
iii) create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or	☐	☒	☐	☐	☐
iv) impede or redirect flood flows?	☐	☐	☒	☐	☐
d) In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?	☐	☐	☒	☐	☐
e) Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?	☐	☐	☐	☒	☐

1.10.1 Environmental Setting

Surface Water

The project site is immediately adjacent to, and within, the LAR. Within Sacramento County, the American River is impounded at Folsom Dam and Nimbus Dam. Folsom Dam, at RM 29.4, was completed in 1955. Releases from Folsom Dam are re-regulated approximately 7 miles downstream by Nimbus Dam (RM 23). Both dams are part of the Federal CVP. Releases from Nimbus Dam to the LAR pass through the Nimbus Power plant, or, at flows in excess of 5,000 cubic feet per second (cfs), the spillway gates.

Water that is stored in upstream reservoirs (primarily Folsom Reservoir) during winter and spring is released in summer and fall for municipal and industrial supply, irrigation, water quality, power generation, recreation, and fish and wildlife purposes. Consequently, the flows in the LAR are generally lower in winter and spring and higher in summer and fall than they were prior to the building of the dams. The dams regulate LAR flows throughout the project site (excepting stormwater flows from the adjacent levee slopes and floodplain and small local drainages such as Carmichael Creek [near Ancil Hoffman Park]), downstream to its confluence with the Sacramento River. Local runoff in the project area flows by gravity overland during storm events, and also through culverts and vegetated or lined intermittent drainages.

Releases from Folsom and Nimbus Dams are operated under State water rights permit and fish protection requirements. SWRCB Decision D-893 in 1958 required minimum flows of 250 cfs from January through mid-September and 500 cfs between mid-September through December 31. The Water Forum, in cooperation with Reclamation, NMFS, USFWS, and CDFW, subsequently developed the Flow Management Standard (FMS) for the LAR. The FMS regulates flows in the LAR below Nimbus Dam, establishing Minimum Release Requirements from 800 to 2,000 cfs. The FMS also included the Lower American River Group to coordinate fishery and operational requirements. The FMS was included in the NMFS 2009 Biological Opinion on the Long-Term Operations of the Central Valley Project and State Water Project Reasonable and Prudent Alternative action. The proposed action would not affect the FMS or Minimum Release Requirements and is designed to meet the target fishery needs of the FMS.

Water Quality

The project site is in the Sacramento Hydrologic Basin Planning Area and the Lower American Hydrologic Subarea, as designated by the Central Valley RWQCB. In accordance with CWA Section 303, water quality standards for this basin are contained in the Water Quality Control Plan for the Sacramento River Basin and the San Joaquin River Basin (Basin Plan). Stormwater runoff from the project site is received by the American River which is listed on the 303(d) list as an impaired water for several constituents of concern, including fecal indicator bacteria, bifenthrin, pyrethroids, toxicity, mercury, and polychlorinated biphenyls (CVRWQCB 2016).

In 1991, the Sacramento Regional County Sanitation District, the County of Sacramento Department of Water Resources, and the City of Sacramento jointly established the Sacramento Coordinated Water Quality Monitoring Program (CMP) to conduct water quality monitoring in the Sacramento and American Rivers. The CMP has routinely monitored the LAR for heavy metals content and for compliance with conventional water-quality parameters. Monitoring has shown that water quality generally meets ambient water-quality criteria for aquatic life protection. Specifically, CMP data for the 1992–1995 monitoring period indicate a mean total suspended solids content of less than 1 milligrams per liter (mg/L), mean electrical conductivity of 52 micro Siemens per centimeter (µS/cm), and a $CaCO_3$ hardness of 25 mg/L (Sacramento County Water Agency 1995). Nevertheless, through its Resolution No. 98-055 (1998) and its CWA Section 303(d) efforts, SWRCB named the LAR as impaired because of group “A” pesticides, mercury, and unknown toxicity and assigned low, medium, and high priority rankings, respectively, for the development of corresponding total maximum daily load programs (CVRWQCB 2002).

Water temperature in the LAR is controlled by releases from Folsom and Nimbus Dams. On June 4, 2009, NMFS issued a biological opinion (BO) for listed anadromous fishes and their critical habitats governing the coordinated long-term operation of the CVP and State Water Project that included water temperature requirements from May 15 through October 31 for juvenile steelhead rearing.

Groundwater

The project site is in the Sacramento Valley Groundwater Basin and abuts the North and South American Subbasins; the LAR serves as the boundary between these two basins (DWR 2003). According to the Groundwater Information Center Interactive Map Application, both subbasins are designated as "High Priority" and groundwater levels in the project area are approximately 30-40 feet from ground surface (DWR 2018).

Flood Management

The majority of the project area is mapped as Zone AE on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map Zone. AE areas are designated as a Regulatory Floodway and are within the 100-year floodplain for the American River. The area near the Nimbus Hatchery is mapped as AO (flood depths 1-3 feet expected due to sheetflow) and the Mississippi Bar borrow site is not mapped in a flood zone (map panels 06067C0205H, 06067C0202H, 060670206H, 06067C0093H, 06067C0094H, 06067C0113H, and 06067C0114H) (FEMA 2019).

1.10.2 Discussion

a) Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality?

Less-than-Significant Impact with Mitigation Incorporated. Both direct and indirect discharges associated with ground-disturbing construction activities for the proposed project could cause surface or groundwater to become contaminated by soil or construction-related substances. The proposed activities include removing and processing gravel borrow, transporting material to restoration sites, earthmoving and placing gravel and woody material in-river, excavating side channels, and revegetating gravel borrow and channel-adjacent floodplain areas.

As described in Section 2, "Alternatives Including the Proposed Action," all side channel excavation areas would be isolated from the main channel during excavation and only after excavating and grading the side channel is complete, would the inlet/outlet of the side channel be opened to introduce flows. Bladder dams may also be used, where appropriate, to allow construction to take place isolated from the river. Gavel sorting and cleaning would occur at borrow sites and adjacent to restoration sites, where appropriately sized material is available, and consists of scooping gravel into a mobile incline screener to separate gravel of an unsuitable size and transport via conveyer where the gravel is shaken and washed, if needed, to dislodge small particles, then stockpiled. The conveyor would be located over a shallow sump to catch the wash water. The sump would be filled with excess gravel and restored to the original grade once borrow activities are complete.

As previously analyzed in the 2008 and 2016 EAs, and incorporated by reference herein, gravel placed in the river would be previously washed to minimize turbidity plumes, if needed. Some turbidity is expected and would be monitored in accordance with relevant requirements and permits. If turbidity levels exceed permit standards, work would be suspended until the standards are met. Consequently, instream work associated with in-river gravel and woody material placement could result in relatively small, short-term, turbidity plumes immediately downstream of the construction area. There would be no dewatering associated with project activities that would require a National Pollutant Discharge Elimination System "Groundwater from Construction and Project Dewatering [#CAG994004] permit.

Project activities could temporarily impair water quality should disturbed material, petroleum products, or construction-related wastes be discharged into the LAR, or onto the ground where they could be carried into receiving waters. Accidental spills of construction-related substances such as oils and fuels could also contaminate both surface water and groundwater. The extent of potential impacts on water quality would depend on several factors: the tendency toward erosion of soil types encountered, soil chemistry, construction practices, extent disturbed area, duration of construction activities, proximity to receiving water bodies, and sensitivity of those water bodies to construction-related contaminants.

During project implementation, bare soil would be exposed to wind and water erosion during excavation and material transport activities. If precautions are not taken to contain sediments, construction activities could produce sediment-laden storm runoff that would degrade water quality. Exposure of construction materials to rain or wind could also result in adverse water quality impacts. Construction activities would take place during the dry season, and span July-September. Regardless of construction timing, direct and indirect impacts to water quality from erosion and stormwater runoff, and ponding during storm events, have the possibility to occur and be potentially significant. The following mitigation measure has been identified to address this impact:

> **Mitigation Measure GEO-1: Prepare and Implement a Storm Water Pollution Prevention Plan and Best Management Practices.**
>
> Please refer to Mitigation Measure GEO-1 in Section 1.7, “Geology and Soils,” for the full text of this mitigation measure.

With incorporation of the project construction practices described above into the proposed project, and implementation of Mitigation Measure GEO-1, the potential for impacts to water quality following project construction would be less than significant.

Gold mining historically occurred upstream and adjacent to the LAR, and management of mercury could be a concern during project construction due to processing methods used during historic mining operations. To address this concern, in 2009, Reclamation conducted sediment characterization testing at several sample pits within the gravel source areas at Mississippi Bar and Sailor Bar. Some test pits did report levels of cadmium, copper, lead, nickel, and zinc over thresholds allowed under the California Toxics Rule and EPA aquatic life standards, but only one pit contained elevated levels of mercury and arsenic. One site at the east of Sailor Bar had high concentrations of all metals. However, the project geologist reported that this is likely due to the presence of Mehrten Formation material in this pit. Mehrten Formation gravels consist of mafic volcanics and as such would have a higher metal content than the surrounding granitic gravels. Additionally, all metals detected at the test pits were associated with fine materials and not the gravel-sized sediment that will be used for project activities (Reclamation 2009). Since all material that will be introduced to the river will be sorted and fines removed at the gravel processing site, there is no concern about introducing the cleaned material to the river and there would be a minimal chance that mercury would be introduced into the LAR due to project gravel borrow or placement activities. The potential for impacts to water quality from elevated levels of mercury, or other metals, would be less than significant.

b) Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?

No Impact. The proposed project would not rely on groundwater use for construction, operation, or maintenance of any project elements. The project would use existing surface water that is already conveyed through the LAR and there are no project components that would interfere with groundwater recharge that already occurs through the bed and banks of the LAR nor impede sustainable management of the groundwater basin. Thus, there would be no impact.

c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:

i) Result in substantial erosion or siltation on- or off-site;

Less-than-Significant Impact. Northwest Hydraulic Consultants, Inc., (NHC) analyzed the potential for the proposed project to cause substantial erosion or siltation on- or offsite using a one-dimensional (1D) sediment transport model of the LAR from the Sacramento River confluence (RM 0) upstream to RM 22, supplemented by a two-dimensional (2D) sediment transport model of the depositional reach of the LAR near William Pond Park (RMs 10-14).

Previous sediment transport model studies and physical observations indicate that the reach of the LAR between RM 13.5 and Nimbus Dam is an erosional reach (see Appendices D and E). This characteristic is expected as this reach is located immediately downstream of Folsom and Nimbus dams, which capture upstream sediment. The gravel augmentation portion of the proposed project targets this erosional reach with strategically placed fine to coarse gravels to replace continuously eroding bed sediment to improve spawning habitat.

The 1D and 2D models included updated surface and sub-surface bed material data collected by NHC in December 2018. The 1D model was used to simulate long-term effects of gravel augmentation, while the 2D model was used to simulate flow-specific effects and to support and verify 1D modeling results. Two scenarios were modeled to simulate long-term effects of gravel placement due to the proposed project including: baseline conditions (future LAR conditions with no gravel placement) and with-project conditions (placement of 30,000 tons/year, which is the proposed project annual maximum amount of gravel that may be placed in the LAR). . The analytical approach and model results are described in more detail in Appendix D, "Hydraulic Analysis Technical Report - Sediment Transport."

Modeling is inherently a simplification of real-time processes. Thus, within the model, the 30,000 tons/year was evenly distributed among the 10 restoration sites and applied annually during July, August, and September. The model was run using the previously developed 73-year hydrologic record (water years 1930-2002) representative of the new Folsom Dam Water Control Manual.

Under the baseline conditions (without gravel placement), sediment load rapidly increases in the erosional reach of the LAR (downstream of Nimbus Dam to RM 13.5) due to ongoing erosion of channel bed material, then rapidly decreases in the reach of historic instream aggregate mining between RMs 10.5-13.5 due to coarse bed material deposition, and then gradually reduces downstream of RM 10.5 due to additional bed material deposition. The simulated project gravel placement would progressively increase sediment loads upstream of about RM 11, with minimal effects on sediment loads downstream of RM 11. The modeled increase in sediment load may include both gravel placed as part of the project and original bed material which could be mobilized by project-induced hydraulic changes.

The gravel that would be placed as part of the proposed project is noticeably finer and more widely graded than the existing coarse surface material in the project reach of the LAR. If gravel placed by the project were mobilized, it would begin to disperse and mix with the existing bed material downstream of the restoration sites, thus locally increasing the mobility of surface bed sediment, and further increasing sediment outflow into the downstream reaches. However, these increases in sediment transport would not represent a significant impact related to onsite or offsite erosion or siltation due to the following:

- Although sediment transport could locally increase in the LAR due to project activities, 1D model results demonstrated that the gravel placed at the restoration sites deposits in the LAR between RMs 10.5-13.5. This reach was previously impacted by instream aggregate mining which created a "sediment trap. " This "sediment trap" captures the existing gravel load from the project reach under baseline conditions and would also capture the additional gravel load transported from the project reach with implementation of the project, greatly reducing further downstream effects under both scenarios. The "sediment trap" (depositional reach) of the LAR, which begins near William B. Pond Park, captures approximately 93% of the long-term annual average sediment load in the LAR (see Appendix D: Table 4.1).

- The model shows that the project's gravel placement would reduce channel erosion upstream of RM 12 (in the project area) and would not impact streambed elevation downstream of RM 12 (the leveed reach, below the project area).

- Placement of the proposed annual maximum gravel volume (30,000 tons/year for 15 years) would not significantly affect channel capacity during the 15-year proposed project duration. Under baseline conditions, approximately 31,000 tons/year are transported out of the project reach. This would increase to 38,800 tons/year under project conditions where the maximum allowed amount of gravel (30,000 tons/year) would be applied to the restoration sites. This represents an approximately 20% increase in the volume of transported sediment. However, even if 30,000 tons per year (the maximum permitted as part of the project for the 16 years from 2019 through 2034) were applied over the entire 73-year model simulation period, this volume would not affect overall LAR channel capacity due to the "sediment trap" between RMs 10.5-13.5 of the LAR created by past aggregate mining near William B. Pond Park.

As shown by the modeling results summarized above and presented in more detail in Appendix D, the project would have a less-than-significant impact to onsite and offsite erosion and siltation.

ii, iii) Substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or offsite; or create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or

Less-than-Significant Impact with Mitigation Incorporated. Stormwater runoff in the Project vicinity currently travels overland as sheetflow to local drainages and the LAR. There are no stormwater facilities that would be affected by the proposed project. The stormwater drainage amount and pattern in the project area would not be altered, and surface runoff would not be increased by construction or operation of the proposed project. However, the potential for substantial additional sources of polluted runoff during and after project construction would be potentially significant. The following mitigation measure has been identified to address this impact:

> **Mitigation Measure GEO-1: Prepare and Implement a Storm Water Pollution Prevention Plan and Best Management Practices.**
>
> Please refer to Mitigation Measure GEO-1 in Section 1.7, "Geology and Soils," for the full text of this mitigation measure.

With the implementation of Mitigation Measure GEO-1, the potential for impacts due to additional sources of polluted runoff during and after project construction would be substantially reduced. This impact would be less than significant with mitigation incorporated.

iv) Impede or redirect flood flows?

Less-than-Significant Impact. cbec analyzed potential for the proposed project to impede or redirect flood flows. This analysis was based on 10% level of design information for the restoration sites and a 2D hydrodynamic model that covers RM 23-13, which includes the project reach (see Appendix E: Hydraulic Analysis Technical Report – Water Surface Elevations). Flood flow scenarios were modeled for two historic topographic/bathymetric datasets (2006/2008 and 2017) and a future conditions dataset with the project restoration site design surfaces incorporated. The model evaluated whether there would be changes in water surface elevation (WSE) or velocity due to the proposed project under at several flow rates, including 115,000 cfs (the former peak design discharge for the LAR), 160,000 cfs (the new peak design discharge for the LAR), and 192,000 cfs (Corps' top-of-levee discharge).

Model results show only small and localized velocity differences between existing and future conditions that do not extend beyond the project area, span the entire wetted channel, or impact levees (see Appendix E: Figures 14-19). Additionally, results for all three flow scenarios show small WSE increases of 0.1 – 0.25 ft above RM 21.5 and 0.1 – 0.15 ft at RM 20.5 (upstream of Fair Oaks Bridge) (see Appendix E: Figure 1-10.1). However, these localized increases would represent a negligible flood risk due to the following:

- The increases would not be adjacent to any Federal or non-Federal levees.
- The increases would be partially mediated by ongoing natural geomorphic process in the LAR. As discussed previously, in Question C(i), the LAR from downstream of Nimbus Dam to RM 13.5 is a net erosional stream due to the lack of sediment input below Folsom and Nimbus Dams. Therefore, sediment is continually eroding from within the channel and banks under existing conditions, which continuously increases conveyance capacity of the channel. This effect is most pronounced at 115,000 cfs between RM 15.5 - 22.25 (see Appendix E: Figures 7 and 8).
- As shown in Table 1-1 in Chapter 1, "Background." of the EA/IS, past Reclamation restoration activities in the LAR (between 2008 and 2016) have already added gravel to several sites along the LAR between RM 23 and 13. Despite this past gravel placement, modeling results show a net reduction in WSE throughout much of the upper portion of the project area. This result demonstrates that past gravel augmentation projects have had no long-term impact to WSEs as high flows periodically mobilize the gravel and move it downstream. Furthermore, there would be no downstream impacts to WSE (downstream of the project area) that can be attributed to project activities; sediment that would be eroded from upstream gravel placement sites and

deposited downstream only partially replaces the gravels that are being eroded in those downstream areas, resulting in no net increase in deposition or WSE.

- cbec conducted a topographic/bathymetric change analysis from 2006/2008 through 2017 and calculated that a total of 338,000 cubic yards of sediment was exported (i.e., eroded and washed away) from the LAR, an annual average rate of 31,000 cubic yards/year. The study confirmed that the LAR exported more gravel than was replaced by the previous gravel augmentation projects and that the past gravel projects did not cause significant channel aggradation in any part of the LAR.

The gravel that would be placed at restoration sites would be highly mobile at the flows analyzed for the proposed project. Despite this, the model conservatively assumes no topographic/ bathymetric change in the LAR (i.e., the gravel would stay as placed and continue to back up flow). During actual flood flows of 115,000 cfs or higher, the gravel would move downstream, deposit over a dispersed area, and the net WSE impact would be smaller than what the model predicts. This conclusion is supported by data that show how the previously restored sites on the LAR evolved over the 2017 water year (which included a peak flow of approximately 82,000 cfs in the LAR). Pre- and post-conditions modeling did not demonstrate that the gravel moving downstream caused an increased flood risk under these conditions. As demonstrated by the analysis summarized above and presented in more detail in Appendix E, the project would have a less-than-significant impact on impedance or redirection of flood flows.

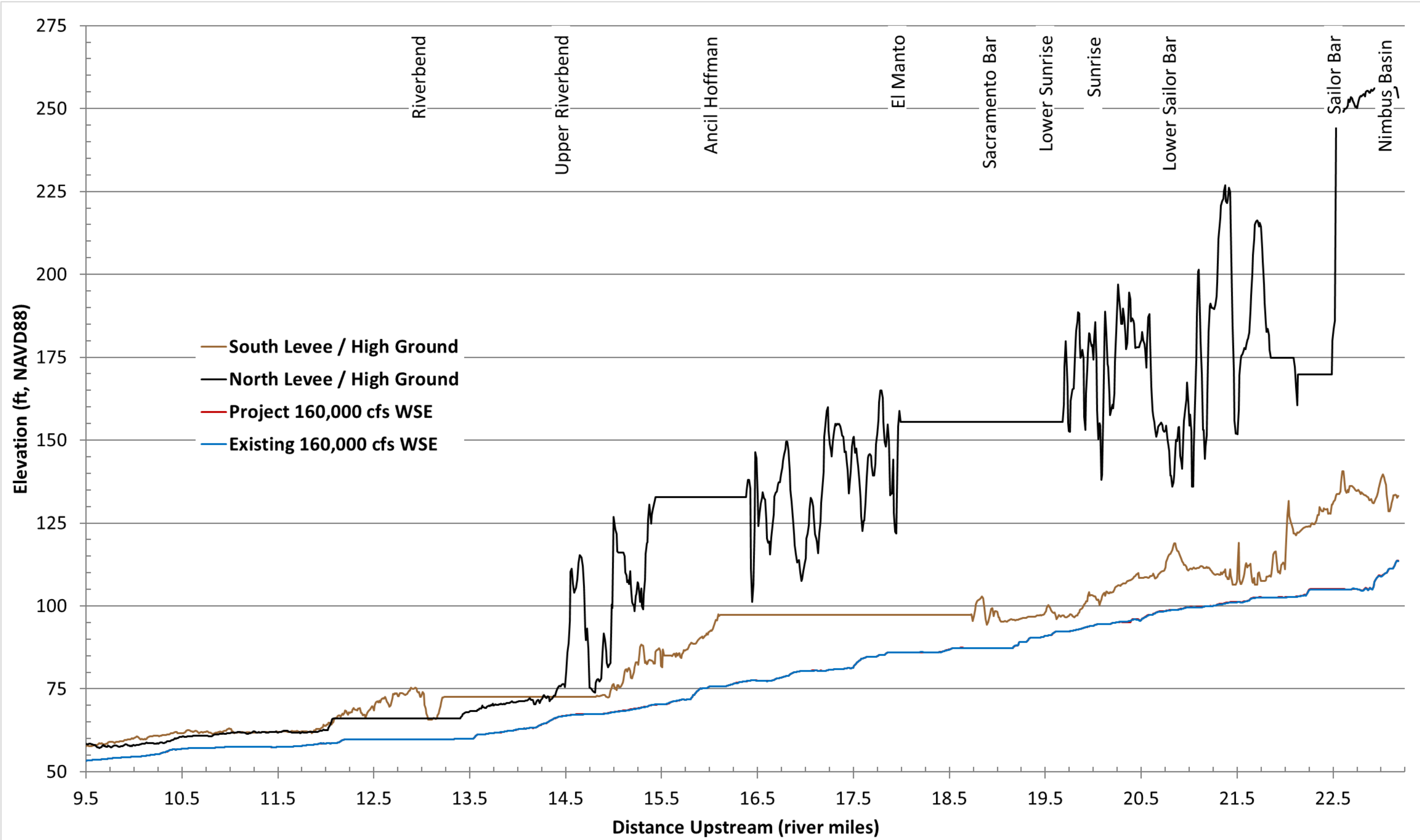
d) In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?

Less-than-Significant Impact. Although the project is mapped in FEMA flood hazard zones (with the exception of the Mississippi Bar area), the entire project reach lies within a designated floodway that is meant to accommodate flood flows and other releases from Folsom and Nimbus dams. Additionally, as discussed in Section 1.7, "Geology and Soils," the project area is not mapped in an area where tsunami or seiche are likely to occur (CGS 2019). Since project work within the designated floodway would occur outside of the flood season and the area is not a likely location for seiche or tsunami, the risk of release of pollutants due to project inundation is very low. This impact would be less than significant.

e) Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?

No Impact. The proposed project is located within the jurisdiction of the Central Valley RWQCB's Water Quality Control Plan for the Sacramento River Basin and the San Joaquin River Basin and also within the North and South American groundwater subbasins (5-021.64 and 5-021.65), as designated in the California Department of Water Resources' (DWR's) Bulletin 118 (DWR 2016). However, the proposed project would not affect implementation of the Water Quality Control Plan nor the Groundwater Sustainability Plan for this area, as there would be no discharge to surface waters nor any use or affect to groundwater related to construction or operation of the proposed project**.** There would be no impact.

Figure 1-10.1. Water Surface Elevations for Baseline and Proposed Project Conditions



1.11 Land Use and Planning

Environmental Issue	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Beneficial Impact
LAND USE AND PLANNING.					
Would the project:					
a) Physically divide an established community?	☐	☐	☐	☒	☐
b) Cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☒	☐

1.11.1 Environmental Setting

The proposed project is located in land use areas designated for recreation and natural preserve by the Sacramento County General Plan (Sacramento County 2011), and the Folsom Lake State Recreation Area & Folsom Powerhouse State Historic Park General Plan/Resource Management Plan (California State Parks and Reclamation 2010). The project site is located within the Arden Bar, River Bend, Ancil Hoffman, Rossmoor Bar, Sacramento Bar, Sunrise, Upper Sunrise, Sunrise Bluffs, Sailor Bar, and Lake Natoma Areas as designated in the American River Parkway Plan (Sacramento County 2008) and does not include any residential areas, except along the designated haul routes.

1.11.2 Discussion

a) Physically divide an established community?

No Impact. Borrow and placement of spawning gravel, side channel excavation, and in-stream habitat structure placement would occur in the LAR and adjacent floodplain areas within the existing Parkway and Folsom Lake State Recreational Area. No residential or commercial land uses are located at the proposed sites and there are no proposed activities that would create a physical barrier within an established community. Thus, there would be no impact.

b) Cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?

No Impact. Implementation of the proposed project would be compatible with continued use of the project area for recreational and natural preserve land uses. No conflict with land use plans would occur. Therefore, there would be no impact.

1.12 Mineral Resources

Environmental Issue	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Beneficial Impact
MINERAL RESOURCES.					
Would the project:					
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the State?	☐	☐	☐	☒	☐
b) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☒	☐

1.12.1 Environmental Setting

The proposed project lies within the Sacramento-Fairfield Production-Consumption Region for Portland cement concrete aggregate, which includes all designated lands within the marketing area of the active aggregate operations supplying the Sacramento-Fairfield urban center. In compliance with the Surface and Mining Reclamation Act, CGS has established the classification system for Mineral Resource Zones (MRZ) shown in **Table 1.12-1** to denote both the location and significance of key extractive resources.

Table 1.12-1 California Geological Survey Mineral Land Classification System

Classification	Description
MRZ-1a	Areas where adequate information indicates that no significant mineral deposits are present or where it is judged that little likelihood exists for their presence
MRZ-1b	Areas of mined out Portland cement concrete-grade aggregate resources
MRZ-2	Areas where adequate information indicates that significant mineral deposits are present or where it is judged that a high likelihood exists for their presence
MRZ-3	Areas containing mineral deposits, the significance of which cannot be evaluated from available data
MRZ-4	Areas where available data is inadequate for assignment to any other mineral resource zone

Notes: MRZ = Mineral Resource Zone
Source: Dupras 1999:Plate 3

1.12.2 Discussion

a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the State?

No Impact. The Mississippi Bar borrow area is classified by CGS as MRZ-1—areas where adequate information indicates that no significant mineral deposits are present or where it is judged that little likelihood exists for their presence (Dupras 1999:Plate 4). The Sailor Bar borrow area and all of the in-river restoration sites are classified as MRZ-2 (Dupras 1999:Plate 4). Both proposed borrow sites have been previously disturbed from historic gold mining operations and have both been used to supply gravel during previous related restoration activities and for other construction projects in the region.

Although the Sailor Bar borrow area and LAR restoration sites are classified as MRZ-2, they are not located within designated Aggregate Resource Areas, which are areas where current land uses are considered compatible with mining aggregate resources by the State Geologist (Dupras 1999). Therefore, there would be no impact.

b) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?

No Impact. The Sacramento County General Plan indicates there are no locally important mineral resources in the vicinity of the proposed borrow or restoration sites (Sacramento County 2011). Therefore, there would be no impact.

1.13 Noise

Environmental Issue	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Beneficial Impact
NOISE.					
Would the project:					
a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or in other applicable standards of other agencies?	☐	☐	☒	☐	☐
b) Generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☒	☐	☐
c) For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒	☐

1.13.1 Environmental Setting

The existing noise environment within the project area is typical of an open-space area within a suburban environment. In the vicinity of the project site, sensitive land uses include the American River Parkway, portions of the Folsom Lake State Recreation Area, and single-family and multi-family residential uses with direct line of site to the proposed gravel augmentation sites, and those located along proposed gravel haul routes. These land uses could potentially experience noise impacts associated with project construction and/or increased traffic from project operation.

1.13.2 Discussion

a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or in other applicable standards of other agencies?

Less-than-Significant Impact. Construction noise impacts typically occur when construction activities take place during noise-sensitive times of the day (e.g., early morning, evening, or nighttime hours), when construction activities occur immediately adjacent to noise sensitive land uses, or when construction durations last over extended periods of time.

The proposed project would generate construction noise from equipment operating at the project site and transport of construction workers, construction materials, and equipment to and from the project site. The list of construction equipment that would be used for project construction activities is shown in **Table 1.13-1** with typical noise levels generated at 50 feet from the equipment (reference levels).

Table 1.13-1 Construction Equipment and Typical Equipment Noise Levels

Type of Equipment	Typical Noise Levels (dB) at 50 Feet
Dozer	85
Dump Truck/Haul Truck	84
Excavator	85
Front-end Loader	80
Generator	70
Gravel Screener/Sorter	85
Pick-up Truck	75
Scraper	85

Notes:
dB = decibels; L_{max} = maximum instantaneous sound level; L_{eq} = 1-hour equivalent sound level (the sound energy averaged over a continuous 1-hour period)
Source: Reclamation 2008

The County's noise ordinance (Section 6.68.070 of the Sacramento County Code) sets a noise standard of 55 dB L_{eq} between 7 a.m. and 10 p.m. Section 6.68.090 (Exemptions) exempts construction noise from its noise standards, provided that construction noise occurs between 6 a.m. and 8 p.m. on weekdays, or 7 a.m. and 8 p.m. on weekends. Since all project-related construction activities would only occur within the hours specified in the County's code, the proposed project would not result in a violation of the County's construction noise standards, and this impact would be less than significant. The project would not generate operational noise beyond occasional vehicle trips for monitoring activities.

The project would include hauling of gravel material from borrow sites at Sailor Bar and Mississippi Bar to the various gravel augmentation sites. Reclamation prepared traffic noise modeling on typical roadways that would be used for gravel hauling in the project vicinity, including U.S. Highway 50, Sunrise Boulevard, Hazel Avenue, Folsom Boulevard, Mather Field Road, Sunset Boulevard, Winding Way, and Illinois Avenue (Reclamation 2008). Increased traffic noise generated by the project ranged from less than 0.1 dB on larger roads (including Sunrise Boulevard, Hazel Avenue, and U.S. Highway 50) to an increase of 3.9 dB on Winding Way. A project-related noise level increase of 5 dB or greater would be significant where ambient noise levels are less than 60 dB Ldn/CNEL; an increase of 3 dB would be significant where ambient noise levels exceed 60 dB Ldn/CNEL. Based on this threshold, Reclamation found that all of the incremental traffic noise increases caused by a previous 1 year project in 2008 would be less than significant. Because the volume of material and roadways that would be used for hauling are similar to those modeled by Reclamation in 2008, traffic noise impacts for any given year of the proposed project would similarly be less than significant. Even when carried out from 2019 through 2035, the noise impacts from the proposed project's construction activities would still remain less than significant during the short construction periods. Therefore, the proposed project would result in a less-than-significant impact on noise during construction activities for the life of the project.

Nevertheless, Reclamation has previously committed to the following actions to further reduce noise associated with constructing the project:

Mitigation Measure NOI-1: Implement Noise Controls.

The City/Water Forum will implement four BMPs for the control of construction noise levels. Implementation of the following BMPs generally reduces construction-generated noise levels by 15 dB to 25 dB:

- Construction operations and the hauling of gravel would be limited to Monday through Friday, except holidays, from 7 a.m. to 6 p.m.
- Provide and maintain noise control devices for construction equipment. Construction equipment shall be properly maintained per manufacturers' specifications and fitted with the best available noise suppression devices (i.e., mufflers, silencers, wraps, etc.).
- Coordinate routes and arrange equipment to minimize disturbance to noise-sensitive uses. Construction equipment usage shall be arranged to minimize travel adjacent to occupied residences and turned off during prolonged periods of non-use.
- Designate a disturbance coordinator to respond to all public complaints.

Timing: During construction.

Responsibility: City/Water Forum and Contractor(s).

b) Generation of excessive groundborne vibration or groundborne noise levels?

Less-than-Significant Impact. The proposed project would not involve the use of any equipment or processes that would generate potentially high levels of ground vibration, such as pile drivers or blasting. Construction operations associated with the proposed project would be anticipated to include backhoes, loaders, excavators, and trucks. No pile driving would occur.

Construction of the proposed project would result in additional vehicle trips on the local roadway network as workers commute and equipment and materials are transported. Heavy truck traffic can generate groundborne vibration, which varies considerably depending on vehicle type, weight, and pavement conditions. However, groundborne vibration levels generated from vehicular traffic are not typically perceptible outside of the road right-of-way for rubber-tired vehicles.

Therefore, the proposed project would have a less-than-significant impact with respect to the exposure to or generation of excessive groundborne noise or vibration levels from construction or construction traffic.

c) For a project located within-the vicinity of a private airstrip or-an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

No Impact. The project site is not within an airport land use plan, or within 2 miles of any airport (Sacramento County 1997). There would be no impact.

1.14 Population and Housing

Environmental Issue	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Beneficial Impact
POPULATION AND HOUSING.					
Would the project:					
a) Induce substantial unplanned population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☐	☒	☐
b) Displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒	☐

1.14.1 Environmental Setting

The project site is located within the Arden Bar, River Bend, Ancil Hoffman, Rossmoor Bar, Sacramento Bar, Sunrise, Upper Sunrise, Sunrise Bluffs, Sailor Bar, and Lake Natoma Areas as designated in the American River Parkway Plan (Sacramento County 2008) and does not include any residential areas, except for along the designated haul routes.

1.14.2 Discussion

a, b) Induce substantial unplanned population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure) or displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?

No Impact. As discussed and analyzed on page 22 of Reclamation's 2008 EA (Reclamation 2008), and incorporated by reference, the proposed project would result in no new population growth in the area and thus would not require additional housing, roads, or other development-related infrastructure. No residential or commercial land uses are located at the borrow or restoration sites. With implementation of the proposed project, no new housing would be developed, and no existing housing or people would be displaced. No conflict with land use plans would occur. There would be no impact to population and housing.

1.15 Public Services

Environmental Issue	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Beneficial Impact
PUBLIC SERVICES.					
Would the project:					
a) Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, or the need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:					
Fire protection?	☐	☐	☐	☒	☐
Police protection?	☐	☐	☐	☒	☐
Schools?	☐	☐	☐	☒	☐
Parks?	☐	☐	☐	☒	☐
Other public facilities?	☐	☐	☐	☒	☐

1.15.1 Environmental Setting

Emergency medical and fire protection is provided by Sacramento Metropolitan Fire, a California Special District, and there are seven fire stations located within two miles of the project area (Sacramento Metropolitan Fire 2019). The project area falls under the jurisdiction of and is served by the Rancho Cordova Police Department, Sacramento County Sheriff, and County Park Rangers. Residential neighborhoods adjacent to the project area are served by the Folsom Cordova and San Juan Unified School Districts. Additionally, the project site is located within the Arden Bar, River Bend, Ancil Hoffman, Rossmoor Bar, Sacramento Bar, Sunrise, Upper Sunrise, Sunrise Bluffs, Sailor Bar, and Lake Natoma Areas as designated in the American River Parkway Plan (Sacramento County 2008).

1.15.2 Discussion

a) Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, or the need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:

Fire protection?

No Impact. Areas along the borrow and restoration sites in the Parkway are readily accessible by the public and are routinely used by existing local and regional residents for recreation. The proposed project would not involve construction of residences or commercial buildings that would increase the population in the Sacramento Metropolitan Fire service area. Construction workers, some likely from outside the immediate adjacent neighborhoods, would be in the area temporarily during construction. Construction and operation of the project would not increase population such that additional fire stations would be needed under General Plan guidelines. The proposed project is consistent with the land use designation for these areas. Existing Sacramento County Parks Fire Fuel Reduction Action Plan activities along the Parkway would continue as would fuels and vegetation management in compliance with County Code (Sacramento County 2018). The project would comply with the requirements of County Parks and General Plan policies regarding adequate fire protection services. As a result, no impact would occur related to fire protection.

Police protection?

No Impact. The project area is already used for undeveloped recreation and is under the jurisdiction of and served by the Rancho Cordova Police Department, Sacramento County Sheriff, and County Park Rangers. The proposed project would not require construction of a new station or expansion of an existing facility in order to provide law enforcement services in the project area. Thus, there would be no impact.

Schools?

No Impact. The project site is located within the Arden Bar, River Bend, Ancil Hoffman, Rossmoor Bar, Sacramento Bar, Sunrise, Upper Sunrise, Sunrise Bluffs, Sailor Bar, and Lake Natoma Areas as designated in the American River Parkway Plan (Sacramento County 2008). The proposed project would not require school or library services because the project does not propose any residential uses that would generate demand for such services. Therefore, there would be no impact.

Parks and Other Public Facilities?

No Impact. Areas along the borrow and restoration sites in the Parkway are readily accessible by the public and are routinely used by existing local and regional residents for recreation. These uses would not change after construction of the project and the project would not require the development of any new park or other facilities. There would be no impact.

1.16 Recreation

Environmental Issue	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Beneficial Impact
RECREATION.					
Would the project:					
a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☒	☐	☐	☐
b) Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment?	☐	☒	☐	☐	☐

1.16.1 Environmental Setting

The proposed project is located in land use areas designated for recreation and natural preserve by the Sacramento County General Plan (Sacramento County 2011), and the Folsom Lake State Recreation Area & Folsom Powerhouse State Historic Park General Plan/Resource Management Plan (California State Parks and Reclamation 2010). The Mississippi Bar borrow site is located within the Folsom Lake State Recreation Area administered by the California Department of Parks and Recreation, through a contract with Reclamation. The Sailor Bar gravel borrow site and all restoration sites are located within the Arden Bar, River Bend, Ancil Hoffman, Rossmoor Bar, Sacramento Bar, Sunrise, Upper Sunrise, Sunrise Bluffs, Sailor Bar, and Lake Natoma Areas as designated in the American River Parkway Plan (Sacramento County 2008).

Both the American River Parkway and the Folsom State Recreation Area provide a wide range of recreational opportunities including boating, bicycling, hiking, jogging, horseback riding, fishing, bird watching, dog walking, and picnicking. Sailor Bar is a very popular fishing, boating, hiking, and dog walking area and contains equestrian trails. In addition, the Jedediah Smith Trail at Upper Sunrise and American River South is very popular with cyclists, joggers, and hikers. A spur off the Jedediah Smith Trail passes under Hazel Avenue and crosses the entrance road to the Nimbus site (Figure 2-1 in the Project Description illustrates the locations of the individual gravel augmentation sites). The area at Mississippi Bar is used mostly for horseback riding, hiking, and dog walking. Shadow Glenn Riding Stable is located at Mississippi Bar, as are a number of walking trails and a paved bicycle path.

The Nimbus site is currently closed to vehicle traffic and is accessible by pedestrians only. However, the Folsom Lake State Recreation Area & Folsom Powerhouse State Historic Park General Plan/Resource Management Plan proposes to develop a hand launch access point at this location when Reclamation removes the existing fish weir. At the upstream-most restoration sites, there is little boating activity, since there is no access upstream of the boat ramp at Sailor Bar. There is light boat traffic, primarily canoes, kayaks, and drift boats, between Upper Sailor Bar and Sunrise. The primary raft put-in is at the Sunrise access area with concessions on both sides of the river. Boating usage is much higher during weekends and holidays than on weekdays, when all project construction would occur.

Fishing is popular along the LAR, and numbers of fishers increase during late summer into early fall, as returning salmon become more numerous. The river is closed to fishing from November 1 through December 31 from the Hazel Avenue Bridge to Ancil Hoffman Park, when the bulk of salmon spawn. The area around the Sailor Bar borrow area is a popular spot for steelhead fishing during winter, and the area above Arden Rapid is popular for shad fishing in spring. As of March 2018, a portion of the LAR from Nimbus Dam downriver one-half mile to the U.S. Geological Survey gauging station cable crossing, is closed to fishing due to the ongoing Nimbus Hatchery Fish Passage Project, which involves work on the hatchery's fish ladder and existing weir (CDFW 2018).

1.16.2 Discussion

a, b) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated or include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment?

Less-than-Significant Impact with Mitigation Incorporated. The project does not involve any new housing that would generate new residents who would increase the use of existing recreational facilities or that would require the construction or expansion of recreation facilities that may have an adverse effect on the environment.

As analyzed in Reclamation's 2008 EA (pages 74-75) and 2016 EA (page 48), Reclamation found there may be temporary impacts to recreational access and safety of recreationists due to construction-related traffic and possible road closures. Access routes have been designed to avoid heavily-used recreation areas; however, several sites would require partial closures of certain areas, roads, and/or trails during haul and/or construction activities. This impact would be potentially significant.

Mississippi Bar Borrow Area
The borrow site and processing area at Mississippi Bar is adjacent to old dredger tailings and is an area that is not widely used by recreationists. Trucks and personnel would use an existing access road across the previously mined adjacent State land to access the borrow and processing area. However, since this area is otherwise open to recreation and is within the Parkway, borrow activities could result in a potentially significant impact.

Sailor Bar Borrow Area
The existing access road for the Sailor Bar borrow area is a fire road closed to the public. Fire equipment and vehicle access would continue during construction. However, since this general area is otherwise open to recreation and is within the Parkway, borrow activities could result in a potentially significant impact to recreation in the localized area afforded accessibility from this road.

Gravel Augmentation and Restoration Sites
Haul trucks and equipment would cross the Jedediah Smith Trail, equestrian trails, and hiking trails to access the river at any of the gravel augmentation and restoration sites. During construction, these trails would be signed, cautioning users that equipment would be crossing. However, during times when repetitive truck trips are expected this could result in a potentially significant impact to recreation access and safety at the restoration sites. The following mitigation measure has been identified to address this impact:

Mitigation Measure REC-1: Prepare and Implement a Trail/Traffic Control and Road Maintenance Plan.

Before the start of project-related construction activities, the City/Water Forum shall prepare and implement a plan to manage expected construction-related traffic to the extent feasible, and to avoid and minimize potential traffic congestion during project-related construction. The traffic control and road maintenance plan shall outline the phasing of activities and the use of specific routes to and from the work site locations to minimize the daily volume of traffic on individual roadways.

The items listed below will be included, as terms of the construction contracts:

- Limit all heavy construction work to occur only between 7:00 am and 6:00 pm on weekdays, avoid hauling on public roads during weekends and holidays, and confine weekend/holiday work to less disruptive tasks using materials previously hauled to the site, to ensure that most construction work occurs when recreational use of the project areas is lightest.
- During construction, ensure that nearby trails are signed, cautioning users that equipment would be crossing.
- Provide a site-specific access plan specifying the roadways on which construction workers are allowed travel to access the work sites.
- Prohibit construction workers from accessing work sites from any locations other than those specified in the plan.
- Provide clearly marked bicycle detours to address bicycle route closures or if bicyclist safety would be otherwise compromised.
- Post warnings about the potential presence of slow-moving vehicles.

Consistent with the traffic control and road maintenance plan, assess pre- and postconstruction condition of roadways identified for use by haul traffic, including repairing to pre-project conditions project-related potholes, fractures, or other damage to roadways used during construction.

Timing: Before, during, and after construction.

Responsibility: **City**/Water Forum and Contractor(s).

Implementation of Mitigation Measure REC-1 would reduce the potentially significant impact associated with temporary impacts to access and the safety of recreationists to a less-than-significant level because the Water Forum would prepare and implement a construction traffic control and road maintenance plan. This impact would be less than significant with mitigation incorporated.

At all in-river restoration sites, boating/swimming traffic is historically light during weekdays when construction would occur and, as described in Section 2.3.4, in-river work would occur during flows of generally less than 3,000 cfs. Additionally, the LAR is a river with all the hazards inherent to flowing cold water. There is recognition that no project can be built to be completely hazard free, particularly during higher flows, and personal responsibility is involved when recreating in and around the river.

However, due to the popularity of water-based recreation along the LAR, impacts to boater/swimmer safety during and after construction could be potentially significant. The following mitigation measure has been identified to address this impact:

Mitigation Measure REC-2: Prepare and Implement a Boater Safety Plan.

Recognizing the high recreational use of the Lower American River, the following safety measures will be implemented as part of the Boater Safety Plan to reduce risk during the design and construction of all in-river habitat elements:

- In-river safety personnel will be posted upstream of each site when boater traffic is heavy, typically Fridays and will implement the following safety measures:
  - Verbally communicate with recreational boaters to warn them of ongoing downstream in-river work,
  - Communicate via radio with downstream construction equipment operators to temporarily stop in-river work until boater traffic has safely passed the restoration site, and
  - Post signs upstream of construction areas to warn boaters of the location and schedule of upcoming in-river work.
- Designs for gravel augmentation will ensure that restoration and enhancement activities do not impede navigation within the main channel The appropriate minimum channel width and depth will be decided on a site-by-site basis during design with the modeling and construction to ensure adequate recreational and emergency access. The City/Water Forum will consult with County Parks to ensure boating access.
- Habitat structures will be placed at the stream margins or within side channels and outside of the main channel flow and thus away from areas where the majority of boater traffic will occur.
- The natural wood material will be angled diagonally down river to reduce the chances of hazardous contact with swimmers, boaters, anglers, and material.
- If any tagged woody material that is placed in the river is washed downstream and, in the judgment of County Parks, becomes a safety hazard, the Water Forum would coordinate wood removal with County Parks and pay existing County contractors to have it removed or moved to a safe location.

Timing: During and after construction.

Responsibility: City/Water Forum and Contractor(s).

Implementation of Mitigation Measure REC-2 would reduce the potentially significant impact associated with boater safety to a less-than-significant level because the Water Forum would prepare and implement a boater safety plan. This impact would be less than significant with mitigation incorporated.

During July and August a few anglers seek early returning salmon; the number of anglers using the LAR increases in September and peaks in October, before the upper river is closed to fishing. In general, fish avoid in-water disturbances, such as construction. Therefore, it is not expected that anglers would want to access the river at specific restoration sites during the short construction period, as there are likely no fish. In any one year, the size of the construction site as compared to the areas inhabited by fish in the remainder of the river is negligible and anglers can easily access other fishing sites during the construction period. Due to the temporary and localized impact to fishing and the availability of abundant fishing opportunities on the LAR, this impact would be less than significant.

Due to gravel placement and the construction of side channels as part of the proposed project, the in-river channel morphology may change slightly from existing conditions. Gravel placement that supports favorable spawning habitat may create discrete areas within the river channel that are deeper or more shallow than existing conditions. Additionally, the creation of side channels may create islands in areas that may have previously been gravel bars or overbank areas. However, although the LAR travels through an urbanized area and is managed as a Parkway, the LAR retains the natural fluvial geomorphic processes of a free-flowing river, especially in this un-leveed reach. These processes are ongoing, flow-driven, and include sediment transport, formation of depositional bars, cut banks, vegetation recruitment and removal, and braiding of channels. Since the proposed project activities approximate the natural characteristics and processes of a free-flowing, gravel bed river and would not differ significantly from existing conditions or ongoing fluvial geomorphic processes along the LAR, this impact would be less than significant.

1.17 Transportation

Environmental Issue	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Beneficial Impact
TRANSPORTATION.					
Would the project:					
a) Conflict with a program plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities?	☐	☐	☒	☐	☐
b) Conflict or be inconsistent with CEQA Guidelines Section 15064.3, subdivision (b)?	☐	☐	☒	☐	☐
c) Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☐	☒	☐
d) Result in inadequate emergency access?	☐	☐	☐	☒	☐

1.17.1 Environmental Setting

Figure 2-1 in Section 2, "Alternatives Including the Proposed Action," presents potential haul routes that may be used to access the borrow sites and gravel augmentation sites during project activities.

The Institute of Transportation Engineers (ITE) has recommended a screening criterion for assessing the effects of construction projects that create temporary traffic increases (ITE 1988). To account for the large percentage of heavy trucks associated with typical construction projects, ITE recommends a threshold level of 50 or more new peak-direction truck trips during the peak-hour. Therefore, a project would cause an increase in traffic that is substantial in relation to the existing traffic load and capacity of the street system, and result in a significant effect related to traffic, if they would result in 50 or more new truck trips (100 passenger car equivalent [PCE] trips) during the a.m. or p.m. peak hours. This is considered an "industry standard" and is the most current guidance for significance thresholds.

1.17.2 Discussion

a, b) Conflict with a program plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities? Conflict or be inconsistent with CEQA Guidelines Section 15064.3, subdivision (b)?

Less-than-Significant Impact. The project would include gravel augmentation and habitat restoration within the American River Parkway and would not result in any land use changes or change in vehicle miles traveled (VMT) compared to the existing conditions. Construction-related activity from the proposed project may potentially disrupt the existing transportation network in the surrounding project area. No lane, street, sidewalk, or on-street bike lane closures are planned, but heavy construction vehicles, materials, and workers would travel to and from the gravel augmentation sites and borrow sites. As a result of these activities, existing roadway operation conditions may be degraded.

Up to 30,000 tons of gravel could be placed in any given year from 2019 through 2035. This would require a total of 3,500 one-way truck trips to transport gravel from the borrow site(s) to the gravel augmentation site over an estimated 4-week period, approximately 175 trips per day, an average of less than 20 trucks per hour over a 10-hour work day. Additional traffic would occur from daily worker trips. Construction-related activity would therefore be substantially less than the threshold of 50 heavy truck trips (or 100 PCE trips) during the peak a.m. or p.m. hour. This impact would be less than significant.

The Jedediah Smith Memorial Trail provides bicycle, pedestrian, and equestrian access along the American River from downtown Sacramento to Folsom. Potential effects on users of the Jedediah Smith Memorial Trail, including bicycle and pedestrian users, are addressed in Section 1.16, “Recreation,” under items a and b.

c) Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?

No Impact. The project would not change any design features for roadways or introduce incompatible uses. There would be no impact.

d) Result in inadequate emergency access?

No Impact. The project would not require any road closures or other changes which could result in inadequate emergency access. The increased number of construction-related trucks to and from the project sites during construction activities would be small and not effect emergency access. There would be no impact.

1.18 Tribal Cultural Resources

Environmental Issue	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Beneficial Impact
III. TRIBAL CULTURAL RESOURCES.					
Would the project cause a substantial adverse change in the significance of a tribal cultural resource, defined in PRC Section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:					
a) Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in PRC Section 5020.1(k), or	☐	☒	☐	☐	☐
b) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of PRC Section 5024.1. In applying the criteria set forth in subdivision (c) of PRC Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.	☐	☒	☐	☐	☒

1.18.1 Environmental Setting

The project is situated in the traditional territory of Miwok and Nisenan California Native American Tribes. Miwok and Nisenan do not themselves constitute political units but rather linguistic units. California Native American Tribal political units in Sacramento County generally consisted of a large, independent central village or two with one or more smaller satellite villages. These independent political units were led by a hereditary chief, generally passing to a male heir though female family members were also sometimes chosen.

Data Sources/Methods

Under PRC Section 21080.3.1 and 21082.3, the CEQA lead agency must consult with tribes traditionally and culturally affiliated with the project area that have requested formal notification and responded with a request for consultation. The parties must consult in good faith. Consultation is deemed concluded when the parties agree to measures to mitigate or avoid a significant effect on a tribal cultural resource when one is present or when a party concludes that mutual agreement cannot be reached. Mitigation measures agreed on during the consultation process must be recommended for inclusion in the environmental document.

Three Tribes have previously requested to be notified regarding proposed projects within their geographic area of cultural affiliation, in accordance with PRC Section 21080.3.1: Buena Vista Rancheria of Mewok Indians, United Auburn Indian Community (UAIC), and Wilton Rancheria. On March 28, 2019, in accordance with PRC 21080.3.1 (b), SAFCA sent a letter to each of these three

Tribes, notifying these Tribes about the proposed project, providing a proposed project description and a map of the project area, and requesting a response within 30 days if consultation concerning the proposed project is requested.

Responses

One Tribe that previously requested to be notified regarding proposed projects within their geographic area of cultural affiliation, in accordance with PRC Section 21080.3.1, responded to the March 28, 2019 letter from SAFCA. In a letter dated April 22, 2019, UAIC acknowledged receipt of the March 28, 2019 letter, requested to initiate consultation on this project, requested information including cultural resources records searches and any assessments, and requested to participate in cultural resources surveys.

On February 25, 2019, the Native American Heritage Commission (NAHC) was also contacted and asked to conduct a search of their Sacred Lands File and to provide a list of Native American contacts for the project area. The NAHC responded on February 26, 2019, stating in its response letter that its Sacred Lands File search had been positive; this response does not necessarily mean that tribal cultural resources are located within the project boundary but rather indicates that a sacred site is located either within or in general proximity to the project area. The response letter also stated that UAIC should be contacted. The response from the NAHC included a list of Native American representatives that might have information regarding cultural resources within the project boundary. Included in the list were the three Tribes contacted in accordance with PRC 21080.3.1(b) (Buena Vista Rancheria, UAIC, and Wilton Rancheria), as well as four Tribal organizations that had not previously requested to be notified in accordance with PRC 21080.3.1(b) concerning projects in their geographic area of cultural affiliation: Colfax-Todds Valley Consolidated Tribe, the Ione Band of Miwok Indians, Nashville Enterprise Miwok-Maidu-Nishinam Tribe, and the Shingle Springs Band of Miwok Indians.

On March 28, 2019, SAFCA sent a letter to each of four Tribes the NAHC list that were not already being contacted in accordance with PRC 21080.3.1(b), notifying these Tribes about the proposed project, providing a proposed project description and a map of the project area, and requesting a response within 30 days if consultation concerning the proposed project is requested. As Lead Agency, the City assumed responsibility for Native American consultation in May 2019.

One Tribe that was identified on the NAHC contact list responded to the March 28, 2019 SAFCA letter. On May 1, 2019, the Shingle Springs Band of Miwok Indians sent an email response stating that they would like to initiate consultation for this project.

Discussion

a, b) Would the project cause a substantial adverse change in the significance of a tribal cultural resource, defined in PRC Section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in PRC Section 5020.1(k), or a resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant

to criteria set forth in subdivision (c) of PRC Section 5024.1. In applying the criteria set forth in subdivision (c) of PRC Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.

Less-than-Significant Impact with Mitigation Incorporated. Although no Tribal Cultural Resources have been identified within the Area of Potential Effect (APE), it is possible that Tribal Cultural Resources could be identified in the APE. This impact would be potentially significant.

Mitigation Measure TCR-1a: Conduct Cultural Resources and Tribal Cultural Resources Sensitivity and Awareness Training Program Prior to Ground-Disturbing Activities

The City/Water Forum shall require the contractor to provide a cultural resources and tribal cultural resources sensitivity and awareness training program for all personnel involved in project construction, including field consultants and construction workers. The training will be developed in coordination with an archaeologist meeting the Secretary of the Interior's Professional Qualifications Standards for Archaeology, as well as culturally affiliated Native American tribes. The City may invite Native American representatives from interested culturally affiliated Native American tribes to participate. The training shall be conducted before any project-related construction activities begin at the project site and will include relevant information regarding sensitive cultural resources and tribal cultural resources, including applicable regulations, protocols for avoidance, and consequences of violating state laws and regulations.

The training will also describe appropriate avoidance and impact minimization measures for cultural resources and tribal cultural resources that could be located at the project site and will outline what to do and who to contact if any potential cultural resources or tribal cultural resources are encountered. Training will emphasize the requirement for confidentiality and culturally appropriate treatment of any discovery of significance to Native Americans and will discuss appropriate behaviors and responsive actions, consistent with Native American tribal values.

Timing: During construction.

Responsibility: City/Water Forum and Contractor(s).

Mitigation Measure TCR-1b: In the Event that Tribal Cultural Resources Are Discovered During Construction, Implement Avoidance and Minimization Measures to Avoid Significant Impacts and Procedures to Evaluate Resources.

If tribal cultural resources (such as Native American archaeological materials, sacred objects, unusual amounts of bone or shell, artifacts, or human remains and associated objects and materials) are encountered at the project site during construction, work shall be suspended within 100 feet of the find (based on the apparent distribution of cultural materials), and the construction contractor shall immediately notify the project's City/Water Forum representative. Avoidance and preservation in place is the preferred manner of mitigating impacts to cultural resources or tribal cultural resources. This will be accomplished, if feasible, by several alternative means, including:

- Planning construction to avoid tribal cultural resources, archaeological sites and/or other cultural resources; incorporating cultural resources within parks, green-space or other open space; covering archaeological resources; deeding a cultural resource to a permanent conservation easement; or other preservation and protection methods agreeable to consulting parties and regulatory authorities with jurisdiction over the activity.
- Recommendations for avoidance of cultural resources or tribal cultural resources will be reviewed by the City/Water Forum representative, interested culturally affiliated Native American tribes and other appropriate agencies, in light of factors such as costs, logistics, feasibility, design, technology and social, cultural and environmental considerations, and the extent to which avoidance is consistent with project objectives. Avoidance and design alternatives may include realignment within the project site to avoid cultural resources or tribal cultural resources, modification of the design to eliminate or reduce impacts to tribal cultural resources or modification or realignment to avoid highly significant features within a cultural resource or tribal cultural resource.
- Native American representatives from interested culturally affiliated Native American tribes will be invited to review and comment on these analyses and shall have the opportunity to meet with the City/Water Forum representative and its representatives who have technical expertise to identify and recommend feasible avoidance and design alternatives, so that appropriate and feasible avoidance and design alternatives can be identified.
- If the discovered cultural resource or tribal cultural resource can be avoided, the construction contractor(s), will install protective fencing outside the site boundary, including a 100-foot buffer area, before construction restarts. The boundary of a tribal cultural resource will be determined in consultation with interested culturally affiliated Native American tribes and tribes will be invited to monitor the installation of fencing. Use of temporary and permanent forms of protective fencing will be determined in consultation with Native American representatives from interested culturally affiliated Native American tribes.
- The construction contractor(s) will maintain the protective fencing throughout construction to avoid the site during all remaining phases of construction. The area will be demarcated as an “Environmentally Sensitive Area”.

If a tribal cultural resource cannot be avoided, the following performance standard shall be met prior to continuance of construction and associated activities that may result in damage to or destruction of tribal cultural resources:

- Each resource will be evaluated for California Register of Historical Resources- (CRHR) eligibility through application of established eligibility criteria (California Code of Regulations 15064.636), in consultation with consulting Native American Tribes, as applicable.

If a tribal cultural resource is determined to be eligible for listing in the CRHR, the City will avoid damaging effects to the resource in accordance with California Public Resources Code Section 21084.3, if feasible. The City shall coordinate the investigation of the find with a qualified archaeologist (meeting the Secretary of the Interior’s Professional Qualifications Standards for Archeology) approved by the City and with interested culturally affiliated Native American tribes that respond to the City’s invitation. As part of the site investigation and resource assessment, the City and the archaeologist shall consult with interested culturally affiliated Native American tribes to assess the significance of the find, make recommendations for further evaluation and treatment as necessary and provide proper management recommendations should potential impacts to the resources be determined by the City to be significant. A written report detailing the site assessment, coordination activities, and management recommendations shall be provided to the City representative by the qualified archaeologist. These recommendations will be documented in the project record. For any recommendations made by interested culturally affiliated Native American tribes that are not implemented, a justification for why the recommendation was not followed will be provided in the project record.

Native American representatives from interested culturally affiliated Native American Tribes and the City/Water Forum representative will also consult to develop measures for long-term management of any discovered Native American cultural resources or tribal cultural resources. Consultation will be limited to actions consistent with the jurisdiction of the City and taking into account ownership of the subject property. To the extent that the City has jurisdiction, routine operation and maintenance within tribal cultural resources retaining tribal cultural integrity shall be consistent with the avoidance and minimization standards identified in this mitigation measure.

If the City determines that the project may cause a significant impact to a tribal cultural resource, and measures are not otherwise identified in the consultation process, the following are examples of mitigation capable of avoiding or substantially lessening potential significant impacts to a tribal cultural resource or alternatives that would avoid significant impacts to the resource. These measures may be considered to avoid or minimize significant adverse impacts and constitute the standard by which an impact conclusion of less-than significant may be reached:

- Avoid and preserve resources in place, including, but not limited to, planning construction to avoid the resources and protect the cultural and natural context, or planning greenspace, parks, or other open space, to incorporate the resources with culturally appropriate protection and management criteria.

- Treat the resource with culturally appropriate dignity taking into account the Tribal cultural values and meaning of the resource, including, but not limited to, the following:

  - Protect the cultural character and integrity of the resource.
  - Protect the traditional use of the resource.
  - Protect the confidentiality of the resource.
  - Establish permanent conservation easements or other interests in real property, with culturally appropriate management criteria for the purposes of preserving or using the resources or places.
  - Protect the resource.

The title to all archaeological sites, and historic or cultural resources on or in submerged lands of California is vested in the state and under the jurisdiction of the California State Lands Commission (Pub. Resources Code, § 6313). Additionally, the final disposition of archaeological, historical, and paleontological resources recovered on state lands under the jurisdiction of the California State Lands Commission must be approved by the Commission.

Responsibility: City/Water Forum

Timing: During Construction

1.19 Utilities and Service Systems

Environmental Issue	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Beneficial Impact
UTILITIES AND SERVICE SYSTEMS.					
Would the project:					
a) Require or result in the relocation or construction of new or expanded water, wastewater treatment or storm water drainage, electric power, natural gas, or telecommunications facilities, the construction or relocation of which could cause significant environmental effects?	☐	☐	☐	☒	☐
b) Have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry, and multiple dry years?	☐	☐	☐	☒	☐
c) Result in a determination by the wastewater treatment provider that serves or may serve the project that it has adequate capacity to serve the project’s projected demand in addition to the provider’s existing commitments?	☐	☐	☐	☒	☐
d) Generate solid waste in excess of State or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals?	☐	☐	☐	☒	☐
e) Comply with Federal, State, and local management and reduction statutes and regulations related to solid waste?	☐	☐	☐	☒	☐

1.19.1 Discussion

a) Require or result in the relocation or construction of new or expanded water, wastewater treatment or storm water drainage, electric power, natural gas, or telecommunications facilities, the construction or relocation of which could cause significant environmental effects?

No Impact. The proposed project would not involve any activities that would require new or expanded water, wastewater treatment or storm water drainage, electric power, natural gas, or telecommunications facilities. No impact would occur.

b) Have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry, and multiple dry years?

No Impact. No new water supplies would be required for the proposed project. The proposed project relies on the operations of Folsom and Nimbus dams for water supplied to the restoration sites. Reclamation is responsible for daily operations and releases at Folsom and Nimbus dams, located upstream of the restoration reaches. Reclamation releases water from Folsom/Nimbus for to serve multiple uses during all water year types, in accordance with the Water Control Manual for the facility (revised September 2017) (Corps 2017). The project would have no impact on the supply of water during normal, dry, and multiple dry years. There would be no impact.

c) Result in a determination by the wastewater treatment provider that serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?

No Impact. The proposed project would not result in changes to wastewater generation. Thus, the proposed project would not exceed a wastewater treatment provider's capacity. No impact would occur.

d,e) Generate solid waste in excess of State or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals and comply with Federal, State, and local management and reduction statutes and regulations related to solid waste?

No Impact. The proposed project would not result in the generation of solid waste. Thus, the proposed project would not exceed capacities or impair attainment of solid waste reduction goals or compliance with solid waste reduction statutes. No impact would occur.

1.20 Wildfire

Environmental Issue	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Beneficial Impact
WILDFIRE.					
If located in or near State responsibility areas or lands classified as very high fire hazard severity zones, **would the project:**					
a) Substantially impair an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☒	☐
b) Due to slope, prevailing winds, and other factors, exacerbate wildfire risks, and thereby expose project occupants to, pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire?	☐	☐	☐	☒	☐
c) Require the installation or maintenance of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines, or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment?	☐	☐	☐	☒	☐
d) Expose people or structures to significant risks, including downslope or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes?	☐	☐	☐	☒	☐

1.20.1 Environmental Setting

The borrow areas and restoration sites are located within local responsibility areas, and none are within a very-high fire hazard severity zone (CAL FIRE 2007, 2008).

1.20.2 Discussion

a) Substantially impair an adopted emergency response plan or emergency evacuation plan?

No Impact. Construction of the proposed project would result in short-term work within the borrow areas and at a maximum of three restoration sites within a construction season and would not require closure or reduced access on any adjacent roads that would interfere with an adopted emergency response plan or evacuation plan. Additionally, none of the roads in the project vicinity are listed as evacuation routes by the Sacramento County Office of Emergency Services (Sacramento County 2018). There would be no impact.

b) Due to slope, prevailing winds, and other factors, exacerbate wildfire risks, and thereby expose project occupants to, pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire?

No Impact. The proposed project involves only gravel borrow, transport and in-river placement, side channel excavation, and habitat structure placement, where appropriate, and would not increase the risk of wildfire or the possibility of uncontrolled spread of wildfire in the project area. Additionally, the proposed project would not contribute to additional temporary occupants of the project site beyond current levels of local and regional recreational users who could be exposed to pollutant concentrations resulting from a wildfire in the project area. No impact would occur.

c) Require the installation or maintenance of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines, or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment?

No Impact. The proposed project would not include any activities that require the installation or maintenance of wildfire prevention or management infrastructure or that would exacerbate fire risk. No impact would occur.

d) Expose people or structures to significant risks, including downslope or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes?

No Impact. The proposed project involves only gravel borrow, transport and in-river placement, side channel excavation, and habitat structure placement, where appropriate. All activities would take place within the LAR or floodplain areas and would not expose people or structures to significant after-fire risks due to changes in drainage patterns, topography, or slope stability. Existing Sacramento County Parks Fire Fuel Reduction Action Plan activities along the Parkway would continue as would fuels and vegetation management in compliance with County Code (Sacramento County 2018). No impact would occur.

1.21 Mandatory Findings of Significance

Environmental Issue	Potentially Significant Impact	Less-than-Significant Impact with Mitigation Incorporated	Less-than-Significant Impact	No Impact	Beneficial Impact
IV. MANDATORY FINDINGS OF SIGNIFICANCE.					
Would the project:					
a) Have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of an endangered, rare, or threatened species, or eliminate important examples of the major periods of California history or prehistory?	☐	☒	☐	☐	☐
b) Have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	☐	☒	☐	☐	☐
c) Have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	☒	☐	☐

1.21.1 Discussion

a) Would the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of an endangered, rare, or threatened species, or eliminate important examples of the major periods of California history or prehistory?

Less-than-Significant Impact with Mitigation Incorporated. The analysis conducted in this CEQA Environmental Checklist concludes that implementation of the proposed project would not have a significant impact on the environment. As evaluated in Section 3.4, “Biological Resources,” impacts on biological resources would be less than significant with mitigation incorporated. The proposed project would not substantially degrade the quality of the environment; substantially reduce the habitat of a fish or wildlife species; cause a fish or wildlife population to drop below self-sustaining levels; threaten to eliminate a plant or animal community; or reduce the number or restrict the range of an endangered, rare, or threatened species. As discussed in Section 3.5, “Cultural Resources,” the proposed project would not eliminate important examples of the major periods of California history or prehistory. This impact would be less than significant.

b) Would the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)

Less-than-Significant Impact. As discussed in this CEQA Environmental Checklist, the proposed project would result in less-than-significant impacts or no impacts on aesthetics, air quality, biological resources, cultural resources, geology and soils, GHG emissions, hazards and hazardous materials, hydrology and water quality, land use and planning, mineral resources, noise, population and housing, public services, recreation, transportation, tribal cultural resources, and utilities and services systems.

The temporary nature of the proposed project's construction impacts (approximately 4 to 6 weeks per year for up to 16 years), and the beneficial changes to habitat at the restoration sites, would result in no impacts or less-than-significant environmental impacts on the physical environment.

Other projects that may affect the project area include angling and state angling regulation changes, voluntary state or private sponsored habitat restoration activities (such as gravel augmentation as mitigation for the Folsom Dam Joint Federal Project), agricultural practices, water withdrawals and diversions, adjacent mining activities, and increased population growth resulting in urbanization and development of floodplain habitats. While state angling regulations have moved towards restrictions on selected sport fishing to protect listed fish species, incidental hooking of Chinook Salmon, hook and release mortality of steelhead, and trampling of redds by wading anglers may continue to cause a threat. Habitat restoration projects may have short-term negative effects associated with in-water construction work, but these effects typically are temporary, localized, and the outcome is expected to benefit listed species and habitats long-term after construction. One specific reasonably foreseeable future project is Reclamation's Nimbus Hatchery Fish Ladder Project. In 2013, Reclamation signed a Record of Decision for the Nimbus Hatchery Fish Passage Project Environmental Impact Statement/Environmental Impact Report. The project is anticipated to begin in 2020 or later. Following the fish ladder construction and the initial years of fish ladder effectiveness testing, the weir foundation may be removed. The removal would likely occur sometime after 2020. Both projects would result in construction activities that could occur simultaneously. But the Proposed Action's construction activities are limited both spatially and temporally, and mitigation measures will reduce construction-related impacts that could interact. Therefore, the Proposed Action, in association with the Nimbus Hatchery Fish Ladder Project, would not result or contribute to any significant cumulative impacts.

c) Would the project have environmental effects that will cause substantial adverse effects on human beings, either directly or indirectly?

Less-than-Significant Impact. The proposed project would result in less-than-significant impacts and would not cause substantial adverse effects on human beings, either directly or indirectly. The impact would be less than significant.

APPENDIX D. PROPOSED MITIGATED NEGATIVE DECLARATION

Project:	Lower American River Anadromous Fish Habitat Restoration Project
Lead Agency:	City of Sacramento

PROJECT DESCRIPTION

The City of Sacramento (City), in association with the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) and Sacramento Water Forum (Water Forum), is proposing the Lower American River Anadromous Fish Habitat Restoration Project (project) in Sacramento County, California, to enhance and restore spawning and rearing habitat for fall-run Chinook salmon and steelhead trout in the Lower American River (LAR). The project includes spawning gravel augmentation, floodplain and side channel creation/enhancement, and instream habitat structure placement in the LAR that would be implemented as part of ongoing Central Valley Project Improvement Act (CVPIA), Section 3406(b)(13) improvement requirements (commonly referred to as the Spawning and Rearing Habitat Restoration Program).

FINDINGS

An Initial Study (IS) has been prepared to assess the project's potential effects on the environment and the significance of those effects. Based on the IS, it has been determined that the proposed project would not have any significant adverse effects on the physical environment after implementation of mitigation measures. This conclusion is supported by the following findings:

1. The proposed project would have no impacts on cultural resources, land use and planning, mineral resources, population and housing, public services, tribal cultural resources and utilities and service systems, and wildfire.

2. The proposed project would have less-than-significant impacts on aesthetics, agriculture and forestry resources, energy, greenhouse gas emissions, noise, and transportation.

3. The proposed project would have potentially significant impacts on air quality, biological resources, , geology and soils, hazards and hazardous materials, hydrology and water quality, and recreation, but mitigation measures are proposed to avoid or reduce these effects to less-than-significant levels.

Following are the mitigation measures that would be implemented by the Water Forum to avoid or minimize environmental impacts. Implementation of these mitigation measures would reduce the environmental impacts of the proposed project to a less-than-significant level.

Mitigation Measure BIO-1: Minimize Injury and Mortality of Special-Status Fish Species.

The City/Water Forum and its construction contractor(s) shall implement the following measures to avoid and minimize direct injury and mortality of special-status fish:

- In-water work shall be restricted to July 1 through September 30, with consideration of the spatial and temporal distribution of spawning and incubating steelhead and fall-run

Chinook salmon. Work past September 30 would be with approval from the National Marine Fisheries Service.

- Construction may be conducted year-round in areas, such as floodplains and side channels, when flowing water is absent due to separation from the main channel by gravel berms that are either naturally present or artificially created.

- In-water work in floodplains and side channels shall be limited to inlet/outlet areas during the last stage of reconnection to the main channel if working outside of the instream work timing window.

- Instream habitat structures shall be placed when fish do not have access to the affected areas, or within timing windows, as described above.

- Measures such as slow, deliberate equipment operation shall be implemented during in-water work to alert fish to equipment operation in the channel before gravel is placed.

- Before project activities begin, worker awareness training shall be provided to inform agency staff and contractors of the need to avoid and minimize potential impacts on special-status fish and the possible penalties for not complying with these requirements. The training shall include, at a minimum, species identification, habitat requirements, and required practices for fish avoidance and protection. An appointed representative shall be identified to employees and contractors to ensure that questions regarding avoidance and protection measures are addressed in a timely manner.

- A biological monitor shall monitor in-water construction activities to confirm proper implementation of conservation measures and water quality protection measures.

Timing: Before and during ground-disturbing activities.

Responsibility: City/Water Forum and Construction Contractor(s).

Mitigation Measure BIO-2: Avoid and Minimize Impacts on Waters of the United States and Water of the State.

The City/Water Forum and its construction contractor(s) shall implement the following measures to avoid and minimize direct fill of waters of the United States and waters of the State in the Lower American River and minimize impacts on seasonal wetland habitats at the borrow sites.

- Ground disturbance shall be limited to gravel augmentation restoration sites and borrow sites. Existing access routes shall be used to obtain access to restoration and borrow sites. The total area of the project activity shall be limited to the minimum necessary. Borrow extraction areas and staging areas shall be placed to avoid and limit disturbance to the Lower American River and seasonal wetland habitats and shall provide a 250-foot setback from seasonal wetland habitats, to the extent feasible.

- Before the commencement of construction activities, high-visibility fencing shall be erected to protect areas of the Lower American River at gravel augmentation sites and identified seasonal wetland habitats at borrow sites that are located adjacent to disturbance areas but can be avoided from encroachment of personnel and equipment. The fencing shall be inspected before the start of each work day and shall be removed only when the construction within a given area is completed. Limits of waters of the United States and wetlands shall be incorporated into project bid specifications, along with a requirement for contractors to avoid these areas.

- A qualified biologist shall monitor all construction activities in waters of the United States to ensure that avoidance and minimization measures are being properly implemented and no unauthorized activities occur. The qualified biologist shall be empowered to stop construction activities that threaten to cause unanticipated and/or unauthorized significant adverse project impacts to allow resolution of these potential impacts by the City/Water Forum and U.S. Bureau of Reclamation. Project activity shall not resume until the conflict has been resolved.

- Authorization for direct fill of jurisdictional habitat in the American River and modification of seasonal wetlands at the borrow sites shall be obtained, as required, from the U.S. Army Corps of Engineers (Corps), Central Valley Regional Water Quality Control Board (RWQCB), and CDFW.
    - **Clean Water Act (CWA) Section 404:** Before any ground-disturbing project activities begin in areas containing wetlands or waters, a qualified biologist shall conduct a formal delineation of waters of the United States for CWA Section 404 permitting. The findings shall be documented in a detailed report as part of the formal Section 404 wetland delineation process.

      Authorization for fill of jurisdictional waters of the United States shall be secured from the Corps via the Section 404 permitting process before project construction. Any mitigation measures determined necessary during the 404 permitting process shall be implemented during project construction.
    - **CWA Section 401:** Water quality certification pursuant to Section 401 of the CWA shall be obtained from the Central Valley RWQCB before starting project construction in any areas that may contain waters of the State. Any measures required as part of the issuance of water quality certification shall be implemented.
    - **Fish and Game Code Section 1602 or similar agreement:** A CDFW lake and streambed alteration agreement or similar approval shall be obtained by the City for all activities that will substantially divert or obstruct the natural flow of water; substantially change or use any material from the bed, channel or bank of any river, stream, or lake; or deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it may pass into any river, stream, or lake. Any conditions of issuance of the lake and streambed alteration agreement, including avoidance, minimization and compensation measures, shall be implemented as part of project implementation.

Timing: Before and during ground-disturbing activities.

Responsibility: City/Water Forum.

Mitigation Measure BIO-3: Minimize Effects to Valley Elderberry Longhorn Beetle.

The City/Water Forum and its construction contractor(s) shall implement the following measures to avoid and minimize potential adverse effects on VELB during project implementation.

- Before project activities begin, worker awareness training shall be provided to inform agency staff and contractors of the need to avoid and minimize potential impacts on VELB and its host plant and the possible penalties for not complying with these requirements. The training shall include, at a minimum, species identification, habitat requirements, and required practices for their avoidance and protection. An appointed representative shall be identified to employees and contractors to ensure that questions regarding avoidance and protection measures are addressed in a timely manner.

- All elderberry shrubs on or adjacent to work areas shall be temporarily fenced and designated as environmentally sensitive areas. These areas shall be avoided by all construction personnel. Fencing shall be placed at least 20 feet from the dripline of each shrub, unless otherwise approved by USFWS.

- Dirt roadways and disturbed areas within 100 feet of elderberry shrubs shall be watered at least twice a day to minimize dust emissions.

Timing: Before and during ground-disturbing activities.

Responsibility: City/Water Forum and Construction Contractor(s).

Mitigation Measure BIO-4: Minimize Effects on Special-status Species and Nesting Birds.

The City/Water Forum and its construction contractor(s) shall implement the following measures to avoid and minimize potential adverse effects on special-status species and nesting birds during project implementation:

- Before project activities begin, worker awareness training shall be provided to inform agency staff and contractors of the need to avoid and minimize potential impacts on special-status species and nesting birds and the possible penalties for not complying with these requirements. The training shall include, at a minimum, species identification, habitat requirements and required practices for their avoidance and protection. An appointed representative shall be identified to employees and contractors to ensure that questions regarding avoidance and protection measures are addressed in a timely manner.

- If vegetation removal is required during the bird nesting season (February 1 through August 15), surveys for active bird nests shall be conducted by a qualified biologist in areas of suitable nesting vegetation designated for removal. A minimum of one survey shall be conducted no more than 7 days before vegetation removal occurs. If active nests are found, removal of vegetation in which the nests are located shall be delayed until a qualified biologist determines that the young have fledged or the nest site is otherwise no longer in use.

- Preconstruction surveys will be conducted by a certified arborist to identify the species of trees and any sensitive habitats (i.e., nesting, critical habitat designations, etc.), and an acceptable replacement ratio determined in coordination with CDFW.

- Preconstruction surveys for special-status plant species, including Sanford's arrowhead, shall be conducted by a qualified biologist, and the City will coordinate with CDFW if the species is found within the project boundary subject to ground disturbance.

- Preconstruction surveys for special-status reptiles, including Western pond turtle, shall be conducted by a qualified biologist, and the City will coordinate with CDFW if the species is observed within the project boundary subject to ground disturbance.

- Preconstruction surveys for active nests of burrowing owl, Swainson's hawk, white-tailed kite, bank swallow, purple martin, and colonial nesting herons and egrets shall be conducted by a qualified biologist in all areas of suitable nesting habitat that could be disturbed by project activities. A minimum of two surveys shall be conducted within 14 days before project activities begin, including at least one survey no more than 7 days before activities begin.

- Appropriate buffers shall be established and maintained around active nest sites to avoid nest failure from project activities. The appropriate size and shape of the buffers shall be determined by a qualified biologist and may vary depending on the nest location, nest stage, construction activity, and existing disturbance levels. The buffers may be adjusted if a qualified biologist determines it would not be likely to adversely affect the nest. Monitoring shall be conducted to confirm that project activities are not resulting in detectable adverse effects on nesting birds or their young. No project activities shall occur within the buffer areas until a qualified biologist determines that the young have fledged or the nest site is otherwise no longer in use.

Timing: Before and during ground-disturbing activities.

Responsibility: City/Water Forum and Construction Contractor(s).

Mitigation Measure GEO-1: Prepare and Implement a Storm Water Pollution Prevention Plan and Associated Best Management Practices.

When required, the City/Water Forum shall prepare and implement the appropriate Stormwater Pollution Prevention Plan (SWPPP), or Stormwater Management Plan (SWMP), as needed, to prevent and control pollution and to minimize and control runoff and erosion in compliance with state and local laws. The SWPPP or SWMP shall identify the activities that may cause pollutant discharge (including sediment) during storms or strong wind events, techniques to control pollutant discharge, and an erosion control plan. Regardless of the need for a SWPPP or SWMP, construction techniques and BMPs will be identified and implemented, as appropriate to reduce the potential for runoff, exposure to hazardous materials, and manage turbidity. Construction techniques will include minimizing site disturbance, controlling water flow over the construction site, stabilizing bare soil, and ensuring proper site cleanup. BMPs that specify erosion and sedimentation control measures to be implemented, may include silt fences, staked straw bales/wattles, silt/sediment basins and traps, geofabric, trench plugs, terraces, water bars, soil stabilizers re-seeding with native species and mulching to revegetate disturbed areas. If suitable vegetation cannot reasonably be expected to become established, non-erodible material will be used for such stabilization.

If required, the SWPPP or SWMP shall also include a spill prevention, control, and countermeasure plan, and applicable hazardous materials business plans, and shall identify the types of materials used for equipment operation (including fuel and hydraulic fluids), and measures to prevent and materials available to clean up hazardous material and waste spills. The SWPPP or SWMP shall also identify emergency procedures for responding to spills. The SWPPP shall also include dust control practices to prevent wind erosion, sediment tracking, and dust generation by construction equipment, including during gravel processing.

The BMPs presented in either document shall be clearly identified and maintained in good working condition throughout the construction process. The construction contractor shall retain a copy of the approved SWPPP or SWMP on the construction site and modify it as necessary to suit specific site conditions through amendments approved by the Central Valley RWQCB, if necessary.

The City and all contractors will abide by regulations governing hazardous materials transport are included in CCR Title 22, the California Vehicle Code (CCR Title 13), and the State Fire Marshal Regulations (CCR Title 19). Transport of hazardous materials can only be conducted under a registration issued by the California Department of Toxic Substances Control. Construction contractors would be required to use, store, and transport hazardous materials in compliance with federal, state, and local regulations during project construction.

Timing: Before and during construction.

Responsibility: City/Water Forum and Construction Contractor(s).

Mitigation Measure GEO-2: Conduct Construction Personnel Education, Stop Work if Paleontological Resources are Discovered, Assess the Significance of the Find, and Prepare and Implement a Recovery Plan, as Required.

To minimize the potential for destruction of or damage to potentially unique, scientifically important paleontological resources during project-related earthmoving activities, the City/Water Forum shall require the measures listed below to be implemented to minimize accidental damage to or destruction of unique paleontological resources.

- Before the start of any earthmoving activities all construction personnel involved with earthmoving activities, including the site superintendent, will be trained regarding the possibility of encountering fossils, the appearance and types of fossils likely to be seen during construction, and proper notification procedures should fossils be encountered.

- If paleontological resources are discovered during earthmoving activities, the construction crew shall notify the City/Water Forum and shall immediately cease work in the vicinity of the find. The City/Water Forum shall retain a qualified paleontologist to evaluate the resource and prepare a recovery plan in accordance with applicable guidelines (Society of Vertebrate Paleontology 1996). The recovery plan may include, but is not limited to, a field survey, construction monitoring, sampling and data recovery procedures, museum storage coordination for any specimen recovered, and a report of findings. Recommendations in the recovery plan that are determined by the Water Forum to be necessary and feasible shall be implemented before construction activities can resume at the site where the paleontological resources were discovered.

Timing: During construction.

Responsibility: City/Water Forum and Construction Contractor(s).

Mitigation Measure NOI-1: Implement Noise Controls.

The City/Water Forum will implement four BMPs for the control of construction noise levels. Implementation of the following BMPs generally reduces construction-generated noise levels by 15 dB to 25 dB:

- Construction operations and the hauling of gravel would be limited to Monday through Friday, except holidays, from 7 a.m. to 6 p.m.
- Provide and maintain noise control devices for construction equipment. Construction equipment shall be properly maintained per manufacturers' specifications and fitted with the best available noise suppression devices (i.e., mufflers, silencers, wraps, etc.).
- Coordinate routes and arrange equipment to minimize disturbance to noise-sensitive uses. Construction equipment usage shall be arranged to minimize travel adjacent to occupied residences and turned off during prolonged periods of non-use.
- Designate a disturbance coordinator to respond to all public complaints.

Timing: During construction.

Responsibility: City/Water Forum and Contractor(s).

Mitigation Measure REC-1: Prepare and Implement a Trail/Traffic Control and Road Maintenance Plan.

Before the start of project-related construction activities, the City/Water Forum shall prepare and implement a plan to manage expected construction-related traffic to the extent feasible, and to avoid and minimize potential traffic congestion during project-related construction. The traffic control and road maintenance plan shall outline the phasing of activities and the use of specific routes to and from the work site locations to minimize the daily volume of traffic on individual roadways.

The items listed below will be included, as terms of the construction contracts:

- Limit all heavy construction work to occur only between 8:00 am and 6:00 pm on weekdays, avoid hauling on public roads during weekends and holidays, and confine weekend/holiday work to less disruptive tasks using materials previously hauled to the site, to ensure that most construction work occurs when recreational use of the project areas is lightest.

- During construction, ensure that nearby trails are signed, cautioning users that equipment would be crossing.

- Provide a site-specific access plan specifying the roadways on which construction workers are allowed travel to access the work sites.

- Prohibit construction workers from accessing work sites from any locations other than those specified in the plan.

- Provide clearly marked bicycle detours to address bicycle route closures or if bicyclist safety would be otherwise compromised.

- Post warnings about the potential presence of slow-moving vehicles.

Consistent with the traffic control and road maintenance plan, assess pre- and postconstruction condition of roadways identified for use by haul traffic, including repairing to pre-project conditions project-related potholes, fractures, or other damage to roadways used during construction.

Timing: Before, during, and after construction.

Responsibility: City/Water Forum and Contractor(s).

Mitigation Measure REC-2: Prepare and Implement a Boater Safety Plan.

Recognizing the high recreational use of the Lower American River, the following safety measures will be implemented as part of the Boater Safety Plan to reduce risk during the design and construction of all in-river habitat elements:

- In-river safety personnel will be posted upstream of each site when boater traffic is heavy, typically Fridays and will implement the following safety measures:

    - Verbally communicate with recreational boaters to warn them of ongoing downstream in-river work,

    - Communicate via radio with downstream construction equipment operators to temporarily stop in-river work until boater traffic has safely passed the restoration site, and

    - Post signs upstream of construction areas to warn boaters of the location and schedule of upcoming in-river work.

- Designs for gravel augmentation will ensure that restoration and enhancement activities do not impede navigation within the main channel. The appropriate minimum channel width and depth will be decided on a site-by-site basis during design with the modeling and construction to ensure adequate recreational and emergency access. The City/Water Forum will consult with County Parks to ensure boating access.

- Habitat structures will be placed at the stream margins or within side channels and outside of the main channel flow and thus away from areas where the majority of boater traffic will occur.
- The natural wood material will be angled diagonally down river to reduce the chances of hazardous contact with swimmers, boaters, anglers, and material.
- If any woody material that is placed in the river is washed downstream and, in the judgment of County Parks, becomes a safety hazard, the Water Forum would coordinate wood removal with County Parks and pay existing County contractors to have it removed or moved to a safe location.

Timing: During and after construction.

Responsibility: City/Water Forum and Contractor(s).

Mitigation Measure TCR-1a: Conduct Cultural Resources and Tribal Cultural Resources Sensitivity and Awareness Training Program Prior to Ground-Disturbing Activities

The City/Water Forum shall require the contractor to provide a cultural resources and tribal cultural resources sensitivity and awareness training program (Worker Environmental Awareness Program [WEAP]) for all personnel involved in project construction, including field consultants and construction workers. The WEAP will be developed in coordination with an archaeologist meeting the Secretary of the Interior's Professional Qualifications Standards for Archaeology, as well as culturally affiliated Native American tribes. The City/Water Forum may invite Native American representatives from interested culturally affiliated Native American tribes to participate. The WEAP shall be conducted before any project-related construction activities begin at the project site. The WEAP will include relevant information regarding sensitive cultural resources and tribal cultural resources, including applicable regulations, protocols for avoidance, and consequences of violating state laws and regulations.

The WEAP will also describe appropriate avoidance and impact minimization measures for cultural resources and tribal cultural resources that could be located at the project site and will outline what to do and who to contact if any potential cultural resources or tribal cultural resources are encountered. The WEAP will emphasize the requirement for confidentiality and culturally appropriate treatment of any discovery of significance to Native Americans and will discuss appropriate behaviors and responsive actions, consistent with Native American tribal values.

Timing: During construction.

Responsibility: City/Water Forum and Contractor(s).

Mitigation Measure TCR-1b: In the Event that Tribal Cultural Resources Are Discovered During Construction, Implement Avoidance and Minimization Measures to Avoid Significant Impacts and Procedures to Evaluate Resources.

If tribal cultural resources (such as Native American archaeological materials, sacred objects, unusual amounts of bone or shell, artifacts, or human remains and associated objects and materials) are encountered at the project site during construction, work shall be suspended within 100 feet of the find (based on the apparent distribution of cultural materials), and the construction contractor shall immediately notify the project's City/Water Forum representative. Avoidance and preservation in place is the preferred manner of mitigating impacts to cultural resources or tribal cultural resources. This will be accomplished, if feasible, by several alternative means, including:

- Planning construction to avoid tribal cultural resources, archaeological sites and/or other cultural resources; incorporating cultural resources within parks, green-space or other open space; covering archaeological resources; deeding a cultural resource to a permanent conservation easement; or other preservation and protection methods agreeable to consulting parties and regulatory authorities with jurisdiction over the activity.

- Recommendations for avoidance of cultural resources or tribal cultural resources will be reviewed by the /Water Forum representative, interested culturally affiliated Native American tribes and other appropriate agencies, in light of factors such as costs, logistics, feasibility, design, technology and social, cultural and environmental considerations, and the extent to which avoidance is consistent with project objectives. Avoidance and design alternatives may include realignment within the project site to avoid cultural resources or tribal cultural resources, modification of the design to eliminate or reduce impacts to tribal cultural resources or modification or realignment to avoid highly significant features within a cultural resource or tribal cultural resource.

- Native American representatives from interested culturally affiliated Native American tribes will be invited to review and comment on these analyses and shall have the opportunity to meet with the City/Water Forum representative and its representatives who have technical expertise to identify and recommend feasible avoidance and design alternatives, so that appropriate and feasible avoidance and design alternatives can be identified.

- If the discovered cultural resource or tribal cultural resource can be avoided, the construction contractor(s), will install protective fencing outside the site boundary, including a 100-foot buffer area, before construction restarts. The boundary of a tribal cultural resource will be determined in consultation with interested culturally affiliated Native American tribes and tribes will be invited to monitor the installation of fencing. Use of temporary and permanent forms of protective fencing will be determined in consultation with Native American representatives from interested culturally affiliated Native American tribes.

- The construction contractor(s) will maintain the protective fencing throughout construction to avoid the site during all remaining phases of construction. The area will be demarcated as an "Environmentally Sensitive Area".

If a tribal cultural resource cannot be avoided, the following performance standard shall be met prior to continuance of construction and associated activities that may result in damage to or destruction of tribal cultural resources:

- Each resource will be evaluated for California Register of Historical Resources- (CRHR) eligibility through application of established eligibility criteria (California Code of Regulations 15064.636), in consultation with consulting Native American Tribes, as applicable.

If a tribal cultural resource is determined to be eligible for listing in the CRHR, the City/Water Forum will avoid damaging effects to the resource in accordance with California Public Resources Code Section 21084.3, if feasible. The City/Water Forum shall coordinate the investigation of the find with a qualified archaeologist (meeting the Secretary of the Interior's Professional Qualifications Standards for Archeology) approved by the City/Water Forum and with interested culturally affiliated Native American tribes that respond to the City's invitation. As part of the site investigation and resource assessment, the City/Water Forum and the archaeologist shall consult with interested culturally affiliated Native American tribes to assess the significance of the find, make recommendations for further evaluation and treatment as necessary and provide proper management recommendations should potential impacts to the resources be determined by the City/Water Forum to be significant. A written report detailing the site assessment, coordination activities, and management recommendations shall be provided to the City/Water Forum representative by the qualified archaeologist. These recommendations will be documented in the project record. For any recommendations made by interested culturally affiliated Native American tribes that are not implemented, a justification for why the recommendation was not followed will be provided in the project record.

Native American representatives from interested culturally affiliated Native American Tribes and the City/Water Forum representative will also consult to develop measures for long-term management of any discovered Native American cultural resources or tribal cultural resources. Consultation will be limited to actions consistent with the jurisdiction of the City and taking into account ownership of the subject property. To the extent that the City has jurisdiction, routine operation and maintenance within tribal cultural resources retaining tribal cultural integrity shall be consistent with the avoidance and minimization standards identified in this mitigation measure.

If the City/Water Forum determines that the project may cause a significant impact to a tribal cultural resource, and measures are not otherwise identified in the consultation process, the following are examples of mitigation capable of avoiding or substantially lessening potential significant impacts to a tribal cultural resource or alternatives that would avoid significant impacts to the resource. These measures may be considered to avoid or minimize significant adverse impacts and constitute the standard by which an impact conclusion of less-than significant may be reached:

- Avoid and preserve resources in place, including, but not limited to, planning construction to avoid the resources and protect the cultural and natural context, or planning greenspace, parks, or other open space, to incorporate the resources with culturally appropriate protection and management criteria.

- Treat the resource with culturally appropriate dignity taking into account the Tribal cultural values and meaning of the resource, including, but not limited to, the following:

    - Protect the cultural character and integrity of the resource.

- Protect the traditional use of the resource.
- Protect the confidentiality of the resource.
- Establish permanent conservation easements or other interests in real property, with culturally appropriate management criteria for the purposes of preserving or using the resources or places.
- Protect the resource.

The title to all archaeological sites, and historic or cultural resources on or in submerged lands of California is vested in the state and under the jurisdiction of the California State Lands Commission (Pub. Resources Code, § 6313). Additionally, the final disposition of archaeological, historical, and paleontological resources recovered on state lands under the jurisdiction of the California State Lands Commission must be approved by the Commission.

Timing: During construction.

Responsibility: City/Water Forum and Contractor(s).

ADOPTION OF MITIGATED NEGATIVE DECLARATION AND APPROVAL OF PROJECT

Certification by Those Responsible for Preparation of This Document. The City of Sacramento is responsible for the preparation of this Mitigated Negative Declaration and the incorporated Initial Study. I believe this document meets the requirements of the California Environmental Quality Act and provides an accurate description of the proposed project, and that the lead agency, in association with Reclamation and the Water Forum, has the means and commitment to implement the project design measures that will assure the project does not have any significant, adverse effects on the physical environment. I recommend adoption of the Mitigated Negative Declaration.

	8-6-19
Tom Gohring, Executive Director (Water Forum) City of Sacramento	Date

*(*To be signed upon completion of the public review process and preparation of a final project approval package including any necessary modifications to project design measures.)*

Approval of the Project by the Lead Agency: To meet Section 21082.1 of the California Environmental Quality Act, the City of Sacramento has independently reviewed and analyzed the Initial Study and Mitigated Negative Declaration for the proposed project and finds that the Initial Study and Mitigated Negative Declaration reflect the independent judgment of the agency. The lead agency finds that the project design features will be implemented as stated in the Mitigated Negative Declaration.

I hereby attest that the Sacramento City Council has approved this proposed project:

City of Sacramento	Date

Appendix D. Hydraulics Analysis Technical Report (Water Surface Elevations)

LOWER AMERICAN RIVER SALMONID HABITAT IMPROVEMENT PROJECT

FUTURE SITES FLOOD MODELING

Prepared for
Sacramento Water Forum

Prepared by
cbec, inc.

April 23, 2019

cbec Project #: 18-1025

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

GLOSSARY OF ACRONYMS

Acronym	Meaning
2D	two-dimensional
AFO	American River at Fair Oaks, USGS gage #11446500
cfs	cubic feet per second
CVFED	Central Valley Floodplain Evaluation and Delineation Program
CVPIA	The Central Valley Project Improvement Act
DEM	digital elevation model
DWR	California Department of Water Resources
EG	"existing grade" or existing conditions topography and roughness
FG	"future grade" or future conditions topography and roughness
ft	feet
HEC	USACE Hydraulic Engineering Center
HEC-RAS	USACE Hydraulic Engineering Center – River Analysis System software
HG	"historic grade" or historic conditions topography and roughness
HWM	high water mark
LiDAR	Light Detection and Ranging
LAR	lower American River
NAVD88	North American Vertical Datum of 1988
RM	river mile
RTK-GPS	Real Time Kinematic Global Positioning System
SAFCA	Sacramento Area Flood Control Agency
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
USFWS	United States Fish and Wildlife Service
USGS	United States Geologic Survey
Water Forum	Sacramento Water Forum
WSE	water surface elevation

1 INTRODUCTION

The Central Valley Project Improvement Act (CVPIA), Section 3406 (b)(13) directs the Department of Interior to develop and implement a continuing program for the purpose of restoring and replenishing, as needed, salmonid spawning gravel lost due to the construction and operation of Central Valley Project dams, bank protection projects, and other actions that have reduced the availability of spawning gravel and rearing habitat in the Upper Sacramento River, Lower American River, and Stanislaus River. The Lower American River Salmonid Spawning Gravel Augmentation and Side Channel Habitat Establishment Program serves as the implementation of Section 3406 (b)(13) in the American River (lower American River or LAR) with the goal of increasing the availability of spawning gravel and rearing habitat for Fall-run Chinook salmon and steelhead (USBR, 2008). Since 2008, the Sacramento Water Forum (Water Forum) in cooperation with the United States Bureau of Reclamation (USBR) and the United States Fish and Wildlife Service (USFWS) have been designing and implementing projects on the lower American River. In general, the implemented projects have had great success in terms of salmonid site utilization based on post project monitoring.

The recent 2017 topo-bathymetric surveys (Quantum Spatial 2018 and cbec 2018) show that the six previously constructed gravel augmentation projects have undergone bedform changes and that spawning gravels have moved downstream (as was anticipated). To continue the gravel augmentation program, the Water Forum has identified four new potential project sites to be built in addition to further habitat enhancement actions at the six previous project sites. The Water Forum has asked cbec to develop 10% level design surfaces and to perform flood impact modeling analyses for all ten of these sites. All design surfaces were incorporated into the existing 2017 topo-bathymetric data, and the hydraulic model developed for the LAR Current Condition Digital Elevation Model (DEM) and two-dimensional (2D) Model Development Project (a joint venture with the Water Forum and the Sacramento Area Flood Control Agency [SAFCA]) was used to analyze the flood impacts. The model development was reported in cbec (2019) and is included in Appendix B.

1.1 PROJECT GOALS

The goals of the project were to:

- Develop 10% level design surfaces to represent planned gravel augmentation and side channel grading activities for the proposed ten project sites where activities may occur in the future. All six of the existing project sites will be based on the original designs and adjusted as needed to tie into the 2017 topography.
- Perform hydraulic modeling for three flow rates (115,000 cubic feet per second [cfs], 160,000 cfs, 192,000 cfs) for two historic topographic data sets (2006/2008 and 2017) and a future conditions topographic data set containing the 2017 base topography with the design surfaces incorporated.
- Analyze the cumulative hydraulic effects of the 10% designs and provide comparisons between the topographic data sets by comparing water surface elevation (WSE) and velocity results from the hydraulic model simulations.

2 10% LEVEL DESIGNS

Autodesk Civil 3D design software was utilized to produce 10% level design surfaces for the ten project sites (See Figure 1) based on the 2017 topographic conditions (a.k.a., existing conditions). Generally, each project design consists of at least one side channel feature and at least one spawning riffle. The 10% level design drawings are included in Appendix A.

2.1 EXISTING PROJECT SITES

The six existing project sites include (from upstream to downstream) Nimbus Basin, Sailor Bar, Lower Sailor Bar, Lower Sunrise, Sacramento Bar, and Riverbend (See Figure 1). cbec designed the Nimbus Basin, Lower Sailor Bar, Sacramento Bar and Riverbend projects, but not the Sailor Bar and Lower Sunrise projects. Original designs for the Sailor Bar and Lower Sunrise projects were procured from the Water Forum and USBR, respectively. While the exact original designs were not recreated for this exercise, the general size, shape, and elevations of the original design features were used to develop the 10% level design surfaces used in this effort. All design features were graded to have a smooth tie-in to the 2017 topographic conditions.

2.2 NEW PROJECT SITES

The four new project sites include (from upstream to downstream): Sunrise, El Manto, Ancil Hoffman, and Upper Riverbend (See Figure 1). For all of the new project sites, cbec based the planform grading extents on a set of conceptual schematics provided by the Water Forum. Riffle and side channel entrance/exit elevation profiles were based on the predicted 2,000 cfs WSE output from the 2017 existing conditions 2D hydrodynamic model at each site. Iterative hydraulic modeling was not performed to optimize the habitat generated from each design, instead riffle elevations were set 1 ft below the existing conditions WSEs as a reasonable estimate of the final design elevation (based upon past experience in the design of these projects). Side channel thalweg (invert) elevations were set at 2 ft below the 2,000 cfs WSEs, based upon the typical relative elevations in past project designs

3 MODEL DEVELOPMENT

The Hydraulic Engineering Center River Analysis System (HEC-RAS) 2D hydrodynamic modeling software was used for the analysis. The model was developed and calibrated by cbec for the lower American River Current Condition DEM and 2D Model Development Project (a joint venture with the Water Forum and SAFCA). The model development was reported in cbec (2019) and is included in Appendix B. This report will cover the adaptations of the model for this effort.

MODEL DOMAIN

The hydrodynamic model domain begins below Nimbus Dam and extends downstream to Watt Avenue. Watt Avenue is a suitable place to end the model because high water marks, a stage gage, and the lack of tidal influences allow a rating curve to be developed at that location. In addition, the farthest downstream gravel augmentation project is located at river mile (RM) 13.5, which is approximately 4 miles upstream of Watt Avenue. Therefore, the proposed projects do not affect hydraulics below Watt Avenue.

3.1 BATHYMETRY AND TOPOGRAPHY

Surfaces that represent three different time periods were modeled: a 2006/2008 historic conditions (HG) DEM, a 2017 existing conditions (EG) DEM, and a future conditions (FG) DEM that incorporates the ten project sites into the 2017 DEM. The 2006/2008 HG DEM is comprised of single-beam sonar transect bathymetric data that were collected by Ayers Associates for the United States Army Corps of Engineers (USACE) in 2006 and overbank LiDAR data for the floodplain topography that was collected in 2008 as part of the Central Valley Floodplain Evaluation and Delineation (CVFED) Program for the California Department of Water Resources (DWR) (DWR 2008). The 2017 EG DEM uses 2017 topo-bathymetric LiDAR (often called “Green LiDAR” that can penetrate water to varying depths) collected by Quantum Spatial (Quantum Spatial 2018), and 2017 single-beam sonar and RTK-GPS survey points collected by cbec (cbec 2018). Finally, all surfaces incorporate bridge piers into the DEM.

3.2 BOUNDARY CONDITIONS

The model calibration and validation runs were based off high-water-marks (HWMs) acquired for the 1986 and 1997 high flow events and RTK-GPS WSE observations that cbec collected during the 2017 water year. The models were calibrated to the 1997 HWMs and then validated by applying the same roughness parameters to the 1986 HWMs and the observed WSEs for the 2017 water year. The calibration and validation results were generally within 0.1-0.15 ft of the WSE and HWM data (cbec 2019). The boundary conditions for the calibration/validation runs and the model runs used for this project are shown in Table 1. LAR discharge data comes from the American River at Fair Oaks United States Geological Survey (USGS) gage (AFO, #11446500).

Three flows were used for this analysis:

- 115,000 cfs – Former peak design discharge for the LAR
- 160,000 cfs – New peak design discharge for the LAR
- 192,000 cfs – USACE top of levee discharge

These flows allow the assessment of whether there are discharge dependent flood effects due to the proposed projects.

Table 1. Boundary conditions used for calibration, validation, and analysis

Purpose	Discharge (cfs)	Watt Ave. Stage (ft, NAVD88)	Comments
Calibration	134,000	49.85	2/19/1986 obs. HWMs
Validation	117,000	47.87	1/2/1997 obs. HWMs
Validation	20,500	29.31	12/20/2016 obs. WSE
Validation	60,300	39.55	1/11/2017 obs. WSE
Validation	82,200	43.70	2/10/2017 obs. WSE
Analysis	115,000	47.80	Former peak design discharge
Analysis	160,000	52.95	Peak design discharge
Analysis	192,000	55.10	USACE top-of-levee

3.3 MODELING PARAMETERS AND ASSUMPTIONS

The HEC-RAS 2D model mesh used for this project consists of mostly square elements in a 20-ft grid. A grid size sensitivity test was conducted to achieve the best balance of accuracy and computational run times. The mesh was further refined with break lines along the levee crests and toes, channel banks, steep slope breaks, topographic high and low points, and bridge piers. The break lines ensure that the model mesh is enforced along topographic features that direct or prevent flow paths (e.g., a levee crest or bridge pier). In addition, the cell spacing along the bridge piers and levee toes were reduced to ~8-12 ft (i.e., smaller sizes to increase resolution of velocity calculations). Table 2 provides an overview of the model parameters.

Table 2. HEC-RAS 2D flood model parameters

Parameter	Value	Notes
HEC-RAS	Version 5.0.6	-
flow module	2D unsteady	-
equation set	Full Momentum	-
theta (0.6 – 1.0)	0.9	-
initial condition	dry bed with warmup period	-
inflows	constant, sub-critical	EG slope = 0.001 (same as bed slope)
outflows	constant elevation	observed condition or rating curve
time step	2 seconds	-
eddy viscosity	-	default

4 FORMULATION OF SCENARIOS

The following scenarios were modeled to assess Project impacts:

1. Historic grade (HG) - 2006/08 topography/bathymetry and roughness
2. Existing grade (EG) - 2017 topography/bathymetry and roughness
3. Future grade (FG) - 2017 topography/bathymetry and roughness with 10% design surfaces

Roughness conditions were assessed by comparing the 2017 LiDAR derived vegetation classified vegetation returns to the 2006 and 2010 NAIP imagery. No significant change in floodplain vegetation was identified; therefore, roughness conditions were kept constant between those two model versions. For the FG surface model, adjustments were made to the roughness layer where the project would remove existing vegetation or expand the perennially wetted channel.

5 MODEL RESULTS

5.1 FG-EG SCENARIO WSE COMPARISONS

Figures 2 – 7 show the WSE differences between the FG and EG scenarios (FG WSE minus EG WSE).

Figures 2 and 3 show the WSE differences for 115,000 cfs. At this flow, the FG model shows WSE increases relative to the EG model of approximately 0.1 – 0.15 ft in the vicinity of RM 21.5 (Lower Sailor Bar Project area) and upstream, and localized WSE increases of around 0.1 ft around the footprint of the remaining Projects. Below RM 15, WSE increases are very localized and are not adjacent to the Federal and Non-Federal levees.

Figures 4 and 5 show the WSE differences for 160,000 cfs. At this flow, the FG model shows WSE increases of approximately 0.1 – 0.25 ft for river mile (RM) 21.5 and above and a localized WSE increase of 0.1 – 0.15 around RM 20.5 (upstream of Sunrise Blvd. Bridge). All other WSE increases are localized, do not span the channel, and are not adjacent to the Federal and Non-Federal levees.

Figures 6 and 7 show the WSE differences for 192,000 cfs. At this flow, the FG model shows WSE increases of approximately 0.1 – 0.25 ft for river mile (RM) 21.5 and upstream and a localized WSE increase of 0.1 – 0.15 around RM 20.5 (upstream of Sunrise Blvd. Bridge). All other WSE increases are localized, do not span the channel, and are not adjacent to the Federal and Non-Federal levees.

In summary, the FG model shows small WSE increases of 0.1 – 0.25 ft upstream of RM 21.5 and 0.1 – 0.15 ft at RM 20.5 (upstream of Sunrise Blvd. Bridge). All other WSE increases are localized and do not span the wetted extent and no WSE increase occurs adjacent to Federal or Non-Federal levees.

EG-HG SCENARIO WSE COMPARISONS

Figures 8 – 13 show the WSE differences between the HG and EG scenarios (HG WSE minus EG WSE).

Figures 8 and 9 show the WSE differences for 115,000 cfs. At this flow, the EG model shows a decrease in WSE relative to the HG model of 0.1-0.25 ft throughout much of the area (from RM ~22.25 downstream to RM 15.5). Small very localized WSE increases are present at a handful of locations.

Figures 10 and 11 show the WSE differences for 160,000 cfs. At this flow, the EG model still shows a decrease in WSE relative to the HG model throughout much of the model area (from RM ~22.25 downstream to RM 15.5), but the differences are at or slightly below the 0.1 ft threshold. Localized WSE increases are present at a handful of locations.

Figures 12 and 13 show the WSE differences for 192,000 cfs. At this flow, the differences between the EG model and HG model simulations become more negligible throughout much of the channel with a consistent reduction in WSE between RM 17.5 and 18.5. Overbank areas show more changes in the +/- 0.1 ft range.

In summary, these results show that the existing conditions model has increased conveyance capacity, especially for lower flood flows. This is due to material being eroded from within the active channel. As the flood flows increase (160,000 to 192,000 cfs), the differences become more and more negligible. The 192,000 cfs run shows more differences in the overbank areas with much of the channel showing negligible differences. Some of these overbank differences, like at RM 18, are tied to decreases in channel WSEs. Other overbank differences are not connected to a WSE change in the main channel and may be due to small differences in elevations that control flow in/out of the overbank areas or crest elevations that are controlling the WSE in the overbank.

5.2 FG-EG SCENARIO VELOCITY COMPARISONS

Figures 14 – 19 show the velocity magnitude differences between the FG and EG scenarios (FG velocity minus EG velocity). The figures show that velocity differences are small and localized and do not extend far beyond the project extents, span the wetted extent, or impact levees.

5.3 LONGITUDINAL WSE AND FREEBOARD COMPARISONS

Figures 20 and 21 show an overview of the levee alignments (termed freeboard centerlines in the figures) and nearby high ground that were used for calculating freeboard during the various flow events modeled. Figures 22 and 23 show the longitudinal WSE comparisons and freeboard[1] calculations for the north and south banks, respectively.

[1] Freeboard is defined as the vertical distance between the WSE and the levee crest, or high ground elevation.

Figure 22 shows the conditions along the right bank of the river (North side) with the sections of Federal and Non-Federal levees annotated. This figure shows that for the leveed sections, freeboard for 115,000 cfs, 160,000 cfs, and 192,000 cfs is at least 8, 3, and 0 ft, respectively (192,000 cfs is the designed top of levee elevation for the Federal levee). Areas above RM 15 have freeboard much greater than 20 ft.

Figure 23 shows the conditions along the left bank of the river (South side) with the sections of Federal and Non-Federal levees annotated. This figure shows that for the leveed sections, freeboard for 115,000 cfs, 160,000 cfs, and 192,000 cfs is at least 8, 4, and 1.5 ft, respectively (192,000 cfs is the designed top of levee elevation for the Federal levee).

These figures confirm that the localized WSE increases larger than 0.1 ft shown in Figures 1-6 have sufficient freeboard (at least 4-ft of freeboard for the LAR design discharge of 160kcfs).

6 CONCLUSIONS / RECOMMENDATIONS

The Project conditions model shows small WSE increases of 0.1 – 0.25 ft above RM 21.5 and 0.1 – 0.15 ft at RM 20.5 (upstream of Fair Oaks Bridge). These increases represent a negligible flood risk due to the following factors:

- The increases are not adjacent to any Federal or Non-Federal levee.
- The increases are partially mediated by a moving baseline. LAR is net erosional due to the lack of sediment input below Folsom and Nimbus Dams. Therefore, sediment is continually eroding from within the channel and banks without replacement and that in turn increases the conveyance capacity. This effect is most pronounced at 115,000 cfs between RM 15.5 - 22.25, as shown in Figures 7 and 8.
- The EG to HG comparison includes the fact that approximately 35,000 cubic yards of gravel has already been added to the system during that timeframe. Despite that, the modeling still shows a net reduction throughout much of the upper portion of the model. This shows that the gravel augmentation projects had no lasting impact to WSEs as high flows mobilize the gravel and move it downstream. Furthermore, downstream impacts did not show up, likely because the sediment supply is not in equilibrium. In other words, the sediment eroded from upstream gravel sites and deposited downstream only partially replaces the gravels that are eroded in those downstream areas for no net impact (see next bullet).
- A topographic change analysis conducted by cbec from 2006/2008 to 2017 calculated that 338,000 yd^3 of sediment was exported from the LAR (an annual average rate of 31,000 yd^3/yr). The study confirmed that the LAR exported more gravel than was replaced by the previous gravel augmentation projects and that the gravel projects did not cause significant aggradation in any part of the river.
- The augmented gravels are highly mobile at the flows analyzed. The model runs assume no topographic change (i.e., the gravel stays as placed and continues to back up flow). In a real flood of 115,000 cfs or higher, the gravel will move downstream, deposit over a more dispersed area, and the net flood impact will be smaller than what the model predicts. This is evident by how the

existing six projects evolved over the 2017 water year (a peak flow of approximately 82,000 cfs), and the pre- and post-conditions modeling did not show that the gravel moving downstream caused an increased flood risk.

In conclusion, the analyses conducted show that the Project will have a negligible flood impact while providing benefits to the system by partially replacing spawning gravels and increasing habitat heterogeneity.

7 REFERENCES

California Department of Water Resources (DWR), 2008. Central Valley Floodplain Evaluation and Delineation Program.

cbec, inc., 2018. LAR Current Condition DEM and 2D Model Development Project – Current Conditions DEM Report. Prepared for The Water Forum and The Sacramento Area Flood Control Agency.

cbec, inc., 2019. LAR Flood Flow Hydrodynamic Modeling Report. Prepared for The Water Forum and the Sacramento Area Flood Control Agency.

Quantum Spatial, 2018. American River, California Topobathymetric LiDAR & Digital Imagery Technical Data Report. Prepared for cbec inc. eco engineering.

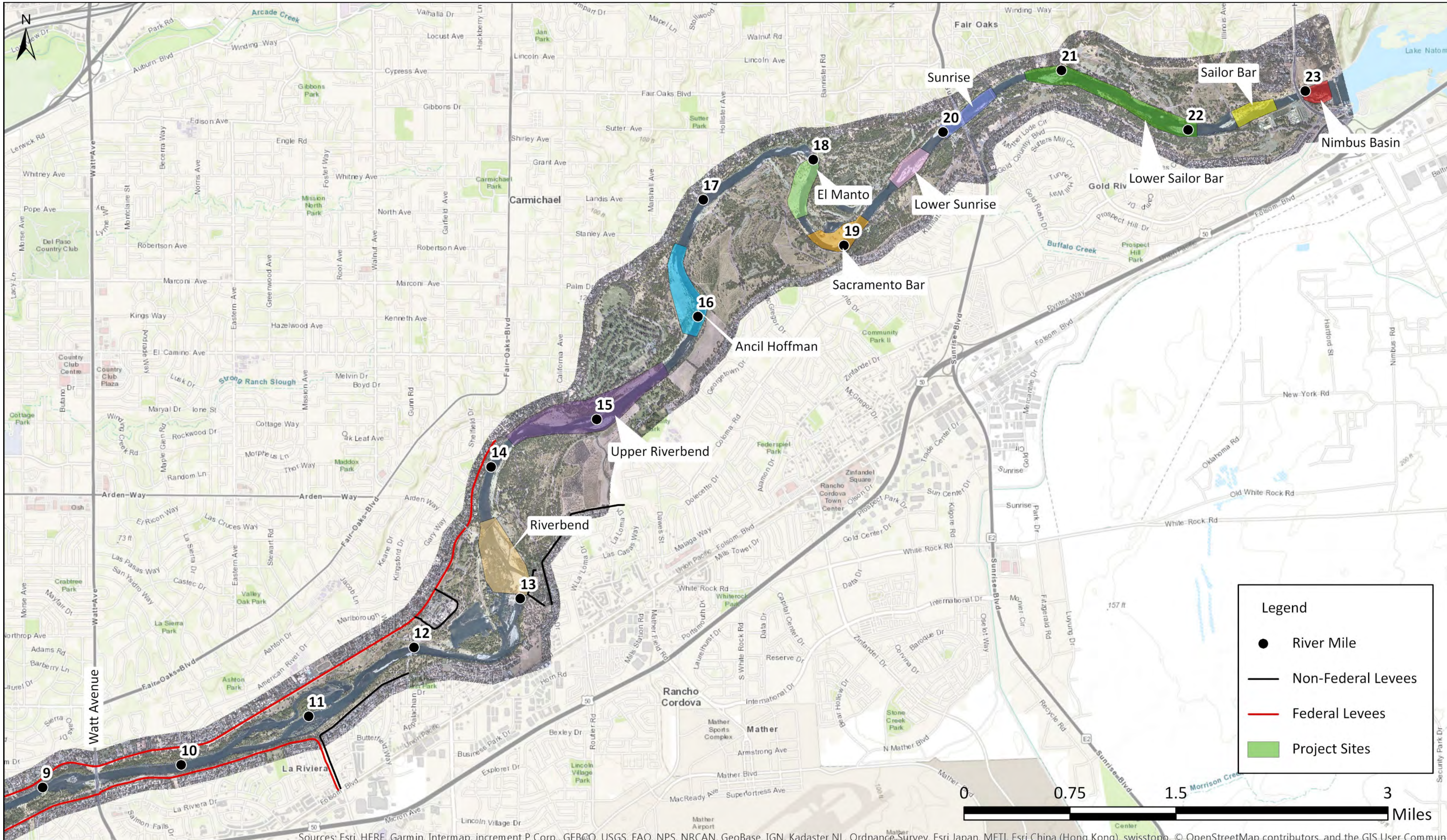
USACE. 2007. Engineering Documentation Report: Yolo Bypass 2-D Hydraulic Model Development and Calibration. US Army Corps of Engineers, Sacramento District.

8 LIST OF PREPARERS

Chris Hammersmark, Ph.D., PE, Project Director
Benjamin Taber, PE., Project Designer
Mathew Weber, M.S., Lead Modeler

FIGURES

Figure 1 – Overview of Project Sites



Notes:

cbec eco engineering

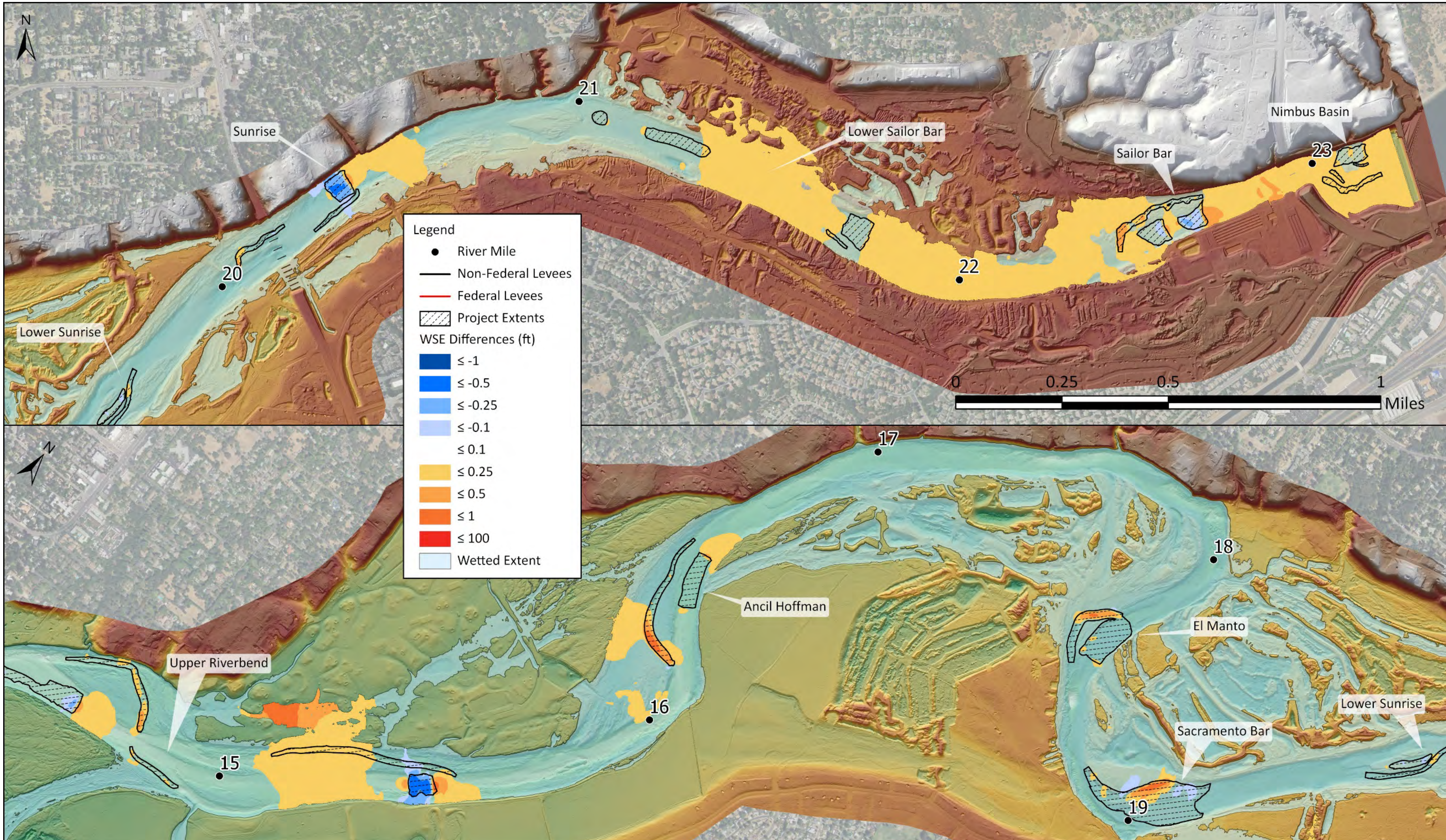
Lower American River Salmonid Habitat Improvement Project

Overview of Project Sites

Project No. 18-1025	Created By: MDW	**Figure 1**

D:\Projects\18-1025_LAR_GA\ArcPro\Figures\Final\R_cbec_Figure_Edit_Tool_v3\02_Outputs\2019-04-05__22_13_49\Figures\Figure_001.docx
4/22/2019

Figure 2 – Upper FG vs. EG 115,000 cfs WSE



Notes: WSE differences between future grade (FG) and existing grade (EG) (FG WSE minus EG WSE)

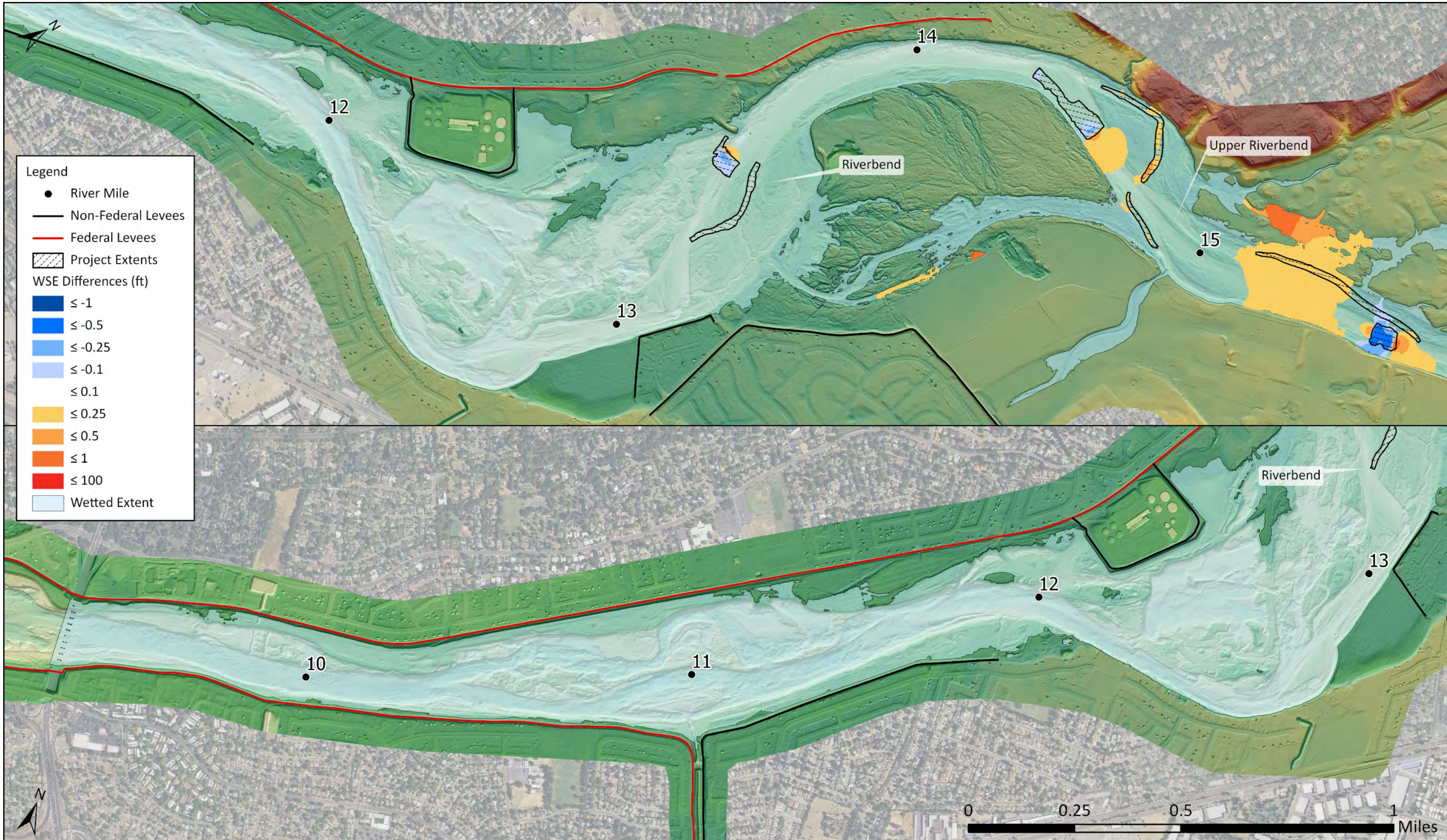
Lower American River Salmonid Habitat Improvement Project

Upper FG vs. EG 115,000 cfs WSE

Project No. 18-1025	Created By: MDW	**Figure 2**

D:\Projects\18-1025_LAR_GA\ArcPro\Figures\Final\R_cbec_Figure_Edit_Tool_v3\02_Outputs\2019-04-05__22_13_49\Figures\Figure_002.docx
4/5/2019

Figure 3 – Lower FG vs. EG 115,000 cfs WSE



Notes: WSE differences between future grade (FG) and existing grade (EG) (FG WSE minus EG WSE)

cbec eco engineering

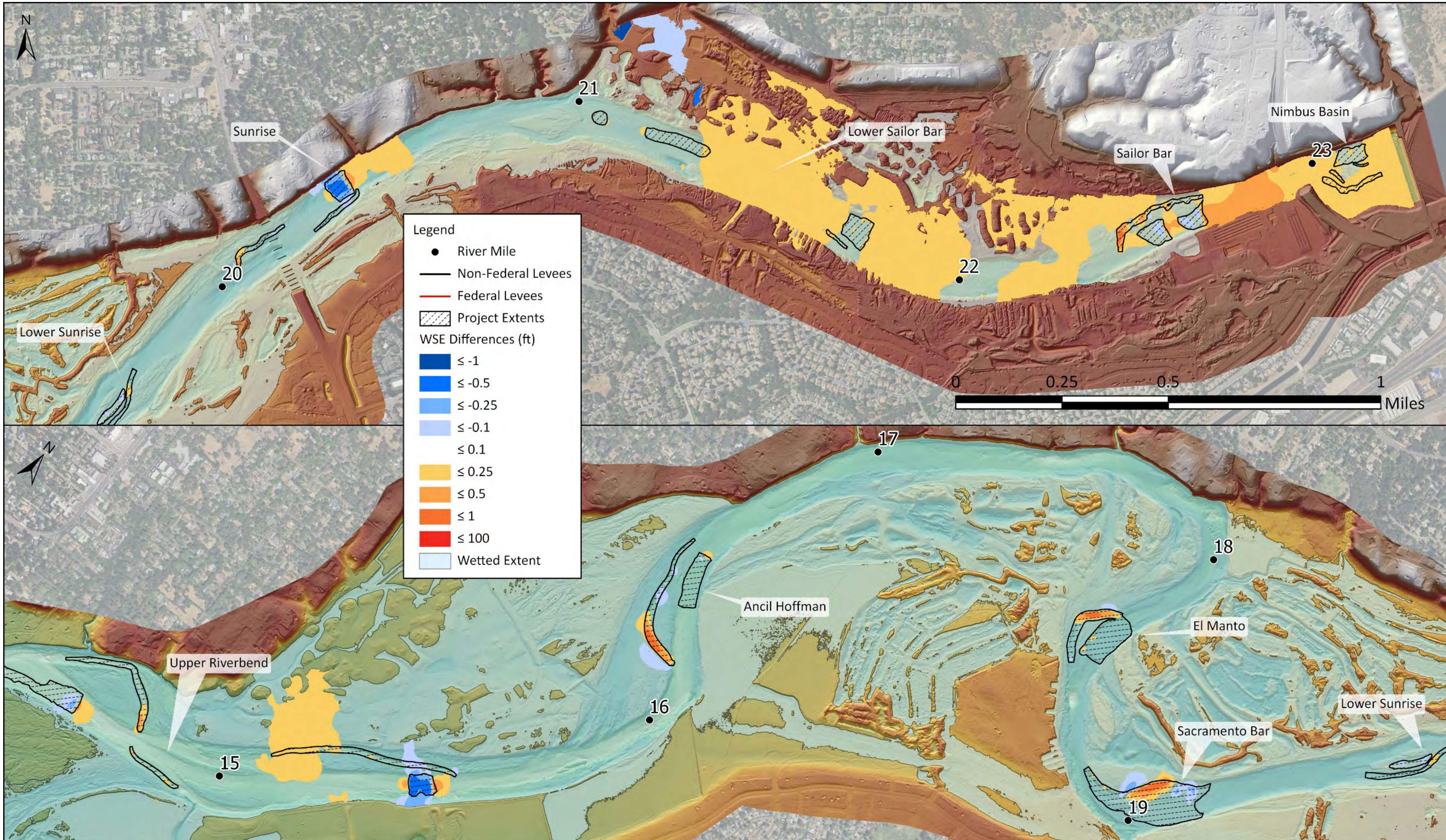
Lower American River Salmonid Habitat Improvement Project

Lower FG vs. EG 115,000 cfs WSE

Project No. 18-1025 | Created By: MDW | **Figure 3**

D:\Projects\18-1025_LAR_GA\ArcPro\Figures\Final\R_cbec_Figure_Edit_Tool_v3\02_Outputs\2019-04-05__22_13_49\Figures\Figure_003.docx
4/5/2019

Figure 4 – Upper FG vs. EG 160,000 cfs WSE



Notes: WSE differences between future grade (FG) and existing grade (EG) (FG WSE minus EG WSE)

cbec eco engineering

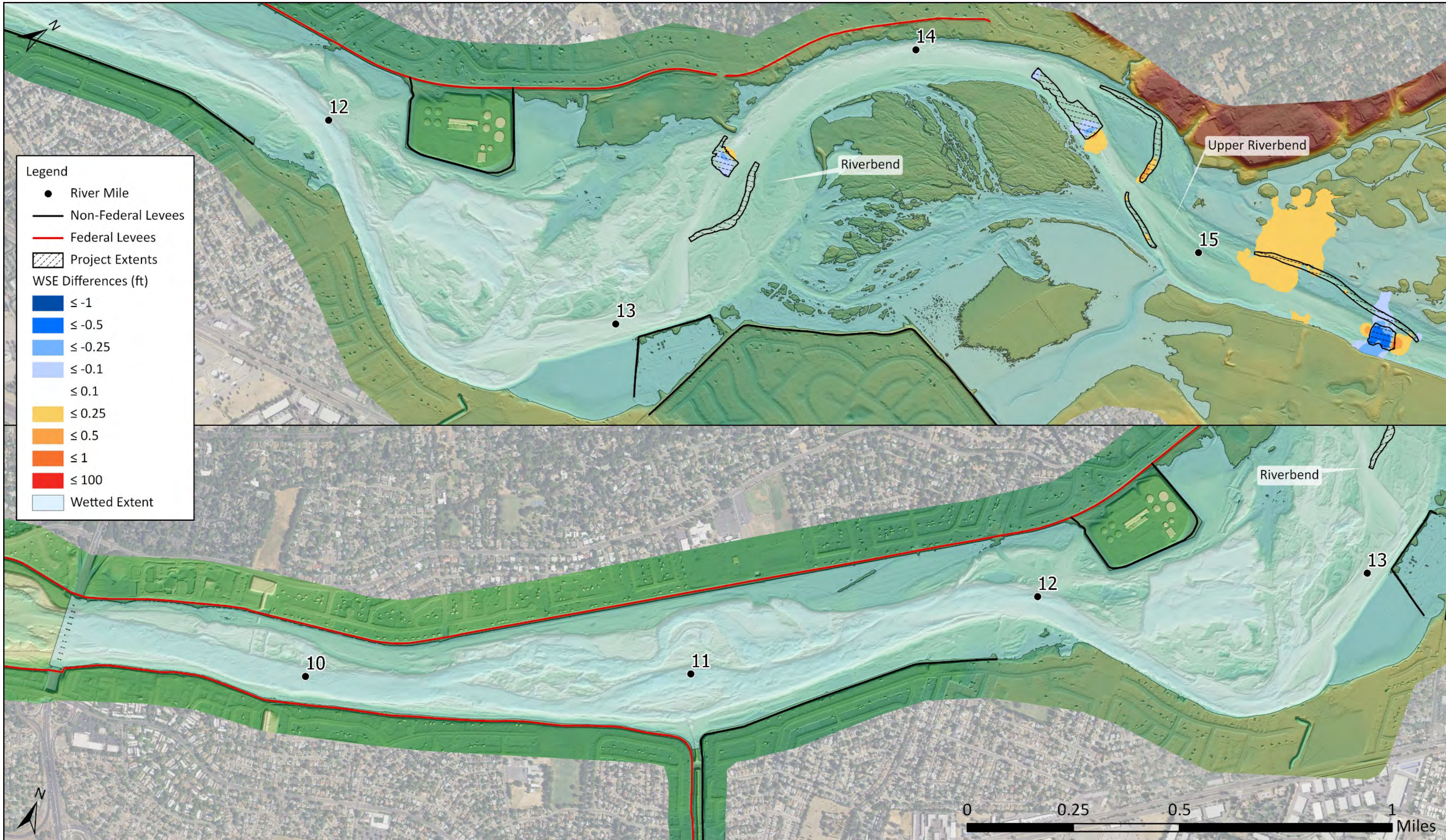
Lower American River Salmonid Habitat Improvement Project

Upper FG vs. EG 160,000 cfs WSE

Project No. 18-1025	Created By: MDW	**Figure 4**

D:\Projects\18-1025_LAR_GA\ArcPro\Figures\Final\R_cbec_Figure_Edit_Tool_v3\02_Outputs\2019-04-05__22_13_49\Figures\Figure_004.docx
4/5/2019

Figure 5 – Lower FG vs. EG 160,000 cfs WSE



Notes: WSE differences between future grade (FG) and existing grade (EG) (FG WSE minus EG WSE)

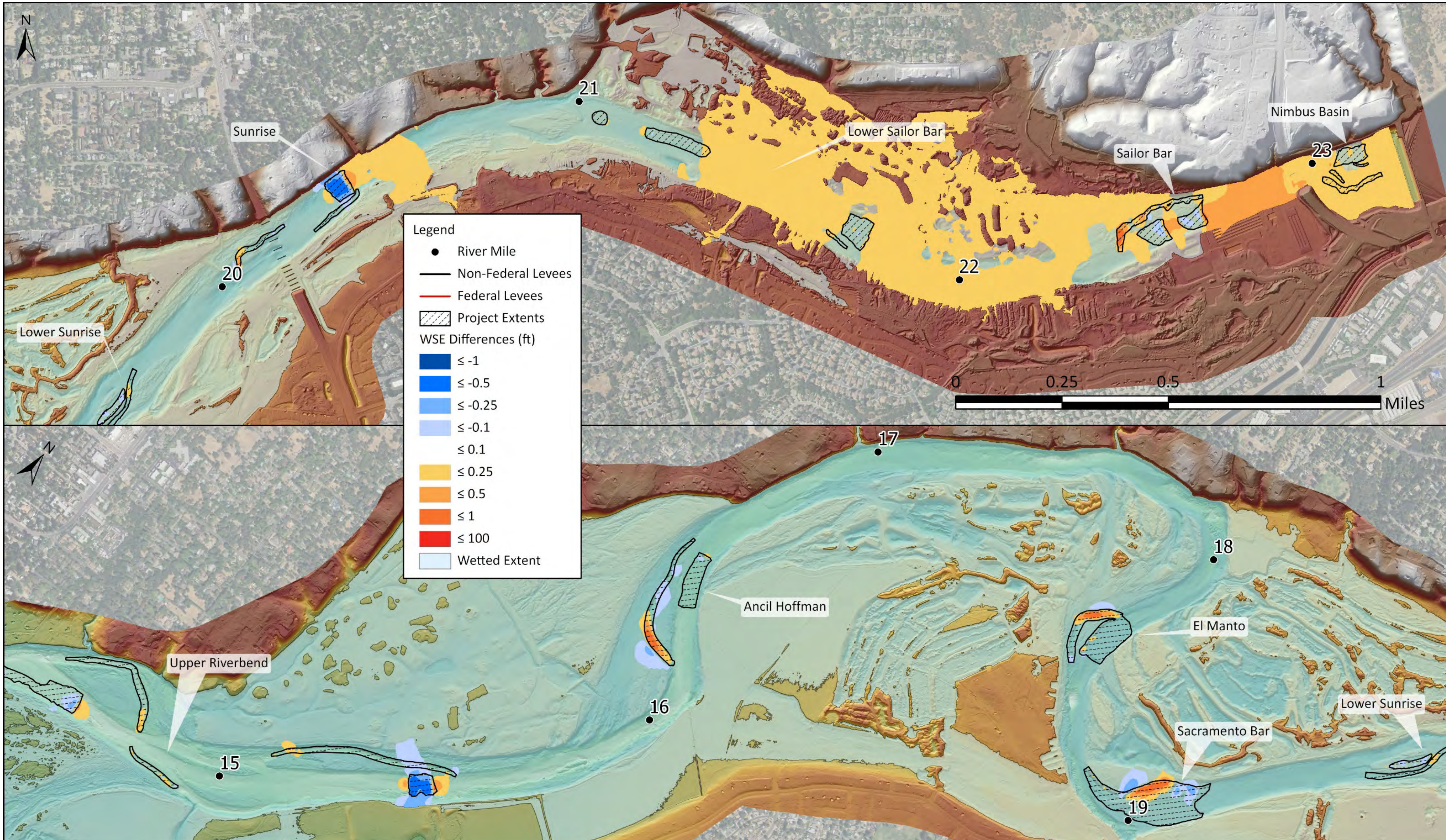
Lower American River Salmonid Habitat Improvement Project

Lower FG vs. EG 160,000 cfs WSE

Project No. 18-1025	Created By: MDW	**Figure 5**

D:\Projects\18-1025_LAR_GA\ArcPro\Figures\Final\R_cbec_Figure_Edit_Tool_v3\02_Outputs\2019-04-05__22_13_49\Figures\Figure_005.docx
4/5/2019

Figure 6 – Upper FG vs. EG 192,000 cfs WSE



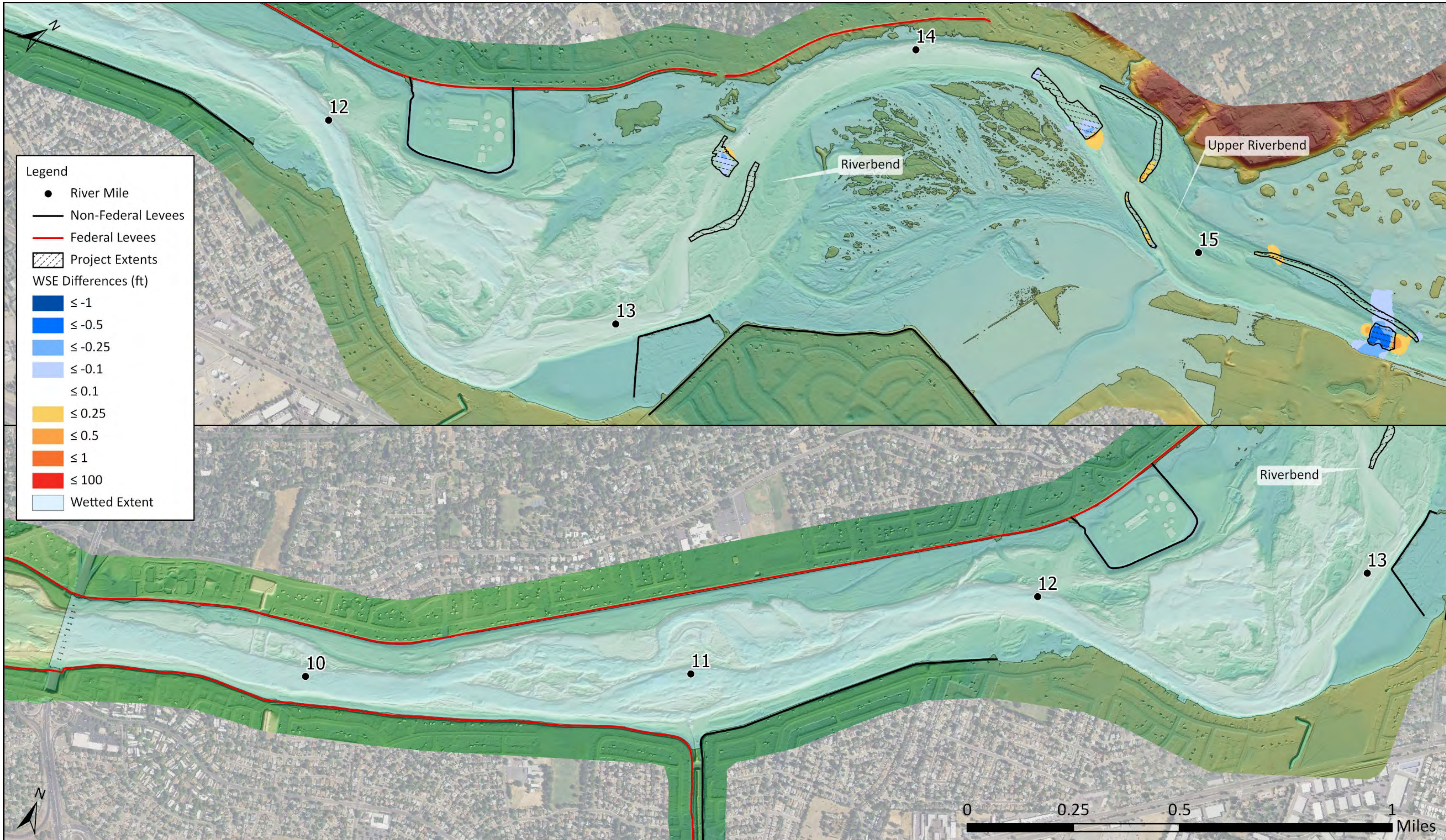
Notes: WSE differences between future grade (FG) and existing grade (EG) (FG WSE minus EG WSE)

Lower American River Salmonid Habitat Improvement Project

Upper FG vs. EG 192,000 cfs WSE

Project No. 18-1025 | Created By: MDW | **Figure 6**

Figure 7 – Lower FG vs. EG 192,000 cfs WSE



Notes: WSE differences between future grade (FG) and existing grade (EG) (FG WSE minus EG WSE)

cbec eco engineering

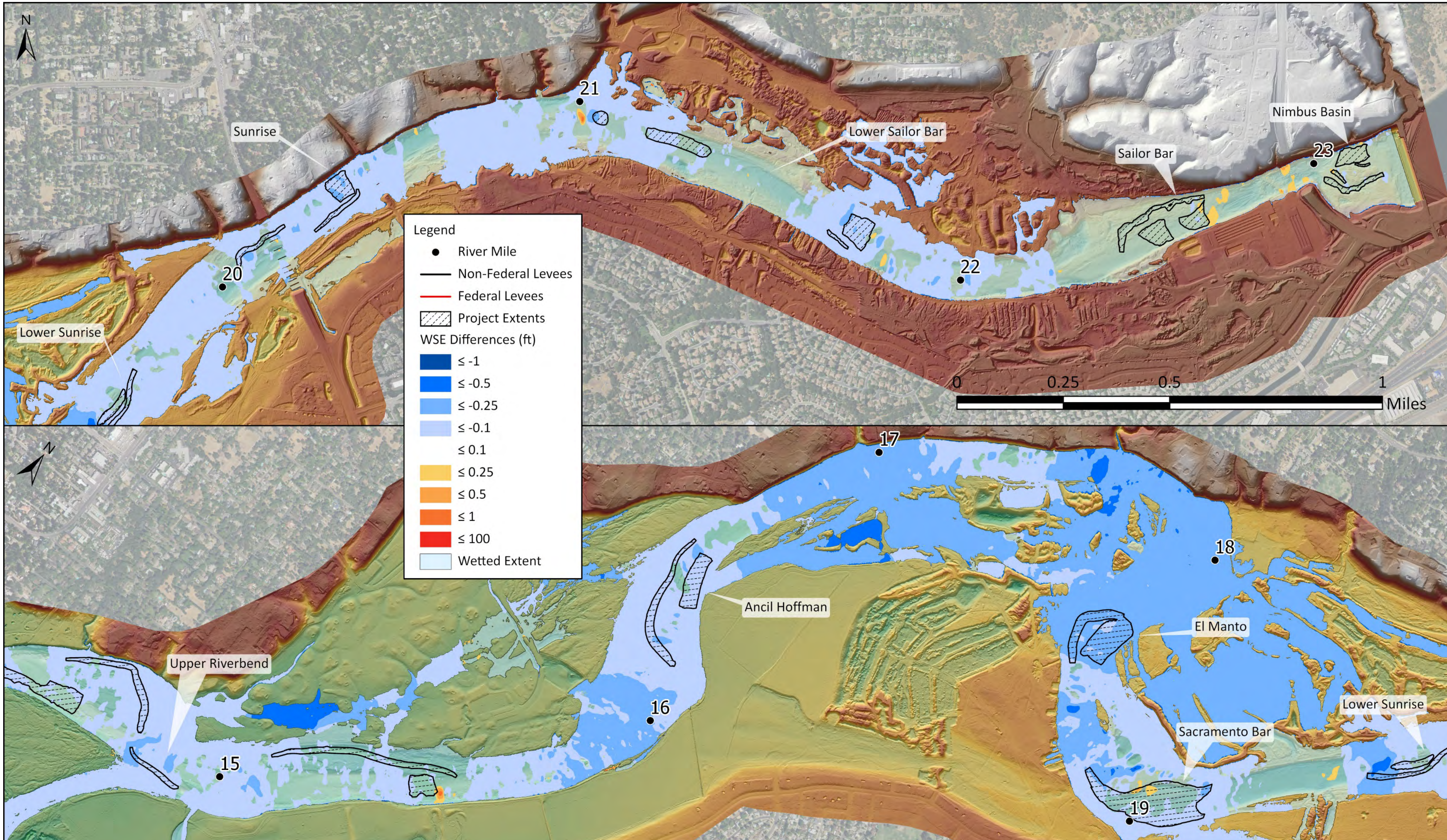
Lower American River Salmonid Habitat Improvement Project

Lower FG vs. EG 192,000 cfs WSE

Project No. 18-1025 | Created By: MDW | **Figure 7**

D:\Projects\18-1025_LAR_GA\ArcPro\Figures\Final\R_cbec_Figure_Edit_Tool_v3\02_Outputs\2019-04-05__22_13_49\Figures\Figure_007.docx
4/5/2019

Figure 8 – Upper EG vs. HG 115,000 cfs WSE



Notes: WSE differences between existing grade (EG) and historic grade (HG) (EG WSE minus HG WSE)

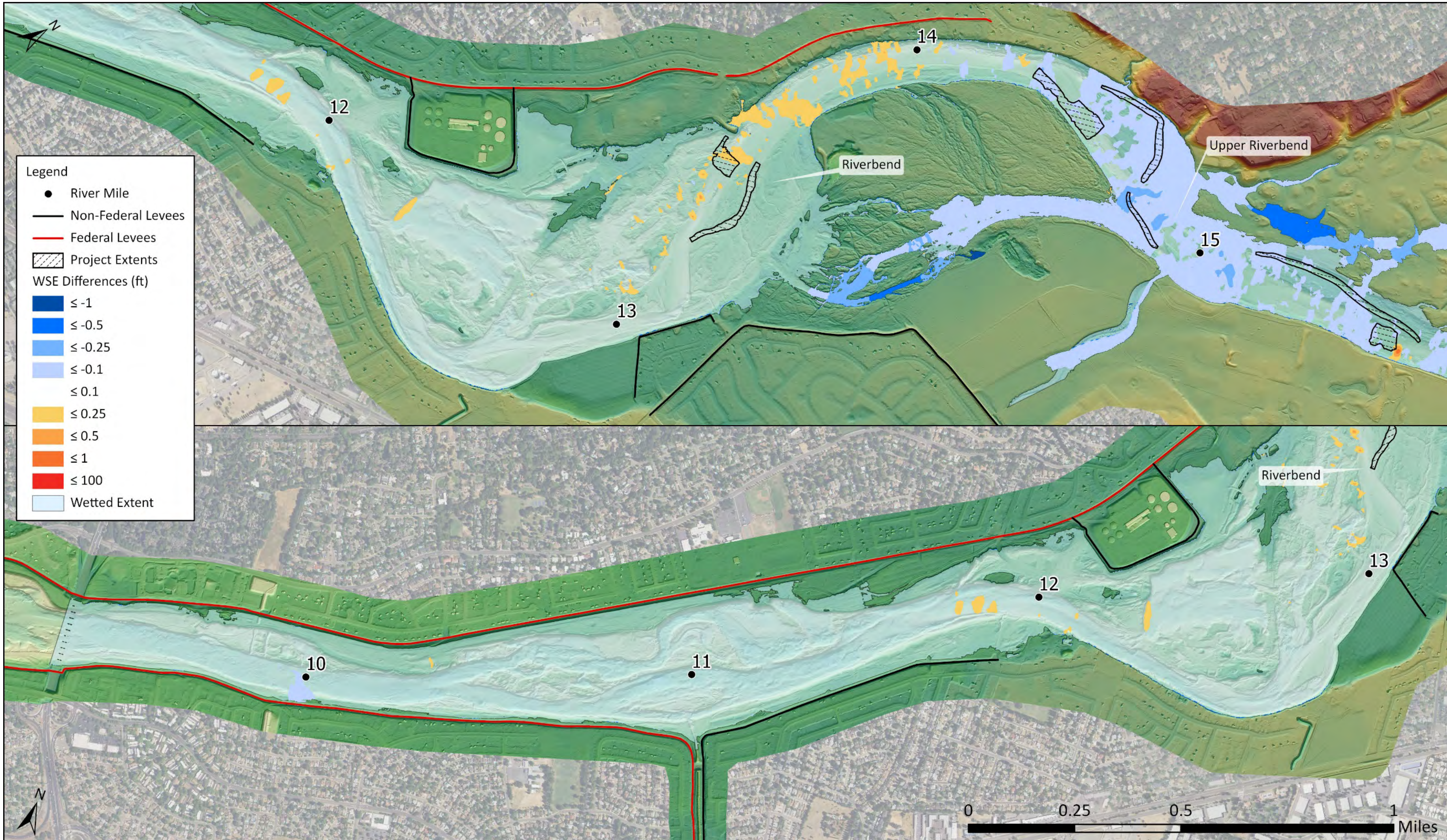
Lower American River Salmonid Habitat Improvement Project

Upper EG vs. HG 115,000 cfs WSE

Project No. 18-1025	Created By: MDW	**Figure 8**

D:\Projects\18-1025_LAR_GA\ArcPro\Figures\Final\R_cbec_Figure_Edit_Tool_v3\02_Outputs\2019-04-05__22_13_49\Figures\Figure_008.docx
4/5/2019

Figure 9 – Lower EG vs. HG 115,000 cfs WSE



Notes: WSE differences between existing grade (EG) and historic grade (HG) (EG WSE minus HG WSE)

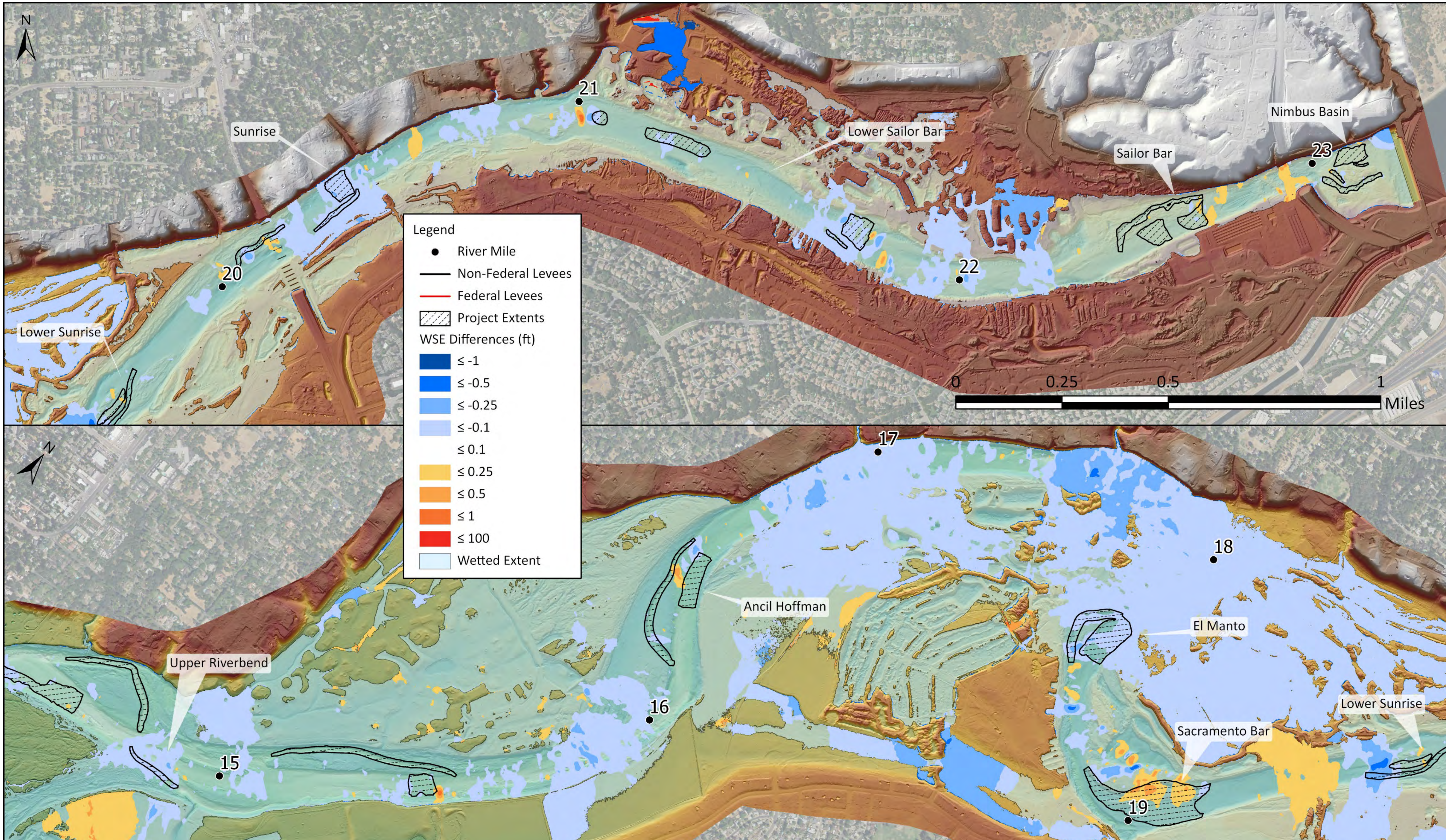
Lower American River Salmonid Habitat Improvement Project

Lower EG vs. HG 115,000 cfs WSE

Project No. 18-1025	Created By: MDW	**Figure 9**

D:\Projects\18-1025_LAR_GA\ArcPro\Figures\Final\R_cbec_Figure_Edit_Tool_v3\02_Outputs\2019-04-05__22_13_49\Figures\Figure_009.docx
4/5/2019

Figure 10 – Upper EG vs. HG 160,000 cfs WSE



Notes: WSE differences between existing grade (EG) and historic grade (HG) (EG WSE minus HG WSE)

cbec eco engineering

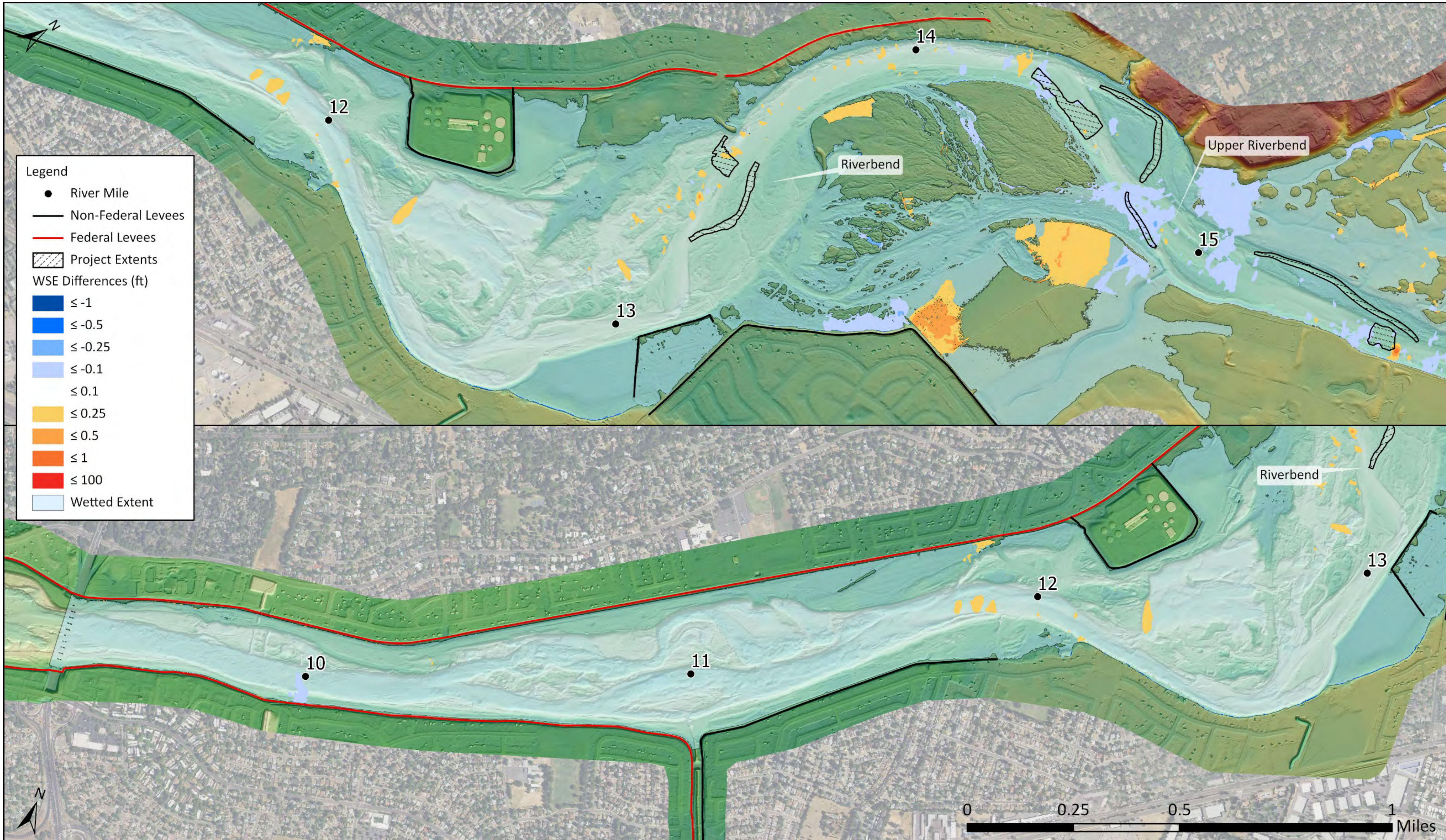
Lower American River Salmonid Habitat Improvement Project

Upper EG vs. HG 160,000 cfs WSE

Project No. 18-1025	Created By: MDW	**Figure 10**

D:\Projects\18-1025_LAR_GA\ArcPro\Figures\Final\R_cbec_Figure_Edit_Tool_v3\02_Outputs\2019-04-05__22_13_49\Figures\Figure_010.docx
4/5/2019

Figure 11 – Lower EG vs. HG 160,000 cfs WSE



Notes: WSE differences between existing grade (EG) and historic grade (HG) (EG WSE minus HG WSE)

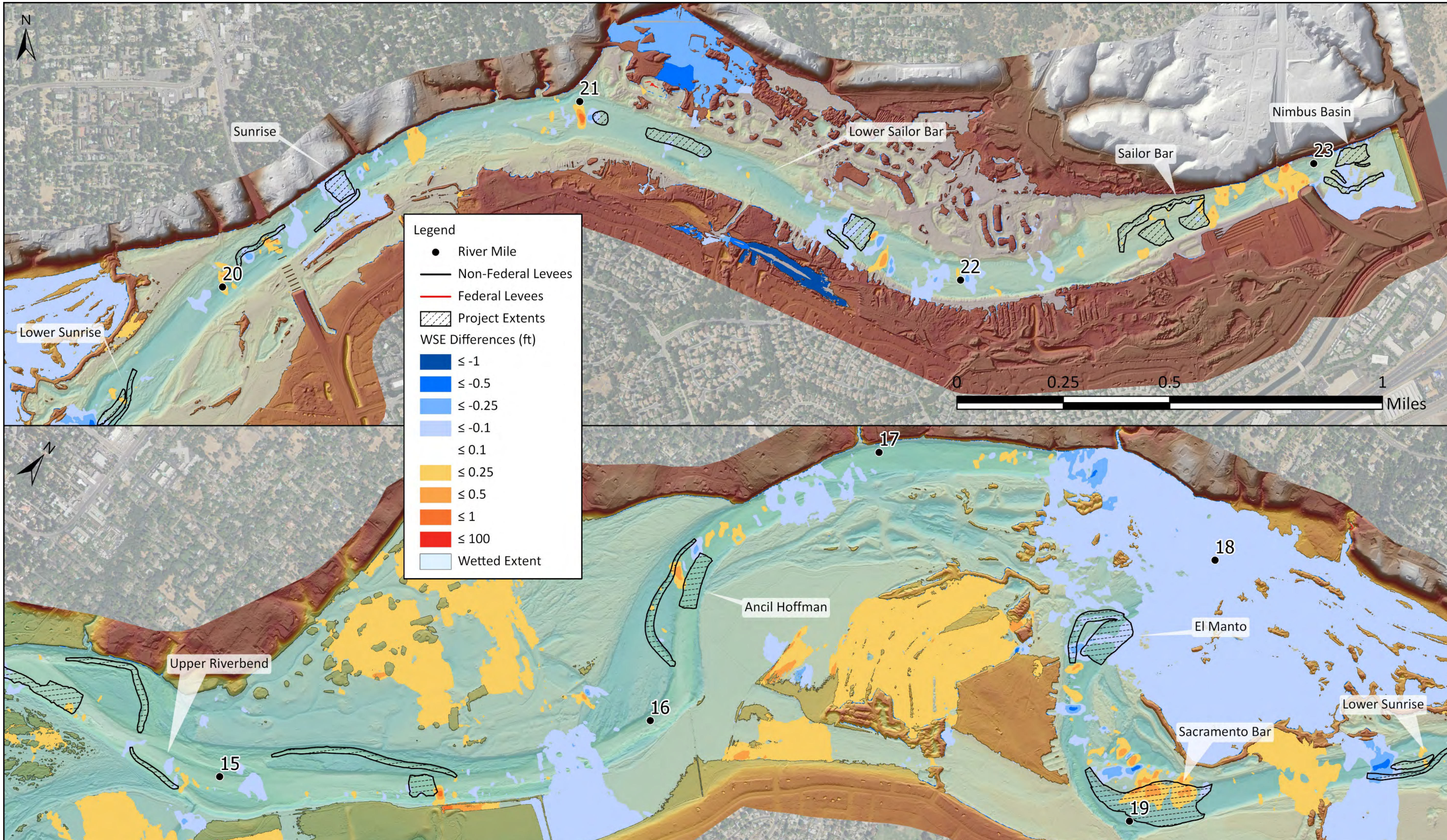
cbec eco engineering

Lower American River Salmonid Habitat Improvement Project

Lower EG vs. HG 160,000 cfs WSE

Project No. 18-1025	Created By: MDW	**Figure 11**

Figure 12 – Upper EG vs. HG 192,000 cfs WSE



Notes: WSE differences between existing grade (EG) and historic grade (HG) (EG WSE minus HG WSE)

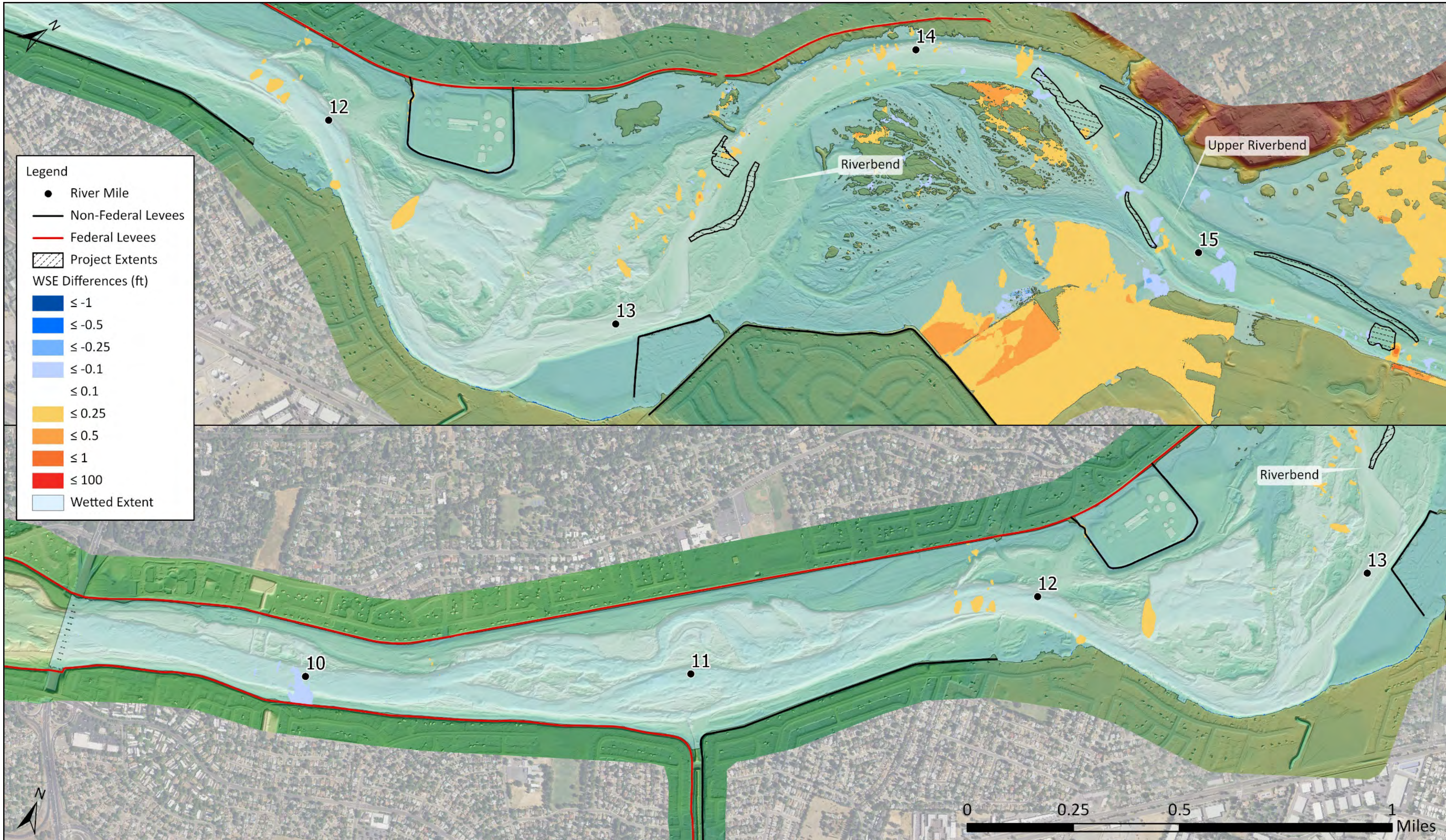
Lower American River Salmonid Habitat Improvement Project

Upper EG vs. HG 192,000 cfs WSE

Project No. 18-1025	Created By: MDW	**Figure 12**

D:\Projects\18-1025_LAR_GA\ArcPro\Figures\Final\R_cbec_Figure_Edit_Tool_v3\02_Outputs\2019-04-05__22_13_49\Figures\Figure_012.docx
4/5/2019

Figure 13 – Lower EG vs. HG 192,000 cfs WSE



Notes: WSE differences between existing grade (EG) and historic grade (HG) (EG WSE minus HG WSE)

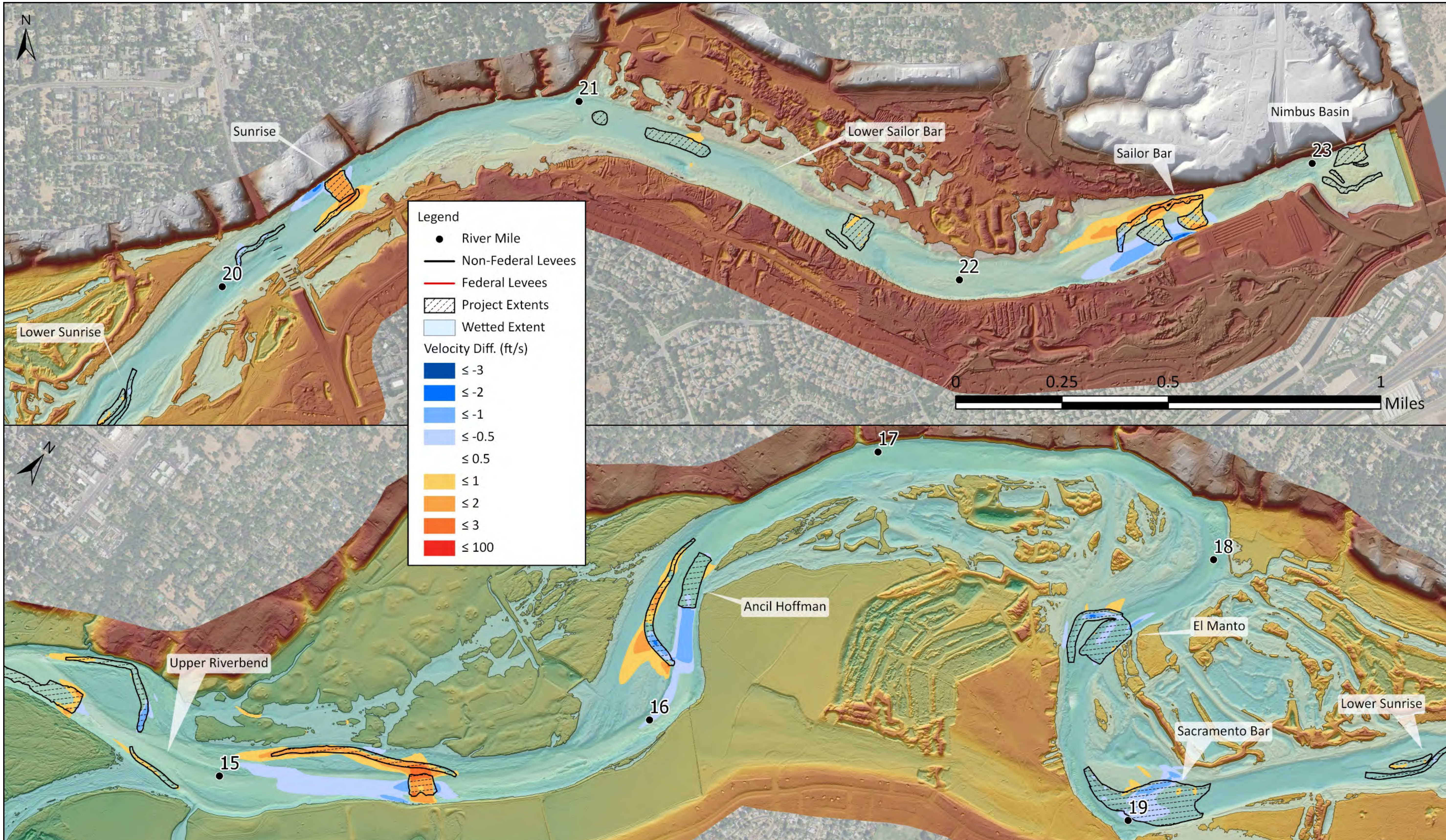
Lower American River Salmonid Habitat Improvement Project

Lower EG vs. HG 192,000 cfs WSE

Project No. 18-1025	Created By: MDW	**Figure 13**

D:\Projects\18-1025_LAR_GA\ArcPro\Figures\Final\R_cbec_Figure_Edit_Tool_v3\02_Outputs\2019-04-05__22_13_49\Figures\Figure_013.docx
4/5/2019

Figure 14 – Upper FG vs. EG 115,000 cfs Velocity



Notes: Velocity differences between future grade (FG) and existing grade (EG) (FG Velocity minus EG Velocity)

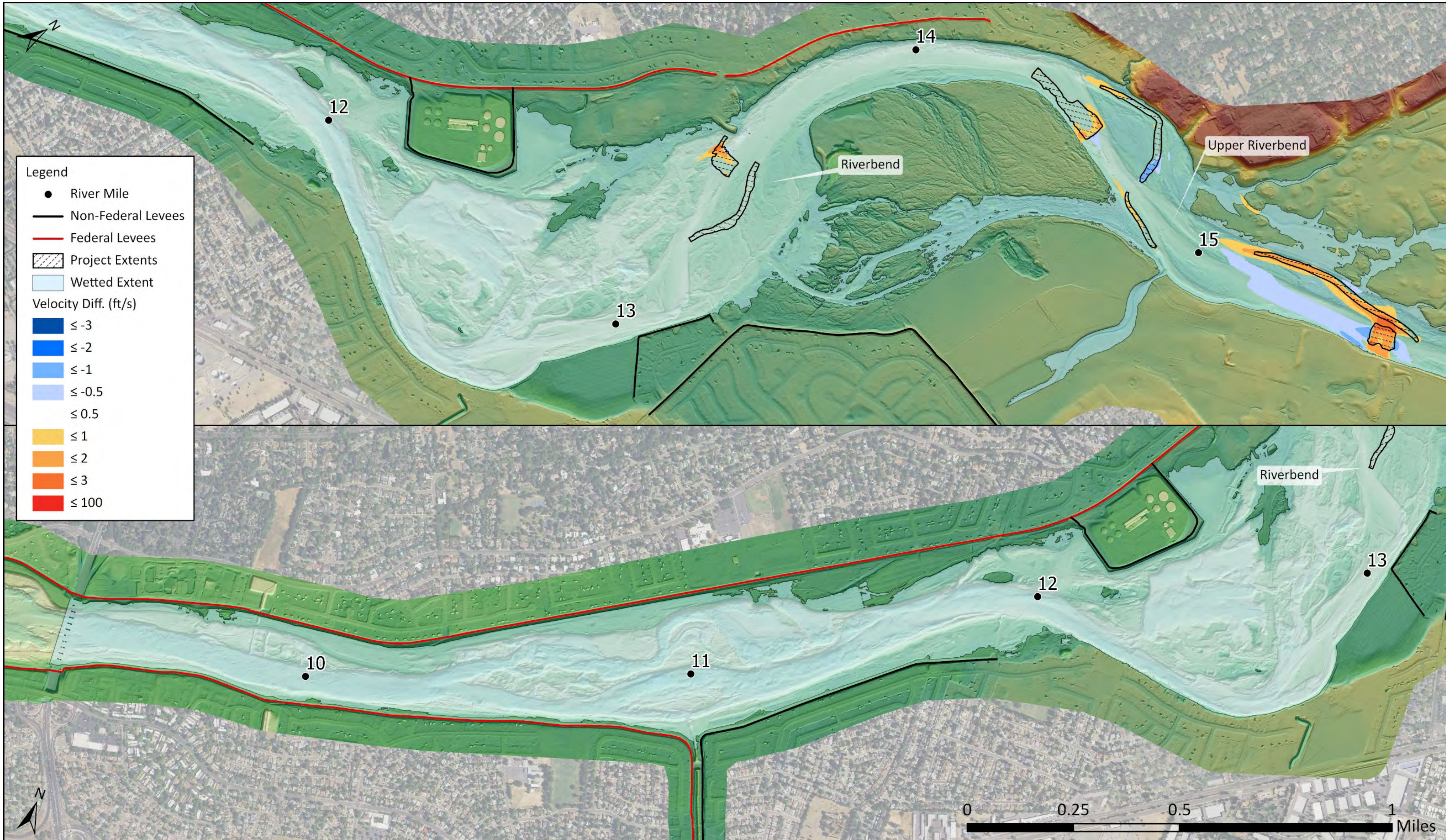
cbec eco engineering

Lower American River Salmonid Habitat Improvement Project

Upper FG vs. EG 115,000 cfs Velocity

Project No. 18-1025	Created By: MDW	**Figure 14**

Figure 15 – Lower FG vs. EG 115,000 cfs Velocity



Notes: Velocity differences between future grade (FG) and existing grade (EG) (FG Velocity minus EG Velocity)

cbec eco engineering

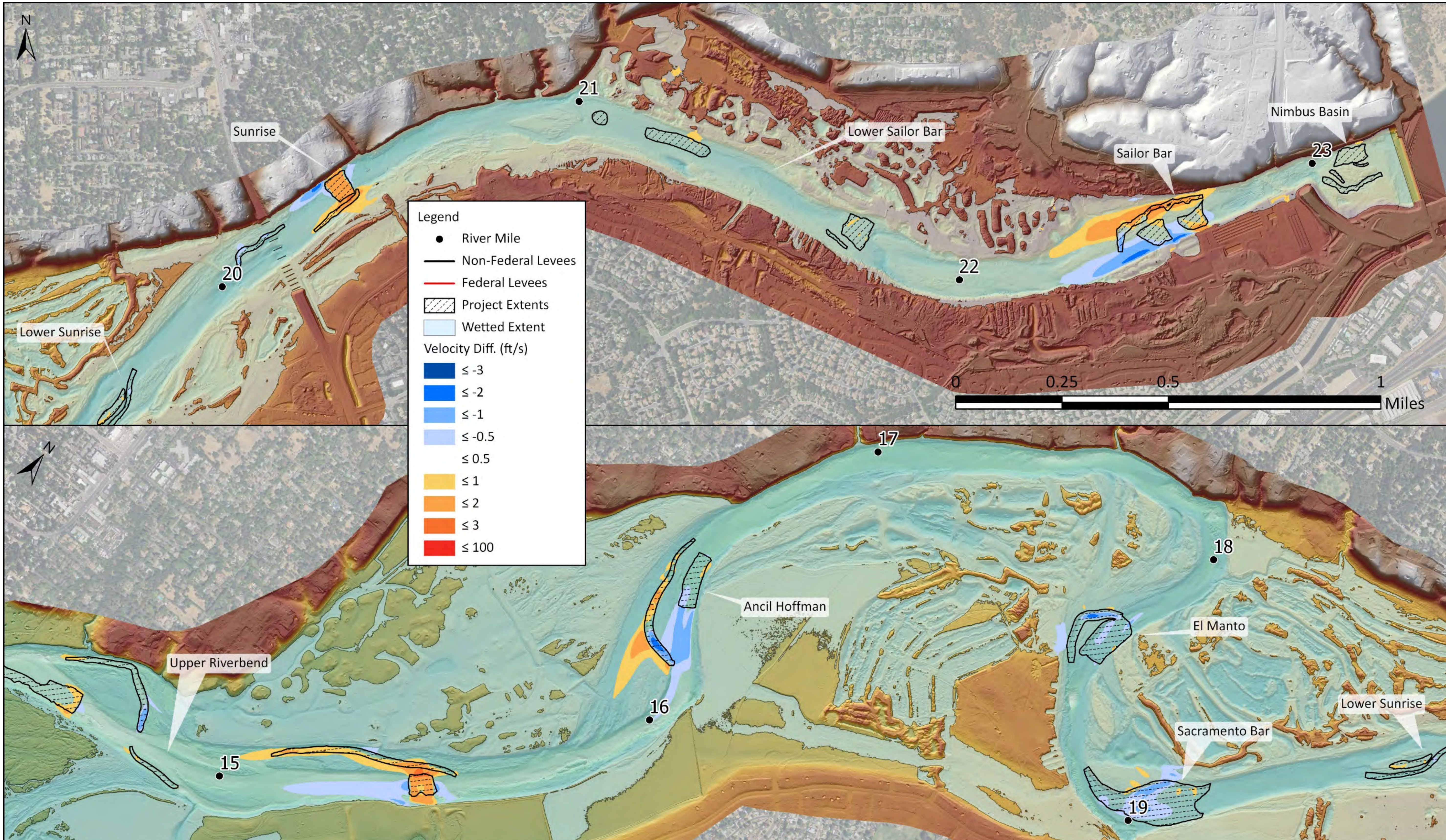
Lower American River Salmonid Habitat Improvement Project

Lower FG vs. EG 115,000 cfs Velocity

Project No. 18-1025	Created By: MDW	**Figure 15**

D:\Projects\18-1025_LAR_GA\ArcPro\Figures\Final\R_cbec_Figure_Edit_Tool_v3\02_Outputs\2019-04-05__22_13_49\Figures\Figure_015.docx
4/5/2019

Figure 16 – Upper FG vs. EG 160,000 cfs Velocity



Notes: Velocity differences between future grade (FG) and existing grade (EG) (FG Velocity minus EG Velocity)

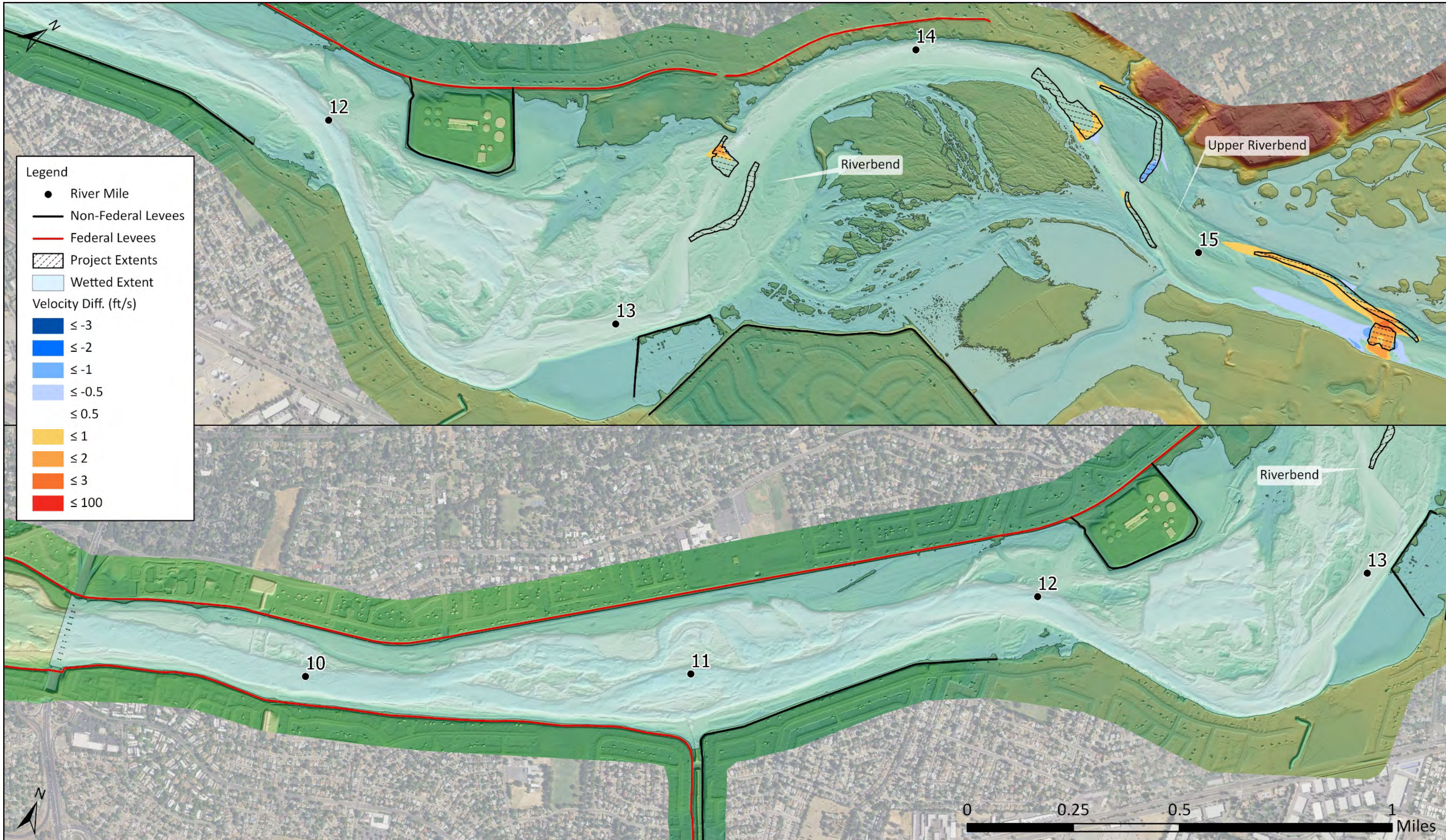
Lower American River Salmonid Habitat Improvement Project

Upper FG vs. EG 160,000 cfs Velocity

Project No. 18-1025 | Created By: MDW | **Figure 16**

D:\Projects\18-1025_LAR_GA\ArcPro\Figures\Final\R_cbec_Figure_Edit_Tool_v3\02_Outputs\2019-04-05__22_13_49\Figures\Figure_016.docx
4/5/2019

Figure 17 – Lower FG vs. EG 160,000 cfs Velocity



Notes: Velocity differences between future grade (FG) and existing grade (EG) (FG Velocity minus EG Velocity)

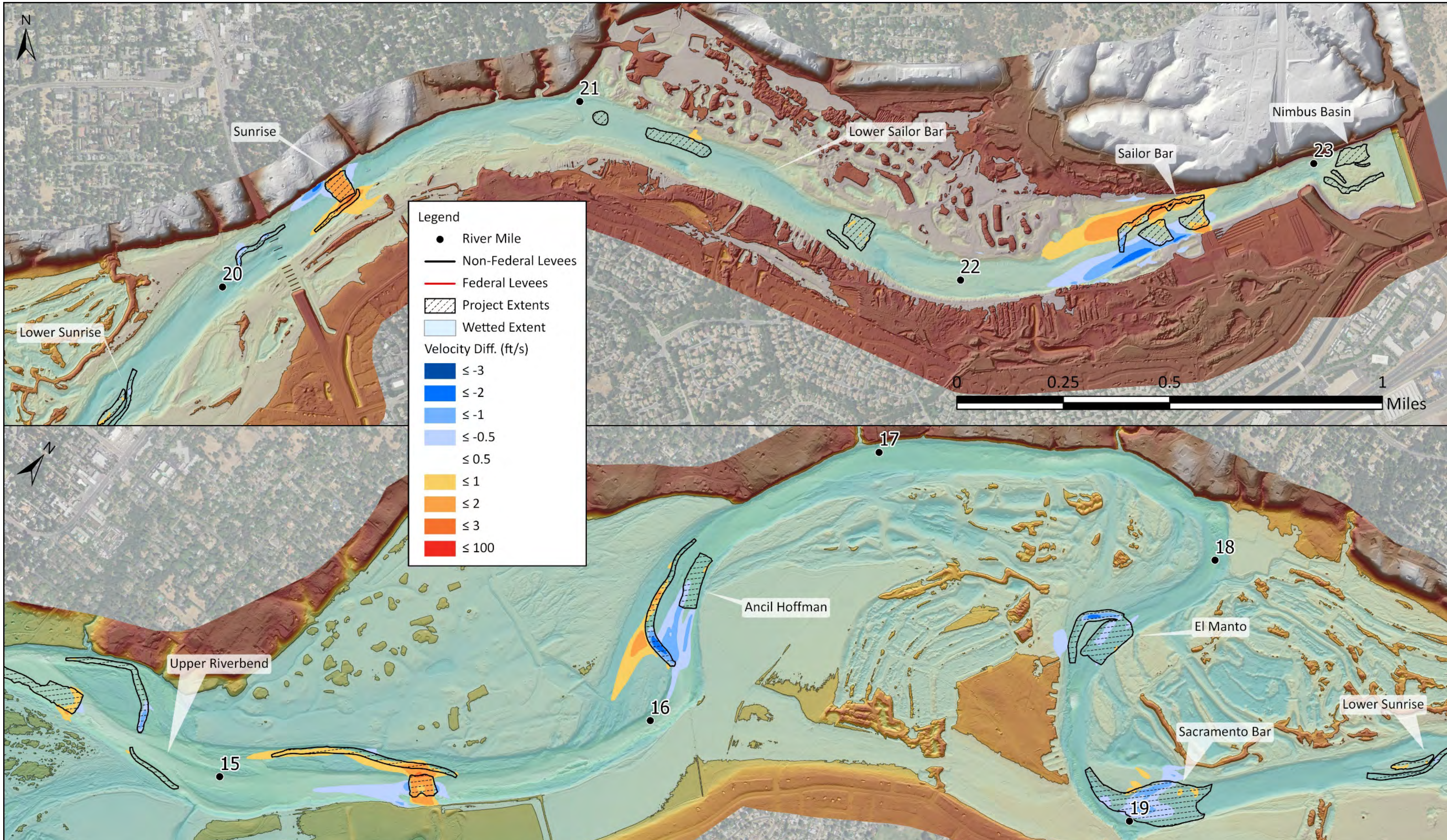
Lower American River Salmonid Habitat Improvement Project

Lower FG vs. EG 160,000 cfs Velocity

Project No. 18-1025	Created By: MDW	**Figure 17**

D:\Projects\18-1025_LAR_GA\ArcPro\Figures\Final\R_cbec_Figure_Edit_Tool_v3\02_Outputs\2019-04-05__22_13_49\Figures\Figure_017.docx
4/5/2019

Figure 18 – Upper FG vs. EG 192,000 cfs Velocity



Notes: Velocity differences between future grade (FG) and existing grade (EG) (FG Velocity minus EG Velocity)

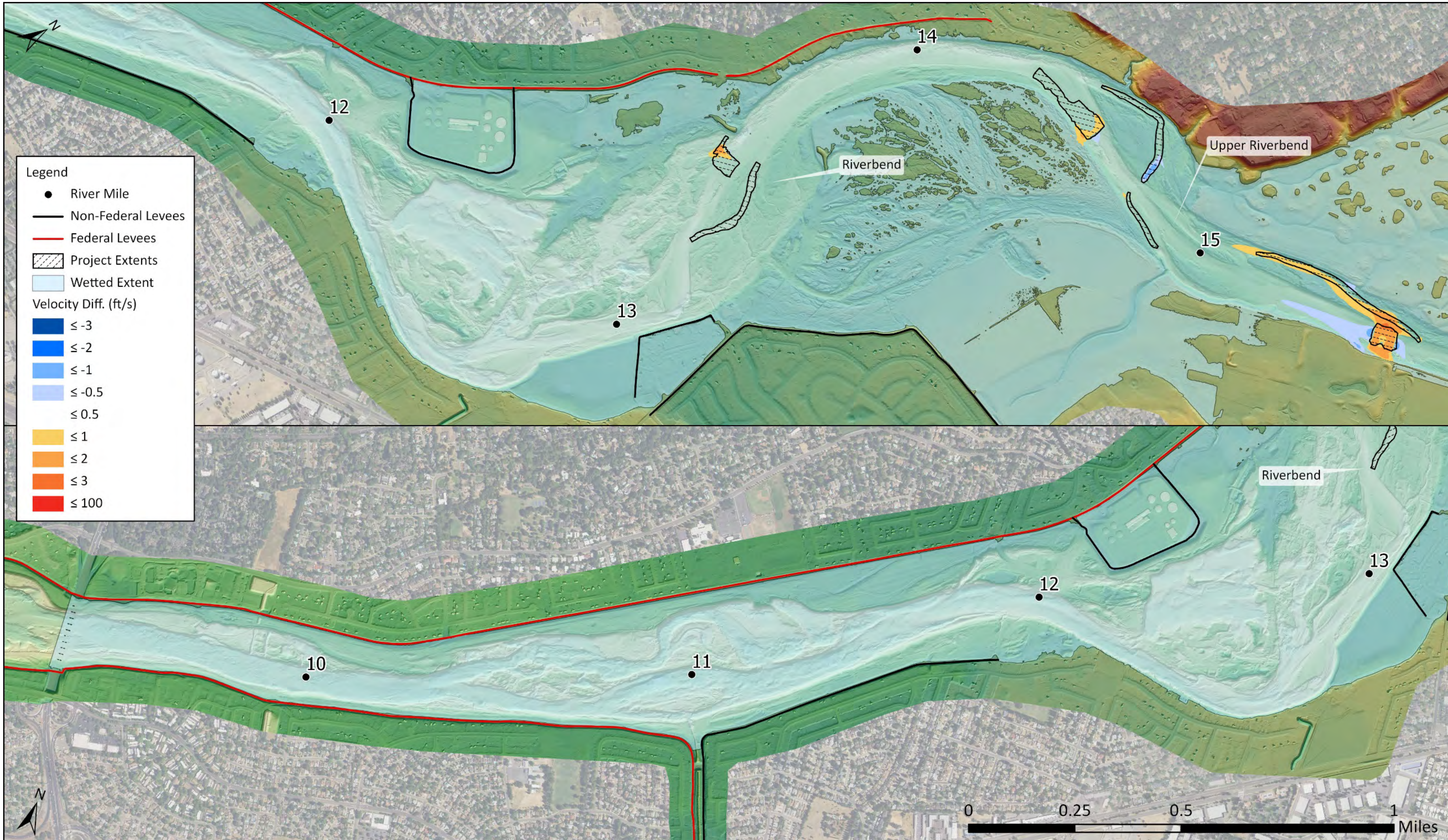
Lower American River Salmonid Habitat Improvement Project

Upper FG vs. EG 192,000 cfs Velocity

Project No. 18-1025	Created By: MDW	**Figure 18**

D:\Projects\18-1025_LAR_GA\ArcPro\Figures\Final\R_cbec_Figure_Edit_Tool_v3\02_Outputs\2019-04-05__22_13_49\Figures\Figure_018.docx
4/5/2019

Figure 19 – Lower FG vs. EG 192,000 cfs Velocity



Notes: Velocity differences between future grade (FG) and existing grade (EG) (FG Velocity minus EG Velocity)

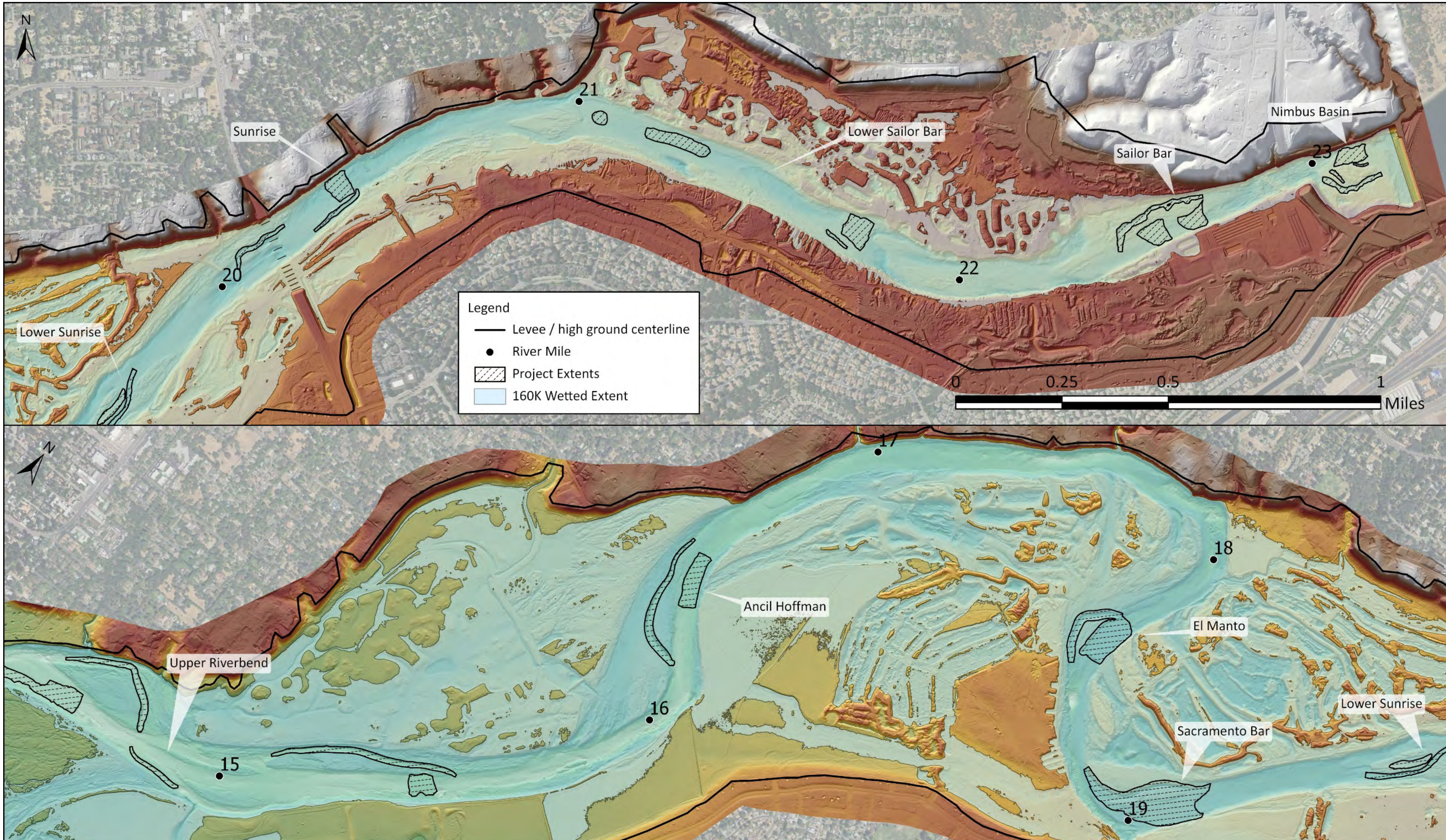
cbec eco engineering

Lower American River Salmonid Habitat Improvement Project

Lower FG vs. EG 192,000 cfs Velocity

Project No. 18-1025	Created By: MDW	**Figure 19**

Figure 20 – Upper Freeboard Centerlines



Notes: Black lines show the levee and high ground delineation for freeboard calculations

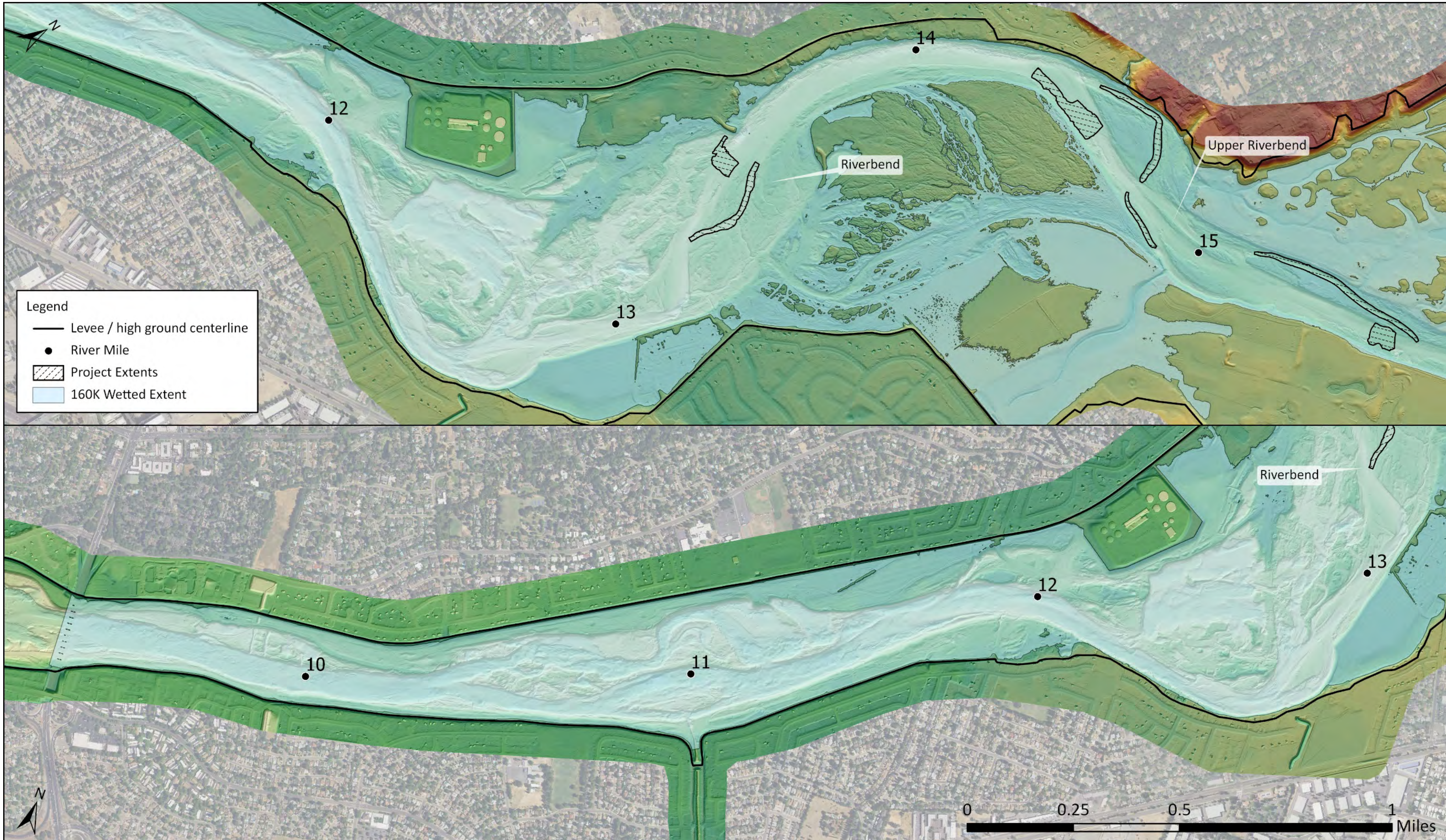
Lower American River Salmonid Habitat Improvement Project

Upper Freeboard Centerlines

Project No. 18-1025 | Created By: MDW | **Figure 20**

D:\Projects\18-1025_LAR_GA\ArcPro\Figures\Final\R_cbec_Figure_Edit_Tool_v3\02_Outputs\2019-04-05__22_13_49\Figures\Figure_020.docx
4/5/2019

Figure 21 – Lower Freeboard Centerlines



Notes: Black lines show the levee and high ground delineation for freeboard calculations

cbec eco engineering

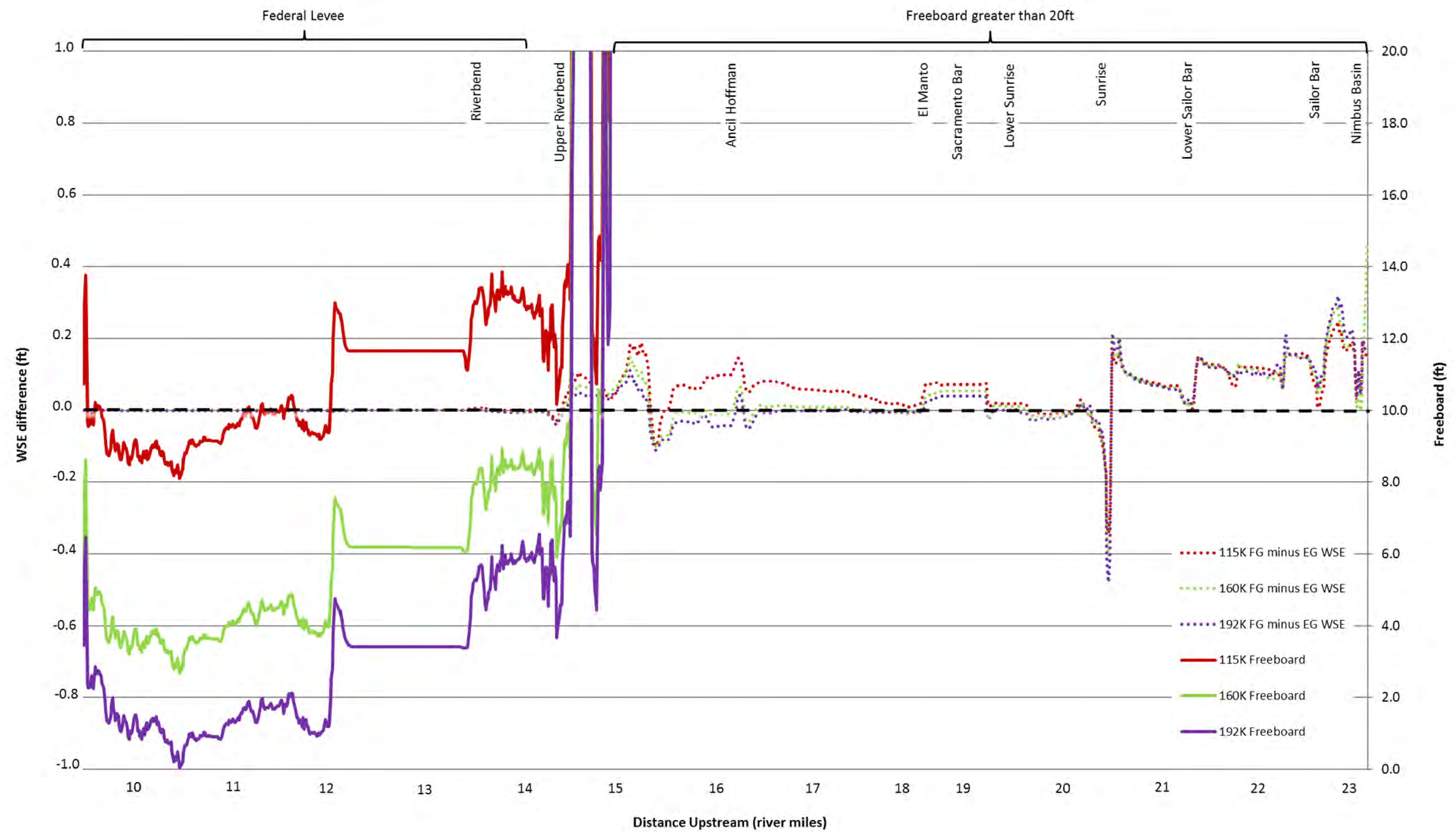
Lower American River Salmonid Habitat Improvement Project

Lower Freeboard Centerlines

Project No. 18-1025	Created By: MDW	**Figure 21**

D:\Projects\18-1025_LAR_GA\ArcPro\Figures\Final\R_cbec_Figure_Edit_Tool_v3\02_Outputs\2019-04-05__22_13_49\Figures\Figure_021.docx
4/5/2019

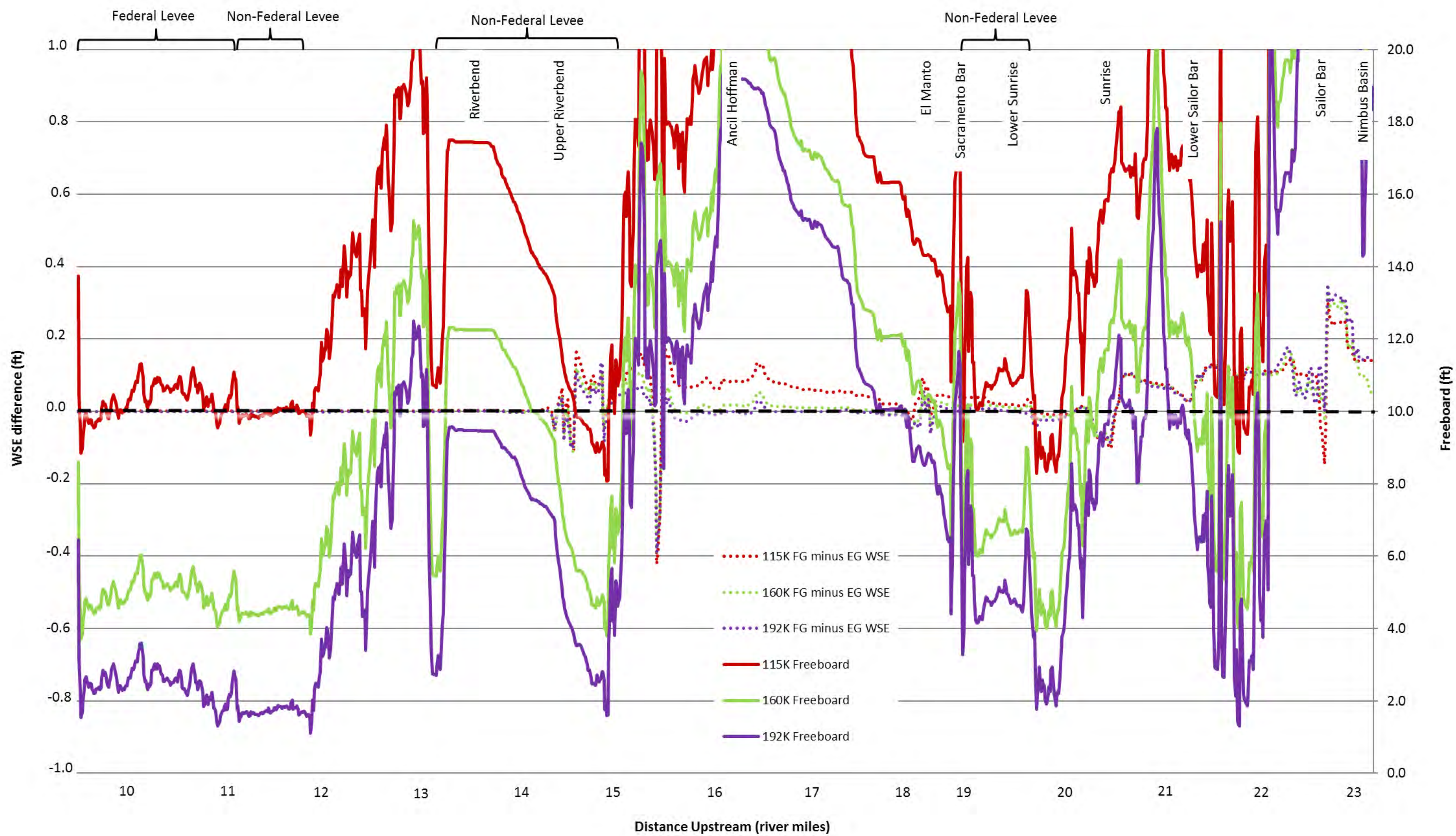
Figure 22 – North Bank Longitudinal Profile



Notes: WSE differences (FG WSE minus EG WSE) and freeboard calculations for the north bank of the river	cbec eco engineering	*Lower American River Salmonid Habitat Improvement Project* **North Bank Longitudinal Profile**		
		Project No. 18-1025	Created By: MDW	**Figure 22**

D:\Projects\18-1025_LAR_GA\ArcPro\Figures\Final\R_cbec_Figure_Edit_Tool_v3\02_Outputs\2019-04-05__22_13_49\Figures\Figure_022.docx
4/5/2019

Figure 23 – South Bank Longitudinal Profile



Notes: WSE differences (FG WSE minus EG WSE) and freeboard calculations for the south bank of the river

cbec eco engineering

Lower American River Salmonid Habitat Improvement Project

South Bank Longitudinal Profile

Project No. 18-1025 | Created By: MDW | **Figure 23**

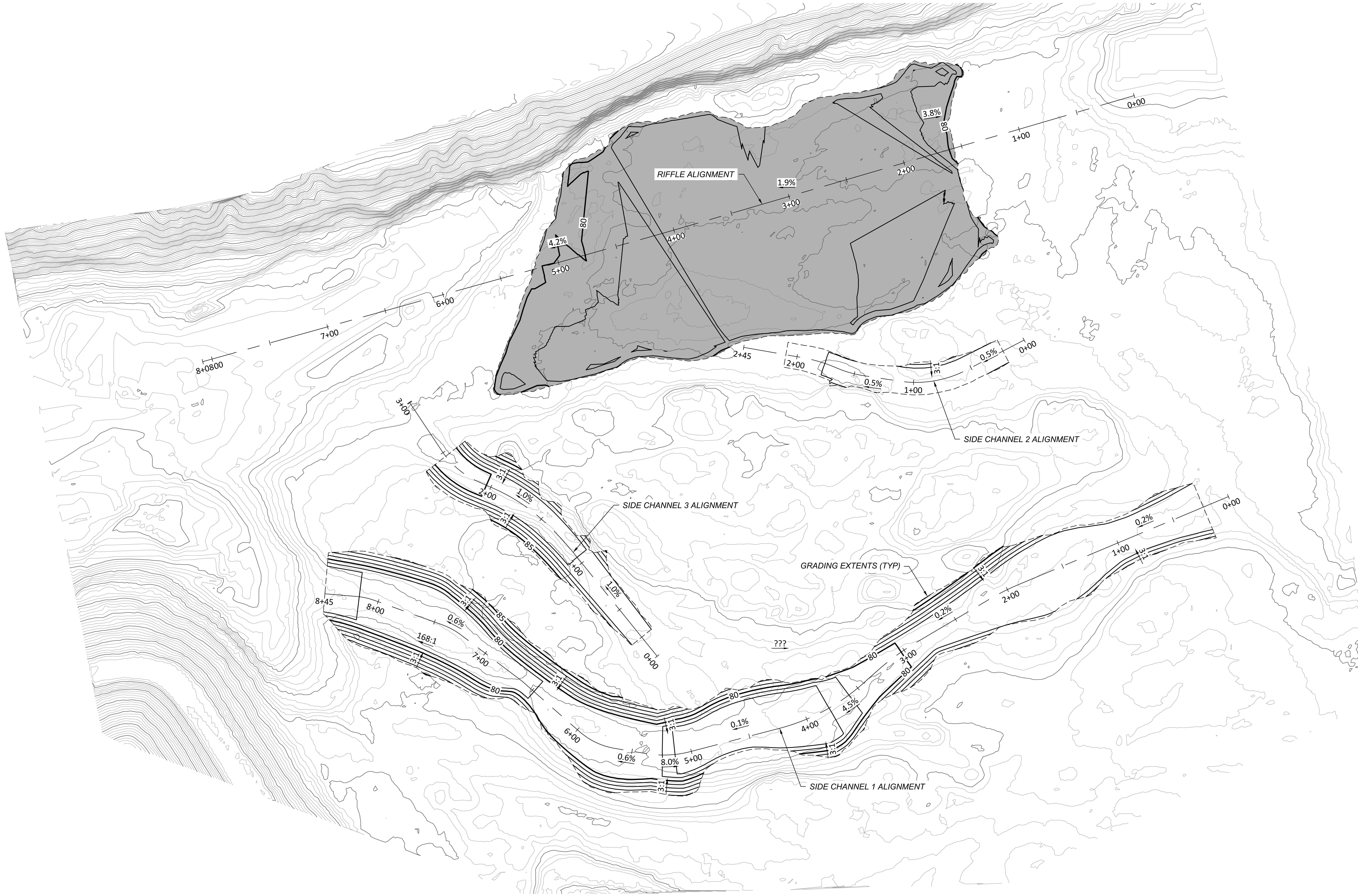
D:\Projects\18-1025_LAR_GA\ArcPro\Figures\Final\R_cbec_Figure_Edit_Tool_v3\02_Outputs\2019-04-05__22_13_49\Figures\Figure_023.docx
4/5/2019

APPENDIX A

FUTURE SITES DRAWINGS

A B C D E

1 2 3 4



0 40 80 120 FT

1" = 40'

PLAN VIEW

SCALE: 1" = 40'

USE OF DOCUMENTS
THIS DOCUMENT, INCLUDING THE INCORPORATED DESIGNS, IS AN INSTRUMENT OF SERVICE FOR THIS PROJECT AND SHALL NOT BE USED FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF cbec, inc.

DOCUMENT RELEASE	PRELIMINARY DRAFT
REVISION NOTES	

DESIGNED ---- DRAWN ---- REVIEWED ---- APPROVED ----

PREPARED BY: cbec eco engineering

SACRAMENTO WATER FORUM
1330 21ST ST, SUITE 103
SACRAMENTO, CA 95811
(916) 808-1993

CLIENT: WATER FORUM

SACRAMENTO CALIFORNIA

LAR SALMONID REARING HABITAT IMPROVEMENT FUTURE SITES MODELING NIMBUS BASIN PLAN

JOB NUMBER 18-1025

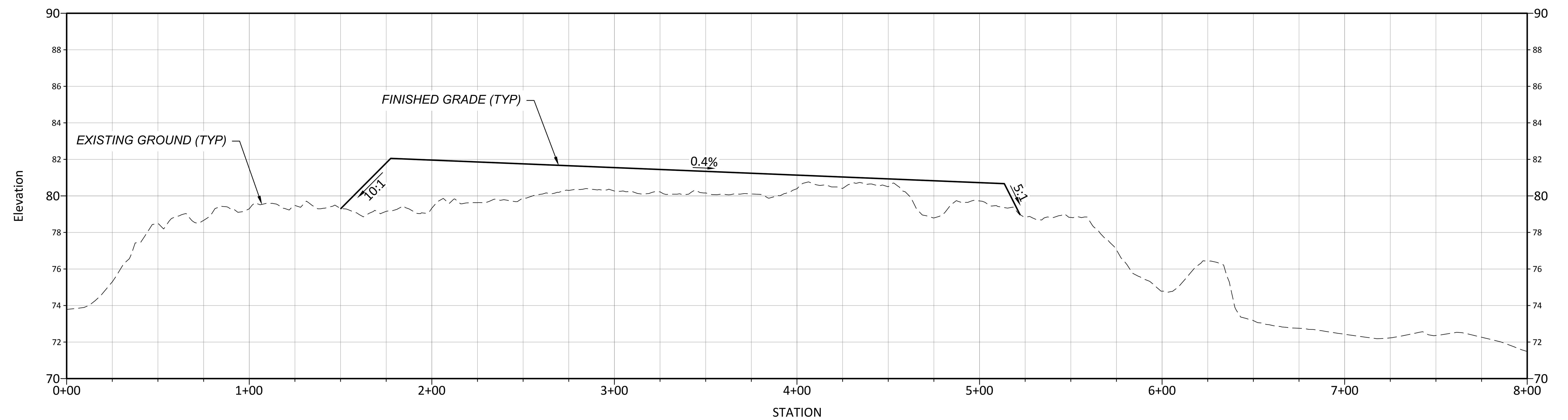
DATE FEB 2019

SHEET C1

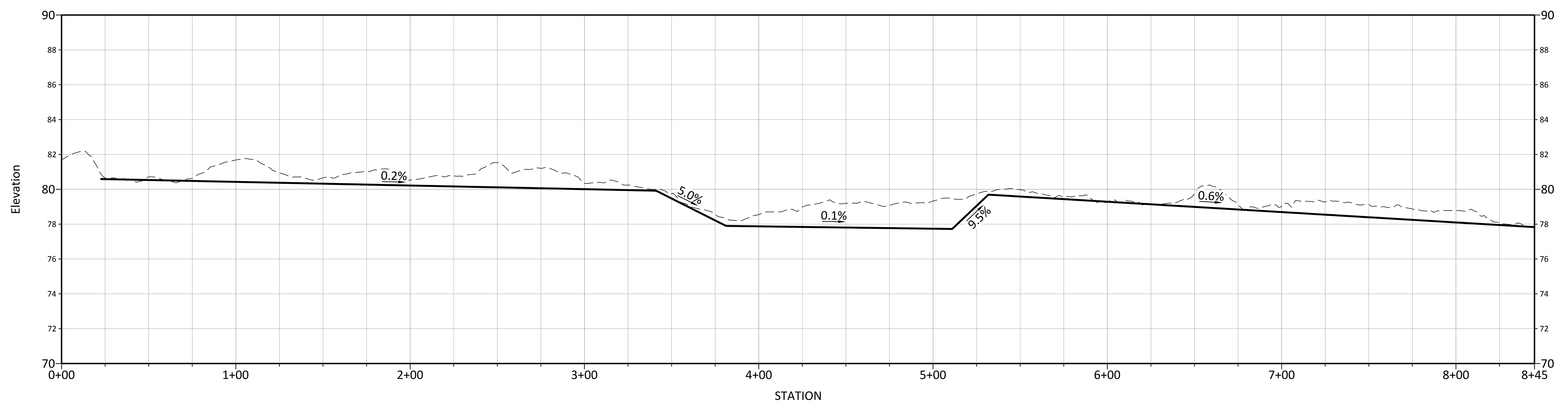
1 OF 13

LOCATION: c:\Work\Projects\18-1025_lar_future_site_modeling\400_Data\403_CAD_DWGS\production\Nimbus_Basin.dwg

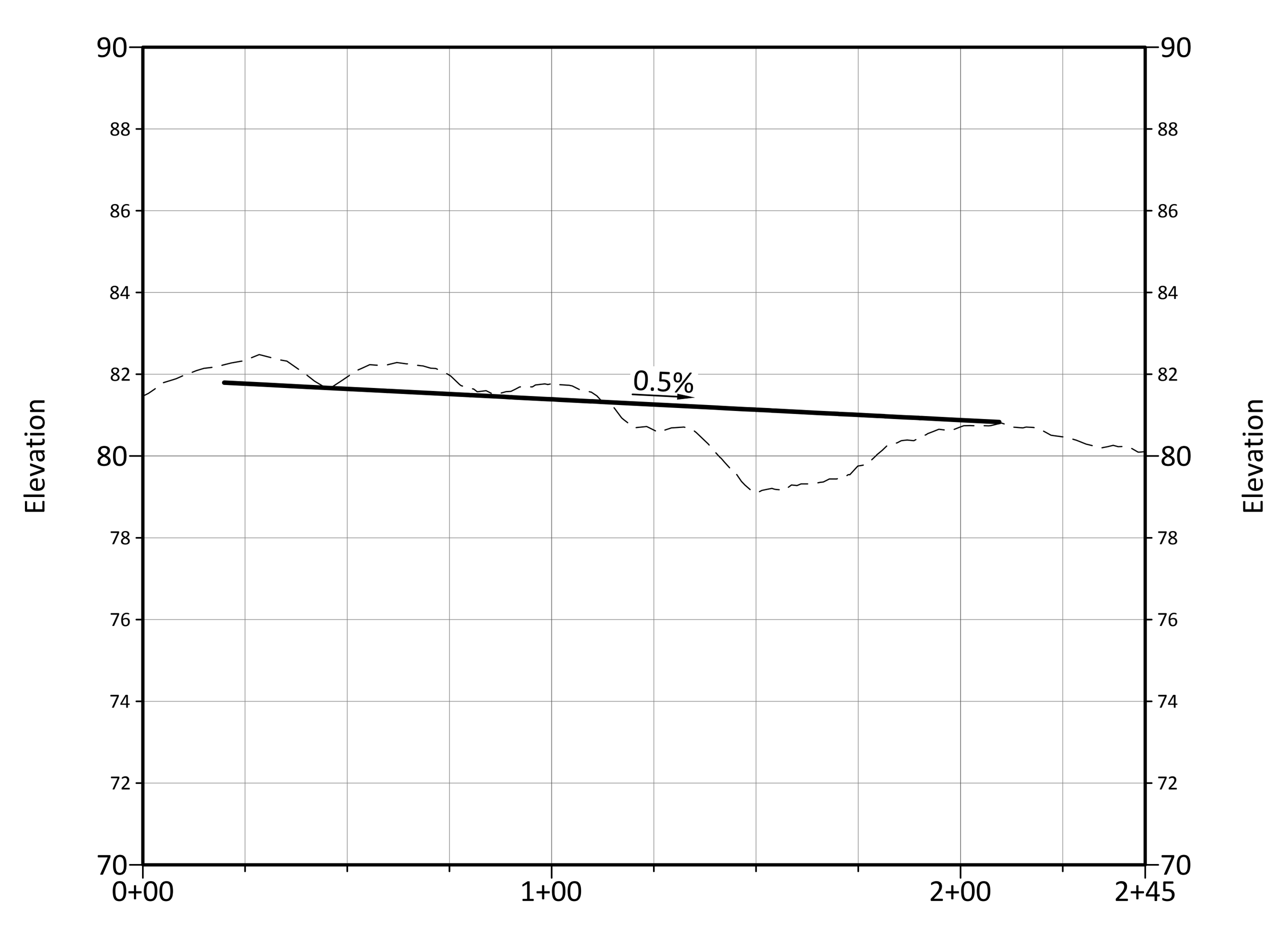
PLOT:4/2/2019



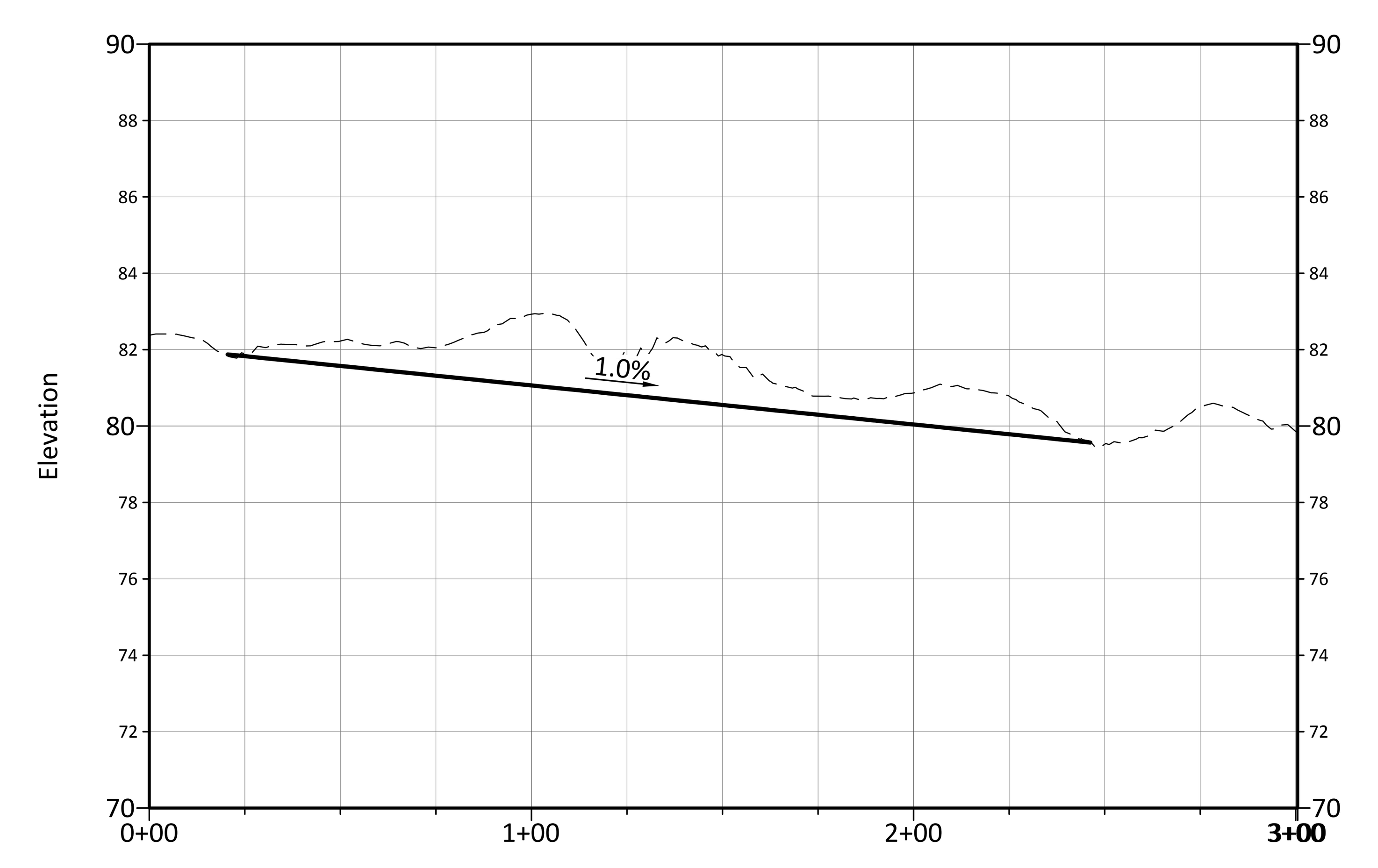
RIFFLE PROFILE
SCALE: 1" = 40'H; 1" = 4'V



SIDE CHANNEL 1 PROFILE
SCALE: 1" = 40'H; 1" = 4'V



SIDE CHANNEL 2 PROFILE
SCALE: 1" = 40'H; 1" = 4'V



SIDE CHANNEL 3 PROFILE
SCALE: 1" = 40'H; 1" = 4'V

0 4 8 12 FT
1" = 4'

0 40 80 120 FT
1" = 40'

DOCUMENT RELEASE
PRELIMINARY DRAFT
REVISION NOTES

DESIGNED ---- | DRAWN ---- | REVIEWED ---- | APPROVED ----

PREPARED BY: cbec eco engineering

CLIENT: SACRAMENTO WATER FORUM
1330 21ST ST, SUITE 103
SACRAMENTO, CA 95811
(916) 808-1993

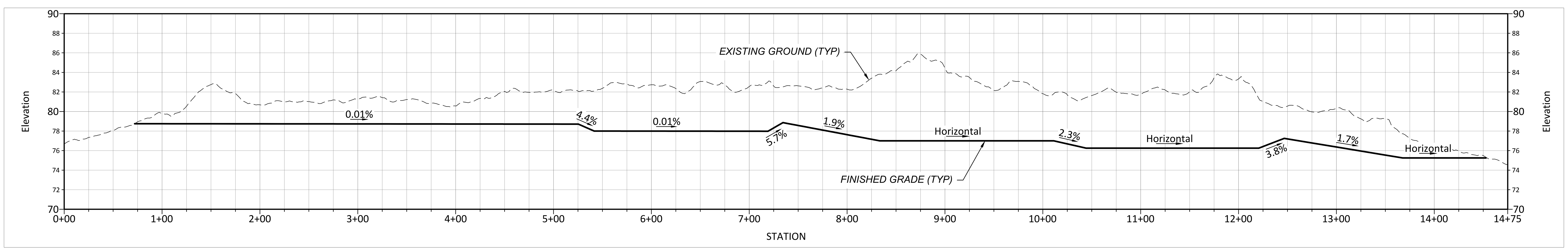
SACRAMENTO CALIFORNIA

LAR SALMONID REARING HABITAT IMPROVEMENT FUTURE SITES MODELING NIMBUS BASIN PROFILES

JOB NUMBER 18-1025
DATE FEB 2019
SHEET C2
2 OF 13

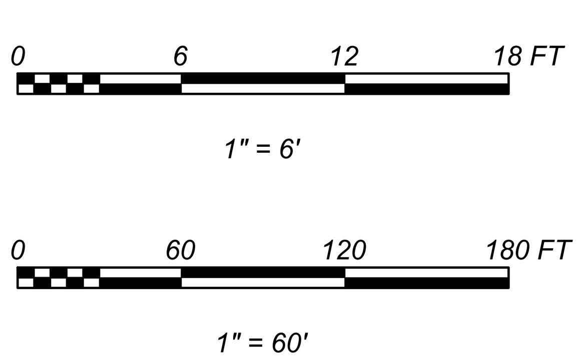
PLAN VIEW

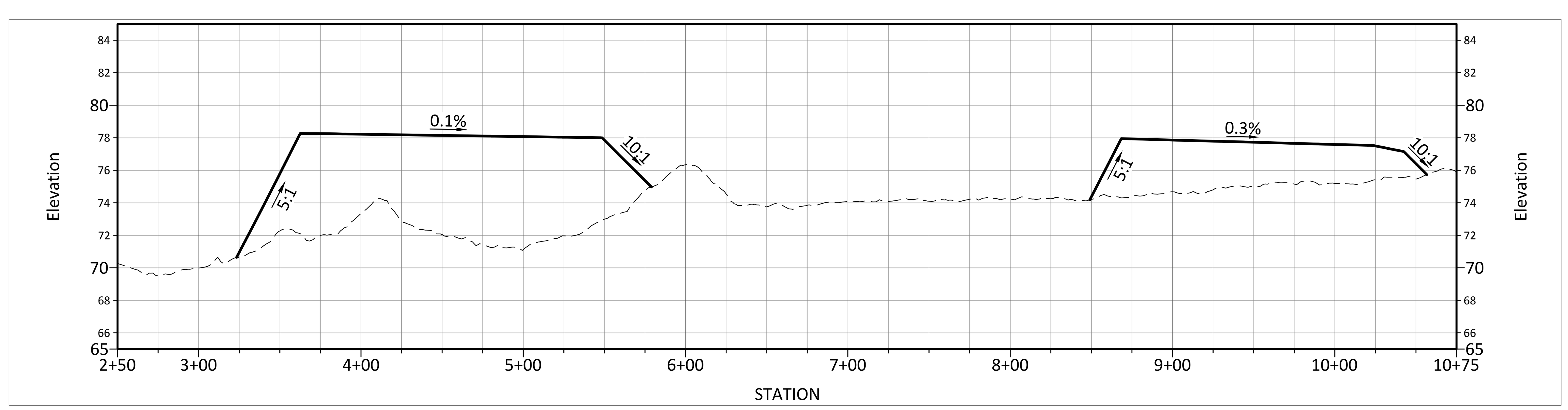
SCALE: 1" = 60'



SIDE CHANNEL PROFILE

SCALE: 1" = 60'H; 1" = 6'V





RIFFLE PROFILE

SCALE: 1" = 60'H; 1" = 6'V

USE OF DOCUMENTS
THIS DOCUMENT, INCLUDING THE INCORPORATED DESIGNS, IS AN INSTRUMENT OF SERVICE FOR THIS PROJECT AND SHALL NOT BE USED FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF cbec, inc.

DOCUMENT RELEASE: PRELIMINARY DRAFT

REVISION NOTES

DESIGNED ----
DRAWN ----
REVIEWED ----
APPROVED ----

PREPARED BY: cbec eco engineering

SACRAMENTO WATER FORUM
1330 21ST ST, SUITE 103
SACRAMENTO, CA 95811
(916) 808-1993

CLIENT: WATER FORUM

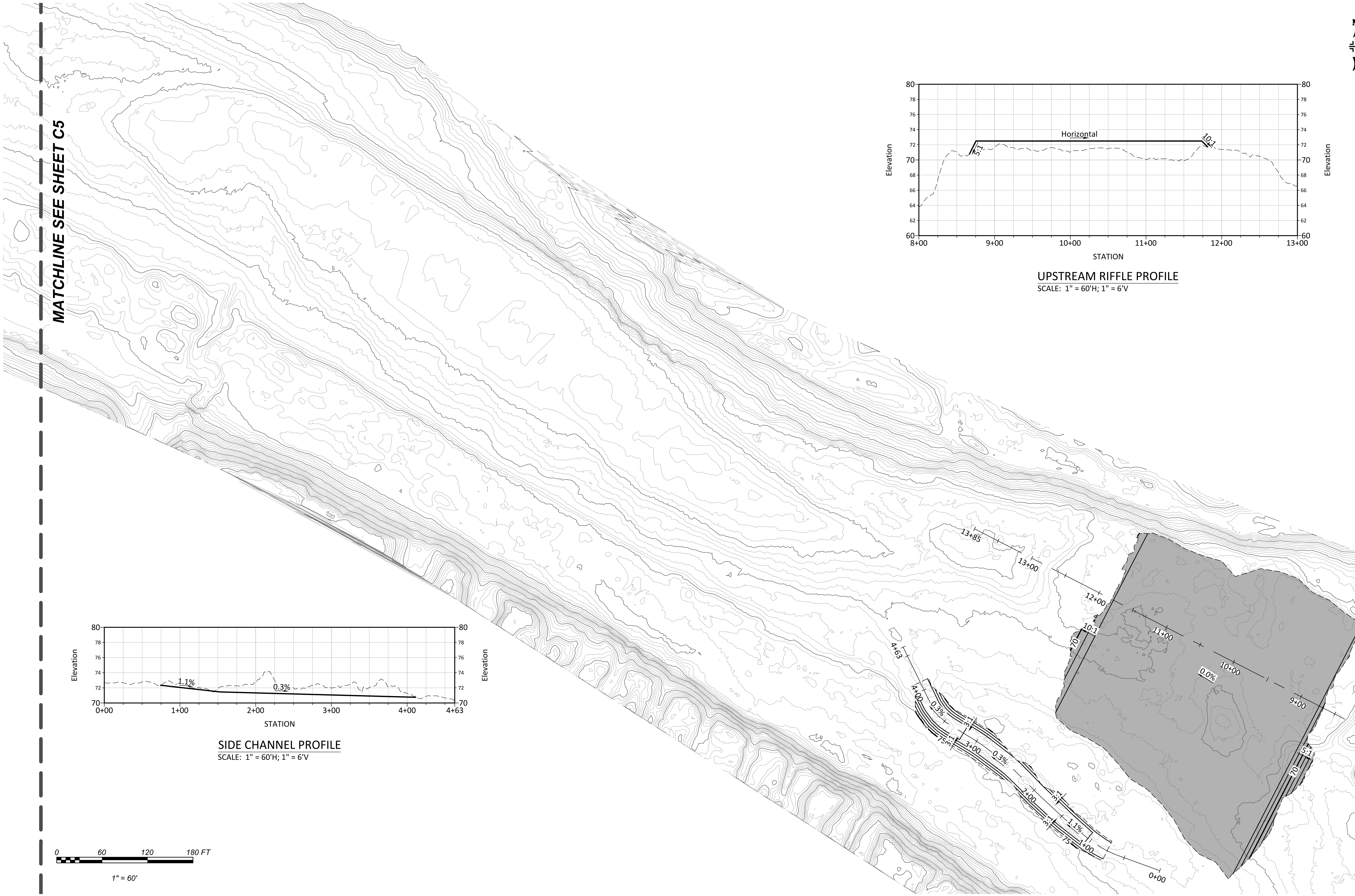
SACRAMENTO CALIFORNIA
LAR SALMONID REARING HABITAT IMPROVEMENT
FUTURE SITES MODELING
UPPER SAILOR BAR PLAN AND PROFILES

JOB NUMBER 18-1025

DATE FEB 2019

SHEET C3

3 OF 13



PLAN VIEW
SCALE: 1" = 60'

UPSTREAM RIFFLE PROFILE
SCALE: 1" = 60'H; 1" = 6'V

SIDE CHANNEL PROFILE
SCALE: 1" = 60'H; 1" = 6'V

DOCUMENT RELEASE: PRELIMINARY DRAFT
REVISION NOTES

DESIGNED ---- | DRAWN ---- | REVIEWED ---- | APPROVED ----

PREPARED BY: cbec eco engineering

SACRAMENTO WATER FORUM
1330 21ST ST, SUITE 103
SACRAMENTO, CA 95811
(916) 808-1993

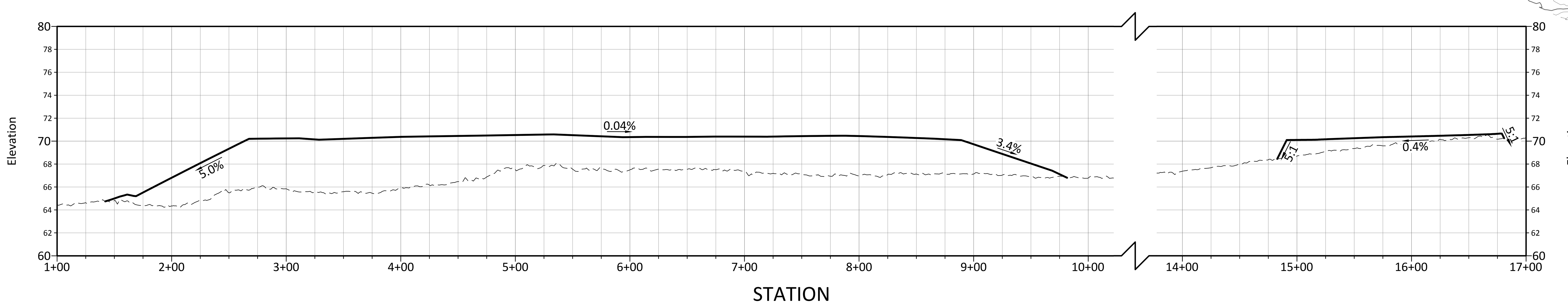
CLIENT: WATER FORUM

SACRAMENTO CALIFORNIA
LAR SALMONID REARING HABITAT IMPROVEMENT FUTURE SITES MODELING
LOWER SAILOR BAR PLAN AND PROFILES 1

JOB NUMBER 18-1025
DATE FEB 2019
SHEET C4
4 OF 13

LOCATION: c:\Work\Projects\18-1025_lar_future_site_modeling\400_Data\403_CAD_DWGS\production\Lower_Sailor.dwg
PLOT:4/2/2019

PLAN VIEW
SCALE: 1" = 60'



DOWNSTREAM RIFFLES PROFILE
SCALE: 1" = 60'H; 1" = 6'V

0 6 12 18 FT
1" = 6'

0 60 120 180 FT
1" = 60'

USE OF DOCUMENTS
THIS DOCUMENT, INCLUDING THE INCORPORATED DESIGNS, IS AN INSTRUMENT OF SERVICE FOR THIS PROJECT AND SHALL NOT BE USED FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF cbec, inc.

DOCUMENT RELEASE
PRELIMINARY DRAFT
REVISION NOTES

DESIGNED ----
DRAWN ----
REVIEWED ----
APPROVED ----

PREPARED BY:
cbec eco engineering

CLIENT:
SACRAMENTO WATER FORUM
1330 21ST ST, SUITE 103
SACRAMENTO, CA 95811
(916) 808-1993

SACRAMENTO CALIFORNIA
LAR SALMONID REARING HABITAT IMPROVEMENT FUTURE SITES MODELING
LOWER SAILOR PLAN AND PROFILES 2

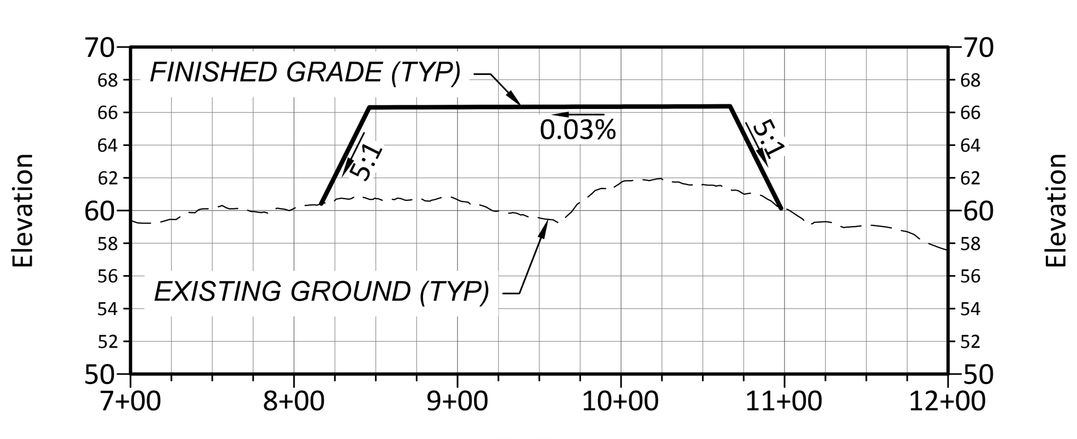
JOB NUMBER
18-1025

DATE
FEB 2019

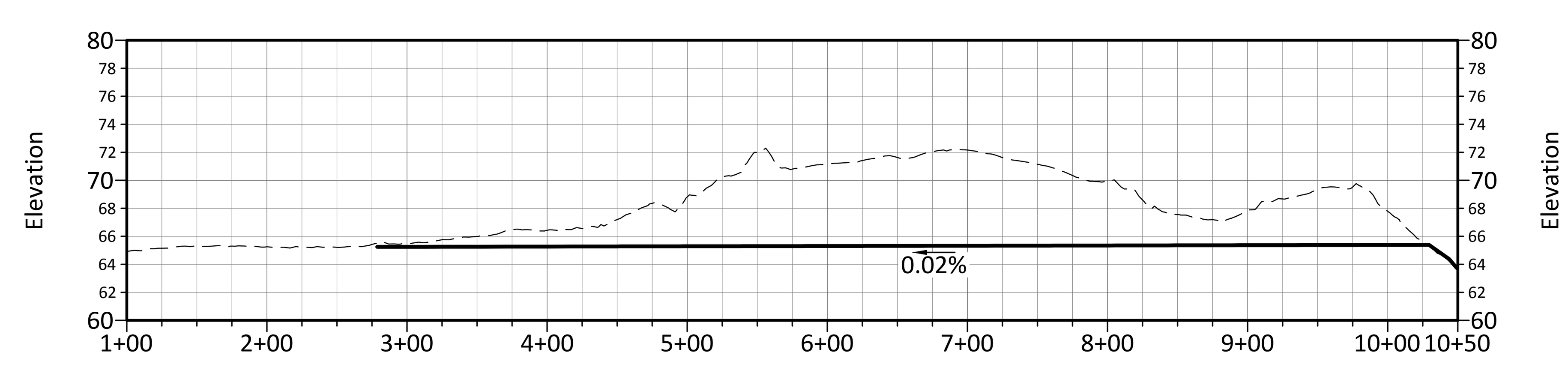
SHEET
C5
5 OF 13

LOCATION: c:\Work\Projects\18-1025_lar_future_site_modeling\400_Data\403_CAD_DWGS\production\Lower_Sailor.dwg
PLOT:4/2/2019

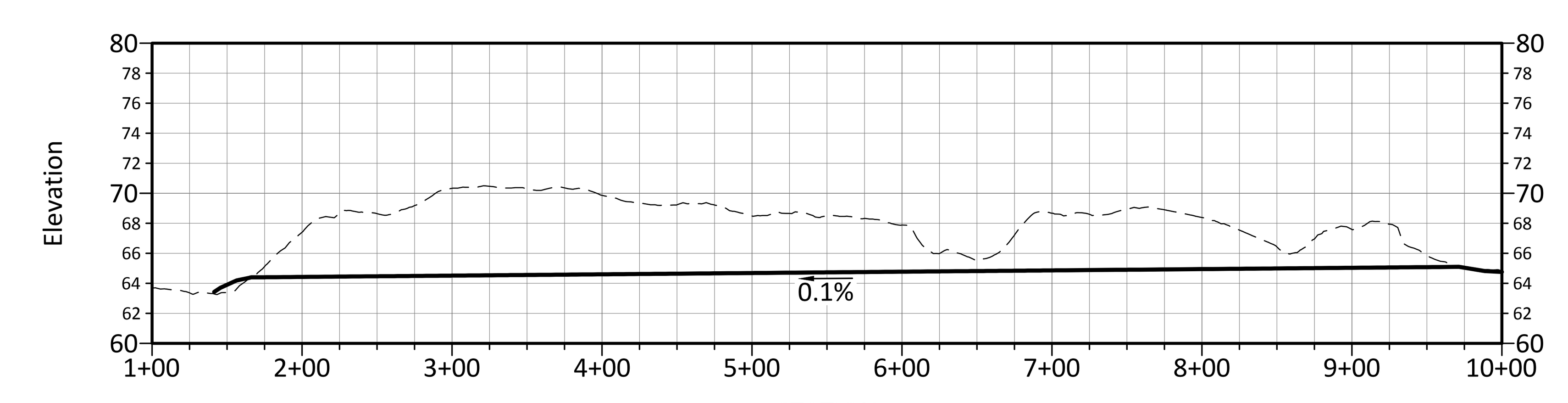
PLAN VIEW
SCALE: 1" = 100'



RIFFLE PROFILE
SCALE: 1" = 100'H; 1" = 10'V



UPSTREAM SIDE CHANNEL PROFILE
SCALE: 1" = 100'H; 1" = 10'V



DOWNSTREAM SIDE CHANNEL PROFILE
SCALE: 1" = 100'H; 1" = 10'V

0 100 200 300 FT
1" = 100'

0 10 20 30 FT
1" = 10'

USE OF DOCUMENTS
THIS DOCUMENT, INCLUDING THE INCORPORATED DESIGNS, IS AN INSTRUMENT OF SERVICE FOR THIS PROJECT AND SHALL NOT BE USED FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF cbec, inc.

DOCUMENT RELEASE
PRELIMINARY DRAFT
REVISION NOTES

DESIGNED ----
DRAWN ----
REVIEWED ----
APPROVED ----

PREPARED BY:
cbec eco engineering

SACRAMENTO WATER FORUM
1330 21ST ST, SUITE 103
SACRAMENTO, CA 95811
(916) 808-1993

CLIENT:
WATER FORUM

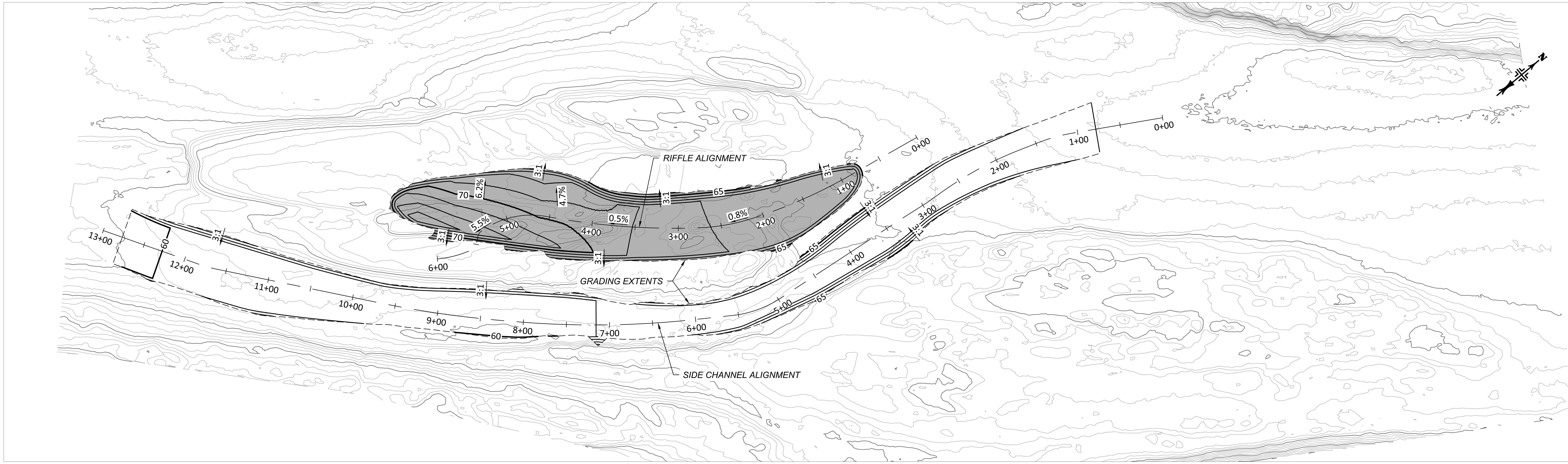
SACRAMENTO CALIFORNIA
LAR SALMONID REARING HABITAT IMPROVEMENT FUTURE SITES MODELING
SUNRISE PLAN AND PROFILES

JOB NUMBER
18-1025

DATE
FEB 2019

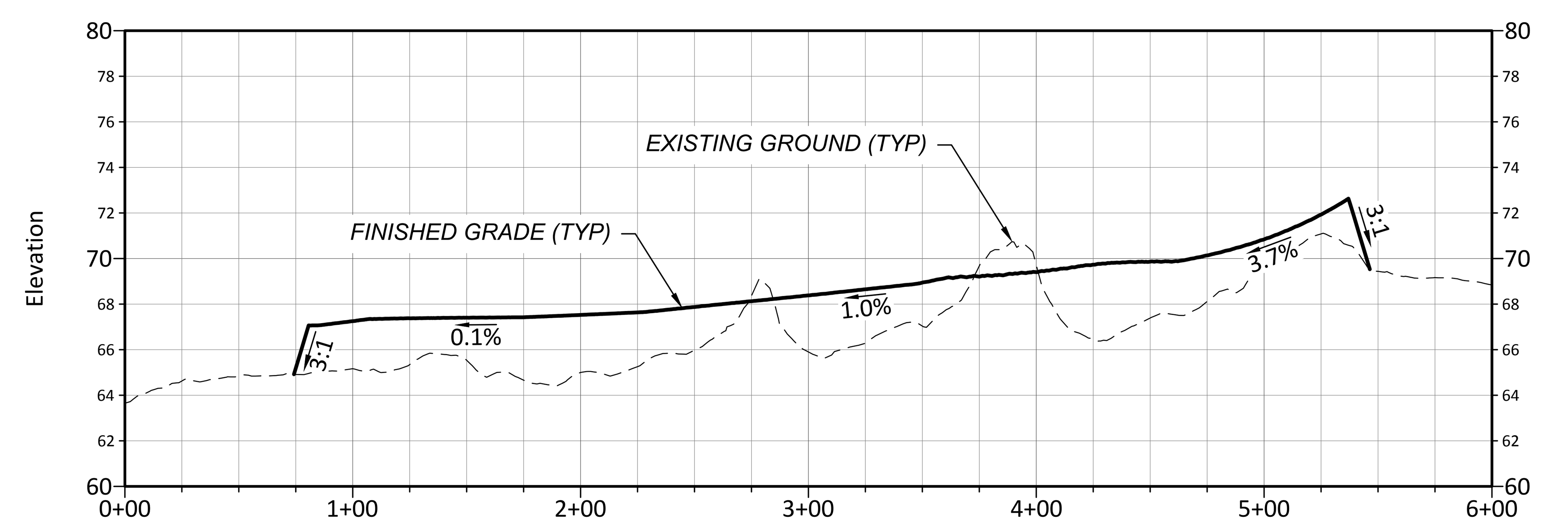
SHEET
C6
6 OF 13

A B C D E



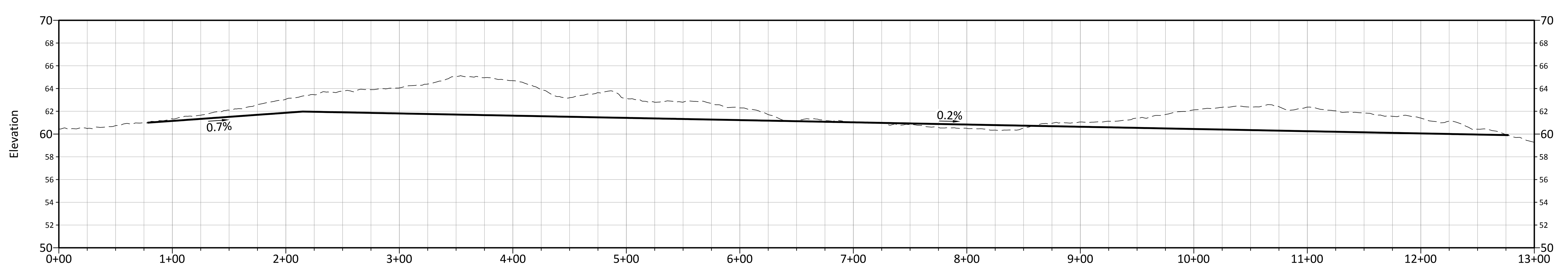
PLAN VIEW

SCALE: 1" = 60'



RIFFLE PROFILE

SCALE: 1" = 60'H; 1" = 6'V



SIDE CHANNEL PROFILE

SCALE: 1" = 60'H; 1" = 6'V

0 6 12 18 FT

1" = 6'

0 60 120 180 FT

1" = 60'

DOCUMENT RELEASE: PRELIMINARY DRAFT

REVISION NOTES

DESIGNED ---- | DRAWN ---- | REVIEWED ---- | APPROVED ----

PREPARED BY: cbec eco engineering

SACRAMENTO WATER FORUM
1330 21ST ST, SUITE 103
SACRAMENTO, CA 95811
(916) 808-1993

CLIENT: WATER FORUM

SACRAMENTO CALIFORNIA

LAR SALMONID REARING HABITAT IMPROVEMENT FUTURE SITES MODELING

LOWER SUNRISE PLAN AND PROFILES

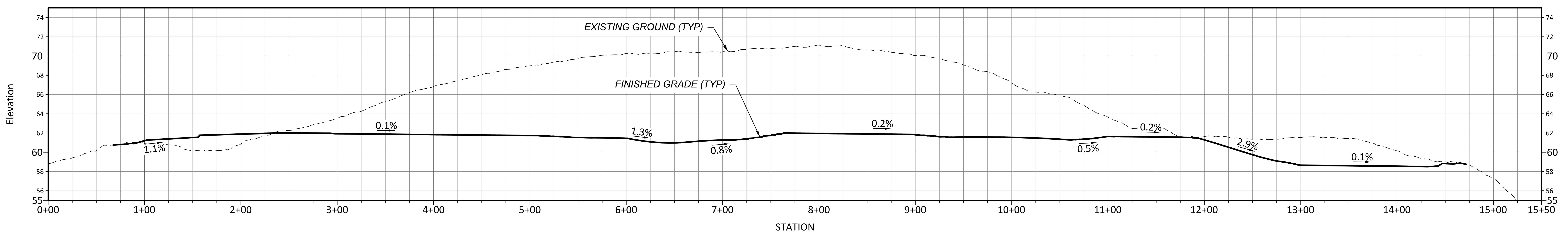
JOB NUMBER 18-1025

DATE FEB 2019

SHEET C7

7 OF 13

PLAN VIEW
SCALE: 1" = 60'



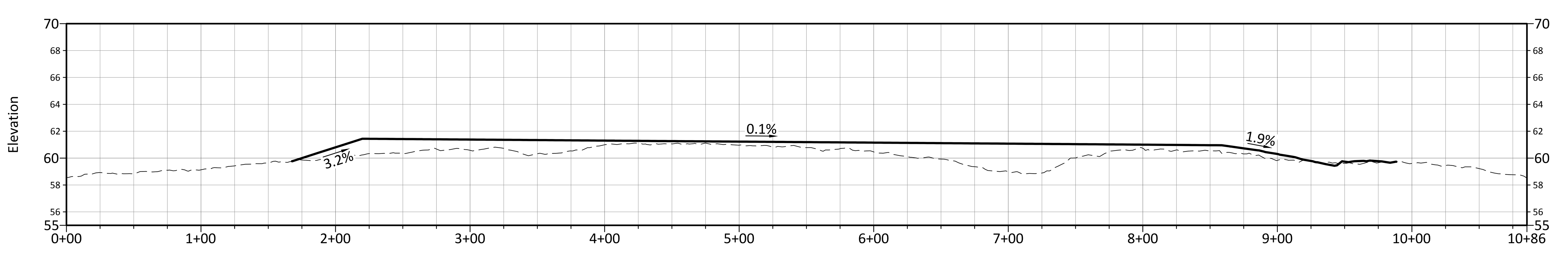
SIDE CHANNEL PROFILE
SCALE: 1" = 60'H; 1" = 6'V

0 6 12 18 FT

1" = 6'

0 60 120 180 FT

1" = 60'



RIFFLE PROFILE
SCALE: 1" = 60'H; 1" = 6'V

USE OF DOCUMENTS
THIS DOCUMENT, INCLUDING THE INCORPORATED DESIGNS, IS AN INSTRUMENT OF SERVICE FOR THIS PROJECT AND SHALL NOT BE USED FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF cbec, inc.

DOCUMENT RELEASE
PRELIMINARY DRAFT
REVISION NOTES

DESIGNED ----
DRAWN ----
REVIEWED ----
APPROVED ----

PREPARED BY:
cbec eco engineering

SACRAMENTO WATER FORUM
1330 21ST ST, SUITE 103
SACRAMENTO, CA 95811
(916) 808-1993

CLIENT:
WATER FORUM

SACRAMENTO CALIFORNIA

LAR SALMONID REARING HABITAT IMPROVEMENT FUTURE SITES MODELING
SACRAMENTO BAR PLAN AND PROFILES

JOB NUMBER
18-1025

DATE
FEB 2019

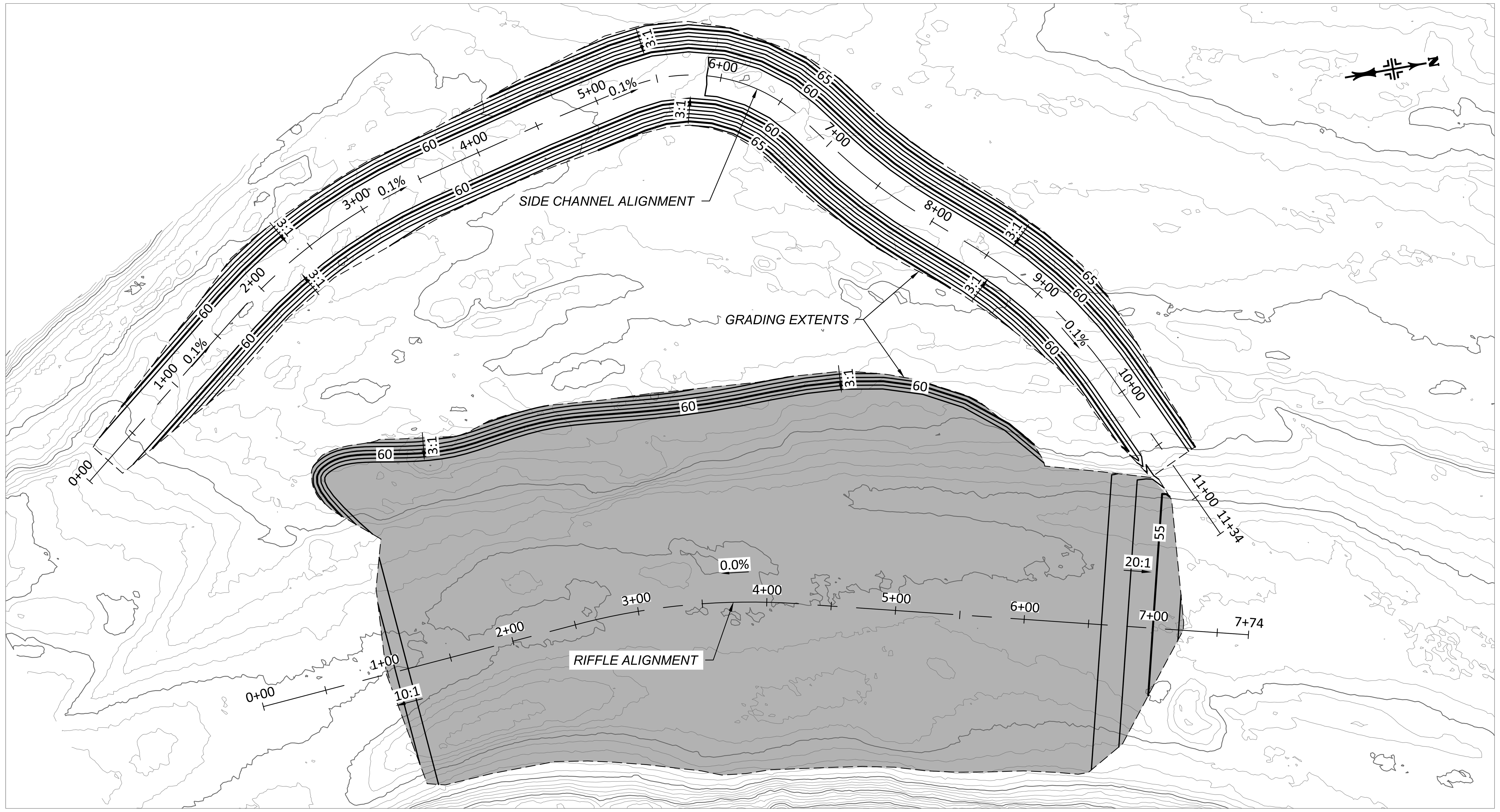
SHEET
C8
8 OF 13

LOCATION: c:\Work\Projects\18-1025_lar_future_site_modeling\400_Data\403_CAD_DWGS\production\SacBar.dwg

PLOT:4/2/2019

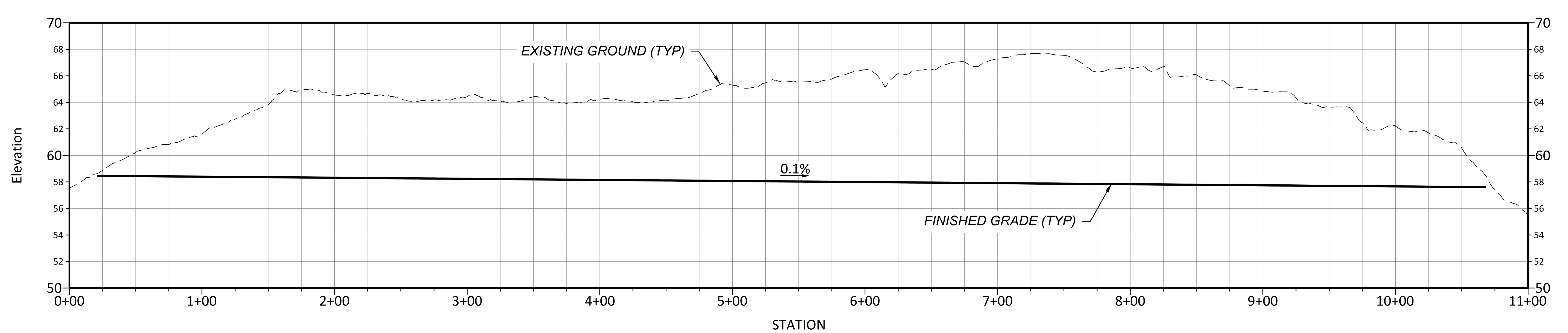
A B C D E

1 2 3 4



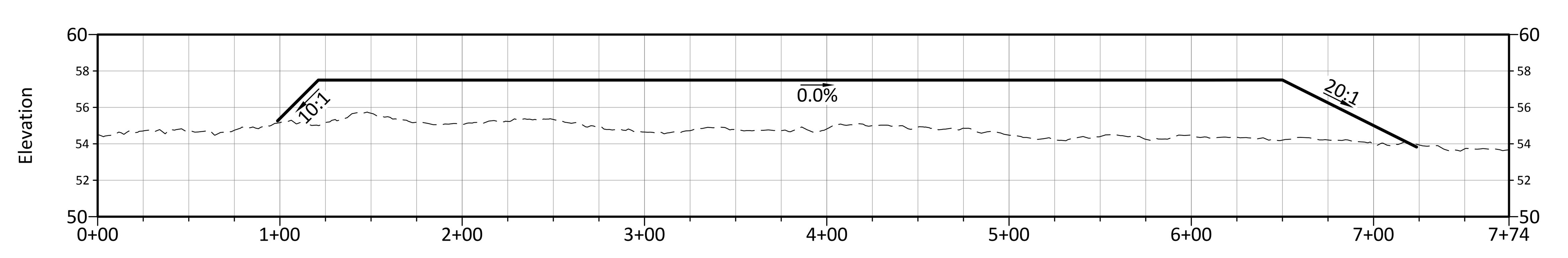
PLAN VIEW

SCALE: 1" = 60'



SIDE CHANNEL PROFILE

SCALE: 1" = 60'H; 1" = 6'V



RIFFLE PROFILE

SCALE: 1" = 60'H; 1" = 6'V

0 60 120 180 FT

1" = 60'

USE OF DOCUMENTS
THIS DOCUMENT, INCLUDING THE INCORPORATED DESIGNS, IS AN INSTRUMENT OF SERVICE FOR THIS PROJECT AND SHALL NOT BE USED FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF cbec, inc.

DOCUMENT RELEASE
PRELIMINARY DRAFT
REVISION NOTES

DESIGNED ---- | DRAWN ---- | REVIEWED ---- | APPROVED ----

PREPARED BY: cbec eco engineering

SACRAMENTO WATER FORUM
1330 21ST ST, SUITE 103
SACRAMENTO, CA 95811
(916) 808-1993

CLIENT: WATER FORUM

SACRAMENTO CALIFORNIA

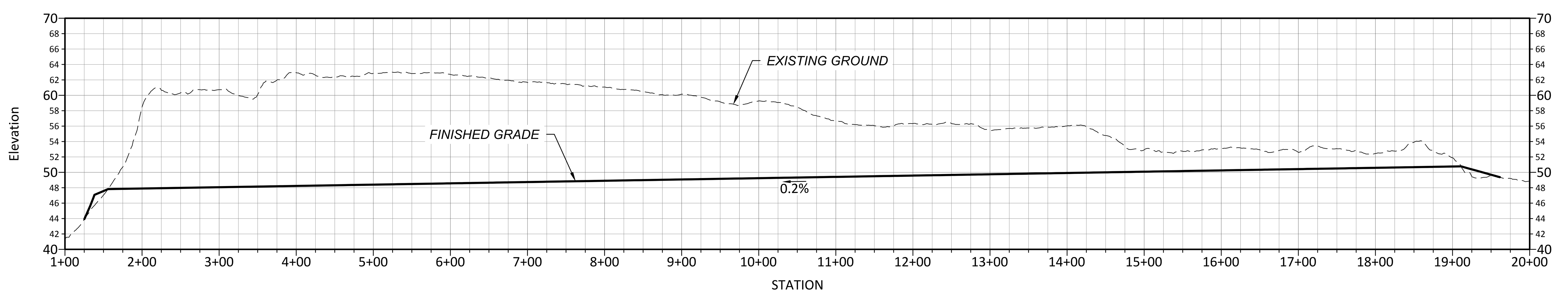
LAR SALMONID REARING HABITAT IMPROVEMENT FUTURE SITES MODELING
EL MANTO PLAN AND PROFILES

JOB NUMBER 18-1025
DATE FEB 2019
SHEET C9
9 OF 13

LOCATION: c:\Work\Projects\18-1025_lar_future_site_modeling\400_Data\403_CAD_DWGS\production\El_Manto.dwg
PLOT:4/2/2019

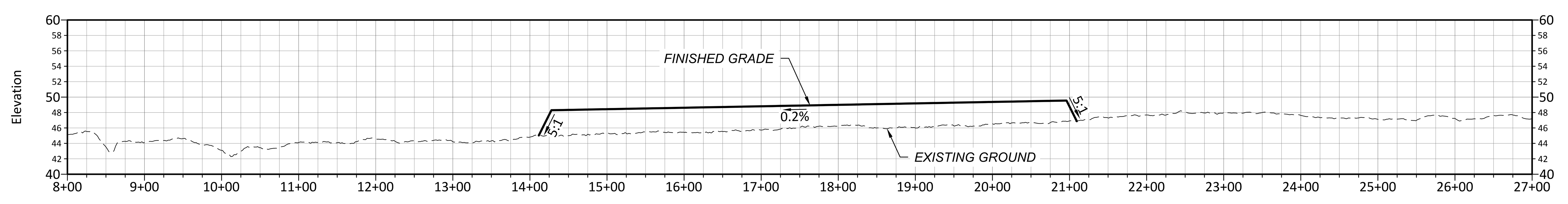
PLAN VIEW

SCALE: 1" = 100'



SIDE CHANNEL PROFILE

SCALE: 1" = 100'H; 1" = 10'V



RIFFLE PROFILE

SCALE: 1" = 100'H; 1" = 10'V

0 100 200 300 FT
1" = 100'

0 10 20 30 FT
1" = 10'

DOCUMENT RELEASE
PRELIMINARY DRAFT
REVISION NOTES

DESIGNED ----
DRAWN ----
REVIEWED ----
APPROVED ----

PREPARED BY: cbec eco engineering

SACRAMENTO WATER FORUM
1330 21ST ST, SUITE 103
SACRAMENTO, CA 95811
(916) 808-1993

CLIENT: WATER FORUM

SACRAMENTO CALIFORNIA

LAR SALMONID REARING HABITAT IMPROVEMENT FUTURE SITES MODELING

ANCIL HOFFMAN PLAN AND PROFILES

JOB NUMBER
18-1025

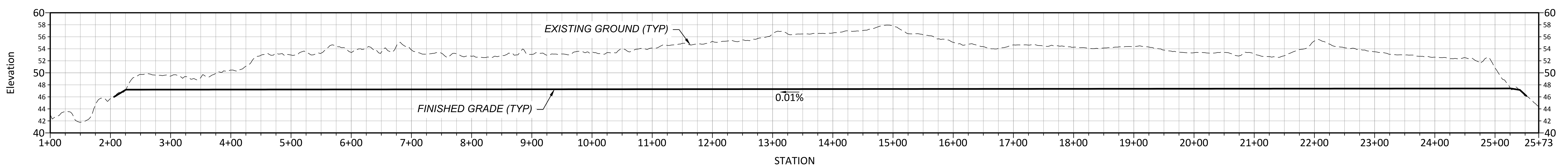
DATE
FEB 2019

SHEET
C10
10 OF 13

A | B | C | D | E

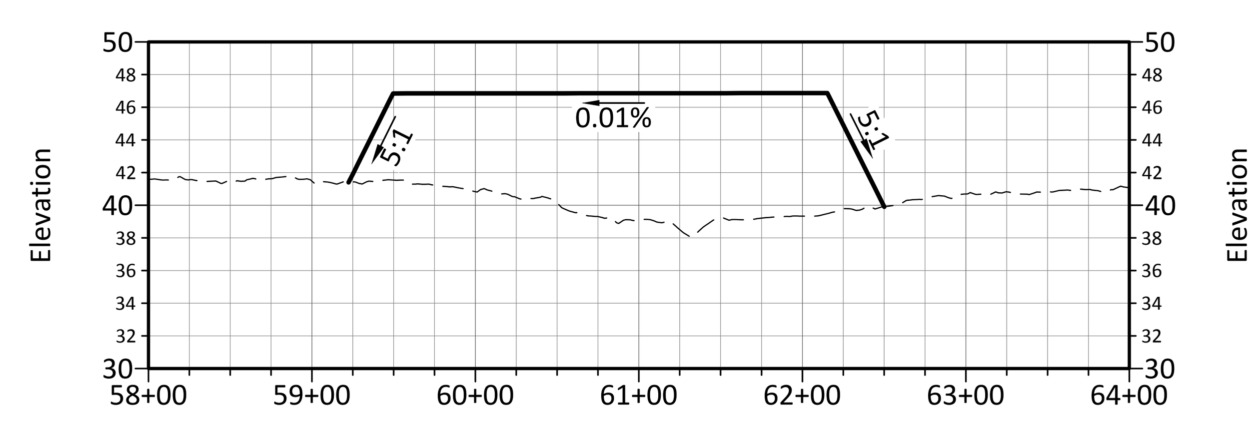
PLAN VIEW

SCALE: 1" = 100'



UPSTREAM SIDE CHANNEL PROFILE

SCALE: 1" = 100'H; 1" = 10'V



UPSTREAM RIFFLE PROFILE

SCALE: 1" = 100'H; 1" = 10'V

0 10 20 30 FT

1" = 10'

0 100 200 300 FT

1" = 100'

DOCUMENT RELEASE
PRELIMINARY DRAFT
REVISION NOTES

DESIGNED ----
DRAWN ----
REVIEWED ----
APPROVED ----

PREPARED BY: cbec eco engineering

CLIENT: SACRAMENTO WATER FORUM
1330 21ST ST, SUITE 103
SACRAMENTO, CA 95811
(916) 808-1993

SACRAMENTO CALIFORNIA

LAR SALMONID REARING HABITAT IMPROVEMENT FUTURE SITES MODELING
UPPER RIVER BEND PLAN AND PROFILES 1

JOB NUMBER 18-1025

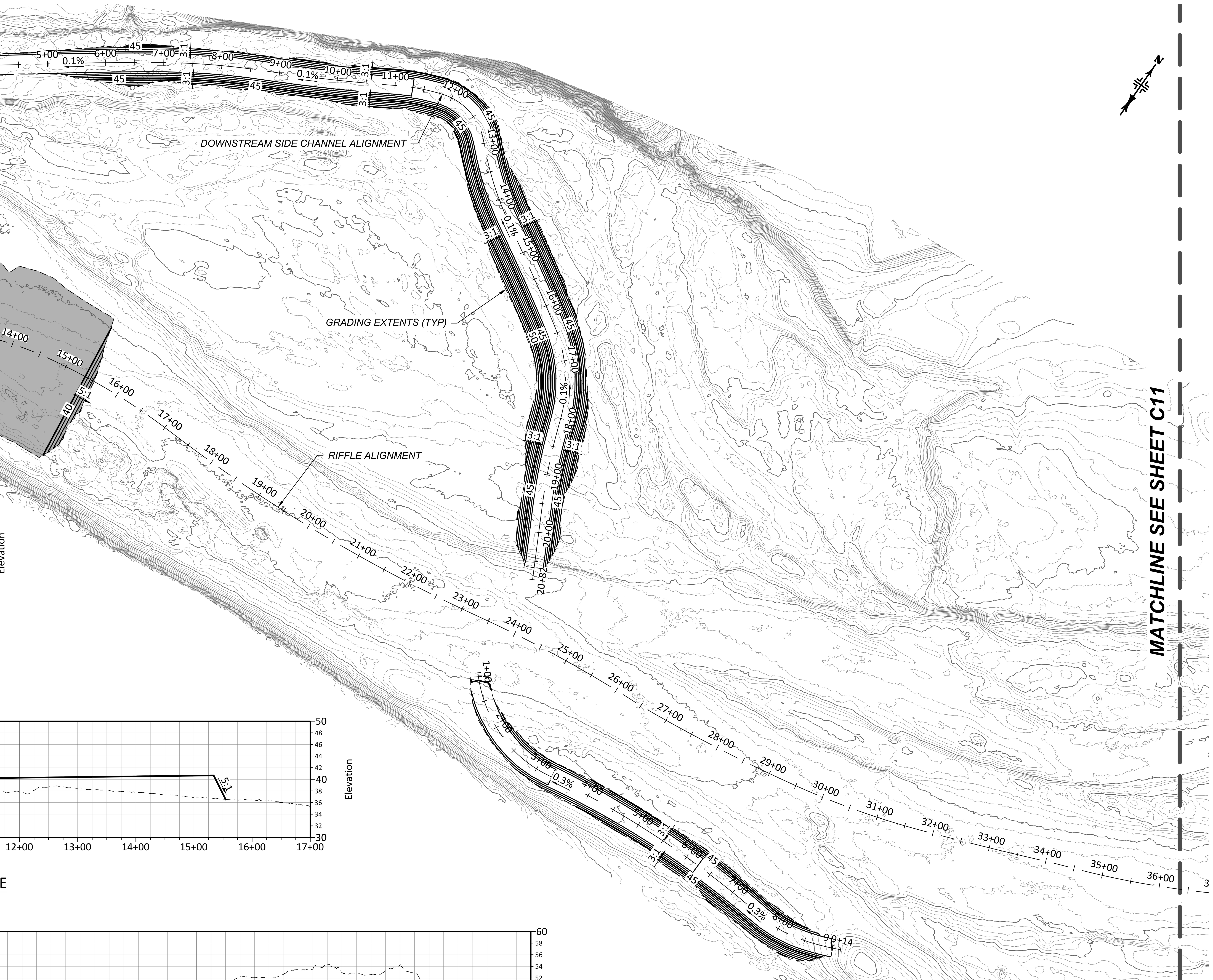
DATE FEB 2019

SHEET C11

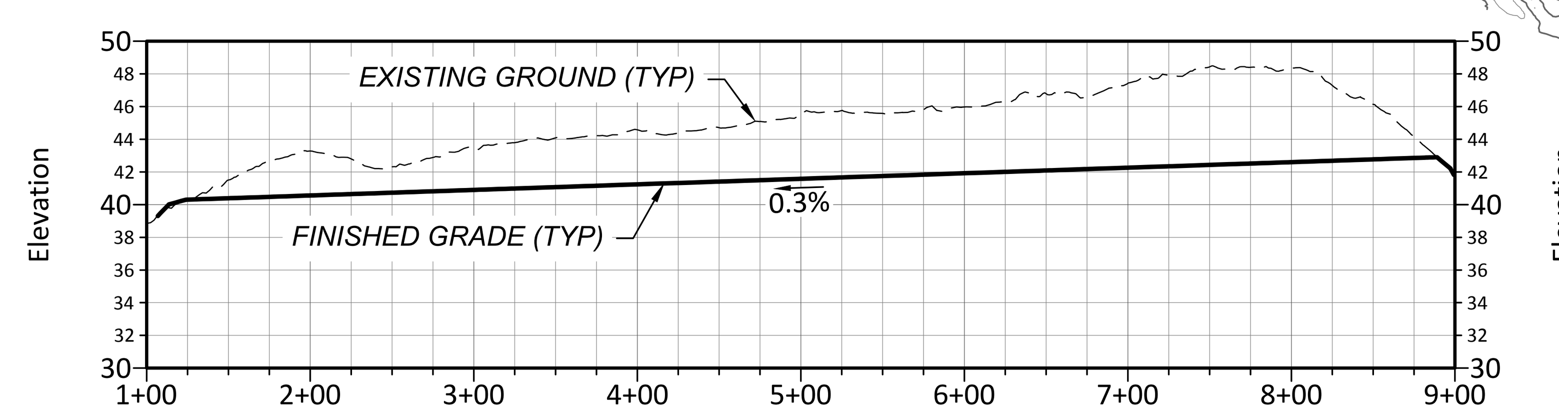
11 OF 13

LOCATION: c:\Work\Projects\18-1025_lar_future_site_modeling\400_Data\403_CAD_DWGS\production\Upper_Riverbend.dwg

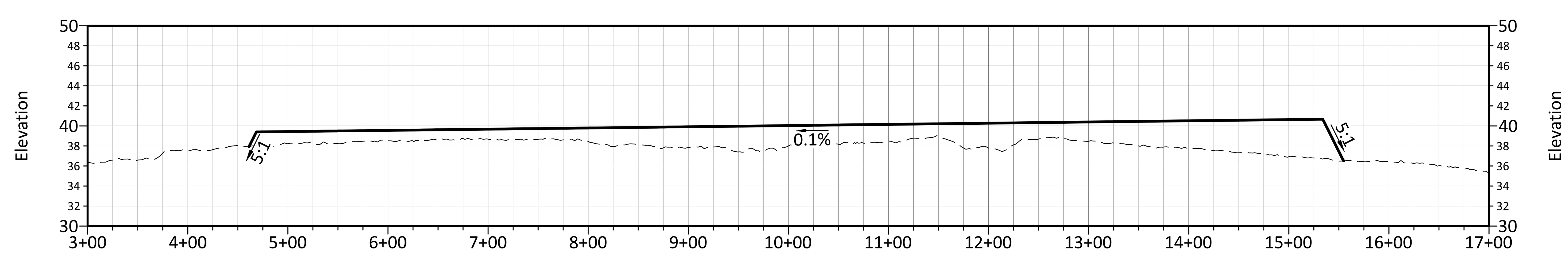
PLOT:4/2/2019



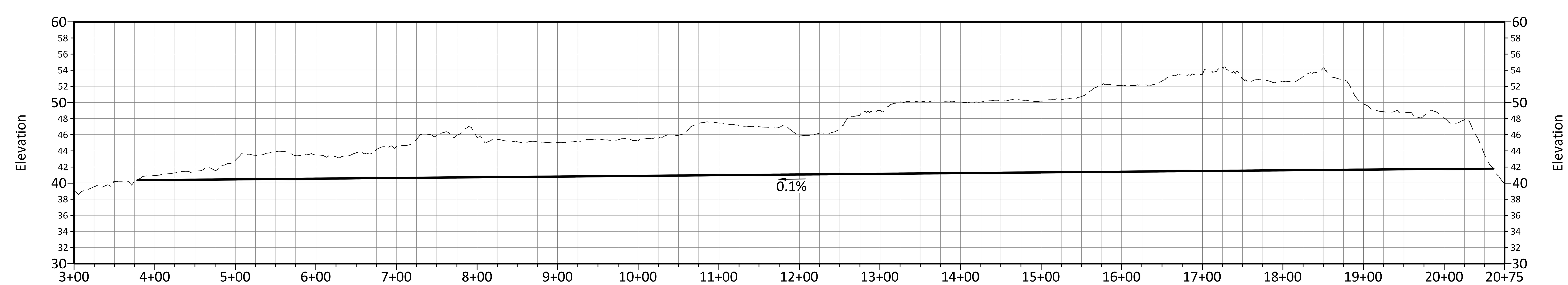
PLAN VIEW
SCALE: 1" = 100'



MIDSTREAM SIDE CHANNEL PROFILE
SCALE: 1" = 100'H; 1" = 10'V



DOWNSTREAM RIFFLE PROFILE
SCALE: 1" = 100'H; 1" = 10'V



DOWNSTREAM SIDE CHANNEL PROFILE
SCALE: 1" = 100'H; 1" = 10'V

0 10 20 30 FT
1" = 10'

0 100 200 300 FT
1" = 100'

DOCUMENT RELEASE
PRELIMINARY DRAFT
REVISION NOTES

DESIGNED ----
DRAWN ----
REVIEWED ----
APPROVED ----

PREPARED BY: cbec eco engineering

SACRAMENTO WATER FORUM
1330 21ST ST, SUITE 103
SACRAMENTO, CA 95811
(916) 808-1993

CLIENT: WATER FORUM

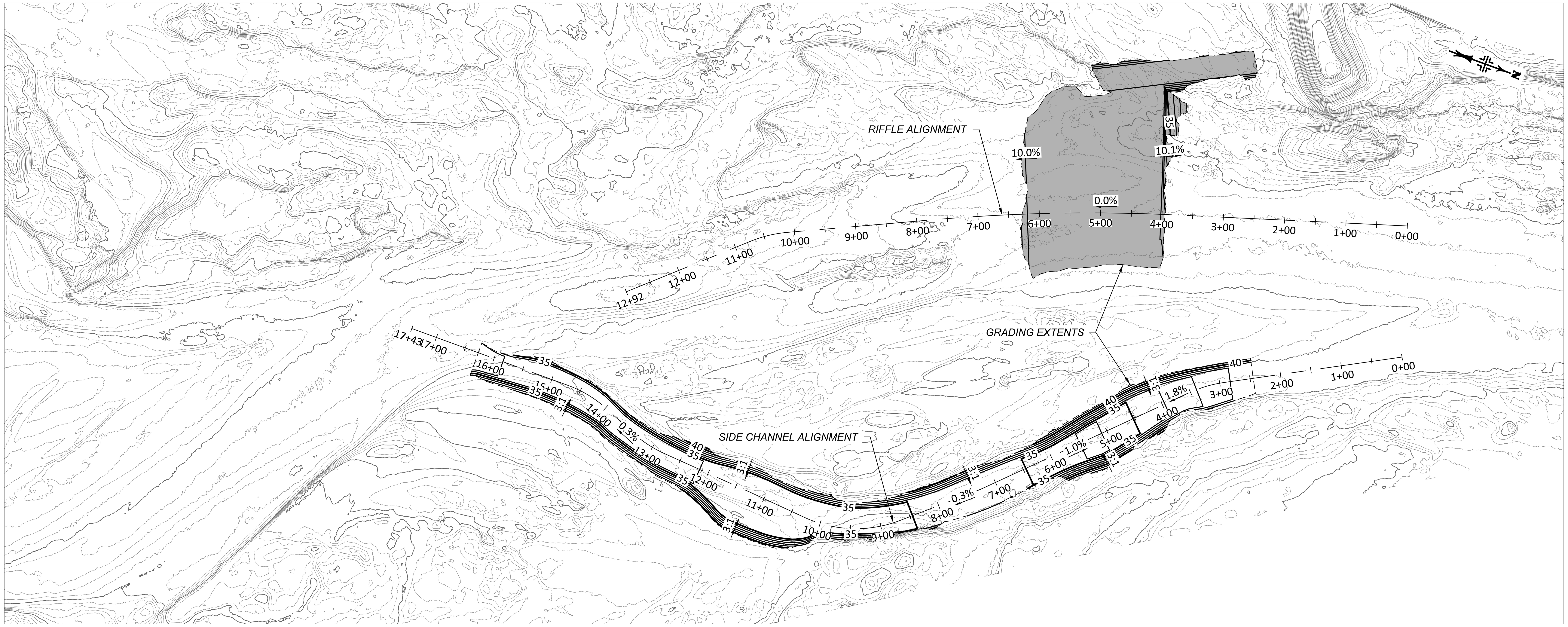
SACRAMENTO CALIFORNIA

LAR SALMONID REARING HABITAT IMPROVEMENT FUTURE SITES MODELING
UPPER RIVER BEND PLAN AND PROFILES 2

JOB NUMBER 18-1025
DATE FEB 2019
SHEET C12
12 OF 13

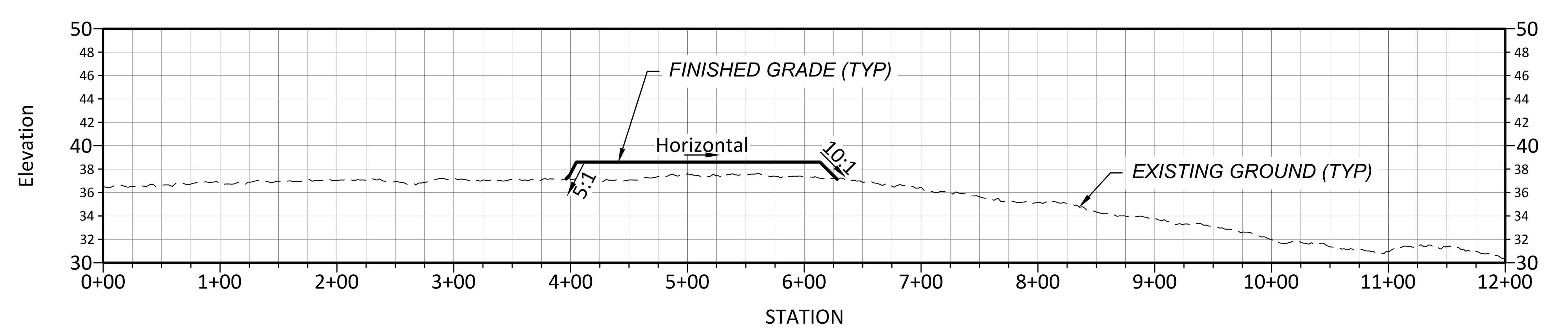
A B C D E

1 2 3 4



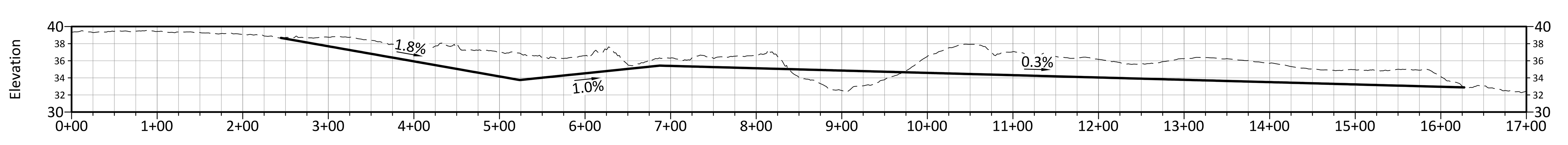
PLAN VIEW

SCALE: 1" = 100'



RIFFLE PROFILE

SCALE: 1" = 100'H; 1" = 10'V



SIDE CHANNEL PROFILE

SCALE: 1" = 100'H; 1" = 10'V

0 10 20 30 FT

1" = 10'

0 100 200 300 FT

1" = 100'

DOCUMENT RELEASE
PRELIMINARY DRAFT

REVISION NOTES

DESIGNED ----
DRAWN ----
REVIEWED ----
APPROVED ----

PREPARED BY:
cbec eco engineering

SACRAMENTO WATER FORUM
1330 21ST ST, SUITE 103
SACRAMENTO, CA 95811
(916) 808-1993

CLIENT: WATER FORUM

SACRAMENTO CALIFORNIA

LAR SALMONID REARING HABITAT IMPROVEMENT
FUTURE SITES MODELING
RIVER BEND PLAN AND PROFILES

JOB NUMBER
18-1025

DATE
FEB 2019

SHEET
C13
13 OF 13

LOCATION: c:\Work\Projects\18-1025_lar_future_site_modeling\400_Data\403_CAD_DWGS\production\Riverbend.dwg

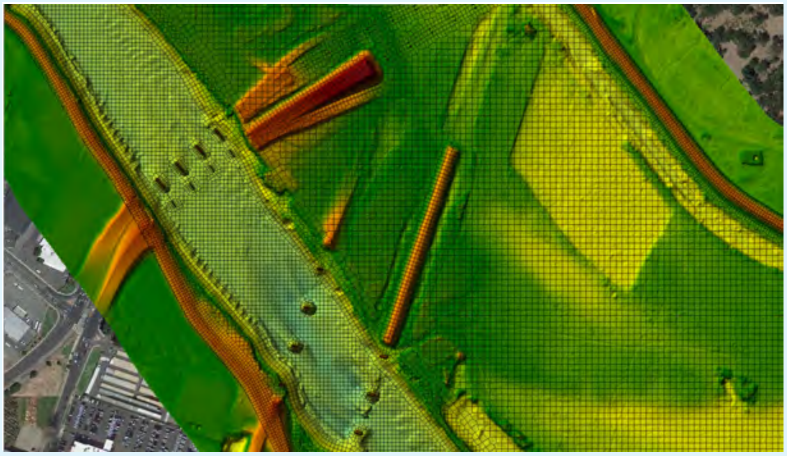
PLOT:4/2/2019

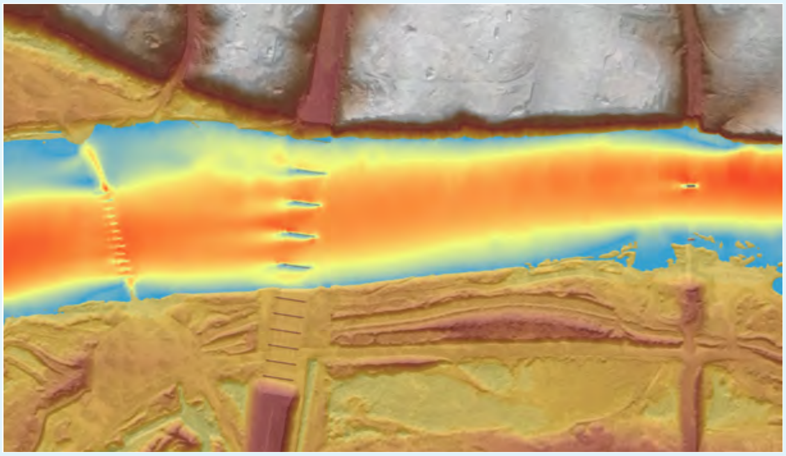
APPENDIX B

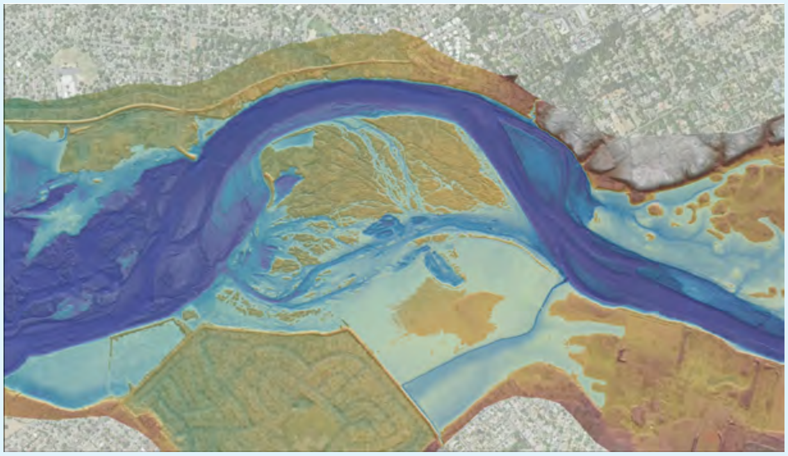
FLOOD FLOW HYDRODYNAMIC MODELING REPORT

cbec eco engineering

Hydrology | Hydraulics | Geomorphology | Design | Field Services







LAR Current Condition DEM And 2D Model Development Project

Flood Flow Hydrodynamic Modeling Report

Prepared for:

SAFCA Sacramento Area Flood Control Agency

WATER FORUM

Prepared by:
cbec, inc. eco engineering

March 2019
Project Number: 17-1005

This report is intended solely for the use and benefit of Sacramento Water Forum and SAFCA. No other person or entity shall be entitled to rely on the details contained herein without the express written consent of cbec, inc., eco engineering, 2544 Industrial Blvd., West Sacramento, CA 95691.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

GLOSSARY OF ACRONYMS

Acronym	Meaning
1D	one-dimensional
2D	two-dimensional
AFO	American River at Fair Oaks, USGS gage #11446500
CDFW	California Department of Fish and Wildlife
cfs	cubic feet per second
CVFED	Central Valley Floodplain Evaluation and Delineation Program
DEM	digital elevation model
DWR	California Department of Water Resources
ft	feet
HEC	USACE Hydraulic Engineering Center
HEC-RAS	USACE Hydraulic Engineering Center – River Analysis System software
HWM	high water mark
LiDAR	Light Detection and Ranging
LAR	lower American River
NAVD88	North American Vertical Datum of 1988
NAIP	National Agriculture Imagery Program
NEMDC	Natomas East Main Drainage Canal (also known as Steelhead Creek)
Project	Lower American Current Condition DEM and 2D Model Development Project
RM	river mile
RTK-GPS	Real Time Kinematic Global Positioning System
SAFCA	Sacramento Area Flood Control Agency
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
WSE	water surface elevation

1 HYDRODYNAMIC MODEL DEVELOPMENT

1.1 OVERVIEW

The lower American River (LAR) Current Condition Digital Elevation Model (DEM) and Two-Dimensional (2D) Model Development Project (Project) includes the following tasks:

1. Develop and calibrate a 2D hydrodynamic model for LAR, capable of simulating flows ranging from 500 cubic feet per second (cfs) to 160,000 cfs using existing historic topographic and bathymetric data.
2. Collect bathymetric and topographic data to develop a current condition (2017) DEM of the river from Nimbus Dam to the confluence with the Sacramento River.
3. Update the topography and bathymetry of the historic condition 2D hydrodynamic model developed in (1) to produce a current condition (2017) 2D hydrodynamic model and calibrate and validate the model using measured water surface elevations (WSE) and high-water marks (HWM).

This report covers the development and calibration/validation of the "high flow" or "flood" model for Task 3. An interim report covered the preliminary modeling for Task 1 (cbec 2018b), and the current conditions DEM development for Task 2 (cbec 2018a) is included in Appendix A.

The current condition hydrodynamic model is based on the best available DEM, which is comprised of October 2017 topo-bathymetric LiDAR (often called "Green LiDAR" that can penetrate water to varying depths), and 2017 single-beam sonar and Real Time Kinematic Global Positioning System (RTK-GPS) survey points. These data were collected as part of this study. All simulations were performed using HEC-RAS developed by the Hydraulic Engineering Center (HEC) of the United States Army Corps of Engineers (USACE). The model is updated to use the latest HEC-RAS version 5.0.7, using the full 2D shallow water equations to produce an estimate for water surface elevation (WSE), depth, and depth-averaged velocity. Analysis of hydrodynamic model results was performed using ArcGIS® Pro 2.3.1 (ESRI, Redlands, CA) and the program R (www.r-project.org). Manning's n values were calibrated and validated to represent high water marks (HWM) from the 1986 and 1997 flood events and observed WSEs collected during the 2017 water year by cbec for the Sacramento Area Flood Control Agency (SAFCA).

1.2 FLOOD MODEL DOMAIN

The lower American River is approximately 23 miles long and extends from Nimbus Dam downstream to the confluence with the Sacramento River. The upper portion of the river has a steeper gradient with a bed slope of approximately 0.001 ft/ft. Downstream of Paradise Beach at approximately USGS river mile (RM) 5.5 (Figure 1), the river experiences tidal fluctuations and the bed slope drops to approximately 0.00035 ft/ft. Non-Federal and Federal levees begin at approximately RM 14 and continue downstream to the confluence with the Sacramento River (Figure 1).

The flood model consists of two domains to limit and optimize computational runtimes while providing a high-resolution (i.e., 20 ft) mesh. The lower domain covers the lower 16 miles, beginning upstream of Ancil Hoffman Park at USGS RM 16 (Figure 1). This allows the lower model domain to cover the entire portion of leveed river, which will support levee and bank erosion analyses. The lower domain model was developed to provide two options for downstream boundary conditions. The first option truncates the model near the Sacramento River by Jibboom Street bridge. This version, shown in Figure 1, is set up with a stage boundary condition that can be driven from observed or scenario-driven WSEs. The second option, shown in Figure 2, includes the Sacramento River confluence with an upstream flow boundary at Sacramento River Station (RS) 61.33 (from the 1D CVFED HEC-RAS model (DWR 2008)) and a downstream stage boundary at the I Street Bridge. This version provides more explicit modeling of Sacramento River conditions and Sacramento Weir operations in addition to providing more accurate hydraulics for the lower portion of the American River (e.g., I-5 bridge area). With these two options, the end user can choose the most suitable version based on the availability of data and the intended purpose of the model. More discussion on boundary conditions for each version is provided in Section 1.4.

The upper model domain begins below Nimbus Dam and extends downstream to Watt Avenue (Figure 3). Watt Avenue is a suitable place to end the upper model because available HWMs, a long-term stage gage (established by cbec for Sacramento Water Forum from May 2009 to present), and the lack of tidal influence allow a rating curve to be developed at Watt Avenue. The two model domains overlap between RM 9.5 (upstream of Watt Avenue) and RM 16. To understand how the boundary conditions influence the model, Figure 4 shows the differences in velocity and WSE within the area of overlap for a flow of 160,000 cubic feet per second (cfs). This represents the worst-case scenario for the boundary conditions influence on the model. WSE and velocity differences between the two models are negligible within ~3/4 of a mile downstream of the start of the lower model domain. This is sufficiently upstream of the Federal levees; therefore, it can be concluded that the boundary condition location has a negligible impact on the results for the flood model within the full leveed section of river.

1.3 BATHYMETRY AND TOPOGRAPHY

The 2017 current conditions DEM comprises of topo-bathymetric LiDAR (often called “Green LiDAR” that can penetrate water to varying depths) that was collected by Quantum Spatial in October 2017 (Quantum Spatial (2018) is provided in Appendix B) top of levee surveys conducted by PSOMAS in November and December 2017, and single beam sonar and wading RTK-GPS surveys conducted by cbec in December 2017 through February 2018 to augment deeper bathymetry not collected the Green LiDAR (cbec (2018a) is provided in Appendix A). Note that the Sacramento River was not surveyed as part of this project and 2008 multibeam data that was collected by Fugro West, Inc. for the California Department of Water Resources (DWR) was used there (Fugro West, Inc. 2008). These data sets were reviewed for accuracy and consistency, compiled and constructed into a raster DEM by cbec. Appendices A and B cover the DEM development.

For HEC-RAS modeling, the DEM was constructed as a 2 ft raster surface with bridge piers incorporated into the DEM. cbec utilized the LiDAR returns, conducted additional field measurements and robotic total station surveys to verify, georeference and size the bridge piers within the channel banks. Combined, these datasets provide the best available, seamless, high-resolution (2 ft raster grid) topography and bathymetry for the entire model domain (Figure 5).

1.4 BOUNDARY CONDITIONS

The boundary conditions for calibration and validation runs were based off HWMs acquired for the 1986 event (source unknown) and 1997 high flow event (collected by MBK engineers) and RTK-GPS WSE observations that cbec collected for the 2017 water year. The models were calibrated to the 1997 HWMs and then validated by applying the same roughness parameters to the 1986 HWMs and the observed WSEs for the 2017 water year. The boundary conditions are shown in Table 1. LAR inflow data comes from the American River at Fair Oaks USGS gage (AFO, #11446500). The Sacramento River inflow values were estimated by balancing reported discharges from the Sacramento Weir Spill USGS gage (SRW, #11426000), the American River at Fair Oaks USGS gage (AFO, #11446500), and the California Department of Water Resources gage on the Sacramento River at the I Street Bridge (CDEC station ID: IST). When Sacramento River water levels are sufficiently elevated and the Sacramento Weir is spilling, the flow in the Sacramento River reverses upstream between the LAR confluence and the Sacramento Weir. Similarly, the 1D HEC-RAS CVFED (DWR 2008) model shows negative flows for Natomas East Main Drainage Canal (NEMDC, otherwise known as Steelhead Creek) during high flows in LAR. The NEMDC inflow values were informed by the CVFED model and scaled to the size of the event.

Table 1. Calibration and validation boundary conditions

Date	LAR Inflow (cfs)	Sac. R. Inflow (cfs)	NEMDC Inflow (cfs)	WSE at I St. (ft, NAVD88)	WSE at Watt Ave. (ft, NAVD88)
02/19/1986	134,000	-35,000	-5000	33.2	49.85
01/02/1997	117,000	-14,000	-5000	32.7	47.87
12/20/2016	20,500	54,000	-500	24.4	29.31
01/11/2017	60,300	25,000	-1500	28.7	39.55
02/10/2017	82,200	5,000	-2000	29.3	43.70

1.5 MODELING PARAMETERS AND ASSUMPTIONS

The HEC-RAS 2D mesh constructed for this project consists of mostly square elements in a 20 ft grid within the 50,000 cfs floodway. The mesh coarsens to a 30 ft grid in the floodplain outside of the 50,000 cfs floodway. To select and optimize these grid sizes, a sensitivity test was conducted to achieve the best balance of accuracy and computational run times. The mesh was further refined with break lines along the levee crests and toes, channel banks, steep slope breaks, topographic high and low points, and bridge piers. The break lines ensure that the model mesh is enforced along topographic features that direct or prevent flow paths (e.g., a levee crest or bridge pier). In addition, the cell spacing along the bridge piers and levee toes were reduced to approximately 8-15 ft (i.e., smaller sizes to increase resolution of velocity calculations). Figures 6 and 7 show the mesh breaklines for the lower and upper model domains, respectively. Table 2 provides an overview of the model parameters applied.

Table 2. HEC-RAS 2D flood model parameters

Parameter	Value	Notes
HEC-RAS	Version 5.0.6[1]	-
flow module	2D unsteady	-
equation set	Full Momentum	-
theta (0.6 – 1.0)	0.9	-
initial condition	dry bed with warmup period	-
inflows	constant, sub-critical	EG slope = 0.001 (same as bed slope)
outflows	constant elevation	observed condition or rating curve
time step	2 – 3 seconds[2]	varies by discharge
eddy viscosity	-	default[3]

[1]The latest version of HEC-RAS (v5.0.7) was released on 19-March 2019 and is purely a bug fix with no changes to the 2D calculations. Thus, this model can be used with the latest version of HEC-RAS.

[2]HEC-RAS 2D results are sensitive to the Courant criteria, which is a function of cell size, time step, and water velocity.

[3]Advised by Gary Brunner, USACE, on 5-May 2017.

The HEC-RAS 2D numerical formulation is sensitive to the Courant criteria,

$$C = \frac{V * \Delta T}{\Delta X}$$

where C is the Courant Number, V is the velocity magnitude (ft/s), ΔT is the time step, ΔX is the average cell size. For the solution to be stable, the Courant Number should be close to 1, and a max up 3. Sensitivity testing showed that the converged WSE solution was sensitive to the Courant Number. Therefore, it is important to conduct tests to find the right combination of time step and mesh grid size to ensure an accurate solution. For these calibration and validation runs, a 3-second time step was used for the 20,500 cfs run and a 2-second time step was used for the remaining higher flows.

The roughness map was developed by using the California Department of Fish and Wildlife's (CDFW) Vegetation Classification and Mapping Program as a baselayer (CDFW 2013). This map was further refined by classifying the 2017 LiDAR data into different vegetation height classes (shrub/sapling, small trees, medium trees, and tall trees). Figure 8 shows an example of the refined roughness map and Section 2.1 presents the calibrated roughness values.

2 FLOOD FLOW MODEL SIMULATIONS

2.1 CALIBRATION AND VALIDATION

Roughness values (Manning's n) for the seventeen landcover domains were calibrated to HWMs obtained after the January 2, 1997 event peak of 117,000 cfs. The model was then validated by applying the same roughness values to the remaining flows. Table 3 shows the final calibrated roughness values and the range of flows over which they are applicable. Roughness values fall within the expected ranges for flood flows (Chow 1959, Barnes 1959). The wetted channel ("lacustrine, riverine" classification) has a low

Manning's n value of 0.0275 with flow depths over 20 ft for much of the channel. Individual patches of woody vegetation were classified as "shrub/sapling", "small trees", "medium tree", or "tall trees" from the 2017 LiDAR returns. The remaining landcover classes (e.g., annual grassland, blue oak-foothill pine, etc.) represent the different zones that were identified by CDFW (2013). Since woody vegetation is largely represented by the four LiDAR vegetation classes, the remaining landcover classes were assigned a relatively small Manning's n value of 0.03-0.04, which is suitable for bare soils/gravels and grasslands of modest flow depths. Finally, "structures" represent the bridge piers and have a high Manning's n value of 0.2, since those zones should not convey flow. The structures are also represented in the DEM to ensure that flow is blocked.

Table 3. Calibrated Manning's n values

Landcover	Manning's n
	20,000 – 160,000 cfs
annual grassland	0.03
barren	0.03
blue oak-foothill pine	0.035
coastal scrub	0.035
eucalyptus	0.035
fresh emergent wetland	0.03
lacustrine, riverine	0.0275
medium trees	0.055
montane hardwood	0.035
orchard	0.035
shrub/sapling	0.045
small trees	0.05
structures	0.2
tall trees	0.07
urban	0.03
valley foothill riparian	0.035
wet meadow	0.03

Figures 9-13 show comparisons between the modeled and observed WSEs for the upper model domain and Figures 14-18 show the comparisons for the lower domain. For the 2017 water year events, the modeled WSEs match the RTK-GPS WSEs well with one potential outlier in the upper model for the 20,500 cfs event (Figure 9). For the HWM data, the model matches the data well with a few outliers for the 1986 event (Figures 13 and 18). In both cases, the discrepancies are bordered by data that matches well upstream and downstream, suggesting that the discrepancies may be an issue with the observed WSE or HWM data. For each flow and in total, the results show no systematic discrepancies. Tables 4 and 5 provide a summary of the calibration results. The average and median WSE differences are largely within 0.1-0.15 ft of the WSE observations. In total, the average and median difference between the modeled and the observed WSEs is 0.05 and 0.09 ft, respectively, for the upper domain model and -0.02 and -0.04

ft, respectively, for the lower domain model. These values indicate that the model is well representing the observed flood flow conditions across a wide range of flows.

Table 4. Summary statistics of modeled vs. observed water surface elevations for the upper domain

Date	Discharge (cfs)	# of Observations	Modeled minus Observed WSE (ft)				
			Min.	Max.	Average	Median	RMSE
2/19/1986	134,000	22	-1.08	1.58	0.07	0.04	0.69
1/2/1997	117,000	6	-0.55	0.74	0.10	0.16	0.39
12/20/2016	20,500	25	-0.89	0.90	0.17	0.14	0.36
1/11/2017	60,300	22	-0.86	0.66	-0.02	0.00	0.36
2/10/2017	82,200	19	-1.15	0.71	-0.06	-0.11	0.45
All dates*	All flows	94	-1.15	1.58	0.05	0.09	0.48

*"All dates" reports the statistics of combining all the upper domain WSE comparisons

Table 5. Summary statistics of modeled vs. observed water surface elevations for the lower domain

Date	Discharge (cfs)	# of Observations	Modeled minus Observed WSE (ft)				
			Min.	Max.	Average	Median	RMSE
2/19/1986	134,000	64	-1.16	1.63	0.07	-0.02	0.61
1/2/1997	117,000	14	-0.74	0.81	-0.09	-0.09	0.46
12/20/2016	20,500	23	-0.62	0.37	-0.01	-0.09	0.28
1/11/2017	60,300	35	-0.77	0.45	-0.08	-0.03	0.25
2/10/2017	82,200	27	-1.18	0.42	-0.13	-0.10	0.34
All dates*	All flows	163	-1.18	1.63	-0.02	-0.04	0.43

*"All dates" reports the statistics of combining all the lower domain WSE comparisons

3 SUMMARY

The development of the current conditions (2017) flood flow model for LAR described herein has been developed to standards appropriate for hydrodynamic modeling purposes. Since the initial development of the flood model for Task 1 covered in the initial technical memorandum (cbec, 2018b), the model has been significantly improved. The model has been updated with the current conditions (2017) topography, bathymetry, and roughness conditions. In-channel bridge piers were measured, georeferenced, and incorporated into the roughness map and DEM. The model mesh has been coarsened outside of the 50,000 cfs wetted extent to optimize computational times. The model has been re-calibrated using version 5.0.6 of HEC-RAS. Since the latest version of HEC-RAS (v5.0.7) released on 19-March 2019 is purely a bug fix with no changes to the 2D calculations, this model can be used with the latest version of HEC-RAS. Lastly, the flood flow model has been successfully validated over a range of flows from 20,500 cfs to 134,000 cfs. The model can now be used appropriately used for supporting bank and levee erosion risk assessment and flood modeling projects on the Lower American River.

4 REFERENCES

Barnes, H.H., 1967. Roughness characteristics of natural channels. U.S. Geological Survey Water-Supply Paper 1849, 213 p.

California Department of Fish and Wildlife(CDFW), 2013. Fine-Scale Riparian Vegetation Mapping of the Central Valley Flood Protection Plan Area – Final Report. https://www.wildlife.ca.gov/Data/VegCAMP/Reports-and-Maps

California Department of Water Resources (DWR), 2008. Central Valley Floodplain Evaluation and Delineation Program.

cbec, inc., 2018a. LAR Current Condition DEM and 2D Model Development Project – Current Conditions DEM Report. Prepared for The Water Forum and The Sacramento Area Flood Control Agency.

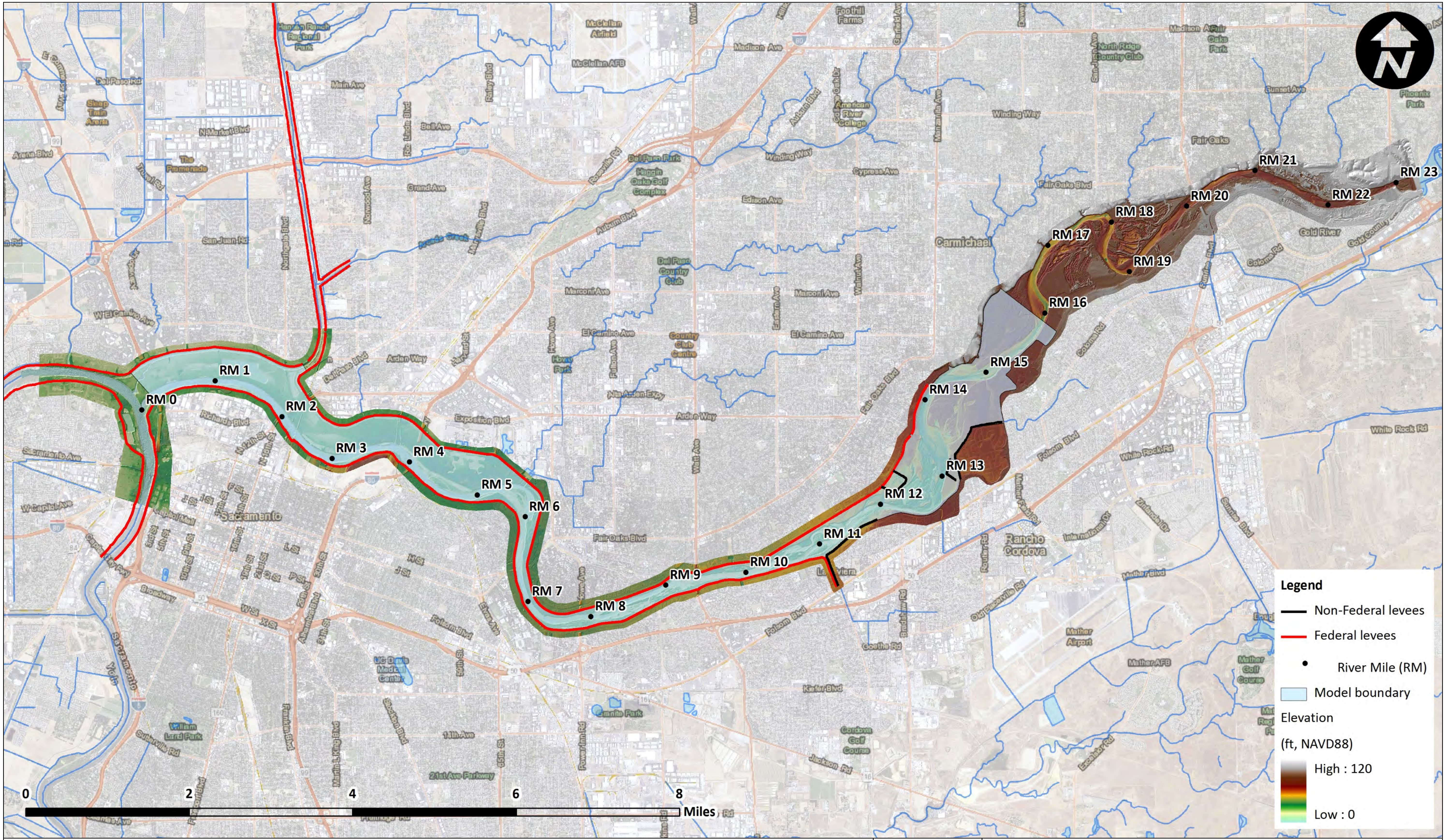
cbec, inc., 2018b. LAR Historic Conditions High Flow Hydrodynamic Modeling Interim Report. Prepared for The Water Forum and the Sacramento Area Flood Control Agency.

Chow, V.T., 1959. Open-channel hydraulics. New York, McGraw-Hill, 680 p.

Fugro West, Inc., 2008. Bathymetric Surveys in Support of Urban Levees, Geotechnical Evaluation. Prepared for URS Corporation and California Department of Water Resources.

Quantum Spatial, 2018. American River, California Topobathymetric LiDAR & Digital Imagery Technical Data Report. Prepared for cbec inc. eco engineering.

FIGURES



Notes: The truncated lower domain model ends at the Jibboom Street bridge and was constructed to allow for a simple stage or rating curve boundary condition.

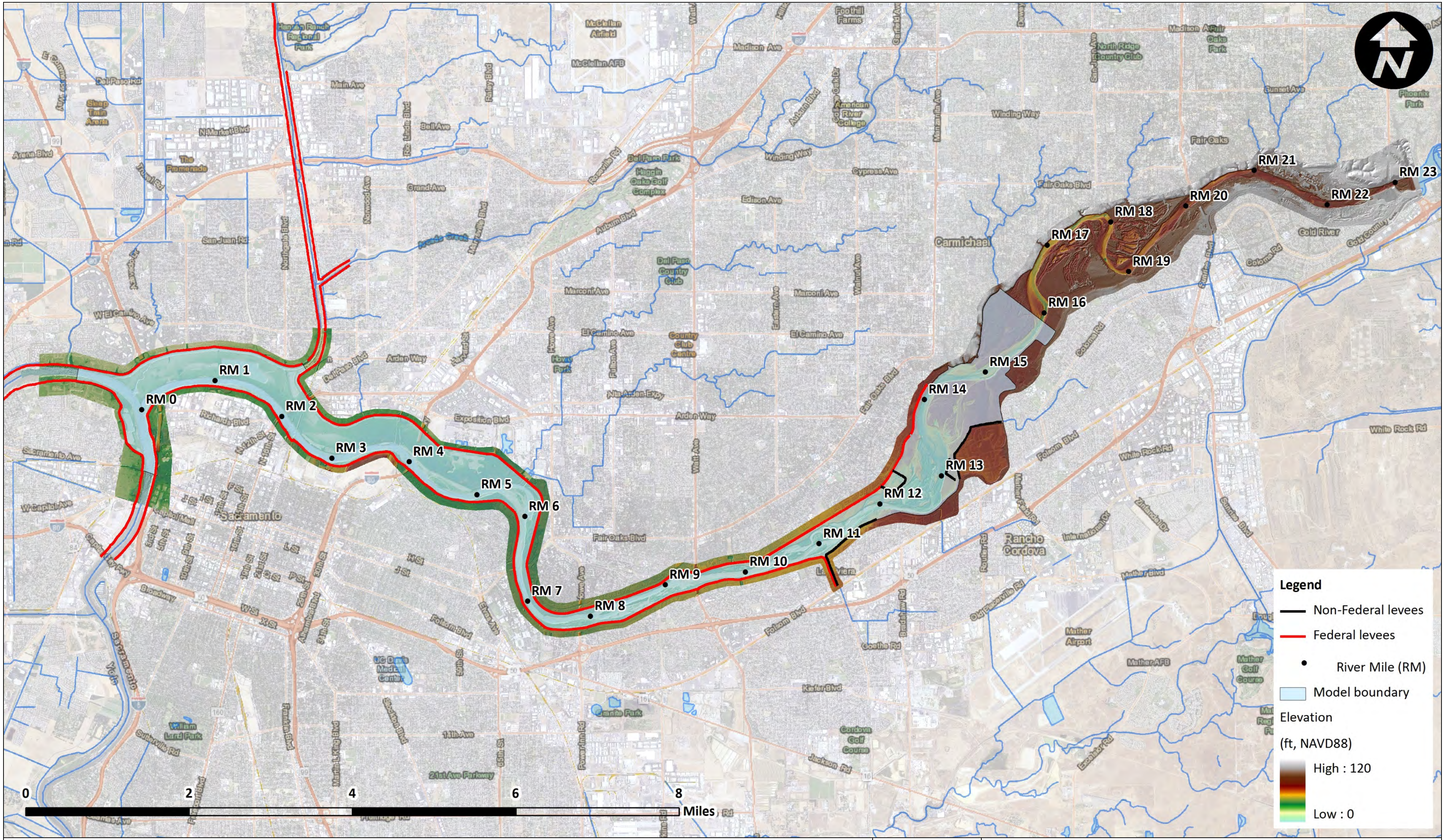
cbec eco engineering

Lower American River Current Condition DEM and 2D Model Development

Truncated lower domain flood model boundary

Project No. 17-1005 | Created By: MDW | **Figure 1**

D:\Projects\17-1005_LAR_RAS_2D\400_Technical_Data\402_GIS_Data\1_Figures\2_LAR17_Flood_TM\Figure1_LowerDomain_LAR.docx
3/28/2019



Notes: The full lower domain model includes the Sacramento River with an upstream Sacramento River flow boundary at RS 61.33 (from the 1D HEC-RAS CVFED model) and a downstream Sacramento River WSE boundary at the I-St bridge. This allows more explicit modeling of Sacramento River conditions.

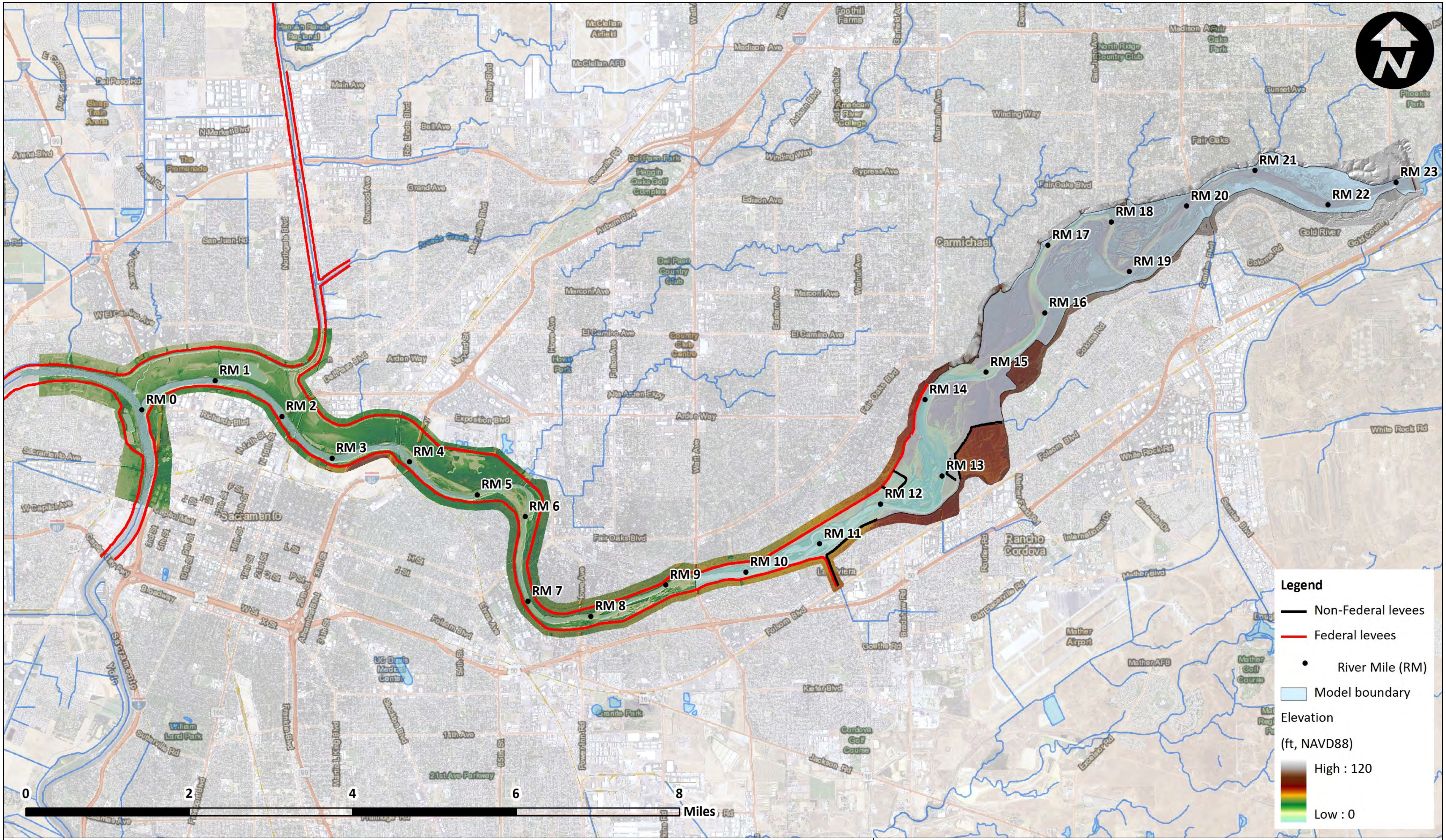
cbec eco engineering

Lower American River Current Condition DEM and 2D Model Development

Lower domain flood model boundary

Project No. 17-1005	Created By: MDW	**Figure 2**

D:\Projects\17-1005_LAR_RAS_2D\400_Technical_Data\402_GIS_Data\1_Figures\2_LAR17_Flood_TM\Figure2_LowerDomain_LAR_SAC.docx
3/28/2019

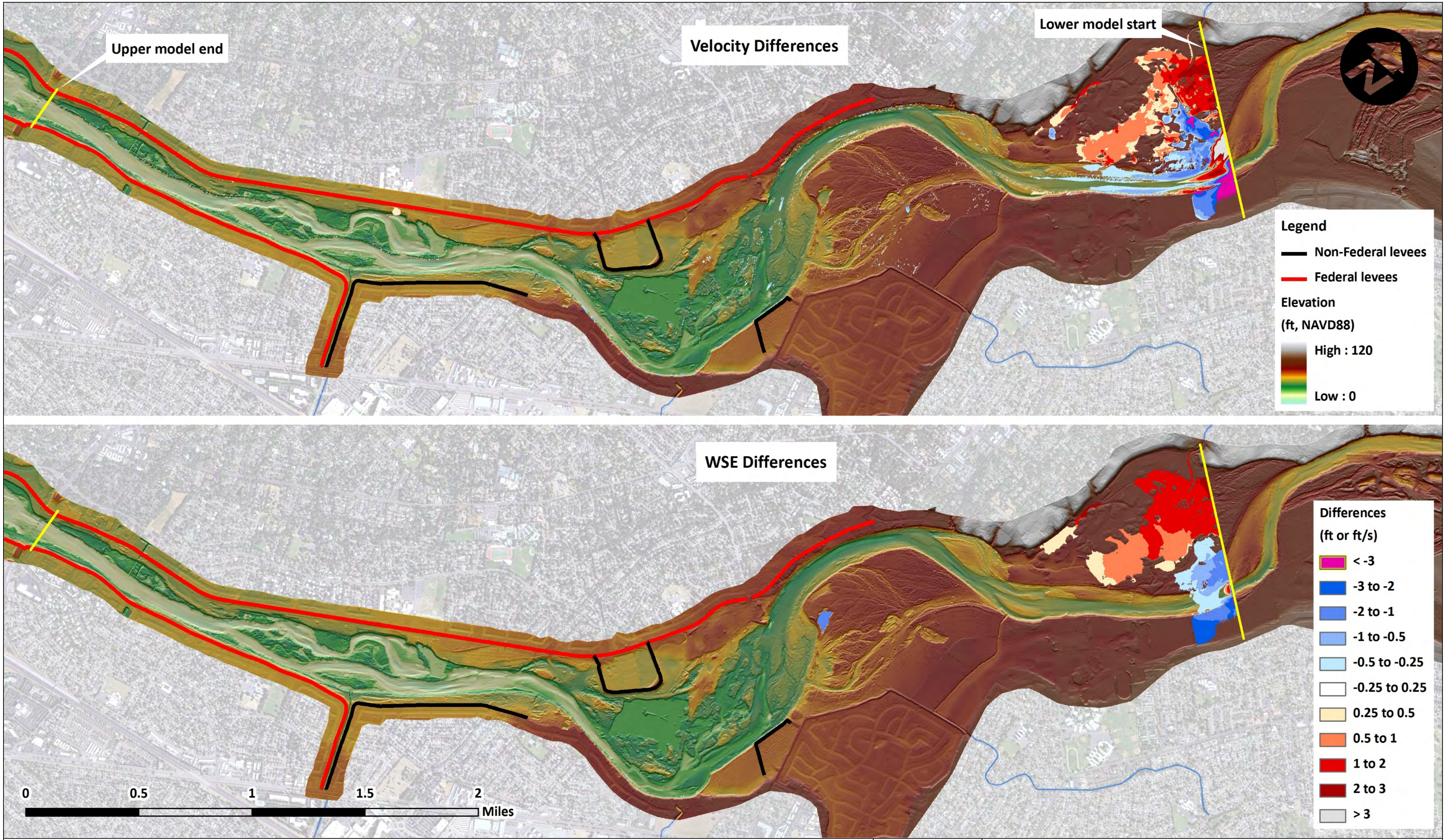


Notes: The upper domain flood model boundary begins below Nimbus Dam and ends at the Watt Avenue bridge.

Lower American River Current Condition DEM and 2D Model Development

Upper domain flood model boundary

Project No. 17-1005 | Created By: MDW | **Figure 3**



Notes: Plots show upper domain model results minus lower domain model results for velocity (top) and water surface elevation (lower plot). The differences end approximately ¾ of a mile downstream of the lower domain model start. This shows that the leveed section of river is not impacted by the upstream boundary condition for the lower domain model.

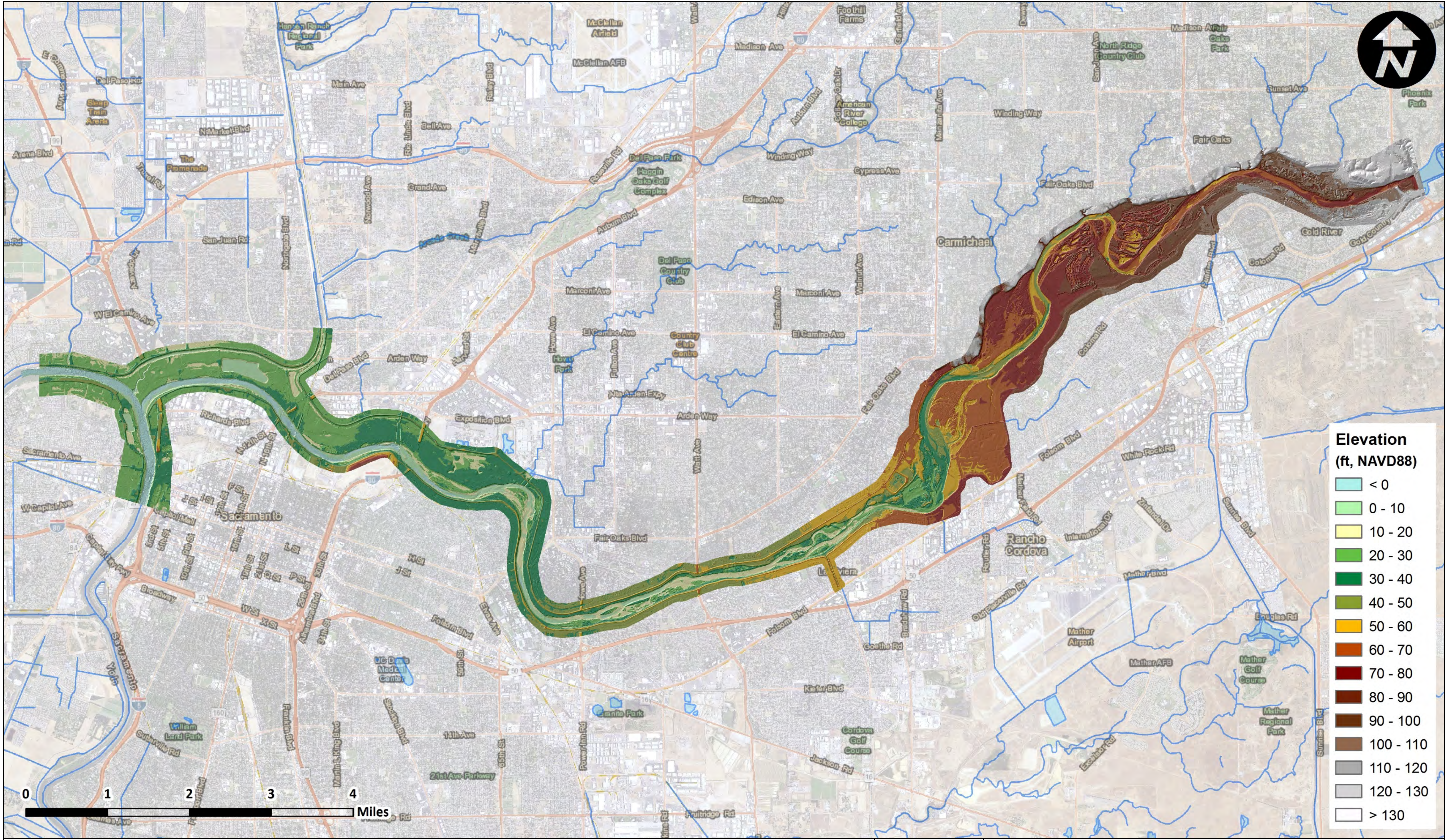
cbec eco engineering

Lower American Current Condition DEM and 2D Model Development

Differences between upper and lower model domain results

Project No. 17-1005	Created By: MDW	**Figure 4**

D:\Projects\17-1005_LAR_RAS_2D\400_Technical_Data\402_GIS_Data\1_Figures\2_LAR17_Flood_TM\Figure4_Model_Overlap.docx
3/6/2019



Notes: The current conditions (2017) DEM includes topobathymetric LiDAR collected by Quantum Spatial in October 2017, top of levee surveys conducted by PSOMAS in November and December 2017, single beam sonar and wading RTK-GPS surveys conducted by cbec in December 2017 through February 2018, and 2008 multi-beam sonar data for the Sacramento River collected for DWR in 2008.

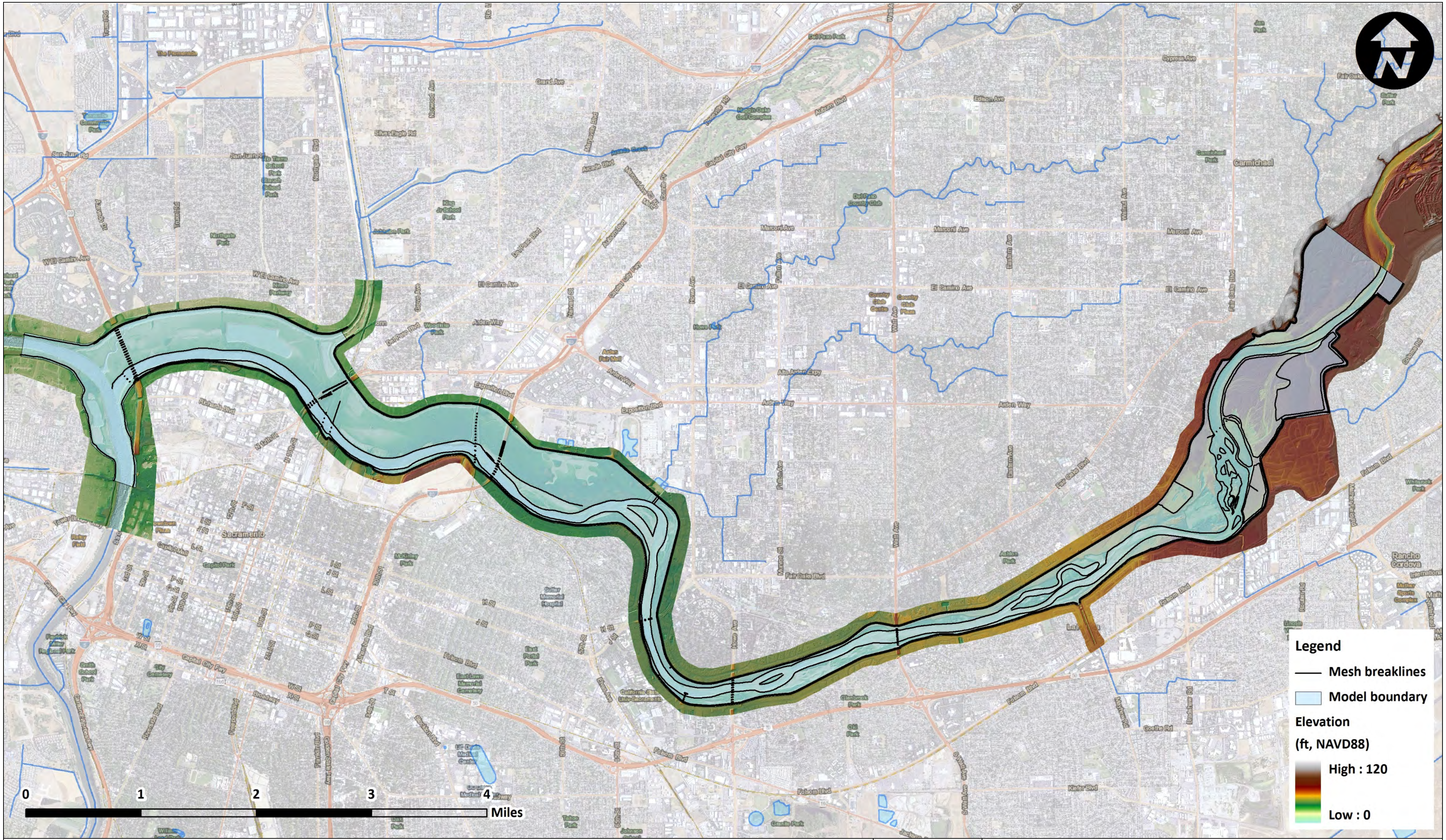
cbec eco engineering

Lower American River Current Condition DEM and 2D Model Development

Current conditions (2017) DEM

Project No. 17-1005	Created By: MDW	**Figure 5**

D:\Projects\17-1005_LAR_RAS_2D\400_Technical_Data\402_GIS_Data\1_Figures\2_LAR17_Flood_TM\Figure5_DEM_LAR_SAC.docx
3/6/2019



Notes: Break lines are located along the channel banks, top and toe of the levees, and edges of the bridge piers. This ensures that the model enforces topographic controls at these locations.

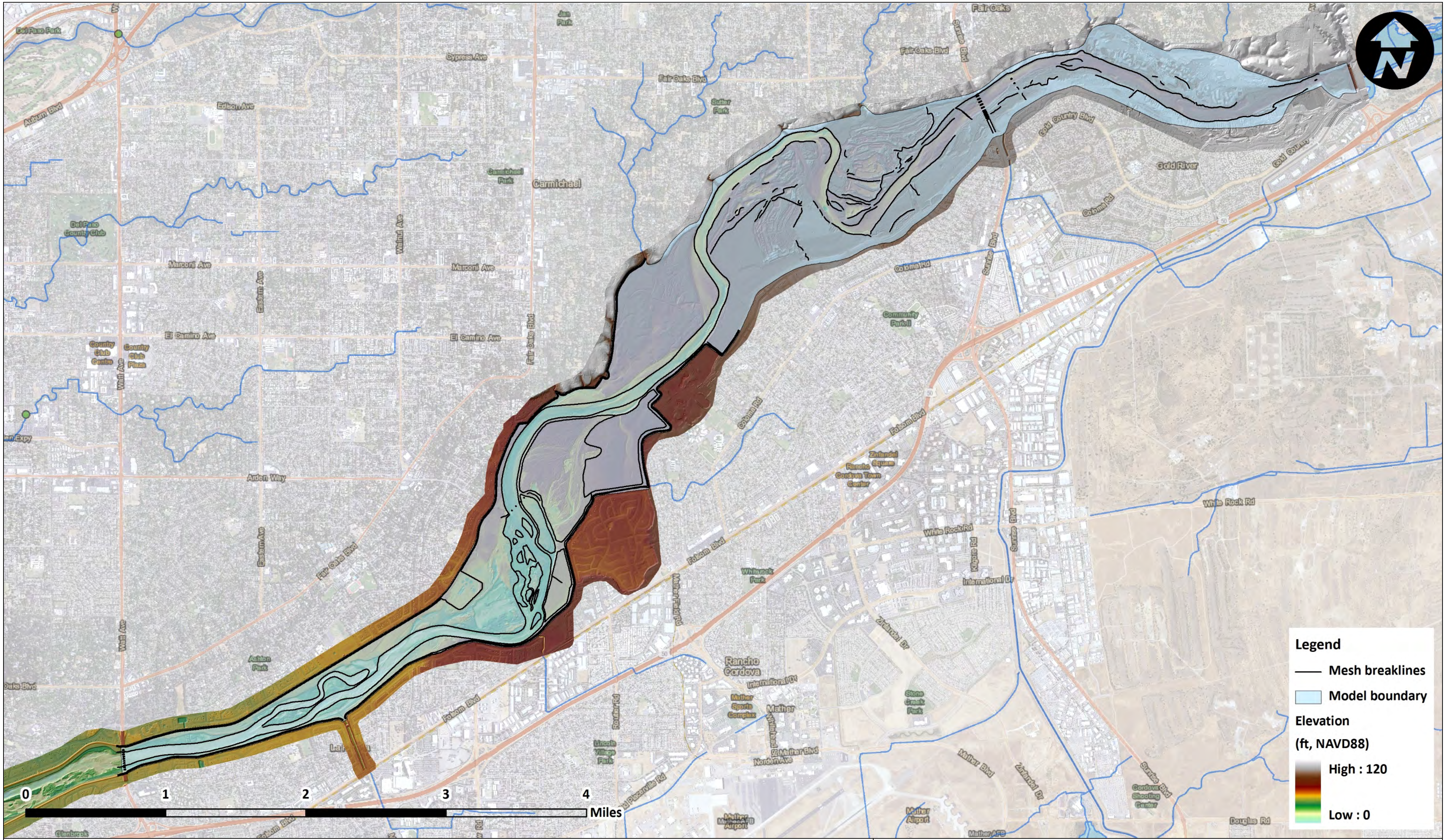
cbec eco engineering

Lower American River Current Condition DEM and 2D Model Development

Lower model mesh break lines

Project No. 17-1005	Created By: MDW	**Figure 6**

D:\Projects\17-1005_LAR_RAS_2D\400_Technical_Data\402_GIS_Data\1_Figures\2_LAR17_Flood_TM\Figure6_LowerBreaklines.docx
3/6/2019



Notes: Break lines are located along the channel banks, top and toe of the levees, and edges of the bridge piers. This ensures that the model enforces topographic controls at these locations.

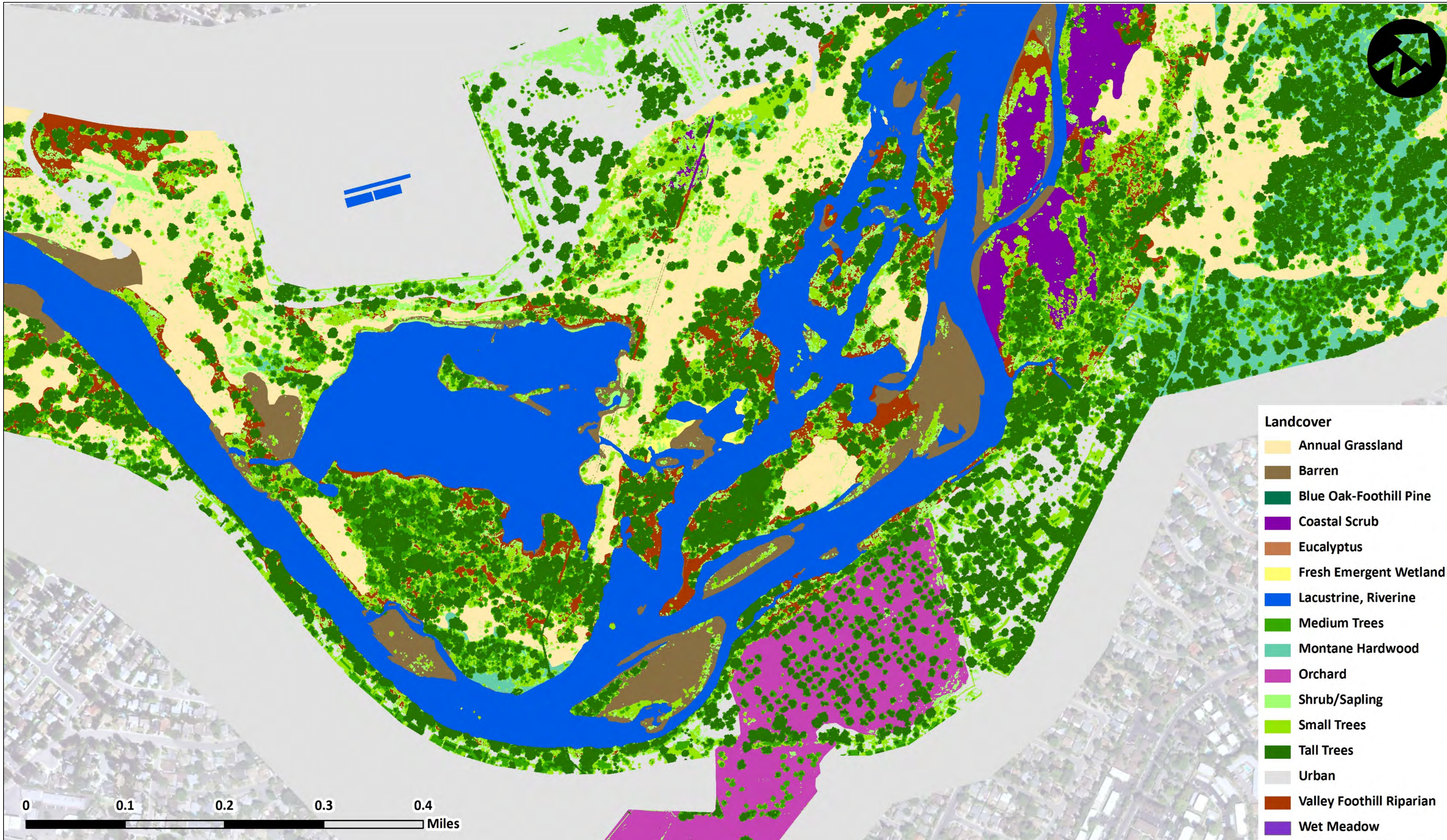
cbec eco engineering

Lower American River Current Condition DEM and 2D Model Development

Upper model mesh break lines

Project No. 17-1005	Created By: MDW	**Figure 7**

D:\Projects\17-1005_LAR_RAS_2D\400_Technical_Data\402_GIS_Data\1_Figures\2_LAR17_Flood_TM\Figure7_UpperBreaklines.docx
3/6/2019

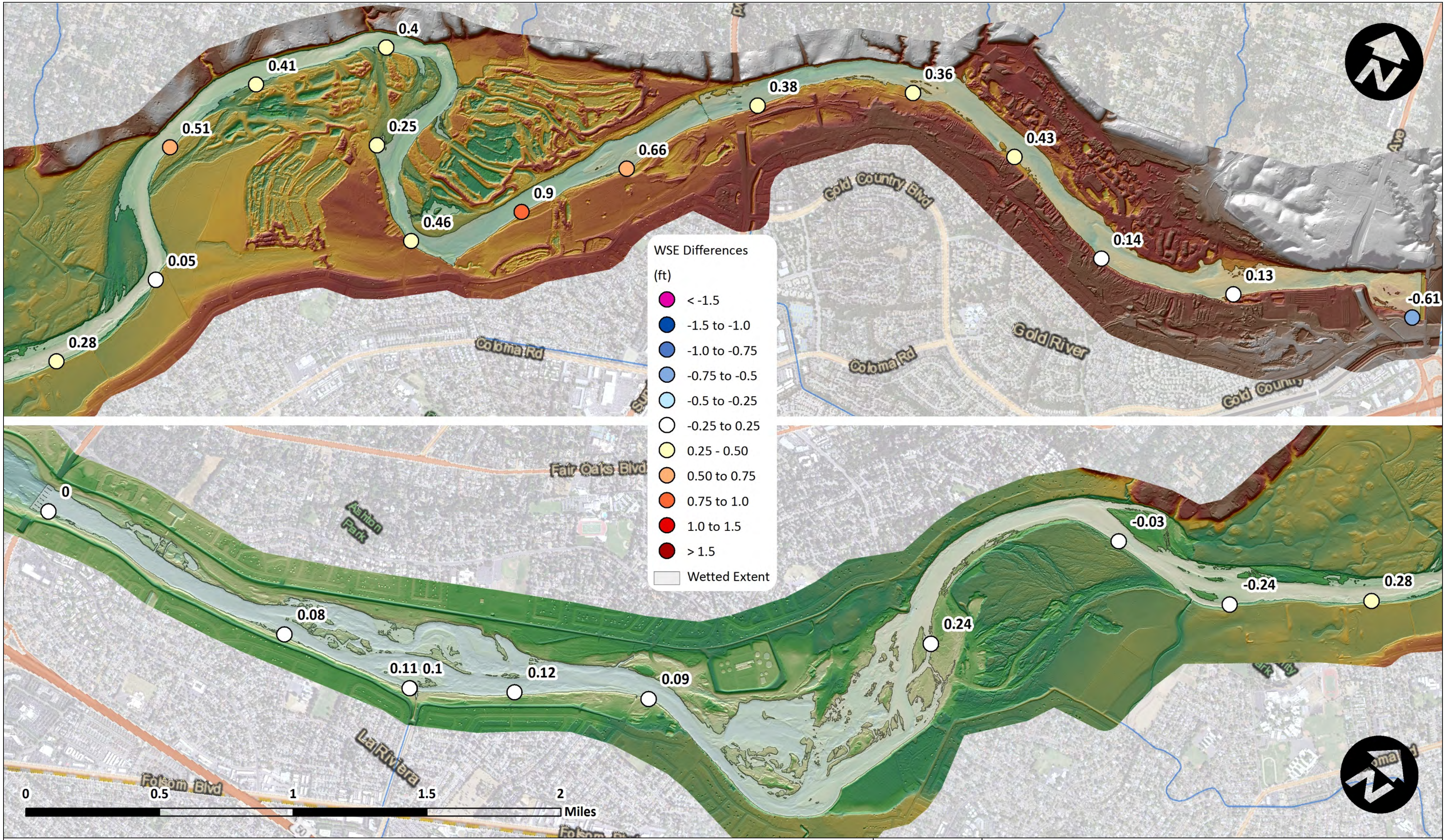


Notes: Landcover classifications come from California's Department of Fish & Wildlife fine-scale vegetation mapping with more refined vegetation mapping from classifying the 2017 LiDAR

Lower American River Current Condition DEM and 2D Model Development

Current conditions (2017) roughness map

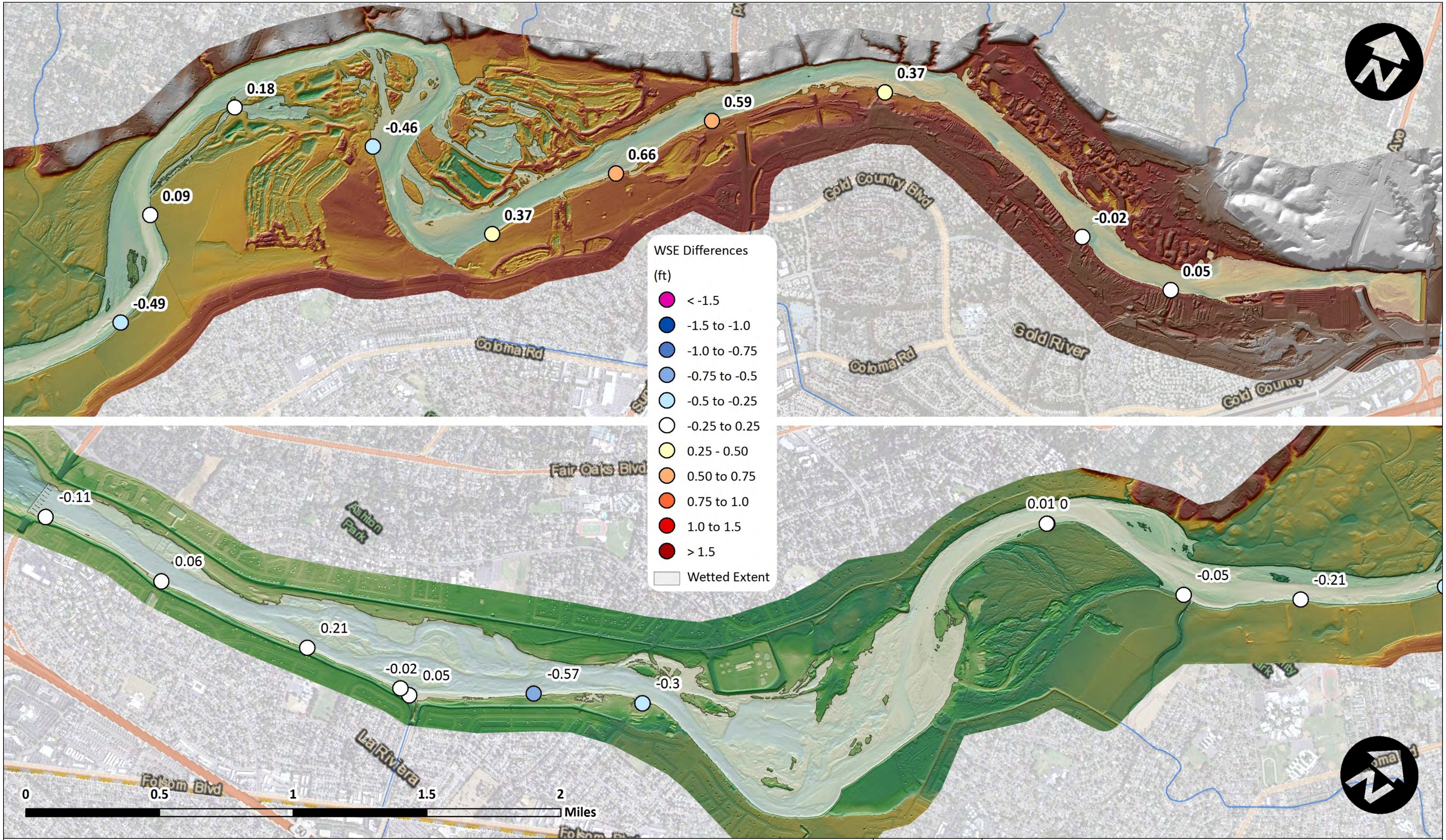
Project No. 17-1005 | Created By: MDW | **Figure 8**



Notes: The model is matching the observed RTK-GPS WSE observations well with no systematic discrepancies and one possible outlier RTK-GPS point.

cbec eco engineering	*Lower American River Current Condition DEM and 2D Model Development*
	Upper model 20,500 cfs 12/20/16 event WSE comparisons
Project No. 17-1005	Created By: MDW	**Figure 9**

D:\Projects\17-1005_LAR_RAS_2D\400_Technical_Data\402_GIS_Data\1_Figures\2_LAR17_Flood_TM\Figure9_Upper_Calibrations_20K.docx
3/28/2019



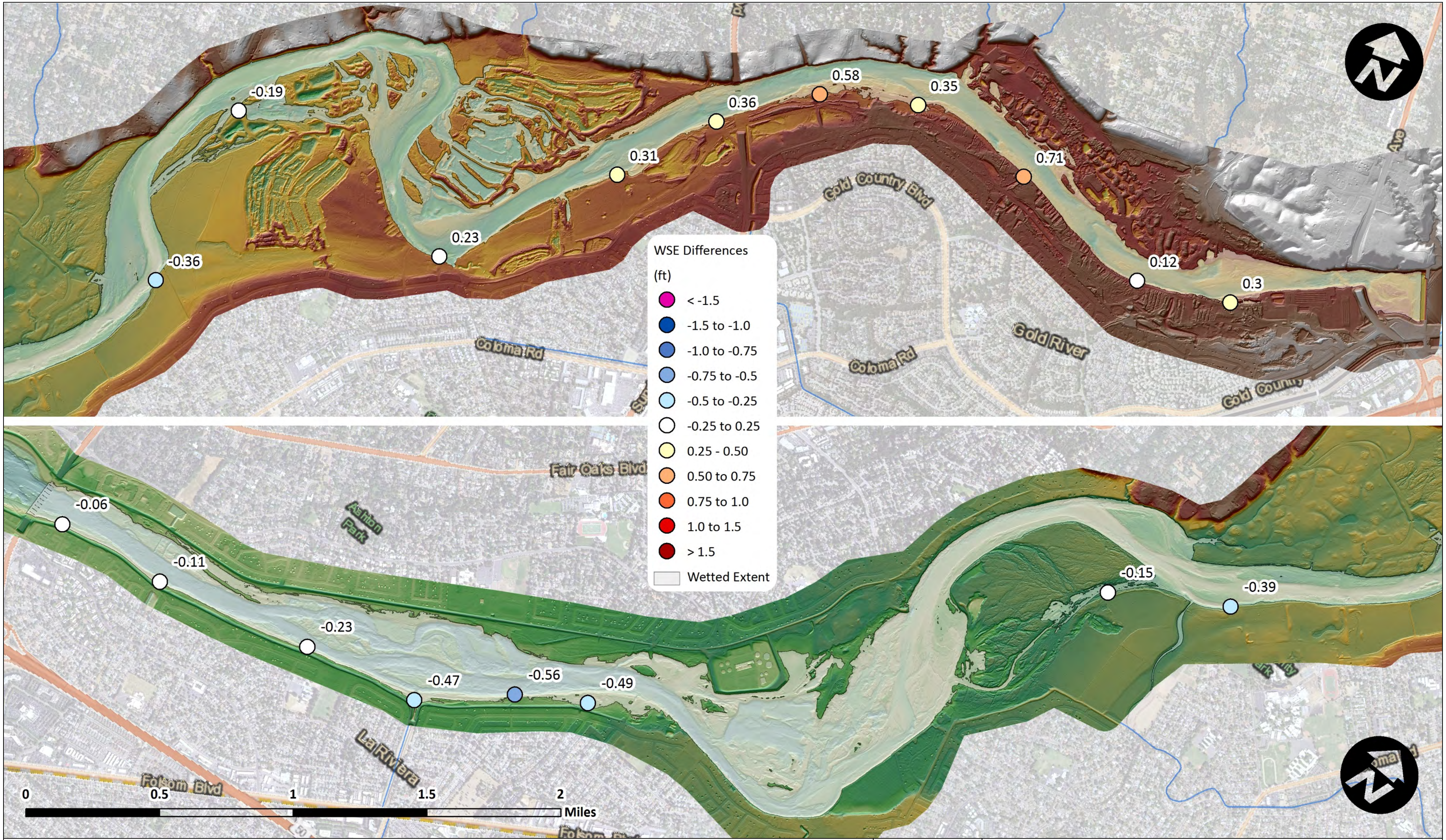
Notes: The model is matching the observed RTK-GPS WSE observations well with no systematic discrepancies.

cbec eco engineering

Lower American River Current Condition DEM and 2D Model Development

Upper model 60,300 cfs 1/11/17 event WSE comparisons

Project No. 17-1005 | Created By: MDW | **Figure 10**



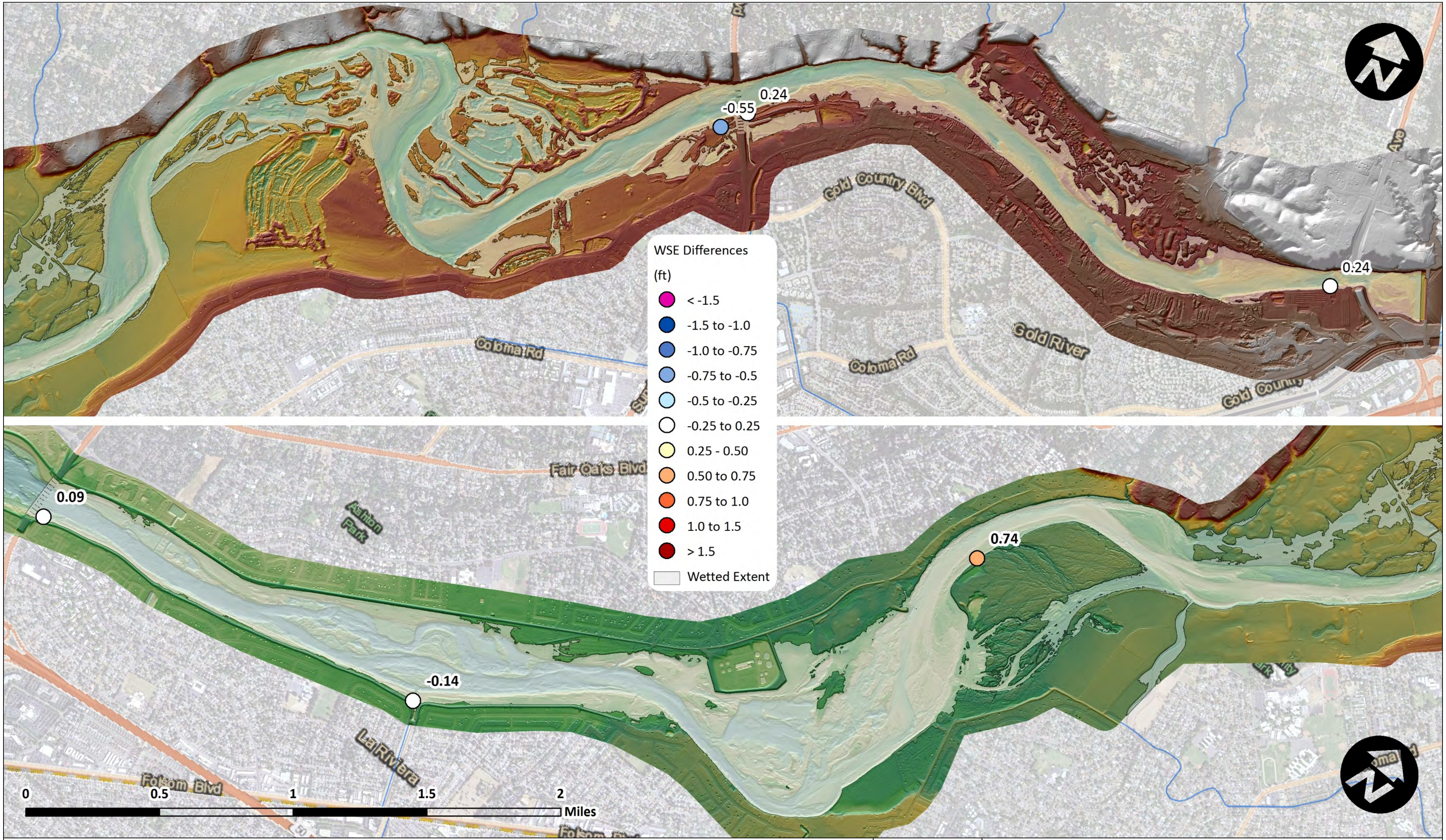
Notes: The model is matching the observed RTK-GPS WSE observations well with no systematic discrepancies.

cbec eco engineering

Lower American River Current Condition DEM and 2D Model Development

Upper model 82,200 cfs 2/10/17 event WSE comparisons

Project No. 17-1005 | Created By: MDW | **Figure 11**



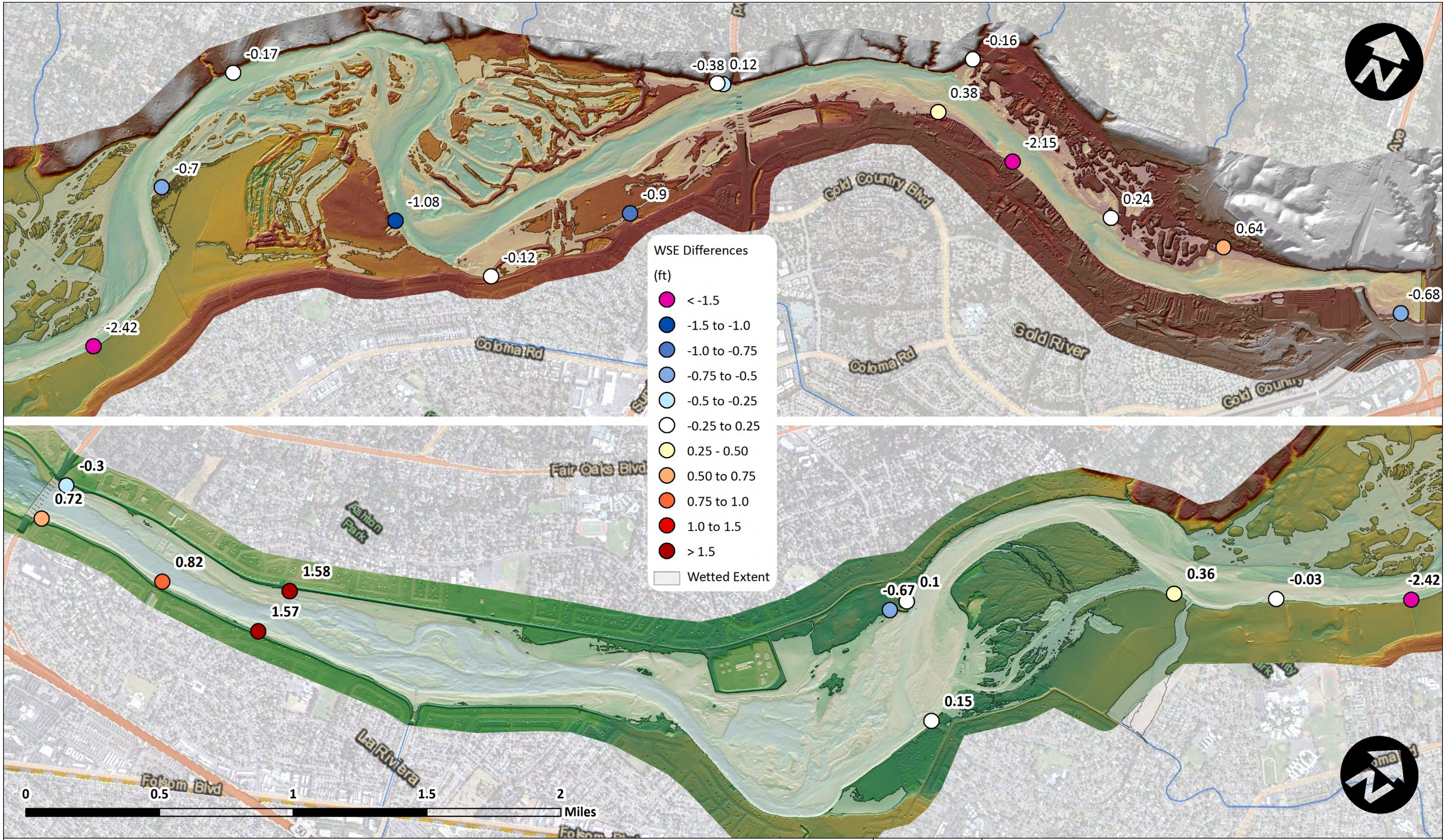
Notes: The model is matching the 1997 HWMs well with no systematic discrepancies.

Lower American River Current Condition DEM and 2D Model Development

Upper model 117,000 cfs 1/2/97 event WSE comparisons

Project No. 17-1005	Created By: MDW	**Figure 12**

D:\Projects\17-1005_LAR_RAS_2D\400_Technical_Data\402_GIS_Data\1_Figures\2_LAR17_Flood_TM\Figure12_Upper_Calibrations_117K.docx
3/28/2019



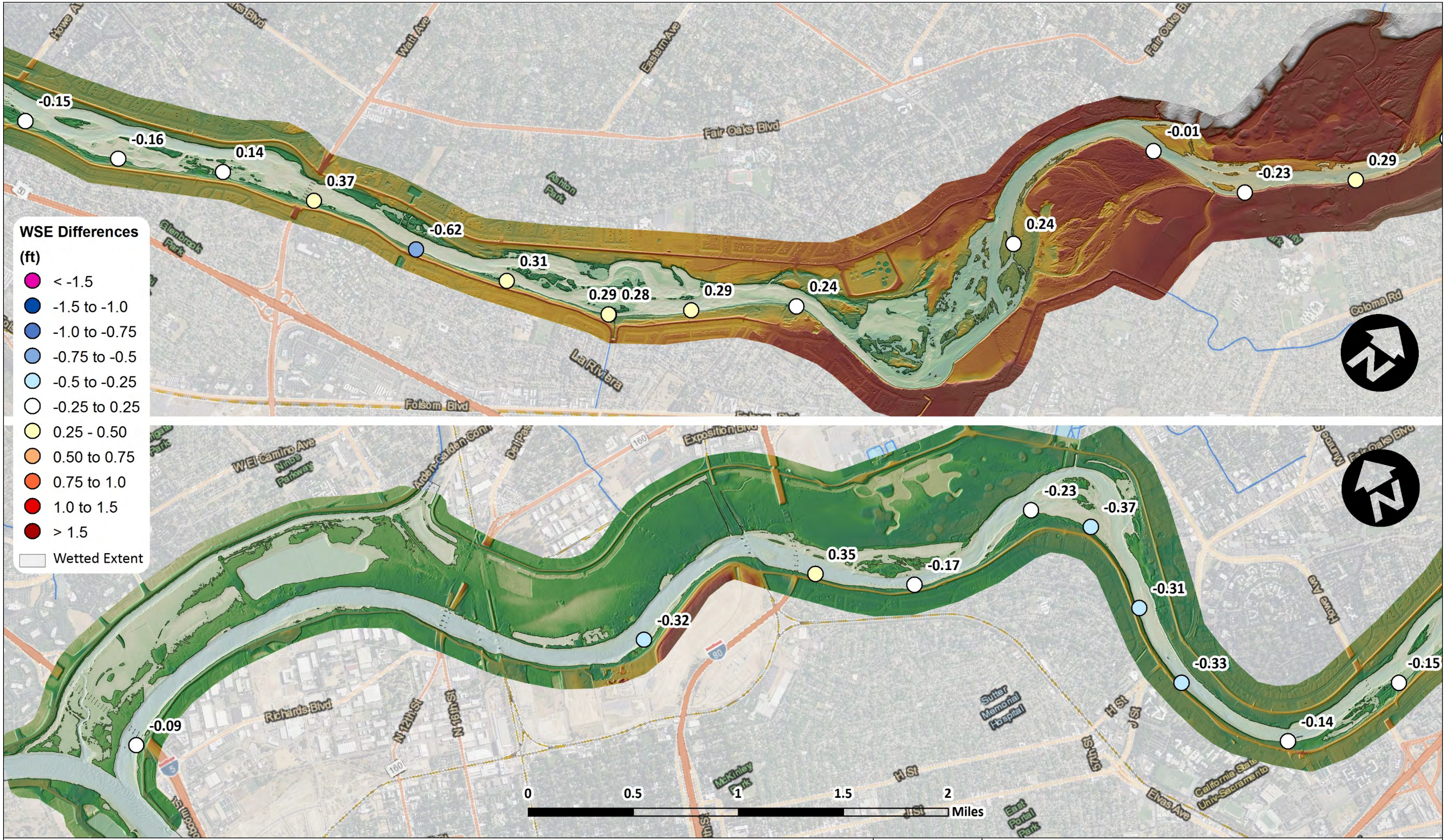
Notes: The model is mostly matching the 1986 HWMs well with no systematic discrepancies. The few outliers that exist generally have well-matched data upstream and downstream. This may suggest problems with the HWM data, especially since HWMs are not as accurate as observed RTK-GPS WSE observations.

cbec eco engineering

Lower American River Current Condition DEM and 2D Model Development

Upper model 134,000 cfs 2/19/86 event WSE comparisons

Project No. 17-1005	Created By: MDW	**Figure 13**



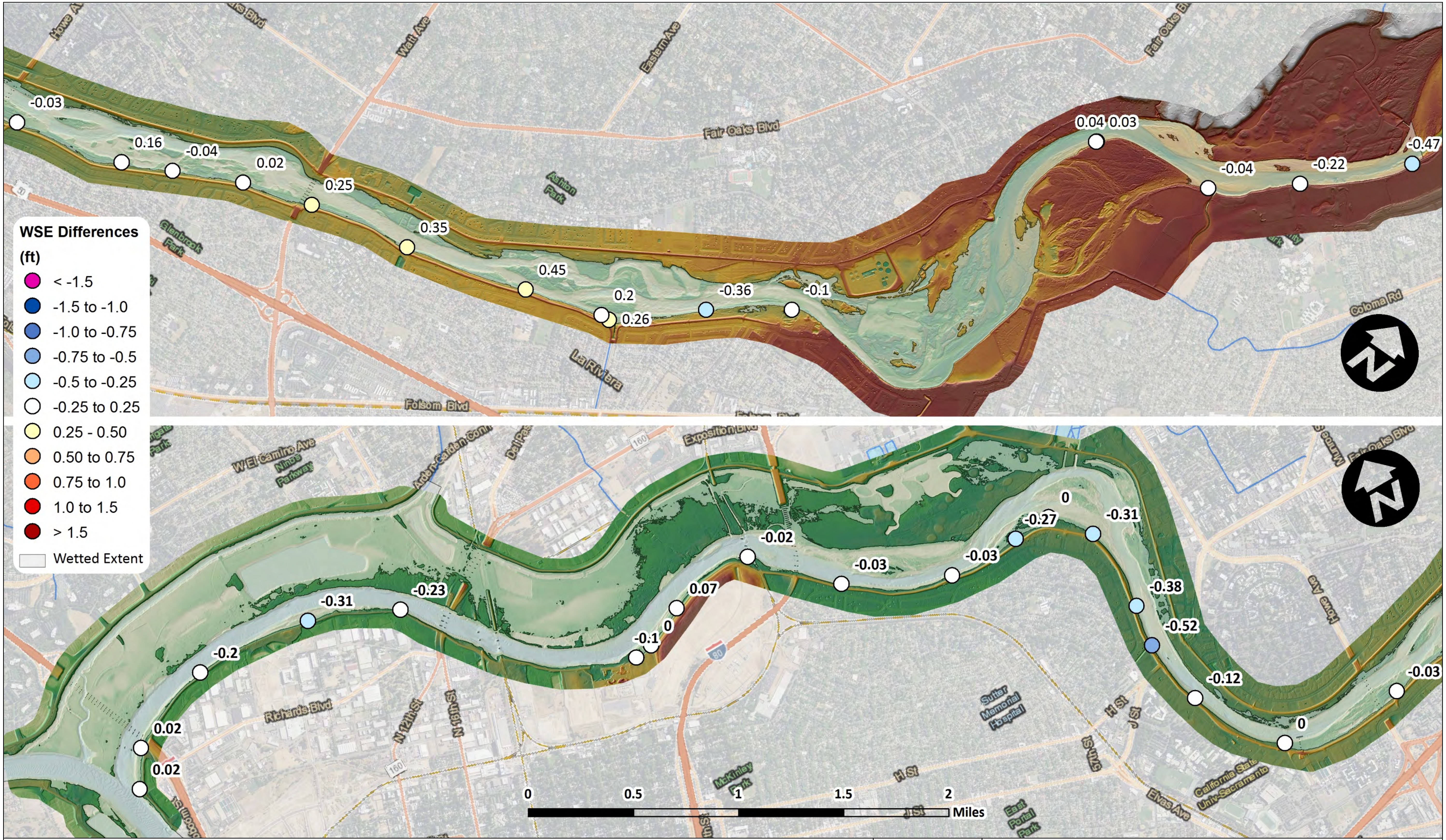
Notes: The model is matching the observed RTK-GPS WSE observations well with no systematic discrepancies.

Lower American River Current Condition DEM and 2D Model Development

Lower model 20,500 cfs 12/20/16 event WSE comparisons

Project No. 17-1005	Created By: MDW	**Figure 14**

D:\Projects\17-1005_LAR_RAS_2D\400_Technical_Data\402_GIS_Data\1_Figures\2_LAR17_Flood_TM\Figure14_Lower_Calibrations_20K.docx
3/28/2019



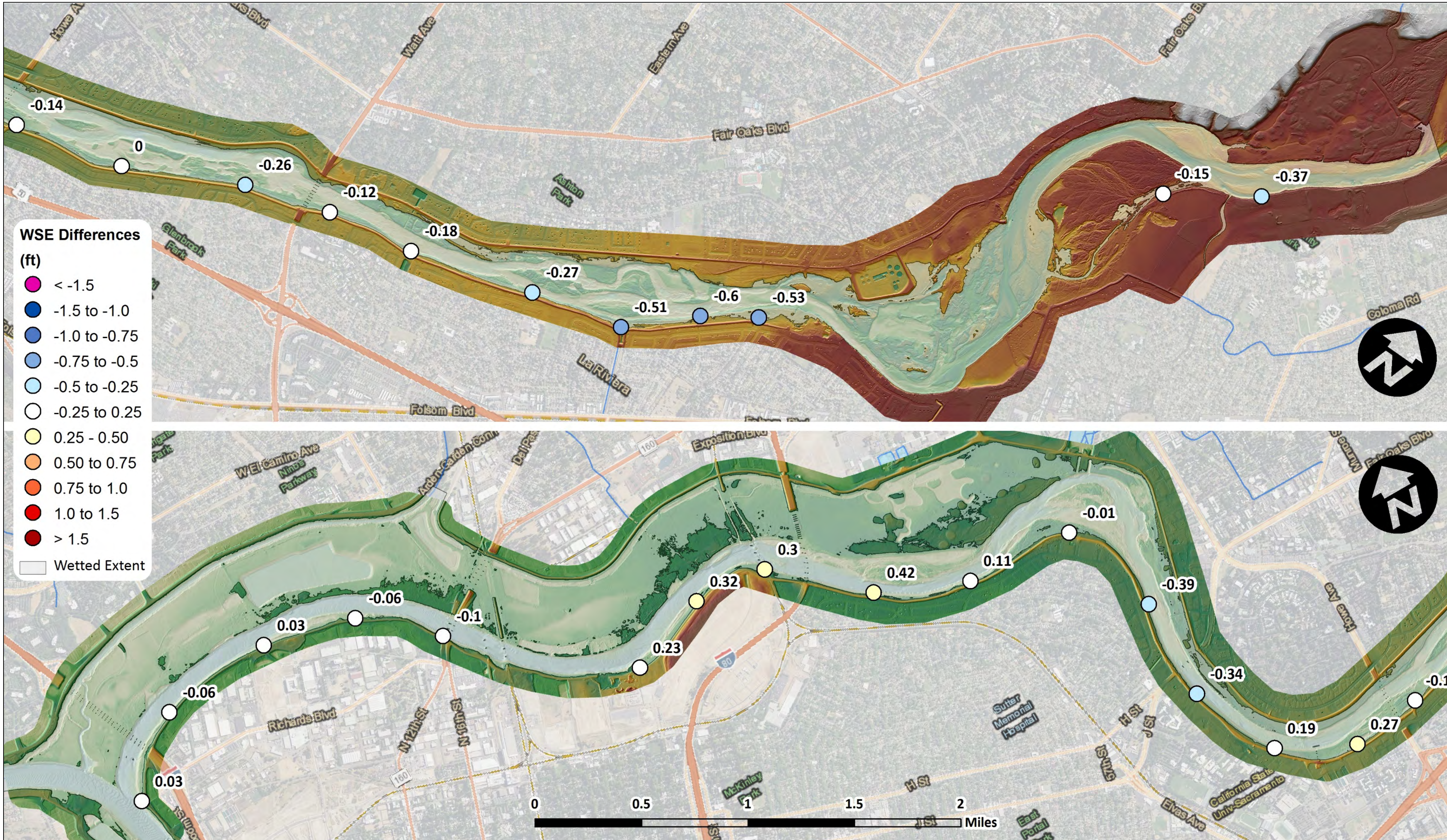
Notes: The model is matching the observed RTK-GPS WSE observations well with no systematic discrepancies.

Lower American River Current Condition DEM and 2D Model Development

Lower model 60,300 cfs 1/11/17 event WSE comparisons

Project No. 17-1005	Created By: MDW	**Figure 15**

D:\Projects\17-1005_LAR_RAS_2D\400_Technical_Data\402_GIS_Data\1_Figures\2_LAR17_Flood_TM\Figure15_Lower_Calibrations_60K.docx
3/28/2019



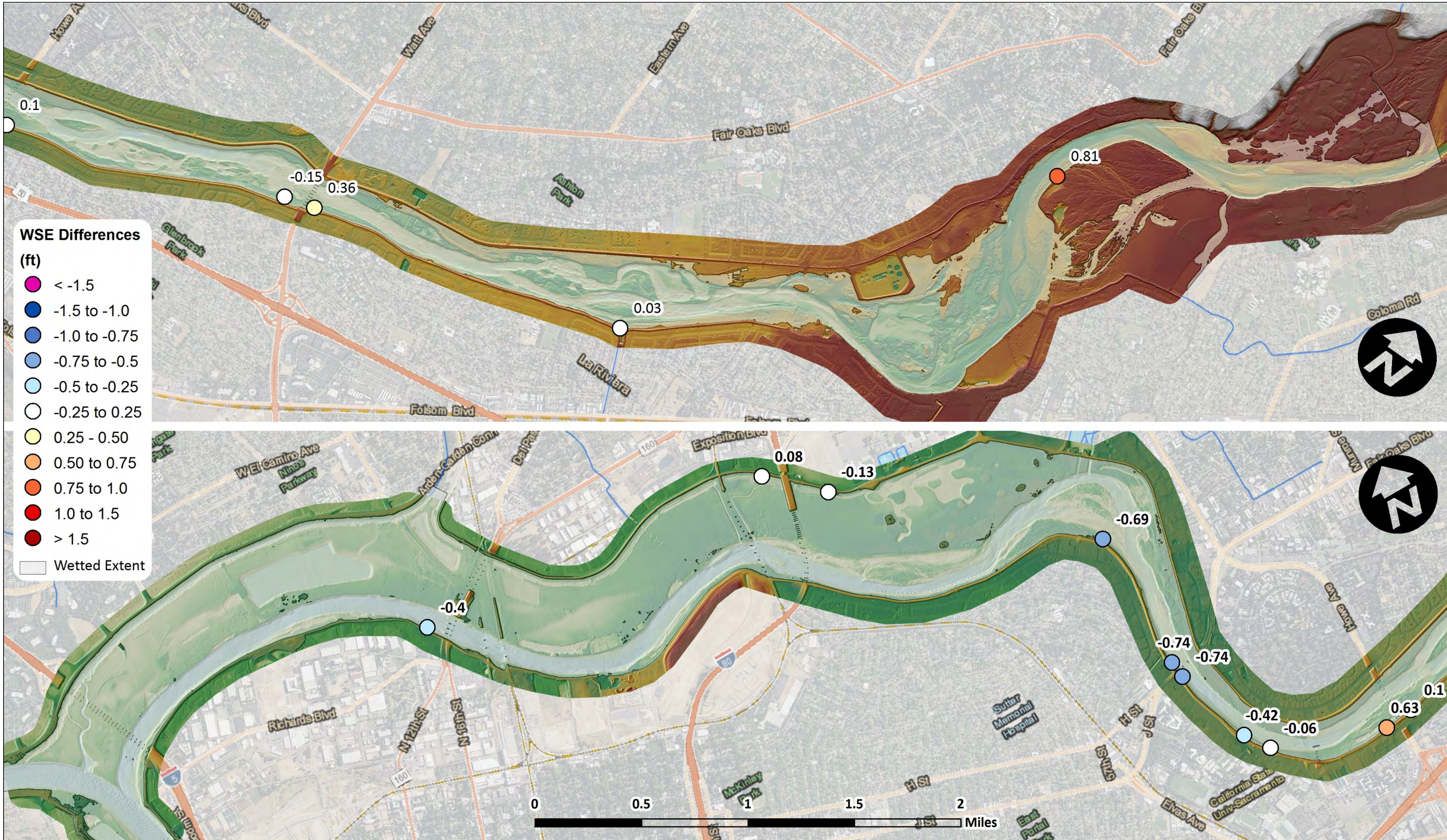
Notes: The model is matching the observed RTK-GPS WSE observations well with no systematic discrepancies.

cbec eco engineering

Lower American River Current Condition DEM and 2D Model Development

Lower model 82,200 cfs 2/10/17 event WSE comparisons

Project No. 17-1005 | Created By: MDW | **Figure 16**

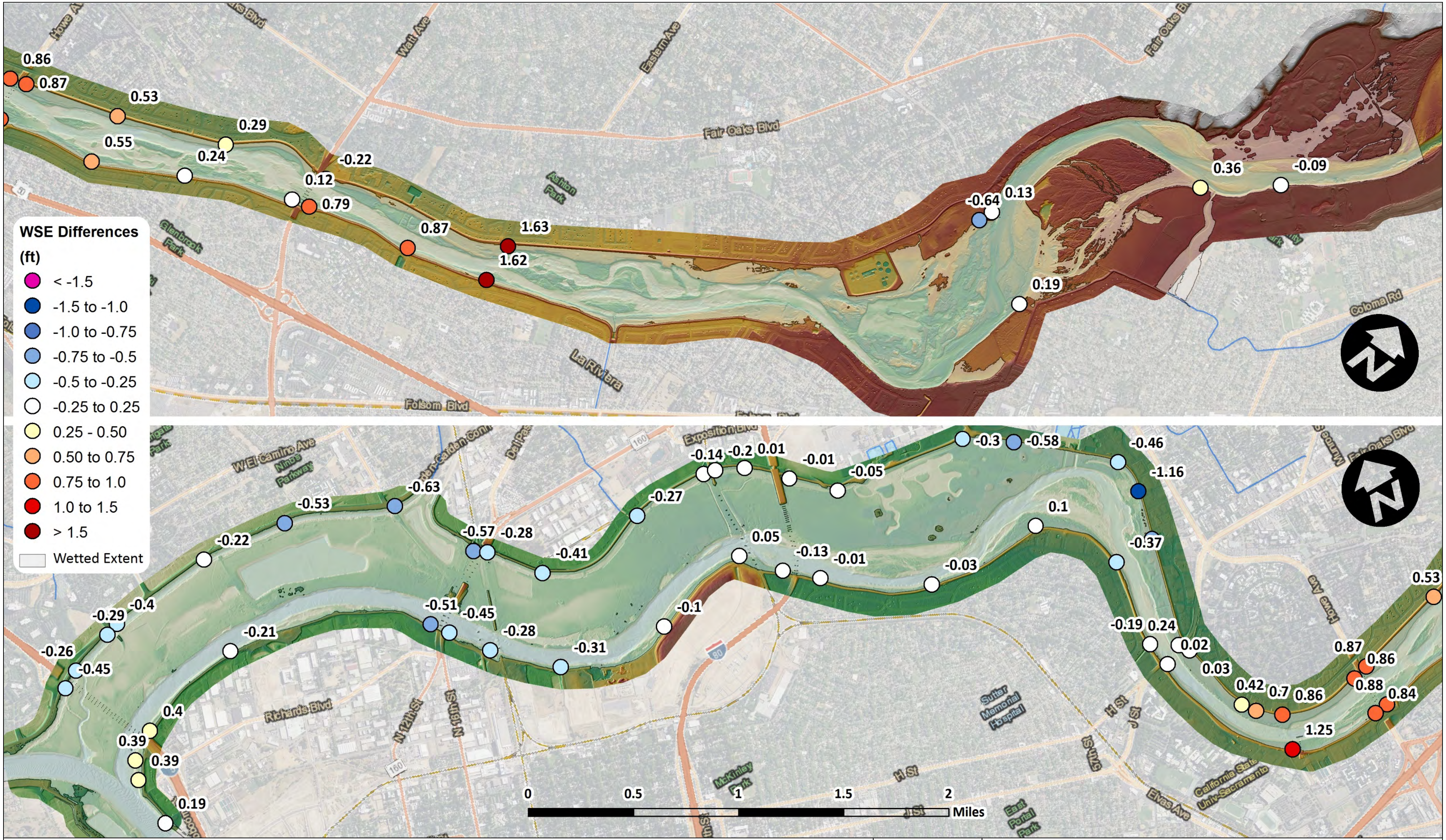


Notes: The model is matching the 1997 HWMs well with no systematic discrepancies.

Lower American River Current Condition DEM and 2D Model Development

Lower model 117,000 cfs 1/2/97 event WSE comparisons

Project No. 17-1005	Created By: MDW	**Figure 17**



Notes: The model is mostly matching the 1986 HWMs well with no systematic discrepancies. The few outliers that exist generally have well-matched data upstream and downstream. This may suggest problems with the HWM data, especially since HWMs are not as accurate as observed RTK-GPS WSE observations.

cbec eco engineering

Lower American River Current Condition DEM and 2D Model Development

Lower model 134,000 cfs 2/19/86 event WSE comparisons

Project No. 17-1005 | Created By: MDW | **Figure 18**

D:\Projects\17-1005_LAR_RAS_2D\400_Technical_Data\402_GIS_Data\1_Figures\2_LAR17_Flood_TM\Figure18_Lower_Calibrations_134K.docx
3/28/2019

cbec
eco engineering

Hydrology | Hydraulics | Geomorphology | Design | Field Services

cbec, Inc. eco engineering
2544 Industrial Blvd
West Sacramento, CA 95691
916.231.6052
cbecoeng.com

Study, Protect, Improve and
Manage Water-Dependent Ecosystems

We are a certified California small business, specializing in hydrology, hydraulics, geomorphology, design and field services.

Appendix E. Hydraulics Analysis Technical Report (Sediment Transport)

LOWER AMERICAN RIVER ANADROMOUS FISH HABITAT RESTORATION PROJECT NUMERICAL SEDIMENT MODELING

FINAL REPORT

Prepared for:

Sacramento Area Flood Control Agency

Sacramento Area Flood Control Agency
Sacramento, CA

5 June 2019

northwest hydraulic consultants
water resource specialists

LOWER AMERICAN RIVER
ANADROMOUS FISH HABITAT RESTORATION PROJECT
NUMERICAL SEDIMENT MODELING

FINAL REPORT

Prepared for:

Sacramento Area Flood Control Agency

1007 7th Street, Floor 7 Suite 3, Sacramento, CA 95814

Prepared by:

Northwest Hydraulic Consultants Inc.

2600 Capitol Ave, Suite 140, Sacramento, CA 95816

5 June 2019

NHC Ref. No. 5004305

Prepared by:

Andrey Shvidchenko, PhD
Senior Engineer

Reviewed by:

Brad Hall
Principal

Brian Wardman, PE
Principal

DISCLAIMER

EXECUTIVE SUMMARY

This numerical sediment modeling study was undertaken by Northwest Hydraulic Consultants Inc. (NHC) to assist the Sacramento Area Flood Control Agency (SAFCA), Sacramento Water Forum (Water Forum), US Army Corps of Engineers (Corps), and Central Valley Flood Protection Board (CVFPB) to better understand the potential impacts of the Lower American River Anadromous Fish Restoration Project (proposed project or proposed action) on flood conveyance in the lower American River (LAR). The main goal of the study was to quantify the volumes of spawning gravel that can be added to the LAR upstream of the leveed reach without significant adverse impacts to flood conveyance.

The analysis used a one-dimensional (1-d) HEC-6T sediment transport model of the LAR (RMs 0-22) supplemented by a two-dimensional (2-d) AdH sediment transport model of the depositional reach near William B. Pond Park (RMs 10-14). The models included surface and sub-surface bed material data collected by NHC in December 2018. The 1-d model was used for long-term simulations of the gravel augmentation effects, while the 2-d model was used to simulate flow-specific effects and to support the 1-d modeling results.

The main results of this sediment modeling study are summarized below:

- 30,000 tons/year for a 73-year simulated period of record is the maximum amount of spawning gravel that can be added each year to the channel without adversely affecting flood conveyance along the LAR. (Note: the proposed project is limited to up to 30,000 tons/year for the next 15 years.) It is recommended to distribute this augmentation load between all restoration sites over the 15-year period to the extent feasible.

- The augmentation gravel initially will not cause significant increases in sediment loads as it gradually accumulates in the channel and mixes with the original bed material. If distributed evenly between the restoration sites, it will take approximately 3 decades with annual importing of augmentation gravel to start increasing sediment delivery downstream of the project reach.

- The application of this entire augmentation gravel load at the most downstream restoration site will result in a greater sediment inflow into and deposition in the region of William B. Pond Park, compared to the scenario when this load is distributed between all the restoration sites.

- The additional sediment load from the gravel augmentation sites will deposit within the reach of past instream gravel mining between RMs 10.5-13.5 and there will be no significant impact to sediment loads and bed changes in the leveed reach downstream of about RM 10 over the 15-year life of the project.

- Because of the simplification of the complex natural sediment transport process in numerical models, the modeling results should be regarded as approximate indicators of the general morphological behavior of the system. Regular field monitoring of the effects of the gravel augmentation activities should be implemented to detect any negative impacts to flood conveyance and channel/bank stability and to adjust gravel augmentation volumes and locations as necessary to avoid significant impacts.

- NHC recommends performing field measurements of sediment transport rates (including gravel bed load and suspended sand load) in the upper reach of the LAR as part of the monitoring program of the effects of the proposed project. Presently, there are no measured bed load transport data on the LAR. These measurements would provide invaluable field data to calibrate and verify existing and future sediment transport models. A program of field measurements of sediment transport provides the information needed to assess and confirm any changes in sediment loads due to the proposed project.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

1-d	one-dimensional
2-d	two-dimensional
AdH	2-d Adaptive Hydraulics computer program
AGU	American Geophysical Union
CBEC	CBEC Eco Engineering
Corps	US Army Corps of Engineers
CVFPB	Central Valley Flood Protection Board
D_{50}	median sediment size
DEM	digital elevation model
HEC-6T	1-d sediment transport computer program
HEC-RAS	1-d/2-d hydraulic computer program
LAR	Lower American River
LiDAR	Light Detection and Ranging
NAVD88	North American Vertical Datum of 1988
NHC	Northwest Hydraulic Consultants, Inc.
RFID	Radio Frequency Identification
RM	River Mile
SAFCA	Sacramento Area Flood Control Agency
USBR	US Bureau of Reclamation
Water Forum	Sacramento Water Forum
WSE	Water surface elevation
WY	Water Year

1 INTRODUCTION

1.1 Background

The Sacramento Water Forum (Water Forum), Sacramento Area Flood Control Agency (SAFCA), and US Bureau of Reclamation (USBR) are proposing to implement the Lower American River Anadromous Fish Restoration Project (proposed project or proposed action) for a 15-year period (2019-2024) to enhance and restore spawning and rearing habitat for Chinook salmon and steelhead trout in the lower American River (LAR). The project includes spawning gravel augmentation, floodplain and side channel creation/enhancement, and instream habitat structure placement (large woody debris). The objective of the proposed project is to help offset impacts to naturally spawned salmonid stocks caused in part by the presence of upstream dams preventing replenishment of natural gravels to the river channel and altering natural flow characteristics.

As part of the project permitting process, the Water Forum and USBR must demonstrate that the proposed project will not negatively impact the US Army Corps of Engineers' (Corps') downstream flood control project and facilities. Northwest Hydraulic Consultants Inc. (NHC) was contracted to assist the Water Forum, USBR, SAFCA, Corps, and Central Valley Flood Protection Board (CVFPB) to better understand the potential impacts of the proposed project on downstream Corps' facilities and flood conveyance on the LAR.

1.2 Proposed Project

A preliminary analysis of digital elevation models (DEMs) based on the 1997, 2006/2008, and 2017 channel surveys indicated that on average about 15,000 cubic yards (or 22,000 tons) of bed material is removed annually from the spawning reach upstream of RM 13.5 (CBEC 2019a). The purpose of the proposed project is to restore and replenish salmonid spawning gravel lost due to the construction and operation of Folsom and Nimbus Dams and other actions that have reduced the availability of spawning gravel and rearing habitat in the LAR. The proposed restoration sites are located in an approximately 9-mile long reach below Nimbus Dam, between approximate River Miles (RMs) 13-23. The location of the sites is shown in Figure 1.1. All project sites are located upstream of the leveed portion of the river.

USBR with assistance from the Water Forum has implemented gravel augmentation at several sites since 2008. The past gravel placement locations and amounts are summarized in Table 1.1. The total amount of spawning gravel added to the LAR during 2008-2016 was approximately 71,000 cubic yards (100,000 tons). On average, about 8,000 cubic yards/year (11,000 tons/year) of gravel were added to the river, except for the large augmentation project completed at the Sacramento Bar in 2016 when nearly 26,000 cubic yards (37,000 tons) of spawning gravel were placed in the channel.

The proposed gravel augmentation sites and amounts are summarized in Table 1.2. The proposed total gravel placement over the 15-year (2019-2034) duration of the project is about 113,000 cubic yards (160,000 tons). According to USBR/SAFCA (2019), gravel would be placed at up to three sites annually, and in some years, it is likely that no gravel would be placed. In-river gravel placement along the entire project reach would not exceed approximately 21,000 cubic yards (30,000 tons) annually. Gravel borrow would occur from dredge tailings located at Sailor Bar and Mississippi Bar. The gravel would be uncrushed, rounded "natural river rock" with no sharp edges. Gravels would be sieved and sorted based on general criteria recommended by the Central Valley Project Improvement Act's Anadromous Fish Restoration Program and studies designed to specify optimum size for LAR salmon and steelhead spawning habitat. The prepared augmentation gravel would be placed in the river using dump trucks and front-end loaders. At some sites, the existing river substrate would be graded with a bulldozer prior to gravel additions to remove armoring (surface layer of larger rock) or to meet topographic design specifications. The augmentation gravel would be distributed along the river bottom to create the hydraulic conditions necessary for salmonid spawning. All spawning gravel augmentation would occur over a 4- to 6-week period during July through September to ensure in-river work is complete prior to annual fall-run Chinook salmon spawning activity.

1.3 Study Objectives

The main goal of the study conducted by NHC was to determine how much gravel can be added to the LAR before there are flood conveyance impacts. The specific objectives were to (1) quantify an average volume per year of spawning gravel which can be added to the active river bed channel upstream of the leveed reach without negative impacts to flood conveyance; (2) identify the number of years gravel augmentation can occur prior to impacts reaching the leveed reach; and (3) outline monitoring programs to continue to better understand current conditions and update future modeled conditions.

The study included the following major tasks: (1) collection of up-to-date surface and sub-surface bed material data along the project reach of the LAR; (2) evaluation of impacts to the upstream non-leveed reach; (3) evaluation of impacts to the leveed reach; and (4) field studies of gravel movement. NHC used the restoration design plans and information about past and proposed gravel augmentation activities from the Water Forum, USBR/SAFCA (2019), and USBR (2014, 2016). New bed material data were collected in December 2018 and analysed for grain-size composition. A previously developed one-dimensional (1-d) HEC-6T model of the LAR was updated with the new bed material data and used to quantify the amount of gravel which can be added without adversely reducing flood capacity in the upstream non-leveed reach. A two-dimensional (2-d) AdH mobile bed model was developed between River Miles (RMs) 10-15 to simulate sediment movement and deposition in this complex reach and to confirm 1-d model results. Field studies include application of the Radio Frequency Identification (RFID) technology to gain insights into the complex process of initiation of movement and transport of different gravel sizes.

The following sections of this report presents results from the bed material sampling program, 1-d HEC-6T modeling, and 2-d AdH modeling completed by NHC. The field application of RFIDs for tracking gravel movement is planned to be implemented over the next several years, is currently in a testing state, and is not discussed in this report.

Table 1.1. Past gravel placement – 2008 to present (USBR/SAFCA 2019).

Year	Site name	River Mile (RM)	Gravel volume (cubic yards)
2008	Upper Sailor Bar	22.5	4,087
2009	Upper Sailor Bar	22.5	4,856
2010	Lower Sailor Bar	21.3	7,055
2011	Lower Sailor Bar	21.1	7,266
2012	Lower Sailor Bar	21.8	8,500
2013	River Bend	13.5	4,750
2014	Nimbus Basin	23.1	8,500
2016	Sacramento Bar	19	25,800
Approximate total to date			~71,000

Table 1.2. Proposed gravel placement – 2019 through 2034 (USBR/SAFCA 2019).

Site name	River Mile (RM)	Restored spawning gravel area (acres)	Restored spawning gravel channel extent (linear ft)	Estimated gravel volume (cubic yards)
Nimbus Basin	23.1	3.5	400	4,000
Upper Sailor Bar	22.5	6	600	14,000
Lower Sailor Bar	21.8			5,500
Lower Sailor Bar	21.3	6.5	2,000	550
Lower Sailor Bar	21.1			13,000
Sunrise	20.1	4	300	13,500
Lower Sunrise	19.6	2.5	600	3,000
Sacramento Bar	19	13	900	6,000
El Manto	18.3	7.5	700	13,500
Ancil Hoffman	16.3	7	700	11,500
Upper River Bend	15.3			13,000
Upper River Bend	15	14	4,000	N/A
Upper River Bend	14.5			11,000
River Bend	13.5	4.5	250	4,500
Total				113,050

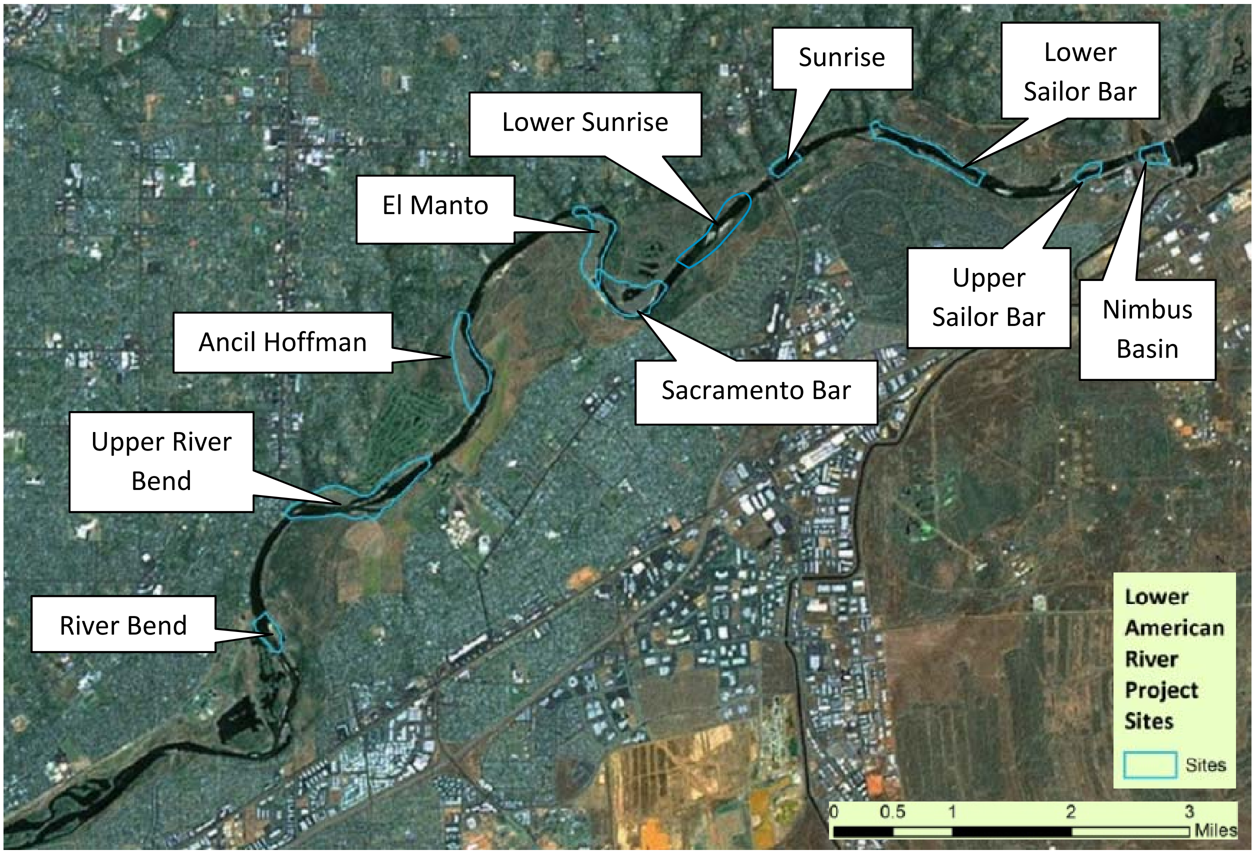


Figure 1.1. Lower American River restoration sites.

2 BED MATERIAL DATA GATHERING

2.1 Sediment Transport Processes in Gravel-Bed Rivers

In gravel-bed rivers, bed material is usually composed of a widely graded, mixed-size sediment including sand, gravel, and cobbles. Finer material will often be winnowed out of the bed surface during low flow conditions, leaving a layer of coarse material on the bed surface (Figure 2.1). This coarse material acts as an armor layer protecting the relatively finer material beneath it from erosion. The thickness of the armor layer is typically determined by the largest grain sizes.

Bed armoring is an important element of stream stability. The coarse armor layer controls the mobilization threshold and transport of the finer sub-surface material. Low flows are unable to break the armor layer, so the quantity of bed sediment transported is limited. Flood flows are capable of breaking the armor layer and it is during these high flow periods that the majority of bed material is transported downstream. When mobilized, gravel and cobbles are typically transported as bed load by rolling and hopping along the bed surface, while sand can be transported both as bed load (during lower flows) and as suspended load (during higher flows). Changes in the armor layer composition (for example, due to the interruption of the upstream sediment supply by dams or due to the gravel augmentation activities) may affect the overall bed mobility and sediment outflow into the downstream reaches. Therefore, bed armoring needs to be accounted for when modeling sediment transport processes in gravel-bed rivers.

2.2 Previous Bed Material Data

A number of bed material measurements along the lower American River (LAR) have been conducted since 1991. The historical bed material data are reviewed in detail in NHC (2011). Most of the previous data were collected from bar surfaces and only a few sub-surface bed material data were collected at some locations.

Grain size distributions of the surface armor and sub-surface bed material were measured at three locations by NHC in November 2011 (NHC 2011). The grain size distributions for these samples are shown in Figure 2.2. The proposed grain size distribution of the augmentation gravel is also shown on this figure for comparison. Median sediment sizes and proportions of sand (grain size 0.062-2 mm), gravel (grain size 2-64 mm), and cobbles (grain size 64-256 mm) in the 2011 samples are summarized in Table 2.1. Field sampling conducted by NHC (2011) indicated that (1) the surface and sub-surface bed materials are mostly composed of gravels and cobbles; (2) the surface bed material is appreciably coarser than the sub-surface material; and (3) significant amounts of sand are contained in the sub-surface material. Results from the NHC's bed material sampling were used to refine the HEC-6T sediment transport model of the LAR, which was originally based on the surface bed material data (NHC 2015).

2.3 2018 Bed Material Sampling

On December 18, 2018 NHC collected surface and sub-surface bed material samples from 9 locations in the vicinity of the proposed gravel augmentation sites. The bed material sampling locations are shown in Figure 2.3 and on the maps of the study reach in Appendix A. The samples were collected into 5 gallon buckets with a shovel and then sieved in a laboratory to determine grain size distributions. Selected photographs of the surface and sub-surface bed material are shown in Figures 2.4 and 2.5. The grain size distributions for the 2018 samples are shown in Figure 2.6 together with the proposed grain size distribution of the augmentation gravel. Median sediment sizes and proportions of sand, gravel, and cobbles in the 2018 samples are summarized in Table 2.1. The 2018 sampling data are in reasonable agreement with the 2011 data.

According to the laboratory analysis of the NHC's samples, surface bed material in the sampled locations is mostly composed of gravel (7-84%) and cobbles (14-93%), with small amounts of sand (1-8%). Median size of the surface material ranges from 90-146 mm in the upstream reach near Nimbus Dam to 30-103 mm downstream of Sunrise Boulevard. Sub-surface deposits are predominantly gravels (44-79%), with smaller amounts of cobbles (0-52%) and sands (7-34%). Median size of the sub-surface sediments ranges from 25-68 mm near Nimbus Dam to 8-54 mm downstream of Sunrise Boulevard. Maximum grain sizes are similar for both the surface and sub-surface samples and range from 105-200 mm near Nimbus Dam to 64-145 mm downstream of Sunrise Boulevard.

The maximum and median sediment sizes for the NHC's bed material samples collected in 2018 are compared with the previous measurements (used to specify bed material characteristics in the LAR HEC-6T model) in Figure 2.7. It is seen from this figure that the measured bed material sizes show significant variability, which is typical of natural gravel-bed rivers. In general, however, the present and past bed material data are in overall agreement. NHC's 2018 sampling data were used to update the composition of the surface and sub-surface materials in the HEC-6T sediment transport model of the lower American River.

The grain size distribution of the augmentation gravel is based on the target gradation for salmon spawning (NHC 2018b). According to the NHC's measurements (see Figures 2.2 and 2.6), the surface bed material at most sampling sites is substantially coarser than the bed material needed for salmon spawning.

Table 2.1. Median sediment size and proportion of sand, gravel, and cobbles in American River surface and sub-surface bed material (NHC 2011 and 2018 data).

Sample ID	Location	HEC-6T Station (RM)	Median size D_{50} (mm)	Proportion[1] (%)		
				Sand	Gravel	Cobbles
NHC 2011 data (surface)						
1a	Sunrise Blvd	19.8	60	1	56	43
2a	Watt Ave	9.3	54	1	65	34
3a	Paradise Bend	5.8	33	8	80	12
NHC 2011 data (sub-surface)						
1b	Sunrise Blvd	19.8	54	11	46	43
2b	Watt Ave	9.3	37	18	50	32
3b	Paradise Bend	5.8	16	15	85	0
NHC 2018 data (surface)						
1a	Nimbus Basin	22.6	90	1	34	65
2a	Upper Sailor Bar	22.0	146	0	7	93
4a	Lower Sailor Bar	20.9	110	0	34	66
5a	Sunrise	20.0	31	7	79	14
6a	Lower Sunrise	19.3	86	0	22	78
7a	Upper Rossmoor Bar	18.0	76	0	33	67
8a	Ancil Hoffman	16.2	53	1	62	37
9a	River Bend	13.2	30	2	84	14
10a	Upper River Bend	14.3	103	0	19	81
NHC 2018 data (sub-surface)						
1b	Nimbus Basin	22.6	25	11	57	32
2b	Upper Sailor Bar	22.0	68	2	46	52
4b	Lower Sailor Bar	20.9	35	12	54	34
5b	Sunrise	20.0	8	34	66	0
6b	Lower Sunrise	19.3	26	13	57	30
7b	Upper Rossmoor Bar	18.0	26	7	79	14
8b	Ancil Hoffman	16.2	37	15	51	34
9b	River Bend	13.2	17	24	70	6
10b	Upper River Bend	14.3	48	11	44	45

Notes:

1. Sand = 0.0625-2 mm, Gravel = 2-64 mm, Cobbles = 64-256 mm (AGU classification).

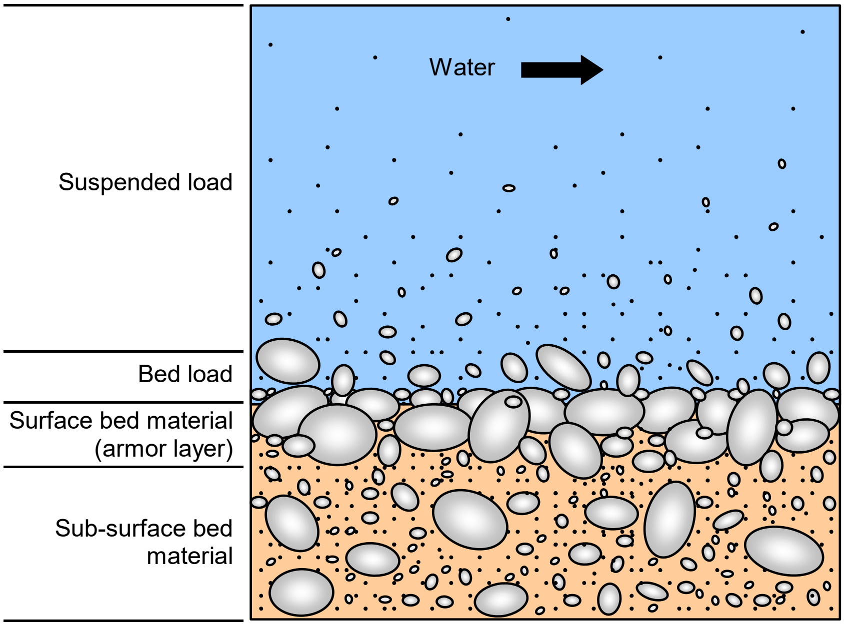


Figure 2.1. Fluvial sediment schematic.

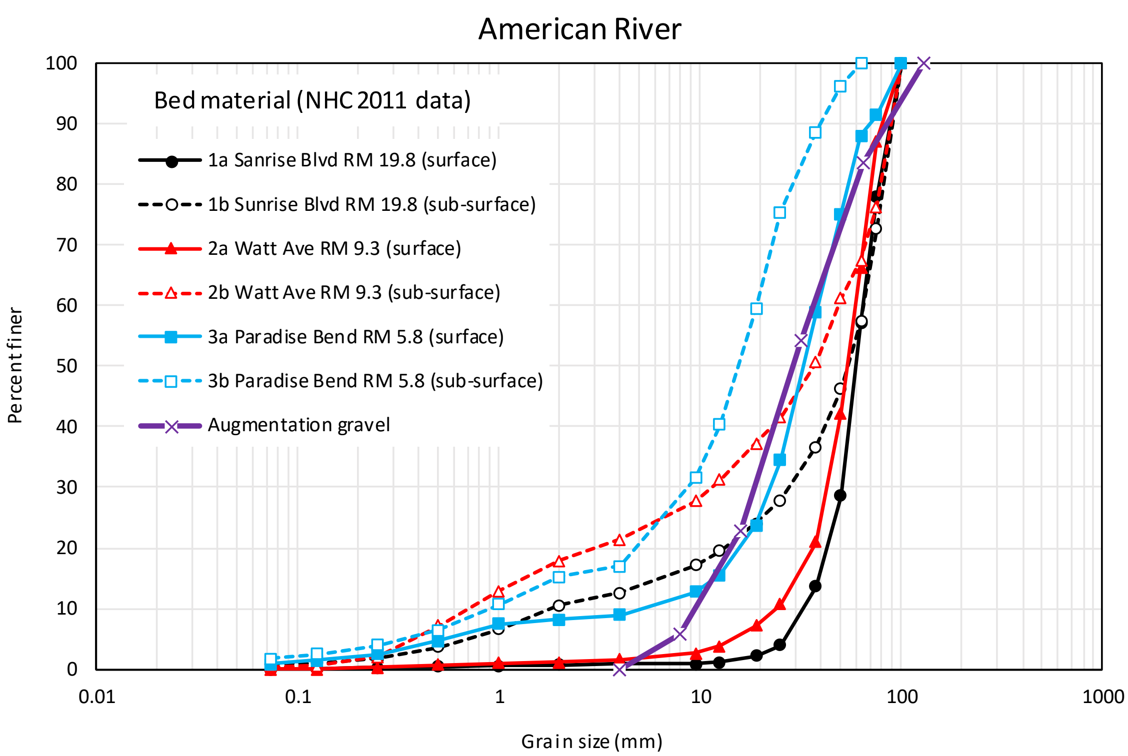


Figure 2.2. Grain size distributions for surface and sub-surface bed material samples collected by NHC in 2011.

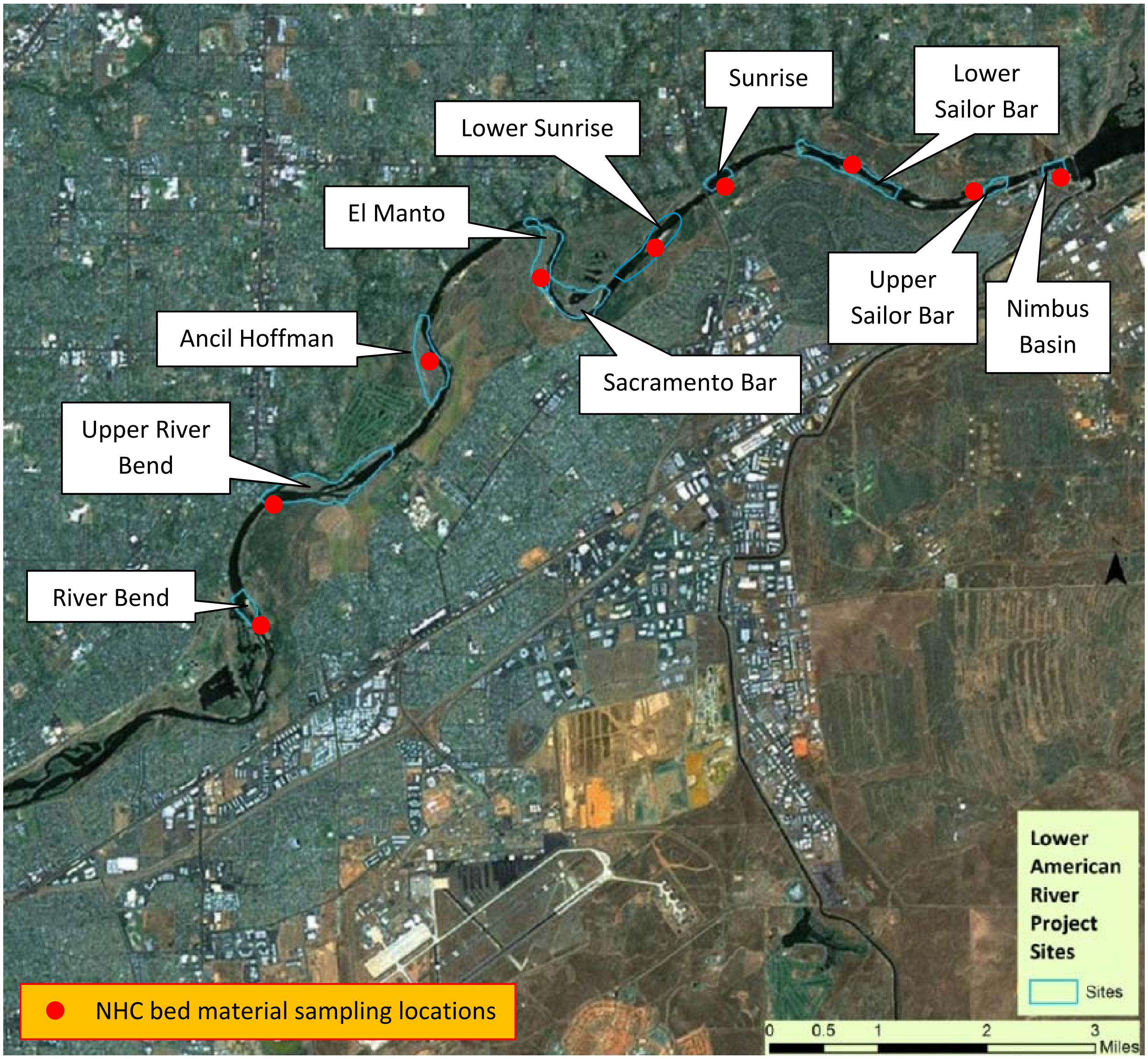


Figure 2.3. NHC 2018 bed material sampling locations.

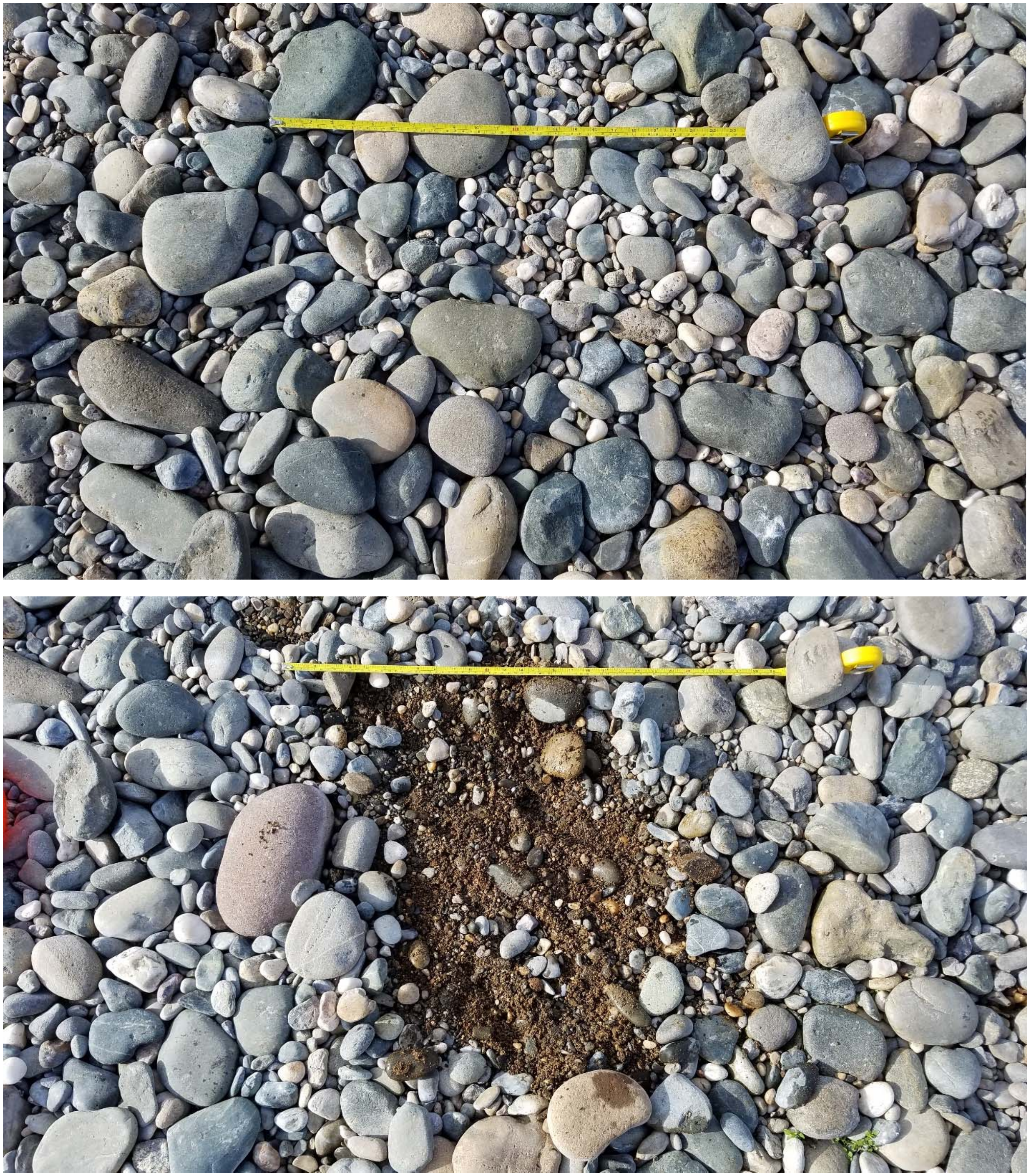


Figure 2.4. Surface (top) and sub-surface (bottom) bed material at Lower Sunrise (samples 6a and 6b).

Figure 2.5. Surface (top) and sub-surface (bottom) bed material at River Bend (samples 9a and 9b).

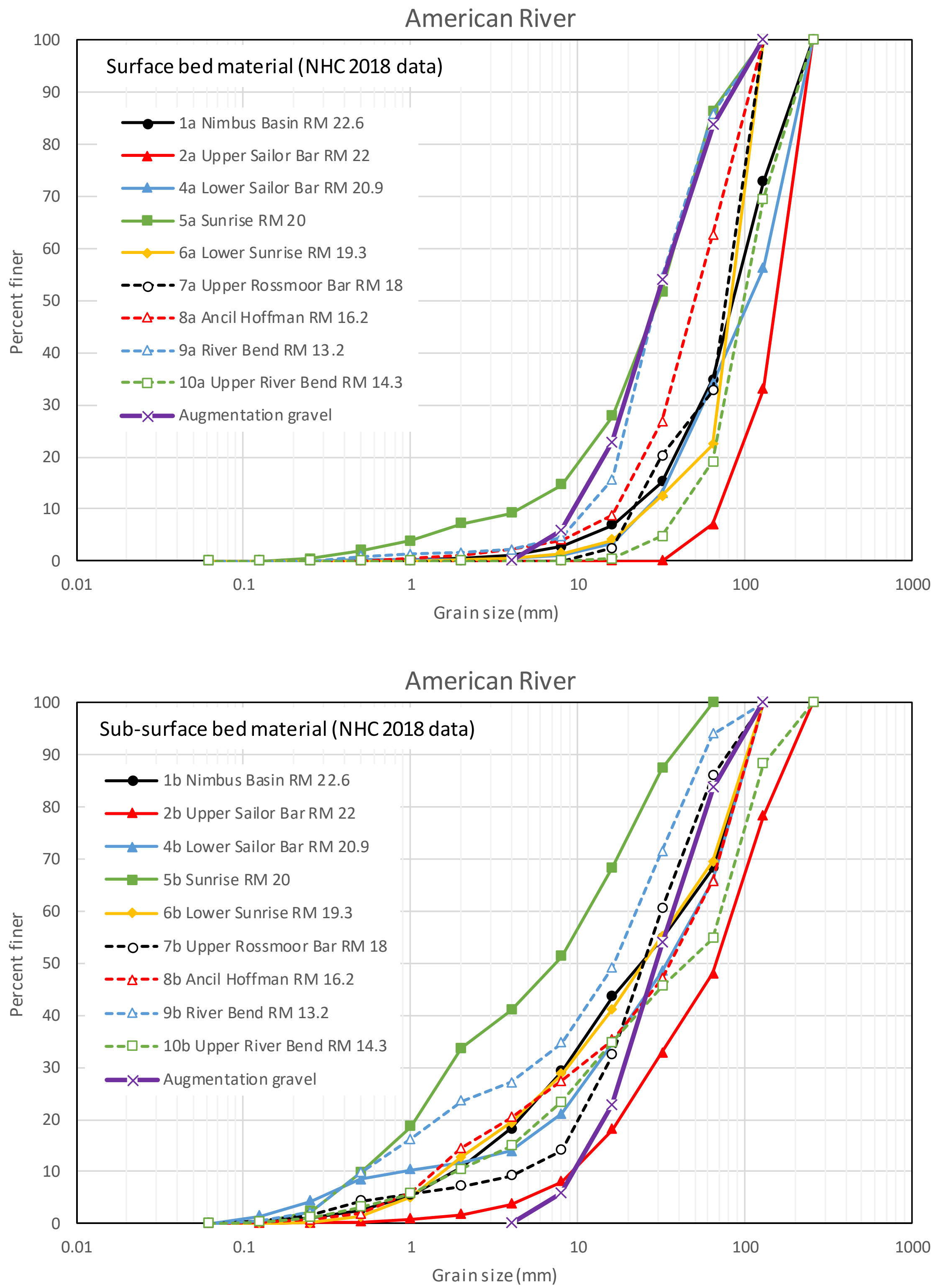


Figure 2.6. Grain size distributions for surface (top) and sub-surface (bottom) bed material samples collected by NHC in 2018.

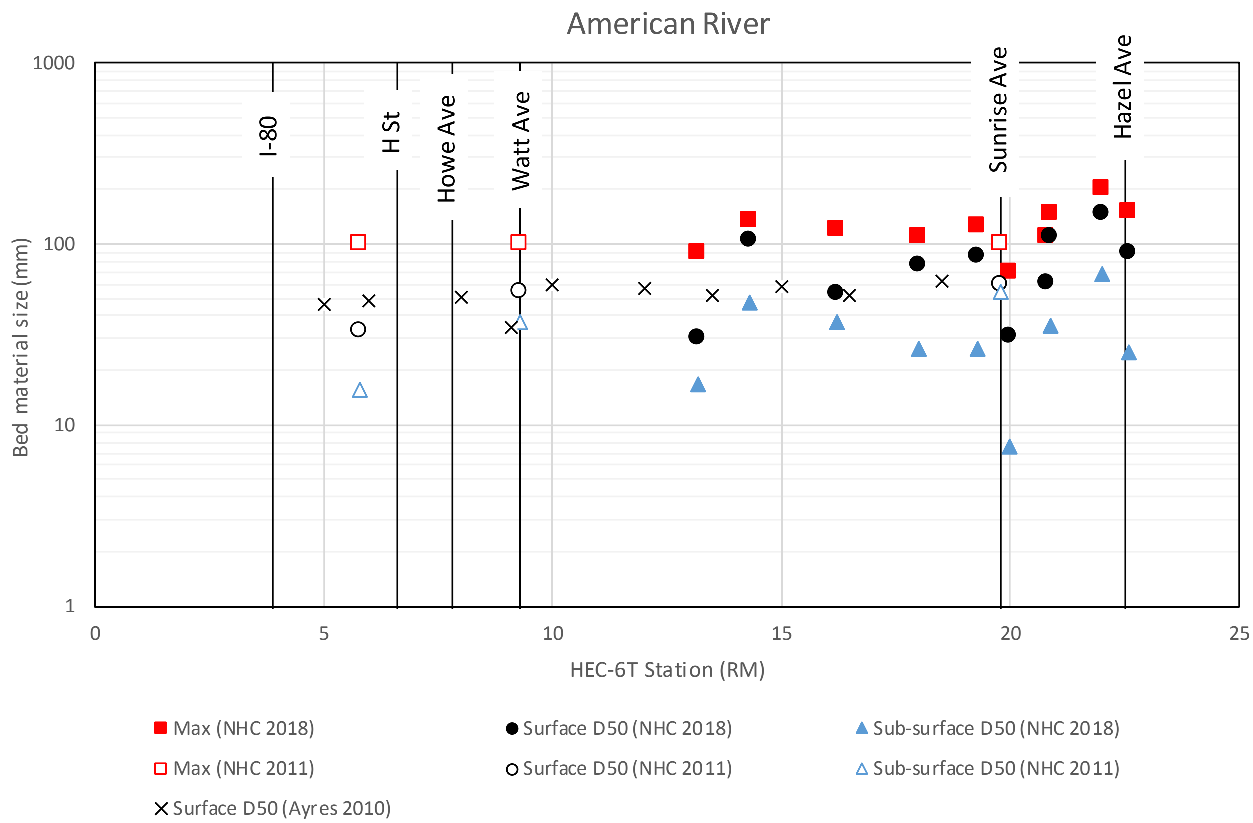


Figure 2.7. Comparison of bed material sizes from various studies (used in HEC-6T model).

3 ONE-DIMENSIONAL MODELING OF THE LOWER AMERICAN RIVER

3.1 HEC-6T Model

NHC (2015) previously developed a one-dimensional (1-d) HEC-6T sediment transport model of the lower American River (LAR). The model included a 22-mile reach of the LAR below Nimbus Dam and an adjoining 32-mile reach of the Sacramento River. The Sacramento River reach was added to eliminate the effect of the downstream model hydraulic boundary on sediment transport computations in the study reach of the LAR.The model geometry was based on the 1997 and 2006 bathymetric surveys. Bed material characteristics in the model were specified from a surface and sub-surface sampling program and geotechnical investigations of erosion-resistant stratigraphy. The model was calibrated to measured sediment loads and bed profiles. As a result of the calibration process, the Laursen-Copeland transport function was selected to model sediment transport through the study reaches of the American and Sacramento Rivers. The calibrated model was used to simulate long-term sediment transport and geomorphic trends over a 73-year period (Water Years, or WYs, 1930-2002) for different hydrologic scenarios (NHC 2017), as well as to determine various effects of proposed project (NHC 2018a, 2018b).

Results of NHC's previous sediment transport model studies (NHC 2015, 2017, 2018a, 2018b) and physical observations (CBEC 2019a) indicate that the reach of the LAR between River Mile (RM) 13.5 and Nimbus Dam is an erosional reach. These results are expected as this channel is immediately downstream of large reservoirs which capture upstream sediment. The proposed project would augment this reach with fine to coarse gravels to replace those being eroded for the purpose of providing spawning habitat to salmon. In the present study, NHC applied the previously developed LAR HEC-6T mobile bed model to quantify the average volume of augmentation gravel which can be added annually to the active river channel upstream of the leveed reach without adverse impacts to flood conveyance.

3.2 Model Application

The LAR HEC-6T model was updated with the new surface and sub-surface bed material data collected in December 2018 (discussed in Chapter 2). The updated model was then used to simulate the long-term effects of the following gravel augmentation scenarios:

(1) Baseline conditions (no gravel augmentation).
(2) Gravel augmentation rate of 15,300 tons/year (tentative amount previously planned by the Water Forum).
(3) Gravel augmentation rate of 30,000 tons/year (the maximum amount for 15 years under the proposed project).
(4) Gravel augmentation rate of 60,000 tons/year.
(5) Gravel augmentation rate of 120,000 tons/year.

The above gravel loads were evenly distributed between the 10 restoration sites (shown in Figure 1.1) and applied each year during July, August, and September, as specified in USBR/SAFCA (2019). The grain size distribution of the augmentation gravel is shown in Figures 2.2 and 2.6. Locations of the HEC-6T model cross-sections and augmentation gravel additions are shown on the study reach maps in Appendix A.

The model was run using the previously developed 73-year hydrologic record (WYs 1930-2002) representative of the new Folsom Dam Water Control Manual (project forecast-based hydrology J602F3-ELD). The model results were used to select the maximum allowable gravel augmentation rate that would not cause long-term bed aggradation and would not increase flood levels. A series of model sensitivity runs were then conducted for the selected maximum allowable augmentation rate to evaluate the effects of the "wettest" period in the hydrologic record (WYs 1970-2002) and the "worst case" gravel placement location (when the entire augmentation gravel load is applied at the most downstream restoration site). Modeling results and results of the sensitivity runs are discussed in the subsequent sections of this report.

3.3 Long-Term Simulation Results

This section discusses the results of long-term model simulations for WYs 1930-2002 with a range of gravel augmentation rates evenly distributed between the 10 restoration sites.

Sediment Load

Total sediment loads (i.e., cumulative load moved past a cross-section in the river during the simulation period) computed along the LAR for WYs 1930-2002 are shown in Figure 3.1. Under the baseline conditions (without gravel augmentation), sediment load rapidly increases in the sediment supply-deficient reach downstream of Nimbus Dam until about RM 13.5 due to erosion of channel bed material, then rapidly decreases in the reach of historic instream aggregate mining between RMs 10.5-13.5 due to coarse bed material deposition, and then gradually reduces downstream of RM 10.5 due to additional bed material deposition. The simulated gravel augmentation progressively increases sediment loads upstream of about RM 11 and shows minimal effects on sediment loads downstream of RM 11. Computed average annual sediment outflows (over the simulation period) from the project reach are provided in Table 3.1.

The computed grain size composition of total sediment loads is shown in Figure 3.2. This figure indicates that cobbles (grain size 64-256 mm) and gravel (grain size 2-64 mm) are mostly transported between Nimbus Dam and RM 11. Downstream of RM 11, the sediment load is predominantly composed of sand (grain size 0.062-2 mm). The addition of spawning gravels at the restoration sites increases the proportion of gravel in computed sediment loads upstream of RM 8 and has minimal effects on the composition of sediment loads downstream of RM 8.

It should be noted that the computed increase in sediment load may include some of the augmentation gravel as well as the original bed material mobilized by the changed flow hydraulics due to the placement of gravel at the restoration sites. For example, placement of spawning gravel at a restoration site may increase local bed elevation, which would increase water surface slope downstream of the restoration site, which in turn would increase erosion of parent bed material in the downstream reach, which would change hydraulic and sediment transport conditions farther downstream. The augmentation gravel is noticeably finer and more widely graded than the existing coarse surface material in the project reach of the LAR (see Figures 2.2 and 2.6). When the augmentation gravel is mobilized it will begin to disperse and mix with the existing bed material downstream of the augmentation site thus increasing locally the mobility of the surface bed material, which would increase sediment outflow into the downstream reaches.

Invert Elevation

Computed invert profiles and changes in invert elevations are shown in Figures 3.3 and 3.4, respectively. The baseline conditions result shows active channel erosion in the sediment supply-deficient reach upstream of about RM 12, bed aggradation in the braided reach between RMs 10-12, channel degradation (limited by the erosion-resistant materials) in the confined reach around RMs 6-7, and minor channel changes in the mouth reach downstream of RM 5. The modeled gravel augmentation scenarios reduce channel erosion upstream of RM 12 and practically have no impact on bed changes downstream of RM 12. The model shows minor localized channel aggradation at several restoration sites (mostly near Nimbus Dam) for the gravel augmentation rates of 15,300 and 30,000 tons/year for 73 years and significant aggradation at the restoration sites for the augmentation rates of 60,000 and 120,000 tons/year for 73 years.

It should be noted that the channel of the LAR is highly irregular at the locations of historic aggregate mining between RMs 10-13.5, which is difficult to represent in the 1-d model and therefore may be subject to simulation errors. This reach was represented in the 2-d model described in Chapter 4 to more accurately assess channel and overbank flow interactions to confirm the result of the 1-d HEC-6T modeling.

Water Surface Elevation

Computed long-term changes in stage-discharge rating curves in the upstream, non-leveed reach are shown for selected locations in Figures 3.5-3.9. Continuous reduction in stage-discharge rating curves with time is obtained in this reach for the baseline conditions (Figure 3.5) and for gravel augmentation rates of 15,300 and 30,000 tons/year (Figures 3.6 and 3.7, respectively). The net reduction in water surface elevations (WSEs) for these scenarios is generally more than 0.5-1 ft over the 73-year simulation period. This stage reduction is a result of the ongoing channel degradation in the non-leveed reach. Minor increases (by up to 0.2-0.5 ft) in stage-discharge rating curves with time is computed at several locations in the upstream, non-leveed reach for the gravel augmentation rate of 60,000 tons/year (Figure 3.8). Significant increases (by over 1-2 ft) in stage-discharge rating curves with time is computed for the most part of the upstream, non-leveed reach for the gravel augmentation rate of 120,000 tons/year (Figure 3.9).

Net changes in WSEs computed for the maximum release of 160,000 cfs after the 73-year simulation period are shown in Figure 3.10. The model results show no increase in the maximum release WSEs in the non-leveed reach upstream of RM 13.5 for the baseline conditions and gravel augmentation rates of 15,300 and 30,000 tons/year. The maximum release WSEs increase at some locations by up to 0.1-0.5 ft for the gravel augmentation rate of 60,000 tons/year and by over 1-2 ft for the gravel augmentation rate of 120,000 tons/year. The simulation results indicate some increase in the maximum release WSEs between RMs 10.5-13.5 for all the modeled gravel augmentation rates (ranging from about 0.1-0.3 ft for at 15,300 tons/year to 0.6-1.2 ft at 120,000 tons/year). Downstream of about RM 7, the baseline conditions results show about 0.5 ft of increase in the maximum release WSEs, which is apparently related to the deposition of overbank sediment in this reach. The modeled gravel augmentation does not change the maximum release WSEs in this reach relative to the baseline conditions.

Based on the mobile bed modeling described above, it was concluded that 30,000 tons/year represents the maximum amount of spawning gravel that can be added each year for 73 years to the channel without affecting the flood conveyance in the non-leveed reach of the LAR. Most of this additional augmentation gravel, if distributed evenly between the restoration sites, will be dispersed and accumulated within the augmentation reach. Some of the augmentation gravel applied at the most downstream restoration site(s) can be transported and deposited within the reach of the past instream aggregate mining between RMs 10.5-13.5. The sediment depositional characteristics of the reach between RMs 10.5-13.5 were confirmed with the 2-d model, as described in Chapter 4.

3.4 Sensitivity Test – High Flow Hydrology

The computed results discussed in the previous section include the cumulative effect of dry, average, and wet years within the full 73-year long hydrologic record (WYs 1930-2002) and therefore show an overall long-term trend in net deposition or erosion. The highest flow events within this long-term record occurred in the 1980s and 1990s. Therefore, comparative test simulations were conducted for the baseline conditions (no gravel augmentation) and for the selected gravel augmentation rate of 30,000 tons/year to evaluate the effects of the “wettest” 33-year long period in the hydrologic record (WYs 1970-2002). Similar to the long-term WYs 1930-2002 simulations, the augmentation gravel was evenly distributed between the 10 restoration sites and applied each year during the low water months of July, August, and September. The main results of these mobile bed model simulations are discussed below.

Sediment Load

Total sediment loads computed along the LAR for WYs 1970-2002 are shown in Figure 3.11. Computed grain size composition of the total sediment loads is shown in Figure 3.12. Computed average annual sediment outflows (over the simulation period) from the project reach are provided in Table 3.1.

The overall sediment load pattern and composition computed for the baseline conditions (no gravel augmentation) is similar to the long-term WYs 1930-2002 simulation. Sediment load rapidly increases between Nimbus Dam and RM 13.5 due to channel bed erosion, then rapidly decreases between RMs 10.5-13.5 due to bed material deposition, and then gradually reduces due to additional deposition downstream of RM 10.5. The computed sediment load includes significant amounts of gravel and sand with some cobbles upstream of RM 11 and is mostly composed of sand downstream of RM 11. Comparing the magnitude in the computed baseline total sediment loads shown in Figures 3.1 and 3.11, it is seen that most of the sediment load transported during WYs 1930-2002 was actually transported during the “wettest” period WYs 1970-2002.

The simulated gravel addition of 30,000 tons/year shows minor effects on the total sediment loads along the LAR and slightly increases the proportion of gravel transported in the project reach during WYs

1970-2002. This suggests that the cumulative amount of the augmentation gravel placed in the river was not yet sufficient to significantly affect bed morphology, flow hydraulics, and sediment load despite the very high flow events within the "wettest" period which caused more active sediment transport processes.

Invert Elevation

Invert profiles and changes in invert elevations computed along the LAR for WYs 1970-2002 are shown in Figures 3.13 and 3.14, respectively. The erosion and degradation pattern obtained for the baseline conditions for the "wettest" period is similar to the main long-term run. The addition of spawning gravels at the rate of 30,000 tons/year for 33 years reduces channel erosion in the project reach and has no significant impact on bed changes downstream of about RM 13.

Water Surface Elevation

Computed changes in stage-discharge rating curves in the upstream, non-leveed reach during the simulated "wettest" period are shown for the baseline conditions in Figure 3.15 and for the gravel augmentation rate of 30,000 tons/year in Figure 3.16. Both of these figures indicate a continuous reduction in stage-discharge rating curves with time over the 33-year modeled period.

Net changes in WSEs computed for the maximum release of 160,000 cfs after the 33-year "wettest" period are shown in Figure 3.17. The figure shows a decrease in the maximum release WSEs in the non-leveed reach upstream of RM 13.5 for both the baseline and gravel augmentation conditions. The addition of 30,000 tons/year of gravel slightly increases (by about 0.1 ft) the maximum release WSEs between RMs 12-13.5 and has no negative impact on WSEs downstream of RM 12, relative to the baseline conditions.

The test simulations discussed above demonstrate the following important results:

(1) The "wettest" period does not have a significant impact on the overall sedimentation processes of augmentation gravel and does not change the previous conclusion about the maximum acceptable augmentation rate of 30,000 tons/year.

(2) It appears that the augmentation gravel initially does not cause significant increases in sediment loads as it gradually accumulates in the channel and mixes with the original bed material. With time, the cumulative amount of augmentation gravel becomes significant and it begins to produce noticeable effect on the bed topography, flow hydraulics, bed material composition, and sediment load. The HEC-6T mobile bed modeling results indicate it takes approximately 3 decades with annual importing of augmentation gravel to start increasing sediment delivery downstream of the gravel augmentation project reach.

3.5 Sensitivity Test – Worst Case Augmentation Gravel Placement

An additional model test run was conducted to evaluate the effect of the "worst case" gravel placement location when the entire augmentation gravel load of 30,000 tons/year is applied at the most downstream restoration site (instead of being evenly distributed between the 10 restoration sites). The model was run for the full 73-year period (WYs 1930-2002) and spawning gravel was added at RM 13.5 each year during low flows in July, August, and September. The results of this mobile bed simulation are discussed below.

Sediment Load

Total sediment loads computed along the LAR for WYs 1930-2002 with 30,000 tons/year of gravel added at the downstream restoration site are shown in Figure 3.18. Sediment loads computed for the baseline conditions and for the gravel augmentation of 30,000 tons/year evenly distributed between all the restoration sites are also shown on this figure for comparison. Grain size compositions of total sediment loads computed for these scenarios are presented in Figure 3.19. Computed average annual sediment outflows (over the 73-year simulation period) from the project reach are provided in Table 3.1.

Compared to the baseline conditions, the application of gravel at the most downstream restoration site significantly increases total sediment load (and proportion of gravel in transported sediment) between RMs 11.5-13.5, reduces sediment load immediately upstream of the site between RMs 13.5-16, and shows minimal effects on sediment transport in the other reaches.

Invert Elevation

Invert profiles and changes in invert elevations computed for the baseline conditions, gravel augmentation of 30,000 tons/year evenly distributed between the restoration sites, and gravel augmentation of 30,000 tons/year at the most downstream restoration site are compared in Figures 3.20 and 3.21. It is seen that the application of the entire augmentation gravel load at the downstream restoration site causes significant bed aggradation (about 5 ft) at this location, increases sediment deposition (by about 1-3 ft relative to the baseline conditions) between RMs 10.5-13.5, and reduces erosion upstream of the gravel application site. At the same time, the “worst case” augmentation gravel placement has no impact on bed profile changes downstream of RM 10, compared to the baseline conditions.

Water Surface Elevation

Changes in stage-discharge rating curves computed for the non-leveed reach for the “worst case” augmentation gravel placement scenario are shown in Figure 3.22 and net changes in WSEs computed for the maximum release of 160,000 cfs after the simulation period are shown in Figure 3.23. The results obtained for the baseline conditions and gravel augmentation of 30,000 tons/year evenly distributed between all the restoration sites are also shown on these figures for comparison.

The model results show a reduction in stage-discharge rating curves and the maximum release WSEs in the non-leveed reach upstream of RM 14 for all these scenarios. Therefore, no loss of conveyance occurs in this reach for the gravel augmentation rate of 30,000 tons/year irrespective of its placement (either evenly distributed between all the restoration sites or applied at the most downstream site). Compared to the baseline conditions (without gravel augmentation), the application of the entire gravel load at the downstream site increases the maximum release WSEs by about 0.5-1 ft between RMs 10.5-14 and shows no impact on WSEs downstream of RM 10.5.

In general, the sensitivity test confirmed that the 30,000 tons/year is a reasonable maximum amount that can be added for 73 years without adversely affecting flood conveyance in the non-leveed reach. However, it is apparent that the application of this entire augmentation gravel load at the most downstream restoration site results in a greater sediment inflow into and deposition within the reach of past instream gravel mining between RMs 10.5-13.5, compared to the scenario when this load is distributed between all the restoration sites.

3.6 Limitations of Results

Because of the simplification of the complex natural sediment transport process in the 1-d numerical model, the computed sediment loads and bed changes should be used with caution, as approximate indicators of the general morphological behavior of the system. According to the NHC (2015) study, the Laursen-Copeland sediment transport method used in the HEC-6T model provides conservative (i.e., high) estimates of sediment loads and channel erosion in the LAR. Therefore, the actual consequence of the gravel augmentation along the LAR may be somewhat different than what is predicted by the model. Regular field monitoring of the effects of the gravel augmentation activities should be implemented to detect any negative impacts to flood conveyance and channel/bank stability (particularly in the leveed reach) and to adjust gravel augmentation volumes and locations accordingly.

Table 3.1. Computed average annual sediment outflow from project reach (at RM 13.3).

Scenario	Simulation period	Augmentation gravel placement	Average sediment load (tons/yr)
Main runs			
Baseline	WYs 1930-2002	No	31,000
Gravel addition 15.3k tons/yr	WYs 1930-2002	Evenly at 10 sites	35,500
Gravel addition 30k tons/yr	WYs 1930-2002	Evenly at 10 sites	38,800
Gravel addition 60k tons/yr	WYs 1930-2002	Evenly at 10 sites	46,600
Gravel addition 120k tons/yr	WYs 1930-2002	Evenly at 10 sites	58,000
Sensitivity test runs			
Baseline	WYs 1970-2002 (wettest)	No	24,500
Gravel addition 30k tons/yr	WYs 1970-2002 (wettest)	Evenly at 10 sites	25,800
Gravel addition 30k tons/yr	WYs 1930-2002	Most d/s site	54,400

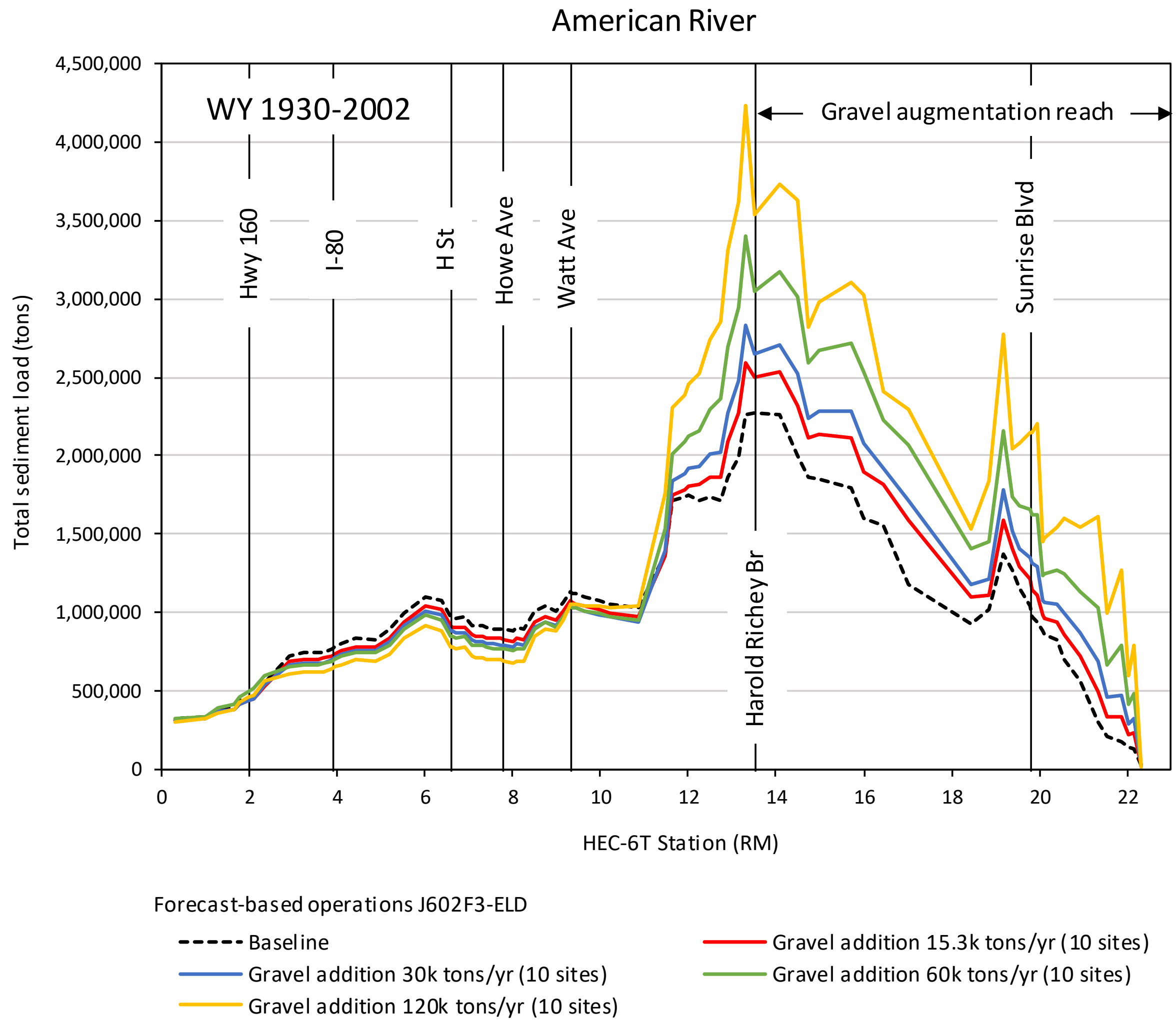


Figure 3.1. Computed total sediment loads for simulation period WYs 1930-2002.

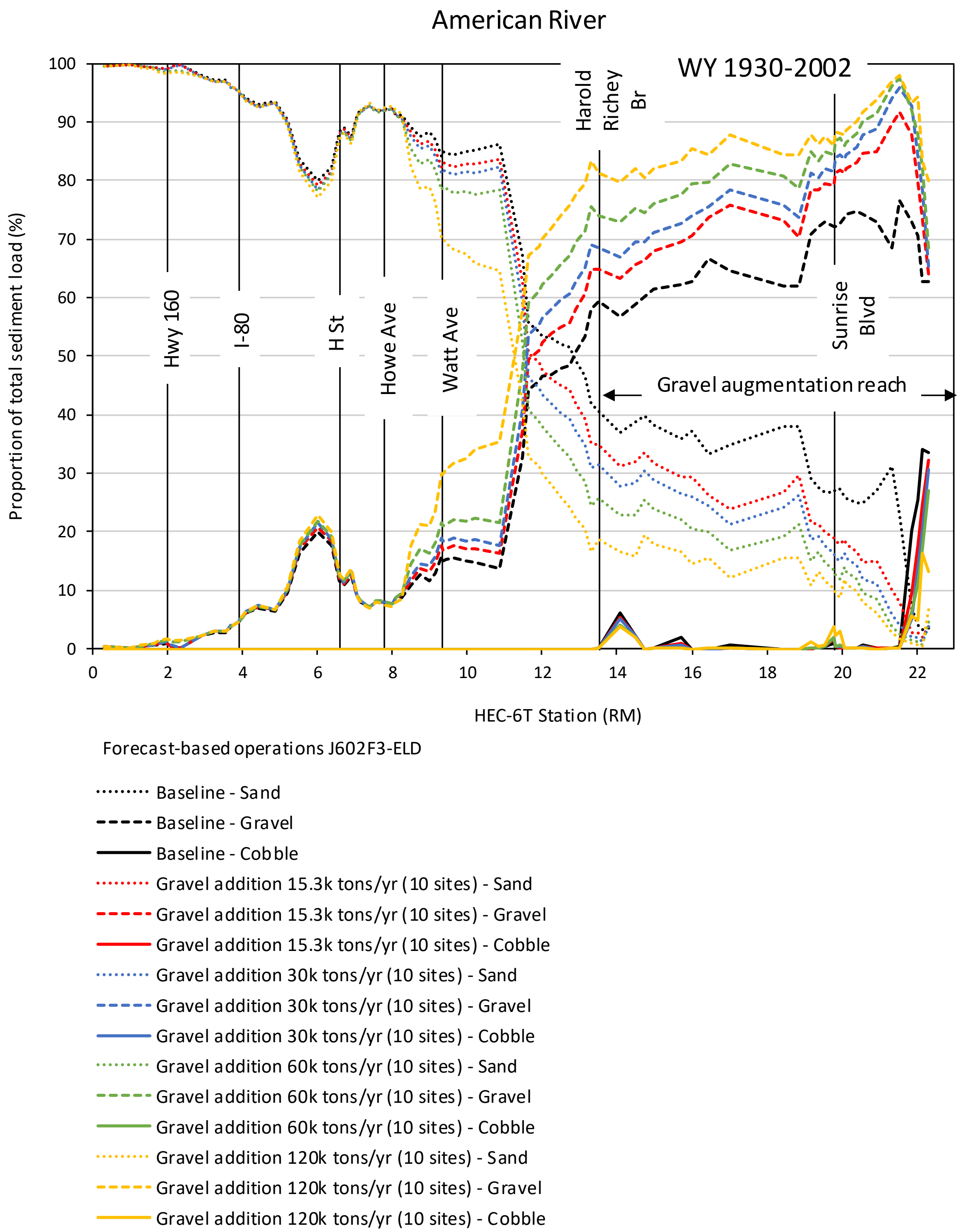


Figure 3.2. Computed composition (by sediment class) of total sediment loads for simulation period WYs 1930-2002.

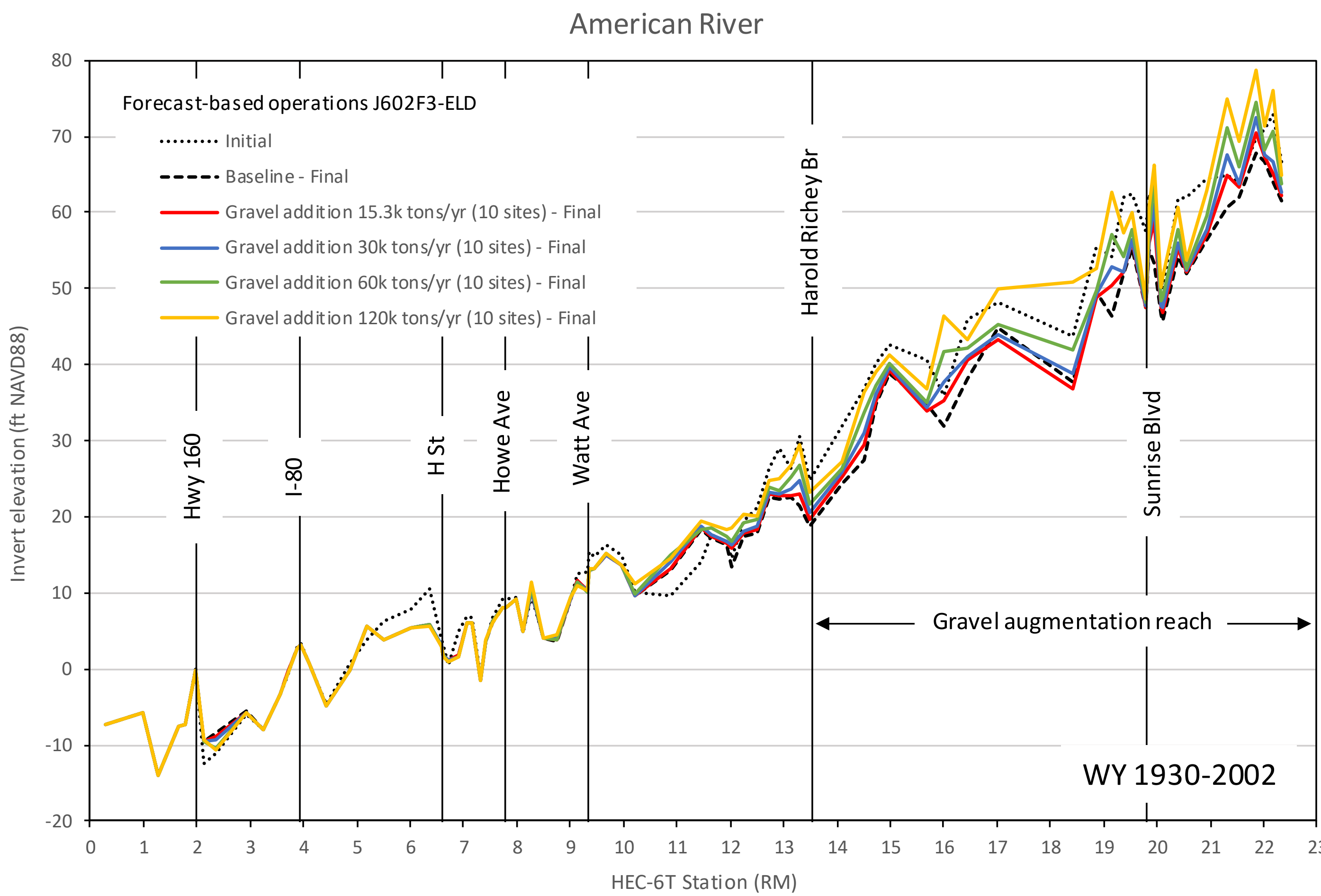


Figure 3.3. Computed invert profiles for simulation period WYs 1930-2002.

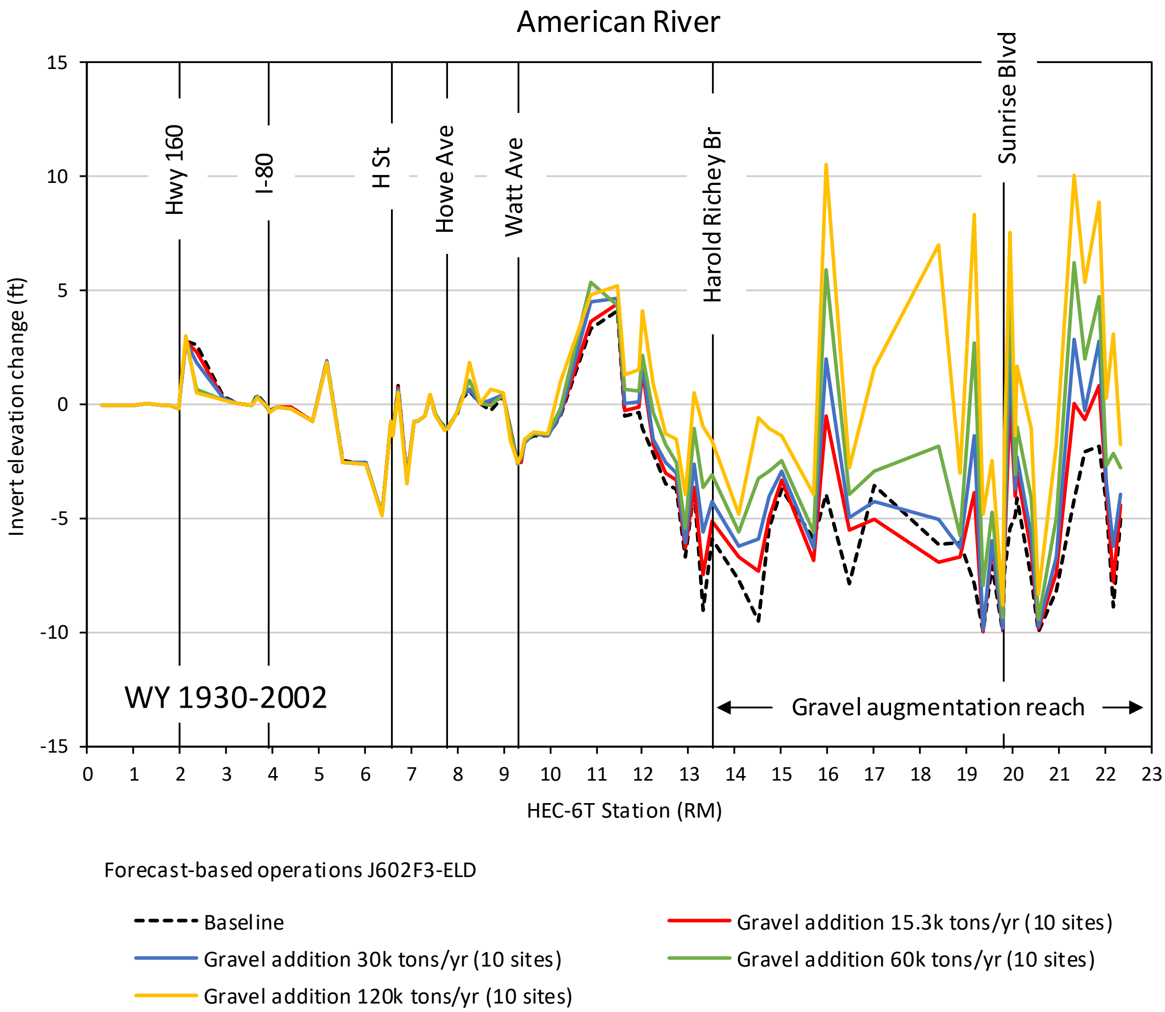


Figure 3.4. Computed changes in invert elevations for simulation period WYs 1930-2002.

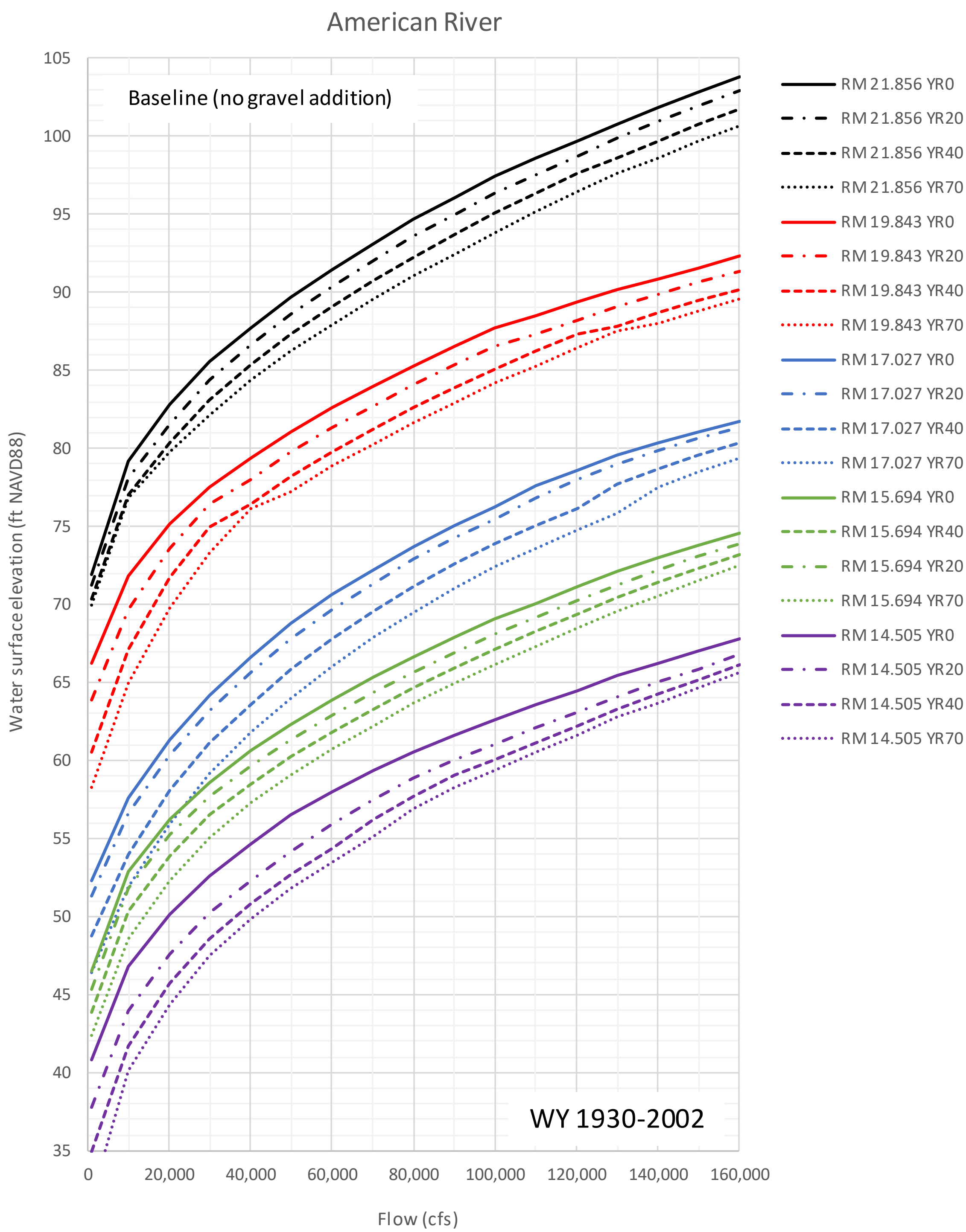


Figure 3.5. Computed changes in stage-discharge rating curves for simulation period WYs 1930-2002 (baseline).

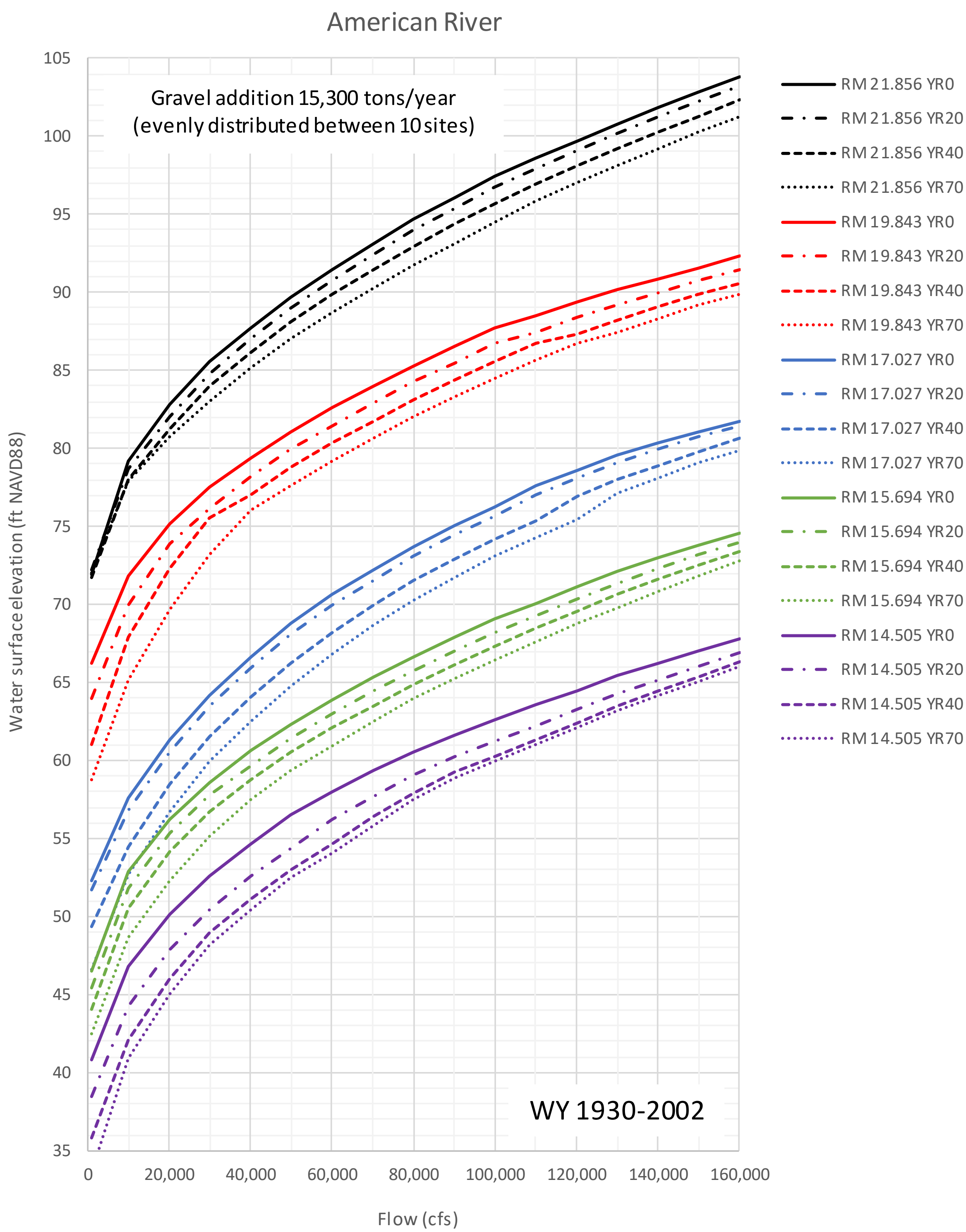


Figure 3.6. Computed changes in stage-discharge rating curves for simulation period WYs 1930-2002 (gravel addition 15,300 tons/year).

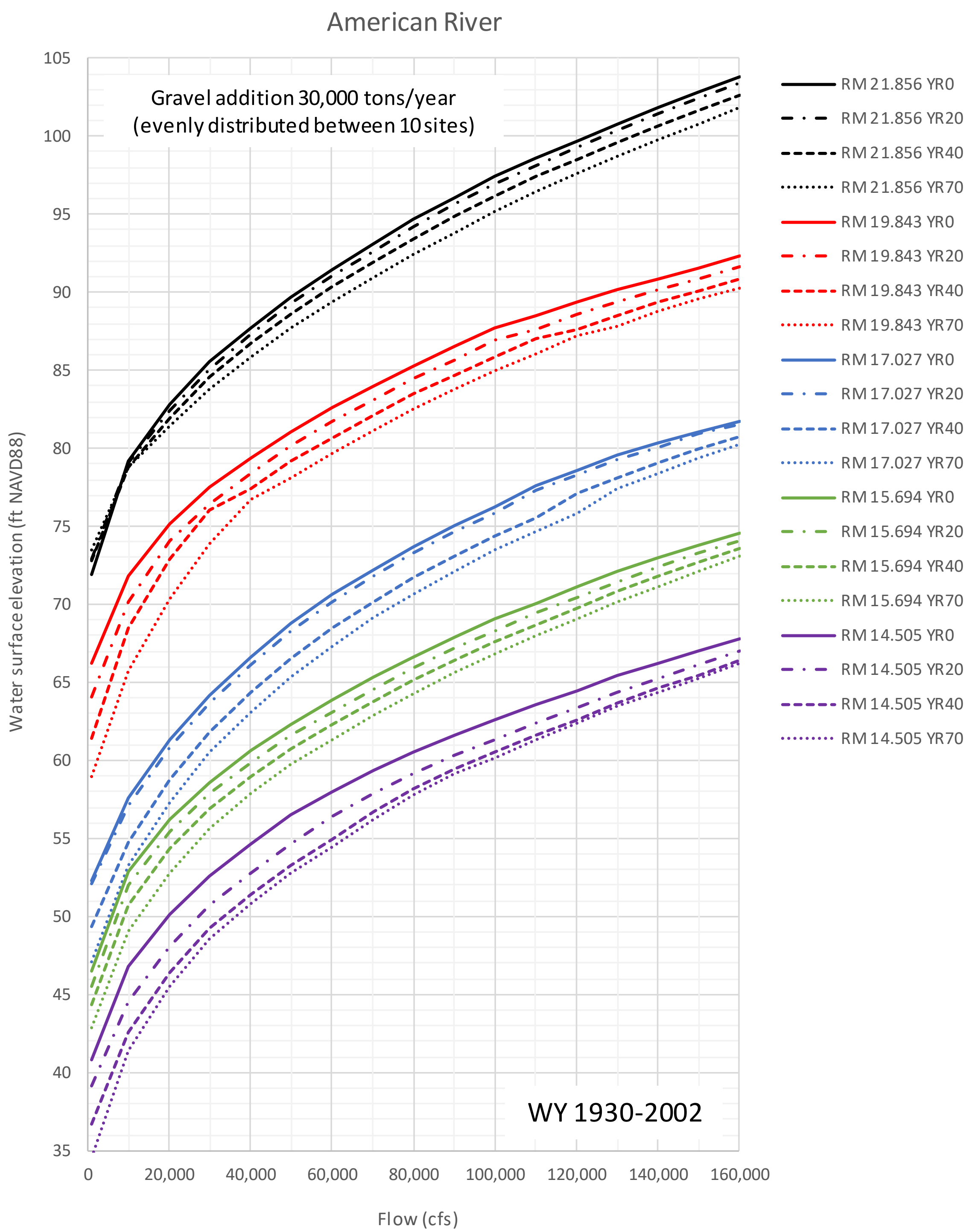


Figure 3.7. Computed changes in stage-discharge rating curves for simulation period WYs 1930-2002 (gravel addition 30,000 tons/year).

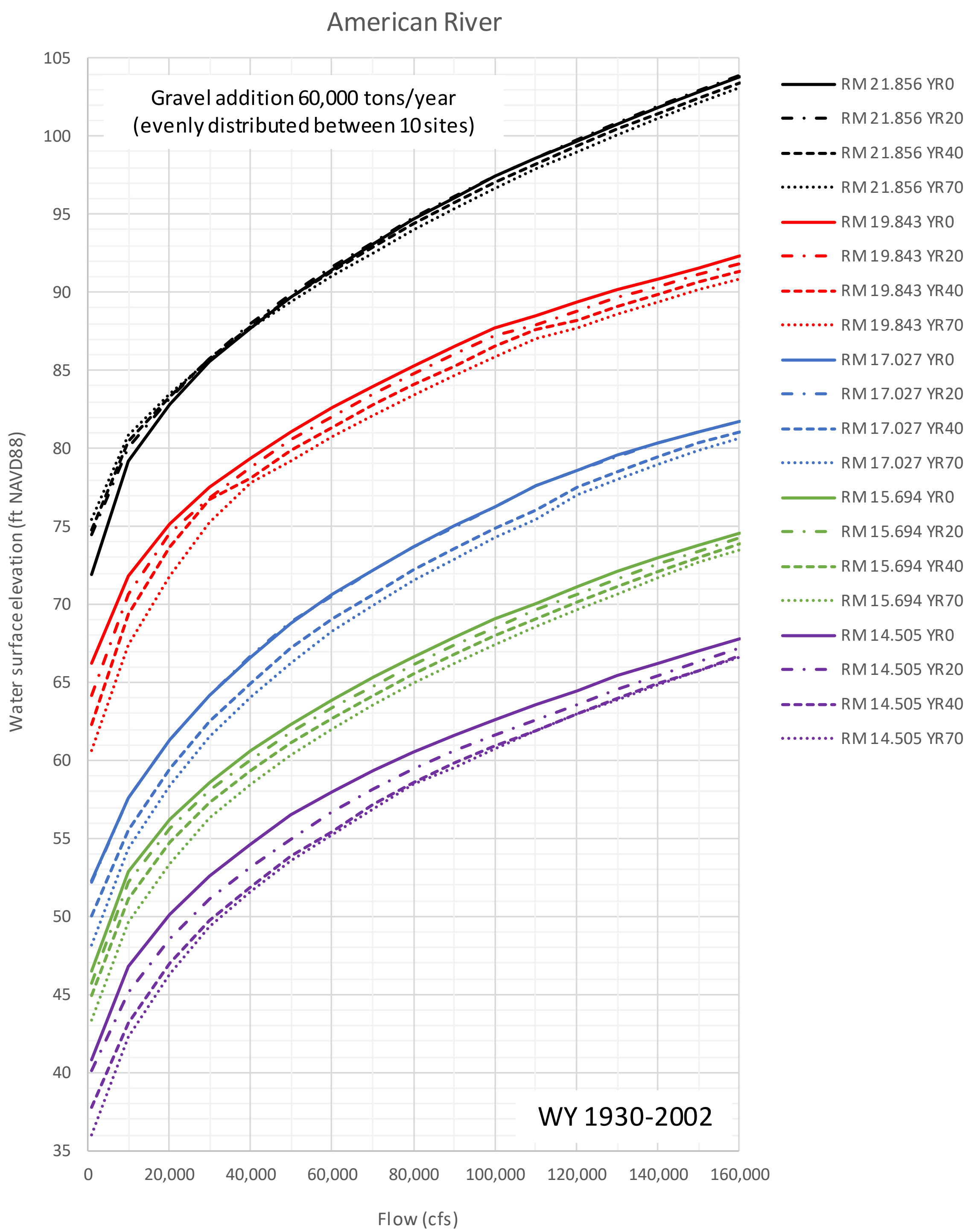


Figure 3.8. Computed changes in stage-discharge rating curves for simulation period WYs 1930-2002 (gravel addition 60,000 tons/year).

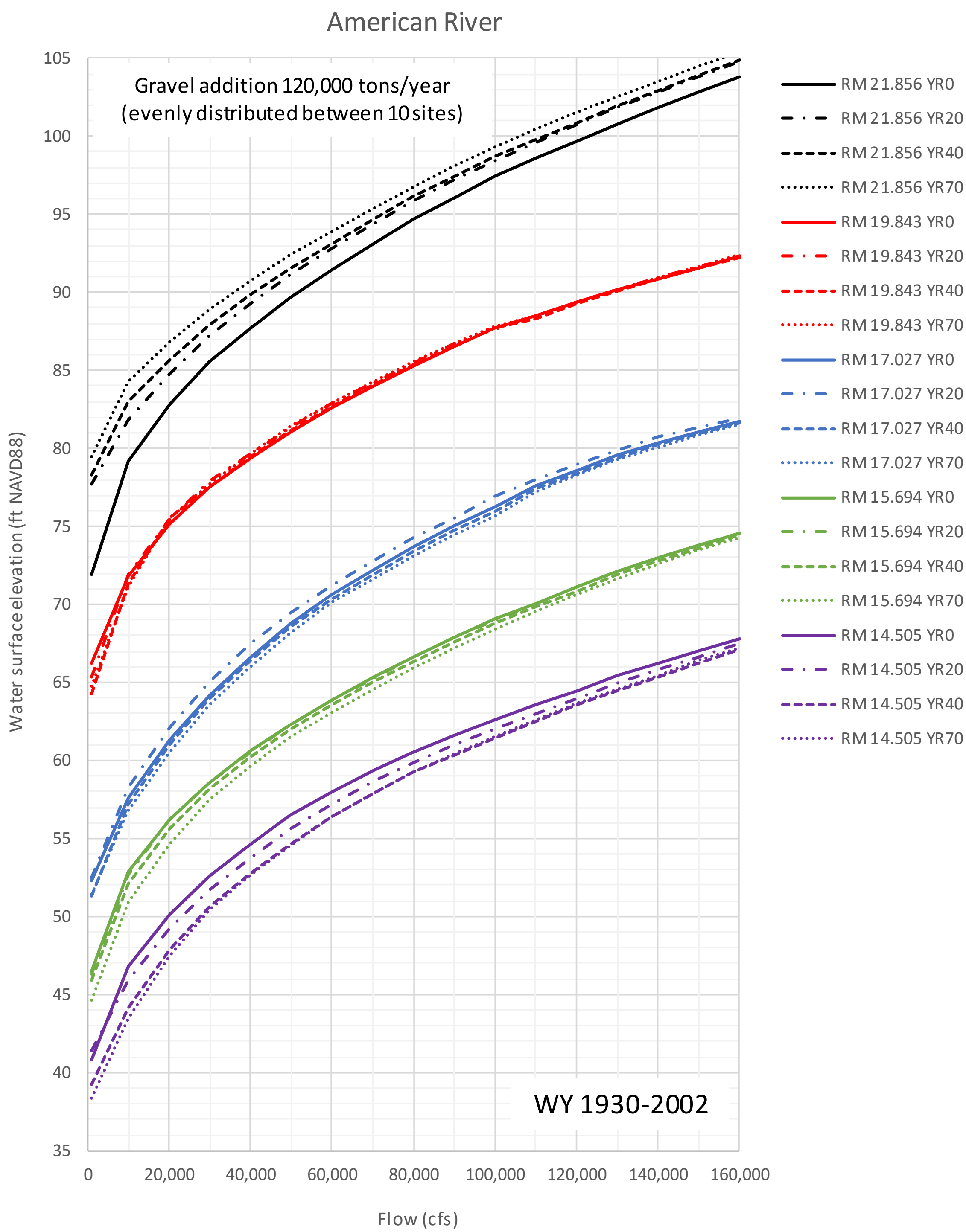


Figure 3.9. Computed changes in stage-discharge rating curves for simulation period WYs 1930-2002 (gravel addition 120,000 tons/year).

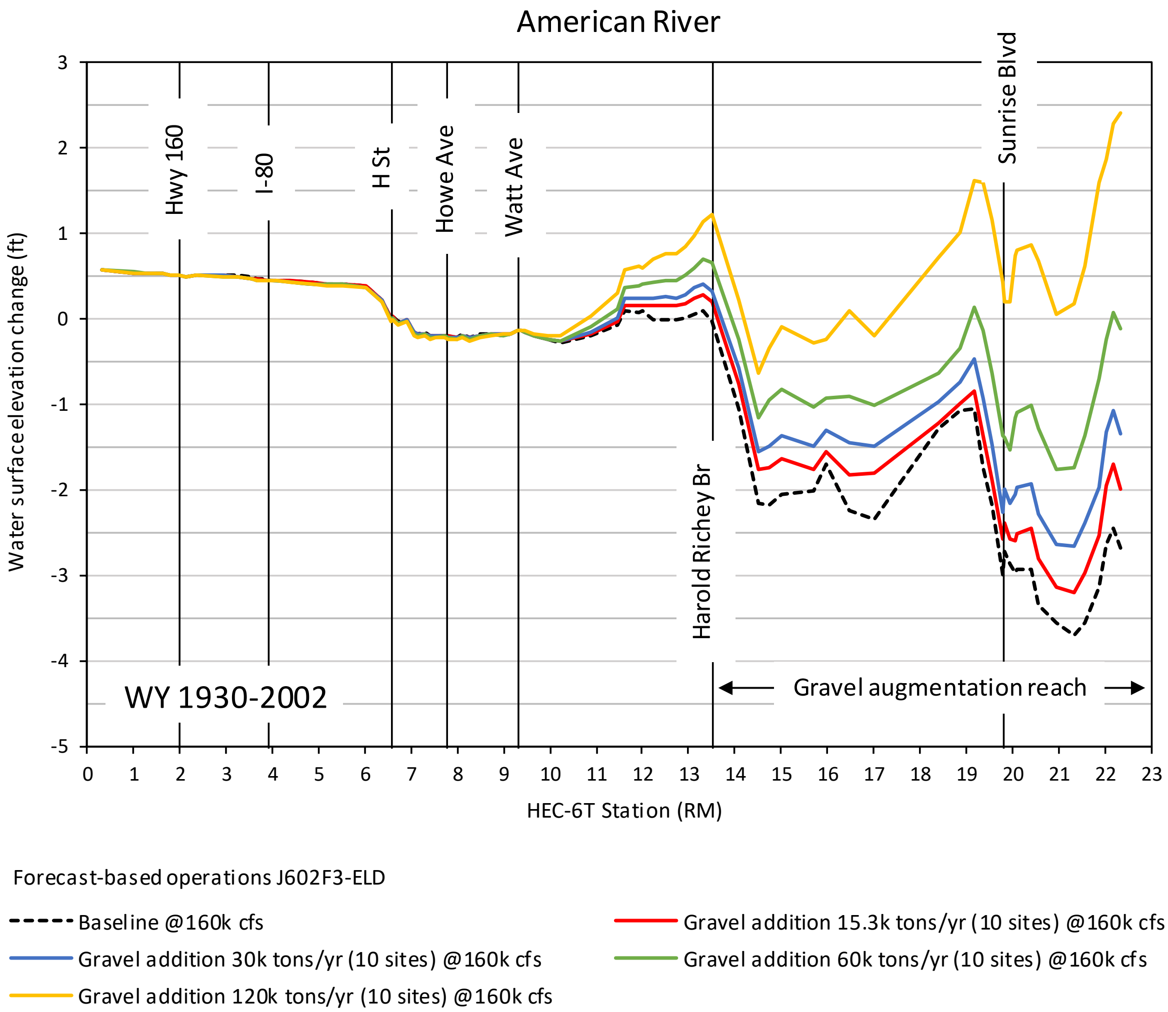


Figure 3.10. Computed changes in water surface elevations at 160,000 cfs for simulation period WYs 1930-2002.

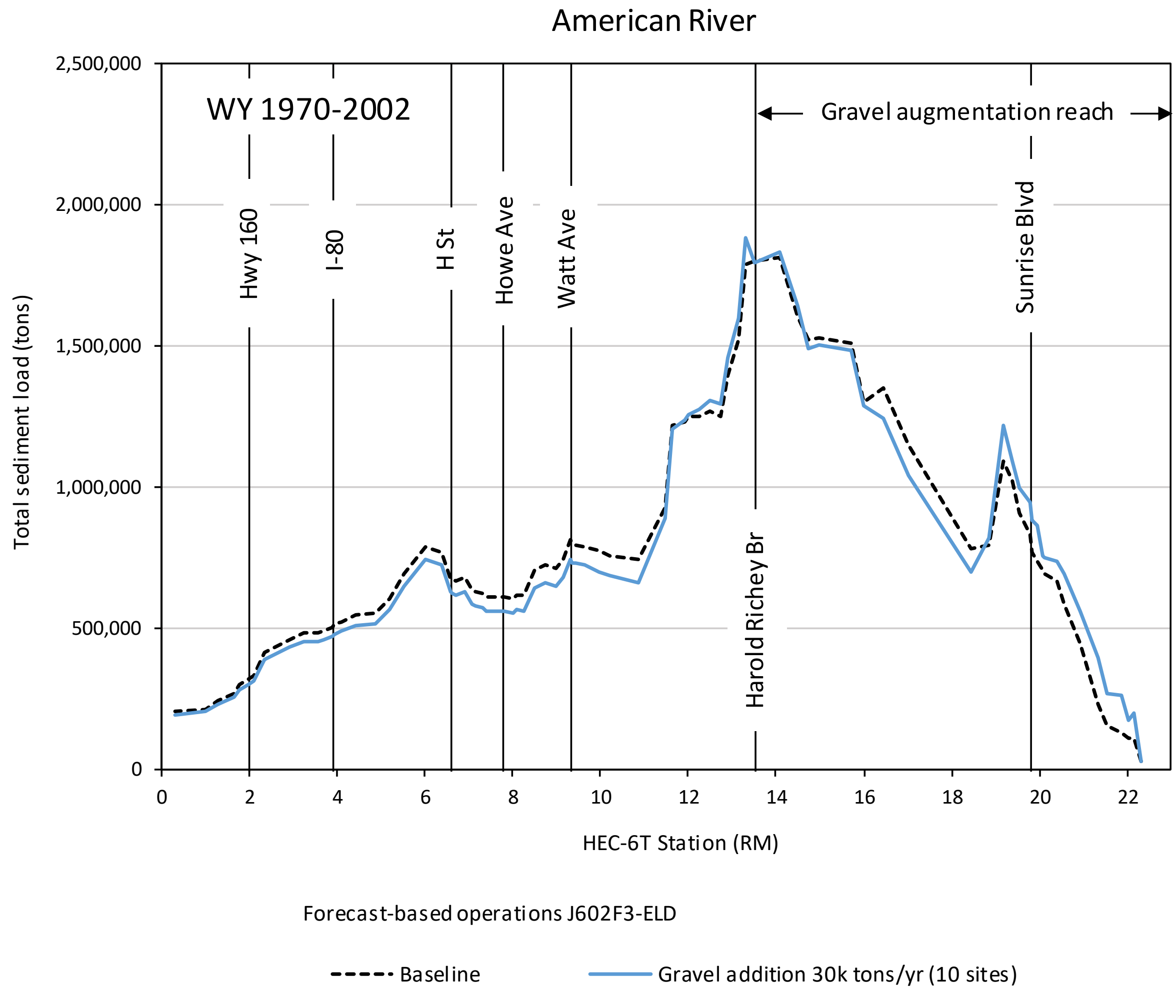


Figure 3.11. Computed total sediment loads for simulation period WYs 1970-2002 (“wettest” period).

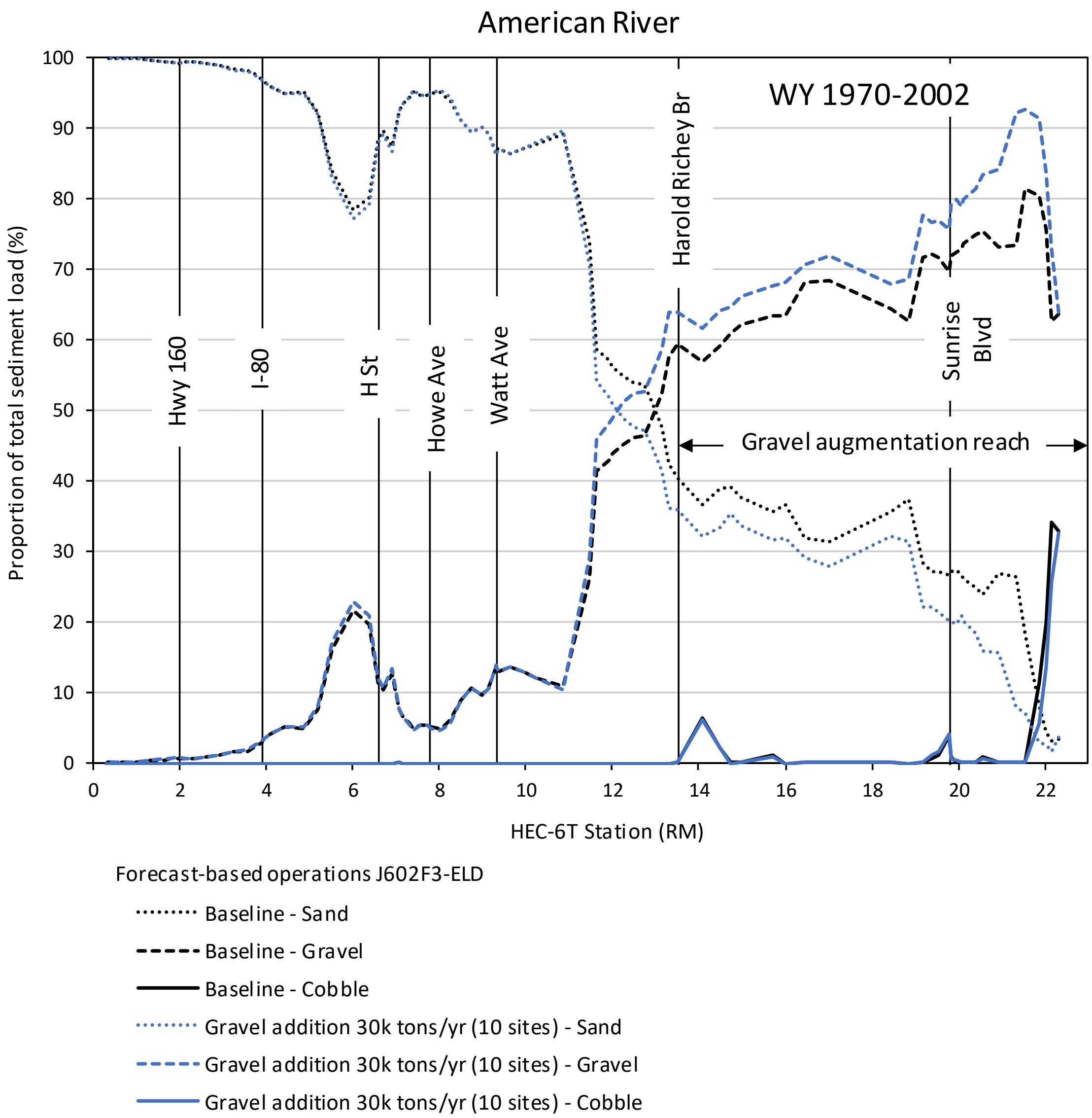


Figure 3.12. Computed composition (by sediment class) of total sediment loads for simulation period WYs 1970-2002 (“wettest” period).

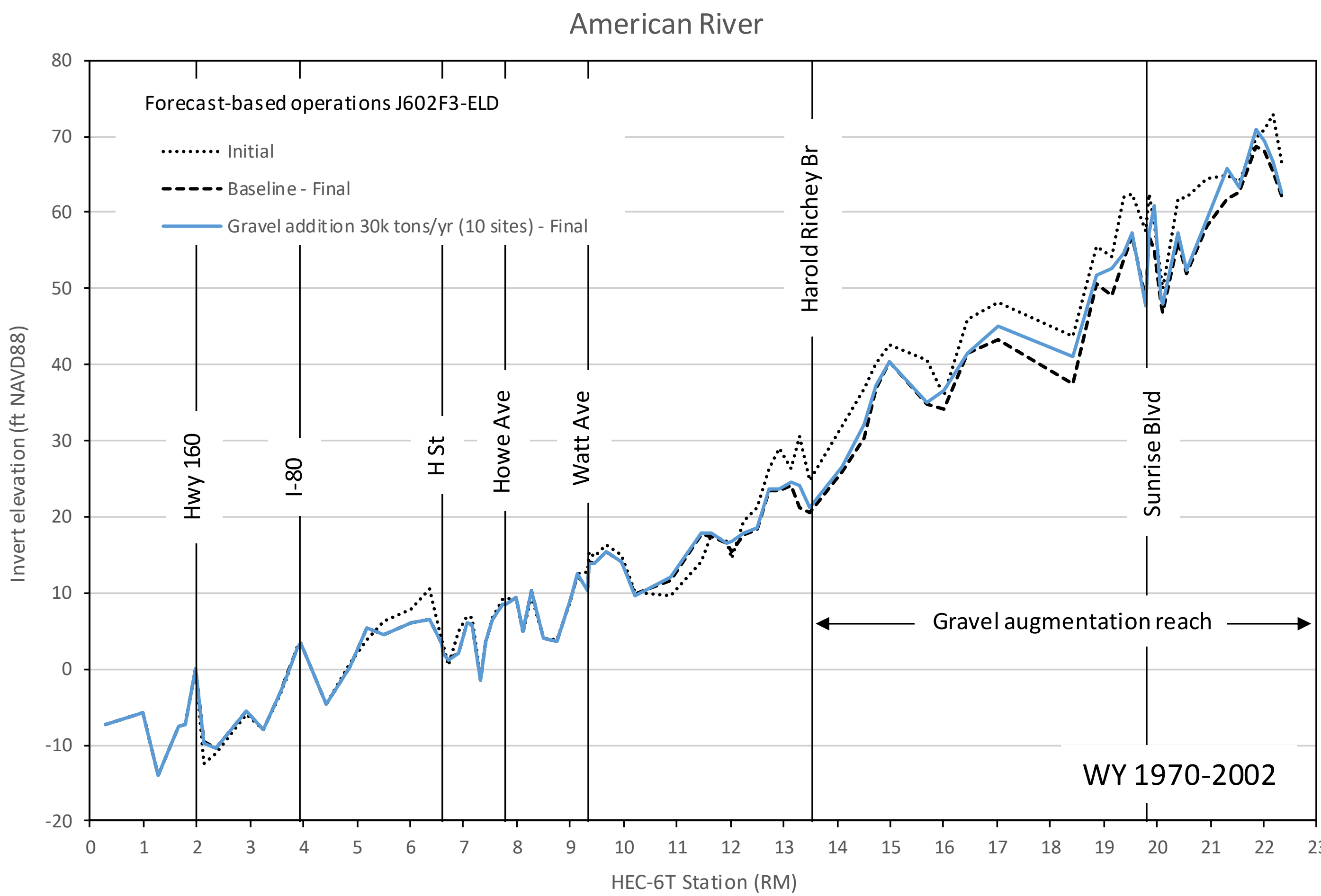


Figure 3.13. Computed invert profiles for simulation period WYs 1970-2002 ("wettest" period).

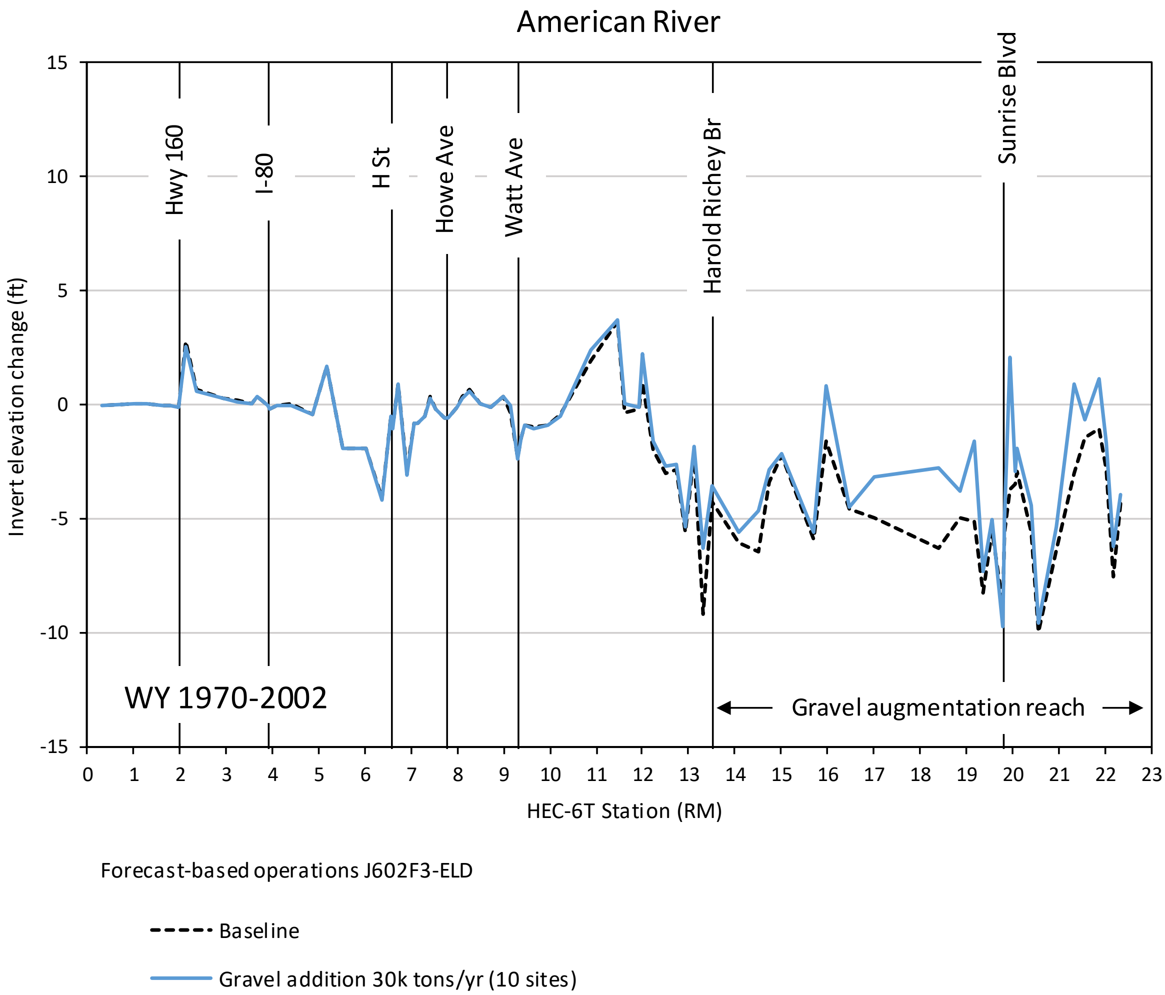


Figure 3.14. Computed changes in invert elevations for simulation period WYs 1970-2002 (“wettest” period).

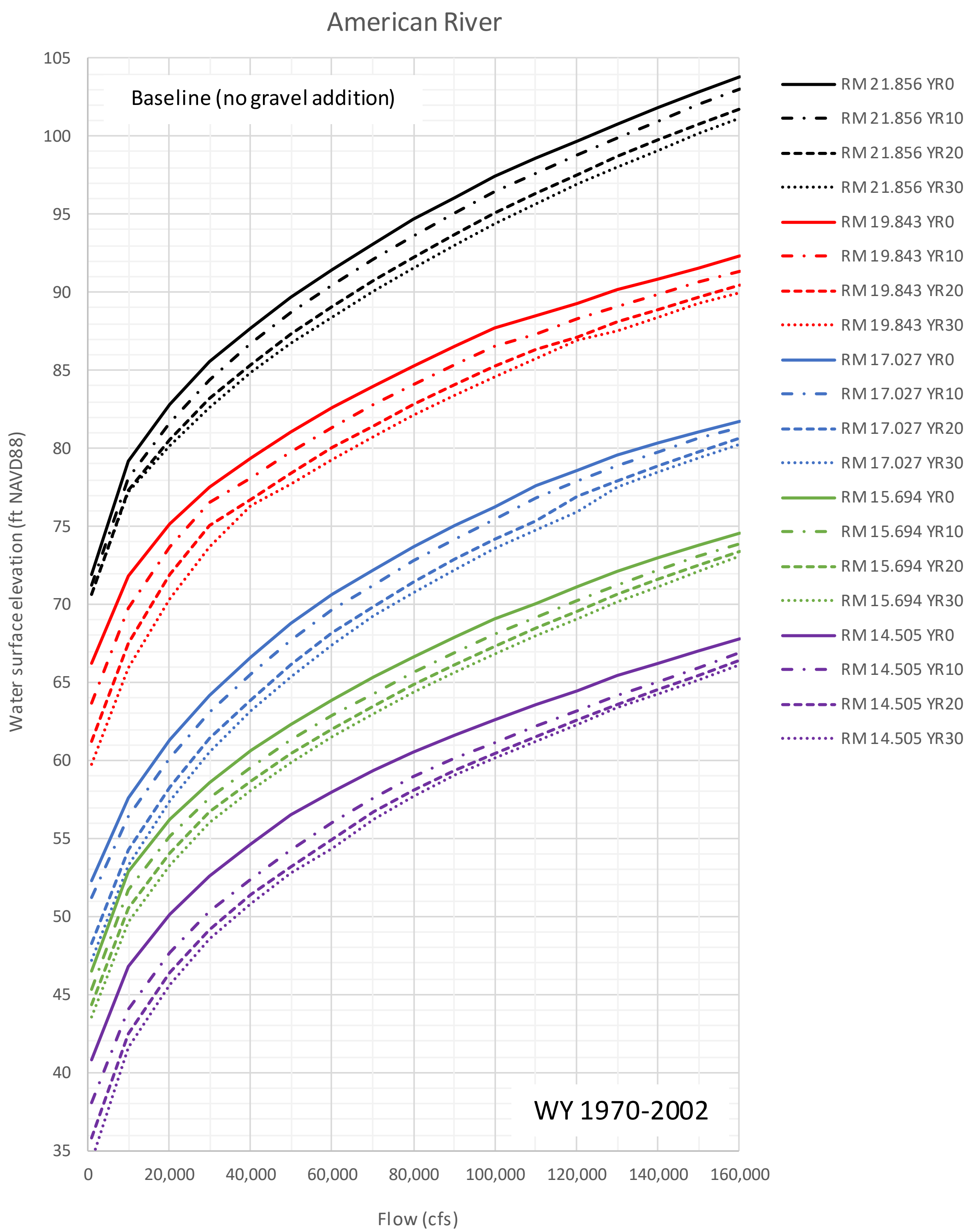


Figure 3.15. Computed changes in stage-discharge rating curves for simulation period WYs 1970-2002 (baseline).

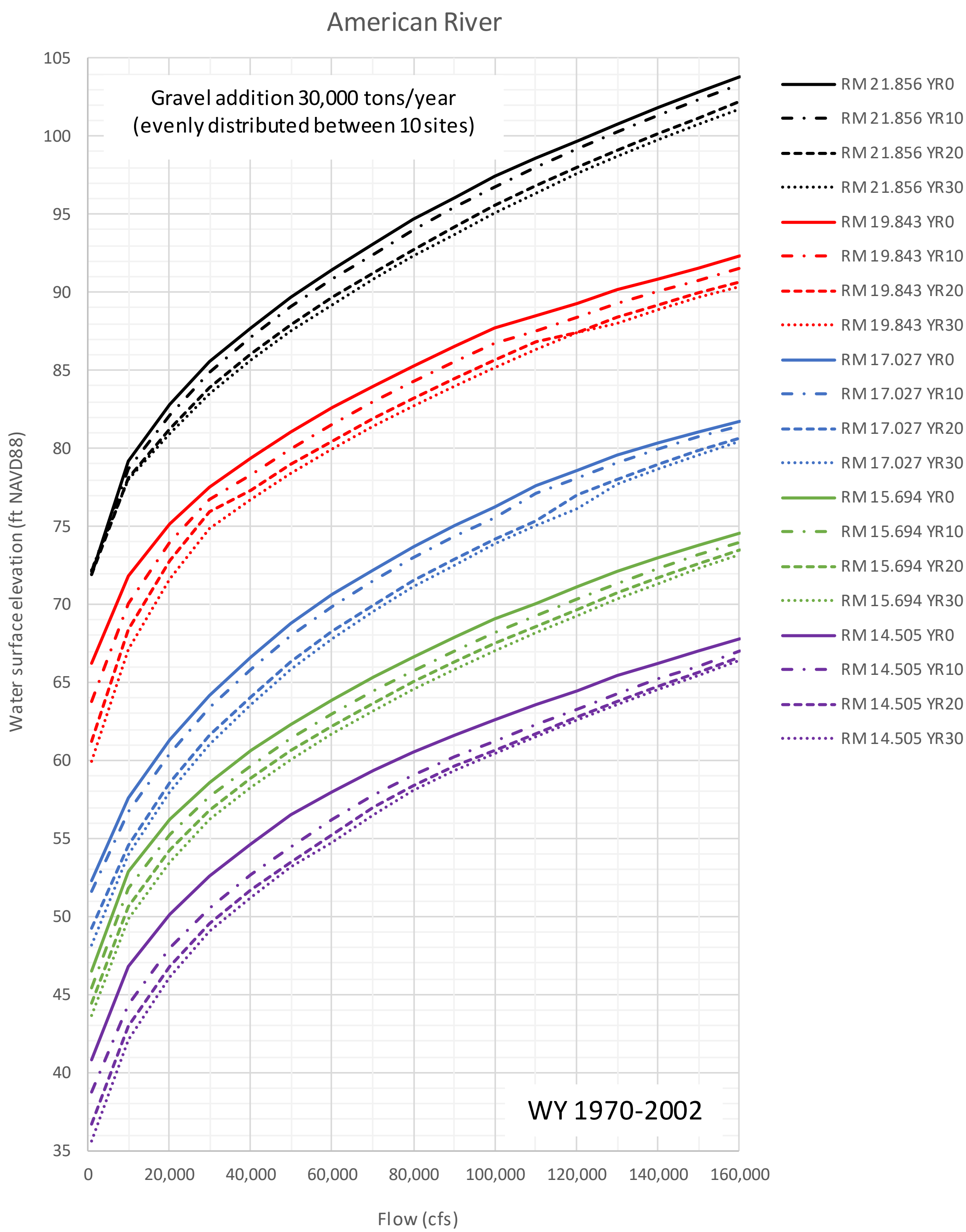


Figure 3.16. Computed changes in stage-discharge rating curves for simulation period WYs 1970-2002 (gravel addition 30,000 tons/year).

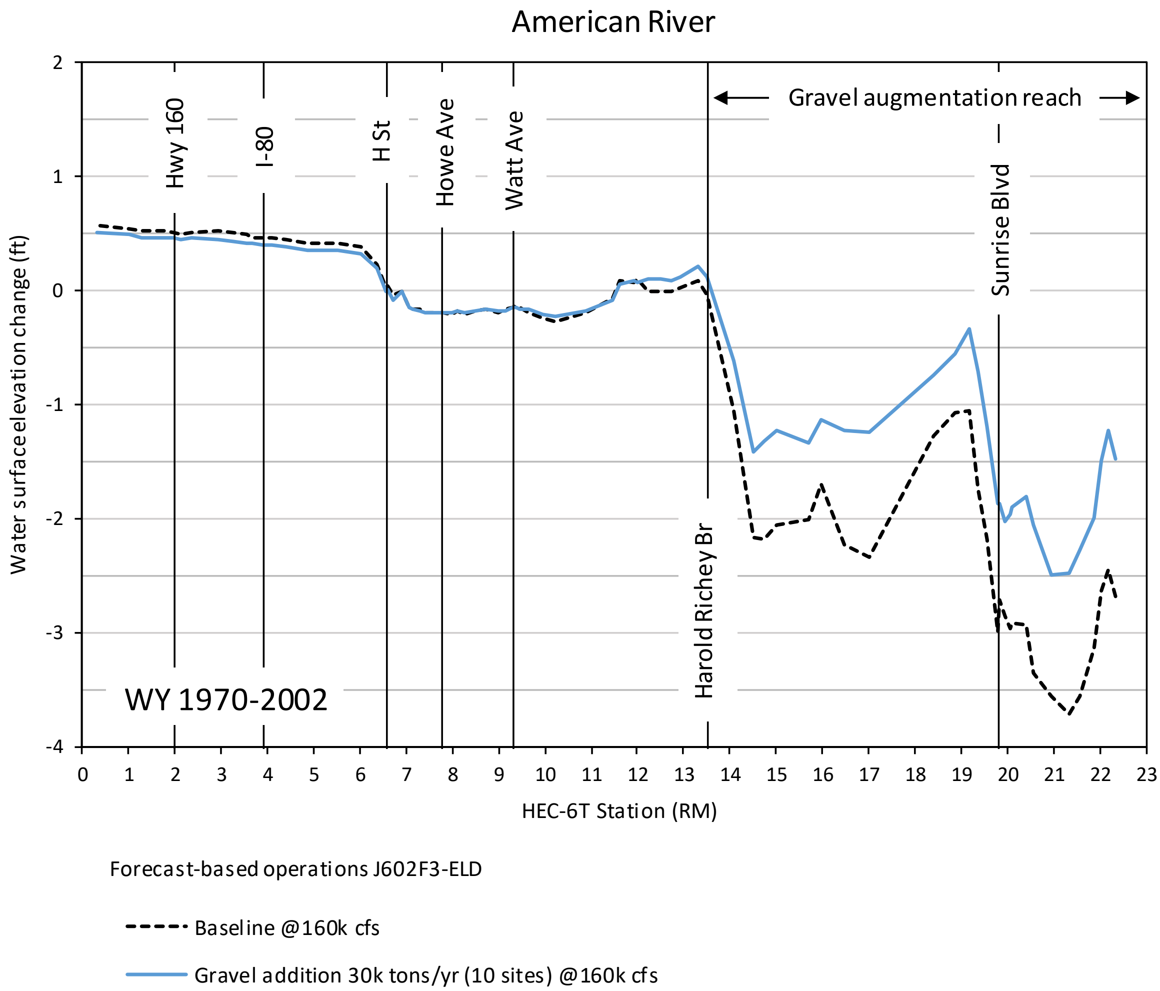


Figure 3.17. Computed changes in water surface elevations at 160,000 cfs for simulation period WYs 1970-2002 (“wettest” period).

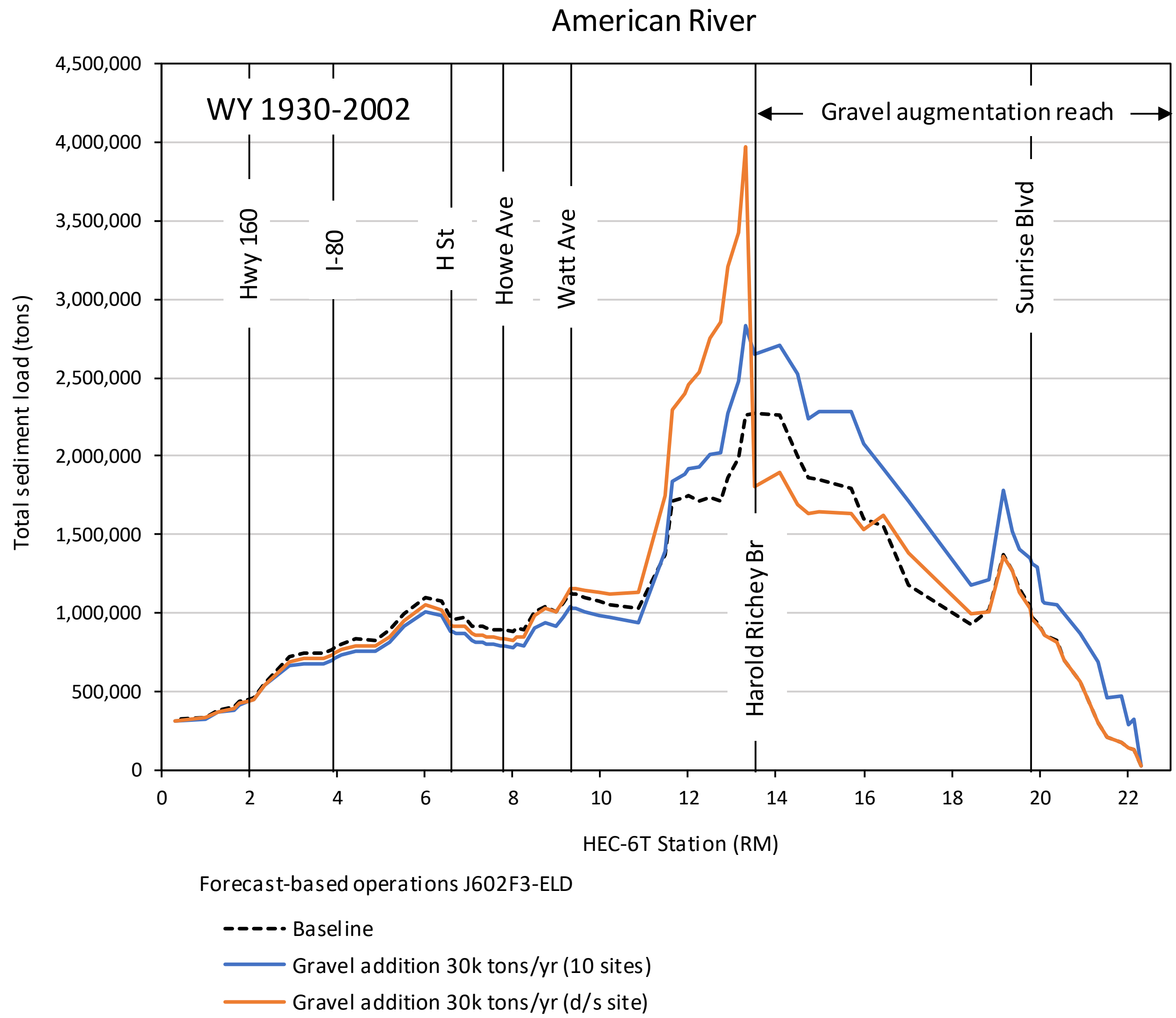


Figure 3.18. Computed total sediment loads for simulation period WYs 1930-2002 ("worst case" gravel placement).

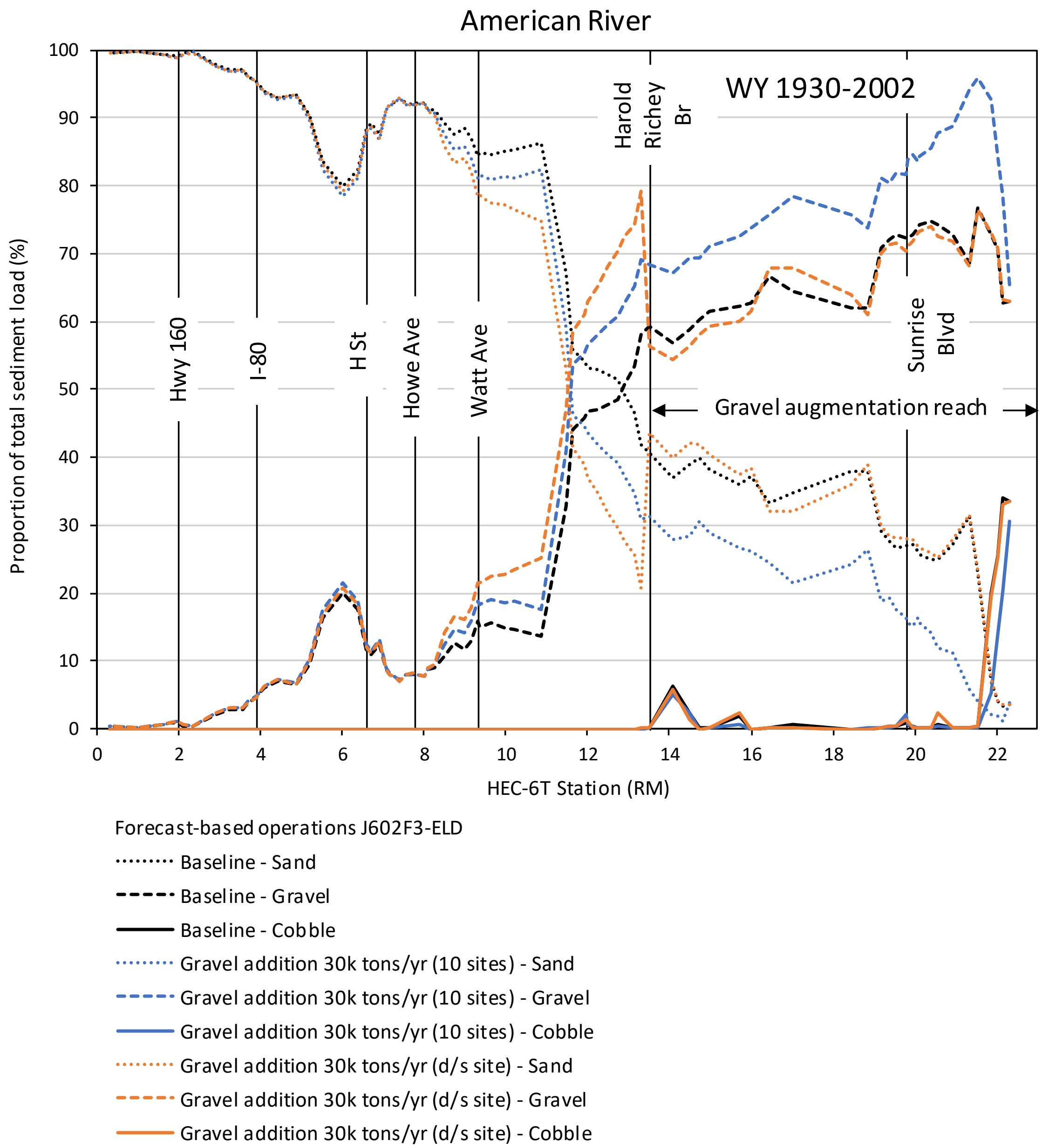


Figure 3.19. Computed composition (by sediment class) of total sediment loads for simulation period WYs 1930-2002 ("worst case" gravel placement).

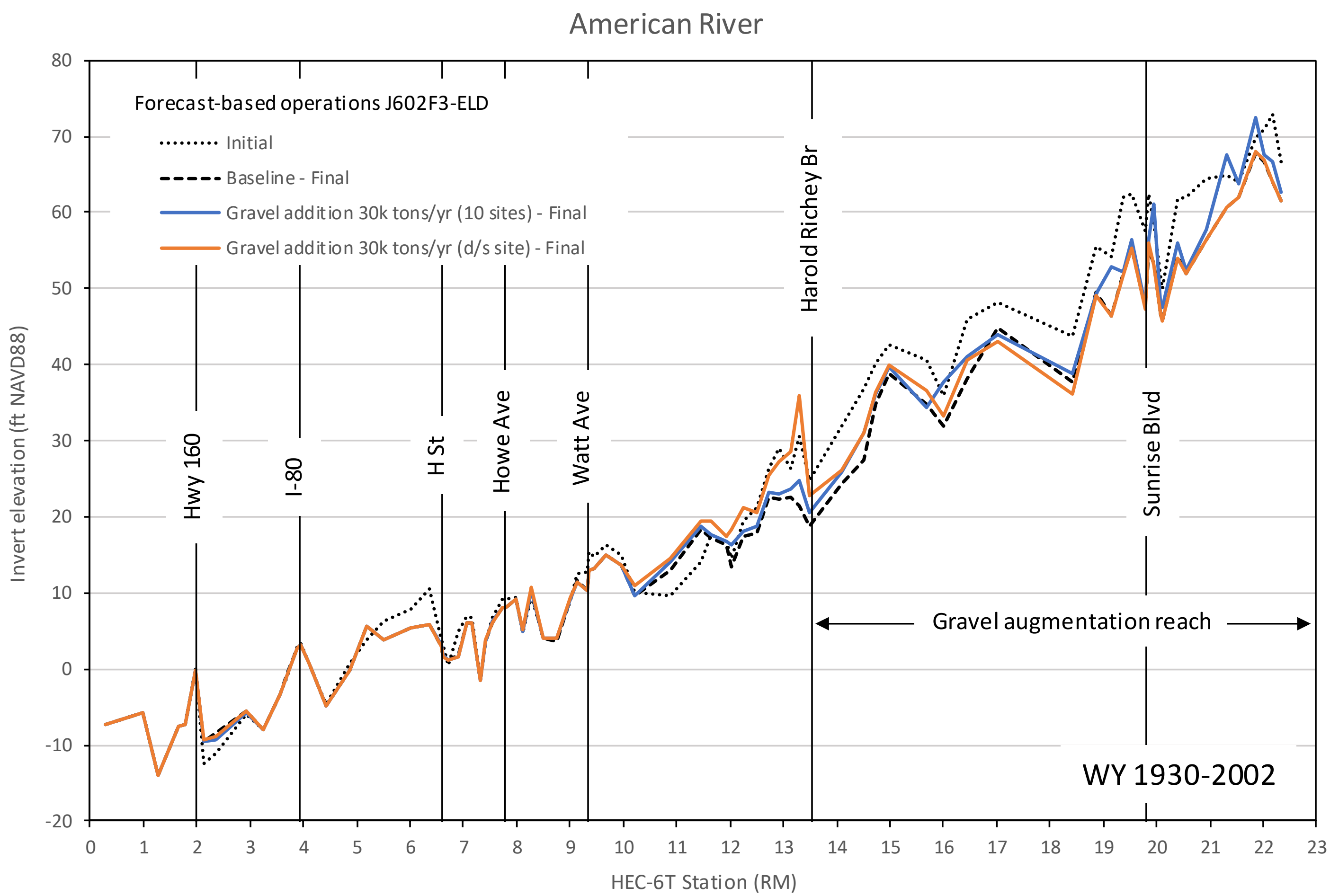


Figure 3.20. Computed invert profiles for simulation period WYs 1930-2002 (“worst case” gravel placement).

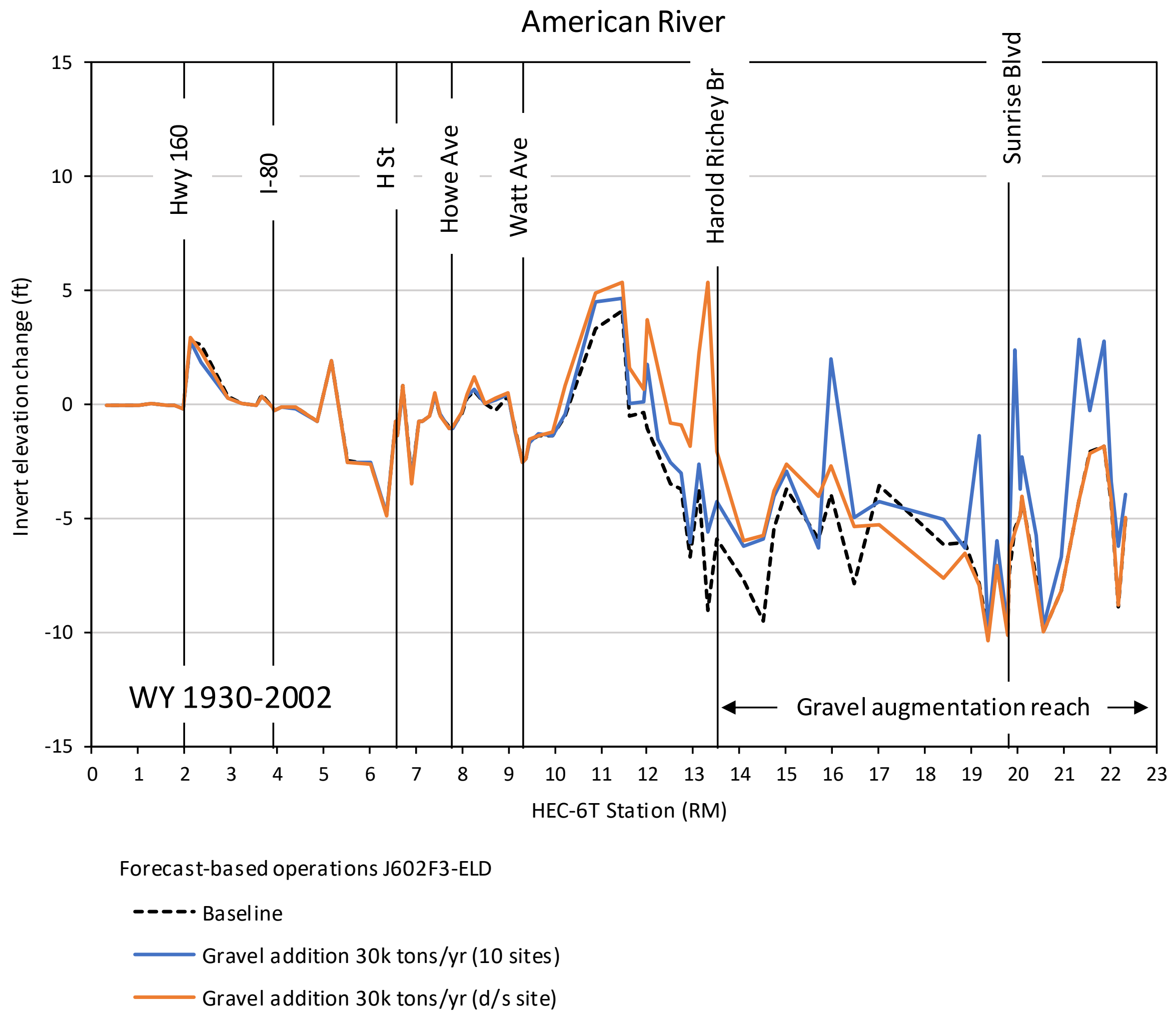


Figure 3.21. Computed changes in invert elevations for simulation period WYs 1930-2002 ("worst case" gravel placement).

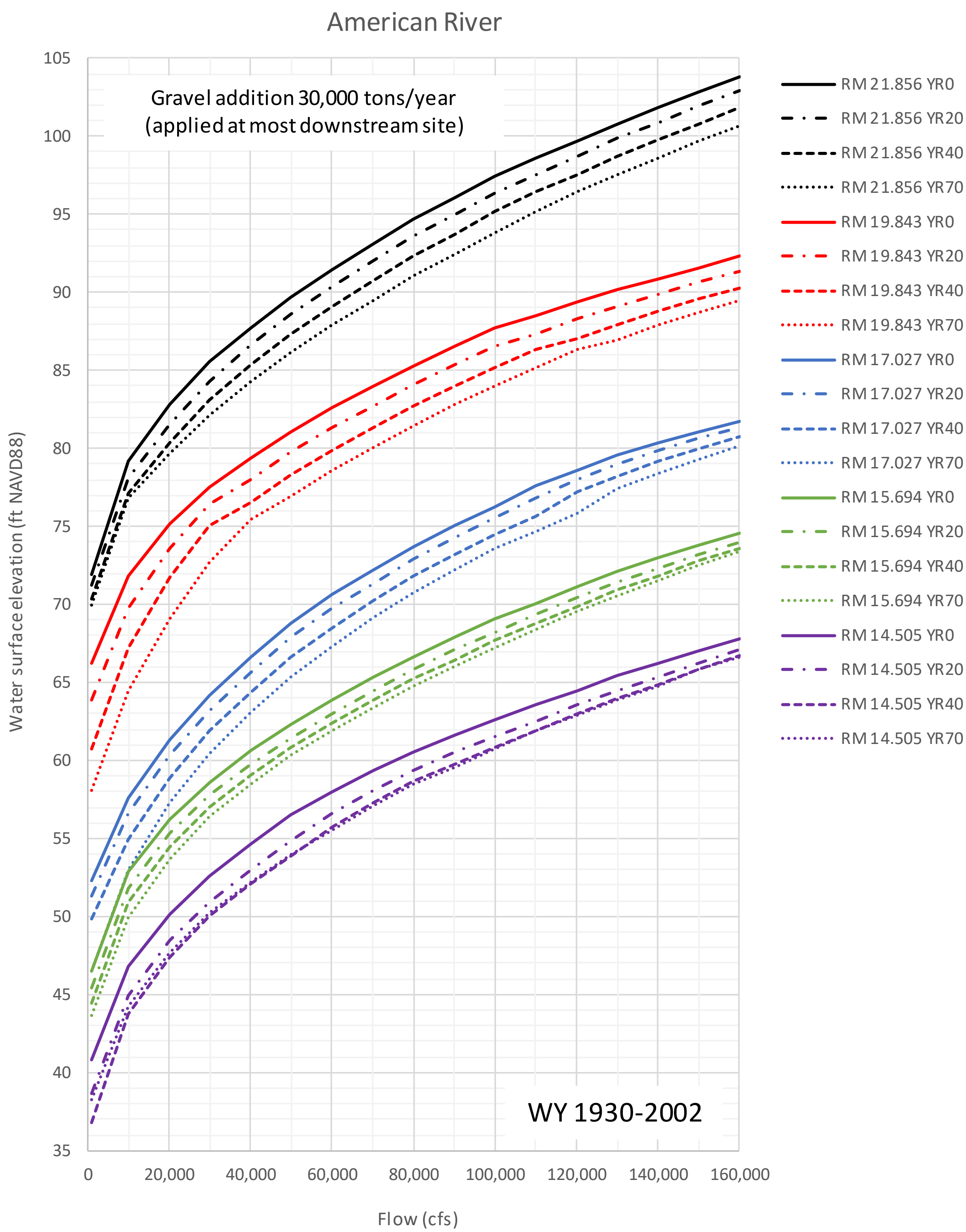


Figure 3.22. Computed changes in stage-discharge rating curves for simulation period WYs 1930-2002 (gravel addition 30,000 tons/year at most downstream restoration site).

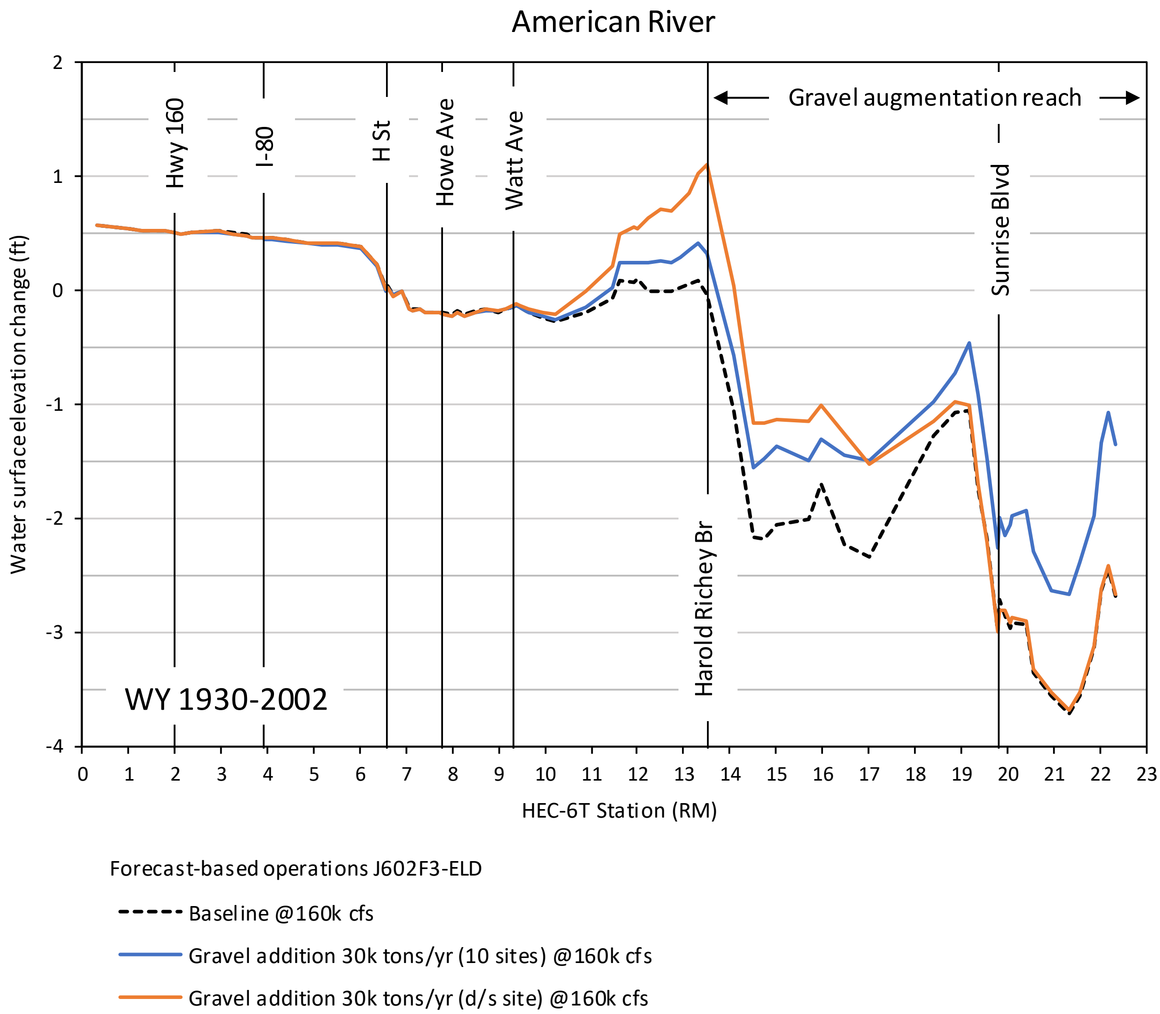


Figure 3.23. Computed changes in water surface elevations at 160,000 cfs for simulation period WYs 1930-2002 ("worst case" gravel placement).

4 TWO-DIMENSIONAL MODELING OF DEPOSITIONAL REACH NEAR WILLIAM B POND PARK

4.1 Purpose

Results of the NHC's 1-d sediment transport modeling (discussed in Chapter 3) demonstrated that a significant portion of the augmentation gravel load deposits in the LAR between RMs 10.5-13.5. This reach was previously impacted by instream aggregate mining which created a "sediment trap" that captures the excess gravel load transported from the upstream project reach. As a result, the 1-d model showed no significant differences in deposition in the downstream leveed reach between the baseline (no gravel augmentation) and gravel augmentation conditions.

The depositional reach between RMs 10.5-13.5 includes a large river bend with numerous high flow cut-off channels. The hydraulics and sediment transport processes in this environment is spatially variable and difficult to represent in a 1-d model. Therefore, NHC developed a two-dimensional (2-d) Adaptive Hydraulics (AdH) sediment transport model to confirm the sediment depositional characteristics of the LAR in the vicinity of William B. Pond Park. The following sections describe the development of the 2-d sediment transport model, derivation of model input parameters, key assumptions, modelled scenarios, and main results from the computer simulations.

4.2 Model Development

Modeling Domain and Geometry

The modeling domain extended from RM 9.3 (Watt Avenue) to about RM 15.7 (Ancil Hoffman Park). The upstream and downstream model boundaries were specified in relatively straight reaches, about 1.5-2 miles away from the main area of interest near William B. Pond Park. This helped to ensure that there was no effect of the flow and sediment boundary conditions on the model solution in the depositional reach. The model geometry was developed using the digital elevation model (DEM) which comprised the topo-bathymetric Light Detection and Ranging (LiDAR) data and bathymetric survey data collected for the LAR in 2017. Mesh spacing within the computational domain was set to 50 ft. This spacing was selected based on NHC's previous experience with 2-d models to reasonably represented channel and floodplain topographic features and, at the same time, provide manageable model run times. The modeling domain, geometry, and location of the study depositional reach near William B. Pond Park are shown in Figure 4.1.

Roughness

Spatially variable model roughness was utilized to represent existing channel and floodplain conditions using the roughness coefficients developed by CBEC Eco Engineering (CBEC) for their 2-d HEC-RAS model of the LAR (CBEC 2019b). A Manning's roughness coefficient of 0.025 was specified for the gravel streambed, 0.033 for grassland areas, 0.048 for shrub and small trees, and 0.07 for large trees.

Bed Material

Gradations of the surface and sub-surface bed material in the model were specified using the results from the NHC's bed material sampling at RM 13.2 (see Chapter 2 for description of bed material sampling data). The thickness of the surface (armor) layer was set to 0.6 ft and corresponded to the largest grain size class in the bed material (similar to the HEC-6T model). The thickness of the sub-surface material was arbitrarily set to 30 ft to provide an unlimited source of sediment for the simulations. There are no indications that the vertical bed erosion in the vicinity of William B. Pond Park is limited by erosion-resistant materials. Available geotechnical data and field observations indicate that erosion-resistant materials are exposed on the bed surface around RMs 9.5-10 (NHC 2015, 2017). However, this reach is located near the downstream model boundary and does not affect sediment transport processes in the depositional reach at William B. Pond Park.

Sediment Inflow

The upstream sediment inflow was set to the equilibrium load to provide a conservatively high estimate of sediment inflow to the modeled reach. This condition produces sediment inflow required for a state of equilibrium at the upstream model boundary. Such a numerical approach may underestimate channel erosion at this location; however, the sediment-supplying reach of the model before William B. Pond Park was sufficiently long for the flow to adjust its sediment transporting capacity and develop appropriate channel morphology.

Sediment Transport Computations

The 2-d AdH model does not include the Laursen-Copeland total sediment load method used in the 1-d HEC-6T model. Therefore, the formulas most appropriate for the conditions of LAR were selected from those available in AdH. The Wright-Parker formula was used for suspended sediment computations and the Meyer-Peter Mueller formula with the Wong-Parker correction was used for bedload transport computations. The Karim Holly Yang hiding factor was used with the bedload formula to better account for the intergranular interaction in mixed-size sediments. Despite of the use of the different sediment transport formulas, the overall sediment transport dynamics and the relative proportions of the gravel load deposited in the William B. Pond Park reach and conveyed farther downstream to the leveed reach are reasonably represented in the 2-d model.

Hydraulic Parameters

Based on a series of preliminary runs, an anisotropic method with vorticity correction and an adaptive estimated eddy viscosity was selected for all the subsequent simulations. These hydraulic parameters provided the most realistic velocity distribution (and hence sediment transport) around the bend in the modeled reach of the LAR.

4.3 Model Application

The 2-d model was run using a range of constant flows: (1) 40,000 cfs, (2) 80,000 cfs, (3) 115,000 cfs, and (4) 160,000 cfs. The corresponding water surface elevations (WSEs) at the downstream model boundary were determined from the CBEC's 2-d HEC-RAS model of the LAR (CBEC 2019b). Fixed-bed simulations were conducted first to establish initial hydraulic conditions along the modeled reach for each flow. Computed WSEs and velocities were compared with those predicted by CBEC's 2-d HEC-RAS model of the LAR to verify the hydraulic performance of the AdH model. The hydraulic parameters computed from the fixed-bed simulations were then used as initial conditions for the subsequent sediment transport simulations with movable bed.

The sediment transport simulations were run for each flow for 10 days to achieve an approximate equilibrium hydraulic and sediment transport condition (reasonably constant WSEs and sediment loads) within the modeling domain. Comparison of the computed sediment inflow at RM 13.5 and sediment outflow at RM 11.5 provided an estimate of the deposition rate in the William B. Pond Park reach for each modeled flow. The computed flow-specific results were annualized to provide an approximate long-term deposition rate in this reach.

4.4 Model Results

This section discusses the results of 2-d simulations in the vicinity of the William B. Pond Park. The model entrance reach near Ancil Hoffman Park and exit reach at Watt Avenue may be subject to model boundary effects and therefore are not discussed herein.

Flow Characteristics

The model results indicate that at 115,000 cfs and below, flow tends to be conveyed primarily in the channel, while at 160,000 cfs some of the flow diverges into the floodplain. Flow depths and velocities computed for the maximum release of 160,000 cfs in the vicinity of William B. Pond Park are shown in Figures 4.2 and 4.3, respectively. Computed depths range from around 20-50 ft in the channel to 5-10 ft over the floodplain. Computed flow velocities range from 10-15 ft/s in the channel to less than 3 ft/s in the floodplain areas. There is an obvious reduction in flow velocity to less than 6 ft/s in the William B. Pond Park reach and farther downstream in the reach of the past in-stream mining – these are the reaches where gravel deposition is likely to occurs.

Bed Changes

Bed elevation changes computed over the 10-day simulation period are shown for each flow in Figures 4.4-4.7. Active sediment deposition is computed in the William B. Pond Park reach for all the modeled flows, particularly between RMs 12-13.5 where the river widens and forms several cut-off channels. The majority of deposition occurs within the main channel and cut-off channels, although some sediment is also deposited over the floodplain, primarily where the flow starts to cut through the park. Another depositional area is computed near RMs 10-11, where the river bifurcates and flows through former in-channel gravel pits. The depositional areas predicted by the 2-d model are generally consistent with the 1-d model results which show that most gravel load is deposited in this reach.

Sediment Load and Deposition

Total sediment loads into (at RM 13.5) and out of (at RM 11.5 below Gristmill Bar) the William B. Pond Park reach computed for each flow are summarized in Table 4.1. The difference between the sediment loads provided an estimate of the existing conditions deposition rates and sediment trapping efficiency (percentage of incoming sediment load deposited in the reach). At 40,000 cfs the deposition rate is minimal, while at flows above 80,000 cfs the deposition rates increase by an order of magnitude.

The long-term average annual sediment deposition rate within the William B. Pond Park reach channels was estimated in accordance with the method described in Corps (1989). This method accounts for the probability of occurrence of various flows during any one year and consists of numerical integration of the sediment yield frequency curve. The long-term average result is, therefore, a statistical measure reflecting the cumulative effect of the flow events of different chance of occurrence. The result of the calculations is presented in Table 4.1.

The calculated long-term average annual deposition rate for the LAR at William B. Pond Park (between RMs 11.5-13.5) is about 21 tons/day or approximately 8,000 tons/year. The calculated average sediment trapping efficiency is 93%.

4.5 Comparison with Other Data

Comparison with Observed Channel Changes

According to the preliminary topographic change results presented in CBEC (2019a), approximately 13,000 cubic yards (19,000 tons) of sediment deposited in this reach between 1997-2017, which gives an average annual deposition of about 700 cubic yards/year (1,000 tons/year). The CBEC deposition rate is less compared to the 2-d model results, but it is of the same order of magnitude. It should be noted that the 2-d model simulations included extremely high flows, while the CBEC data include the effects of relatively moderate flood events (the maximum observed flow in the LAR during the 1997-2017 period was 85,400 cfs, which is close to the 50-year event). On the other hand, the 2-d simulations used a series of steady flows (not actual hydrographs) run over the same initial channel topography, and therefore the average deposition rate calculated from the 2-d model results should be regarded as an approximate estimate.

Comparison with 1-D Model

The 1-d HEC-6T model results obtained with the long-term project hydrology (WYs 1930-2002) indicate an average annual deposition in the William B. Pond Park reach (RMs 11.5-13.5) of about 12,000 tons/year for the baseline conditions (without gravel augmentation), 20,000 tons/year for the gravel augmentation of 30,000 tons/year evenly distributed between the restoration sites, and 30,000 tons/year for the gravel augmentation of 30,000 tons/year applied at the most downstream restoration site immediately upstream of the William B. Pond Park reach. According to the 1-d model results, the sediment trapping efficiency in this reach ranges from about 40 to 60%. The depositional characteristics predicted by the 1-d model for the baseline conditions (without gravel augmentation) are quite similar to the values predicted by the 2-d model (see Table 4.1). Therefore, despite of the use of different sediment transport formulas and different modeling approaches, the 2-d AdH model generally confirms the depositional characteristics and trends predicted in the vicinity of William B. Pond Park by the 1-d HEC-6T model.

The 1-d HEC-6T model shows about 3 times higher sediment loads in the vicinity of William B. Pond Park compared to the 2-d AdH model. As mentioned previously in this report, the sediment transport function used in the 1-d model provides conservative (i.e., high) estimates of sediment loads along the LAR. On the other hand, the bed load transport formula used in the 2-d model accounts for grain-size interactions, which reduces transport of sand and fine gravel. There are no measured sediment transport data for this reach to determine which transport function provides more realistic results. It should be noted that bed aggradation and degradation are not caused by the magnitude of sediment loads, but rather by the difference between sediment inflow into and outflow from a reach (i.e., sediment budget). As is shown above in this section, the sediment budget (deposition rate) for this reach is quite similar between the 1-d and 2-d models.

Overall, both the 1-d and 2-d model results suggest that the William B. Pond Park reach of the LAR is a depositional area which captures most of the incoming gravel load. This is not too surprising given that the channel geomorphology shows that this area has a substantial slope break, creating an inland delta. Additionally, this area has been mined in the past, which has increased the area for deposition and decreased the overall capacity to transport material past this reach. The trapping capacity of this reach is sufficient to accumulate any increases in sediment inflow caused by the proposed project so that there would be no significant changes in sediment loads entering the leveed reach of the LAR.

Table 4.1. Computed deposition at William B. Pond Park (between RMs 11.5-13.5).

Flow (cfs)	Return period (years)	Probability of occurrence	Sediment inflow RM 13.5 (tons/day)	Sediment outflow RM 11.5 (tons/day)	Deposition RM 11.5-13.5 (tons/day)	Trap efficiency (%)
160,000	364	0.003	254	27	227	89
115,000	100	0.01	275	20	255	93
80,000	50	0.02	187	10	177	95
40,000	25	0.04	31	2	29	94
Long-term average annual			22	1	21	93

Notes:

1. Trap efficiency = deposition / sediment inflow.

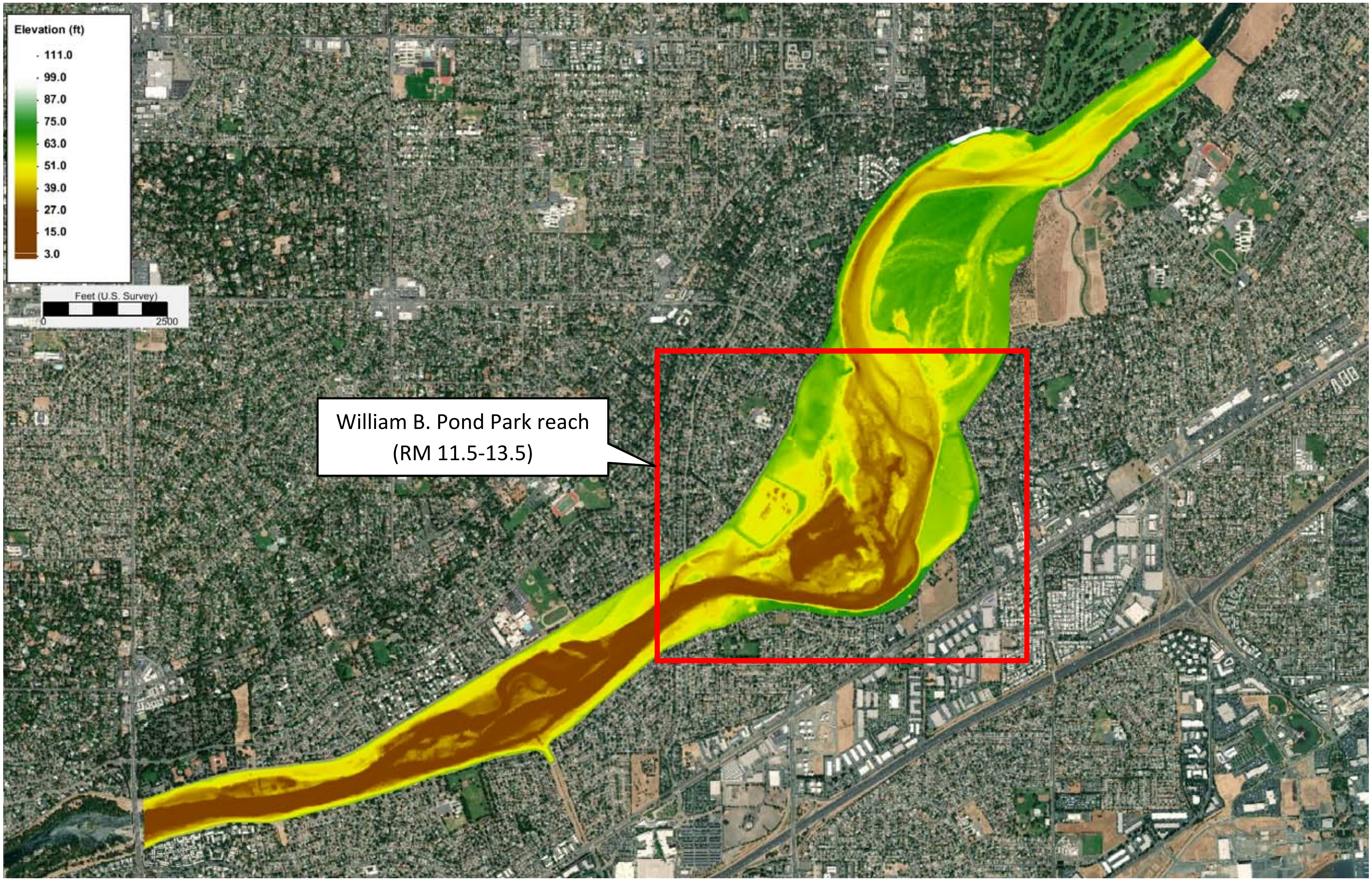


Figure 4.1. AdH model extents and geometry.

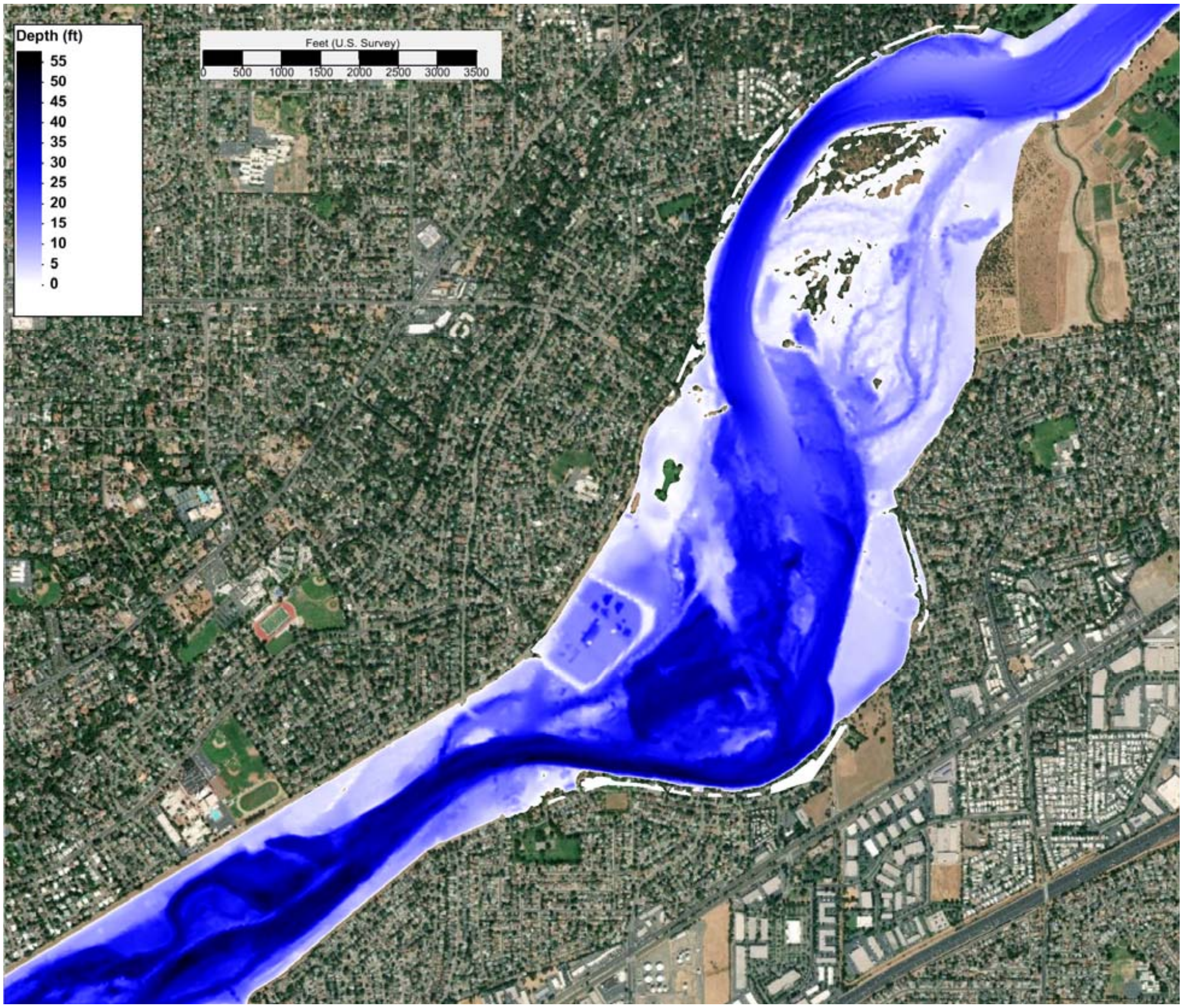


Figure 4.2. Flow depths at 160,000 cfs.

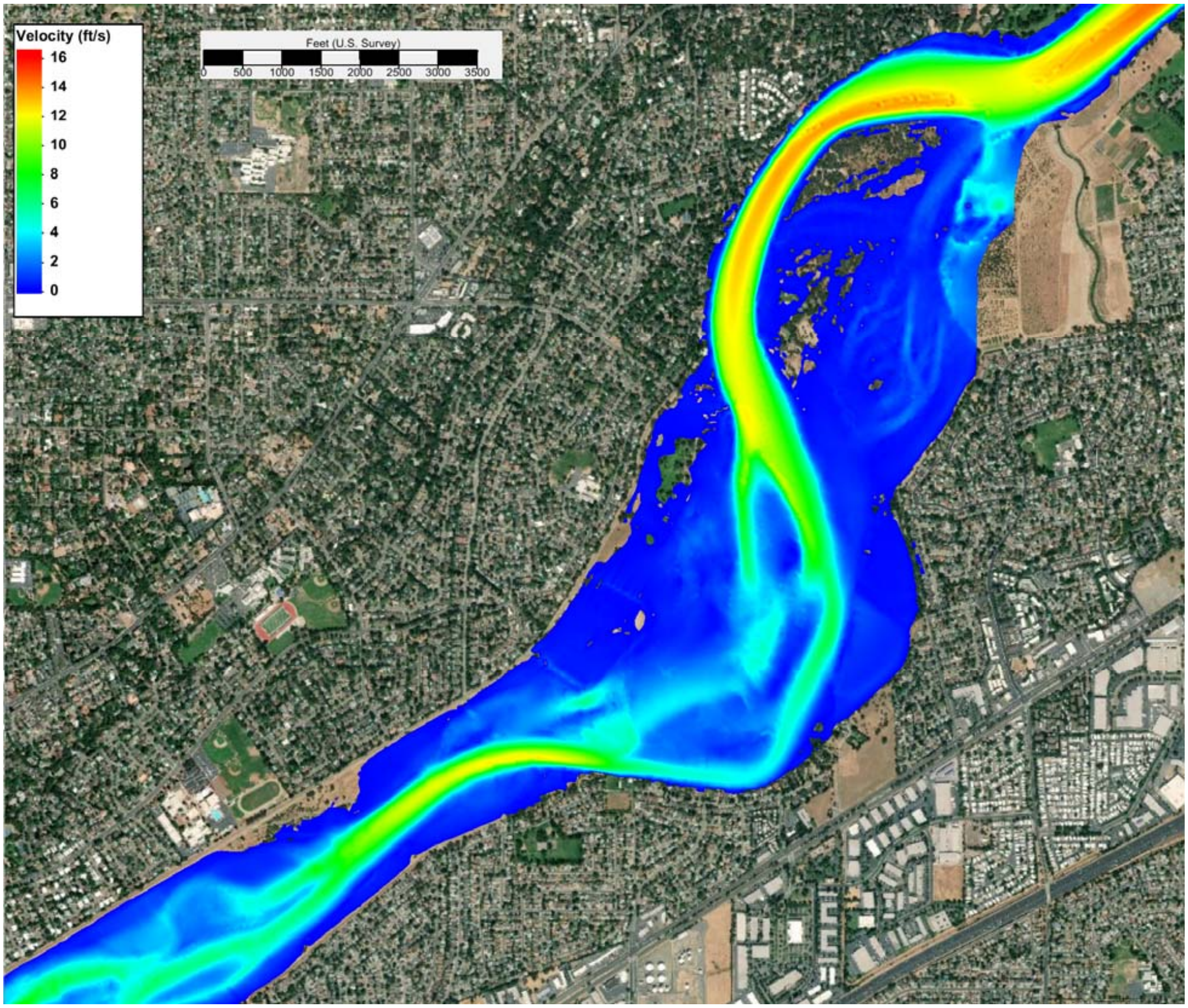


Figure 4.3. Flow velocities at 160,000 cfs.

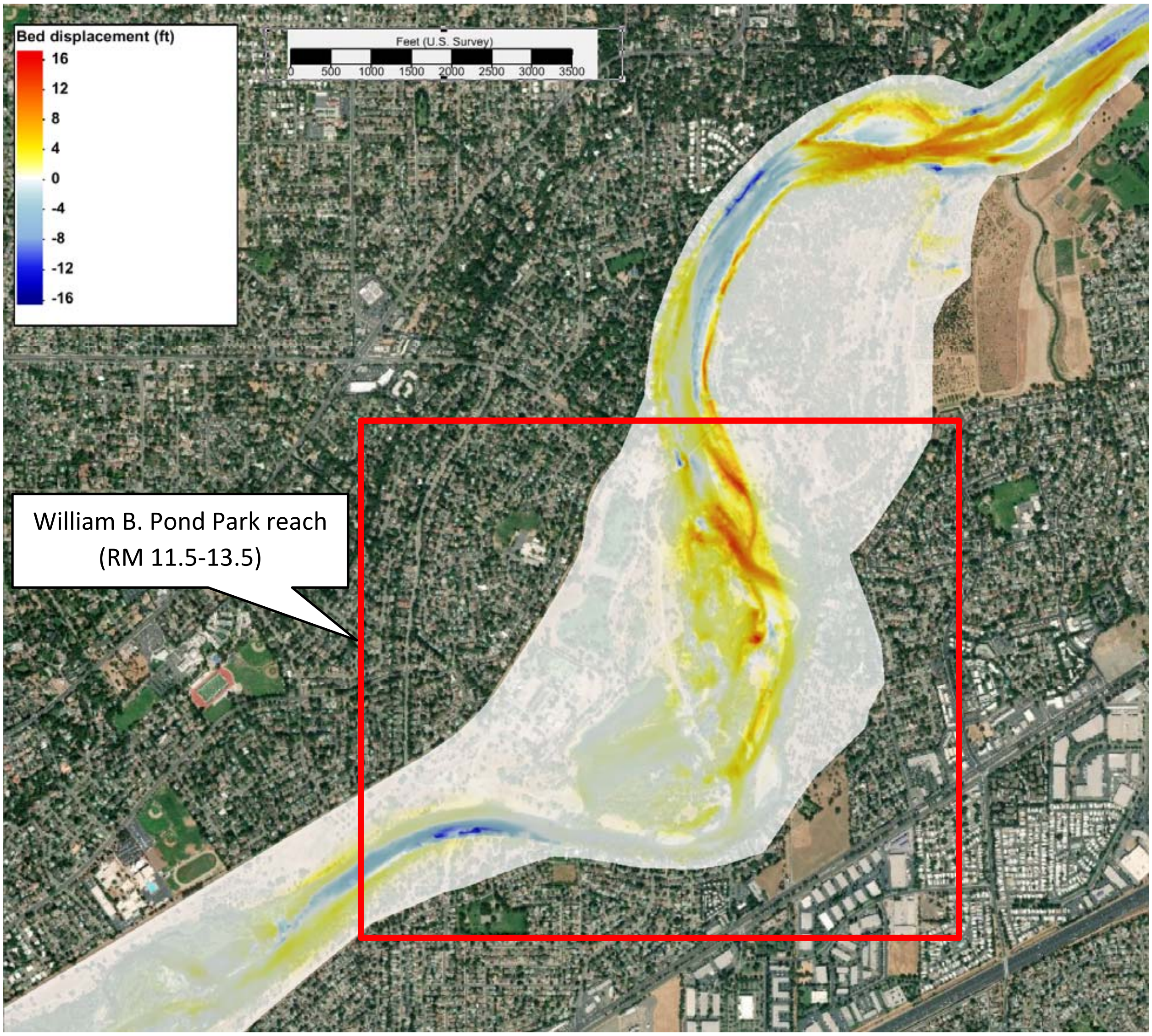


Figure 4.4. Bed elevation change at 160,000 cfs (during 10-day simulation period).

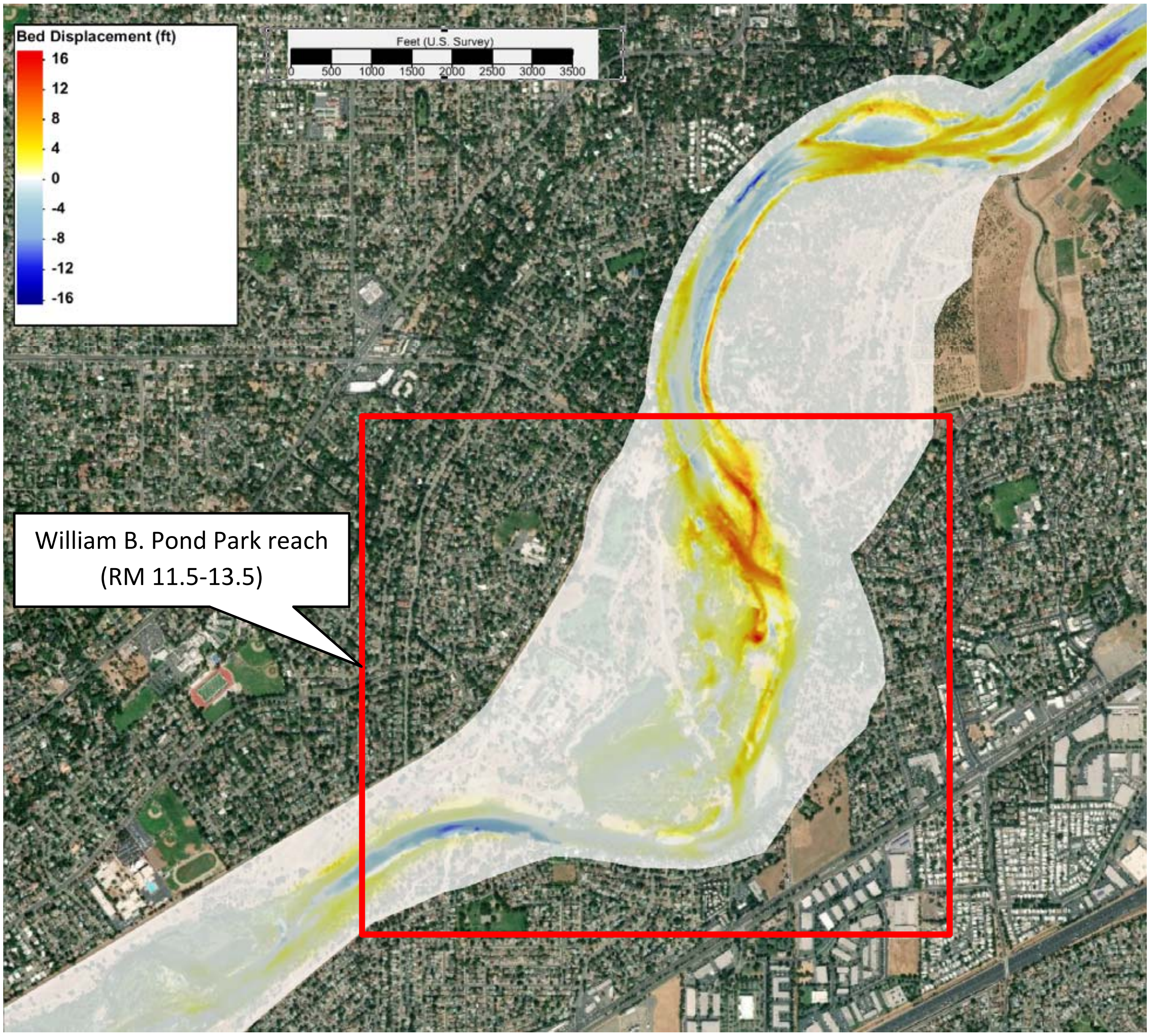


Figure 4.5. Bed elevation change at 115,000 cfs (during 10-day simulation period).

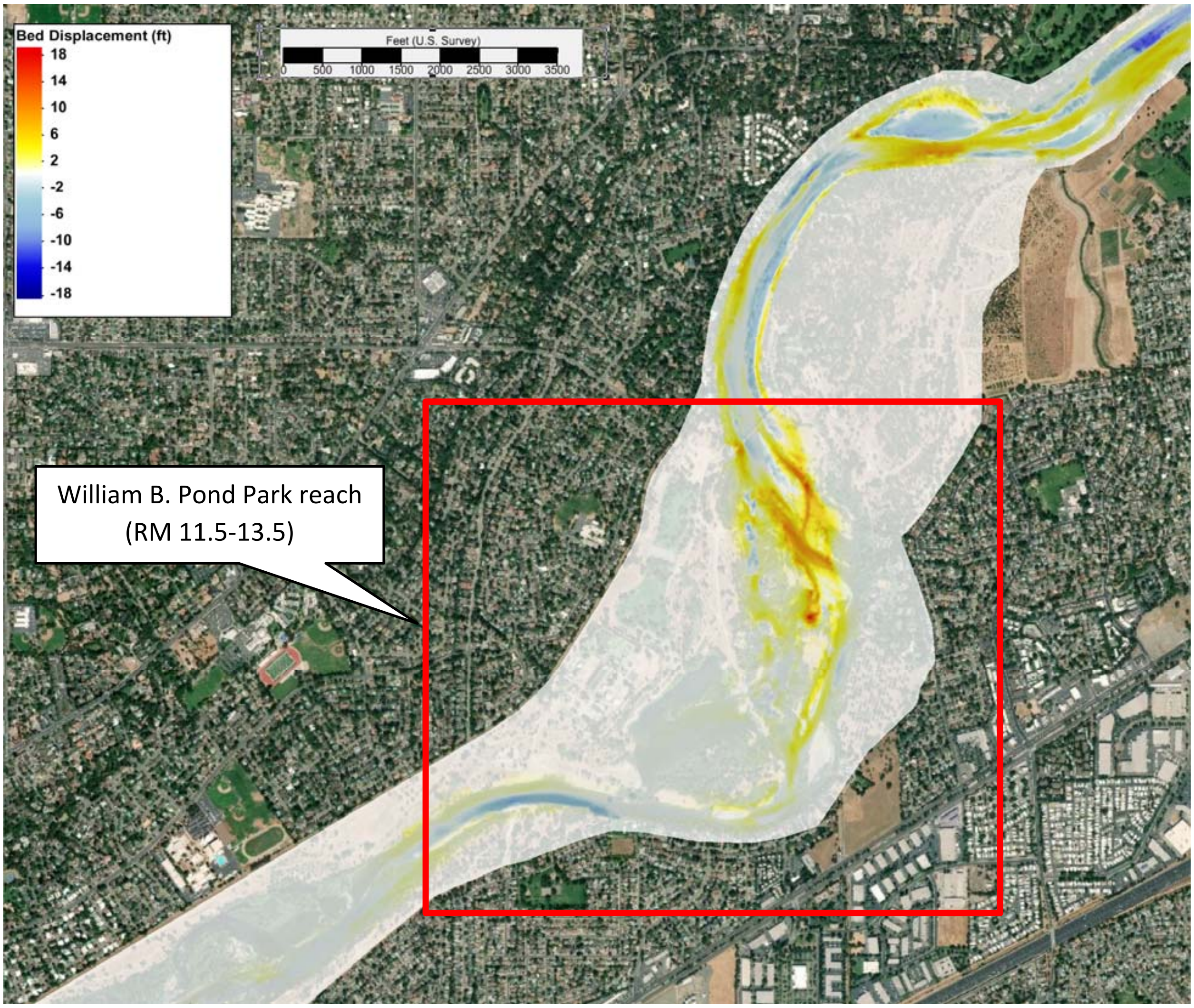


Figure 4.6. Bed elevation change at 80,000 cfs (during 10-day simulation period).

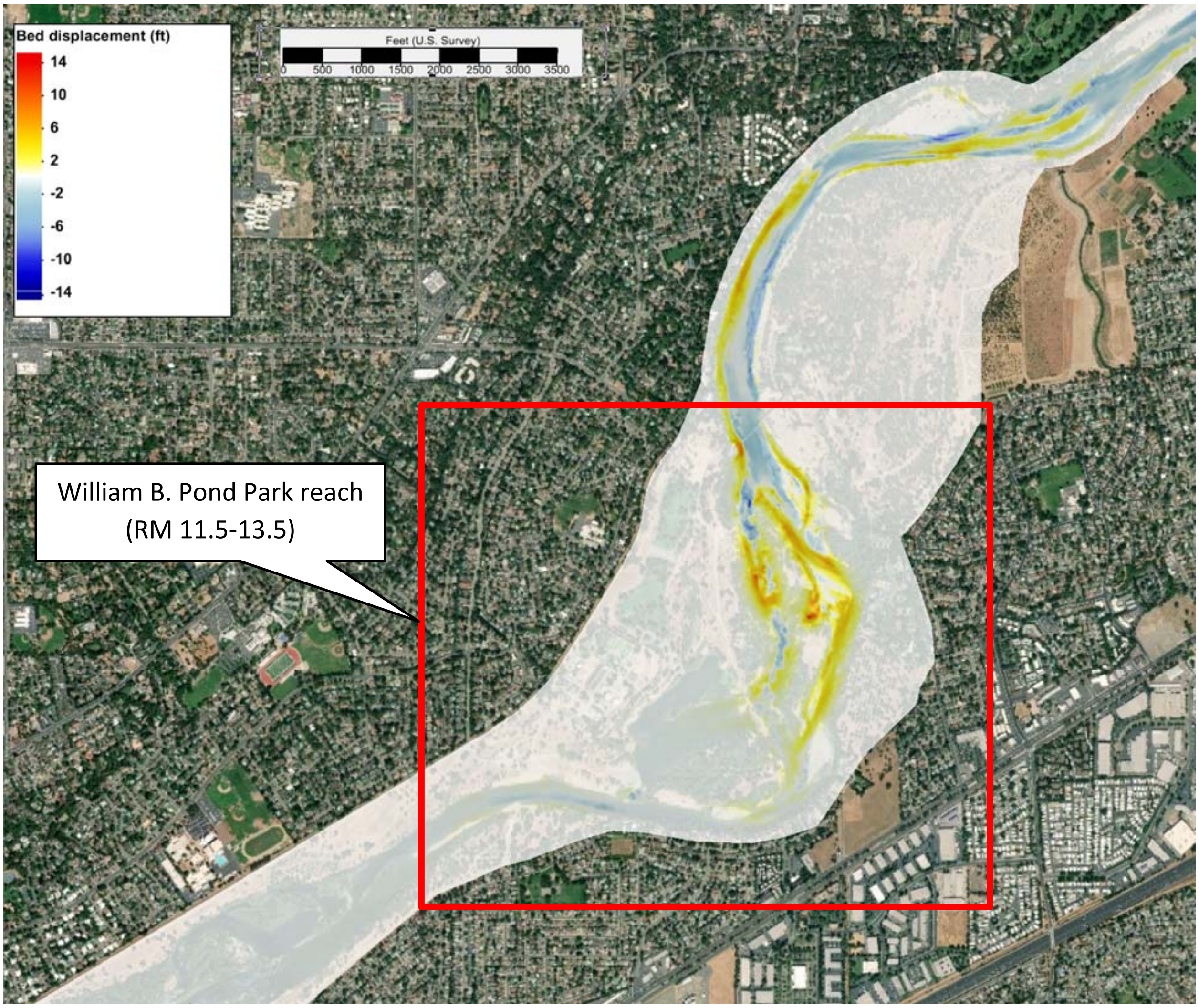


Figure 4.7. Bed elevation change at 40,000 cfs (during 10-day simulation period).

5 SUMMARY AND CONCLUSIONS

The main goal of this numerical sediment modeling study undertaken by NHC was to quantify the volumes of spawning gravel that can be added to the LAR upstream of the leveed reach without negative impacts to flood conveyance. The analysis used a 1-d HEC-6T sediment transport model of the LAR (RMs 0-22) supplemented by a 2-d AdH sediment transport model of the depositional reach near William B. Pond Park (RMs 10-14). The models included surface and sub-surface bed material data collected by NHC in December 2018. The 1-d model was used for long-term simulations of the gravel augmentation effects, while the 2-d model was used to simulate flow-specific effects and to support the 1-d modeling results.

The main results of this sediment modeling study are summarized below:

- 30,000 tons/year for a 73-year simulated period of record is the maximum amount of spawning gravel that can be added each year to the channel without adversely affecting flood conveyance along the LAR. (Note: the proposed project is limited to up to 30,000 tons/year for the next 15 years.) It is recommended to distribute this augmentation load between all restoration sites over the 15-year period to the extent feasible.

- The augmentation gravel initially will not cause significant increases in sediment loads as it gradually accumulates in the channel and mixes with the original bed material. If distributed evenly between the restoration sites, it will take approximately 3 decades with annual importing of augmentation gravel to start increasing sediment delivery downstream of the project reach.

- The application of this entire augmentation gravel load at the most downstream restoration site will result in a greater sediment inflow into and deposition in the region of William B. Pond Park, compared to the scenario when this load is distributed between all the restoration sites.

- The additional sediment load from the gravel augmentation sites will deposit within the reach of past instream gravel mining between RMs 10.5-13.5 and there will be no significant impact to sediment loads and bed changes in the leveed reach downstream of about RM 10 over the 15-year life of the project.

- Because of the simplification of the complex natural sediment transport process in numerical models, the modeling results should be regarded as approximate indicators of the general morphological behavior of the system. Regular field monitoring of the effects of the gravel augmentation activities should be implemented to detect any negative impacts to flood conveyance and channel/bank stability and to adjust gravel augmentation volumes and locations as necessary to avoid significant impacts.

- NHC recommends performing field measurements of sediment transport rates (including gravel bed load and suspended sand load) in the upper reach of the LAR as part of the monitoring program of the effects of the proposed project. Presently, there are no measured bed load transport data on the LAR. These measurements would provide invaluable field data to calibrate and verify existing and future sediment transport models. A program of field measurements of sediment transport provides the information needed to assess and confirm any changes in sediment loads due to the proposed project.

6 REFERENCES

Ayres (2010). Channel Stability Analysis of the Lower American River, Folsom Dam to the Confluence Sacramento, California. Report prepared for US Army Corps of Engineers by Ayres Associates, Sacramento, CA, January 8, 2010.

CBEC (2019a). Preliminary Topographic Change Results (by Matt Weber, Chris Bowles, and Chris Hammersmark). 1/17/2019.

CBEC (2019b). LAR Current Condition DEM And 2D Model Development Project – Flood Flow Hydrodynamic Modeling Report. Prepared for Sacramento Area Flood Control Agency by cbec, inc. eco engineering. March 2019.

Corps (1989). Sedimentation Investigations of Rivers and Reservoirs. Engineering Manual EM 1110-2-4000. US Army Corps of Engineers. 15 December 1989.

NHC (2011). Sacramento River Sediment Study, Phase II: Task 13 – American River Bed Material Sampling. Memorandum prepared for US Army Corps of Engineers, Sacramento District by Northwest Hydraulic Consultants, West Sacramento, CA. December 5, 2011.

NHC (2015). Sacramento River Sediment Study, Phase II, CA. Folsom Dam Modification, Water Control Manual Update. Lower American River HEC-6T Model. Report prepared for US Army Corps of Engineers, Sacramento District, Sacramento, CA by Northwest Hydraulic Consultants, Sacramento, CA. 30 September 2015.

NHC (2017). U.S. Army Corps of Engineers Supplemental Analysis, Folsom Dam Water Control Manual Update, HEC-6T Sediment Modeling. Report prepared for Sacramento Area Flood Control Agency and US Army Corps of Engineers, Sacramento District by Northwest Hydraulic Consultants Inc., Sacramento, CA. 9 August 2017.

NHC (2018a). Folsom WCM Update – Gravel Augmentation Volumes. Letter report prepared for Sacramento Area Flood Control Agency by Northwest Hydraulic Consultants Inc., Sacramento, CA. 15 May 2018.

NHC (2018b). Lower American River Anadromous Fish Habitat Restoration Project – Assessment of Potential Downstream Geomorphic and Hydraulic Impacts. Letter report prepared for Sacramento Area Flood Control Agency by Northwest Hydraulic Consultants Inc., Sacramento, CA. 18 May 2018.

USBR (2014). Lower American River Salmonid Spawning Gravel Augmentation and Side-Channel Habitat Establishment Program – Nimbus Basin. Supplemental Environmental Assessment. U.S. Department of the Interior, Bureau of Reclamation. August 2014.

USBR (2016). Lower American River Anadromous Fish Habitat Restoration Project. Environmental Assessment. US Department of the Interior, Bureau of Reclamation, Mid Pacific Region. February 2016.

USBR/SAFCA (2019). Lower American River Anadromous Fish Habitat Restoration Project. Supplemental Environmental Assessment/Initial Study and Proposed Mitigated Negative Declaration. US Department of the Interior, Bureau of Reclamation, Mid Pacific Region and Sacramento Area Flood Control Agency. April 2019.

APPENDIX A

American River Study Reach

US Army Corps of Engineers

nhc northwest hydraulic consultants

Legend

- HEC-6T Model Stationing
- HEC-6T Cross Sections
- NHC's Bed Material Sampling Locations
- HEC-6T Gravel Addition

N

DATA SOURCES:
NAIP Color Orthoimagery, 5/22-7/5 2012.
ESRI Roads, 2012.

SCALE - 1:12,000

0 500 1,000 Feet

California State Plane, Zone 6
Units: Feet

Job: 5004305

Date: FEBRUARY 2019

Appendix A

Sacramento Sediment - Phase 2

American River Study Reach

Sheet 1

ABC, P:\50071 Sac Sediment Phase 2\GIS\Workmaps\Figures\Cross_Section_Location_Maps\American_River_Study_Reach.mxd

US Army Corps of Engineers

nhc northwest hydraulic consultants

Legend

- HEC-6T Model Stationing
- HEC-6T Cross Sections
- NHC's Bed Material Sampling Locations
- HEC-6T Gravel Addition

N

DATA SOURCES:
NAIP Color Orthoimagery, 5/22-7/5 2012.
ESRI Roads, 2012.

SCALE - 1:12,000
0 500 1,000 Feet

California State Plane, Zone 6
Units: Feet

Job: 5004305

Date: FEBRUARY 2019

Appendix A

Sacramento Sediment - Phase 2

American River Study Reach

Sheet 2

US Army Corps of Engineers

nhc northwest hydraulic consultants

Legend

HEC-6T Model Stationing

HEC-6T Cross Sections

NHC's Bed Material Sampling Locations

HEC-6T Gravel Addition

DATA SOURCES:
NAIP Color Orthoimagery, 5/22-7/5 2012.
ESRI Roads, 2012.

SCALE - 1:12,000

0 500 1,000 Feet

California State Plane, Zone 6
Units: Feet

Job: 5004305

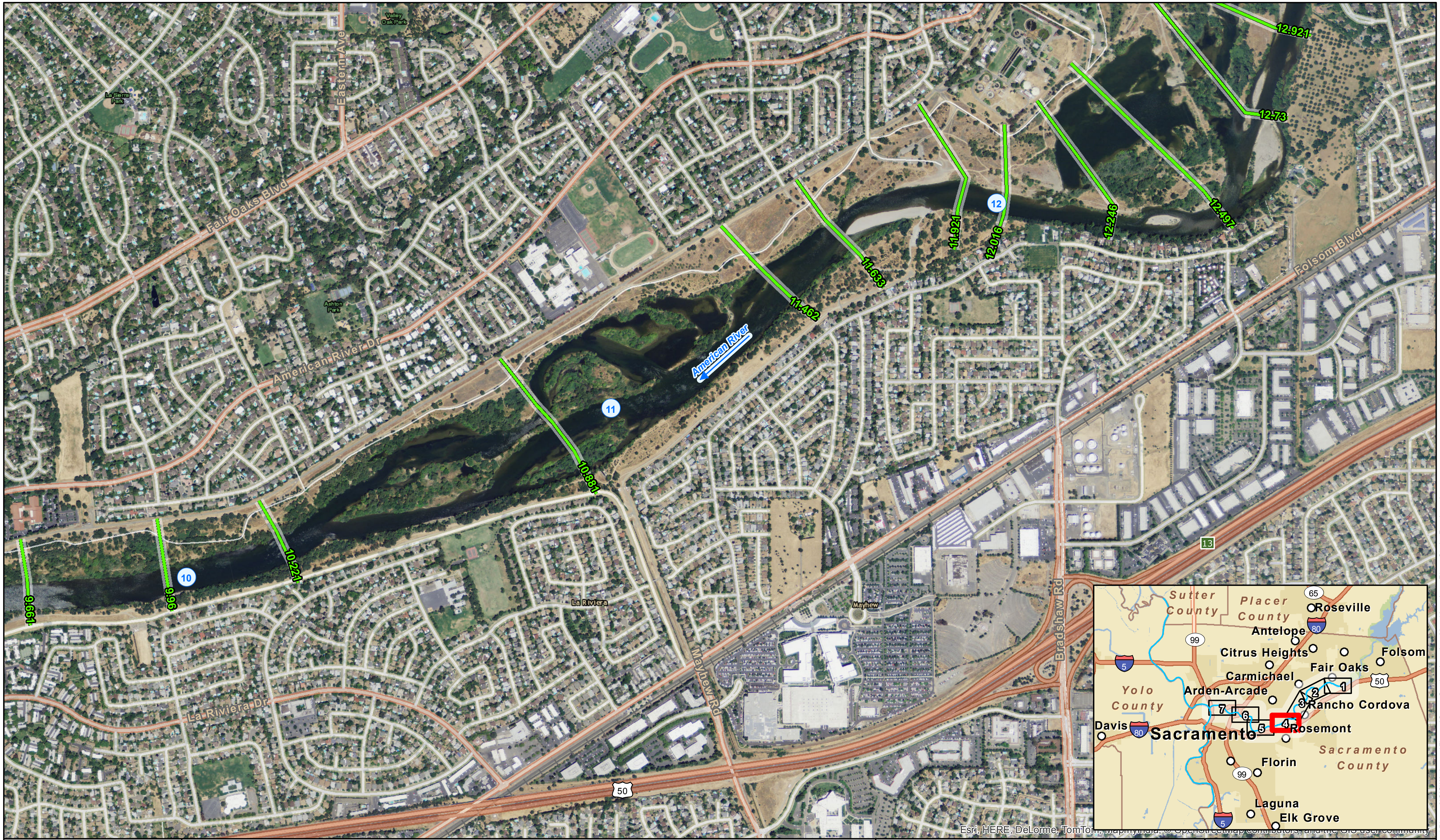
Date: FEBRUARY 2019

Appendix A

Sacramento Sediment - Phase 2

American River Study Reach

Sheet 3



US Army Corps of Engineers

nhc northwest hydraulic consultants

Legend

HEC-6T Model Stationing

HEC-6T Cross Sections

N

DATA SOURCES:
NAIP Color Orthoimagery, 5/22-7/5 2012.
ESRI Roads, 2012.

SCALE - 1:12,000

0 500 1,000 Feet

California State Plane, Zone 6
Units: Feet

Job: 50571

Date: DECEMBER 2014

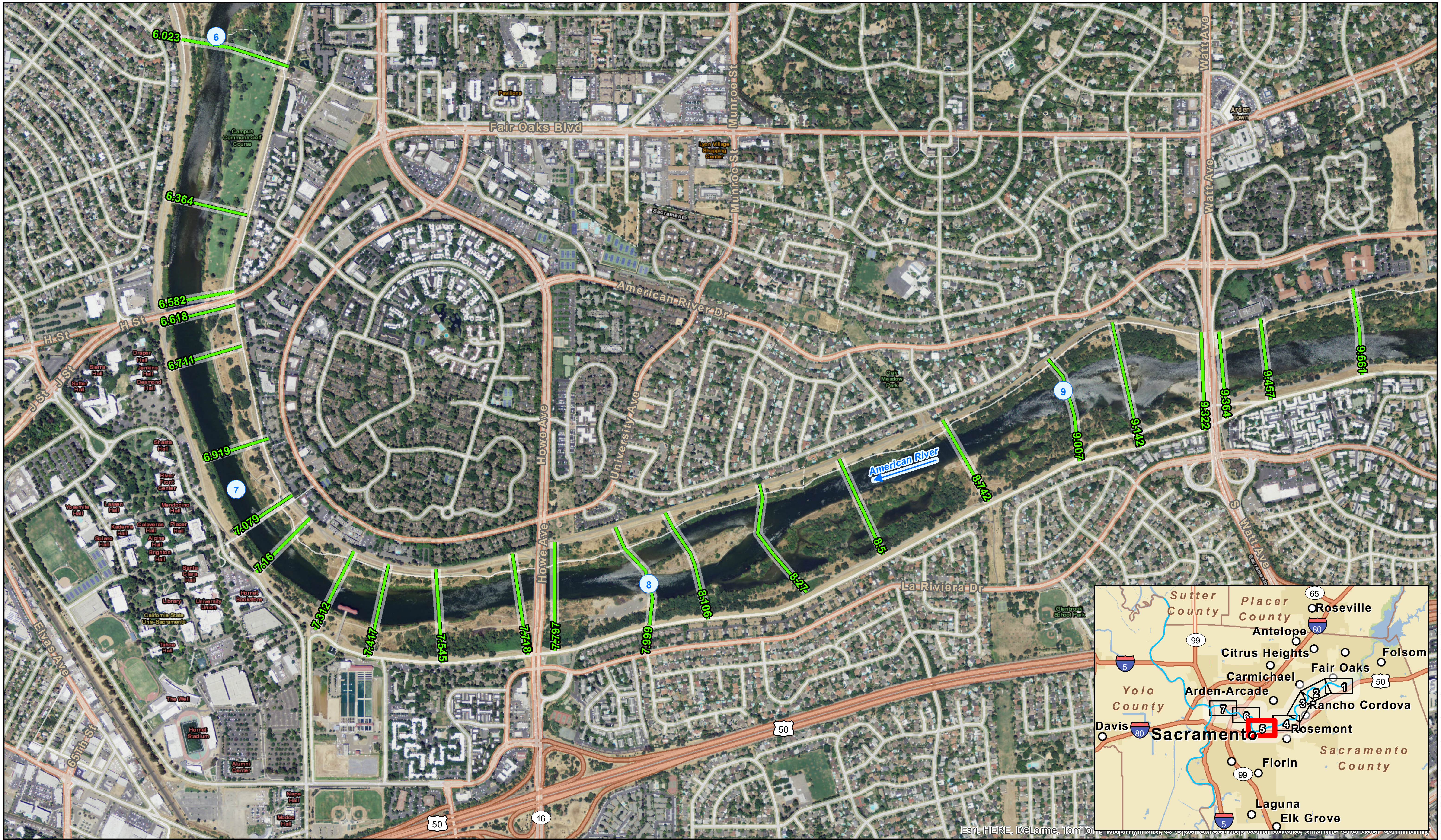
Appendix A

Sacramento Sediment - Phase 2

American River Study Reach

Sheet 4

ABC, P:\50571 Sac Sediment Phase 2\GIS\Workmaps\Figures\Cross_Section_Location_Maps\American_River_Study_Reach.mxd



US Army Corps of Engineers

nhc northwest hydraulic consultants

Legend

HEC-6T Model Stationing

HEC-6T Cross Sections

N

DATA SOURCES:
NAIP Color Orthoimagery, 5/22-7/5 2012.
ESRI Roads, 2012.

SCALE - 1:12,000

0 500 1,000 Feet

California State Plane, Zone 6
Units: Feet

Job: 50571

Date: DECEMBER 2014

Appendix A

Sacramento Sediment - Phase 2

American River
Study Reach
Sheet 5

US Army Corps of Engineers

nhc northwest hydraulic consultants

Legend

HEC-6T Model Stationing

HEC-6T Cross Sections

N

DATA SOURCES:
NAIP Color Orthoimagery, 5/22-7/5 2012.
ESRI Roads, 2012.

SCALE - 1:12,000

0 500 1,000 Feet

California State Plane, Zone 6
Units: Feet

Job: 50571

Date: DECEMBER 2014

Appendix A

Sacramento Sediment - Phase 2

American River Study Reach

Sheet 6

ABC, P:\50571 Sac Sediment Phase 2\GIS\Workmaps\Figures\Cross_Section_Location_Maps\American_River_Study_Reach.mxd

US Army Corps of Engineers

nhc northwest hydraulic consultants

Legend
- HEC-6T Model Stationing
- HEC-6T Cross Sections

N

DATA SOURCES:
NAIP Color Orthoimagery, 5/22-7/5 2012.
ESRI Roads, 2012.

SCALE - 1:12,000
0 500 1,000 Feet

California State Plane, Zone 6
Units: Feet

Job: 50571

Date: DECEMBER 2014

Appendix A

Sacramento Sediment - Phase 2

American River Study Reach

Sheet 7

Appendix F. Air Quality Model Results

Lower American River Gravel Augmentation Project

Sacramento County, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
User Defined Recreational	0.00	User Defined Unit	34.50	0.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	3.5	**Precipitation Freq (Days)**	58
Climate Zone	3			**Operational Year**	2020
Utility Company	Sacramento Municipal Utility District				
CO2 Intensity (lb/MWhr)	590.31	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Assuming worse case scenario for 3 restoration activites occuring at the same time

Construction Phase - Assuming the project will only occur from July to September.

Off-road Equipment - From Construction Equipment Table in Project Description

Off-road Equipment - From Construction Equipment Table in Project Description

Off-road Equipment -

Off-road Equipment -

Off-road Equipment - From Construction Equipment Table in Project Description

Off-road Equipment - From Construction Equipment Table in Project Description

Trips and VMT - trip distance is 12 miles for import and 15-20 miles for mobilization and site restoration

Grading - Acres disturbed for borrow site, stockpiles near river, and excavated gravel

Vehicle Emission Factors -

Vehicle Emission Factors -

Vehicle Emission Factors -

Fleet Mix -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	740.00	3.00
tblConstructionPhase	NumDays	75.00	56.00
tblConstructionPhase	NumDays	75.00	56.00
tblConstructionPhase	NumDays	75.00	56.00
tblConstructionPhase	NumDays	30.00	7.00
tblLandUse	LotAcreage	0.00	34.50
tblOffRoadEquipment	HorsePower	402.00	150.00
tblOffRoadEquipment	HorsePower	402.00	150.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	2.00
tblOffRoadEquipment	PhaseName		Spawning Gravel Replenishment
tblOffRoadEquipment	PhaseName		Site Restoration
tblOffRoadEquipment	PhaseName		Spawning Gravel Replenishment
tblOffRoadEquipment	PhaseName		Site Restoration
tblOffRoadEquipment	PhaseName		Spawning Gravel Replenishment

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2019	7.8649	84.7710	50.3271	0.0975	18.5001	3.9627	22.4628	4.7383	3.6522	8.3905	0.0000	9,726.950 8	9,726.950 8	2.6044	0.0000	9,792.059 8
Maximum	**7.8649**	**84.7710**	**50.3271**	**0.0975**	**18.5001**	**3.9627**	**22.4628**	**4.7383**	**3.6522**	**8.3905**	**0.0000**	**9,726.950 8**	**9,726.950 8**	**2.6044**	**0.0000**	**9,792.059 8**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2019	7.8649	84.7710	50.3271	0.0975	18.5001	3.9627	22.4628	4.7383	3.6522	8.3905	0.0000	9,726.950 8	9,726.950 8	2.6044	0.0000	9,792.059 8
Maximum	**7.8649**	**84.7710**	**50.3271**	**0.0975**	**18.5001**	**3.9627**	**22.4628**	**4.7383**	**3.6522**	**8.3905**	**0.0000**	**9,726.950 8**	**9,726.950 8**	**2.6044**	**0.0000**	**9,792.059 8**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Mobilization	Site Preparation	7/1/2019	7/9/2019	5	7	
2	Spawning Gravel Replenishment	Grading	7/10/2019	9/25/2019	5	56	
3	Floodplain and Side Channel Creation/ Enhancement	Grading	7/10/2019	9/25/2019	5	56	
4	Instream Habitat Structure Placement	Grading	7/10/2019	9/25/2019	5	56	
5	Site Restoration	Building Construction	9/26/2019	9/30/2019	5	3	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Spawning Gravel Replenishment	Dumpers/Tenders	4	8.00	16	0.38
Spawning Gravel Replenishment	Excavators	1	8.00	158	0.38
Spawning Gravel Replenishment	Off-Highway Trucks	2	8.00	150	0.38
Spawning Gravel Replenishment	Other Material Handling Equipment	2	8.00	168	0.40
Spawning Gravel Replenishment	Rubber Tired Dozers	3	8.00	247	0.40
Spawning Gravel Replenishment	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Floodplain and Side Channel Creation/ Enhancement	Excavators	1	8.00	158	0.38
Floodplain and Side Channel Creation/ Enhancement	Rubber Tired Dozers	1	8.00	247	0.40
Floodplain and Side Channel Creation/ Enhancement	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Instream Habitat Structure Placement	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Site Restoration	Graders	1	10.00	187	0.41
Site Restoration	Off-Highway Trucks	3	10.00	150	0.38

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Mobilization	0	23.00	0.00	6.00	10.00	6.50	15.00	LD_Mix	HDT_Mix	HHDT
Spawning Gravel Replenishment	0	15.00	0.00	2,471.00	10.00	6.50	7.00	LD_Mix	HDT_Mix	HHDT
Floodplain and Side Channel Creation/ En	0	0.00	0.00	0.00	0.00	0.00	0.00	LD_Mix	HDT_Mix	HHDT
Instream Habitat Structure Placement	0	0.00	0.00	0.00	0.00	0.00	0.00	LD_Mix	HDT_Mix	HHDT
Site Restoration	0	8.00	0.00	6.00	10.00	6.50	19.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Mobilization - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Total					**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**			**0.0000**			**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	6.0800e-003	0.2149	0.0514	5.4000e-004	0.0112	8.5000e-004	0.0120	3.0600e-003	8.2000e-004	3.8800e-003		57.3168	57.3168	3.5500e-003		57.4056
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1078	0.0592	0.8304	1.8900e-003	0.1750	1.2500e-003	0.1762	0.0464	1.1500e-003	0.0476		188.2876	188.2876	5.9300e-003		188.4357
Total	**0.1139**	**0.2741**	**0.8818**	**2.4300e-003**	**0.1862**	**2.1000e-003**	**0.1883**	**0.0495**	**1.9700e-003**	**0.0514**		**245.6044**	**245.6044**	**9.4800e-003**		**245.8414**

3.2 Mobilization - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Total					**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**			**0.0000**			**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	6.0800e-003	0.2149	0.0514	5.4000e-004	0.0112	8.5000e-004	0.0120	3.0600e-003	8.2000e-004	3.8800e-003		57.3168	57.3168	3.5500e-003		57.4056
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1078	0.0592	0.8304	1.8900e-003	0.1750	1.2500e-003	0.1762	0.0464	1.1500e-003	0.0476		188.2876	188.2876	5.9300e-003		188.4357
Total	**0.1139**	**0.2741**	**0.8818**	**2.4300e-003**	**0.1862**	**2.1000e-003**	**0.1883**	**0.0495**	**1.9700e-003**	**0.0514**		**245.6044**	**245.6044**	**9.4800e-003**		**245.8414**

3.3 Spawning Gravel Replenishment - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					13.3081	0.0000	13.3081	3.4019	0.0000	3.4019			0.0000			0.0000
Off-Road	5.7356	57.6959	35.9616	0.0613		2.9087	2.9087		2.6817	2.6817		6,016.3081	6,016.3081	1.8525		6,062.6216
Total	**5.7356**	**57.6959**	**35.9616**	**0.0613**	**13.3081**	**2.9087**	**16.2168**	**3.4019**	**2.6817**	**6.0836**		**6,016.3081**	**6,016.3081**	**1.8525**		**6,062.6216**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.1981	7.6055	1.6712	0.0151	0.2693	0.0230	0.2924	0.0738	0.0220	0.0958		1,616.2086	1,616.2086	0.1242		1,619.3125
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0703	0.0386	0.5416	1.2300e-003	0.1141	8.1000e-004	0.1149	0.0303	7.5000e-004	0.0310		122.7963	122.7963	3.8600e-003		122.8929
Total	**0.2684**	**7.6441**	**2.2128**	**0.0164**	**0.3834**	**0.0238**	**0.4073**	**0.1040**	**0.0228**	**0.1268**		**1,739.0049**	**1,739.0049**	**0.1280**		**1,742.2053**

3.3 Spawning Gravel Replenishment - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					13.3081	0.0000	13.3081	3.4019	0.0000	3.4019			0.0000			0.0000
Off-Road	5.7356	57.6959	35.9616	0.0613		2.9087	2.9087		2.6817	2.6817	0.0000	6,016.308 1	6,016.308 1	1.8525		6,062.621 6
Total	**5.7356**	**57.6959**	**35.9616**	**0.0613**	**13.3081**	**2.9087**	**16.2168**	**3.4019**	**2.6817**	**6.0836**	**0.0000**	**6,016.308 1**	**6,016.308 1**	**1.8525**		**6,062.621 6**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.1981	7.6055	1.6712	0.0151	0.2693	0.0230	0.2924	0.0738	0.0220	0.0958		1,616.208 6	1,616.208 6	0.1242		1,619.312 5
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0703	0.0386	0.5416	1.2300e-003	0.1141	8.1000e-004	0.1149	0.0303	7.5000e-004	0.0310		122.7963	122.7963	3.8600e-003		122.8929
Total	**0.2684**	**7.6441**	**2.2128**	**0.0164**	**0.3834**	**0.0238**	**0.4073**	**0.1040**	**0.0228**	**0.1268**		**1,739.004 9**	**1,739.004 9**	**0.1280**		**1,742.205 3**

3.4 Floodplain and Side Channel Creation/ Enhancement - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					4.8086	0.0000	4.8086	1.2324	0.0000	1.2324			0.0000			0.0000
Off-Road	1.6281	17.0937	9.8500	0.0168		0.8741	0.8741		0.8042	0.8042		1,664.0959	1,664.0959	0.5265		1,677.2585
Total	**1.6281**	**17.0937**	**9.8500**	**0.0168**	**4.8086**	**0.8741**	**5.6827**	**1.2324**	**0.8042**	**2.0366**		**1,664.0959**	**1,664.0959**	**0.5265**		**1,677.2585**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.4 Floodplain and Side Channel Creation/ Enhancement - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					4.8086	0.0000	4.8086	1.2324	0.0000	1.2324			0.0000			0.0000
Off-Road	1.6281	17.0937	9.8500	0.0168		0.8741	0.8741		0.8042	0.8042	0.0000	1,664.0959	1,664.0959	0.5265		1,677.2585
Total	**1.6281**	**17.0937**	**9.8500**	**0.0168**	**4.8086**	**0.8741**	**5.6827**	**1.2324**	**0.8042**	**2.0366**	**0.0000**	**1,664.0959**	**1,664.0959**	**0.5265**		**1,677.2585**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.5 Instream Habitat Structure Placement - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Off-Road	0.2328	2.3374	2.3027	3.1100e-003		0.1560	0.1560		0.1436	0.1436		307.5419	307.5419	0.0973		309.9744
Total	**0.2328**	**2.3374**	**2.3027**	**3.1100e-003**	**0.0000**	**0.1560**	**0.1560**	**0.0000**	**0.1436**	**0.1436**		**307.5419**	**307.5419**	**0.0973**		**309.9744**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.5 Instream Habitat Structure Placement - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Off-Road	0.2328	2.3374	2.3027	3.1100e-003		0.1560	0.1560		0.1436	0.1436	0.0000	307.5419	307.5419	0.0973		309.9744
Total	**0.2328**	**2.3374**	**2.3027**	**3.1100e-003**	**0.0000**	**0.1560**	**0.1560**	**0.0000**	**0.1436**	**0.1436**	**0.0000**	**307.5419**	**307.5419**	**0.0973**		**309.9744**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.6 Site Restoration - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.8243	18.8731	14.8362	0.0266		0.8273	0.8273		0.7611	0.7611		2,632.954 1	2,632.954 1	0.8330		2,653.780 1
Total	**1.8243**	**18.8731**	**14.8362**	**0.0266**		**0.8273**	**0.8273**		**0.7611**	**0.7611**		**2,632.954 1**	**2,632.954 1**	**0.8330**		**2,653.780 1**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0168	0.5797	0.1420	1.5300e-003	0.0331	2.4600e-003	0.0355	9.0500e-003	2.3500e-003	0.0114		163.9810	163.9810	9.6200e-003		164.2214
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0375	0.0206	0.2889	6.6000e-004	0.0609	4.3000e-004	0.0613	0.0161	4.0000e-004	0.0165		65.4913	65.4913	2.0600e-003		65.5429
Total	**0.0543**	**0.6003**	**0.4309**	**2.1900e-003**	**0.0939**	**2.8900e-003**	**0.0968**	**0.0252**	**2.7500e-003**	**0.0279**		**229.4723**	**229.4723**	**0.0117**		**229.7643**

3.6 Site Restoration - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.8243	18.8731	14.8362	0.0266		0.8273	0.8273		0.7611	0.7611	0.0000	2,632.954 1	2,632.954 1	0.8330		2,653.780 1
Total	**1.8243**	**18.8731**	**14.8362**	**0.0266**		**0.8273**	**0.8273**		**0.7611**	**0.7611**	**0.0000**	**2,632.954 1**	**2,632.954 1**	**0.8330**		**2,653.780 1**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0168	0.5797	0.1420	1.5300e-003	0.0331	2.4600e-003	0.0355	9.0500e-003	2.3500e-003	0.0114		163.9810	163.9810	9.6200e-003		164.2214
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0375	0.0206	0.2889	6.6000e-004	0.0609	4.3000e-004	0.0613	0.0161	4.0000e-004	0.0165		65.4913	65.4913	2.0600e-003		65.5429
Total	**0.0543**	**0.6003**	**0.4309**	**2.1900e-003**	**0.0939**	**2.8900e-003**	**0.0968**	**0.0252**	**2.7500e-003**	**0.0279**		**229.4723**	**229.4723**	**0.0117**		**229.7643**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
User Defined Recreational	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
User Defined Recreational	10.00	5.00	6.50	0.00	0.00	0.00	0	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
User Defined Recreational	0.551662	0.040953	0.203778	0.123762	0.021802	0.005583	0.018466	0.022043	0.002076	0.002280	0.006004	0.000618	0.000971

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Lower American River Gravel Augmentation Project

Sacramento County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
User Defined Recreational	0.00	User Defined Unit	34.50	0.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	3.5	**Precipitation Freq (Days)**	58
Climate Zone	3			**Operational Year**	2020
Utility Company	Sacramento Municipal Utility District				
CO2 Intensity (lb/MWhr)	590.31	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Assuming worse case scenario for 3 restoration activites occuring at the same time

Construction Phase - Assuming the project will only occur from July to September.

Off-road Equipment - From Construction Equipment Table in Project Description

Off-road Equipment - From Construction Equipment Table in Project Description

Off-road Equipment -

Off-road Equipment -

Off-road Equipment - From Construction Equipment Table in Project Description

Off-road Equipment - From Construction Equipment Table in Project Description

Trips and VMT - trip distance is 12 miles for import and 15-20 miles for mobilization and site restoration

Grading - Acres disturbed for borrow site, stockpiles near river, and excavated gravel

Vehicle Emission Factors -

Vehicle Emission Factors -

Vehicle Emission Factors -

Fleet Mix -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	740.00	3.00
tblConstructionPhase	NumDays	75.00	56.00
tblConstructionPhase	NumDays	75.00	56.00
tblConstructionPhase	NumDays	75.00	56.00
tblConstructionPhase	NumDays	30.00	7.00
tblLandUse	LotAcreage	0.00	34.50
tblOffRoadEquipment	HorsePower	402.00	150.00
tblOffRoadEquipment	HorsePower	402.00	150.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	2.00
tblOffRoadEquipment	PhaseName		Spawning Gravel Replenishment
tblOffRoadEquipment	PhaseName		Site Restoration
tblOffRoadEquipment	PhaseName		Spawning Gravel Replenishment
tblOffRoadEquipment	PhaseName		Site Restoration
tblOffRoadEquipment	PhaseName		Spawning Gravel Replenishment

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2019	0.2232	2.4073	1.4347	2.7700e-003	0.5184	0.1122	0.6307	0.1328	0.1034	0.2362	0.0000	250.7759	250.7759	0.0674	0.0000	252.4616
Maximum	**0.2232**	**2.4073**	**1.4347**	**2.7700e-003**	**0.5184**	**0.1122**	**0.6307**	**0.1328**	**0.1034**	**0.2362**	**0.0000**	**250.7759**	**250.7759**	**0.0674**	**0.0000**	**252.4616**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2019	0.2232	2.4073	1.4347	2.7700e-003	0.5184	0.1122	0.6307	0.1328	0.1034	0.2362	0.0000	250.7757	250.7757	0.0674	0.0000	252.4614
Maximum	**0.2232**	**2.4073**	**1.4347**	**2.7700e-003**	**0.5184**	**0.1122**	**0.6307**	**0.1328**	**0.1034**	**0.2362**	**0.0000**	**250.7757**	**250.7757**	**0.0674**	**0.0000**	**252.4614**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
1	7-1-2019	9-30-2019	2.6199	2.6199
		Highest	2.6199	2.6199

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Mobilization	Site Preparation	7/1/2019	7/9/2019	5	7	
2	Spawning Gravel Replenishment	Grading	7/10/2019	9/25/2019	5	56	
3	Floodplain and Side Channel Creation/ Enhancement	Grading	7/10/2019	9/25/2019	5	56	
4	Instream Habitat Structure Placement	Grading	7/10/2019	9/25/2019	5	56	
5	Site Restoration	Building Construction	9/26/2019	9/30/2019	5	3	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Spawning Gravel Replenishment	Dumpers/Tenders	4	8.00	16	0.38
Spawning Gravel Replenishment	Excavators	1	8.00	158	0.38
Spawning Gravel Replenishment	Off-Highway Trucks	2	8.00	150	0.38
Spawning Gravel Replenishment	Other Material Handling Equipment	2	8.00	168	0.40
Spawning Gravel Replenishment	Rubber Tired Dozers	3	8.00	247	0.40
Spawning Gravel Replenishment	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Floodplain and Side Channel Creation/ Enhancement	Excavators	1	8.00	158	0.38
Floodplain and Side Channel Creation/ Enhancement	Rubber Tired Dozers	1	8.00	247	0.40
Floodplain and Side Channel Creation/ Enhancement	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Instream Habitat Structure Placement	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Site Restoration	Graders	1	10.00	187	0.41
Site Restoration	Off-Highway Trucks	3	10.00	150	0.38

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Mobilization	0	23.00	0.00	6.00	10.00	6.50	15.00	LD_Mix	HDT_Mix	HHDT
Spawning Gravel Replenishment	0	15.00	0.00	2,471.00	10.00	6.50	7.00	LD_Mix	HDT_Mix	HHDT
Floodplain and Side Channel Creation/ En	0	0.00	0.00	0.00	0.00	0.00	0.00	LD_Mix	HDT_Mix	HHDT
Instream Habitat Structure Placement	0	0.00	0.00	0.00	0.00	0.00	0.00	LD_Mix	HDT_Mix	HHDT
Site Restoration	0	8.00	0.00	6.00	10.00	6.50	19.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Mobilization - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total					**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.0000e-005	7.8000e-004	1.8000e-004	0.0000	4.0000e-005	0.0000	4.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.1805	0.1805	1.0000e-005	0.0000	0.1808
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.3000e-004	2.3000e-004	2.4700e-003	1.0000e-005	5.9000e-004	0.0000	6.0000e-004	1.6000e-004	0.0000	1.6000e-004	0.0000	0.5405	0.5405	2.0000e-005	0.0000	0.5409
Total	**3.5000e-004**	**1.0100e-003**	**2.6500e-003**	**1.0000e-005**	**6.3000e-004**	**0.0000**	**6.4000e-004**	**1.7000e-004**	**0.0000**	**1.7000e-004**	**0.0000**	**0.7210**	**0.7210**	**3.0000e-005**	**0.0000**	**0.7217**

3.2 Mobilization - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total					**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.0000e-005	7.8000e-004	1.8000e-004	0.0000	4.0000e-005	0.0000	4.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.1805	0.1805	1.0000e-005	0.0000	0.1808
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.3000e-004	2.3000e-004	2.4700e-003	1.0000e-005	5.9000e-004	0.0000	6.0000e-004	1.6000e-004	0.0000	1.6000e-004	0.0000	0.5405	0.5405	2.0000e-005	0.0000	0.5409
Total	**3.5000e-004**	**1.0100e-003**	**2.6500e-003**	**1.0000e-005**	**6.3000e-004**	**0.0000**	**6.4000e-004**	**1.7000e-004**	**0.0000**	**1.7000e-004**	**0.0000**	**0.7210**	**0.7210**	**3.0000e-005**	**0.0000**	**0.7217**

3.3 Spawning Gravel Replenishment - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.3726	0.0000	0.3726	0.0953	0.0000	0.0953	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1606	1.6155	1.0069	1.7200e-003		0.0814	0.0814		0.0751	0.0751	0.0000	152.8213	152.8213	0.0471	0.0000	153.9977
Total	**0.1606**	**1.6155**	**1.0069**	**1.7200e-003**	**0.3726**	**0.0814**	**0.4541**	**0.0953**	**0.0751**	**0.1703**	**0.0000**	**152.8213**	**152.8213**	**0.0471**	**0.0000**	**153.9977**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	5.6800e-003	0.2164	0.0491	4.2000e-004	7.3100e-003	6.7000e-004	7.9800e-003	2.0100e-003	6.4000e-004	2.6500e-003	0.0000	40.4469	40.4469	3.2600e-003	0.0000	40.5284
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.7000e-003	1.1900e-003	0.0129	3.0000e-005	3.0800e-003	2.0000e-005	3.1100e-003	8.2000e-004	2.0000e-005	8.4000e-004	0.0000	2.8198	2.8198	9.0000e-005	0.0000	2.8220
Total	**7.3800e-003**	**0.2175**	**0.0620**	**4.5000e-004**	**0.0104**	**6.9000e-004**	**0.0111**	**2.8300e-003**	**6.6000e-004**	**3.4900e-003**	**0.0000**	**43.2667**	**43.2667**	**3.3500e-003**	**0.0000**	**43.3503**

3.3 Spawning Gravel Replenishment - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.3726	0.0000	0.3726	0.0953	0.0000	0.0953	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1606	1.6155	1.0069	1.7200e-003		0.0814	0.0814		0.0751	0.0751	0.0000	152.8211	152.8211	0.0471	0.0000	153.9975
Total	**0.1606**	**1.6155**	**1.0069**	**1.7200e-003**	**0.3726**	**0.0814**	**0.4541**	**0.0953**	**0.0751**	**0.1703**	**0.0000**	**152.8211**	**152.8211**	**0.0471**	**0.0000**	**153.9975**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	5.6800e-003	0.2164	0.0491	4.2000e-004	7.3100e-003	6.7000e-004	7.9800e-003	2.0100e-003	6.4000e-004	2.6500e-003	0.0000	40.4469	40.4469	3.2600e-003	0.0000	40.5284
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.7000e-003	1.1900e-003	0.0129	3.0000e-005	3.0800e-003	2.0000e-005	3.1100e-003	8.2000e-004	2.0000e-005	8.4000e-004	0.0000	2.8198	2.8198	9.0000e-005	0.0000	2.8220
Total	**7.3800e-003**	**0.2175**	**0.0620**	**4.5000e-004**	**0.0104**	**6.9000e-004**	**0.0111**	**2.8300e-003**	**6.6000e-004**	**3.4900e-003**	**0.0000**	**43.2667**	**43.2667**	**3.3500e-003**	**0.0000**	**43.3503**

3.4 Floodplain and Side Channel Creation/ Enhancement - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1346	0.0000	0.1346	0.0345	0.0000	0.0345	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0456	0.4786	0.2758	4.7000e-004		0.0245	0.0245		0.0225	0.0225	0.0000	42.2700	42.2700	0.0134	0.0000	42.6043
Total	**0.0456**	**0.4786**	**0.2758**	**4.7000e-004**	**0.1346**	**0.0245**	**0.1591**	**0.0345**	**0.0225**	**0.0570**	**0.0000**	**42.2700**	**42.2700**	**0.0134**	**0.0000**	**42.6043**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Floodplain and Side Channel Creation/ Enhancement - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1346	0.0000	0.1346	0.0345	0.0000	0.0345	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0456	0.4786	0.2758	4.7000e-004		0.0245	0.0245		0.0225	0.0225	0.0000	42.2699	42.2699	0.0134	0.0000	42.6043
Total	**0.0456**	**0.4786**	**0.2758**	**4.7000e-004**	**0.1346**	**0.0245**	**0.1591**	**0.0345**	**0.0225**	**0.0570**	**0.0000**	**42.2699**	**42.2699**	**0.0134**	**0.0000**	**42.6043**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Instream Habitat Structure Placement - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	6.5200e-003	0.0655	0.0645	9.0000e-005		4.3700e-003	4.3700e-003		4.0200e-003	4.0200e-003	0.0000	7.8119	7.8119	2.4700e-003	0.0000	7.8737
Total	**6.5200e-003**	**0.0655**	**0.0645**	**9.0000e-005**	**0.0000**	**4.3700e-003**	**4.3700e-003**	**0.0000**	**4.0200e-003**	**4.0200e-003**	**0.0000**	**7.8119**	**7.8119**	**2.4700e-003**	**0.0000**	**7.8737**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Instream Habitat Structure Placement - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	6.5200e-003	0.0655	0.0645	9.0000e-005		4.3700e-003	4.3700e-003		4.0200e-003	4.0200e-003	0.0000	7.8119	7.8119	2.4700e-003	0.0000	7.8737
Total	**6.5200e-003**	**0.0655**	**0.0645**	**9.0000e-005**	**0.0000**	**4.3700e-003**	**4.3700e-003**	**0.0000**	**4.0200e-003**	**4.0200e-003**	**0.0000**	**7.8119**	**7.8119**	**2.4700e-003**	**0.0000**	**7.8737**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Site Restoration - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	2.7400e-003	0.0283	0.0223	4.0000e-005		1.2400e-003	1.2400e-003		1.1400e-003	1.1400e-003	0.0000	3.5829	3.5829	1.1300e-003	0.0000	3.6112
Total	**2.7400e-003**	**0.0283**	**0.0223**	**4.0000e-005**		**1.2400e-003**	**1.2400e-003**		**1.1400e-003**	**1.1400e-003**	**0.0000**	**3.5829**	**3.5829**	**1.1300e-003**	**0.0000**	**3.6112**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	3.0000e-005	9.0000e-004	2.2000e-004	0.0000	5.0000e-005	0.0000	5.0000e-005	1.0000e-005	0.0000	2.0000e-005	0.0000	0.2217	0.2217	1.0000e-005	0.0000	0.2220
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.0000e-005	3.0000e-005	3.7000e-004	0.0000	9.0000e-005	0.0000	9.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0806	0.0806	0.0000	0.0000	0.0806
Total	**8.0000e-005**	**9.3000e-004**	**5.9000e-004**	**0.0000**	**1.4000e-004**	**0.0000**	**1.4000e-004**	**3.0000e-005**	**0.0000**	**4.0000e-005**	**0.0000**	**0.3022**	**0.3022**	**1.0000e-005**	**0.0000**	**0.3026**

3.6 Site Restoration - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	2.7400e-003	0.0283	0.0223	4.0000e-005		1.2400e-003	1.2400e-003		1.1400e-003	1.1400e-003	0.0000	3.5829	3.5829	1.1300e-003	0.0000	3.6112
Total	**2.7400e-003**	**0.0283**	**0.0223**	**4.0000e-005**		**1.2400e-003**	**1.2400e-003**		**1.1400e-003**	**1.1400e-003**	**0.0000**	**3.5829**	**3.5829**	**1.1300e-003**	**0.0000**	**3.6112**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	3.0000e-005	9.0000e-004	2.2000e-004	0.0000	5.0000e-005	0.0000	5.0000e-005	1.0000e-005	0.0000	2.0000e-005	0.0000	0.2217	0.2217	1.0000e-005	0.0000	0.2220
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.0000e-005	3.0000e-005	3.7000e-004	0.0000	9.0000e-005	0.0000	9.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0806	0.0806	0.0000	0.0000	0.0806
Total	**8.0000e-005**	**9.3000e-004**	**5.9000e-004**	**0.0000**	**1.4000e-004**	**0.0000**	**1.4000e-004**	**3.0000e-005**	**0.0000**	**4.0000e-005**	**0.0000**	**0.3022**	**0.3022**	**1.0000e-005**	**0.0000**	**0.3026**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
User Defined Recreational	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
User Defined Recreational	10.00	5.00	6.50	0.00	0.00	0.00	0	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
User Defined Recreational	0.551662	0.040953	0.203778	0.123762	0.021802	0.005583	0.018466	0.022043	0.002076	0.002280	0.006004	0.000618	0.000971

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
User Defined Recreational	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
User Defined Recreational	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Lower American River Gravel Augmentation Project

Sacramento County, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
User Defined Recreational	0.00	User Defined Unit	34.50	0.00	0

1.2 Other Project Characteristics

Urbanization Urban **Wind Speed (m/s)** 3.5 **Precipitation Freq (Days)** 58

Climate Zone 3 **Operational Year** 2025

Utility Company Sacramento Municipal Utility District

CO2 Intensity (lb/MWhr) 590.31 **CH4 Intensity (lb/MWhr)** 0.029 **N2O Intensity (lb/MWhr)** 0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Assuming worse case scenario for 3 restoration activites occuring at the same time

Construction Phase - Assuming the project will only occur from July to September.

Off-road Equipment - From Construction Equipment Table in Project Description

Off-road Equipment - From Construction Equipment Table in Project Description

Off-road Equipment -

Off-road Equipment -

Off-road Equipment - From Construction Equipment Table in Project Description

Off-road Equipment - From Construction Equipment Table in Project Description

Trips and VMT - trip distance is 12 miles for import and 15-20 miles for mobilization and site restoration

Grading - Acres disturbed for borrow site, stockpiles near river, and excavated gravel

Vehicle Emission Factors -

Vehicle Emission Factors -

Vehicle Emission Factors -

Fleet Mix -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	30.00	7.00
tblConstructionPhase	NumDays	75.00	56.00
tblConstructionPhase	NumDays	75.00	56.00
tblConstructionPhase	NumDays	75.00	56.00
tblConstructionPhase	NumDays	740.00	3.00
tblLandUse	LotAcreage	0.00	34.50
tblOffRoadEquipment	HorsePower	402.00	150.00
tblOffRoadEquipment	HorsePower	402.00	150.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	2.00
tblOffRoadEquipment	PhaseName		Spawning Gravel Replenishment
tblOffRoadEquipment	PhaseName		Spawning Gravel Replenishment
tblOffRoadEquipment	PhaseName		Spawning Gravel Replenishment
tblOffRoadEquipment	PhaseName		Site Restoration
tblOffRoadEquipment	PhaseName		Site Restoration

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2024	5.1124	51.0229	44.6022	0.0965	18.4998	2.1149	20.6147	4.7382	1.9515	6.6896	0.0000	9,447.9018	9,447.9018	2.5828	0.0000	9,512.4725
Maximum	**5.1124**	**51.0229**	**44.6022**	**0.0965**	**18.4998**	**2.1149**	**20.6147**	**4.7382**	**1.9515**	**6.6896**	**0.0000**	**9,447.9018**	**9,447.9018**	**2.5828**	**0.0000**	**9,512.4725**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2024	5.1124	51.0229	44.6022	0.0965	18.4998	2.1149	20.6147	4.7382	1.9515	6.6896	0.0000	9,447.9018	9,447.9018	2.5828	0.0000	9,512.4725
Maximum	**5.1124**	**51.0229**	**44.6022**	**0.0965**	**18.4998**	**2.1149**	**20.6147**	**4.7382**	**1.9515**	**6.6896**	**0.0000**	**9,447.9018**	**9,447.9018**	**2.5828**	**0.0000**	**9,512.4725**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Mobilization	Site Preparation	7/1/2024	7/9/2024	5	7	
2	Spawning Gravel Replenishment	Grading	7/10/2024	9/25/2024	5	56	
3	Floodplain and Side Channel Creation/ Enhancement	Grading	7/10/2024	9/25/2024	5	56	
4	Instream Habitat Structure Placement	Grading	7/10/2024	9/25/2024	5	56	
5	Site Restoration	Building Construction	9/26/2024	9/30/2024	5	3	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Spawning Gravel Replenishment	Dumpers/Tenders	4	8.00	16	0.38
Spawning Gravel Replenishment	Excavators	1	8.00	158	0.38
Spawning Gravel Replenishment	Off-Highway Trucks	2	8.00	150	0.38
Spawning Gravel Replenishment	Other Material Handling Equipment	2	8.00	168	0.40
Spawning Gravel Replenishment	Rubber Tired Dozers	3	8.00	247	0.40
Spawning Gravel Replenishment	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Floodplain and Side Channel Creation/ Enhancement	Excavators	1	8.00	158	0.38
Floodplain and Side Channel Creation/ Enhancement	Rubber Tired Dozers	1	8.00	247	0.40
Floodplain and Side Channel Creation/ Enhancement	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Instream Habitat Structure Placement	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Site Restoration	Graders	1	10.00	187	0.41
Site Restoration	Off-Highway Trucks	3	10.00	150	0.38

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Mobilization	0	23.00	0.00	6.00	10.00	6.50	15.00	LD_Mix	HDT_Mix	HHDT
Spawning Gravel Replenishment	0	15.00	0.00	2,471.00	10.00	6.50	7.00	LD_Mix	HDT_Mix	HHDT
Floodplain and Side Channel Creation/ En	0	0.00	0.00	0.00	0.00	0.00	0.00	LD_Mix	HDT_Mix	HHDT
Instream Habitat Structure Placement	0	0.00	0.00	0.00	0.00	0.00	0.00	LD_Mix	HDT_Mix	HHDT
Site Restoration	0	8.00	0.00	6.00	10.00	6.50	19.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Mobilization - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Total					**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**			**0.0000**			**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	3.4100e-003	0.1310	0.0340	5.0000e-004	0.0112	2.6000e-004	0.0114	3.0600e-003	2.5000e-004	3.3100e-003		53.7588	53.7588	3.0500e-003		53.8349
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0755	0.0345	0.5411	1.5800e-003	0.1750	1.1000e-003	0.1761	0.0464	1.0100e-003	0.0474		157.2108	157.2108	3.4100e-003		157.2960
Total	**0.0789**	**0.1655**	**0.5751**	**2.0800e-003**	**0.1861**	**1.3600e-003**	**0.1875**	**0.0495**	**1.2600e-003**	**0.0507**		**210.9695**	**210.9695**	**6.4600e-003**		**211.1309**

3.2 Mobilization - 2024

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Total					**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**			**0.0000**			**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	3.4100e-003	0.1310	0.0340	5.0000e-004	0.0112	2.6000e-004	0.0114	3.0600e-003	2.5000e-004	3.3100e-003		53.7588	53.7588	3.0500e-003		53.8349
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0755	0.0345	0.5411	1.5800e-003	0.1750	1.1000e-003	0.1761	0.0464	1.0100e-003	0.0474		157.2108	157.2108	3.4100e-003		157.2960
Total	**0.0789**	**0.1655**	**0.5751**	**2.0800e-003**	**0.1861**	**1.3600e-003**	**0.1875**	**0.0495**	**1.2600e-003**	**0.0507**		**210.9695**	**210.9695**	**6.4600e-003**		**211.1309**

3.3 Spawning Gravel Replenishment - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					13.3081	0.0000	13.3081	3.4019	0.0000	3.4019			0.0000			0.0000
Off-Road	3.7910	34.4293	32.3586	0.0613		1.5837	1.5837		1.4625	1.4625		5,893.376 4	5,893.376 4	1.8534		5,939.710 6
Total	**3.7910**	**34.4293**	**32.3586**	**0.0613**	**13.3081**	**1.5837**	**14.8918**	**3.4019**	**1.4625**	**4.8644**		**5,893.376 4**	**5,893.376 4**	**1.8534**		**5,939.710 6**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.1090	5.1441	1.0234	0.0142	0.2690	7.2500e-003	0.2763	0.0737	6.9400e-003	0.0806		1,521.216 8	1,521.216 8	0.1028		1,523.786 5
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0493	0.0225	0.3529	1.0300e-003	0.1141	7.2000e-004	0.1148	0.0303	6.6000e-004	0.0309		102.5288	102.5288	2.2200e-003		102.5844
Total	**0.1582**	**5.1666**	**1.3762**	**0.0152**	**0.3831**	**7.9700e-003**	**0.3911**	**0.1039**	**7.6000e-003**	**0.1115**		**1,623.745 6**	**1,623.745 6**	**0.1050**		**1,626.370 8**

3.3 Spawning Gravel Replenishment - 2024

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					13.3081	0.0000	13.3081	3.4019	0.0000	3.4019			0.0000			0.0000
Off-Road	3.7910	34.4293	32.3586	0.0613		1.5837	1.5837		1.4625	1.4625	0.0000	5,893.3764	5,893.3764	1.8534		5,939.7106
Total	**3.7910**	**34.4293**	**32.3586**	**0.0613**	**13.3081**	**1.5837**	**14.8918**	**3.4019**	**1.4625**	**4.8644**	**0.0000**	**5,893.3764**	**5,893.3764**	**1.8534**		**5,939.7106**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.1090	5.1441	1.0234	0.0142	0.2690	7.2500e-003	0.2763	0.0737	6.9400e-003	0.0806		1,521.2168	1,521.2168	0.1028		1,523.7865
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0493	0.0225	0.3529	1.0300e-003	0.1141	7.2000e-004	0.1148	0.0303	6.6000e-004	0.0309		102.5288	102.5288	2.2200e-003		102.5844
Total	**0.1582**	**5.1666**	**1.3762**	**0.0152**	**0.3831**	**7.9700e-003**	**0.3911**	**0.1039**	**7.6000e-003**	**0.1115**		**1,623.7456**	**1,623.7456**	**0.1050**		**1,626.3708**

3.4 Floodplain and Side Channel Creation/ Enhancement - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					4.8086	0.0000	4.8086	1.2324	0.0000	1.2324			0.0000			0.0000
Off-Road	1.0192	9.9788	8.6317	0.0168		0.4567	0.4567		0.4202	0.4202		1,629.0131	1,629.0131	0.5269		1,642.1845
Total	**1.0192**	**9.9788**	**8.6317**	**0.0168**	**4.8086**	**0.4567**	**5.2653**	**1.2324**	**0.4202**	**1.6526**		**1,629.0131**	**1,629.0131**	**0.5269**		**1,642.1845**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.4 Floodplain and Side Channel Creation/ Enhancement - 2024

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category					lb/day								lb/day			
Fugitive Dust					4.8086	0.0000	4.8086	1.2324	0.0000	1.2324			0.0000			0.0000
Off-Road	1.0192	9.9788	8.6317	0.0168		0.4567	0.4567		0.4202	0.4202	0.0000	1,629.0131	1,629.0131	0.5269		1,642.1845
Total	**1.0192**	**9.9788**	**8.6317**	**0.0168**	**4.8086**	**0.4567**	**5.2653**	**1.2324**	**0.4202**	**1.6526**	**0.0000**	**1,629.0131**	**1,629.0131**	**0.5269**		**1,642.1845**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category					lb/day								lb/day			
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.5 Instream Habitat Structure Placement - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Off-Road	0.1439	1.4483	2.2356	3.1200e-003		0.0665	0.0665		0.0612	0.0612		301.7667	301.7667	0.0976		304.2067
Total	**0.1439**	**1.4483**	**2.2356**	**3.1200e-003**	**0.0000**	**0.0665**	**0.0665**	**0.0000**	**0.0612**	**0.0612**		**301.7667**	**301.7667**	**0.0976**		**304.2067**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.5 Instream Habitat Structure Placement - 2024

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category						lb/day							lb/day			
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Off-Road	0.1439	1.4483	2.2356	3.1200e-003		0.0665	0.0665		0.0612	0.0612	0.0000	301.7667	301.7667	0.0976		304.2067
Total	**0.1439**	**1.4483**	**2.2356**	**3.1200e-003**	**0.0000**	**0.0665**	**0.0665**	**0.0000**	**0.0612**	**0.0612**	**0.0000**	**301.7667**	**301.7667**	**0.0976**		**304.2067**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category						lb/day							lb/day			
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.6 Site Restoration - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.2872	10.8282	14.6048	0.0266		0.4322	0.4322		0.3976	0.3976		2,573.4840	2,573.4840	0.8323		2,594.2920
Total	**1.2872**	**10.8282**	**14.6048**	**0.0266**		**0.4322**	**0.4322**		**0.3976**	**0.3976**		**2,573.4840**	**2,573.4840**	**0.8323**		**2,594.2920**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	9.4700e-003	0.3419	0.0959	1.4300e-003	0.0330	7.5000e-004	0.0338	9.0400e-003	7.2000e-004	9.7500e-003		153.6805	153.6805	8.3300e-003		153.8889
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0263	0.0120	0.1882	5.5000e-004	0.0609	3.8000e-004	0.0612	0.0161	3.5000e-004	0.0165		54.6820	54.6820	1.1900e-003		54.7117
Total	**0.0357**	**0.3539**	**0.2841**	**1.9800e-003**	**0.0939**	**1.1300e-003**	**0.0950**	**0.0252**	**1.0700e-003**	**0.0262**		**208.3625**	**208.3625**	**9.5200e-003**		**208.6005**

3.6 Site Restoration - 2024

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.2872	10.8282	14.6048	0.0266		0.4322	0.4322		0.3976	0.3976	0.0000	2,573.484 0	2,573.484 0	0.8323		2,594.292 0
Total	**1.2872**	**10.8282**	**14.6048**	**0.0266**		**0.4322**	**0.4322**		**0.3976**	**0.3976**	**0.0000**	**2,573.484 0**	**2,573.484 0**	**0.8323**		**2,594.292 0**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	9.4700e-003	0.3419	0.0959	1.4300e-003	0.0330	7.5000e-004	0.0338	9.0400e-003	7.2000e-004	9.7500e-003		153.6805	153.6805	8.3300e-003		153.8889
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0263	0.0120	0.1882	5.5000e-004	0.0609	3.8000e-004	0.0612	0.0161	3.5000e-004	0.0165		54.6820	54.6820	1.1900e-003		54.7117
Total	**0.0357**	**0.3539**	**0.2841**	**1.9800e-003**	**0.0939**	**1.1300e-003**	**0.0950**	**0.0252**	**1.0700e-003**	**0.0262**		**208.3625**	**208.3625**	**9.5200e-003**		**208.6005**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
User Defined Recreational	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
User Defined Recreational	10.00	5.00	6.50	0.00	0.00	0.00	0	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
User Defined Recreational	0.568817	0.036545	0.209097	0.111572	0.015710	0.004830	0.018344	0.024276	0.001951	0.001803	0.005698	0.000617	0.000741

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Lower American River Gravel Augmentation Project

Sacramento County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
User Defined Recreational	0.00	User Defined Unit	34.50	0.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	3.5	**Precipitation Freq (Days)**	58
Climate Zone	3			**Operational Year**	2025
Utility Company	Sacramento Municipal Utility District				
CO2 Intensity (lb/MWhr)	590.31	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Assuming worse case scenario for 3 restoration activites occuring at the same time

Construction Phase - Assuming the project will only occur from July to September.

Off-road Equipment - From Construction Equipment Table in Project Description

Off-road Equipment - From Construction Equipment Table in Project Description

Off-road Equipment -

Off-road Equipment -

Off-road Equipment - From Construction Equipment Table in Project Description

Off-road Equipment - From Construction Equipment Table in Project Description

Trips and VMT - trip distance is 12 miles for import and 15-20 miles for mobilization and site restoration

Grading - Acres disturbed for borrow site, stockpiles near river, and excavated gravel

Vehicle Emission Factors -

Vehicle Emission Factors -

Vehicle Emission Factors -

Fleet Mix -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	30.00	7.00
tblConstructionPhase	NumDays	75.00	56.00
tblConstructionPhase	NumDays	75.00	56.00
tblConstructionPhase	NumDays	75.00	56.00
tblConstructionPhase	NumDays	740.00	3.00
tblLandUse	LotAcreage	0.00	34.50
tblOffRoadEquipment	HorsePower	402.00	150.00
tblOffRoadEquipment	HorsePower	402.00	150.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	2.00
tblOffRoadEquipment	PhaseName		Spawning Gravel Replenishment
tblOffRoadEquipment	PhaseName		Spawning Gravel Replenishment
tblOffRoadEquipment	PhaseName		Spawning Gravel Replenishment
tblOffRoadEquipment	PhaseName		Site Restoration
tblOffRoadEquipment	PhaseName		Site Restoration

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2024	0.1453	1.4472	1.2731	2.7400e-003	0.5184	0.0599	0.5783	0.1328	0.0553	0.1880	0.0000	243.5453	243.5453	0.0669	0.0000	245.2166
Maximum	**0.1453**	**1.4472**	**1.2731**	**2.7400e-003**	**0.5184**	**0.0599**	**0.5783**	**0.1328**	**0.0553**	**0.1880**	**0.0000**	**243.5453**	**243.5453**	**0.0669**	**0.0000**	**245.2166**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2024	0.1453	1.4472	1.2731	2.7400e-003	0.5184	0.0599	0.5783	0.1328	0.0553	0.1880	0.0000	243.5451	243.5451	0.0669	0.0000	245.2163
Maximum	**0.1453**	**1.4472**	**1.2731**	**2.7400e-003**	**0.5184**	**0.0599**	**0.5783**	**0.1328**	**0.0553**	**0.1880**	**0.0000**	**243.5451**	**243.5451**	**0.0669**	**0.0000**	**245.2163**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
1	**7-1-2024**	**9-30-2024**	1.5869	1.5869
		Highest	1.5869	1.5869

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Mobilization	Site Preparation	7/1/2024	7/9/2024	5	7	
2	Spawning Gravel Replenishment	Grading	7/10/2024	9/25/2024	5	56	
3	Floodplain and Side Channel Creation/ Enhancement	Grading	7/10/2024	9/25/2024	5	56	
4	Instream Habitat Structure Placement	Grading	7/10/2024	9/25/2024	5	56	
5	Site Restoration	Building Construction	9/26/2024	9/30/2024	5	3	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Spawning Gravel Replenishment	Dumpers/Tenders	4	8.00	16	0.38
Spawning Gravel Replenishment	Excavators	1	8.00	158	0.38
Spawning Gravel Replenishment	Off-Highway Trucks	2	8.00	150	0.38
Spawning Gravel Replenishment	Other Material Handling Equipment	2	8.00	168	0.40
Spawning Gravel Replenishment	Rubber Tired Dozers	3	8.00	247	0.40
Spawning Gravel Replenishment	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Floodplain and Side Channel Creation/ Enhancement	Excavators	1	8.00	158	0.38
Floodplain and Side Channel Creation/ Enhancement	Rubber Tired Dozers	1	8.00	247	0.40
Floodplain and Side Channel Creation/ Enhancement	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Instream Habitat Structure Placement	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Site Restoration	Graders	1	10.00	187	0.41
Site Restoration	Off-Highway Trucks	3	10.00	150	0.38

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Mobilization	0	23.00	0.00	6.00	10.00	6.50	15.00	LD_Mix	HDT_Mix	HHDT
Spawning Gravel Replenishment	0	15.00	0.00	2,471.00	10.00	6.50	7.00	LD_Mix	HDT_Mix	HHDT
Floodplain and Side Channel Creation/ En	0	0.00	0.00	0.00	0.00	0.00	0.00	LD_Mix	HDT_Mix	HHDT
Instream Habitat Structure Placement	0	0.00	0.00	0.00	0.00	0.00	0.00	LD_Mix	HDT_Mix	HHDT
Site Restoration	0	8.00	0.00	6.00	10.00	6.50	19.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Mobilization - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total					**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-005	4.7000e-004	1.2000e-004	0.0000	4.0000e-005	0.0000	4.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.1693	0.1693	1.0000e-005	0.0000	0.1695
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.3000e-004	1.3000e-004	1.5900e-003	0.0000	5.9000e-004	0.0000	6.0000e-004	1.6000e-004	0.0000	1.6000e-004	0.0000	0.4513	0.4513	1.0000e-005	0.0000	0.4516
Total	**2.4000e-004**	**6.0000e-004**	**1.7100e-003**	**0.0000**	**6.3000e-004**	**0.0000**	**6.4000e-004**	**1.7000e-004**	**0.0000**	**1.7000e-004**	**0.0000**	**0.6206**	**0.6206**	**2.0000e-005**	**0.0000**	**0.6211**

3.2 Mobilization - 2024

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total					**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-005	4.7000e-004	1.2000e-004	0.0000	4.0000e-005	0.0000	4.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.1693	0.1693	1.0000e-005	0.0000	0.1695
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.3000e-004	1.3000e-004	1.5900e-003	0.0000	5.9000e-004	0.0000	6.0000e-004	1.6000e-004	0.0000	1.6000e-004	0.0000	0.4513	0.4513	1.0000e-005	0.0000	0.4516
Total	**2.4000e-004**	**6.0000e-004**	**1.7100e-003**	**0.0000**	**6.3000e-004**	**0.0000**	**6.4000e-004**	**1.7000e-004**	**0.0000**	**1.7000e-004**	**0.0000**	**0.6206**	**0.6206**	**2.0000e-005**	**0.0000**	**0.6211**

3.3 Spawning Gravel Replenishment - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.3726	0.0000	0.3726	0.0953	0.0000	0.0953	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1062	0.9640	0.9060	1.7200e-003		0.0443	0.0443		0.0410	0.0410	0.0000	149.6987	149.6987	0.0471	0.0000	150.8756
Total	**0.1062**	**0.9640**	**0.9060**	**1.7200e-003**	**0.3726**	**0.0443**	**0.4170**	**0.0953**	**0.0410**	**0.1362**	**0.0000**	**149.6987**	**149.6987**	**0.0471**	**0.0000**	**150.8756**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	3.1300e-003	0.1451	0.0304	3.9000e-004	7.3100e-003	2.1000e-004	7.5200e-003	2.0100e-003	2.0000e-004	2.2100e-003	0.0000	38.0504	38.0504	2.7000e-003	0.0000	38.1178
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.2000e-003	6.9000e-004	8.3100e-003	3.0000e-005	3.0800e-003	2.0000e-005	3.1000e-003	8.2000e-004	2.0000e-005	8.4000e-004	0.0000	2.3547	2.3547	5.0000e-005	0.0000	2.3559
Total	**4.3300e-003**	**0.1458**	**0.0387**	**4.2000e-004**	**0.0104**	**2.3000e-004**	**0.0106**	**2.8300e-003**	**2.2000e-004**	**3.0500e-003**	**0.0000**	**40.4051**	**40.4051**	**2.7500e-003**	**0.0000**	**40.4737**

3.3 Spawning Gravel Replenishment - 2024

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.3726	0.0000	0.3726	0.0953	0.0000	0.0953	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1062	0.9640	0.9060	1.7200e-003		0.0443	0.0443		0.0410	0.0410	0.0000	149.6985	149.6985	0.0471	0.0000	150.8754
Total	**0.1062**	**0.9640**	**0.9060**	**1.7200e-003**	**0.3726**	**0.0443**	**0.4170**	**0.0953**	**0.0410**	**0.1362**	**0.0000**	**149.6985**	**149.6985**	**0.0471**	**0.0000**	**150.8754**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	3.1300e-003	0.1451	0.0304	3.9000e-004	7.3100e-003	2.1000e-004	7.5200e-003	2.0100e-003	2.0000e-004	2.2100e-003	0.0000	38.0504	38.0504	2.7000e-003	0.0000	38.1178
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.2000e-003	6.9000e-004	8.3100e-003	3.0000e-005	3.0800e-003	2.0000e-005	3.1000e-003	8.2000e-004	2.0000e-005	8.4000e-004	0.0000	2.3547	2.3547	5.0000e-005	0.0000	2.3559
Total	**4.3300e-003**	**0.1458**	**0.0387**	**4.2000e-004**	**0.0104**	**2.3000e-004**	**0.0106**	**2.8300e-003**	**2.2000e-004**	**3.0500e-003**	**0.0000**	**40.4051**	**40.4051**	**2.7500e-003**	**0.0000**	**40.4737**

3.4 Floodplain and Side Channel Creation/ Enhancement - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1346	0.0000	0.1346	0.0345	0.0000	0.0345	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0285	0.2794	0.2417	4.7000e-004		0.0128	0.0128		0.0118	0.0118	0.0000	41.3788	41.3788	0.0134	0.0000	41.7134
Total	**0.0285**	**0.2794**	**0.2417**	**4.7000e-004**	**0.1346**	**0.0128**	**0.1474**	**0.0345**	**0.0118**	**0.0463**	**0.0000**	**41.3788**	**41.3788**	**0.0134**	**0.0000**	**41.7134**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Floodplain and Side Channel Creation/ Enhancement - 2024

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1346	0.0000	0.1346	0.0345	0.0000	0.0345	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0285	0.2794	0.2417	4.7000e-004		0.0128	0.0128		0.0118	0.0118	0.0000	41.3788	41.3788	0.0134	0.0000	41.7134
Total	**0.0285**	**0.2794**	**0.2417**	**4.7000e-004**	**0.1346**	**0.0128**	**0.1474**	**0.0345**	**0.0118**	**0.0463**	**0.0000**	**41.3788**	**41.3788**	**0.0134**	**0.0000**	**41.7134**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Instream Habitat Structure Placement - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	4.0300e-003	0.0406	0.0626	9.0000e-005		1.8600e-003	1.8600e-003		1.7100e-003	1.7100e-003	0.0000	7.6652	7.6652	2.4800e-003	0.0000	7.7272
Total	**4.0300e-003**	**0.0406**	**0.0626**	**9.0000e-005**	**0.0000**	**1.8600e-003**	**1.8600e-003**	**0.0000**	**1.7100e-003**	**1.7100e-003**	**0.0000**	**7.6652**	**7.6652**	**2.4800e-003**	**0.0000**	**7.7272**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Instream Habitat Structure Placement - 2024

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	4.0300e-003	0.0406	0.0626	9.0000e-005		1.8600e-003	1.8600e-003		1.7100e-003	1.7100e-003	0.0000	7.6652	7.6652	2.4800e-003	0.0000	7.7272
Total	**4.0300e-003**	**0.0406**	**0.0626**	**9.0000e-005**	**0.0000**	**1.8600e-003**	**1.8600e-003**	**0.0000**	**1.7100e-003**	**1.7100e-003**	**0.0000**	**7.6652**	**7.6652**	**2.4800e-003**	**0.0000**	**7.7272**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Site Restoration - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	1.9300e-003	0.0162	0.0219	4.0000e-005		6.5000e-004	6.5000e-004		6.0000e-004	6.0000e-004	0.0000	3.5019	3.5019	1.1300e-003	0.0000	3.5303
Total	**1.9300e-003**	**0.0162**	**0.0219**	**4.0000e-005**		**6.5000e-004**	**6.5000e-004**		**6.0000e-004**	**6.0000e-004**	**0.0000**	**3.5019**	**3.5019**	**1.1300e-003**	**0.0000**	**3.5303**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-005	5.3000e-004	1.5000e-004	0.0000	5.0000e-005	0.0000	5.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.2077	0.2077	1.0000e-005	0.0000	0.2080
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.0000e-005	2.0000e-005	2.4000e-004	0.0000	9.0000e-005	0.0000	9.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0673	0.0673	0.0000	0.0000	0.0673
Total	**4.0000e-005**	**5.5000e-004**	**3.9000e-004**	**0.0000**	**1.4000e-004**	**0.0000**	**1.4000e-004**	**3.0000e-005**	**0.0000**	**3.0000e-005**	**0.0000**	**0.2750**	**0.2750**	**1.0000e-005**	**0.0000**	**0.2753**

3.6 Site Restoration - 2024

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	1.9300e-003	0.0162	0.0219	4.0000e-005		6.5000e-004	6.5000e-004		6.0000e-004	6.0000e-004	0.0000	3.5019	3.5019	1.1300e-003	0.0000	3.5303
Total	**1.9300e-003**	**0.0162**	**0.0219**	**4.0000e-005**		**6.5000e-004**	**6.5000e-004**		**6.0000e-004**	**6.0000e-004**	**0.0000**	**3.5019**	**3.5019**	**1.1300e-003**	**0.0000**	**3.5303**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-005	5.3000e-004	1.5000e-004	0.0000	5.0000e-005	0.0000	5.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.2077	0.2077	1.0000e-005	0.0000	0.2080
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.0000e-005	2.0000e-005	2.4000e-004	0.0000	9.0000e-005	0.0000	9.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0673	0.0673	0.0000	0.0000	0.0673
Total	**4.0000e-005**	**5.5000e-004**	**3.9000e-004**	**0.0000**	**1.4000e-004**	**0.0000**	**1.4000e-004**	**3.0000e-005**	**0.0000**	**3.0000e-005**	**0.0000**	**0.2750**	**0.2750**	**1.0000e-005**	**0.0000**	**0.2753**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
User Defined Recreational	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
User Defined Recreational	10.00	5.00	6.50	0.00	0.00	0.00	0	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
User Defined Recreational	0.568817	0.036545	0.209097	0.111572	0.015710	0.004830	0.018344	0.024276	0.001951	0.001803	0.005698	0.000617	0.000741

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
User Defined Recreational	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
User Defined Recreational	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Lower American River Gravel Augmentation Project

Sacramento County, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
User Defined Recreational	0.00	User Defined Unit	34.50	0.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	3.5	**Precipitation Freq (Days)**	58
Climate Zone	3			**Operational Year**	2030
Utility Company	Sacramento Municipal Utility District				
CO2 Intensity (lb/MWhr)	590.31	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Assuming worse case scenario for 3 restoration activites occuring at the same time

Construction Phase - Assuming the project will only occur from July to September.

Off-road Equipment - From Construction Equipment Table in Project Description

Off-road Equipment - From Construction Equipment Table in Project Description

Off-road Equipment -

Off-road Equipment -

Off-road Equipment - From Construction Equipment Table in Project Description

Off-road Equipment - From Construction Equipment Table in Project Description

Trips and VMT - trip distance is 12 miles for import and 15-20 miles for mobilization and site restoration

Grading - Acres disturbed for borrow site, stockpiles near river, and excavated gravel

Vehicle Emission Factors -

Vehicle Emission Factors -

Vehicle Emission Factors -

Fleet Mix -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	30.00	6.00
tblConstructionPhase	NumDays	75.00	56.00
tblConstructionPhase	NumDays	75.00	56.00
tblConstructionPhase	NumDays	75.00	56.00
tblConstructionPhase	NumDays	740.00	3.00
tblConstructionPhase	PhaseEndDate	8/10/2029	7/9/2029
tblConstructionPhase	PhaseEndDate	11/23/2029	9/25/2029
tblConstructionPhase	PhaseEndDate	3/8/2030	9/25/2029
tblConstructionPhase	PhaseEndDate	6/21/2030	9/25/2029

tblConstructionPhase	PhaseEndDate	4/22/2033	9/30/2029
tblConstructionPhase	PhaseStartDate	8/11/2029	7/10/2029
tblConstructionPhase	PhaseStartDate	11/24/2029	7/10/2029
tblConstructionPhase	PhaseStartDate	3/9/2030	7/10/2029
tblConstructionPhase	PhaseStartDate	6/22/2030	9/26/2029
tblLandUse	LotAcreage	0.00	34.50
tblOffRoadEquipment	HorsePower	402.00	150.00
tblOffRoadEquipment	HorsePower	402.00	150.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	2.00
tblOffRoadEquipment	PhaseName		Spawning Gravel Replenishment
tblOffRoadEquipment	PhaseName		Spawning Gravel Replenishment
tblOffRoadEquipment	PhaseName		Spawning Gravel Replenishment
tblOffRoadEquipment	PhaseName		Site Restoration
tblOffRoadEquipment	PhaseName		Site Restoration

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2029	4.7603	46.7388	43.8107	0.0959	18.4996	1.8736	20.3732	4.7381	1.7295	6.4675	0.0000	9,387.4646	9,387.4646	2.5786	0.0000	9,451.9303
Maximum	**4.7603**	**46.7388**	**43.8107**	**0.0959**	**18.4996**	**1.8736**	**20.3732**	**4.7381**	**1.7295**	**6.4675**	**0.0000**	**9,387.4646**	**9,387.4646**	**2.5786**	**0.0000**	**9,451.9303**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2029	4.7603	46.7388	43.8107	0.0959	18.4996	1.8736	20.3732	4.7381	1.7295	6.4675	0.0000	9,387.4646	9,387.4646	2.5786	0.0000	9,451.9302
Maximum	**4.7603**	**46.7388**	**43.8107**	**0.0959**	**18.4996**	**1.8736**	**20.3732**	**4.7381**	**1.7295**	**6.4675**	**0.0000**	**9,387.4646**	**9,387.4646**	**2.5786**	**0.0000**	**9,451.9302**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Mobilization	Site Preparation	7/1/2029	7/9/2029	5	6	
2	Spawning Gravel Replenishment	Grading	7/10/2029	9/25/2029	5	56	
3	Floodplain and Side Channel Creation/ Enhancement	Grading	7/10/2029	9/25/2029	5	56	
4	Instream Habitat Structure Placement	Grading	7/10/2029	9/25/2029	5	56	
5	Site Restoration	Building Construction	9/26/2029	9/30/2029	5	3	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Spawning Gravel Replenishment	Dumpers/Tenders	4	8.00	16	0.38
Spawning Gravel Replenishment	Excavators	1	8.00	158	0.38
Spawning Gravel Replenishment	Off-Highway Trucks	2	8.00	150	0.38
Spawning Gravel Replenishment	Other Material Handling Equipment	2	8.00	168	0.40
Spawning Gravel Replenishment	Rubber Tired Dozers	3	8.00	247	0.40
Spawning Gravel Replenishment	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Floodplain and Side Channel Creation/ Enhancement	Excavators	1	8.00	158	0.38
Floodplain and Side Channel Creation/ Enhancement	Rubber Tired Dozers	1	8.00	247	0.40
Floodplain and Side Channel Creation/ Enhancement	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Instream Habitat Structure Placement	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Site Restoration	Graders	1	10.00	187	0.41
Site Restoration	Off-Highway Trucks	3	10.00	150	0.38

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Mobilization	0	23.00	0.00	6.00	10.00	6.50	15.00	LD_Mix	HDT_Mix	HHDT
Spawning Gravel Replenishment	0	15.00	0.00	2,471.00	10.00	6.50	7.00	LD_Mix	HDT_Mix	HHDT
Floodplain and Side Channel Creation/ En	0	0.00	0.00	0.00	0.00	0.00	0.00	LD_Mix	HDT_Mix	HHDT
Instream Habitat Structure Placement	0	0.00	0.00	0.00	0.00	0.00	0.00	LD_Mix	HDT_Mix	HHDT
Site Restoration	0	8.00	0.00	6.00	10.00	6.50	19.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Mobilization - 2029

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Total					**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**			**0.0000**			**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	3.6300e-003	0.1327	0.0369	5.7000e-004	0.0130	2.4000e-004	0.0133	3.5600e-003	2.3000e-004	3.8000e-003		61.1129	61.1129	3.4500e-003		61.1992
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0558	0.0221	0.3840	1.3200e-003	0.1750	8.6000e-004	0.1758	0.0464	8.0000e-004	0.0472		131.8999	131.8999	2.1500e-003		131.9536
Total	**0.0595**	**0.1548**	**0.4209**	**1.8900e-003**	**0.1880**	**1.1000e-003**	**0.1891**	**0.0500**	**1.0300e-003**	**0.0510**		**193.0128**	**193.0128**	**5.6000e-003**		**193.1528**

3.2 Mobilization - 2029

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Total					**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**			**0.0000**			**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	3.6300e-003	0.1327	0.0369	5.7000e-004	0.0130	2.4000e-004	0.0133	3.5600e-003	2.3000e-004	3.8000e-003		61.1129	61.1129	3.4500e-003		61.1992
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0558	0.0221	0.3840	1.3200e-003	0.1750	8.6000e-004	0.1758	0.0464	8.0000e-004	0.0472		131.8999	131.8999	2.1500e-003		131.9536
Total	**0.0595**	**0.1548**	**0.4209**	**1.8900e-003**	**0.1880**	**1.1000e-003**	**0.1891**	**0.0500**	**1.0300e-003**	**0.0510**		**193.0128**	**193.0128**	**5.6000e-003**		**193.1528**

3.3 Spawning Gravel Replenishment - 2029

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					13.3081	0.0000	13.3081	3.4019	0.0000	3.4019			0.0000			0.0000
Off-Road	3.5474	31.6371	31.9150	0.0614		1.4093	1.4093		1.3021	1.3021		5,893.4412	5,893.4412	1.8534		5,939.7758
Total	**3.5474**	**31.6371**	**31.9150**	**0.0614**	**13.3081**	**1.4093**	**14.7174**	**3.4019**	**1.3021**	**4.7040**		**5,893.4412**	**5,893.4412**	**1.8534**		**5,939.7758**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0971	4.5642	0.9288	0.0137	0.2688	5.5200e-003	0.2743	0.0736	5.2800e-003	0.0789		1,476.5921	1,476.5921	0.0992		1,479.0717
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0364	0.0144	0.2504	8.6000e-004	0.1141	5.6000e-004	0.1147	0.0303	5.2000e-004	0.0308		86.0216	86.0216	1.4000e-003		86.0567
Total	**0.1335**	**4.5786**	**1.1793**	**0.0146**	**0.3829**	**6.0800e-003**	**0.3890**	**0.1039**	**5.8000e-003**	**0.1096**		**1,562.6138**	**1,562.6138**	**0.1006**		**1,565.1283**

3.3 Spawning Gravel Replenishment - 2029

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					13.3081	0.0000	13.3081	3.4019	0.0000	3.4019			0.0000			0.0000
Off-Road	3.5474	31.6371	31.9150	0.0614		1.4093	1.4093		1.3021	1.3021	0.0000	5,893.4411	5,893.4411	1.8534		5,939.7758
Total	**3.5474**	**31.6371**	**31.9150**	**0.0614**	**13.3081**	**1.4093**	**14.7174**	**3.4019**	**1.3021**	**4.7040**	**0.0000**	**5,893.4411**	**5,893.4411**	**1.8534**		**5,939.7758**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0971	4.5642	0.9288	0.0137	0.2688	5.5200e-003	0.2743	0.0736	5.2800e-003	0.0789		1,476.5921	1,476.5921	0.0992		1,479.0717
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0364	0.0144	0.2504	8.6000e-004	0.1141	5.6000e-004	0.1147	0.0303	5.2000e-004	0.0308		86.0216	86.0216	1.4000e-003		86.0567
Total	**0.1335**	**4.5786**	**1.1793**	**0.0146**	**0.3829**	**6.0800e-003**	**0.3890**	**0.1039**	**5.8000e-003**	**0.1096**		**1,562.6138**	**1,562.6138**	**0.1006**		**1,565.1283**

3.4 Floodplain and Side Channel Creation/ Enhancement - 2029

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					4.8086	0.0000	4.8086	1.2324	0.0000	1.2324			0.0000			0.0000
Off-Road	0.9473	9.1879	8.4868	0.0168		0.4041	0.4041		0.3718	0.3718		1,629.3539	1,629.3539	0.5270		1,642.5280
Total	**0.9473**	**9.1879**	**8.4868**	**0.0168**	**4.8086**	**0.4041**	**5.2127**	**1.2324**	**0.3718**	**1.6042**		**1,629.3539**	**1,629.3539**	**0.5270**		**1,642.5280**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.4 Floodplain and Side Channel Creation/ Enhancement - 2029

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					4.8086	0.0000	4.8086	1.2324	0.0000	1.2324			0.0000			0.0000
Off-Road	0.9473	9.1879	8.4868	0.0168		0.4041	0.4041		0.3718	0.3718	0.0000	1,629.353 8	1,629.353 8	0.5270		1,642.528 0
Total	**0.9473**	**9.1879**	**8.4868**	**0.0168**	**4.8086**	**0.4041**	**5.2127**	**1.2324**	**0.3718**	**1.6042**	**0.0000**	**1,629.353 8**	**1,629.353 8**	**0.5270**		**1,642.528 0**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.5 Instream Habitat Structure Placement - 2029

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Off-Road	0.1321	1.3351	2.2297	3.1200e-003		0.0541	0.0541		0.0498	0.0498		302.0559	302.0559	0.0977		304.4981
Total	**0.1321**	**1.3351**	**2.2297**	**3.1200e-003**	**0.0000**	**0.0541**	**0.0541**	**0.0000**	**0.0498**	**0.0498**		**302.0559**	**302.0559**	**0.0977**		**304.4981**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.5 Instream Habitat Structure Placement - 2029

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Off-Road	0.1321	1.3351	2.2297	3.1200e-003		0.0541	0.0541		0.0498	0.0498	0.0000	302.0559	302.0559	0.0977		304.4981
Total	**0.1321**	**1.3351**	**2.2297**	**3.1200e-003**	**0.0000**	**0.0541**	**0.0541**	**0.0000**	**0.0498**	**0.0498**	**0.0000**	**302.0559**	**302.0559**	**0.0977**		**304.4981**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.6 Site Restoration - 2029

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.1943	9.3552	14.5376	0.0266		0.3833	0.3833		0.3526	0.3526		2,572.1679	2,572.1679	0.8319		2,592.9652
Total	**1.1943**	**9.3552**	**14.5376**	**0.0266**		**0.3833**	**0.3833**		**0.3526**	**0.3526**		**2,572.1679**	**2,572.1679**	**0.8319**		**2,592.9652**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	8.6800e-003	0.2947	0.0896	1.3900e-003	0.0330	6.0000e-004	0.0336	9.0300e-003	5.7000e-004	9.6000e-003		149.8749	149.8749	8.1100e-003		150.0776
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0194	7.6800e-003	0.1336	4.6000e-004	0.0609	3.0000e-004	0.0612	0.0161	2.8000e-004	0.0164		45.8782	45.8782	7.5000e-004		45.8969
Total	**0.0281**	**0.3024**	**0.2232**	**1.8500e-003**	**0.0939**	**9.0000e-004**	**0.0948**	**0.0252**	**8.5000e-004**	**0.0260**		**195.7531**	**195.7531**	**8.8600e-003**		**195.9745**

3.6 Site Restoration - 2029

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.1943	9.3552	14.5376	0.0266		0.3833	0.3833		0.3526	0.3526	0.0000	2,572.1679	2,572.1679	0.8319		2,592.9652
Total	**1.1943**	**9.3552**	**14.5376**	**0.0266**		**0.3833**	**0.3833**		**0.3526**	**0.3526**	**0.0000**	**2,572.1679**	**2,572.1679**	**0.8319**		**2,592.9652**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	8.6800e-003	0.2947	0.0896	1.3900e-003	0.0330	6.0000e-004	0.0336	9.0300e-003	5.7000e-004	9.6000e-003		149.8749	149.8749	8.1100e-003		150.0776
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0194	7.6800e-003	0.1336	4.6000e-004	0.0609	3.0000e-004	0.0612	0.0161	2.8000e-004	0.0164		45.8782	45.8782	7.5000e-004		45.8969
Total	**0.0281**	**0.3024**	**0.2232**	**1.8500e-003**	**0.0939**	**9.0000e-004**	**0.0948**	**0.0252**	**8.5000e-004**	**0.0260**		**195.7531**	**195.7531**	**8.8600e-003**		**195.9745**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
User Defined Recreational	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
User Defined Recreational	10.00	5.00	6.50	0.00	0.00	0.00	0	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
User Defined Recreational	0.568817	0.036545	0.209097	0.111572	0.015710	0.004830	0.018344	0.024276	0.001951	0.001803	0.005698	0.000617	0.000741

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000

6.2 Area by SubCategory

Unmitigated

SubCategory	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Lower American River Gravel Augmentation Project

Sacramento County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
User Defined Recreational	0.00	User Defined Unit	34.50	0.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	3.5	**Precipitation Freq (Days)**	58
Climate Zone	3			**Operational Year**	2030
Utility Company	Sacramento Municipal Utility District				
CO2 Intensity (lb/MWhr)	590.31	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Assuming worse case scenario for 3 restoration activites occuring at the same time

Construction Phase - Assuming the project will only occur from July to September.

Off-road Equipment - From Construction Equipment Table in Project Description

Off-road Equipment - From Construction Equipment Table in Project Description

Off-road Equipment -

Off-road Equipment -

Off-road Equipment - From Construction Equipment Table in Project Description

Off-road Equipment - From Construction Equipment Table in Project Description

Trips and VMT - trip distance is 12 miles for import and 15-20 miles for mobilization and site restoration

Grading - Acres disturbed for borrow site, stockpiles near river, and excavated gravel

Vehicle Emission Factors -

Vehicle Emission Factors -

Vehicle Emission Factors -

Fleet Mix -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	30.00	6.00
tblConstructionPhase	NumDays	75.00	56.00
tblConstructionPhase	NumDays	75.00	56.00
tblConstructionPhase	NumDays	75.00	56.00
tblConstructionPhase	NumDays	740.00	3.00
tblConstructionPhase	PhaseEndDate	8/10/2029	7/9/2029
tblConstructionPhase	PhaseEndDate	11/23/2029	9/25/2029
tblConstructionPhase	PhaseEndDate	3/8/2030	9/25/2029
tblConstructionPhase	PhaseEndDate	6/21/2030	9/25/2029

tblConstructionPhase	PhaseEndDate	4/22/2033	9/30/2029
tblConstructionPhase	PhaseStartDate	8/11/2029	7/10/2029
tblConstructionPhase	PhaseStartDate	11/24/2029	7/10/2029
tblConstructionPhase	PhaseStartDate	3/9/2030	7/10/2029
tblConstructionPhase	PhaseStartDate	6/22/2030	9/26/2029
tblLandUse	LotAcreage	0.00	34.50
tblOffRoadEquipment	HorsePower	402.00	150.00
tblOffRoadEquipment	HorsePower	402.00	150.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	2.00
tblOffRoadEquipment	PhaseName		Spawning Gravel Replenishment
tblOffRoadEquipment	PhaseName		Spawning Gravel Replenishment
tblOffRoadEquipment	PhaseName		Spawning Gravel Replenishment
tblOffRoadEquipment	PhaseName		Site Restoration
tblOffRoadEquipment	PhaseName		Site Restoration

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2029	0.1352	1.3246	1.2502	2.7200e-003	0.5183	0.0531	0.5714	0.1328	0.0490	0.1817	0.0000	241.9315	241.9315	0.0667	0.0000	243.5999
Maximum	**0.1352**	**1.3246**	**1.2502**	**2.7200e-003**	**0.5183**	**0.0531**	**0.5714**	**0.1328**	**0.0490**	**0.1817**	**0.0000**	**241.9315**	**241.9315**	**0.0667**	**0.0000**	**243.5999**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2029	0.1352	1.3246	1.2502	2.7200e-003	0.5183	0.0531	0.5714	0.1328	0.0490	0.1817	0.0000	241.9313	241.9313	0.0667	0.0000	243.5996
Maximum	**0.1352**	**1.3246**	**1.2502**	**2.7200e-003**	**0.5183**	**0.0531**	**0.5714**	**0.1328**	**0.0490**	**0.1817**	**0.0000**	**241.9313**	**241.9313**	**0.0667**	**0.0000**	**243.5996**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
1	**7-1-2029**	**9-30-2029**	1.4547	1.4547
		Highest	1.4547	1.4547

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Mobilization	Site Preparation	7/1/2029	7/9/2029	5	6	
2	Spawning Gravel Replenishment	Grading	7/10/2029	9/25/2029	5	56	
3	Floodplain and Side Channel Creation/ Enhancement	Grading	7/10/2029	9/25/2029	5	56	
4	Instream Habitat Structure Placement	Grading	7/10/2029	9/25/2029	5	56	
5	Site Restoration	Building Construction	9/26/2029	9/30/2029	5	3	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

<u>OffRoad Equipment</u>

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Spawning Gravel Replenishment	Dumpers/Tenders	4	8.00	16	0.38
Spawning Gravel Replenishment	Excavators	1	8.00	158	0.38
Spawning Gravel Replenishment	Off-Highway Trucks	2	8.00	150	0.38
Spawning Gravel Replenishment	Other Material Handling Equipment	2	8.00	168	0.40
Spawning Gravel Replenishment	Rubber Tired Dozers	3	8.00	247	0.40
Spawning Gravel Replenishment	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Floodplain and Side Channel Creation/ Enhancement	Excavators	1	8.00	158	0.38
Floodplain and Side Channel Creation/ Enhancement	Rubber Tired Dozers	1	8.00	247	0.40
Floodplain and Side Channel Creation/ Enhancement	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Instream Habitat Structure Placement	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Site Restoration	Graders	1	10.00	187	0.41
Site Restoration	Off-Highway Trucks	3	10.00	150	0.38

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Mobilization	0	23.00	0.00	6.00	10.00	6.50	15.00	LD_Mix	HDT_Mix	HHDT
Spawning Gravel Replenishment	0	15.00	0.00	2,471.00	10.00	6.50	7.00	LD_Mix	HDT_Mix	HHDT
Floodplain and Side Channel Creation/ En	0	0.00	0.00	0.00	0.00	0.00	0.00	LD_Mix	HDT_Mix	HHDT
Instream Habitat Structure Placement	0	0.00	0.00	0.00	0.00	0.00	0.00	LD_Mix	HDT_Mix	HHDT
Site Restoration	0	8.00	0.00	6.00	10.00	6.50	19.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Mobilization - 2029

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total					**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-005	4.1000e-004	1.1000e-004	0.0000	4.0000e-005	0.0000	4.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.1650	0.1650	1.0000e-005	0.0000	0.1652
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.5000e-004	7.0000e-005	9.6000e-004	0.0000	5.1000e-004	0.0000	5.1000e-004	1.3000e-004	0.0000	1.4000e-004	0.0000	0.3245	0.3245	1.0000e-005	0.0000	0.3247
Total	**1.6000e-004**	**4.8000e-004**	**1.0700e-003**	**0.0000**	**5.5000e-004**	**0.0000**	**5.5000e-004**	**1.4000e-004**	**0.0000**	**1.5000e-004**	**0.0000**	**0.4895**	**0.4895**	**2.0000e-005**	**0.0000**	**0.4899**

3.2 Mobilization - 2029

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total					**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-005	4.1000e-004	1.1000e-004	0.0000	4.0000e-005	0.0000	4.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.1650	0.1650	1.0000e-005	0.0000	0.1652
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.5000e-004	7.0000e-005	9.6000e-004	0.0000	5.1000e-004	0.0000	5.1000e-004	1.3000e-004	0.0000	1.4000e-004	0.0000	0.3245	0.3245	1.0000e-005	0.0000	0.3247
Total	**1.6000e-004**	**4.8000e-004**	**1.0700e-003**	**0.0000**	**5.5000e-004**	**0.0000**	**5.5000e-004**	**1.4000e-004**	**0.0000**	**1.5000e-004**	**0.0000**	**0.4895**	**0.4895**	**2.0000e-005**	**0.0000**	**0.4899**

3.3 Spawning Gravel Replenishment - 2029

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.3726	0.0000	0.3726	0.0953	0.0000	0.0953	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0993	0.8858	0.8936	1.7200e-003		0.0395	0.0395		0.0365	0.0365	0.0000	149.7003	149.7003	0.0471	0.0000	150.8773
Total	**0.0993**	**0.8858**	**0.8936**	**1.7200e-003**	**0.3726**	**0.0395**	**0.4121**	**0.0953**	**0.0365**	**0.1317**	**0.0000**	**149.7003**	**149.7003**	**0.0471**	**0.0000**	**150.8773**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.7800e-003	0.1287	0.0275	3.8000e-004	7.3000e-003	1.6000e-004	7.4600e-003	2.0000e-003	1.5000e-004	2.1600e-003	0.0000	36.9471	36.9471	2.6000e-003	0.0000	37.0121
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.9000e-004	4.4000e-004	5.8500e-003	2.0000e-005	3.0800e-003	2.0000e-005	3.1000e-003	8.2000e-004	1.0000e-005	8.3000e-004	0.0000	1.9753	1.9753	3.0000e-005	0.0000	1.9761
Total	**3.6700e-003**	**0.1291**	**0.0333**	**4.0000e-004**	**0.0104**	**1.8000e-004**	**0.0106**	**2.8200e-003**	**1.6000e-004**	**2.9900e-003**	**0.0000**	**38.9225**	**38.9225**	**2.6300e-003**	**0.0000**	**38.9882**

3.3 Spawning Gravel Replenishment - 2029

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.3726	0.0000	0.3726	0.0953	0.0000	0.0953	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0993	0.8858	0.8936	1.7200e-003		0.0395	0.0395		0.0365	0.0365	0.0000	149.7001	149.7001	0.0471	0.0000	150.8771
Total	**0.0993**	**0.8858**	**0.8936**	**1.7200e-003**	**0.3726**	**0.0395**	**0.4121**	**0.0953**	**0.0365**	**0.1317**	**0.0000**	**149.7001**	**149.7001**	**0.0471**	**0.0000**	**150.8771**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.7800e-003	0.1287	0.0275	3.8000e-004	7.3000e-003	1.6000e-004	7.4600e-003	2.0000e-003	1.5000e-004	2.1600e-003	0.0000	36.9471	36.9471	2.6000e-003	0.0000	37.0121
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.9000e-004	4.4000e-004	5.8500e-003	2.0000e-005	3.0800e-003	2.0000e-005	3.1000e-003	8.2000e-004	1.0000e-005	8.3000e-004	0.0000	1.9753	1.9753	3.0000e-005	0.0000	1.9761
Total	**3.6700e-003**	**0.1291**	**0.0333**	**4.0000e-004**	**0.0104**	**1.8000e-004**	**0.0106**	**2.8200e-003**	**1.6000e-004**	**2.9900e-003**	**0.0000**	**38.9225**	**38.9225**	**2.6300e-003**	**0.0000**	**38.9882**

3.4 Floodplain and Side Channel Creation/ Enhancement - 2029

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1346	0.0000	0.1346	0.0345	0.0000	0.0345	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0265	0.2573	0.2376	4.7000e-004		0.0113	0.0113		0.0104	0.0104	0.0000	41.3875	41.3875	0.0134	0.0000	41.7221
Total	**0.0265**	**0.2573**	**0.2376**	**4.7000e-004**	**0.1346**	**0.0113**	**0.1460**	**0.0345**	**0.0104**	**0.0449**	**0.0000**	**41.3875**	**41.3875**	**0.0134**	**0.0000**	**41.7221**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Floodplain and Side Channel Creation/ Enhancement - 2029

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1346	0.0000	0.1346	0.0345	0.0000	0.0345	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0265	0.2573	0.2376	4.7000e-004		0.0113	0.0113		0.0104	0.0104	0.0000	41.3875	41.3875	0.0134	0.0000	41.7221
Total	**0.0265**	**0.2573**	**0.2376**	**4.7000e-004**	**0.1346**	**0.0113**	**0.1460**	**0.0345**	**0.0104**	**0.0449**	**0.0000**	**41.3875**	**41.3875**	**0.0134**	**0.0000**	**41.7221**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Instream Habitat Structure Placement - 2029

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.7000e-003	0.0374	0.0624	9.0000e-005		1.5100e-003	1.5100e-003		1.3900e-003	1.3900e-003	0.0000	7.6726	7.6726	2.4800e-003	0.0000	7.7346
Total	**3.7000e-003**	**0.0374**	**0.0624**	**9.0000e-005**	**0.0000**	**1.5100e-003**	**1.5100e-003**	**0.0000**	**1.3900e-003**	**1.3900e-003**	**0.0000**	**7.6726**	**7.6726**	**2.4800e-003**	**0.0000**	**7.7346**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Instream Habitat Structure Placement - 2029

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.7000e-003	0.0374	0.0624	9.0000e-005		1.5100e-003	1.5100e-003		1.3900e-003	1.3900e-003	0.0000	7.6726	7.6726	2.4800e-003	0.0000	7.7346
Total	**3.7000e-003**	**0.0374**	**0.0624**	**9.0000e-005**	**0.0000**	**1.5100e-003**	**1.5100e-003**	**0.0000**	**1.3900e-003**	**1.3900e-003**	**0.0000**	**7.6726**	**7.6726**	**2.4800e-003**	**0.0000**	**7.7346**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Site Restoration - 2029

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	1.7900e-003	0.0140	0.0218	4.0000e-005		5.7000e-004	5.7000e-004		5.3000e-004	5.3000e-004	0.0000	3.5002	3.5002	1.1300e-003	0.0000	3.5285
Total	**1.7900e-003**	**0.0140**	**0.0218**	**4.0000e-005**		**5.7000e-004**	**5.7000e-004**		**5.3000e-004**	**5.3000e-004**	**0.0000**	**3.5002**	**3.5002**	**1.1300e-003**	**0.0000**	**3.5285**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-005	4.5000e-004	1.4000e-004	0.0000	5.0000e-005	0.0000	5.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.2026	0.2026	1.0000e-005	0.0000	0.2029
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.0000e-005	1.0000e-005	1.7000e-004	0.0000	9.0000e-005	0.0000	9.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0564	0.0564	0.0000	0.0000	0.0565
Total	**4.0000e-005**	**4.6000e-004**	**3.1000e-004**	**0.0000**	**1.4000e-004**	**0.0000**	**1.4000e-004**	**3.0000e-005**	**0.0000**	**3.0000e-005**	**0.0000**	**0.2590**	**0.2590**	**1.0000e-005**	**0.0000**	**0.2593**

3.6 Site Restoration - 2029

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	1.7900e-003	0.0140	0.0218	4.0000e-005		5.7000e-004	5.7000e-004		5.3000e-004	5.3000e-004	0.0000	3.5001	3.5001	1.1300e-003	0.0000	3.5284
Total	**1.7900e-003**	**0.0140**	**0.0218**	**4.0000e-005**		**5.7000e-004**	**5.7000e-004**		**5.3000e-004**	**5.3000e-004**	**0.0000**	**3.5001**	**3.5001**	**1.1300e-003**	**0.0000**	**3.5284**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-005	4.5000e-004	1.4000e-004	0.0000	5.0000e-005	0.0000	5.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.2026	0.2026	1.0000e-005	0.0000	0.2029
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.0000e-005	1.0000e-005	1.7000e-004	0.0000	9.0000e-005	0.0000	9.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0564	0.0564	0.0000	0.0000	0.0565
Total	**4.0000e-005**	**4.6000e-004**	**3.1000e-004**	**0.0000**	**1.4000e-004**	**0.0000**	**1.4000e-004**	**3.0000e-005**	**0.0000**	**3.0000e-005**	**0.0000**	**0.2590**	**0.2590**	**1.0000e-005**	**0.0000**	**0.2593**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
User Defined Recreational	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
User Defined Recreational	10.00	5.00	6.50	0.00	0.00	0.00	0	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
User Defined Recreational	0.568817	0.036545	0.209097	0.111572	0.015710	0.004830	0.018344	0.024276	0.001951	0.001803	0.005698	0.000617	0.000741

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
User Defined Recreational	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
User Defined Recreational	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Lower American River Gravel Augmentation Project

Sacramento County, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
User Defined Recreational	0.00	User Defined Unit	34.50	0.00	0

1.2 Other Project Characteristics

Urbanization Urban **Wind Speed (m/s)** 3.5 **Precipitation Freq (Days)** 58

Climate Zone 3 **Operational Year** 2035

Utility Company Sacramento Municipal Utility District

CO2 Intensity (lb/MWhr) 590.31 **CH4 Intensity (lb/MWhr)** 0.029 **N2O Intensity (lb/MWhr)** 0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Assuming worse case scenario for 3 restoration activites occuring at the same time

Construction Phase - Assuming the project will only occur from July to September.

Off-road Equipment - From Construction Equipment Table in Project Description

Off-road Equipment - From Construction Equipment Table in Project Description

Off-road Equipment -

Off-road Equipment -

Off-road Equipment - From Construction Equipment Table in Project Description

Off-road Equipment - From Construction Equipment Table in Project Description

Trips and VMT - trip distance is 12 miles for import and 15-20 miles for mobilization and site restoration

Grading - Acres disturbed for borrow site, stockpiles near river, and excavated gravel

Vehicle Emission Factors -

Vehicle Emission Factors -

Vehicle Emission Factors -

Fleet Mix -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	30.00	5.00
tblConstructionPhase	NumDays	75.00	56.00
tblConstructionPhase	NumDays	75.00	56.00
tblConstructionPhase	NumDays	75.00	56.00
tblConstructionPhase	NumDays	740.00	4.00
tblConstructionPhase	PhaseEndDate	8/11/2034	7/9/2034
tblConstructionPhase	PhaseEndDate	11/24/2034	9/25/2034
tblConstructionPhase	PhaseEndDate	3/9/2035	9/25/2034
tblConstructionPhase	PhaseEndDate	6/22/2035	9/25/2034

tblConstructionPhase	PhaseEndDate	4/23/2038	9/29/2034
tblConstructionPhase	PhaseStartDate	8/12/2034	7/10/2034
tblConstructionPhase	PhaseStartDate	11/25/2034	7/10/2034
tblConstructionPhase	PhaseStartDate	3/10/2035	7/10/2034
tblConstructionPhase	PhaseStartDate	6/23/2035	9/26/2034
tblLandUse	LotAcreage	0.00	34.50
tblOffRoadEquipment	HorsePower	402.00	150.00
tblOffRoadEquipment	HorsePower	402.00	150.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	2.00
tblOffRoadEquipment	PhaseName		Spawning Gravel Replenishment
tblOffRoadEquipment	PhaseName		Spawning Gravel Replenishment
tblOffRoadEquipment	PhaseName		Spawning Gravel Replenishment
tblOffRoadEquipment	PhaseName		Site Restoration
tblOffRoadEquipment	PhaseName		Site Restoration

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2034	4.8663	26.6868	42.6121	0.1133	18.4995	0.7960	19.2955	4.7381	0.7958	5.5338	0.0000	10,868.0641	10,868.0641	0.5179	0.0000	10,881.0107
Maximum	**4.8663**	**26.6868**	**42.6121**	**0.1133**	**18.4995**	**0.7960**	**19.2955**	**4.7381**	**0.7958**	**5.5338**	**0.0000**	**10,868.0641**	**10,868.0641**	**0.5179**	**0.0000**	**10,881.0107**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2034	4.8663	26.6868	42.6121	0.1133	18.4995	0.7960	19.2955	4.7381	0.7958	5.5338	0.0000	10,868.0641	10,868.0641	0.5179	0.0000	10,881.0107
Maximum	**4.8663**	**26.6868**	**42.6121**	**0.1133**	**18.4995**	**0.7960**	**19.2955**	**4.7381**	**0.7958**	**5.5338**	**0.0000**	**10,868.0641**	**10,868.0641**	**0.5179**	**0.0000**	**10,881.0107**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Mobilization	Site Preparation	7/1/2034	7/9/2034	5	5	
2	Spawning Gravel Replenishment	Grading	7/10/2034	9/25/2034	5	56	
3	Floodplain and Side Channel Creation/ Enhancement	Grading	7/10/2034	9/25/2034	5	56	
4	Instream Habitat Structure Placement	Grading	7/10/2034	9/25/2034	5	56	
5	Site Restoration	Building Construction	9/26/2034	9/29/2034	5	4	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Spawning Gravel Replenishment	Dumpers/Tenders	4	8.00	16	0.38
Spawning Gravel Replenishment	Excavators	1	8.00	158	0.38
Spawning Gravel Replenishment	Off-Highway Trucks	2	8.00	150	0.38
Spawning Gravel Replenishment	Other Material Handling Equipment	2	8.00	168	0.40
Spawning Gravel Replenishment	Rubber Tired Dozers	3	8.00	247	0.40
Spawning Gravel Replenishment	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Floodplain and Side Channel Creation/ Enhancement	Excavators	1	8.00	158	0.38
Floodplain and Side Channel Creation/ Enhancement	Rubber Tired Dozers	1	8.00	247	0.40
Floodplain and Side Channel Creation/ Enhancement	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Instream Habitat Structure Placement	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Site Restoration	Graders	1	10.00	187	0.41
Site Restoration	Off-Highway Trucks	3	10.00	150	0.38

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Mobilization	0	23.00	0.00	6.00	10.00	6.50	15.00	LD_Mix	HDT_Mix	HHDT
Spawning Gravel Replenishment	0	15.00	0.00	2,471.00	10.00	6.50	7.00	LD_Mix	HDT_Mix	HHDT
Floodplain and Side Channel Creation/ En	0	0.00	0.00	0.00	0.00	0.00	0.00	LD_Mix	HDT_Mix	HHDT
Instream Habitat Structure Placement	0	0.00	0.00	0.00	0.00	0.00	0.00	LD_Mix	HDT_Mix	HHDT
Site Restoration	0	8.00	0.00	6.00	10.00	6.50	19.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Mobilization - 2034

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Total					**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**			**0.0000**			**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	4.1300e-003	0.1446	0.0432	6.7000e-004	0.0156	2.4000e-004	0.0159	4.2800e-003	2.2000e-004	4.5000e-003		72.2920	72.2920	4.0100e-003		72.3922
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0380	0.0148	0.2869	1.1900e-003	0.1750	6.1000e-004	0.1756	0.0464	5.6000e-004	0.0470		118.5080	118.5080	1.4100e-003		118.5433
Total	**0.0421**	**0.1594**	**0.3302**	**1.8600e-003**	**0.1906**	**8.5000e-004**	**0.1914**	**0.0507**	**7.8000e-004**	**0.0515**		**190.8000**	**190.8000**	**5.4200e-003**		**190.9356**

3.2 Mobilization - 2034

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Total					**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**			**0.0000**			**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	4.1300e-003	0.1446	0.0432	6.7000e-004	0.0156	2.4000e-004	0.0159	4.2800e-003	2.2000e-004	4.5000e-003		72.2920	72.2920	4.0100e-003		72.3922
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0380	0.0148	0.2869	1.1900e-003	0.1750	6.1000e-004	0.1756	0.0464	5.6000e-004	0.0470		118.5080	118.5080	1.4100e-003		118.5433
Total	**0.0421**	**0.1594**	**0.3302**	**1.8600e-003**	**0.1906**	**8.5000e-004**	**0.1914**	**0.0507**	**7.8000e-004**	**0.0515**		**190.8000**	**190.8000**	**5.4200e-003**		**190.9356**

3.3 Spawning Gravel Replenishment - 2034

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					13.3081	0.0000	13.3081	3.4019	0.0000	3.4019			0.0000			0.0000
Off-Road	3.5969	16.6751	30.9711	0.0746		0.6087	0.6087		0.6087	0.6087		7,025.5768	7,025.5768	0.3188		7,033.5454
Total	**3.5969**	**16.6751**	**30.9711**	**0.0746**	**13.3081**	**0.6087**	**13.9168**	**3.4019**	**0.6087**	**4.0106**		**7,025.5768**	**7,025.5768**	**0.3188**		**7,033.5454**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0910	4.2048	0.8997	0.0135	0.2687	4.3000e-003	0.2730	0.0735	4.1200e-003	0.0777		1,453.6771	1,453.6771	0.0954		1,456.0625
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0248	9.6800e-003	0.1871	7.7000e-004	0.1141	4.0000e-004	0.1145	0.0303	3.6000e-004	0.0306		77.2878	77.2878	9.2000e-004		77.3109
Total	**0.1158**	**4.2145**	**1.0868**	**0.0143**	**0.3828**	**4.7000e-003**	**0.3875**	**0.1038**	**4.4800e-003**	**0.1083**		**1,530.9650**	**1,530.9650**	**0.0963**		**1,533.3734**

3.3 Spawning Gravel Replenishment - 2034

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					13.3081	0.0000	13.3081	3.4019	0.0000	3.4019			0.0000			0.0000
Off-Road	3.5969	16.6751	30.9711	0.0746		0.6087	0.6087		0.6087	0.6087	0.0000	7,025.576 7	7,025.576 7	0.3188		7,033.545 4
Total	**3.5969**	**16.6751**	**30.9711**	**0.0746**	**13.3081**	**0.6087**	**13.9168**	**3.4019**	**0.6087**	**4.0106**	**0.0000**	**7,025.576 7**	**7,025.576 7**	**0.3188**		**7,033.545 4**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0910	4.2048	0.8997	0.0135	0.2687	4.3000e-003	0.2730	0.0735	4.1200e-003	0.0777		1,453.677 1	1,453.677 1	0.0954		1,456.062 5
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0248	9.6800e-003	0.1871	7.7000e-004	0.1141	4.0000e-004	0.1145	0.0303	3.6000e-004	0.0306		77.2878	77.2878	9.2000e-004		77.3109
Total	**0.1158**	**4.2145**	**1.0868**	**0.0143**	**0.3828**	**4.7000e-003**	**0.3875**	**0.1038**	**4.4800e-003**	**0.1083**		**1,530.965 0**	**1,530.965 0**	**0.0963**		**1,533.373 4**

3.4 Floodplain and Side Channel Creation/ Enhancement - 2034

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					4.8086	0.0000	4.8086	1.2324	0.0000	1.2324			0.0000			0.0000
Off-Road	0.9815	4.7693	8.2090	0.0206		0.1636	0.1636		0.1636	0.1636		1,951.7941	1,951.7941	0.0876		1,953.9838
Total	**0.9815**	**4.7693**	**8.2090**	**0.0206**	**4.8086**	**0.1636**	**4.9722**	**1.2324**	**0.1636**	**1.3960**		**1,951.7941**	**1,951.7941**	**0.0876**		**1,953.9838**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.4 Floodplain and Side Channel Creation/ Enhancement - 2034

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					4.8086	0.0000	4.8086	1.2324	0.0000	1.2324			0.0000			0.0000
Off-Road	0.9815	4.7693	8.2090	0.0206		0.1636	0.1636		0.1636	0.1636	0.0000	1,951.7941	1,951.7941	0.0876		1,953.9838
Total	**0.9815**	**4.7693**	**8.2090**	**0.0206**	**4.8086**	**0.1636**	**4.9722**	**1.2324**	**0.1636**	**1.3960**	**0.0000**	**1,951.7941**	**1,951.7941**	**0.0876**		**1,953.9838**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.5 Instream Habitat Structure Placement - 2034

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Off-Road	0.1722	1.0280	2.3452	3.8000e-003		0.0190	0.0190		0.0190	0.0190		359.7283	359.7283	0.0152		360.1081
Total	**0.1722**	**1.0280**	**2.3452**	**3.8000e-003**	**0.0000**	**0.0190**	**0.0190**	**0.0000**	**0.0190**	**0.0190**		**359.7283**	**359.7283**	**0.0152**		**360.1081**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.5 Instream Habitat Structure Placement - 2034

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Off-Road	0.1722	1.0280	2.3452	3.8000e-003		0.0190	0.0190		0.0190	0.0190	0.0000	359.7283	359.7283	0.0152		360.1081
Total	**0.1722**	**1.0280**	**2.3452**	**3.8000e-003**	**0.0000**	**0.0190**	**0.0190**	**0.0000**	**0.0190**	**0.0190**	**0.0000**	**359.7283**	**359.7283**	**0.0152**		**360.1081**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

3.6 Site Restoration - 2034

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.2284	3.2786	14.8524	0.0328		0.1348	0.1348		0.1348	0.1348		3,103.0199	3,103.0199	0.1075		3,105.7077
Total	**1.2284**	**3.2786**	**14.8524**	**0.0328**		**0.1348**	**0.1348**		**0.1348**	**0.1348**		**3,103.0199**	**3,103.0199**	**0.1075**		**3,105.7077**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	6.2000e-003	0.1996	0.0657	1.0300e-003	0.0247	3.7000e-004	0.0251	6.7700e-003	3.5000e-004	7.1200e-003		110.8391	110.8391	5.9000e-003		110.9865
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0132	5.1600e-003	0.0998	4.1000e-004	0.0609	2.1000e-004	0.0611	0.0161	1.9000e-004	0.0163		41.2202	41.2202	4.9000e-004		41.2325
Total	**0.0194**	**0.2047**	**0.1655**	**1.4400e-003**	**0.0856**	**5.8000e-004**	**0.0862**	**0.0229**	**5.4000e-004**	**0.0235**		**152.0593**	**152.0593**	**6.3900e-003**		**152.2190**

3.6 Site Restoration - 2034

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.2284	3.2786	14.8524	0.0328		0.1348	0.1348		0.1348	0.1348	0.0000	3,103.0199	3,103.0199	0.1075		3,105.7077
Total	**1.2284**	**3.2786**	**14.8524**	**0.0328**		**0.1348**	**0.1348**		**0.1348**	**0.1348**	**0.0000**	**3,103.0199**	**3,103.0199**	**0.1075**		**3,105.7077**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	6.2000e-003	0.1996	0.0657	1.0300e-003	0.0247	3.7000e-004	0.0251	6.7700e-003	3.5000e-004	7.1200e-003		110.8391	110.8391	5.9000e-003		110.9865
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0132	5.1600e-003	0.0998	4.1000e-004	0.0609	2.1000e-004	0.0611	0.0161	1.9000e-004	0.0163		41.2202	41.2202	4.9000e-004		41.2325
Total	**0.0194**	**0.2047**	**0.1655**	**1.4400e-003**	**0.0856**	**5.8000e-004**	**0.0862**	**0.0229**	**5.4000e-004**	**0.0235**		**152.0593**	**152.0593**	**6.3900e-003**		**152.2190**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
User Defined Recreational	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
User Defined Recreational	10.00	5.00	6.50	0.00	0.00	0.00	0	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
User Defined Recreational	0.568817	0.036545	0.209097	0.111572	0.015710	0.004830	0.018344	0.024276	0.001951	0.001803	0.005698	0.000617	0.000741

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**		**0.0000**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Lower American River Gravel Augmentation Project

Sacramento County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
User Defined Recreational	0.00	User Defined Unit	34.50	0.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	3.5	**Precipitation Freq (Days)**	58
Climate Zone	3			**Operational Year**	2035
Utility Company	Sacramento Municipal Utility District				
CO2 Intensity (lb/MWhr)	590.31	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Assuming worse case scenario for 3 restoration activites occuring at the same time

Construction Phase - Assuming the project will only occur from July to September.

Off-road Equipment - From Construction Equipment Table in Project Description

Off-road Equipment - From Construction Equipment Table in Project Description

Off-road Equipment -

Off-road Equipment -

Off-road Equipment - From Construction Equipment Table in Project Description

Off-road Equipment - From Construction Equipment Table in Project Description

Trips and VMT - trip distance is 12 miles for import and 15-20 miles for mobilization and site restoration

Grading - Acres disturbed for borrow site, stockpiles near river, and excavated gravel

Vehicle Emission Factors -

Vehicle Emission Factors -

Vehicle Emission Factors -

Fleet Mix -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	30.00	5.00
tblConstructionPhase	NumDays	75.00	56.00
tblConstructionPhase	NumDays	75.00	56.00
tblConstructionPhase	NumDays	75.00	56.00
tblConstructionPhase	NumDays	740.00	4.00
tblConstructionPhase	PhaseEndDate	8/11/2034	7/9/2034
tblConstructionPhase	PhaseEndDate	11/24/2034	9/25/2034
tblConstructionPhase	PhaseEndDate	3/9/2035	9/25/2034
tblConstructionPhase	PhaseEndDate	6/22/2035	9/25/2034

tblConstructionPhase	PhaseEndDate	4/23/2038	9/29/2034
tblConstructionPhase	PhaseStartDate	8/12/2034	7/10/2034
tblConstructionPhase	PhaseStartDate	11/25/2034	7/10/2034
tblConstructionPhase	PhaseStartDate	3/10/2035	7/10/2034
tblConstructionPhase	PhaseStartDate	6/23/2035	9/26/2034
tblLandUse	LotAcreage	0.00	34.50
tblOffRoadEquipment	HorsePower	402.00	150.00
tblOffRoadEquipment	HorsePower	402.00	150.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	2.00
tblOffRoadEquipment	PhaseName		Spawning Gravel Replenishment
tblOffRoadEquipment	PhaseName		Spawning Gravel Replenishment
tblOffRoadEquipment	PhaseName		Spawning Gravel Replenishment
tblOffRoadEquipment	PhaseName		Site Restoration
tblOffRoadEquipment	PhaseName		Site Restoration

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2034	0.1388	0.7554	1.2243	3.2400e-003	0.5183	0.0226	0.5408	0.1328	0.0226	0.1553	0.0000	281.6280	281.6280	0.0135	0.0000	281.9641
Maximum	**0.1388**	**0.7554**	**1.2243**	**3.2400e-003**	**0.5183**	**0.0226**	**0.5408**	**0.1328**	**0.0226**	**0.1553**	**0.0000**	**281.6280**	**281.6280**	**0.0135**	**0.0000**	**281.9641**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2034	0.1388	0.7554	1.2243	3.2400e-003	0.5183	0.0226	0.5408	0.1328	0.0226	0.1553	0.0000	281.6277	281.6277	0.0135	0.0000	281.9638
Maximum	**0.1388**	**0.7554**	**1.2243**	**3.2400e-003**	**0.5183**	**0.0226**	**0.5408**	**0.1328**	**0.0226**	**0.1553**	**0.0000**	**281.6277**	**281.6277**	**0.0135**	**0.0000**	**281.9638**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
1	7-1-2034	9-30-2034	0.8864	0.8864
		Highest	0.8864	0.8864

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Mobilization	Site Preparation	7/1/2034	7/9/2034	5	5	
2	Spawning Gravel Replenishment	Grading	7/10/2034	9/25/2034	5	56	
3	Floodplain and Side Channel Creation/ Enhancement	Grading	7/10/2034	9/25/2034	5	56	
4	Instream Habitat Structure Placement	Grading	7/10/2034	9/25/2034	5	56	
5	Site Restoration	Building Construction	9/26/2034	9/29/2034	5	4	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

<u>OffRoad Equipment</u>

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Spawning Gravel Replenishment	Dumpers/Tenders	4	8.00	16	0.38
Spawning Gravel Replenishment	Excavators	1	8.00	158	0.38
Spawning Gravel Replenishment	Off-Highway Trucks	2	8.00	150	0.38
Spawning Gravel Replenishment	Other Material Handling Equipment	2	8.00	168	0.40
Spawning Gravel Replenishment	Rubber Tired Dozers	3	8.00	247	0.40
Spawning Gravel Replenishment	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Floodplain and Side Channel Creation/ Enhancement	Excavators	1	8.00	158	0.38
Floodplain and Side Channel Creation/ Enhancement	Rubber Tired Dozers	1	8.00	247	0.40
Floodplain and Side Channel Creation/ Enhancement	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Instream Habitat Structure Placement	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Site Restoration	Graders	1	10.00	187	0.41
Site Restoration	Off-Highway Trucks	3	10.00	150	0.38

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Mobilization	0	23.00	0.00	6.00	10.00	6.50	15.00	LD_Mix	HDT_Mix	HHDT
Spawning Gravel Replenishment	0	15.00	0.00	2,471.00	10.00	6.50	7.00	LD_Mix	HDT_Mix	HHDT
Floodplain and Side Channel Creation/ En	0	0.00	0.00	0.00	0.00	0.00	0.00	LD_Mix	HDT_Mix	HHDT
Instream Habitat Structure Placement	0	0.00	0.00	0.00	0.00	0.00	0.00	LD_Mix	HDT_Mix	HHDT
Site Restoration	0	8.00	0.00	6.00	10.00	6.50	19.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Mobilization - 2034

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total					**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-005	3.7000e-004	1.1000e-004	0.0000	4.0000e-005	0.0000	4.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.1626	0.1626	1.0000e-005	0.0000	0.1629
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.0000e-005	4.0000e-005	5.9000e-004	0.0000	4.2000e-004	0.0000	4.2000e-004	1.1000e-004	0.0000	1.1000e-004	0.0000	0.2428	0.2428	0.0000	0.0000	0.2429
Total	**9.0000e-005**	**4.1000e-004**	**7.0000e-004**	**0.0000**	**4.6000e-004**	**0.0000**	**4.6000e-004**	**1.2000e-004**	**0.0000**	**1.2000e-004**	**0.0000**	**0.4055**	**0.4055**	**1.0000e-005**	**0.0000**	**0.4058**

3.2 Mobilization - 2034

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total					**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-005	3.7000e-004	1.1000e-004	0.0000	4.0000e-005	0.0000	4.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.1626	0.1626	1.0000e-005	0.0000	0.1629
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.0000e-005	4.0000e-005	5.9000e-004	0.0000	4.2000e-004	0.0000	4.2000e-004	1.1000e-004	0.0000	1.1000e-004	0.0000	0.2428	0.2428	0.0000	0.0000	0.2429
Total	**9.0000e-005**	**4.1000e-004**	**7.0000e-004**	**0.0000**	**4.6000e-004**	**0.0000**	**4.6000e-004**	**1.2000e-004**	**0.0000**	**1.2000e-004**	**0.0000**	**0.4055**	**0.4055**	**1.0000e-005**	**0.0000**	**0.4058**

3.3 Spawning Gravel Replenishment - 2034

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.3726	0.0000	0.3726	0.0953	0.0000	0.0953	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1007	0.4669	0.8672	2.0900e-003		0.0170	0.0170		0.0170	0.0170	0.0000	178.4579	178.4579	8.1000e-003	0.0000	178.6603
Total	**0.1007**	**0.4669**	**0.8672**	**2.0900e-003**	**0.3726**	**0.0170**	**0.3897**	**0.0953**	**0.0170**	**0.1123**	**0.0000**	**178.4579**	**178.4579**	**8.1000e-003**	**0.0000**	**178.6603**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.6100e-003	0.1185	0.0265	3.7000e-004	7.3000e-003	1.2000e-004	7.4200e-003	2.0000e-003	1.2000e-004	2.1200e-003	0.0000	36.3781	36.3781	2.5000e-003	0.0000	36.4406
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.1000e-004	3.0000e-004	4.3200e-003	2.0000e-005	3.0800e-003	1.0000e-005	3.1000e-003	8.2000e-004	1.0000e-005	8.3000e-004	0.0000	1.7738	1.7738	2.0000e-005	0.0000	1.7743
Total	**3.2200e-003**	**0.1188**	**0.0309**	**3.9000e-004**	**0.0104**	**1.3000e-004**	**0.0105**	**2.8200e-003**	**1.3000e-004**	**2.9500e-003**	**0.0000**	**38.1519**	**38.1519**	**2.5200e-003**	**0.0000**	**38.2149**

3.3 Spawning Gravel Replenishment - 2034

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.3726	0.0000	0.3726	0.0953	0.0000	0.0953	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1007	0.4669	0.8672	2.0900e-003		0.0170	0.0170		0.0170	0.0170	0.0000	178.4577	178.4577	8.1000e-003	0.0000	178.6601
Total	**0.1007**	**0.4669**	**0.8672**	**2.0900e-003**	**0.3726**	**0.0170**	**0.3897**	**0.0953**	**0.0170**	**0.1123**	**0.0000**	**178.4577**	**178.4577**	**8.1000e-003**	**0.0000**	**178.6601**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.6100e-003	0.1185	0.0265	3.7000e-004	7.3000e-003	1.2000e-004	7.4200e-003	2.0000e-003	1.2000e-004	2.1200e-003	0.0000	36.3781	36.3781	2.5000e-003	0.0000	36.4406
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.1000e-004	3.0000e-004	4.3200e-003	2.0000e-005	3.0800e-003	1.0000e-005	3.1000e-003	8.2000e-004	1.0000e-005	8.3000e-004	0.0000	1.7738	1.7738	2.0000e-005	0.0000	1.7743
Total	**3.2200e-003**	**0.1188**	**0.0309**	**3.9000e-004**	**0.0104**	**1.3000e-004**	**0.0105**	**2.8200e-003**	**1.3000e-004**	**2.9500e-003**	**0.0000**	**38.1519**	**38.1519**	**2.5200e-003**	**0.0000**	**38.2149**

3.4 Floodplain and Side Channel Creation/ Enhancement - 2034

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1346	0.0000	0.1346	0.0345	0.0000	0.0345	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0275	0.1335	0.2299	5.8000e-004		4.5800e-003	4.5800e-003		4.5800e-003	4.5800e-003	0.0000	49.5779	49.5779	2.2200e-003	0.0000	49.6335
Total	**0.0275**	**0.1335**	**0.2299**	**5.8000e-004**	**0.1346**	**4.5800e-003**	**0.1392**	**0.0345**	**4.5800e-003**	**0.0391**	**0.0000**	**49.5779**	**49.5779**	**2.2200e-003**	**0.0000**	**49.6335**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Floodplain and Side Channel Creation/ Enhancement - 2034

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1346	0.0000	0.1346	0.0345	0.0000	0.0345	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0275	0.1335	0.2299	5.8000e-004		4.5800e-003	4.5800e-003		4.5800e-003	4.5800e-003	0.0000	49.5778	49.5778	2.2200e-003	0.0000	49.6334
Total	**0.0275**	**0.1335**	**0.2299**	**5.8000e-004**	**0.1346**	**4.5800e-003**	**0.1392**	**0.0345**	**4.5800e-003**	**0.0391**	**0.0000**	**49.5778**	**49.5778**	**2.2200e-003**	**0.0000**	**49.6334**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Instream Habitat Structure Placement - 2034

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	4.8200e-003	0.0288	0.0657	1.1000e-004		5.3000e-004	5.3000e-004		5.3000e-004	5.3000e-004	0.0000	9.1375	9.1375	3.9000e-004	0.0000	9.1472
Total	**4.8200e-003**	**0.0288**	**0.0657**	**1.1000e-004**	**0.0000**	**5.3000e-004**	**5.3000e-004**	**0.0000**	**5.3000e-004**	**5.3000e-004**	**0.0000**	**9.1375**	**9.1375**	**3.9000e-004**	**0.0000**	**9.1472**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Instream Habitat Structure Placement - 2034

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	4.8200e-003	0.0288	0.0657	1.1000e-004		5.3000e-004	5.3000e-004		5.3000e-004	5.3000e-004	0.0000	9.1375	9.1375	3.9000e-004	0.0000	9.1472
Total	**4.8200e-003**	**0.0288**	**0.0657**	**1.1000e-004**	**0.0000**	**5.3000e-004**	**5.3000e-004**	**0.0000**	**5.3000e-004**	**5.3000e-004**	**0.0000**	**9.1375**	**9.1375**	**3.9000e-004**	**0.0000**	**9.1472**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Site Restoration - 2034

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	2.4600e-003	6.5600e-003	0.0297	7.0000e-005		2.7000e-004	2.7000e-004		2.7000e-004	2.7000e-004	0.0000	5.6300	5.6300	2.0000e-004	0.0000	5.6349
Total	**2.4600e-003**	**6.5600e-003**	**0.0297**	**7.0000e-005**		**2.7000e-004**	**2.7000e-004**		**2.7000e-004**	**2.7000e-004**	**0.0000**	**5.6300**	**5.6300**	**2.0000e-004**	**0.0000**	**5.6349**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-005	4.1000e-004	1.3000e-004	0.0000	5.0000e-005	0.0000	5.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.1998	0.1998	1.0000e-005	0.0000	0.2001
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.0000e-005	1.0000e-005	1.6000e-004	0.0000	1.2000e-004	0.0000	1.2000e-004	3.0000e-005	0.0000	3.0000e-005	0.0000	0.0676	0.0676	0.0000	0.0000	0.0676
Total	**3.0000e-005**	**4.2000e-004**	**2.9000e-004**	**0.0000**	**1.7000e-004**	**0.0000**	**1.7000e-004**	**4.0000e-005**	**0.0000**	**4.0000e-005**	**0.0000**	**0.2673**	**0.2673**	**1.0000e-005**	**0.0000**	**0.2676**

3.6 Site Restoration - 2034

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	2.4600e-003	6.5600e-003	0.0297	7.0000e-005		2.7000e-004	2.7000e-004		2.7000e-004	2.7000e-004	0.0000	5.6300	5.6300	2.0000e-004	0.0000	5.6349
Total	**2.4600e-003**	**6.5600e-003**	**0.0297**	**7.0000e-005**		**2.7000e-004**	**2.7000e-004**		**2.7000e-004**	**2.7000e-004**	**0.0000**	**5.6300**	**5.6300**	**2.0000e-004**	**0.0000**	**5.6349**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-005	4.1000e-004	1.3000e-004	0.0000	5.0000e-005	0.0000	5.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.1998	0.1998	1.0000e-005	0.0000	0.2001
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.0000e-005	1.0000e-005	1.6000e-004	0.0000	1.2000e-004	0.0000	1.2000e-004	3.0000e-005	0.0000	3.0000e-005	0.0000	0.0676	0.0676	0.0000	0.0000	0.0676
Total	**3.0000e-005**	**4.2000e-004**	**2.9000e-004**	**0.0000**	**1.7000e-004**	**0.0000**	**1.7000e-004**	**4.0000e-005**	**0.0000**	**4.0000e-005**	**0.0000**	**0.2673**	**0.2673**	**1.0000e-005**	**0.0000**	**0.2676**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
User Defined Recreational	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
User Defined Recreational	10.00	5.00	6.50	0.00	0.00	0.00	0	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
User Defined Recreational	0.568817	0.036545	0.209097	0.111572	0.015710	0.004830	0.018344	0.024276	0.001951	0.001803	0.005698	0.000617	0.000741

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
User Defined Recreational	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
User Defined Recreational	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Appendix G. Biological Resources Technical Report

GEI Consultants

March 25, 2019

Lilly Allen
Sacramento Water Forum
915 I Street
Sacramento, CA 95814

Geotechnical
Environmental
Water Resources
Ecological

Subject: Biological Resources Technical Report for the Lower American River Spawning Gravel Augmentation and Habitat Improvement Project

Dear Ms. Allen:

The City of Sacramento (City) is conducting studies to support the Lower American River Spawning Gravel Augmentation and Habitat Improvement Project (proposed action or proposed project). GEI Consultants, Inc. (GEI) conducted a desktop investigation of the proposed restoration sites and borrow sites and analysis of potential significant impacts of the project on biological resources. This letter report describes habitat types present on the restoration and borrow sites, including potential waters of the United States; evaluates habitat suitability and potential for special-status species to occur on, or adjacent to, the restoration and borrow sites; and evaluates potential for special-status species and sensitive habitats to be significantly impacted by implementing the proposed action.

Project Location

The proposed action would be implemented at various sites on the lower American River, below Lake Natoma and above the confluence with the Sacramento River, from approximately River Mile (RM) 23 downstream to RM 13, in Sacramento County (**Attachment A, Figure 1**). The restoration and borrow sites are on the Folsom, Citrus Heights, and Carmichael 7.5-minute U.S. Geological Survey (USGS) Quadrangles, Township 9 North, Range 6 and 7 East (**Attachment A, Figure 2**).

Desktop Investigation

The desktop investigation included review of existing documentation for prior gravel augmentation in the lower American River, completed by the City of Sacramento (City), Sacramento Area Water Forum (Water Forum) and U.S. Department of the Interior, Bureau of Reclamation (Reclamation), and other available sources of information on biological resources in the project vicinity.

The California Department of Fish and Wildlife (CDFW) California Natural Diversity Database (CNDDB) (CDFW 2019) and the California Native Plant Society (CNPS) online Inventory of Rare and Endangered Vascular Plants of California (CNPS 2019) were reviewed. These reviews were centered on the Folsom, Citrus Heights, and Carmichael USGS 7.5-minute quadrangles and included the eight surrounding quadrangles. Database search results are provided in **Attachment B**. A list of resources under jurisdiction of the U.S. Fish and Wildlife Service (USFWS) that could occur in the project vicinity was obtained from the USFWS Information for Planning and Conservation (IPaC) website (USFWS 2019a), and the National Marine Fisheries Service (NMFS) California Species List Tools (NMFS 2018) was queried for Federally listed anadromous fish populations have been documented in the Folsom, Citrus Heights, or Carmichael USGS

GEI Consultants, Inc.
2868 Prospect Park Drive, Suite 400, Rancho Cordova, CA 95670
916.631.4500 fax 916.634.4501

quadrangle. The IPaC and NMFS resource lists are provided in **Attachment B**. Aerial imagery on Google Earth®, National Wetlands Inventory data, and the Natural Resources Conservation Service *Soil Survey of Sacramento County, California* (NRCS 2017) also were reviewed.

Environmental Setting

Elevation of the project study area ranges from approximately 50 feet above mean sea level at the downstream end of the River Bend restoration site to approximately 200 feet at the upstream end of the Mississippi Bar borrow site (**Attachment A, Figure 2**).

Habitat Types

Habitat types on the restoration sites include valley oak woodland, mixed riparian forest, and willow scrub. The borrow sites are primarily barren and composed of dredge tailings. The habitat descriptions below are based on the wetland delineation report prepared for the *Lower American River Anadromous Fish Habitat Restoration Program* (Reclamation 2015) and the *American River Gravel Augmentation Project* (Water Forum 2008). The American River flows through the restoration sites and is described below under "Sensitive Habitats". Seasonal wetland habitats were previously identified in dredge tailing piles on the borrow sites and are also described below under "Sensitive Habitats".

Valley Oak Woodland

Valley oak woodland is typically common on floodplain terraces higher and farther from the main channel than other riparian plant communities. Mature valley oaks (*Quercus lobata*) dominate this plant community. Oak spacing is variable, ranging from open to closed canopy. The mature oaks range from medium to large, approximately 15–35 meters tall. Below the open oak canopy, the grass and forb understory is often dominated by creeping rye grass (*Leymus triticoides*) and nonnative invasive grasses. Shrubs interspersed among the oaks may include blue elderberry (*Sambucus nigra* ssp. *caerulea*), coyote brush (*Baccharis salicifolia*), and poison oak (*Toxicodendron diversilobum*). Riparian trees are infrequent, but may include box elder (*Acer negundo*), Oregon ash (*Fraxinus latifolia*), and Fremont cottonwood (*Populus fremontii*).

Mixed Riparian Forest

Low on the floodplain and close to the main channel, valley oak woodland transitions to mixed riparian forest. In mixed riparian forest, very tall oaks are less common, and the frequency of sapling oaks is higher. A mid-story canopy layer is present and composed of medium-sized trees and tall shrubs, such as western sycamore (*Platanus racemosa*) and box elder. The understory contains a greater proportion of smaller shrubs than in valley oak woodland. Mixed riparian forest along the lower American River is dominated by mature cottonwoods, Oregon ash, box elder, black willow (*Salix gooddingii*), and red willow (*S. laevigata*). Willow shrubs, including narrowleaf (*S. exigua*) and arroyo (*S. lasiolepis*) willows, may also be present but are most frequently encountered near the top of the channel bank. Where there are openings in the overstory, dense patches of California mugwort (*Artemisia douglasiana*) and California wild rose (*Rosa californica*) may form. Canopy openings also provide suitable habitat for aggressive vines such as Himalayan blackberry (*Rubus armeniacus*) and native California grape (*Vitis californica*).

Willow Scrub

Along the top of the channel bank, mixed riparian forest becomes dominated by willows, as the frequency and duration of flooding increases. Willow scrub communities are composed of young, newly established willows and cottonwoods that can survive the frequent physical battering and flood inundation. Narrowleaf willow is common along the channel edge and forms dense thickets on in-channel point bars. The presence of willows allows fine sediments to accumulate and additional riparian plants to establish. Willow scrub communities are early successional habitats because they are the first plant communities to form on newly established point bars along rivers and require disturbance for seed germination.

Fish and Wildlife

Fish and wildlife populations that use the lower American River and associated riparian corridor have been highly altered by past levee construction, urban and suburban development, and other land use conversions. Most of the American River floodplain and its riparian habitats, permanent and seasonal wetlands, and oak woodlands and savannas had been lost, and the wide diversity and large numbers of associated native fish and wildlife species have been greatly reduced. The abundance of species restricted to natural habitats has decreased, and in some cases particular species are no longer found. However, the remnant native habitats of the American River Parkway have allowed some fish and wildlife populations to persist. The project study area provides habitat for many common birds, amphibian, reptiles, and mammals, particularly those that are able to use the narrow corridors of remnant natural vegetation. Wider portions of the parkway and areas with more diversity in native habitat types and vegetation structure likely to support a greater diversity of wildlife species.

A variety of fish species are known or have potential to occur in the lower 23 miles of the American River from Nimbus Dam to the Sacramento River, including backwaters and dredge ponds (**Table 1**). Approximately half of these species are game fish.

Table 1. Central Valley Native and Nonnative Fish Species with Potential to Occur in the Lower American River

Common Name	Scientific Name	Origin
Lamprey (two species)	*Lampetra spp.*	Native
Chinook Salmon (winter, spring, fall, and late fall runs)	*Oncorhynchus tshawytscha*	Native
Chum salmon	*Oncorhynchus keta*	Native
Steelhead/rainbow trout	*Oncorhynchus mykiss*	Native
White sturgeon	*Acipenser transmontanus*	Native
Green sturgeon	*Acipenser medirostris*	Native
Delta smelt	*Hypomesus transpacificus*	Native
Wakasagi	*Hypomesus nipponensis*	Nonnative
Sacramento sucker	*Catostomus occidentalis*	Native
Sacramento pikeminnow	*Ptychocheilus grandis*	Native
Sacramento splittail	*Pogonichthys macrolepidotus*	Native
Sacramento blackfish	*Orthodon microlepidotus*	Native
Hardhead	*Mylopharodon conocephalus*	Native
Speckled dace	*Rhinichthys osculus*	Native
California roach	*Lavinia symmetricus*	Native
Hitch	*Lavinia exilicauda*	Native
Golden shiner	*Notemigonus crysoleucas*	Nonnative
Fathead minnow	*Pimephales promelas*	Nonnative
Goldfish	*Carassius auratus*	Nonnative
Carp	*Cyprinus carpio*	Nonnative
Threadfin shad	*Dorosoma petenense*	Nonnative

Table 1. Central Valley Native and Nonnative Fish Species with Potential to Occur in the Lower American River

Common Name	Scientific Name	Origin
American shad	*Alosa sapidissima*	Nonnative
Black bullhead	*Ameiurus melas*	Nonnative
Brown bullhead	*Ameiurus nebulosus*	Nonnative
White catfish	*Ameiurus catus*	Nonnative
Channel catfish	*Ictalurus punctatus*	Nonnative
Mosquito fish	*Gambusia affinis*	Nonnative
Inland silverside	*Menidia audena*	Nonnative
Threespine stickleback	*Gasterosteus aculaetus*	Native
Striped bass	*Morone saxatilis*	Nonnative
Bluegill	*Lepomis macrochirus*	Nonnative
Green sunfish	*Lepomis cyanellus*	Nonnative
Redear sunfish	*Lepomis microlophus*	Nonnative
Warmouth	*Lepomis gulosus*	Nonnative
White crappie	*Pomoxis annularis*	Nonnative
Black crappie	*Pomoxis nigromaculatus*	Nonnative
Largemouth bass	*Micropterus salmoides*	Nonnative
Redeye bass	*Micropterus coosae*	Nonnative
Spotted bass	*Micropterus punctulatus*	Nonnative
Small mouth bass	*Micropterus dolomieu*	Nonnative
Bigscale logperch	*Percina macrolepida*	Nonnative
Prickly sculpin	*Cottus asper*	Native
Tule perch	*Hysterocarpus traski*	Native

Source: Snider, B., and R.G. Titus. 2000.

Sensitive Biological Resources

Sensitive biological resources addressed in this assessment include those that are afforded consideration or protection under the California Environmental Quality Act (CEQA), California Fish and Game Code (FGC), California Endangered Species Act (CESA), Federal Endangered Species Act (ESA), Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), Clean Water Act (CWA), and Porter-Cologne Water Quality Control Act (Porter-Cologne Act).

Special-status Species

For the purposes of this assessment, special-status species include plants and animals that fall into any of the following categories:

- species officially listed by the Federal government or the State of California as endangered, threatened, or rare;
- candidate species for Federal or State listing as endangered or threatened;
- species proposed for Federal or State listing as endangered or threatened;
- taxa (i.e., taxonomic categories or groups) that meet the criteria for listing;

- wildlife species identified by CDFW as species of special concern and plant taxa considered by CDFW to be "rare, threatened, or endangered in California;"
- species listed as Fully Protected under the FGC; or
- species afforded protection under local or regional planning documents.

Plant taxa are assigned by CDFW to one of the following six California Rare Plant Ranks (CRPRs):

- CRPR 1A—Plants presumed to be extinct in California;
- CRPR 1B—Plants that are rare, threatened, or endangered in California and elsewhere;
- CRPR 2A—Plants that are presumed extirpated in California, but are more common elsewhere;
- CRPR 2B—Plants that are rare, threatened, or endangered in California but more common elsewhere;
- CRPR 3—Plants about which more information is needed (a review list); or
- CRPR 4—Plants of limited distribution (a watch list).

All plants with a CRPR are considered "special plants" by CDFW. The term "special plants" is a broad term used by CDFW to refer to all plant taxa inventoried in the CNDDB, regardless of their legal or protection status. As indicated above, only plant taxa considered by CDFW to be "rare, threatened, or endangered in California" (i.e., CRPR 1B and 2B plants) are considered special-status for purposes of this analysis. CDFW applies the term "California species of special concern" to fish and wildlife species that are not listed under CESA but that are nonetheless declining at a rate that could result in listing, or that historically occurred in low numbers and are subject to current known threats to their persistence.

Figure 3 and Figure 4 in **Attachment A** show all CNDDB occurrences of plant and wildlife species that meet the definition of special-status species described above that have been documented within 3 miles of the restoration and borrow sites. Results of the CNDDB search (see **Attachment B**) yielded occurrences of 21 special-status plants and animals in the Carmichael, Citrus Heights, and Folsom USGS quadrangles, 18 of which have been documented within 3 miles of the restoration and borrow sites. (Note: Not all species tracked in the CNDDB and included in the search results in Attachment B meet the definition of a special-status species described above.)

Eight fish and wildlife species and two plant species listed as "threatened" or "endangered" under ESA are included on the IPaC list. The NMFS species lists indicate that three Federally listed anadromous fish populations occur in the Folsom, Citrus Heights, and Carmichael USGS quadrangles.

Special-status Plants

Table 2 provides information on special-status plant species that were evaluated for potential to occur on the restoration or borrow sites. Species included in the CNDDB or CNPS search results, but that occupy elevation ranges higher or lower than the elevation of the restoration or borrow sites or otherwise could be determined to have no potential to occur in the project vicinity, were eliminated from consideration and are not included in Table 2. Based on the review of existing documentation and knowledge of the local setting, the potential for special-status plant species to occur within the restoration sites is limited to Sanford's arrowhead (*Sagittaria sanfordii*).

Table 2. Special-status Plants Evaluated for Potential to Occur on the Restoration or Borrow Sites

Species	Blooming Period	Status[1] Federal	State	Habitat Associations	Potential to Occur on the Restoration or Borrow Sites
Dwarf downingia *pusilla*	March–May	–	2B.2	Vernal pools and similar seasonal wetlands in valley and foothill grassland	None; no suitable habitat is present on the restoration or borrow sites.
Boggs Lake hedge-hyssop *Gratiola heterosepala*	April–August	–	SE 1B.2	Lake margins and vernal pools on clay soils	None; no suitable habitat is present on the restoration or borrow sites.
Ahart's dwarf rush *Juncus leiospermus* var. *ahartii*	March–May	–	1B.2	Vernal pool margins and swales in valley and foothill grassland, often on gopher mounds	None; no suitable habitat is present on the restoration or borrow sites.
Legenere *limosa*	April–June	–	1B.1	Vernal pools	None; no suitable habitat is present on the restoration or borrow sites.
Pincushion navarretia *myersii* ssp. *myersii*	April–May	–	1B.1	Vernal pools, often on acidic soils	None; no suitable habitat is present on the restoration or borrow sites.
Slender Orcutt grass *Orcuttia tenuis*	May–September	FT	SE 1B.1	Vernal pools, often on gravelly soils	None; no suitable habitat is present on the restoration or borrow sites.
Sacramento Orcutt grass *Orcuttia viscida*	April-July	FE	SE 1B.1	Vernal pools	None; no suitable habitat is present on the restoration or borrow sites.
Sanford's arrowhead *Sagittaria sanfordii*	May–October	–	1B.2	Assorted shallow freshwater marshes and swamps; generally, occurs in standing or slow-moving freshwater ponds, marshes, ditches, and sloughs	Low; suitable habitat is restricted to slow moving or ponded water located off the main channel of the lower American River; nearest known occurrence is in a concrete lined drainage channel along the south bank of the river upstream of Ancil Hoffman Park.

[1] **Status Definitions**
– = No status

Federal Status
FE = Listed as Endangered under the Federal Endangered Species Act
FT = Listed as Threatened under the Federal Endangered Species Act

State Status
SE = Listed as Endangered under the California Endangered Species Act

California Rare Plant Ranks
1B = Plant species considered rare or endangered in California and elsewhere
2B = Plant species considered rare or endangered in California but more common elsewhere

California Rare Plant Rank Extensions
.1 = Seriously endangered in California (greater than 80 percent of occurrences are threatened and/or have a high degree and immediacy of threat)
.2 = Fairly endangered in California (20 to 80 percent of occurrences are threatened and/or have a moderate degree and immediacy of threat)

Sources: CDFW 2019; CNPS 2019; USFWS 2019a; data compiled by GEI Consultants, Inc. in 2019

Special-status Wildlife

Table 3 provides information on special-status aquatic and terrestrial wildlife species that were evaluated for potential to occur on or adjacent to the restoration or borrow sites. Based on the review of existing documentation and knowledge of the local setting, a number of species are known to or have moderate to high potential to occur on or adjacent to the restoration and/or borrow sites.

Table 3. Special-status Wildlife Evaluated for Potential to Occur on or Adjacent to the Restoration or Borrow Sites

Species	Status: Federal	Status: State	Habitat Associations	Potential to Occur on or Adjacent to the Restoration or Borrow Sites
Invertebrates				
Vernal pool fairy shrimp *Branchinecta lynchi*	FT	–	Vernal pools and other seasonal wetlands, typically small but including a wide range of sizes	Known to occur; one occurrence was documented in wetlands near dredge tailings at the Sailor Bar borrow site, near Illinois Avenue.
Valley elderberry longhorn beetle Desmocerus californicus dimorphus	FT	–	Closely associated with blue elderberry (*Sambucus* sp.), which is an obligate host for the beetle larvae	Known to occur; suitable habitat is present and occurrences have been documented at multiple locations on or adjacent to the restoration sites; four sites between RM 14 and RM 17 are within designated critical habitat.
Vernal pool tadpole shrimp *Lepidurus packardi*	FE	–	Vernal pools and other seasonal wetlands, typically medium to large but including a wide range of sizes with relatively long inundation period	Moderate; could occur in wetlands in dredge tailings at the borrow sites, if these wetlands provide suitable habitat conditions.
Amphibians				
California red-legged frog *Rana draytonii*	FT	SSC	Lowlands and foothill streams, and marshes; requires permanent or late season sources of deep water with dense, shrubby, riparian, or emergent vegetation for breeding	None; no suitable habitat is present on or adjacent to the restoration or borrow sites.
Western spadefoot *Spea hammondii*	–	SSC	Vernal pools and other seasonal wetlands in valley and foothill grasslands	None; no suitable habitat is present on or adjacent to the restoration or borrow sites.

Table 3. Special-status Wildlife Evaluated for Potential to Occur on or Adjacent to the Restoration or Borrow Sites

Species	Status: Federal	Status: State	Habitat Associations	Potential to Occur on or Adjacent to the Restoration or Borrow Sites
Reptiles				
Western pond turtle *Emys marmorata*	–	SSC	A variety of permanent or nearly permanent water bodies, typically deep water, in a wide range of habitats; nests in sunny upland habitats, typically within several hundred feet of aquatic habitat	Known to occur; American River provides suitable aquatic habitat; potential basking habitat occurs along the shorelines, and potential nesting habitat occurs in adjacent suitable uplands.
Giant garter snake *Thamnophis gigas*	FT	ST	Freshwater marsh, agricultural wetlands, irrigation/drainage canals, sloughs, ponds, low gradient streams, and adjacent uplands	None; no suitable habitat is present on or adjacent to the restoration or borrow sites.
Birds				
Tricolored blackbird *Agelaius tricolor*	–	CE, SSC	Nests in freshwater marsh, riparian scrub, grain crops, and other dense, low vegetation and forages in grasslands and agricultural fields	None; nesting colonies do not occur in willow scrub along the lower American River, and no other suitable habitat is present on or adjacent to the restoration or borrow sites.
Grasshopper sparrow *Ammodramus savannarum*	–	SSC	Nests and forages in grasslands, with a mix of grasses, forbs, and scattered shrubs, on rolling hills and lowland plains	None; no suitable habitat is present on or adjacent to the restoration or borrow sites.
Golden eagle *Aquila chrysaetos*	–	FP	Variety of habitats in foothills, mountains, high plains, and dessert; primarily nests on cliffs in steep canyons, but also in large trees in open areas	Low; does not nest in the immediate vicinity, but transient and other non-breeding individuals could occasionally occur in the area.
Burrowing owl *Athene cunicularia*	–	SSC	Nests and forages in grasslands, agricultural lands, open shrublands, and open woodlands with natural or artificial burrows or friable soils	Low; marginally suitable habitat is present adjacent to the borrow sites.
Swainson's hawk *Buteo swainsoni*	–	ST	Nests in woodlands and scattered trees and forages in grasslands and agricultural fields	Known to occur; has nested at Ancil Hoffman Park, and suitable nest trees are available throughout the lower American River.

Table 3. Special-status Wildlife Evaluated for Potential to Occur on or Adjacent to the Restoration or Borrow Sites

Species	Status		Habitat Associations	Potential to Occur on or Adjacent to the Restoration or Borrow Sites
	Federal	State		
Western yellow-billed cuckoo *Coccyzus americanus*	FT		Riparian forest with dense deciduous trees and shrubs	Low; does not nest along the lower American River, but migrant individuals could occur in transit to breeding sites farther north.
White-tailed kite *Elanus leucurus*	–	FP	Nests in woodlands and isolated trees and forages in grasslands, pasture, and agricultural fields	Known to occur; several nests have been documented in the study area.
Bald eagle *Haliaeetus leucocephalus*	–	SE, FP	Coastal shorelines and wetlands, lakes, reservoirs, and rivers. Nests in large trees, typically in mountain and foothill forests and woodlands near reservoirs, lakes, and rivers	Moderate; not known to nest downstream of Lake Natoma, but the restoration sites provide suitable foraging habitat.
Purple martin *Progne subis*	–	SSC	Deciduous woodland and coniferous forest; typically nests in old woodpecker cavities in tall, isolated tree or snag; also nests in human-made structures	Moderate; not known to nest along the lower American River, but bridges over the river and snags throughout the study area could provide suitable nest sites; could forage over project and borrow sites.
Bank swallow *Riparia*	–	ST	Forages in a variety of habitats and nests in vertical banks or bluffs of suitable soil, typically adjacent to water	Known to occur; nest colonies have been documented upstream and downstream of Sunrise Boulevard; could nest at project and borrow sites if suitable habitat is present; could forage over restoration and borrow sites.
Mammals				
Pallid bat *Antrozous pallidus*	–	SSC	Variety of habitats, including woodland, forest, grassland, and desert; roosts in tree cavities, rock crevices, mines, caves, and human structures.	Moderate; has not been documented recently in the project vicinity, but riparian forest and oak woodland at the restoration sites and nearby bridges could provide suitable roost sites; could forage over restoration and borrow sites.
American badger *Taxidea taxus*	–	SSC	Arid, open grassland, shrubland, and woodland with soils suitable for burrowing.	Low; marginally suitable habitat is present adjacent to the borrow sites, but this species typically avoids urban and suburban environments.

Table 3. Special-status Wildlife Evaluated for Potential to Occur on or Adjacent to the Restoration or Borrow Sites

Species	Status: Federal	Status: State	Habitat Associations	Potential to Occur on or Adjacent to the Restoration or Borrow Sites

[1] **Status Definitions**

– = No status

Federal Status
FE = Listed as Endangered under the Federal Endangered Species Act
FT = Listed as Threatened under the Federal Endangered Species Act

State Status
CE = Candidate for Listing as Endangered under the California Endangered Species Act
FP = Fully Protected under the California Fish and Game Code
SE = Listed as Endangered under the California Endangered Species Act
SSC = California Species of Special Concern
ST = Listed as Threatened under the California Endangered Species Act

Sources: CDFW 2018; GEI data 2018; USFWS 2018a

Special-status Fish

The following Federally and State-listed fish could occur at the restoration sites:

- California Central Valley steelhead (*Oncorhynchus mykiss*) distinct population segment (DPS) – Federally threatened
- Sacramento River winter-run Chinook salmon (*O. tshawytscha*) evolutionarily significant unit (ESU) – Federally and State endangered
- Central Valley spring-run Chinook salmon (*O. tshawytscha*) ESU – Federally and State threatened

In addition to these threatened or endangered species, Central Valley fall-run Chinook salmon (*O. tshawytscha*), river lamprey (*Lampetra fluviatilis*), and hardhead (*Mylopharodon conocephalus*), all of which are California species of special concern, also could occur at the restoration sites. **Table 4** presents the temporal occurrence in the lower Sacramento River of special-status anadromous salmonids likely to occur at the restoration sites.

Despite modeling predictions indicating suitable habitat for Southern DPS of North American green sturgeon (*Acipenser medirostris*) occurs in the lower American River, no green sturgeon have been documented in the watershed (Mora et al. 2009, Beamesderfer et al. 2004). Considering the high level of recreational use and multi-year fishery monitoring efforts in the lower American River, the absence of any reported green sturgeon observations indicates an extremely low likelihood of green sturgeon presence on the restoration sites; therefore, this species is not addressed further in this document. In years of high flow, during early winter, Sacramento splittail (*Pogonichthys macrolepidotus*) may enter the American River and spawn in the lower reaches in areas of over-bank flooding, and various life stages of Sacramento splittail may inhabit the lower reaches of the river from December through May. However, because these spawning and rearing areas are well downstream of the restoration sites, this species also is not addressed further.

Recent steelhead monitoring data are scarce for the Lower American River system. The in-river population is small, with observations of a few hundred adult steelhead returning to spawn in the American River each year. During relatively recent observations (2003-2005, 2007), the presence of some spawning steelhead with adipose fins indicates that some in-river spawners are of wild origin (Hannon 2013). However, these wild origin fish are likely progeny of hatchery fish, because the in-river population is likely entirely made up of Nimbus Fish Hatchery steelhead or their descendants (NMFS 2009). Juvenile rainbow/steelhead trout primarily use riffles and fast water habitats. As a result, there is a low likelihood that juvenile steelhead will be present in unrestored restoration sites before or during project activities.

Historically, there was no Sacramento River winter-run Chinook salmon ESU spawning population in the American River. However, small numbers of putative winter-run Chinook salmon juveniles have been captured in a rotary screw trap deployed at approximately RM 9, just downstream of the Watt Avenue Bridge (1995-1999, 2013, and 2014) (PSMFC 2014a,b; Snider and Payne 1998; Snider and Titus 2000, 2001). This indicates that some nonnatal rearing may occur in the lower American River. Most of these juveniles have been captured from January through March, with some captured as early as December and as late as April. Based on observed capture periods and warm temperatures during the summer months, nonnatal rearing is not anticipated to occur before November.

Table 4. Temporal Occurrence of Special-status Anadromous Salmonids in the Lower American River

Species	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
California Central Valley Steelhead												
Adult Immigration												
Adult Holding												
Spawning												
Egg Incubation												
Juvenile Rearing												
Juvenile Emigration												
Sacramento River Winter-run Chinook Salmon												
Juvenile Nonnatal Rearing												
Juvenile Emigration												
Central Valley Spring-run Chinook Salmon												
Juvenile Nonnatal Rearing												
Juvenile Emigration												
Central Valley Fall-run Chinook Salmon												
Adult Immigration												
Adult Holding												
Spawning												

Egg Incubation												
Juvenile Rearing												
Juvenile Emigration												

Source: SAFCA 2001; PSMFC 2014a, b; Snider and Payne 1998; Snider and Titus 2000, 2001.

Historically, a Central Valley spring-run Chinook salmon spawning population occurred in the American River, but this population no longer exists due to their inability to access suitable spawning grounds upstream of Nimbus and Folsom dams. However, small numbers of putative spring-run Chinook salmon juveniles have been captured in the RM 9 rotary screw trap (1995-1999, 2013, and 2014) (PSMFC 2014a,b; Snider and Payne 1998; Snider and Titus 2000, 2001). This indicates that some nonnatal rearing may occur within the lower American River. Most of these juveniles have been captured from February through April, with some captured as early as December and as late as May. Based on observed capture periods and warm temperatures during the summer months, nonnatal rearing is not anticipated to occur before November.

Fall-run Chinook salmon spawning in the lower American River is induced by the release of cold water from Folsom Reservoir. Since 2000, 13,500–178,000 fall-run Chinook salmon have returned annually to the lower American River (Healey and Redding 2008). During this period, the hatchery took between 4,500–26,000 salmon; the remaining fish spawned in the river or died or were caught before spawning. Salmon that reach the hatchery diversion weir but do not enter the hatchery are thought to ultimately drop back downstream and spawn. When relatively large numbers of salmon return to spawn, there is insufficient spawning habitat available in the upper portions of the river. Placement of additional spawning gravel will help alleviate this limitation.

Sensitive Habitats

Sensitive habitats include those that are of special concern to resource agencies or are afforded specific consideration through CEQA, ESA, Magnuson-Stevens Act, Section 1602 of the FGC, Section 404 of the CWA, and the Porter-Cologne Act. Sensitive habitats may be of special concern for a variety of reasons, including their locally or regionally declining status, or because they provide important habitat to special-status species.

Critical Habitat and Essential Fish Habitat

Two areas of designated critical habitat for VELB are located on or adjacent to several of the restoration sites, between approximately RM 18 and RM19 and from RM 14.5 to RM 17 (USFWS 2019b). In addition, the American River from the confluence with the Sacramento River to Nimbus Dam is designated as critical habitat for Central Valley steelhead (USFWS 2019b) and Essential Fish Habitat (EFH) for Chinook salmon (NMFS 2018).

Other Habitats Protected under Federal and State Regulations

Under Section 404 of the Federal CWA, the U.S. Army Corps of Engineers (USACE) regulates discharge of dredged or fill material into aquatic features that qualify as waters of the United States; wetlands that support hydrophytic vegetation, hydric soil types, and wetland hydrology may also qualify for USACE jurisdiction under Section 404 of the CWA. Under Section 401 of the CWA, the Central Valley Regional Water Quality Control Board (RWQCB) regulates discharge of dredged or fill material into waters of the United States that drain to the Central Valley, to ensure such activities do not violate State or Federal water quality standards; the Central Valley RWQCB also regulates waters of the State, in compliance with the Porter-Cologne

Act. In addition, all diversions, obstruction, or changes to the natural flow or bed, channel, or bank of any river, stream, or lake in California that supports wildlife resources is subject to the regulatory approval of CDFW pursuant to Section 1602 of the FGC.

The American River is a navigable river from the confluence with the Sacramento River to Bradshaw Road (RM 12). Navigable rivers are subject to regulatory permitting under Section 10 of the Rivers and Harbors Act of 1899. Because all restoration sites are located upstream of RM 13, Section 10 of the Rivers and Harbors Act does not apply to the project.

The lower American River has a well-defined ordinary high-water mark (OHWM) that is readily identifiable by changes in vegetation, scour, water staining, and drift marks. The channel bottom is composed of gravels, cobbles, and unconsolidated sediments. Water depth fluctuates during summer months in this portion of the river, because it is downstream of Nimbus Dam and flows are subject to compliance with Central Valley Project Improvement Act. The lower American River at the restoration sites is a jurisdictional water of the United States subject to regulation under Sections 404 and 401 of the CWA and Section 1602 of the FGC.

Seasonal wetlands located above the plane of the OHWM of the river are known to occur at the borrow sites, notably in concave areas of dredge tailings (Water Forum 2008). These seasonal wetland features are characterized by hydrophytic vegetation, hydric soils, and positive indicators of hydrology, including surface water, saturated soils, and algal matting (Water Forum 2008). Seasonal wetland vegetation is variable along the lower American River, largely due to changes in soil substrate, micro watershed, and aspect, but it is dominated by hydrophytes, including tall flatsedge (*Cyperus eragrostis*), curly dock (*Rumex pulcher*), pale spikerush (*Eleocharis macrostachya*), and rushes (*Juncus* spp.). Seasonal wetland habitats on the borrow sites are subject to regulation under Sections 404 and 401 of the CWA and Section 1602 of the FGC.

Natural Communities of Special Concern

CDFW maintains a list of terrestrial natural communities that are native to California, the *Natural Communities* (CDFW 2018). Within that list, CDFW identifies and ranks natural communities of special concern considered to be highly imperiled. Valley oak woodland and riparian habitats, including those that occur on the restoration sites, are communities of special concern.

Potential Impacts of the Proposed Action

Impacts of the proposed action on biological resources could result from removing gravel from the borrow sites, placing gravel in the American River, creating/enhancing floodplain and side channel habitat, and placing instream habitat structures. All in-channel activities would occur over a 4- to 6-week period in July–September. Although these activities would occur during the low-water season, in-water work could temporarily disturb aquatic biological resources and degrade water quality. Terrestrial impacts are anticipated to be relatively minor. Existing access points and routes to the borrow and restoration sites would be used. Vegetation removal may be required to create side-channels, but is anticipated to be very small (i.e., up to 20 trees at each site over the 16-year duration of the proposed action). It may be necessary to trim some trees along the access routes.

Potential for sensitive biological resources, including special-status species and regulated habitats, to be impacted by implementing the proposed action is evaluated below. This impact discussion focuses on resources with reasonable potential to occur on the restoration or borrow sites during project activities. Therefore, special-status plant and wildlife species that are unlikely to occur, because of a lack of suitable conditions, known extant range of the species, and/or lack of occurrence records, are not addressed in this discussion. Although nonnatal rearing winter-run and spring-run Chinook salmon juveniles can occur seasonally at the restoration sites, they are not present during the construction work window and also are not addressed in this discussion.

Special-status Species

Plants

Sanford's arrowhead is the only special-status plant species with potential to occur in the study area. This plant has three occurrences mapped along the American River, including one occurrence in a concrete lined drainage channel, near the restoration site approximately 0.8 mile downstream of the Rossmoor Drive access point. The other nearby occurrences are along the river, within 3 miles of restoration sites. Ground disturbance at the restoration sites would primarily occur below the OHWM in areas where waters are generally fast moving and well oxygenated. Because Sanford's arrowhead occurs in slow moving waters, it is very unlikely to occur in areas of project-related disturbance, and unlikely to be adversely affected by project implementation. Therefore, this impact would be **less than significant**.

Fisheries

The proposed action includes a suite of habitat modification/restoration activities with the expressed intent to improve conditions for anadromous salmonids in the lower American River. Activities to augment spawning gravel, enhance floodplain and side channel habitats, and place instream habitat structures, are expected to improve habitat and increase spawning and rearing. Monitoring of past gravel placement indicates new spawning habitat for salmonids has been created. Therefore, impacts associated with changes in habitat conditions would be **beneficial**.

Operation of construction equipment in or adjacent to the river presents the risk of a spill of hazardous materials into the river (e.g., construction equipment leaking fluids). Additionally, on-site refueling of construction equipment can result in minor fuel and oil spills. Without rapid containment and clean up, these materials could have deleterious effects on special-status fish within the exposure area. Although juvenile salmonids are highly mobile and thus have the ability to avoid potentially hazardous materials, exposure to such materials could result in mortality of large numbers of special-status fishes and have a substantial adverse effect on local populations. Therefore, this potential impact from project-related increases in pollutant discharge on special-status fish would be **potentially significant**. Implementing Mitigation Measure 1 would reduce this impact to less than significant.

Project activities could result in short-term increases in suspended sediment and turbidity levels and impact fish populations through reduced food availability and feeding efficiency and exposure sediment released into the water column. At high levels, suspended solids can adversely affect the physiology and behavior of aquatic organisms and suppress photosynthetic activity at the base of food webs, affecting aquatic organisms either directly or indirectly (Alabaster and Lloyd 1980). Fish responses to increased turbidity and suspended sediment can range from behavioral changes (alarm reactions, abandonment of cover, and avoidance) to sublethal effects (e.g., reduced feeding rate), and, at high suspended sediment concentrations for prolonged periods, lethal effects (Newcombe and Jensen 1996). If this occurs while embryos are incubating, injury or mortality to incubating eggs or alevins can occur through the infiltration of fine sediment into salmonid redds with a reduction of intra-gravel water circulation and, in severe cases, entombment of salmonid eggs. Deposition of fine sediments in food-producing riffles also can reduce the abundance and availability of aquatic insects on which fish feed and result in loss of cover. Riffle supplementation and floodplain and side channel creation/enhancement require applying the gravel directly to the streambed and/or grading it, thereby disturbing silt and sand on the river bottom and increasing potential for adverse effects.

The amount of sediment that may be re-suspended by project activities is not anticipated to be substantial, and any re-suspension and re-deposition of instream sediments is expected to be localized and temporary. In addition, project activities would primarily occur within the middle of the active channel, where fewer juvenile salmonids are expected to be rearing. Previous studies indicate that juvenile salmonids tend to be found within 10-20 feet of river banks (Allen 2000, FISHBIO and Normandeau Associates 2012, Palmer and Hellmair 2012). Although some rearing and migrating juveniles may be found farther from the banks, the area disturbed by project activities and associated turbidity at any given time is expected to affect less than 40 percent of the river width and to be most concentrated within about 200 feet downstream of the restoration site. Therefore, juvenile salmonids will have opportunities to move to other portions of the channel where they can avoid potential impacts from turbidity increases. In addition, in-work work windows would prevent the siltation of steelhead redds and eggs. However, project-related increases in suspended sediment and turbidity have potential to cause adverse behavioral responses and sublethal and lethal effects, potentially resulting in a substantial adverse effect on local populations of juvenile salmonids and other special-status fish. Therefore, this impact would be **potentially significant**. Implementing Mitigation Measure 2 would reduce this impact to less than significant.

Gravel placement and grading activities for riffle supplementation, excavation activities for floodplain and side channel enhancement, and instream placement of habitat structures have potential to affect special-status fishes through displacement, disruption of normal behaviors, and direct injury or mortality. Rearing habitat for juvenile salmonids is generally well-distributed, allowing for juvenile movement to other areas to avoid the physical disturbance of construction activities. However, fish would not be able to use portions of the river where equipment is actively working or the associated turbidity plume occurs, and displacement may temporarily expose juvenile fish to a greater risk of predation. Although juvenile salmonids are generally expected to avoid areas where equipment is actively placing or excavating gravel, an undetermined number of these and other special-status fishes may attempt to find shelter in the substrate and could be injured or killed by equipment. Placing material in the active channel would generally occur along non-vegetated channel margins where juvenile salmonid presence is expected to be minimal due to the lack of vegetation cover. However, using heavy equipment in areas that are accessible by fish and/or installing temporary stream crossings could result in injury or mortality and have a substantial adverse effect on local populations. Therefore, this potential impact from direct injury or mortality of special-status fish would be **potentially significant**. Implementing Mitigation Measure 3 would reduce the impact to less than significant.

Invertebrates

Vernal pool fairy shrimp (*Branchinecta lynchi*) is known to occur within 3 miles of the restoration and borrow sites, including one occurrence near the Sailor Bar borrow site. This occurrence is from seasonal wetland habitat on the high floodplain terrace (CDFW 2019), outside the area of dredge tailings that would be used as borrow material. Vernal pool tadpole shrimp (*Lepidurus packardi*) has not been documented in this wetland, but it also could occur if habitat conditions are suitable. Based on review of aerial photography and past wetland delineation reports (Water Forum 2008, Reclamation 2015), up to 0.24 acre of seasonal wetland habitat is present on the Sailor Bar and Mississippi borrow sites combined. Seasonal wetlands in tailings on the borrow sites are less likely to be suitable for vernal pool fairy shrimp and vernal pool tadpole shrimp than wetlands on the high floodplain and are not expected to sustain ponded water long enough for either species to complete its lifecycle. However, potential for these species to occur on the borrow sites cannot be entirely excluded. Because project activities would remove material from dredge tailings, seasonal wetland habitat potentially occupied by vernal pool fairy shrimp and vernal pool tadpole shrimp could be removed. This could have a substantial adverse effect on the local populations, depending on the amount of occupied habitat that is affected. Therefore, this potential impact from direct habitat modification would be **potentially significant**. Implementing Mitigation Measures 1, 2, and 6 (identified for impacts on State and Federally protected wetlands discussed below) would reduce this impact to less than significant.

Blue elderberry shrubs, the host plant for VELB larvae, are widely distributed throughout the restoration and borrow sites. There are a number of known occurrences of VELB on or near the sites, and two areas of designated critical habitat for VELB are located on or adjacent to the restoration sites. Project activities would not require removal or trimming of elderberry shrubs, but elderberry shrubs adjacent to the restoration and borrow sites could be indirectly affected. VELB typically emerge from elderberry shrubs in March to July. Because project activities would occur July–September, direct loss of individuals is unlikely to occur. However, indirect impacts on elderberry shrubs could affect habitat quality and larvae that may be present in the shrubs. Depending on the number of shrubs occupied by VELB that are affected, this could have a substantial adverse effect on the local VELB population. Therefore, this potential impact from indirect effects on elderberry shrubs would be **potentially significant**. Implementing Mitigation Measure 4 would reduce the impact to less than significant.

Reptiles

Western pond turtle (*Emys marmorata*) is known to occur along the lower American River and could be present on-site during project activities. Natural basking sites, such as partially submerged logs or rocks, vary in abundance along the lower American River, including at the restoration sites. However, habitat on the restoration and borrow sites is unlikely to be used for nesting, due to unsuitable substrate conditions. Placing gravel in the river could reduce habitat suitability for western pond turtle, but creating/enhancing floodplain and side channel habitat and placing in-stream woody material at restoration sites could improve habitat quality. If individual pond turtles are present on or adjacent to the restoration sites, they are likely to leave affected areas when project activities begin, and extensive areas of equally suitable habitat are present in immediately adjacent areas. Because project activities in a given year would be limited to a very small proportion of the overall project area and large river corridor, the number of individuals potentially affected would be low and is unlikely to substantially affect the local population. Therefore, this impact would be **less than significant**.

Birds

Eight special-status bird species—golden eagle (*Aquila chrysaetos*), bald eagle (*Haliaeetus leucocephalus*), western yellow-billed cuckoo (*Coccyzus americanus*), burrowing owl (*Athene cunicularia*), Swainson's hawk (*Buteo swainsoni*), white-tailed kite (*Elanus leucurus*), bank swallow (*Riparia riparia*), and purple martin (*Progne subis*)—have potential to occur on or adjacent to the restoration and/or borrow sites. Because project activities in a given year would be limited to a very small proportion of the overall project area and equally suitable habitat is relatively abundant in the project vicinity, any potential disruption of foraging activities would be very minor. Swainson's hawk, white-tailed kite, and bank swallow are known to nest on or near the restoration and borrow sites, but the sites generally support little vegetation cover and extensive areas of higher-quality forest and woodland nesting habitat is present along the lower American River. Project activities are anticipated to require limited and selective tree removal where side-channels are created. Tree removal and trimming, if necessary, would be very limited and would not substantially reduce the amount of nesting habitat. Suitable nesting habitat for burrowing owl and bank swallow may be present adjacent to restoration or borrow sites, but the sites themselves are unlikely to provide suitable burrow substrate for either species. However, if active nests of special-status birds are present on or near the restoration or borrow sites, they could be disturbed by heavy equipment operation and construction personnel, potentially resulting in nest abandonment, reduced care of eggs or young, or premature fledging. Depending on the species and number of individuals that are affected, nest failure could have a substantial adverse effect on the local population. Therefore, this potential impact from failure of active nests of special-status birds would be **potentially significant**. Implementing Mitigation Measure 5 would reduce the impact to less than significant.

Mammals

Pallid bats (*Antrozous pallidus*) could forage over the restoration and borrow sites, but foraging activities are unlikely to be disturbed by construction activities. Forest and woodland habitat adjacent to the restoration and borrow sites and in bridges over the river may provide marginally suitable roost sites. However, these areas are not expected to support maternity roosts or other large numbers of roosting individuals, because pallid bats are very sensitive to disturbance of roost sites and may avoid existing disturbance from recreational use and adjacent residential areas. Because project activities would not remove roosting habitat, potential impacts are anticipated to be limited to disturbance of temporary roost sites for small numbers of individuals. This would not have a substantial adverse effect, if a population of pallid bats occurs at the restoration sites. Therefore, this impact would be **less than significant**.

American badger (*Taxidea taxus*) has low potential to occur in grassland and open woodland adjacent to the borrow sites. Although an individual was recently documented near Folsom dam (CDFW 2019), this species typically avoids heavily populated areas and is unlikely to occur regularly along the lower American River. Because project activities in a given year would be limited to a very small proportion of the overall study area, and badgers are unlikely to occur throughout most of the study area, the number of individuals potentially affected would be very low and is unlikely to substantially affect the local or regional population. Therefore, this impact would be **less than significant**.

Sensitive Habitats

The American River is a water of the United States subject to regulation under Sections 404 and 401 of the CWA and Section 1602 of the FGC. Implementing the proposed action would result in direct modification and placement of fill below the OHWM but would not result in the loss of channel capacity. However, project activities could temporarily degrade water quality in the river. Seasonal wetlands are known to occur at the borrow sites and could be directly modified if borrow material is removed from tailings that support wetlands. Degradation of river water quality and loss of seasonal wetlands that are considered sensitive aquatic sites could have a substantial adverse effect. Therefore, this potential impact on waters of the United States would be **potentially significant**. Implementing Mitigation Measures 1, 2, and 6 would reduce the impact to less than significant.

The proposed action is designed to improve conditions for anadromous salmonids in the lower American River, and monitoring has indicated that past gravel placement has created new spawning habitat for salmonids. Therefore, although project activities would temporarily disturb designated critical habitat for Central Valley steelhead and EFH for Chinook salmon, the overall result would be beneficial, and critical habitat would not be adversely affected. In addition, although project activities have potential to indirectly affect individual elderberry shrubs on or adjacent to the project and borrow sites, they would not result in substantial adverse effects to the two areas of designated critical habitat for VELB. Therefore, this impact would be **less than significant**.

Other Potential Impacts on Biological Resources

Movement Corridors and Nursery Sites

The restoration and borrow sites are part of a much larger contiguous extent of woodland and riparian habitats along the lower American River. The river system serves as a corridor and/or primary route for fish and wildlife migration movement. Project activities would not substantially interfere with the movement of native wildlife, because activities would be limited to a very small proportion of the overall project area and larger river corridor in a given year, would occur over a relatively brief period of time each year, and would not completely impede upstream or downstream wildlife movement. The in-water construction work window is timed specifically to avoid all periods of migration for anadromous salmonids. Therefore, potential impacts on fish and wildlife movement and migration would be **less than significant**.

The in-river construction work window would avoid the risk to spawning salmonid adults, incubating eggs, and pre-emergent fry. However, significant impacts on rearing juvenile salmonids and spawning and rearing of other native fish could occur (as described above under special-status fish). The lower American River serves as a nursery site for colonial-nesting bird species. In addition to potential for bank swallow and purple martin nest colonies in the project area (see above under special-status birds), three great blue heron (*Ardea herodias*) and great egret (*Ardea alba*) nest colonies are known to occur near the restoration /borrow sites. If nest colonies on or near the restoration or borrow sites are active during project implementation, they could be disturbed by heavy equipment operation and construction personnel, potentially resulting in nest abandonment, reduced care of eggs or young, or premature fledging. Because such colony sites are typically used for many years, nest failure and potential long-term colony abandonment could have a substantial adverse effect on the local nesting populations. Therefore, this potential impact on rearing juvenile salmonids, spawning and rearing of other native fish, and active heron/egret nest colonies would be **potentially significant**. Implementing Mitigation Measures 1, 2, 3, and 5 would reduce this impact to less than significant.

Local Policies and Ordinances

The restoration and borrow sites are located within the area addressed by the *American River Parkway Plan* (Parkway Plan) (Sacramento County 2008). The Parkway Plan identifies policies and standards for projects within the plan area. The proposed action supports goals to preserve and protect anadromous and resident fishes and meets policies and standards defined in the Parkway Plan. Specifically, it is consistent with the Aquatic Communities Policy 3.7 to preserve, protect and/or restore riparian and in-channel habitat necessary for spawning and rearing of fish species. Sacramento County policies and ordinances (i.e., Sacramento County General Plan and the Sacramento County Tree Preservation and Protection Ordinance) protect native oak trees. The project may result in the selective removal of trees to create side-channels, but the removal of protected oaks is not anticipated. Therefore, the proposed action would have **no impact** related to potential conflict with local policies or ordinances protecting biological resources.

Habitat Conservation Plans

The restoration and borrow sites are not within an area covered by an adopted Habitat Conservation Plan or Natural Community Conservation Plan. Actions and goals of the proposed action are consistent with those identified in the recovery plan for Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead (NMFS 2014). Additionally, the proposed action is designed to meet objectives of the Central Valley Project Improvement Act to mitigate effects of the Central Valley Project on native fishes. Therefore, the proposed action would have **no impact** related to potential conflict with any adopted conservation plan.

Mitigation Measures

The following measures have been identified to reduce potential impacts on biological resources to less than significant.

Mitigation Measure 1: Implement a Spill Prevention and Control Plan.

City/Water Forum shall implement the following measure to avoid and minimize adverse effects of project-related increases in pollutant discharge on special-status fish.

A written spill prevention and control plan (SPCP) shall be prepared and implemented. The SPCP and all material necessary for its implementation shall be accessible on-site prior to initiation of project construction and throughout the construction period. The SPCP shall include a plan for the emergency cleanup of any spills of fuel or other material. Employees/construction workers shall be provided the necessary information from the SPCP to prevent or reduce the discharge of pollutants from construction activities to waters and to use the appropriate measures should a spill occur. In the event of a spill, work shall stop immediately and NMFS, USFWS, and CDFW shall be notified within 24 hours.

Significance after Mitigation: With implementation of Mitigation Measure 1, the potentially significant impact associated with adverse effects of project-related increases in pollutant discharge on special-status fish would be reduced to a **less-than-significant** level, because the proposed action would avoid and minimize potential for and effects of accidental spill of hazardous materials into the river.

Mitigation Measure 2: Implement a Stormwater Pollution Prevention Plan.

City/Water Forum shall implement the following measure to avoid and minimize adverse effects of project-related increases in suspended sediment and increased turbidity on special-status fish.

A Storm Water Pollution Prevention Plan (SWPPP) that identifies specific best management practices (BMPs) to avoid and minimize impacts on water quality during construction activities shall be prepared and implemented, as needed. BMPs may include:

- Erosion control measures that minimize soil or sediment from entering waterways and wetlands shall be installed, monitored for effectiveness, and maintained throughout construction activities.

Significance after Mitigation: With implementation of Mitigation Measure 2, the potentially significant impact associated with adverse effects of project-related increases in suspended sediment and turbidity on special-status fish would be reduced to a **less-than-significant** level, because the proposed action would avoid and minimize potential for increase in suspended sediments and turbidity.

Mitigation Measure 3: Minimize Injury and Mortality of Special Status Fish Species

City/Water Forum shall implement the following measure to avoid and minimize direct injury and mortality of special-status fish.

- In-water work shall be restricted to July 1 through September 30, with consideration of the spatial and temporal distribution of spawning and incubating steelhead and fall-run Chinook salmon. Work past September 30 would be with approval from the National Marine Fisheries Service.

- Construction may be conducted year-round in areas, such as floodplains and side channels, when flowing water is absent due to separation from the main channel by gravel berms that are either naturally present or artificially created.
- In-water work in floodplains and side channels shall be limited to inlet/outlet areas during the last stage of reconnection to the main channel if working outside of the instream work timing window
- Instream habitat structures shall be placed when fish do not have access to the affected areas, as described above.
- Measures such as slow, deliberate equipment operation and tapping the water surface before entering the channel shall be implemented during in-water work to alert fish to equipment operation in the channel before gravel is placed.
- Before project activities begin, worker Environmental Awareness Training shall be provided to inform agency staff and contractors of the need to avoid and minimize potential impacts on special-status fish and the possible penalties for not complying with these requirements. The training shall include, at a minimum, species identification, habitat requirements and required practices for their avoidance and protection. A designated enforcement lead shall be identified to employees and contractors to ensure that questions regarding avoidance and protection measures are addressed in a timely manner.
- A designated enforcement lead shall monitor in-water construction activities to confirm proper implementation of conservation measures and water quality protection measures.

Significance after Mitigation: With implementation of Mitigation Measure 3, the potentially significant impact associated with project-related injury or mortality of special-status fish would be reduced to a **less-than-significant** level, because the proposed action would enforce restrictions related to in-water work, educate agency staff and contractors, and conduct biological monitoring.

Mitigation Measure 4: Minimize Effects to Valley Elderberry Longhorn Beetle.

City/Water Forum shall implement the following measures to avoid and minimize potential adverse effects on valley elderberry longhorn beetle during project implementation.

- Before project activities begin, worker Environmental Awareness Training shall be provided to inform agency staff and contractors of the need to avoid and minimize potential impacts on VELB and its host plant and the possible penalties for not complying with these requirements. The training shall include, at a minimum, species identification, habitat requirements and required practices for their avoidance and protection. A designated enforcement lead shall be identified to employees and contractors to ensure that questions regarding avoidance and protection measures are addressed in a timely manner.
- All elderberry shrubs on or adjacent to work areas shall be temporarily fenced and designated as environmentally sensitive areas. These areas shall be avoided by all construction personnel. Fencing shall be placed at least 20 feet from the dripline of each shrub, unless otherwise approved by USFWS.
- Dirt roadways and disturbed areas within 100 feet of elderberry shrubs shall be watered at least twice a day to minimize dust emissions.

Significance after Mitigation: With implementation of Mitigation Measure 4, the potentially significant impact associated with adverse effects to VELB would be reduced to a **less-than-significant** level because the proposed action would educate agency staff and contractors and avoid and minimize potential disturbance of elderberry shrubs.

Mitigation Measure 5: Minimize Effects on Special-status and Other Nesting Birds

City/Water Forum shall implement the following measures to avoid and minimize potential adverse effects on special-status and other nesting birds during project implementation.

- Before project activities begin, worker Environmental Awareness Training shall be provided to inform agency staff and contractors of the need to avoid and minimize potential impacts on nesting birds and the possible penalties for not complying with these requirements. The training shall include, at a minimum, species identification, habitat requirements and required practices for their avoidance and protection. A designated enforcement lead shall be identified to employees and contractors to ensure that questions regarding avoidance and protection measures are addressed in a timely manner.
- If vegetation removal is required during the bird nesting season (February 1 through August 15), surveys for active bird nests shall be conducted by a qualified biologist in areas of suitable nesting vegetation designated for removal. A minimum of one survey shall be conducted no more than 7 days before vegetation removal occurs. If active nests are found, removal of vegetation in which the nests are located shall be delayed until a qualified biologist determines that the young have fledged or the nest site is otherwise no longer in use.
- Preconstruction surveys for active nests of burrowing owl, Swainson’s hawk, white-tailed kite, bank swallow, purple martin, and colonial nesting herons and egrets shall be conducted by a qualified biologist in all areas of suitable nesting habitat that could be disturbed by project activities. A minimum of two surveys shall be conducted within 14 days before project activities begin, including at least one survey no more than 7 days before activities begin.
- Appropriate buffers shall be established and maintained around active nest sites to avoid nest failure from project activities. The appropriate size and shape of the buffers shall be determined by a qualified biologist and may vary depending on the nest location, nest stage, construction activity, and existing disturbance levels. The buffers may be adjusted if a qualified biologist determines it would not be likely to adversely affect the nest. Monitoring shall be conducted to confirm that project activities are not resulting in detectable adverse effects on nesting birds or their young. No project activities shall occur within the buffer areas until a qualified biologist determines that the young have fledged or the nest site is otherwise no longer in use.

Significance after Mitigation: With implementation of Mitigation Measure 5, the potentially significant impact associated with failure of active nests of special-status birds and colonial-nesting herons/egrets would be reduced to a **less-than-significant** level because the proposed action would educate agency staff and contractors and implement buffers around active nests to minimize potential for nest failure.

Mitigation Measure 6: Avoid and Minimize Impacts on Waters of the United States and Waters of the State.

City/Water Forum shall implement the following measures to avoid and minimize direct fill of waters of the United States and waters of the State in the Lower American River and minimize impacts on seasonal wetland habitats at the borrow sites.

- Ground disturbance shall be limited to gravel augmentation restoration sites and borrow sites. Existing access routes shall be used to obtain access to restoration and borrow sites. The total area of the project activity shall be limited to the minimum necessary. Borrow extraction areas and staging areas shall be placed to avoid and limit disturbance to the Lower American River and seasonal wetland habitats and shall provide a 250-foot setback from seasonal wetland habitats, to the extent feasible.
- Before the commencement of construction activities, high-visibility fencing shall be erected to protect areas of the Lower American River at gravel augmentation sites and identified seasonal wetland habitats at borrow sites that are located adjacent to disturbance areas but can be avoided from encroachment of personnel and equipment. The fencing shall be inspected before the start of each work day and shall be removed only when the construction within a given area is completed. Limits of waters of the United States and wetlands shall be incorporated into project bid specifications, along with a requirement for contractors to avoid these areas.
- A designated enforcement lead shall monitor all construction activities in waters of the United States to ensure that avoidance and minimization measures are being properly implemented and no unauthorized activities occur. The designated enforcement lead shall be empowered to stop construction activities that threaten to cause unanticipated and/or unauthorized significant adverse project impacts to allow resolution of these potential impacts by the City/Water Forum and U.S. Bureau of Reclamation. Project activity shall not resume until the conflict has been resolved.
- Authorization for direct fill of jurisdictional habitat in the American River and modification of seasonal wetlands at the borrow sites shall be obtained, as required, from USACE, Central Valley RWQCB, and CDFW.
  - **CWA Section 404:** Before any ground-disturbing project activities begin in areas containing wetlands or waters, a qualified biologist shall conduct a formal delineation of waters of the United States for CWA Section 404 permitting. The findings shall be documented in a detailed report as part of the formal Section 404 wetland delineation process.

    Authorization for fill of jurisdictional waters of the United States shall be secured from USACE via the Section 404 permitting process before project construction. Any mitigation measures determined necessary during the 404 permitting process shall be implemented during project construction.
  - **CWA Section 401:** Water quality certification pursuant to Section 401 of the CWA shall be obtained from the Central Valley RWQCB before starting project construction in any areas that may contain waters of the State. Any measures required as part of the issuance of water quality certification shall be implemented.
  - **FGC Section 1602 or similar agreement:** A CDFW lake and streambed alteration agreement or similar approval from CDFW shall be obtained by the City for all activities that will substantially divert or obstruct the natural flow of water; substantially change or use any material from the bed, channel or bank of any river,

stream, or lake; or deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it may pass into any river, stream, or lake. Any conditions of issuance of the lake and streambed alteration agreement, including avoidance, minimization, and compensation measures, shall be implemented as part of project implementation.

Significance after Mitigation: With implementation of Mitigation Measure 6, the potentially significant impact associated with waters of the United States would be reduced to a **less-than-significant** level because direct and indirect impacts to would be avoided and minimized.

Conclusions

Potential significant impacts on biological resources from implementing the proposed action can be reduced to less than significant by implementing appropriate mitigation measures identified in this report. Therefore, implementing the proposed action, including the proposed mitigation measures, would not result in any significant impacts to biological resources.

If you have any questions or concerns regarding this monitoring report, please contact me by phone at 916-912-4941 or e-mail at snorris@geiconsultants.com.

Sincerely,

Sarah A. Norris
Senior Regulatory Specialist, Biologist

Anne King
Senior Wildlife Biologist

Attachment A: Figures 1-5
Attachment B: Special-status Species Query Results
Attachment C: Photographs of Study Area

1804694

References

Alabaster, J. S., and R. Lloyd. 1980. *Water quality criteria for freshwater fish*. Boston, Massachusetts: Buttersworth, Inc.

Allen, M. A. 2000. Seasonal microhabitat use by juvenile spring Chinook salmon in the Yakima River basin, Washington. *Rivers* 7:314–332.

Beamesderfer, R., M. Simpson, G. Kopp, J. Inman, A. Fuller, and D. Demko. 2004. *Historical and current information on green sturgeon occurrence in the Sacramento and San Joaquin rivers and tributaries*. S.P. Cramer & Associates, Inc.

Bureau of Reclamation. 2015 (May). *Delineation of Waters of the United States for the Lower American River Anadromous Fish Habitat Restoration Program Sacramento County, California.* U.S. Department of the Interior.

California Department of Fish and Wildlife. 2019. Results of electronic database search for sensitive species occurrences. Version 5.2.14. Biogeographic Data Branch. Available at https://www.wildlife.ca.gov/Data/CNDDB/Maps-and-Data. Accessed March 15, 2019.

_____2018. (October 15). *Sensitive Communities.* https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=153609&inline. Accessed March 19, 2019.

California Native Plant Society. 2019. *Inventory of Rare and Endangered Plants*. Online edition, v8-03 0.39. Sacramento, CA. Available at http://www.rareplants.cnps.org. Accessed March 15, 2019.

FISHBIO and Normandeau Associates. 2012. *Stanislaus River Chinook fry habitat assessment, 2007- 2011 Summary Report*. Prepared for South San Joaquin Irrigation District and Oakdale Irrigation District.

Hannon, J. 2013. *American River Steelhead (*Oncorhynchus mykiss*) Spawning – 2013, with comparisons to prior years*. Central Valley Project, American River, California Mid-Pacific Region. Bureau of Reclamation. Sacramento, CA. 32 p.

Healey, M. and J. Redding. 2008. *Lower American River chinook salmon escapement survey October 2007 – January 2008*. Department of Fish and Game, Preliminary Technical Report.

Mora, E.A., S.T. Lindley, D.L. Erickson and A.P. Klimley. 2009. Do impassable dams and flow regulation constrain the distribution of green sturgeon in the Sacramento River, California? J. Appl. Ichthyol. 25(Suppl. 2): 9–47.

Newcombe, C.P., and J.O.T. Jensen. 1996. Channel suspended sediment and fisheries: a synthesis for quantitative assessment of risk and impact. North American Journal of Fisheries Management 16:693-727.

National Marine Fisheries Service. 2009. Biological opinion and conference opinion on the long-term operations of the Central Valley Project and State Water Project. June 4, 2009. Southwest Region, Long Beach, CA.

_____2014. *Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-Run Chinook Salmon and Central Valley Spring-Run Chinook Salmon and The Distinct Population Segment of California Central Valley Steelhead*. West Coast Region, Sacramento, CA.

_____2018. California Species List Tools, kmz of NMFS Resources in California. Available: https://www.westcoast.fisheries.noaa.gov/maps_data/california_species_list_tools.html. Accessed March 15, 2019.

Natural Resources Conservation Service. 2017. Web Soil Survey. Last updated August 21, 2017. Available: http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm. Accessed March 19, 2019.

NMFS. See National Marine Fisheries Service.

NRCS. See Natural Resources Conservation Service.

Pacific States Marine Fisheries Commission. 2014a. *Juvenile salmonid emigration monitoring in the Lower American River, California, January – May 2014*. Report prepared for the U.S. Fish and Wildlife Service and California Department of Fish and Wildlife. Sacramento, California. 112 p.

———. 2014b. *Juvenile salmonid emigration monitoring in the Lower American River, California, January – June 2013*. Report prepared for the U.S. Fish and Wildlife Service and California Department of Fish and Wildlife. Sacramento, California. 54 p.

Palmer, M., and M. Hellmair. 2012. *Sacramento River Bank Protection Project Long-Term Aquatic Monitoring Program, Fiscal Years 2011 through 2015, Annual Report 2011*. Prepared by FISHBIO for U.S. Army Corps of Engineers. 66 p + appendices.

PSMFC. *See* Pacific States Marine Fisheries Commission

Reclamation. *See* Bureau of Reclamation.

Sacramento County. 2008. *American River Parkway Plan*. Available: http://www.regionalparks.saccounty.net/Parks/Documents/Parks/ARPP06-021909_sm.pdf. Accessed March 20, 2019. Sacramento, CA.

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

Snider, B., and R.G. Titus. 2000. *Lower American River emigration survey. October 1996 - September 1997*. California Department of Fish and Game Stream Evaluation Program Technical Report 00-2. 64 p.

———. 2001. *Lower American River emigration survey. October 1997 - September 1998*. California Department of Fish and Game Stream Evaluation Program Technical Report 01-6. 68 p.

Snider, B., R.G. Titus, and B.A. Payne. *1998. Lower American River emigration survey, October 1995 - September 1996*. Report prepared by California Department of Fish and Game Stream Flow and Habitat Evaluation Program. 60 p.

The Sacramento Water Forum. 2008 (May). *Preliminary Delineation of Waters of the United States, Including Wetlands for the American River Gravel Augmentation Project.* Prepared by EDAW. Sacramento, CA.

U.S. Fish and Wildlife Service. 2019a. IPaC Resource List. Sacramento Fish and Wildlife Office, Sacramento, CA.

_____. 2019b. Critical Habitat for Threatened and Endangered Species. Available at: https://fws.maps.arcgis.com/home/webmap/viewer.html?webmap=9d8de5e265ad4fe09893cf75b8dbfb77. Accessed March 18, 2019.

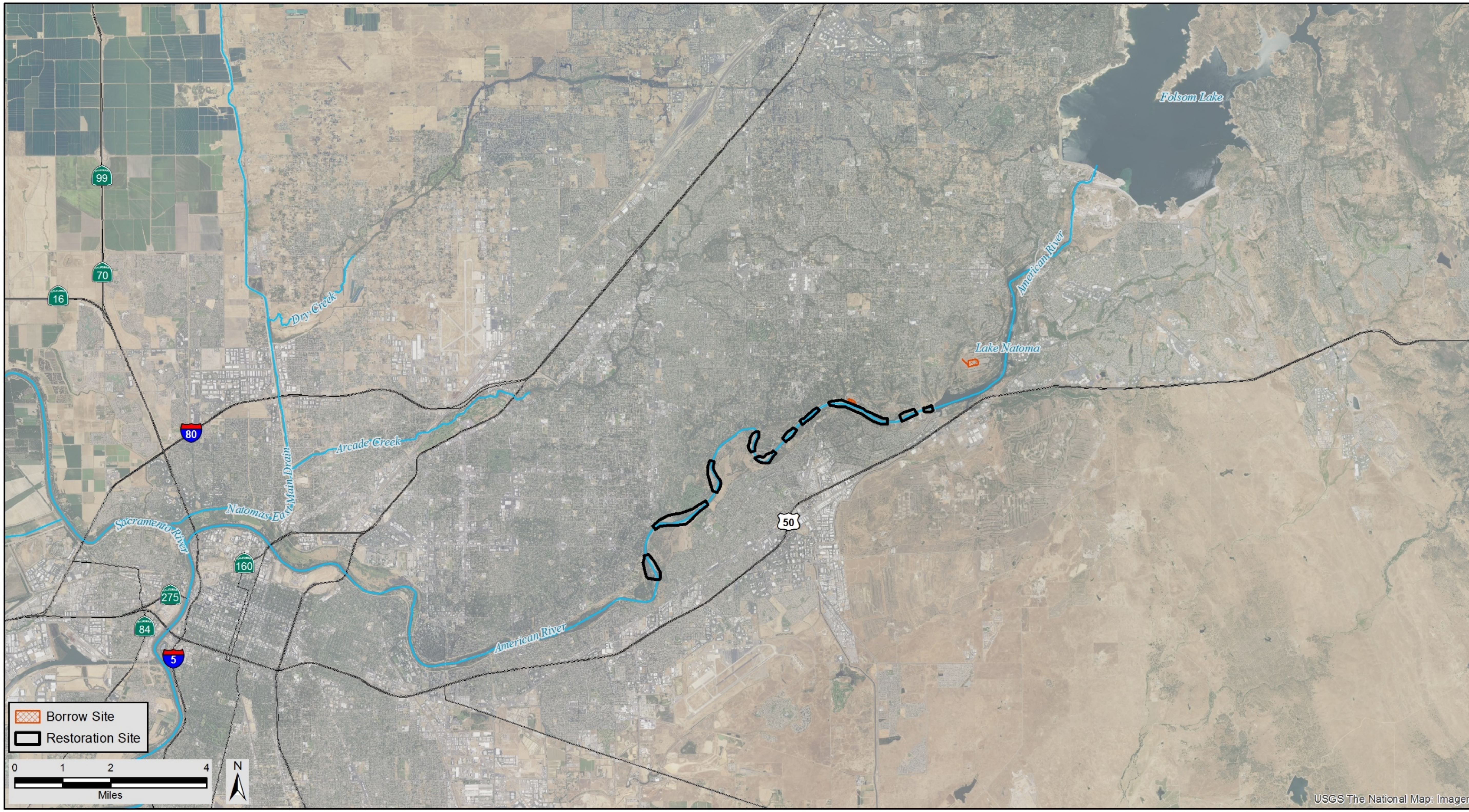
USFWS. *See* U.S. Fish and Wildlife Service.

USGS. See U.S. Geological Survey.

Water Forum. *See* The Sacramento Water Forum.

Attachment A - Figures

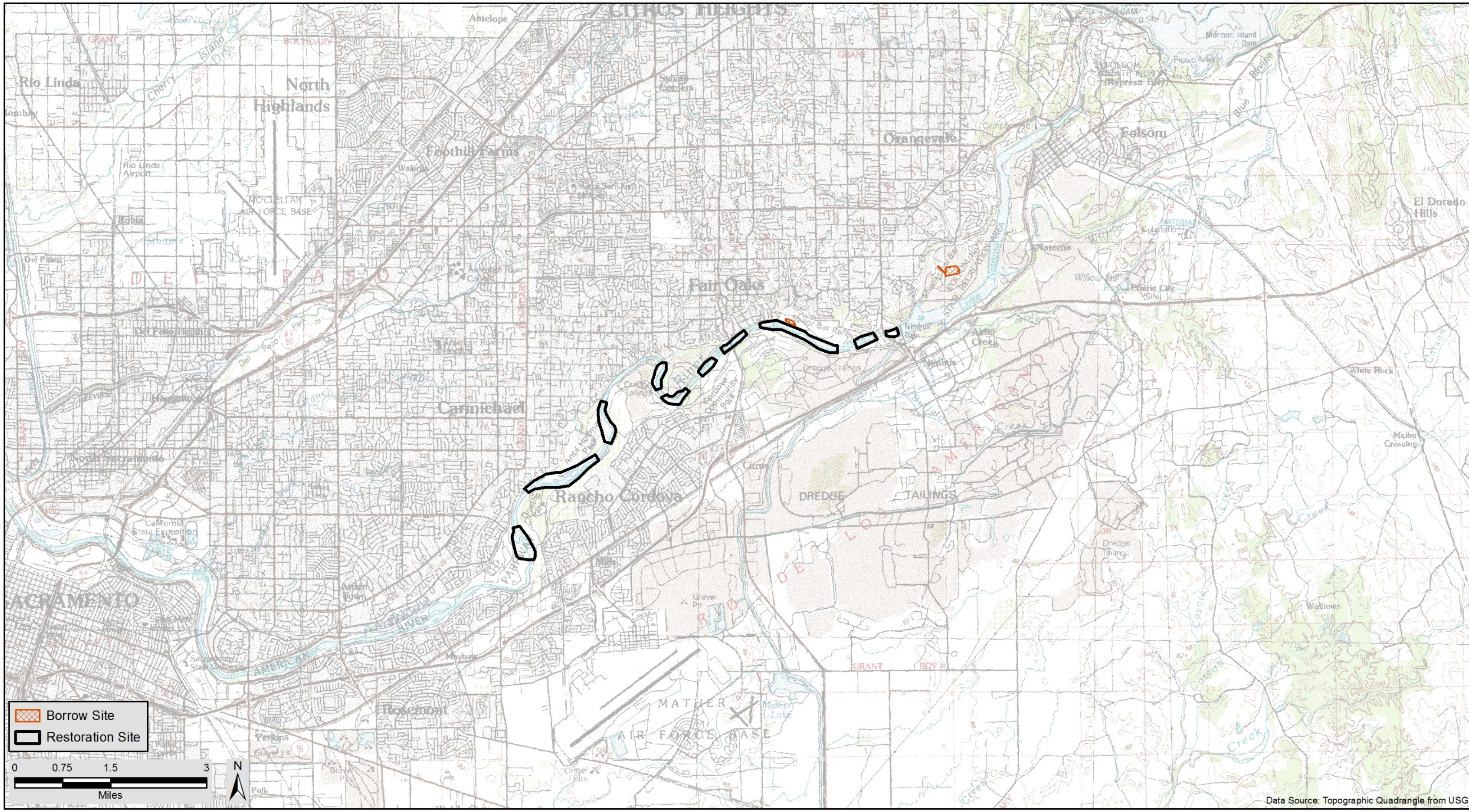
Figure 1. Regional Location



20Mar2019 RS Z:\Projects\1804694_SAFCA\1804694_G003_ProjectLocation.mxd

Source: GEI Consultants, Inc. 2019

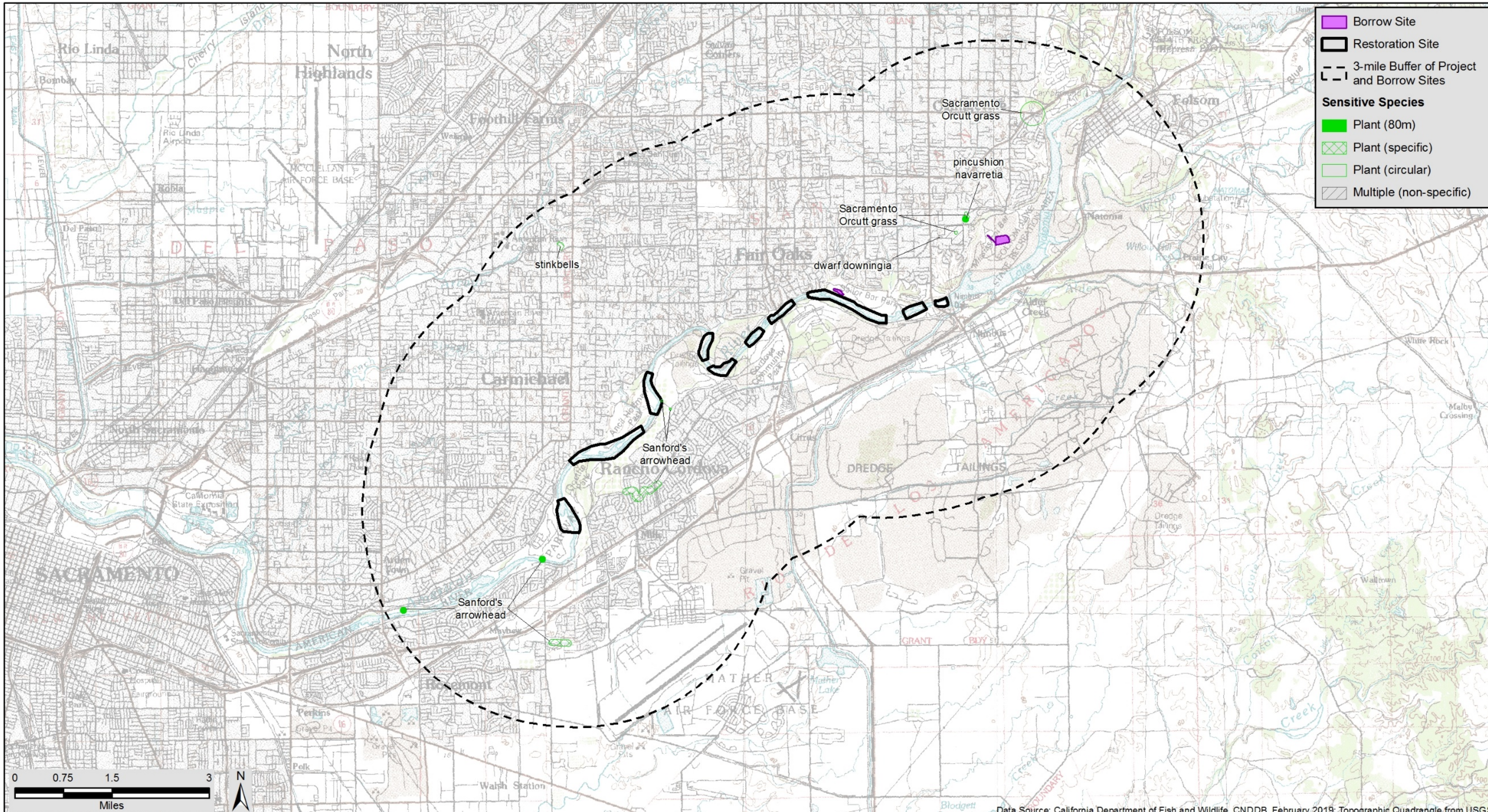
Figure 2. Topographic Map



20Mar2019 RS Z:\Projects\1804694_SAFCA\1804694_G004_Topo.mxd

Source: GEI Consultants, Inc. 2019

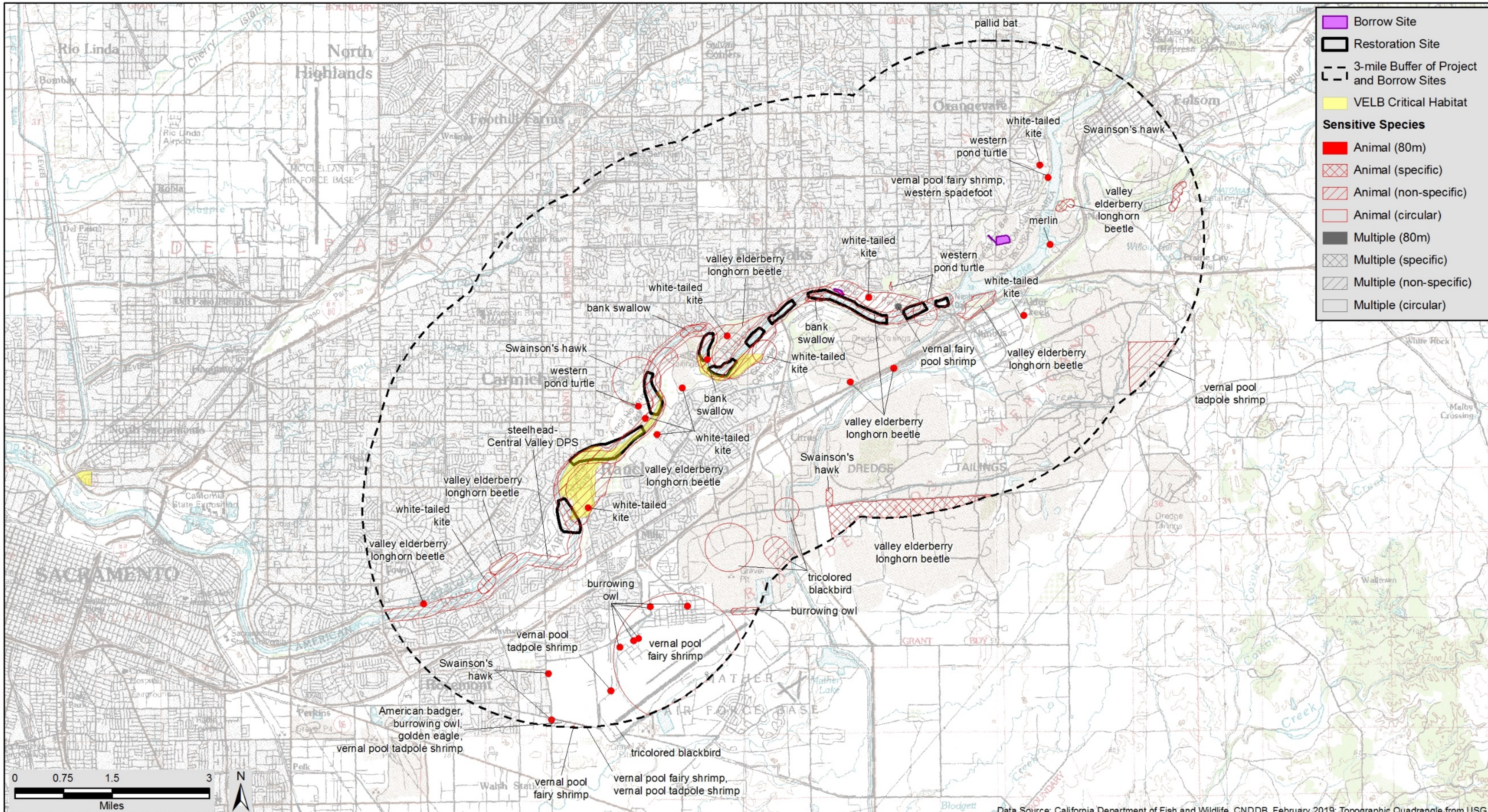
Figure 3. California Natural Diversity Database Plant Occurrences within 3 Miles of the Restoration and Borrow Sites



20Mar2019 RS Z:\Projects\1804694_SAFCA\1804694_G001_CNDDB_Plants.mxd

Source: GEI Consultants, Inc. 2019

Figure 4. California Natural Diversity Database Wildlife Occurrences and Designated Critical Habitat within 3 Miles of the Restoration and Borrow Sites



20Mar2019 RS Z:\Projects\1804694_SAFCA\1804694_G002_CNDDB_Animals.mxd

Source: GEI Consultants, Inc. 2019

Attachment B – Special Status Species Query Results

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad IS (Citrus Heights (3812163) OR Carmichael (3812153) OR Folsom (3812162) OR Pleasant Grove (3812174) OR Rio Linda (3812164) OR Sacramento East (3812154) OR Roseville (3812173) OR Elk Grove (3812143) OR Rocklin (3812172) OR Clarksville (3812161) OR Buffalo Creek (3812152))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Accipiter cooperii Cooper's hawk	ABNKC12040	None	None	G5	S4	WL
Agelaius tricolor tricolored blackbird	ABPBXB0020	None	Candidate Endangered	G2G3	S1S2	SSC
Alkali Meadow Alkali Meadow	CTT45310CA	None	None	G3	S2.1	
Alkali Seep Alkali Seep	CTT45320CA	None	None	G3	S2.1	
Ammodramus savannarum grasshopper sparrow	ABPBXA0020	None	None	G5	S3	SSC
Andrena blennospermatis Blennosperma vernal pool andrenid bee	IIHYM35030	None	None	G2	S2	
Andrena subapasta An andrenid bee	IIHYM35210	None	None	G1G2	S1S2	
Antrozous pallidus pallid bat	AMACC10010	None	None	G5	S3	SSC
Aquila chrysaetos golden eagle	ABNKC22010	None	None	G5	S3	FP
Ardea alba great egret	ABNGA04040	None	None	G5	S4	
Ardea herodias great blue heron	ABNGA04010	None	None	G5	S4	
Athene cunicularia burrowing owl	ABNSB10010	None	None	G4	S3	SSC
Balsamorhiza macrolepis big-scale balsamroot	PDAST11061	None	None	G2	S2	1B.2
Branchinecta lynchi vernal pool fairy shrimp	ICBRA03030	Threatened	None	G3	S3	
Branchinecta mesovallensis midvalley fairy shrimp	ICBRA03150	None	None	G2	S2S3	
Buteo regalis ferruginous hawk	ABNKC19120	None	None	G4	S3S4	WL
Buteo swainsoni Swainson's hawk	ABNKC19070	None	Threatened	G5	S3	
Ceanothus roderickii Pine Hill ceanothus	PDRHA04190	Endangered	Rare	G1	S1	1B.1

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Chlorogalum grandiflorum Red Hills soaproot	PMLIL0G020	None	None	G3	S3	1B.2
Chloropyron molle ssp. hispidum hispid salty bird's-beak	PDSCR0J0D1	None	None	G2T1	S1	1B.1
Clarkia biloba ssp. brandegeeae Brandegee's clarkia	PDONA05053	None	None	G4G5T4	S4	4.2
Coccyzus americanus occidentalis western yellow-billed cuckoo	ABNRB02022	Threatened	Endangered	G5T2T3	S1	
Crocanthemum suffrutescens Bisbee Peak rush-rose	PDCIS020F0	None	None	G2?Q	S2?	3.2
Desmocerus californicus dimorphus valley elderberry longhorn beetle	IICOL48011	Threatened	None	G3T2	S2	
Downingia pusilla dwarf downingia	PDCAM060C0	None	None	GU	S2	2B.2
Dumontia oregonensis hairy water flea	ICBRA23010	None	None	G1G3	S1	
Elanus leucurus white-tailed kite	ABNKC06010	None	None	G5	S3S4	FP
Elderberry Savanna Elderberry Savanna	CTT63440CA	None	None	G2	S2.1	
Emys marmorata western pond turtle	ARAAD02030	None	None	G3G4	S3	SSC
Erethizon dorsatum North American porcupine	AMAFJ01010	None	None	G5	S3	
Falco columbarius merlin	ABNKD06030	None	None	G5	S3S4	WL
Fremontodendron decumbens Pine Hill flannelbush	PDSTE03030	Endangered	Rare	G1	S1	1B.2
Fritillaria agrestis stinkbells	PMLIL0V010	None	None	G3	S3	4.2
Galium californicum ssp. sierrae El Dorado bedstraw	PDRUB0N0E7	Endangered	Rare	G5T1	S1	1B.2
Gratiola heterosepala Boggs Lake hedge-hyssop	PDSCR0R060	None	Endangered	G2	S2	1B.2
Great Valley Valley Oak Riparian Forest Great Valley Valley Oak Riparian Forest	CTT61430CA	None	None	G1	S1.1	
Haliaeetus leucocephalus bald eagle	ABNKC10010	Delisted	Endangered	G5	S3	FP
Hydrochara rickseckeri Ricksecker's water scavenger beetle	IICOL5V010	None	None	G2?	S2?	
Juncus leiospermus var. ahartii Ahart's dwarf rush	PMJUN011L1	None	None	G2T1	S1	1B.2

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Juncus leiospermus var. leiospermus Red Bluff dwarf rush	PMJUN011L2	None	None	G2T2	S2	1B.1
Lasionycteris noctivagans silver-haired bat	AMACC02010	None	None	G5	S3S4	
Laterallus jamaicensis coturniculus California black rail	ABNME03041	None	Threatened	G3G4T1	S1	FP
Legenere limosa legenere	PDCAM0C010	None	None	G2	S2	1B.1
Lepidurus packardi vernal pool tadpole shrimp	ICBRA10010	Endangered	None	G4	S3S4	
Linderiella occidentalis California linderiella	ICBRA06010	None	None	G2G3	S2S3	
Melospiza melodia song sparrow ("Modesto" population)	ABPBXA3010	None	None	G5	S3?	SSC
Navarretia myersii ssp. myersii pincushion navarretia	PDPLM0C0X1	None	None	G2T2	S2	1B.1
Northern Claypan Vernal Pool Northern Claypan Vernal Pool	CTT44120CA	None	None	G1	S1.1	
Northern Hardpan Vernal Pool Northern Hardpan Vernal Pool	CTT44110CA	None	None	G3	S3.1	
Northern Volcanic Mud Flow Vernal Pool Northern Volcanic Mud Flow Vernal Pool	CTT44132CA	None	None	G1	S1.1	
Oncorhynchus mykiss irideus pop. 11 steelhead - Central Valley DPS	AFCHA0209K	Threatened	None	G5T2Q	S2	
Orcuttia tenuis slender Orcutt grass	PMPOA4G050	Threatened	Endangered	G2	S2	1B.1
Orcuttia viscida Sacramento Orcutt grass	PMPOA4G070	Endangered	Endangered	G1	S1	1B.1
Packera layneae Layne's ragwort	PDAST8H1V0	Threatened	Rare	G2	S2	1B.2
Pandion haliaetus osprey	ABNKC01010	None	None	G5	S4	WL
Phalacrocorax auritus double-crested cormorant	ABNFD01020	None	None	G5	S4	WL
Progne subis purple martin	ABPAU01010	None	None	G5	S3	SSC
Rana boylii foothill yellow-legged frog	AAABH01050	None	Candidate Threatened	G3	S3	SSC
Rana draytonii California red-legged frog	AAABH01022	Threatened	None	G2G3	S2S3	SSC
Riparia riparia bank swallow	ABPAU08010	None	Threatened	G5	S2	

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Sagittaria sanfordii Sanford's arrowhead	PMALI040Q0	None	None	G3	S3	1B.2
Spea hammondii western spadefoot	AAABF02020	None	None	G3	S3	SSC
Taxidea taxus American badger	AMAJF04010	None	None	G5	S3	SSC
Thamnophis gigas giant gartersnake	ARADB36150	Threatened	Threatened	G2	S2	
Valley Needlegrass Grassland Valley Needlegrass Grassland	CTT42110CA	None	None	G3	S3.1	
Wyethia reticulata El Dorado County mule ears	PDAST9X0D0	None	None	G2	S2	1B.2

Record Count: 66

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Sacramento County, California

Local office

Sacramento Fish And Wildlife Office

(916) 414-6600
(916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population, even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

---

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information.
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Reptiles

NAME	STATUS
Giant Garter Snake Thamnophis gigas No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/4482	Threatened

Amphibians

NAME	STATUS
California Red-legged Frog Rana draytonii There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/2891	Threatened
California Tiger Salamander Ambystoma californiense There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/2076	Threatened

Fishes

NAME	STATUS
Delta Smelt Hypomesus transpacificus There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/321	Threatened

Insects

NAME	STATUS
Valley Elderberry Longhorn Beetle Desmocerus californicus dimorphus There is **final** critical habitat for this species. Your location overlaps the critical habitat. https://ecos.fws.gov/ecp/species/7850	Threatened

Crustaceans

NAME	STATUS
Conservancy Fairy Shrimp Branchinecta conservatio There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/8246	Endangered
Vernal Pool Fairy Shrimp Branchinecta lynchi There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/498	Threatened
Vernal Pool Tadpole Shrimp Lepidurus packardi There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/2246	Endangered

Flowering Plants

NAME	STATUS
Sacramento Orcutt Grass Orcuttia viscida There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/5507	Endangered
Slender Orcutt Grass Orcuttia tenuis There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/1063	Threatened

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

This location overlaps the critical habitat for the following species:

NAME	TYPE
Valley Elderberry Longhorn Beetle Desmocerus californicus dimorphus https://ecos.fws.gov/ecp/species/7850#crithab	Final

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON (IF A BREEDING SEASON IS INDICATED FOR A BIRD ON YOUR LIST, THE BIRD MAY BREED IN YOUR PROJECT AREA SOMETIME WITHIN THE TIMEFRAME SPECIFIED, WHICH IS A VERY LIBERAL ESTIMATE OF THE

DATES INSIDE WHICH THE BIRD BREEDS ACROSS ITS ENTIRE RANGE. "BREEDS ELSEWHERE" INDICATES THAT THE BIRD DOES NOT LIKELY BREED IN YOUR PROJECT AREA.)

Bald Eagle Haliaeetus leucocephalus — Breeds Jan 1 to Aug 31

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1626

Burrowing Owl Athene cunicularia — Breeds Mar 15 to Aug 31

This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/9737

California Thrasher Toxostoma redivivum — Breeds Jan 1 to Jul 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Clark's Grebe Aechmophorus clarkii — Breeds Jan 1 to Dec 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Common Yellowthroat Geothlypis trichas sinuosa — Breeds May 20 to Jul 31

This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/2084

Golden Eagle Aquila chrysaetos — Breeds Jan 1 to Aug 31

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1680

Lawrence's Goldfinch Carduelis lawrencei

Breeds Mar 20 to Sep 20

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9464

Lewis's Woodpecker Melanerpes lewis

Breeds Apr 20 to Sep 30

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9408

Long-billed Curlew Numenius americanus

Breeds elsewhere

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/5511

Nuttall's Woodpecker Picoides nuttallii

Breeds Apr 1 to Jul 20

This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/9410

Oak Titmouse Baeolophus inornatus

Breeds Mar 15 to Jul 15

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9656

Rufous Hummingbird selasphorus rufus

Breeds elsewhere

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/8002

Song Sparrow Melospiza melodia

Breeds Feb 20 to Sep 5

This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Spotted Towhee Pipilo maculatus clementae — Breeds Apr 15 to Jul 20

This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/4243

Tricolored Blackbird Agelaius tricolor — Breeds Mar 15 to Aug 10

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3910

Whimbrel Numenius phaeopus — Breeds elsewhere

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9483

Wrentit Chamaea fasciata — Breeds Mar 15 to Aug 10

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Yellow-billed Magpie Pica nuttalli — Breeds Apr 1 to Jul 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9726

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ “Proper Interpretation and Use of Your Migratory Bird Report” before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

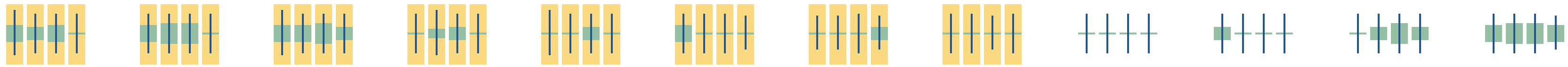
No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

■ probability of presence ■ breeding season | survey effort – no data

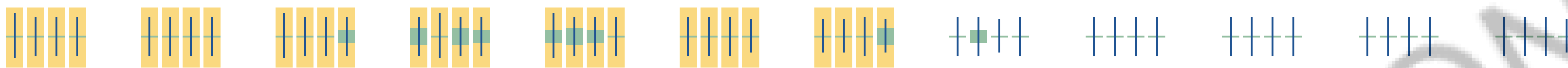
SPECIES JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

Bald Eagle
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

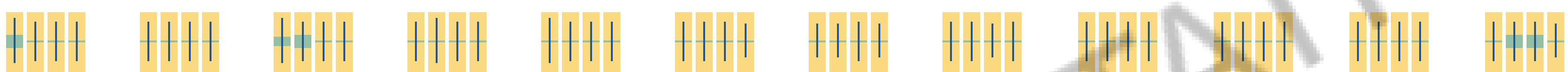


Burrowing Owl
BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)

California Thrasher
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

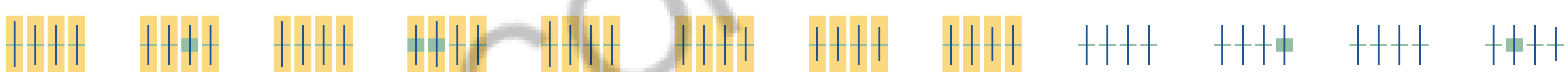


Clark's Grebe
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

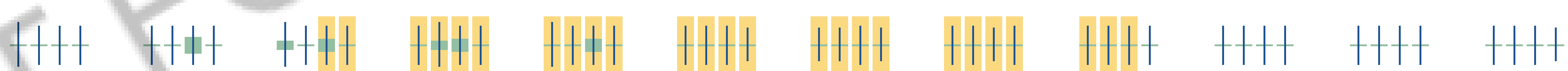


Common Yellowthroat
BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)

Golden Eagle
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Lawrence's Goldfinch
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Lewis's Woodpecker
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Long-billed Curlew
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Nuttall's Woodpecker
BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)

Oak Titmouse
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Rufous Hummingbird
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

SPECIES JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

Song Sparrow
BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)

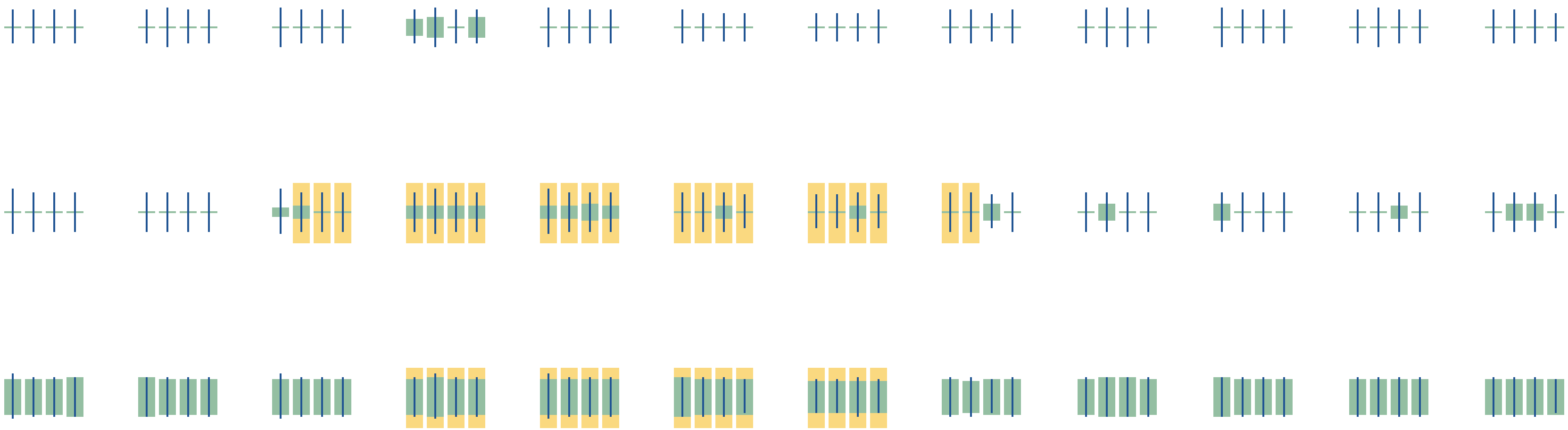
Spotted Towhee
BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)

Tricolored Blackbird
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Whimbrel
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Wrentit
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Yellow-billed Magpie
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures and/or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the E-bird Explore Data Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

FRESHWATER EMERGENT WETLAND

- PEM1A
- PEM1Ax
- PEM1Cx
- PEM1C
- PEM1Fx

FRESHWATER FORESTED/SHRUB WETLAND

- PSSA
- PSSCx
- PFOCx
- PFOA
- PFOC
- PFOAx
- PSSC
- PSSAx

FRESHWATER POND

- PUBFx
- PUBHx
- PABFx
- PUBHh
- PUBKx
- PUBFh
- PUSCh
- PUSCx
- PUBF

LAKE

- L1UBHh

RIVERINE

- R2UBH
- R2USA

- R2USC
- R2UBHx
- R4SBC
- R4SBAx
- R5UBF
- R4SBA

A full description for each wetland code can be found at the National Wetlands Inventory website

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

CNPS California Native Plant Society Inventory of Rare and Endangered Plants

Plant List

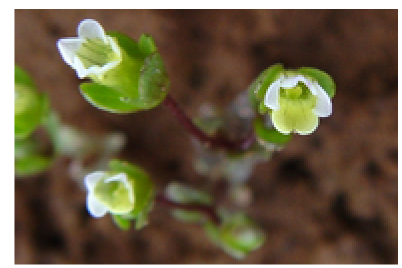
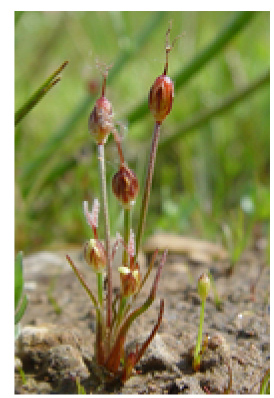
15 matches found. *Click on scientific name for details*

Search Criteria

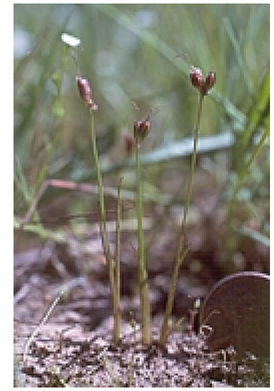
Found in Quads 3812174, 3812173, 3812172, 3812164, 3812163, 3812162, 3812154 3812153 and 3812152;

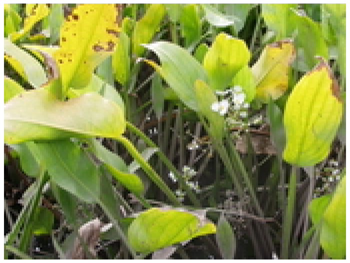
Modify Search Criteria Export to Excel Modify Columns Modify Sort Remove Photos

Scientific Name	Common Name	Family	Lifeform	Blooming Period	CA Rare Plant Rank	State Listing Status	Federal Listing Status	Habitats	Lowest Elevation	Highest Elevation	Photo
Balsamorhiza macrolepis	big-scale balsamroot	Asteraceae	perennial herb	Mar-Jun	1B.2			• Chaparral • Cismontane woodland • Valley and foothill grassland	45 m	1555 m	 1998 Dean Wm. Taylor
Brodiaea rosea ssp. vallicola	valley brodiaea	Themidaceae	perennial bulbiferous herb	Apr-May(Jun)	4.2			• Valley and foothill grassland (swales) • Vernal pools	10 m	335 m	no photo available
Chloropyron molle ssp. hispidum	hispid bird's-beak	Orobanchaceae	annual herb (hemiparasitic)	Jun-Sep	1B.1			• Meadows and seeps • Playas • Valley and foothill grassland	1 m	155 m	 2012 Doug Wirtz
Clarkia biloba ssp.	Brandegee's clarkia	Onagraceae	annual herb	May-Jul	4.2			• Chaparral • Cismontane woodland	75 m	915 m	

brandegeeae							• Lower montane coniferous forest			 2008 Virginia Moran
Downingia pusilla	dwarf downingia	Campanulaceae	annual herb	Mar-May	2B.2		• Valley and foothill grassland (mesic) • Vernal pools	1 m	445 m	 2011 Dylan Neubauer
Fritillaria agrestis	stinkbells	Liliaceae	perennial bulbiferous herb	Mar-Jun	4.2		• Chaparral • Cismontane woodland • Pinyon and juniper woodland • Valley and foothill grassland	10 m	1555 m	 1998 John Game
Gratiola heterosepala	Boggs Lake hedge-hyssop	Plantaginaceae	annual herb	Apr-Aug	1B.2	CE	• Marshes and swamps (lake margins) • Vernal pools	10 m	2375 m	 2004 Carol W. Witham
Juncus leiospermus var. ahartii	Ahart's dwarf rush	Juncaceae	annual herb	Mar-May	1B.2		• Valley and foothill grassland (mesic)	30 m	229 m	

2004 Carol W. Witham

Juncus leiospermus var. leiospermus	Red Bluff dwarf rush	Juncaceae	annual herb	Mar-Jun	1B.1			• Chaparral • Cismontane woodland • Meadows and seeps • Valley and foothill grassland • Vernal pools	35 m	1250 m	 1987 Dean Wm. Taylor
Legenere limosa	legenere	Campanulaceae	annual herb	Apr-Jun	1B.1			• Vernal pools	1 m	880 m	 1993 Dean Wm. Taylor
Navarretia myersii ssp. myersii	pincushion navarretia	Polemoniaceae	annual herb	Apr-May	1B.1			• Vernal pools	20 m	330 m	no photo available
Navarretia nigelliformis ssp. nigelliformis	adobe navarretia	Polemoniaceae	annual herb	Apr-Jun	4.2			• Valley and foothill grassland vernally mesic • Vernal pools sometimes	100 m	1000 m	 2008 Steve Matson
Orcuttia tenuis	slender Orcutt grass	Poaceae	annual herb	May-Sep(Oct)	1B.1	CE	FT	• Vernal pools	35 m	1760 m	 1991 Dean Wm. Taylor

Orcuttia viscida	Sacramento Orcutt grass	Poaceae	annual herb	Apr-Jul(Sep)	1B.1	CE	FE	• Vernal pools	30 m	100 m	 2004 Carol W. Witham
Sagittaria sanfordii	Sanford's arrowhead	Alismataceae	perennial rhizomatous herb (emergent)	May-Oct(Nov)	1B.2			• Marshes and swamps (assorted shallow freshwater)	0 m	650 m	 2007 Wendy Fisher

Suggested Citation

California Native Plant Society, Rare Plant Program. 2019. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Website http://www.rareplants.cnps.org [accessed 15 March 2019].

Quad Name **Carmichael**
Quad Number **38121-E3**

ESA Anadromous Fish

SONCC Coho ESU (T) -
CCC Coho ESU (E) -
CC Chinook Salmon ESU (T) -
CVSR Chinook Salmon ESU (T) - **X**
SRWR Chinook Salmon ESU (E) - **X**
NC Steelhead DPS (T) -
CCC Steelhead DPS (T) -
SCCC Steelhead DPS (T) -
SC Steelhead DPS (E) -
CCV Steelhead DPS (T) - **X**
Eulachon (T) -
sDPS Green Sturgeon (T) -

ESA Anadromous Fish Critical Habitat

SONCC Coho Critical Habitat -
CCC Coho Critical Habitat -
CC Chinook Salmon Critical Habitat -
CVSR Chinook Salmon Critical Habitat -
SRWR Chinook Salmon Critical Habitat -
NC Steelhead Critical Habitat -
CCC Steelhead Critical Habitat -
SCCC Steelhead Critical Habitat -
SC Steelhead Critical Habitat -
CCV Steelhead Critical Habitat - **X**
Eulachon Critical Habitat -
sDPS Green Sturgeon Critical Habitat -

ESA Marine Invertebrates

Range Black Abalone (E) -
Range White Abalone (E) -

ESA Marine Invertebrates Critical Habitat

Black Abalone Critical Habitat -

ESA Sea Turtles

East Pacific Green Sea Turtle (T) -
Olive Ridley Sea Turtle (T/E) -
Leatherback Sea Turtle (E) -
North Pacific Loggerhead Sea Turtle (E) -

ESA Whales

Blue Whale (E) -
Fin Whale (E) -
Humpback Whale (E) -
Southern Resident Killer Whale (E) -
North Pacific Right Whale (E) -
Sei Whale (E) -
Sperm Whale (E) -

ESA Pinnipeds

Guadalupe Fur Seal (T) -
Steller Sea Lion Critical Habitat -

Essential Fish Habitat

Coho EFH -
Chinook Salmon EFH - **X**
Groundfish EFH -
Coastal Pelagics EFH -
Highly Migratory Species EFH -

MMPA Species (See list at left)

ESA and MMPA Cetaceans/Pinnipeds
See list at left and consult the NMFS Long Beach office
562-980-4000

MMPA Cetaceans -
MMPA Pinnipeds -

Quad Name **Citrus Heights**
Quad Number **38121-F3**

ESA Anadromous Fish

SONCC Coho ESU (T) -
CCC Coho ESU (E) -
CC Chinook Salmon ESU (T) -
CVSR Chinook Salmon ESU (T) - **X**
SRWR Chinook Salmon ESU (E) - **X**
NC Steelhead DPS (T) -
CCC Steelhead DPS (T) -
SCCC Steelhead DPS (T) -
SC Steelhead DPS (E) -
CCV Steelhead DPS (T) - **X**
Eulachon (T) -
sDPS Green Sturgeon (T) -

ESA Anadromous Fish Critical Habitat

SONCC Coho Critical Habitat -
CCC Coho Critical Habitat -
CC Chinook Salmon Critical Habitat -
CVSR Chinook Salmon Critical Habitat -
SRWR Chinook Salmon Critical Habitat -
NC Steelhead Critical Habitat -
CCC Steelhead Critical Habitat -
SCCC Steelhead Critical Habitat -
SC Steelhead Critical Habitat -
CCV Steelhead Critical Habitat - **X**
Eulachon Critical Habitat -
sDPS Green Sturgeon Critical Habitat -

ESA Marine Invertebrates

Range Black Abalone (E) -
Range White Abalone (E) -

ESA Marine Invertebrates Critical Habitat

Black Abalone Critical Habitat -

ESA Sea Turtles

East Pacific Green Sea Turtle (T) -
Olive Ridley Sea Turtle (T/E) -
Leatherback Sea Turtle (E) -
North Pacific Loggerhead Sea Turtle (E) -

ESA Whales

Blue Whale (E) -
Fin Whale (E) -
Humpback Whale (E) -
Southern Resident Killer Whale (E) -
North Pacific Right Whale (E) -
Sei Whale (E) -
Sperm Whale (E) -

ESA Pinnipeds

Guadalupe Fur Seal (T) -
Steller Sea Lion Critical Habitat -

Essential Fish Habitat

Coho EFH -
Chinook Salmon EFH - **X**
Groundfish EFH -
Coastal Pelagics EFH -
Highly Migratory Species EFH -

MMPA Species (See list at left)

ESA and MMPA Cetaceans/Pinnipeds

See list at left and consult the NMFS Long Beach office
562-980-4000

MMPA Cetaceans -
MMPA Pinnipeds -

Quad Name	**Folsom**
Quad Number	**38121-F2**

ESA Anadromous Fish

SONCC Coho ESU (T) -
CCC Coho ESU (E) -
CC Chinook Salmon ESU (T) -
CVSR Chinook Salmon ESU (T) - **X**
SRWR Chinook Salmon ESU (E) -
NC Steelhead DPS (T) -
CCC Steelhead DPS (T) -
SCCC Steelhead DPS (T) -
SC Steelhead DPS (E) -
CCV Steelhead DPS (T) - **X**
Eulachon (T) -
sDPS Green Sturgeon (T) -

ESA Anadromous Fish Critical Habitat

SONCC Coho Critical Habitat -
CCC Coho Critical Habitat -
CC Chinook Salmon Critical Habitat -
CVSR Chinook Salmon Critical Habitat -
SRWR Chinook Salmon Critical Habitat -
NC Steelhead Critical Habitat -
CCC Steelhead Critical Habitat -
SCCC Steelhead Critical Habitat -
SC Steelhead Critical Habitat -
CCV Steelhead Critical Habitat - **X**
Eulachon Critical Habitat -
sDPS Green Sturgeon Critical Habitat -

ESA Marine Invertebrates

Range Black Abalone (E) -
Range White Abalone (E) -

ESA Marine Invertebrates Critical Habitat

Black Abalone Critical Habitat -

ESA Sea Turtles

East Pacific Green Sea Turtle (T) -
Olive Ridley Sea Turtle (T/E) -
Leatherback Sea Turtle (E) -
North Pacific Loggerhead Sea Turtle (E) -

ESA Whales

Blue Whale (E) -
Fin Whale (E) -
Humpback Whale (E) -
Southern Resident Killer Whale (E) -
North Pacific Right Whale (E) -
Sei Whale (E) -
Sperm Whale (E) -

ESA Pinnipeds

Guadalupe Fur Seal (T) -
Steller Sea Lion Critical Habitat -

Essential Fish Habitat

Coho EFH -
Chinook Salmon EFH - **X**
Groundfish EFH -
Coastal Pelagics EFH -
Highly Migratory Species EFH -

MMPA Species (See list at left)

ESA and MMPA Cetaceans/Pinnipeds

See list at left and consult the NMFS Long Beach office
562-980-4000

MMPA Cetaceans -
MMPA Pinnipeds -

Attachment C – Study Area Photos

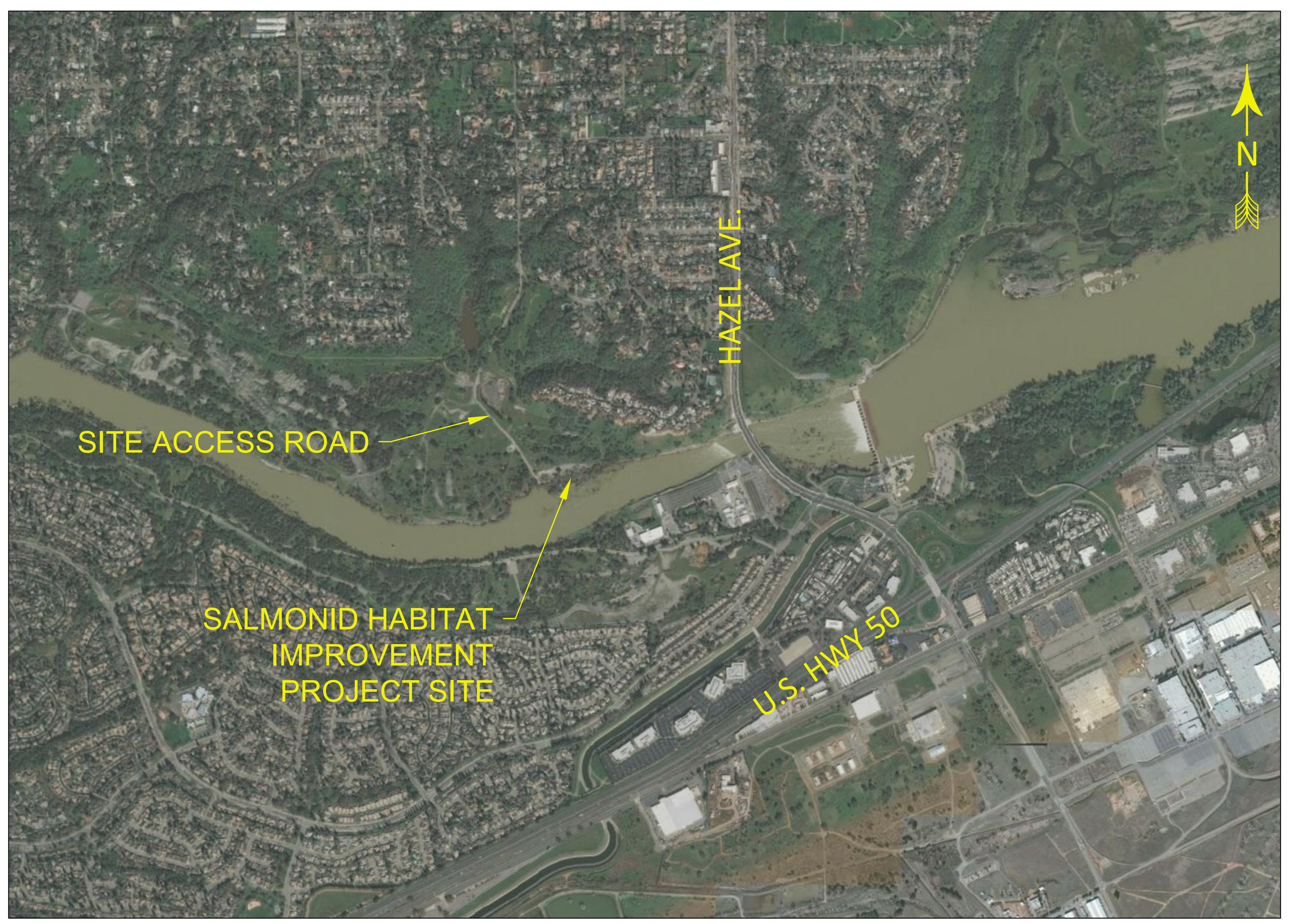

View of furthest downstream restoration site located near William B. Pond Park near RM 14.


View of restoration site located at RM 16.5.

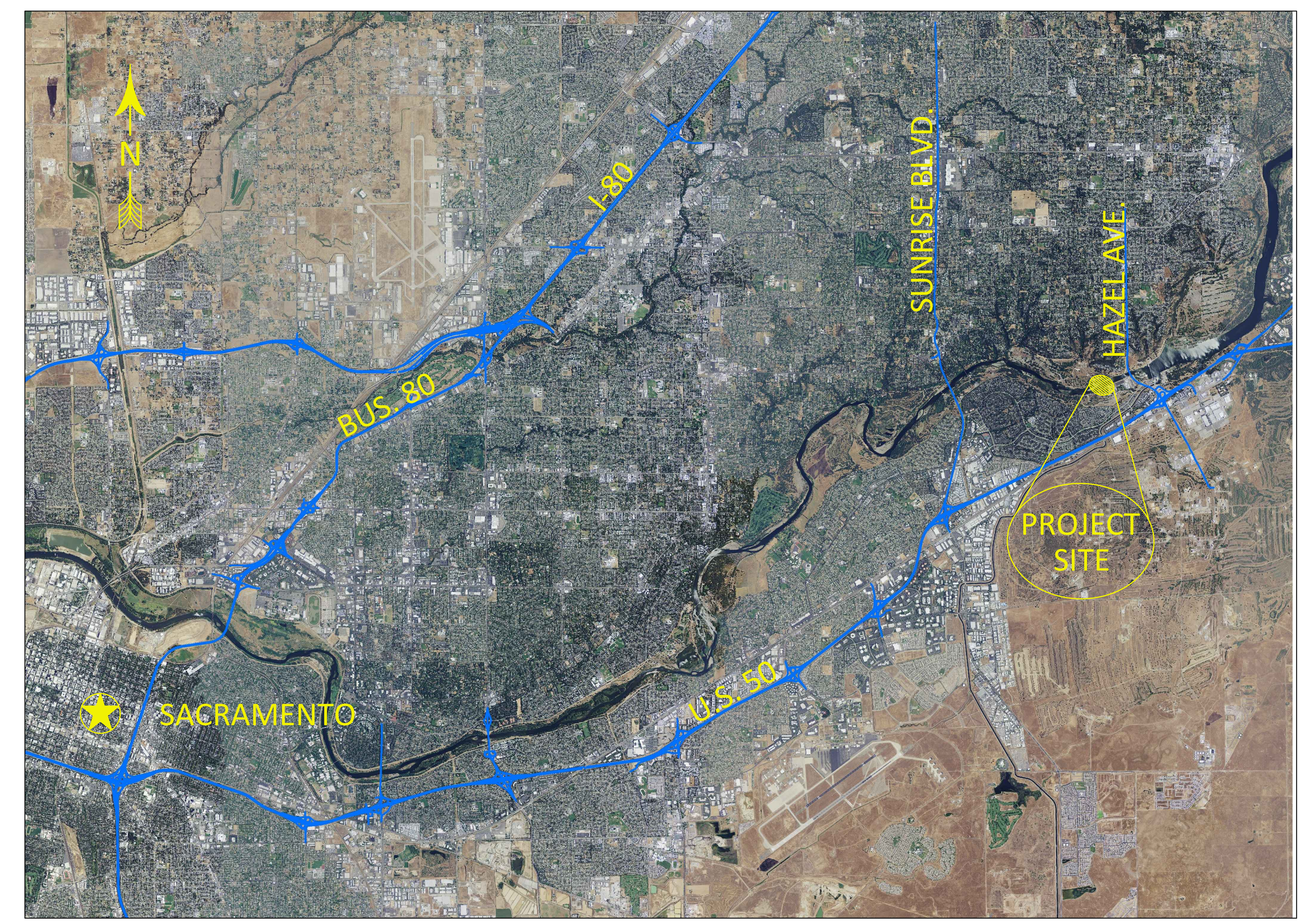
Project Design Detail Plates

LOWER AMERICAN RIVER
SALMONID HABITAT IMPROVEMENT PROJECT

UPPER SAILOR BAR, RIVER MILE 22.50
UNITED STATES BUREAU OF RECLAMATION,
UNITED STATES FISH AND WILDLIFE SERVICE
AND THE WATER FORUM
IN COOPERATION WITH
CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE



LOCATION MAP



VICINITY MAP

LEGEND

- EXISTING CONTOURS
- PROPOSED CONTOURS
- SCOUR RESISTANT SUBSTRATE
- SPAWNING GRAVEL BACKFILL
- OVER EXCAVATION AREA
- GRADING LIMITS
- GRADING BREAKLINE
- CONSTRUCTION LINES
- CONSTRUCTION STAKE
- XX.X SPOT ELEVATION

CONTACTS

THE WATER FORUM	TOM GOHRING, EXECUTIVE DIRECTOR	(916) 808-1998
USBR	JOHN HANNON, FISHERIES BIOLOGIST	(916) 414-2413
cbec, INC.	CHRIS HAMMERSMARK, DIRECTOR	(916) 668-5236

CONTOURS AND ELEVATIONS SHOWN ON PLANS PROVIDED BY SITE SURVEY TIED INTO NATIONAL GEODETIC SURVEY CONTROL POINT DH6482 LOCATED AT LAT:38°35'23.61", LONG:121°17'18.8" WITH A PUBLISHED ELEVATION OF 99.7 FT (NAVD88, GEOID 12A). OUTLYING TOPOGRAPHY IS REFERENCED TO THE 2017 WATER FORUM AND SAFCA LIDAR DATASET

X — INDICATES SECTION LABEL
\# — INDICATES SHEET NUMBER IN WHICH SECTION APPEARS

SHEET LIST TABLE

Sheet Number	Sheet Title
C1	COVER SHEET
C2	PROJECT OVERVIEW
C3	SITE PLAN
C4	PROFILES
C5	SECTIONS
C6	STAKING PLAN

DOCUMENT RELEASE: DRAFT
REVISION NOTES

DESIGNED: BST
DRAWN: JP
REVIEWED: BST
APPROVED: CTH

PREPARED BY: cbec eco engineering

PREPARED FOR: AMERICAN RIVER SALMONID HABITAT IMPROVEMENT PROJECT

SACRAMENTO, CALIFORNIA
LOWER AMERICAN RIVER SALMONID HABITAT IMPROVEMENT PROJECT AT UPPER SAILOR BAR
COVER SHEET

JOB NUMBER: 18-1007
DATE: APRIL 2019
SHEET: C1
1 OF 6

USE OF DOCUMENTS
THIS DOCUMENT, INCLUDING THE INCORPORATED DESIGNS, IS AN INSTRUMENT OF SERVICE FOR THIS PROJECT AND SHALL NOT BE USED FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF cbec, inc.

DOCUMENT RELEASE	REVISION NOTES
DRAFT	

DESIGNED BST
DRAWN JP
REVIEWED BST
APPROVED CTH

PREPARED BY: cbec eco engineering

PREPARED FOR: AMERICAN RIVER SALMONID HABITAT IMPROVEMENT PROJECT

SACRAMENTO CALIFORNIA

LOWER AMERICAN RIVER SALMONID HABITAT IMPROVEMENT PROJECT AT UPPER SAILOR BAR

PROJECT OVERVIEW

JOB NUMBER 18-1007

DATE APRIL 2019

SHEET C2
2 OF 6

USE OF DOCUMENTS THIS DOCUMENT, INCLUDING THE INCORPORATED DESIGNS, IS AN INSTRUMENT OF SERVICE FOR THIS PROJECT AND SHALL NOT BE USED FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF cbec, inc.

DOCUMENT RELEASE	
DRAFT	
REVISION NOTES	

DESIGNED	BST
DRAWN	JP
REVIEWED	BST
APPROVED	CTH

PREPARED BY: cbec eco engineering

PREPARED FOR : AMERICAN RIVER SALMONID HABITAT IMPROVEMENT PROJECT

RECLAMATION

WATER FORUM

SACRAMENTO CALIFORNIA

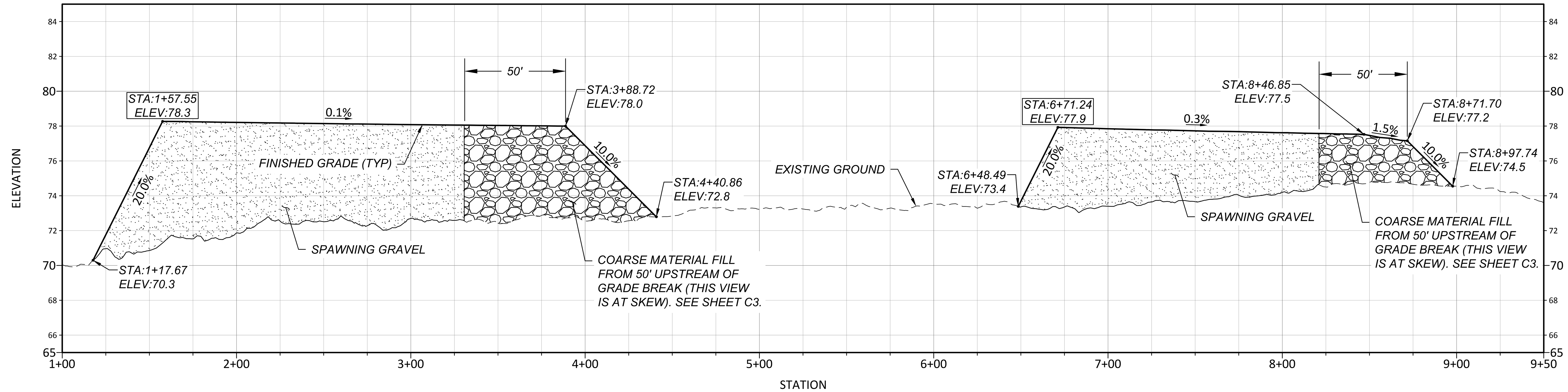
LOWER AMERICAN RIVER SALMONID HABITAT IMPROVEMENT PROJECT AT UPPER SAILOR BAR SITE PLAN

JOB NUMBER 18-1007

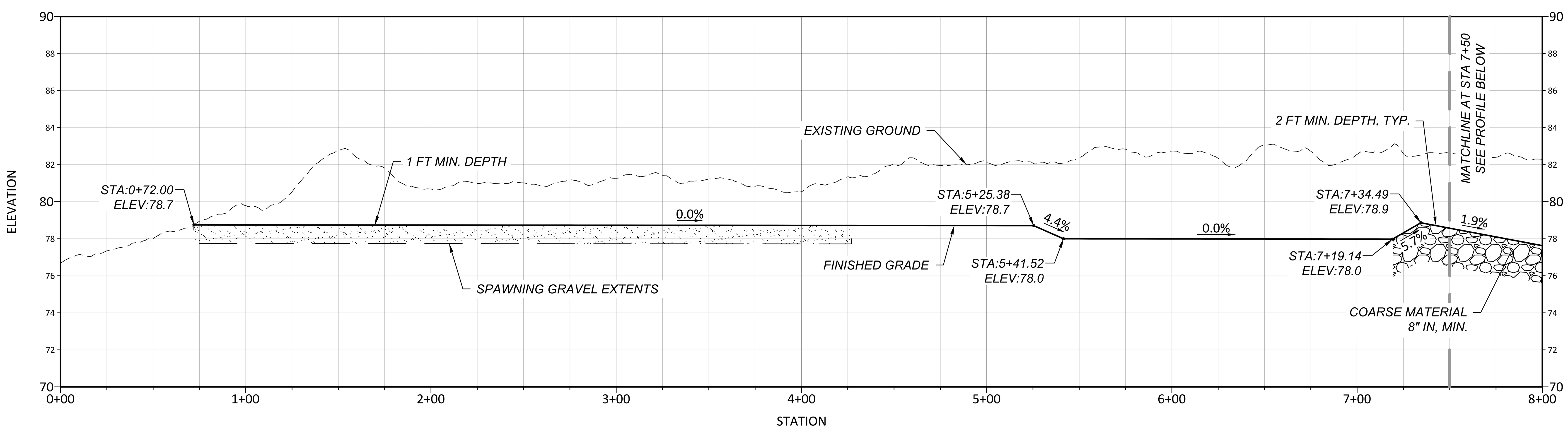
DATE APRIL 2019

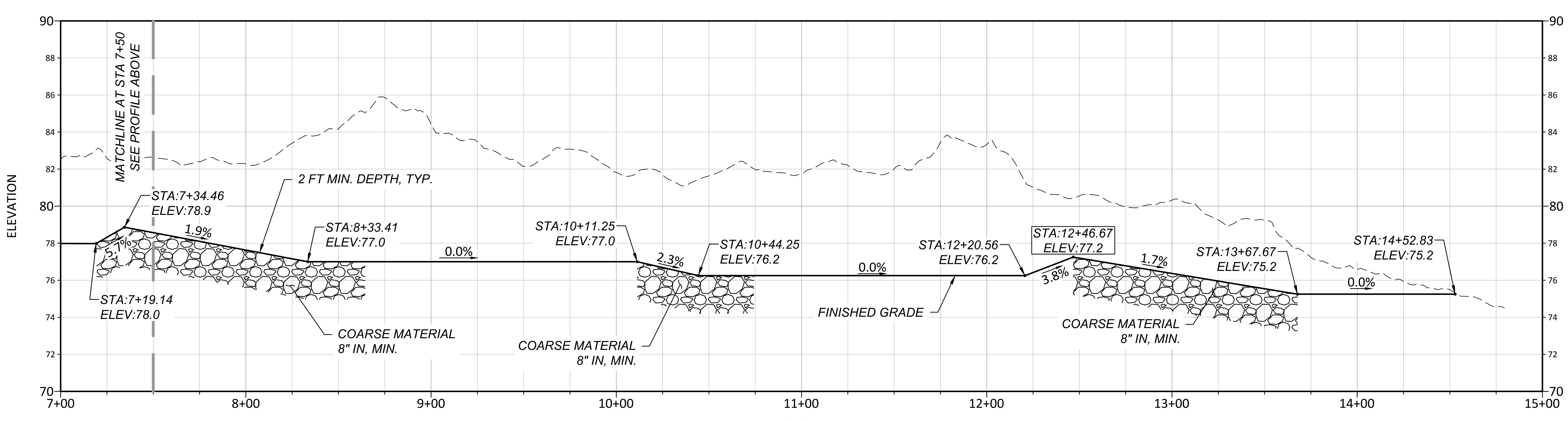
SHEET C3

3 OF 6

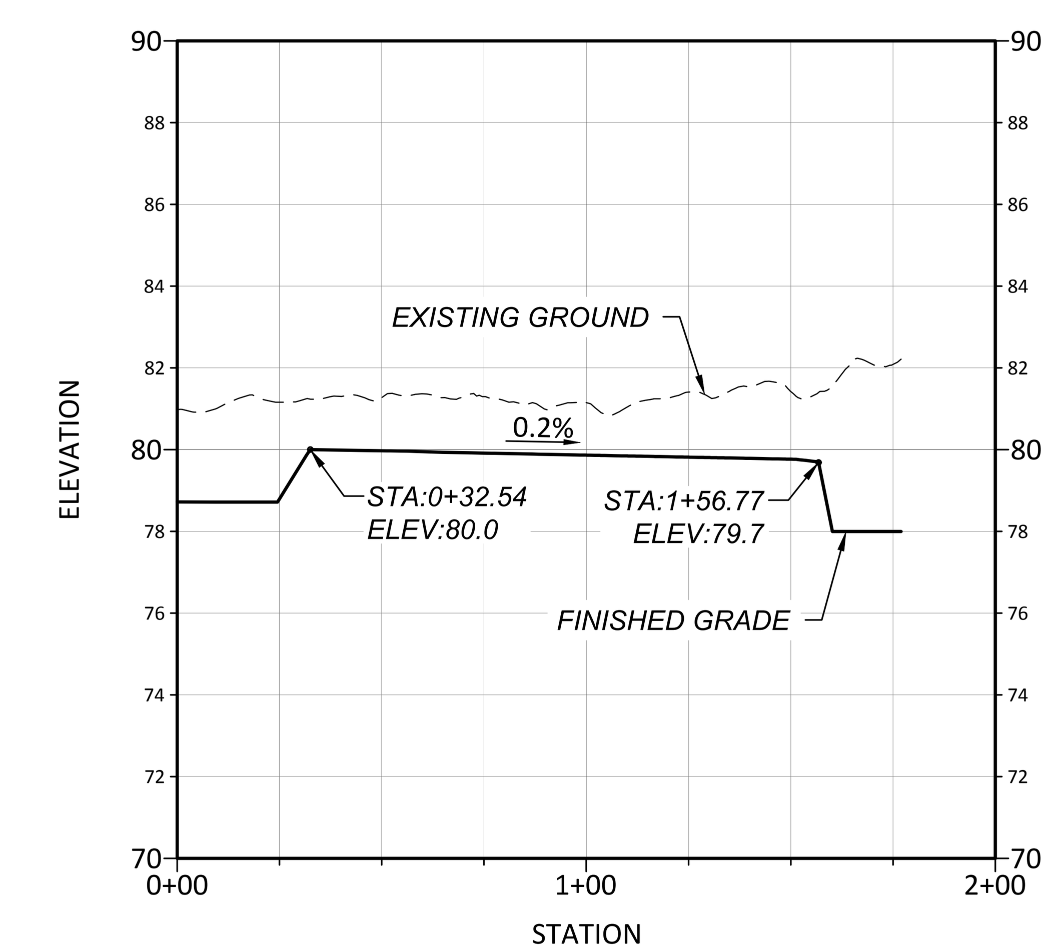


-- C3 MAIN CHANNEL PROFILE
SCALE: H1" = 40'; V1" = 4'





-- C3 SIDE CHANNEL PROFILE
SCALE: H1" = 40'; V1" = 4'



-- C3 SIDE CHANNEL BYPASS PROFILE
SCALE: H1" = 40'; V1" = 4'

HORIZONTAL SCALE: 0 40 80 120 FT
1" = 40'

VERTICAL SCALE: 0 4 8 12 FT
1" = 4'

USE OF DOCUMENTS
THIS DOCUMENT, INCLUDING THE INCORPORATED DESIGNS, IS AN INSTRUMENT OF SERVICE FOR THIS PROJECT AND SHALL NOT BE USED FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF cbec, inc.

DOCUMENT RELEASE: DRAFT
REVISION NOTES

DESIGNED BST
DRAWN JP
REVIEWED BST
APPROVED CTH

PREPARED BY: cbec eco engineering

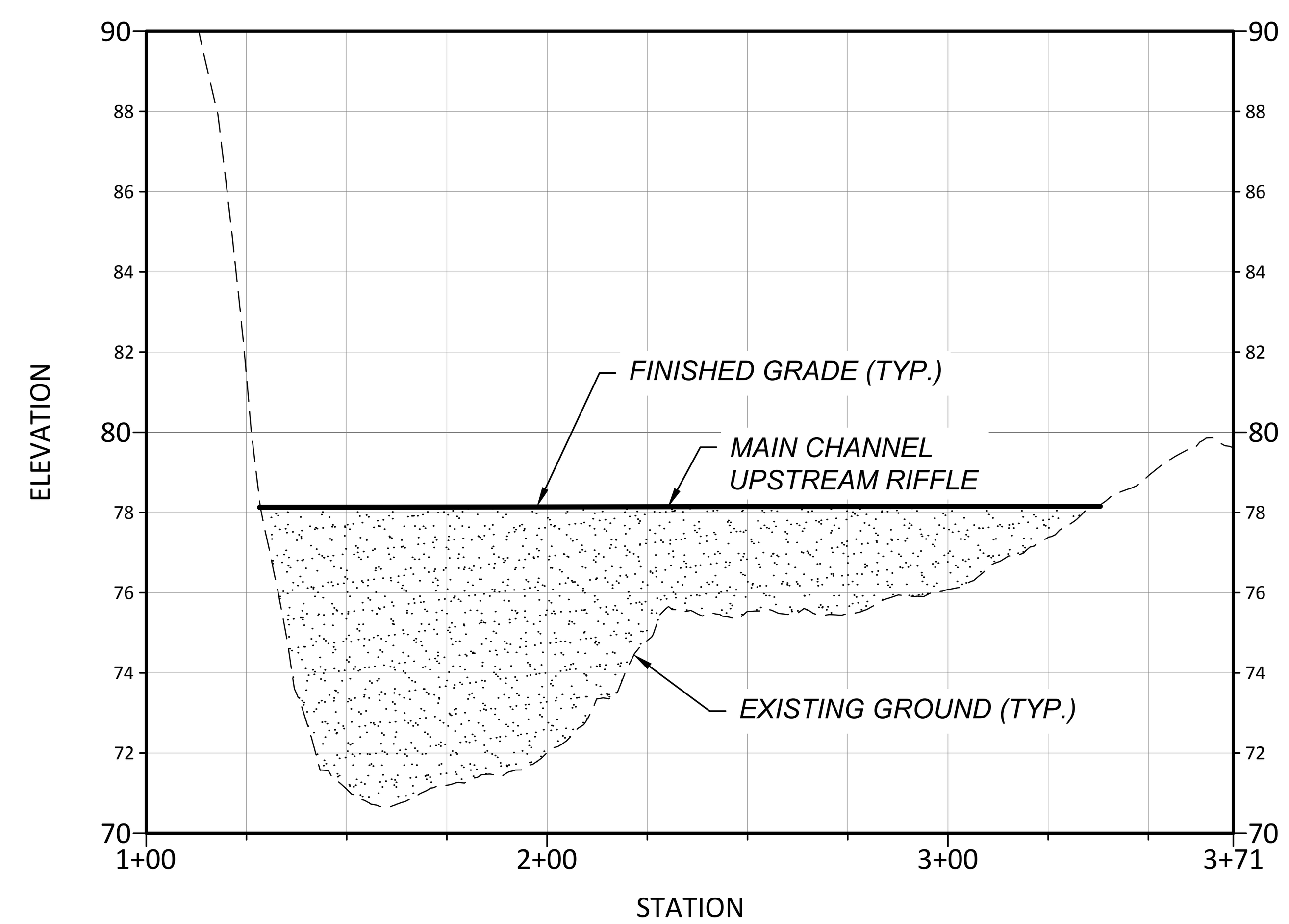
PREPARED FOR: AMERICAN RIVER SALMONID HABITAT IMPROVEMENT PROJECT

SACRAMENTO CALIFORNIA
LOWER AMERICAN RIVER SALMONID HABITAT IMPROVEMENT PROJECT AT UPPER SAILOR BAR
PROFILES

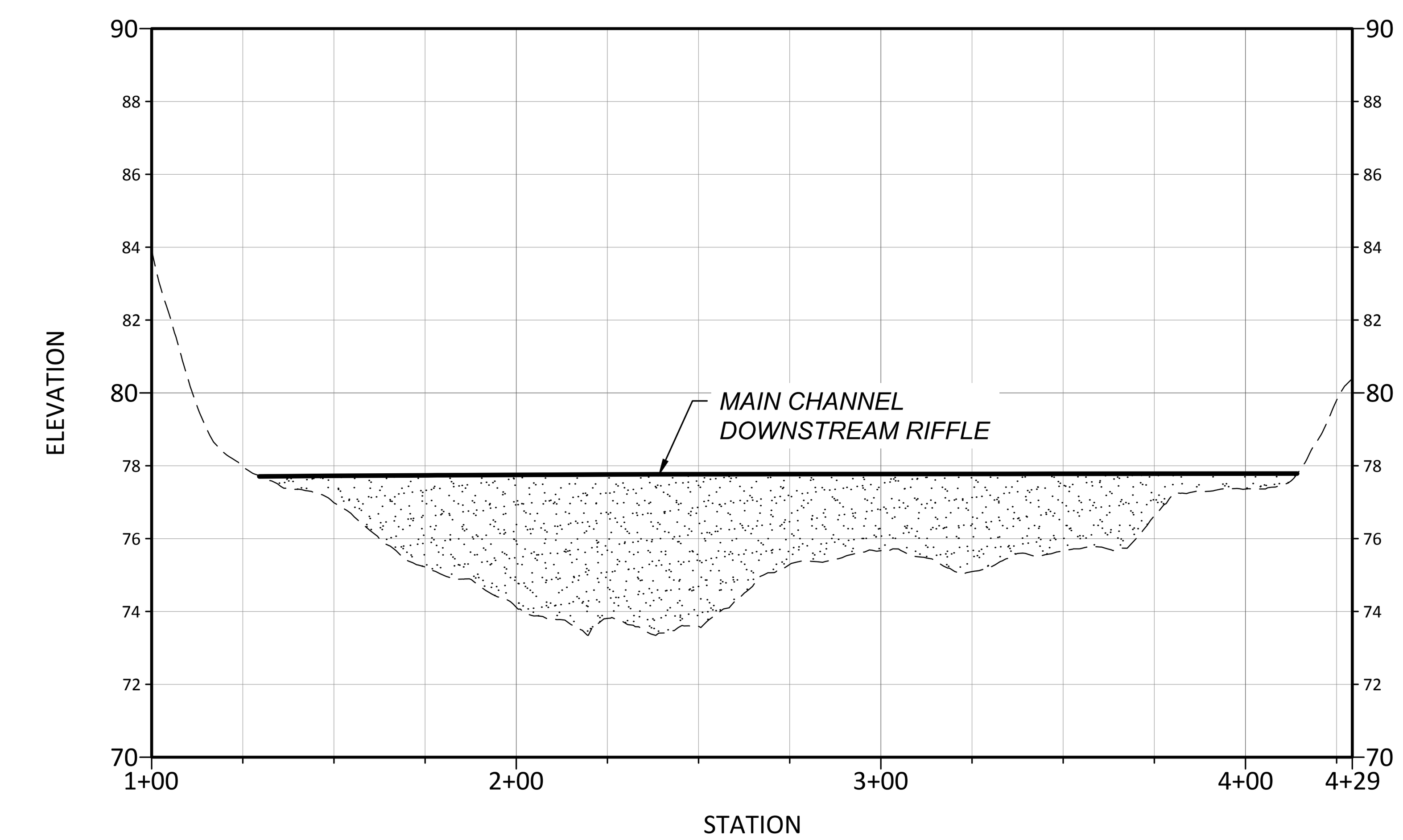
JOB NUMBER 18-1007
DATE APRIL 2019
SHEET C4
4 OF 6

LOCATION: D:\Projects\18-1007_2018_LAR_GA_Upper_Sailor_Bar\400_Technical_Data\403_CAD_Data_DWGS\Production\Profiles.dwg
PLOT:4/19/2019

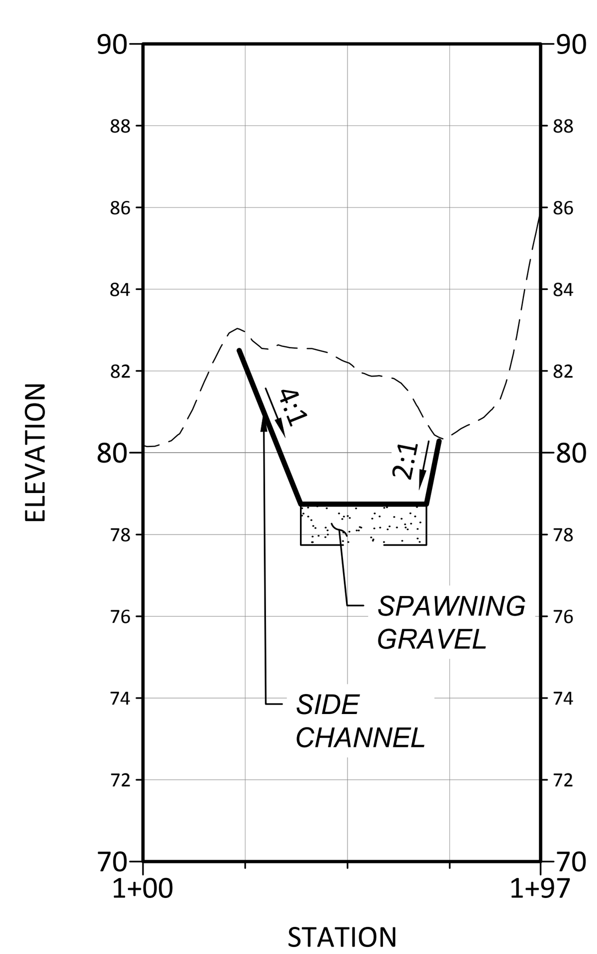
A B C D E



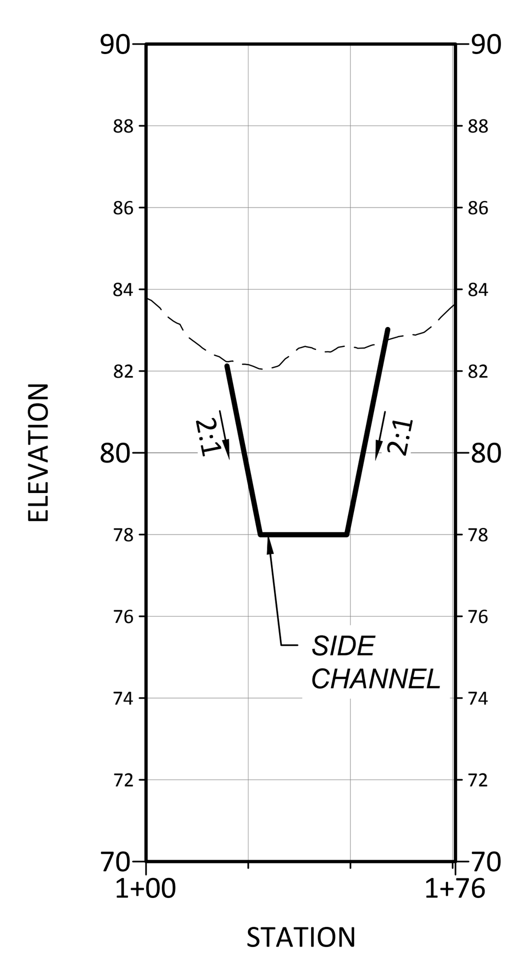
A / C3 TYPICAL SECTION
SCALE: H1" = 40'; V1" = 4'



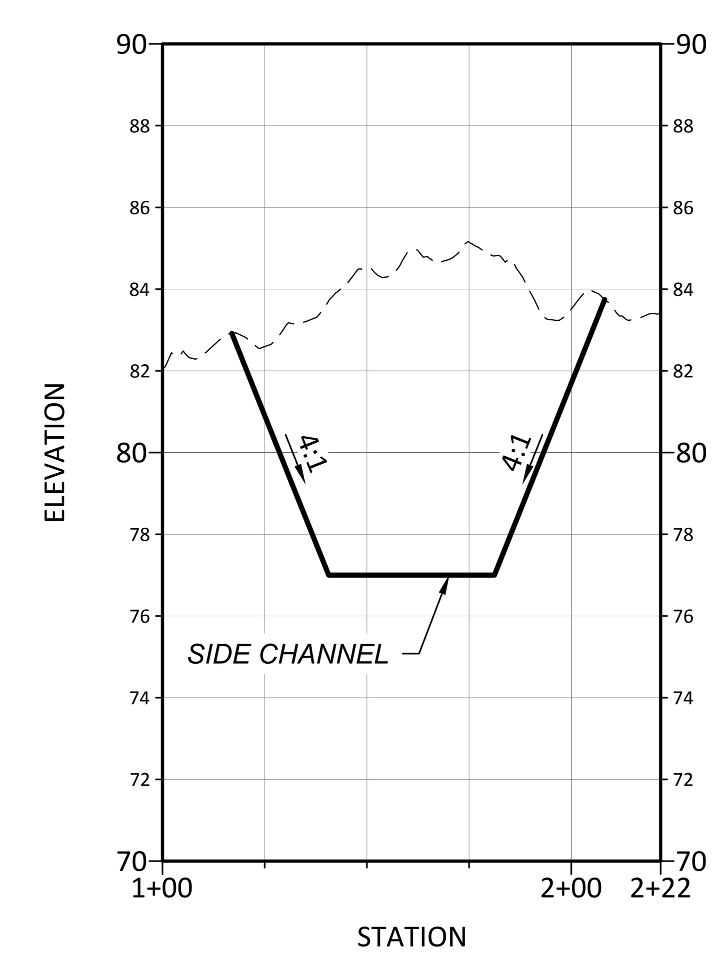
B / C3 TYPICAL SECTION
SCALE: H1" = 40'; V1" = 4'



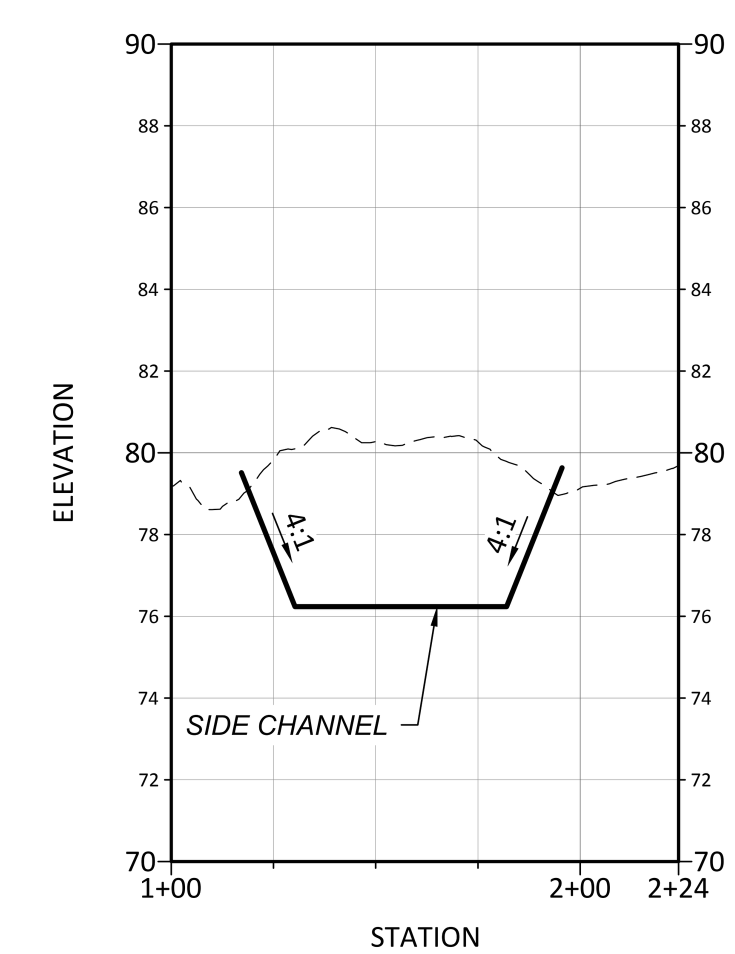
C / C3 TYPICAL SECTION
SCALE: H1" = 40'; V1" = 4'



D / C3 TYPICAL SECTION
SCALE: H1" = 40'; V1" = 4'



E / C3 TYPICAL SECTION
SCALE: H1" = 40'; V1" = 4'



F / C3 TYPICAL SECTION
SCALE: H1" = 40'; V1" = 4'

HORIZONTAL SCALE: 0 40 80 120 FT
1" = 40'

VERTICAL SCALE: 0 4 8 12 FT
1" = 4'

DOCUMENT RELEASE: DRAFT
REVISION NOTES

DESIGNED BST
DRAWN JP
REVIEWED BST
APPROVED CTH

PREPARED BY: cbec eco engineering

PREPARED FOR: AMERICAN RIVER SALMONID HABITAT IMPROVEMENT PROJECT

SACRAMENTO CALIFORNIA
LOWER AMERICAN RIVER SALMONID HABITAT IMPROVEMENT PROJECT AT UPPER SAILOR BAR
SECTIONS

JOB NUMBER 18-1007
DATE APRIL 2019
SHEET C5
5 OF 6

NOTE:
1. STATION CALLOUTS ARE IN REFERENCE TO PROFILE GRADE BREAKS. SEE SHEET C4

USE OF DOCUMENTS THIS DOCUMENT, INCLUDING THE INCORPORATED DESIGNS, IS AN INSTRUMENT OF SERVICE FOR THIS PROJECT AND SHALL NOT BE USED FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF cbec, inc.

DOCUMENT RELEASE	DRAFT
REVISION NOTES	

DESIGNED	DRAWN	REVIEWED	APPROVED
BST	JP	BST	CTH

PREPARED BY: cbec eco engineering

PREPARED FOR: AMERICAN RIVER SALMONID HABITAT IMPROVEMENT PROJECT

RECLAMATION
WATER FORUM

SACRAMENTO CALIFORNIA

LOWER AMERICAN RIVER SALMONID HABITAT IMPROVEMENT PROJECT AT UPPER SAILOR BAR
STAKING PLAN

JOB NUMBER 18-1007

DATE APRIL 2019

SHEET C6