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U.S. FISH AND WILDLIFE SERVICE

DRAFT COORDINATION ACT REPORT

APPENDIX A

LOWER CACHE CREEK FEASIBILITY STUDY

Yolo County, CA

December 2019

United States Army Corps of Engineers
Sacramento District

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Suite W-2605
Sacramento, California 95825-1846

In Reply Refer to:
08ESMF00-
2019-CPA-0014

AUG 29 2019

Mr. Michael Jewell
Acting Chief, Planning Division
U.S. Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, California 95814

Subject: Revised Draft Fish and Wildlife Coordination Act Report for the Lower Cache Creek Flood Reduction Project, Yolo County, California

Dear Mr. Jewell:

Enclosed is the U.S. Fish and Wildlife Service's revised draft Fish and Wildlife Coordination Act (FWCA) report for the Corps of Engineers' Lower Cache Creek Flood Reduction Project, Yolo County, California. This report has been prepared under the authority of, and in accordance with, the provisions of section 2(b) of the FWCA (48 stat. 401, as amended; 16 U.S.C. 661 et seq.). This request updates the draft FWCA completed in 2004 on recent revisions to the project.

By copy of this letter we are sending copies to the NOAA National Marine Fisheries Service and California Department of Fish and Wildlife for review and comment.

If you have any questions regarding the revised draft FWCA report for the Lower Cache Creek Flood Reduction Project, please contact Cathy Johnson, cathy_s_johnson@fws.gov at (916)414-6596, or myself douglas_weinrich@fws.gov at (916) 414-6563.

Sincerely,

Doug Weinrich

Doug Weinrich
Assistant Field Supervisor

Enclosure

cc:
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ec:
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UNITED STATES DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE

REVISED DRAFT
FISH AND WILDLIFE
COORDINATION ACT REPORT

LOWER CACHE CREEK FLOOD REDUCTION PROJECT
YOLO COUNTY, CALIFORNIA

PREPARED FOR:
U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
SACRAMENTO, CALIFORNIA

PREPARED BY:
SACRAMENTO FISH AND WILDLIFE OFFICE
U.S. FISH AND WILDLIFE SERVICE
SACRAMENTO, CALIFORNIA

AUGUST 2019

EXECUTIVE SUMMARY

The U.S. Fish and Wildlife Service (Service) is assisting the U.S. Army Corps of Engineers (Corps) in the preparation of a Feasibility Study and Environmental Impact Statement/ Environmental Impact Report (EIS/EIR) for the Lower Cache Creek Flood Reduction Project, Yolo County, California. The California Department of Water Resources is the project's non-Federal sponsor and the City of Woodland is the local sponsor. The objective of the proposed project is to reduce potential flood risk within Woodland and unincorporated areas of Yolo County. The proposed project involves constructing about 6 miles of new levee just north of Woodland. The area between the new levee and Cache Creek would serve as a flood bypass

The Corps originally analyzed three alternatives: (1) No Action; (2) Construct about 6 miles of new levee just north of Woodland (proposed project); and (3) Construct about 19 miles of flood control structures consisting of a combination of new setback levees and raising of existing levees.

This report identifies fish and wildlife resources within the project area, and impacts of the proposed flood control project on these resources. It provides recommendations to protect existing fish and wildlife resources and to minimize resource losses caused by project construction. Habitat Evaluation Procedures (HEP) was used to assess project impacts on terrestrial resources in the project area.

Under Alternative 2, the proposed project, about 0.28 acre of scrub shrub, 121.9 acres of agriculture/ruderal, and 1.5 acres of orchard habitats would be affected. An additional 0.52 acre of upland would be affected by placing riprap along the Interstate 5 (I-5) embankment.

To offset the loss of scrub shrub removed for the haul road, 0.31 acre of scrub shrub would need to be replanted. This could be accomplished by replanting the area disturbed by the haul road (0.28 acre) and development of an additional 0.03 acre. The loss of 0.52 acre of upland along I-5 would be mitigated at a 1:1 ratio. In addition, the loss of 54 native tree species and 46 non-native tree species would be mitigated at a 5:1 and 1:1 ratio respectively, and planted on 2.89 acres. The upland and tree mitigation should occur at a 3.41-acre site. The loss of agricultural land would be mitigated with the planting of native grasses and forbs on the new levee. The loss of orchard could be offset by planting native trees on a 1.5 acre site.

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INTRODUCTION

This is the U.S. Fish and Wildlife Service's (Service) revised draft Fish and Wildlife Coordination Act (FWCA) report for the Lower Cache Creek Flood Reduction Project. This report is prepared under the authority of, and in accordance with the FWCA, as amended. This study was authorized by the Flood Control Act of 1962 (Public Law 87-874). The California Department of Water Resources is the project's non-Federal sponsor and the City of Woodland (or City) is the project's local sponsor. A reconnaissance study was completed in June 1994 and the Service's most recent draft FWCA report was completed in 2002.

The information presented is based primarily upon project planning information made available by the Army Corps of Engineers (Corps), various reports pertinent to the project area, and a previous application of the Habitat Evaluation Procedures (HEP) methodology. Coordination with the National Marine Fisheries Service (NOAA Fisheries) and California Department of Fish and Wildlife (CDFW) is being accomplished by providing a copy of this report for review and comment.

Design capacity for Cache Creek is 30,000 cubic feet per second (cfs). In 1958, 1983, 1995, 2006, 2011, 2017 and 2019 the creek rose to the top of both levees and overflowed toward the cities of Woodland and Davis. The peak flow in 1983 at the Yolo gage was about 33,000 cfs with an exceedence frequency of about a 20-year event. There was at least one levee break downstream of Road 102. The peak flow in 1986 was about 26,000 cfs with an exceedence frequency of about a 5-year event. During both the 1983 and 1986 events, local agencies patched levee boils to prevent potential levee breaks. The peak flow in 1995 was about 36,500 cfs. Future floods of greater magnitude and duration could result in levee failure and channel overbank flooding. In 2019, Cache Creek at Huff's Corner experienced a significant high-water event of 24,600 cfs that resulted in water surface elevations that peaked at 84.9 feet, which is 3.9 feet above "Flood Stage" and 2.8 feet above "Danger Stage" at the Cache Creek Yolo gage.

The Corps assumes that the existing levees only provide flood protection for a peak flow of 30,000 cfs, or a 10-year event. Specific problems with the levees include aging, subsidence, surface erosion, internal erosion, seepage, and slides within the levee embankment or foundation soils.

This revised draft FWCA report updates an earlier draft FWCA report and presents the current views of the Service on this project. Our analysis is based on engineering and other project information provided by the Corps. Our appraisal of resources is based on literature reviews; personal communications with other recognized experts; field investigations and surveys; best professional judgement of Service biologists; and a projection of future conditions using current land-use information and analyses provided by the Corps. Our analyses will not remain valid if the project, the resource base, or anticipated future conditions change significantly.

AREA DESCRIPTION

Cache Creek originates at Clear Lake in the mountains west of the Sacramento Valley, and is fed by Clear Lake and tributaries downstream of the lake, with a total drainage of about 1,150 square miles. The creek has deposited rich alluvial soils along its course, which today is irrigated farmland using water diverted from Cache Creek or pumped from groundwater. Significant structures on Cache

Creek include Indian Valley Dam, Clear Lake Dam, and an irrigation diversion dam at Capay. Gravel mining has occurred on a 14.5-mile reach of Cache Creek between Capay and Yolo since at least the 1930s. The project area is just north of Woodland. It includes the section of Cache Creek from Road 94B downstream to the Cache Creek Settling Basin (CCSB) in Yolo County (Figure 1). The primary communities in the area include the cities of Woodland and Yolo.

PROJECT DESCRIPTION

The proposed project consists of improving existing levees and the construction of a new levee just north of the City in order to protect it from flooding emanating from Lower Cache Creek. The Corps determined the necessary height of the levee embankment north of the City and the capacity of the project features by modeling a range of flood flow magnitudes/return frequencies, then estimating the cost and benefits for four incremental heights.

The proposed project is comprised of six distinct project reaches (Reach N through Reach S) (Figure 1). A typical section consists of the levee embankment, seepage berms, and drainage canal; cutoff walls; weir; and closure structures. A detailed description of proposed project follows:

Modifications to Existing Levees / CCSB
The proposed project would rehabilitate the southwest levee (Segment N) of the CCSB by constructing a 45-foot-deep cutoff wall through the levee, and a portion of the southern levee (Segment N) of the CCSB would be rehabilitated with a 60-foot-deep cutoff wall. A 3,000-foot-long section of the west levee of the settling basin would be degraded to an elevation of 43 feet (NAVD 88) to accommodate a concrete weir with a height of 9 feet above the existing adjacent grade. The weir would serve to accept floodwater emanating from Cache Creek west of the CCSB, and would prevent backflow from the CCSB to the west during smaller, more frequent flood events. The existing outlet weir of the CCSB would remain unchanged. The future without project condition assumes that the southern 5,250-foot portion of the CCSB training levee would be degraded to improve the distribution of sediment within the basin before construction begins.

New Levees and Other Proposed Project Features
A new levee with a 20-foot-wide crest and a 30-foot-wide landside seepage berm would begin near the intersection of County Road 20 and County Road 98 and extend east to the CCSB. The alignment of the levee would generally follow the northern city limit line west of State Route 113 (SR 113) and Churchill Downs Avenue east of SR 113. The height of the new levee would vary from 6 feet near County Road 98 to 14 feet at its intersection with the existing west levee of the CCSB. Rock slope protection is proposed on the waterside slope of the new levee from County Road 101 east to the southern end of the proposed inlet weir near County Road 20.

A trapezoidal drainage channel with a design capacity of 350 cubic feet per second (cfs) would be constructed north (waterward) of the new levee in Reaches P through S in order to capture smaller, more frequent events and discharge them to the CCSB, and also to provide the necessary fill material for the project. This drainage channel may vary in width during subsequent design phases in order to create a balanced earthwork goal for the project.

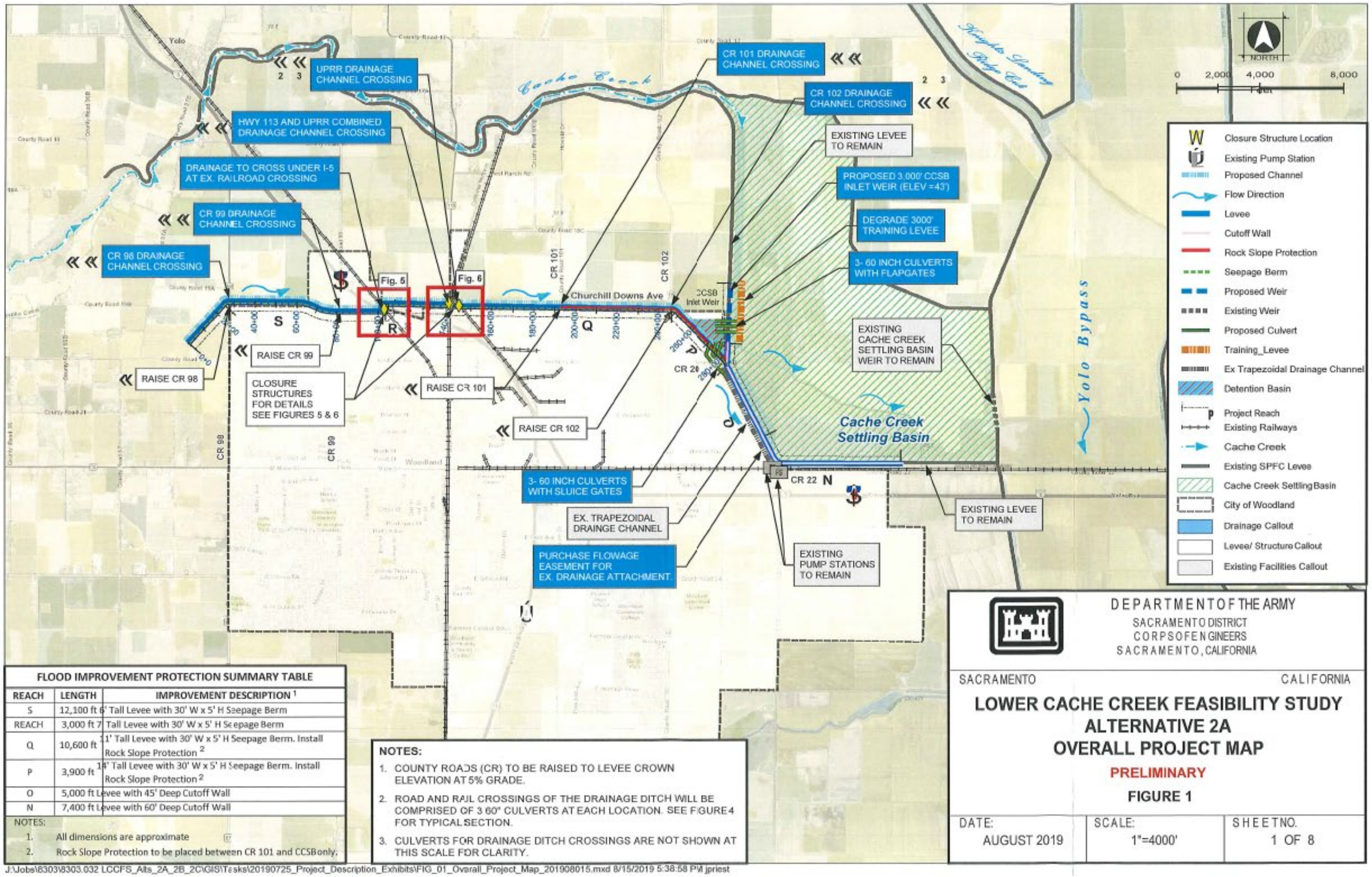

Figure 1. Lower Cache Creek Flood Reduction Project Area

A total of four closure structures (gates that are assembled by operations and maintenance (O&M) personnel prior to the flood) would be constructed where the embankment crosses the Union Pacific Railroad (UPRR) tracks near Interstate 5 (I-5), the UPRR tracks west of SR 113, SR 113, and the UPRR tracks east of SR 113. Due to the limited distance between the closure structures, short sections of floodwall would be constructed to connect the closure structure at the I-5 crossing to the existing roadway embankment and to connect the closure structures at the SR 113 crossing and the adjacent UPRR crossing to the west.

Internal Drainage
Water impounded by the proposed levee and the west levee of the CCSB would be drained via new culverts into the CCSB and to the City's interior drainage system. A detention basin would be located at the downstream end of the proposed drainage canal along Segment P. The detention basin would include an east and south outlet. The east outlet would provide for gravity drainage to the CCSB and consist of a set of three 60-inch diameter culverts fitted with flap gates. This would allow gravity flow into the CCSB after stages in the CCSB have fallen below the inlet weir crest. Reverse flow from the CCSB into the detention basin would be prevented by the flap gates. The south outlet would consist of a set of three 60-inch diameter culverts fitted with sluice gates. The gated culverts would discharge to a ditch that terminates at a pump station owned and operated by the City. The sluice gate outlet, in combination with the detention basin, would allow for temporary detention of drainage until the pump station had available capacity to discharge the floodwaters to the Yolo Bypass. The design and operation of these systems has not been fully developed yet, and would be optimized during later phases of project development.

Roadway Improvements
The new levee would require the raising of County Road 98, County Road 99, County Road 101, and County Road 102. Culverts would be installed at each of these raised crossings, as well as under SR 113 and the two UPRR crossings along the alignment. An existing railroad underpass at I-5 would be used to convey flood waters under the interstate. In order to prevent erosion due to high velocities in this area, those portions of the area found to have velocities of over 5 feet per second (fps) would be lined with concrete. This protection would be installed across the entire project footprint area where flood flows velocities exceed the 5 fps limit. This area includes the existing slopes of the I-5 roadway embankment, the slopes of the proposed Reach R and Reach S levees, the proposed channel (both bottom and slope), and the existing UPRR railway.

Summary of Improvements

Table 1. Provides a Summary of the Features and Improvements for the Proposed Project.

Feature	Improvement Description	Applicable Reaches	Quantity
New Levee	New Levee with Seepage Berm	Q (Partial), R, S	3.9 Miles
New Levee with RSP	New Levee with Seepage Berm and Rock Slope Protection	P, Q (Partial)	1.7 Miles
Improve Existing Levee	Improve existing levee with cutoff wall	N, O	2.3 Miles
Drainage Channel	New drainage channel and culverts. Also serves as borrow source for levee fill.	P, Q, R, S	5.6 Miles
Elevated Roadways	Elevate Roadway over levee at CR98, CR99, CR101, and CR102	P, Q, R, S	4
Gated Roadway Closure Structure	Gate at SR 113	Q, R	1
Gated Railroad Closure Structures	Gate for Railroad at I-5, West of SR 113, East of SR 113	Q, R, S	3
Cache Creek Settling Basin Inlet Weir	Concrete Inlet Weir	CCSB Inlet Weir	3,000 Feet
Degrade Training Levee	Degrade 3,000 feet of Existing Cache Creek Settling Basin Training Levee	Training Levee	3,000 Feet
Detention Basin and Outlets	New Detention Basin and Outlets	P	1
Improve Existing Drainage Ditch	Utilize Existing drainage ditch from Detention Basin to City of Woodland Pump Station.	O	1 Mile

Footprint / Right-of-Way (ROW) Needs
Fee title would be obtained for areas beneath the physical project features (i.e. embankment, seepage berm, drainage canal, etc.). Easements would be obtained for the area 15 feet beyond the toe of waterside features and 20 feet beyond the toe of landside features. A summary of the land uses impacted by the proposed project footprint and easements is included in Table 2 below.

Residual Floodplain
Preliminary analysis performed by MBK Engineers, Inc.for Alternative 2A in 2016 demonstrated that this alternative is estimated to increase the depth of flooding north of the proposed levee east of SR 113 by as much as 6.5 feet for the 1/100 or 1% annual chance exceedance (ACE) flood event, and would increase the depth of flooding west of SR 113 by as much as 2 feet. Additionally, this alternative increases the flood depth on 14 structures during a 1% ACE flood event. The duration of residual flooding was not evaluated for this option.

Table 2. Estimated Right-of-Way Needs for the LowerCache Creek Flood Reduction Project.

Land Use Type	Estimated Acreage
Agricultural	283.0
City's Jurisdiction	1.4
Agricultural/Residential Low Density	3.6
Agricultural/Residential Medium Density	18.1
Other Public / ROW / Roadway	12.9
Total	**319.0**

Construction *Methods*

Site Preparation
Site preparation would include clearing and grubbing, and stripping activities within the levee and seepage berm construction footprint. Up to 319 acres are anticipated to be cleared. Clearing and grubbing activities involve the removal of larger woody vegetation, including trees, rootballs, and other existing debris within the project footprint. These activities would be completed using excavators and bulldozers, and the debris would be transported by haul truck to a permitted disposal site, likely the Yolo County Central Landfill, about 11 miles from the project site. Stripping would involve excavating 6 to 12 inches of organic material from the land surface. Topsoil would be stockpiled at the borrow/staging areas. Topsoil removed from the borrow areas, project footprint, and the maintenance corridor would be placed on the embankment slopes after levee construction is complete to promote vegetative growth.

Seepage Berm Construction
A seepage berm is a wide embankment structure that consists of soil fill placed landward of the new embankment to form a widened prism. Fill would be placed in accordance with the Corps' construction standards for lift thickness and compaction to achieve the desired height. Each lift would be moisture-conditioned and compacted to the specified density using appropriate compaction equipment. The seepage berm would be 5 feet thick and extend up to 30 feet from the landside toe of the levee.

Cutoff Wall Construction
A cutoff wall consists of a deep trench excavated into the foundation soil of the embankment, along the levee centerline, that is backfilled with soil-bentonite slurry. The cutoff wall(s) would extend up to 60 feet deep, as measured from the bottom of the new "select levee fill" cap, and be 3 feet wide. As the trench is excavated, it would be filled with bentonite slurry to keep the sidewalls from caving in. Adjacent to the trench, the excavated material would be mixed with bentonite slurry in appropriate proportions to achieve the required cutoff wall strength and permeability properties, then backfilled into the excavated trench.

Cutoff wall construction requires temporary establishment of an on-site slurry batch plant that would occupy 1 to 2 acres. Batch plants would be located at 1-mile intervals along the levee in defined staging areas. Each batch plant site would likely contain tanks for water storage, bulk bag supplies of bentonite, bentonite and cement storage silos, a cyclone mixer, pumps, and two generators that meet air quality requirements. The site would also accommodate slurry tanks to store the blended slurries temporarily until they are pumped to the work sites. Slurry ingredients would be mixed with water at the batch plant and the mixture would be pumped from the tanks through pipes to the cutoff wall construction work sites. The batch plant would produce two different slurry mixes, one for trench stabilization and one for the soil backfill mix. Therefore, two slurry pipes or hoses, typically 4- or 6-inch high-density polyethylene pipes, would be laid on the ground and extend to all work sites. An additional pipe may be used to supply water to the work sites.

Levee and Drainage Canal Construction
A trapezoidal drainage canal is proposed waterward of the proposed levee in Segments P-S. An existing trapezoidal channel serves the levee system landward of Segments N and O. Material excavated from the drainage canal would either be used in the construction of the levee embankment, or disposed of in a legal manner.

Where there is a seepage berm, levee foundation preparation includes excavating an inspection trench up to 6 feet deep and 12 feet wide, centered under the outer edge of the waterside levee crown. Material excavated for the inspection trench would be stockpiled at the borrow/staging areas.

Most material excavated from the trapezoidal drainage canal would be suitable for levee fill and used in the construction of the levee embankment. Additional levee embankment fill would be transported from the borrow areas and placed in specified lifts by motor graders, in accordance with accepted levee construction standards for lift thickness and compaction to achieve the desired levee height and configuration. Each lift would be moisture-conditioned and compacted to the specified minimum density using a suitable compactor.

Stockpiled topsoil would be placed on the levee slopes. An all-weather patrol road along the levee crown and an access road along the landside toe of the levee would be constructed for flood fighting and O&M purposes. After all levee construction is complete, the levee slopes and other disturbed areas would be hydroseeded.

Closure Structure Construction
Closure structures are needed where the proposed levee crosses existing improvements that cannot be raised (i.e. major roads and railroads). The closure structures would consist of permanent and temporary components that would be installed only during high-water events. The temporary components would be the property of the City and stored in their maintenance yard.

The permanent components of the closure structure would generally consist of:

- Foundation piles
- Concrete retaining walls and steel support structure
- Galvanized metal steel plates to prevent seepage through railroad ballast (at railroad crossings)

Construction of the permanent components of the closure structure are anticipated to be performed within available track curfews (or roadway closures), without physically altering the tracks or roadways. Excavation and construction would occur in close proximity to the tracks, but the tracks are not anticipated to be removed, modified, or disturbed as part of the construction effort.

CCSB West Levee Degrade/Weir Construction
A 3,000-foot-long portion of the existing CCSB West Levee would be degraded to an elevation of 43 feet NAVD88 to construct a weir. Excavated material would either be stockpiled for use on the project, or disposed of legally. Excavated material from the CCSB levees may be used to offset borrow material needs, although this would need to be evaluated by the Corps during design.

Stormwater Pollution Prevention
Temporary erosion/runoff best management control measures would be implemented during construction to prevent the discharge of pollutants resulting from erosion and sediment migration from the construction, staging, and borrow areas. These temporary control measures may include secondary containment for storage of fuel and oil and management of stockpiles and disturbed areas by means of earthen berms, diversion ditches, straw wattles, straw bales, silt fences, gravel filters, mulching, revegetation, and temporary covers as appropriate. Erosion and stormwater pollution control measures would be consistent with National Pollutant Discharge Elimination System permit requirements and would be included in a Stormwater Pollution Prevention Plan (SWPPP). After construction is complete, temporary facilities would be demobilized and the site stabilized. Site restoration activities for areas disturbed by construction activities, including borrow areas, may include regrading, reseeding, constructing permanent diversion ditches, using straw wattles and bales, and applying straw mulch and other measures deemed appropriate.

Structure and Road Demolition
Structure and road demolition activities would include removing standing structures within the levee and borrow area footprints. All structural demolition would be done in compliance with existing regulations, including asbestos abatement requirements. These activities may require use of equipment with a percussion hammer attachment for breaking up concrete foundations. Debris would be loaded into waste containers and transported by haul truck to a permitted disposal site, likely the Yolo County Central Landfill.

Construction Material Sources and Needs

The earthwork quantities indicate that the project is pretty close to balanced (total estimated fill needed is about 956,000 CY, reusable material is estimated to be about 289,000 CY, and the new trapezoidal ditch generates about 638,000 CY potentially leaving less than 30,000 CY of import. Given the 20% fill contingencies included in the fill estimates, the site may end up being balanced. Fill material for the embankment and seepage berm would be obtained from construction of the trapezoidal drainage ditch north of the levee toe, as well as potential borrow areas within the CCSB, or from an existing permitted stockpile within 5 miles of the project site. Aggregate base and asphalt would be obtained from local sources.

The suitability of the material near the location of the proposed levees was evaluated by the City during early phases of this project. The City's evaluation indicates that, although the material is generally fat clay and does not meet the Corps EM 1110-2-1913 criteria for liquid limit, about 95%

of the material excavated could be used as levee embankment fill with proper design details and construction processing. These materials would be subject to surficial desiccation cracking that could be problematic from a maintenance standpoint. Lime treatment during construction, flattening of embankment slopes, and/or mixing with less plastic materials could be used to reduce the potential for cracking.

Staging, Site Access, and Construction-Related Traffic

Staging areas would only be provided within the right-of-way and easement limits to be obtained for the project, as well as other staging areas. The contractor may reach agreements with landowners for additional staging locations outside of these limits. Staging areas would be used by the contractor for storage of equipment and materials, project offices, employee parking, and other uses needed for construction of the project.

Personnel, equipment, and imported materials would reach the project site via I-5, SR 113, County Road 102, and County Road 22. Once on-site, haul trucks would use the embankment footprint to transport material between borrow and staging areas and the levee construction area. Staging would occur within the construction footprint and defined staging areas as shown on Figure 1.

It is expected that about 15 trailer ("low-boy") truck round trips would be required to transport the contractor's plant and equipment to the site, and a similar number of round trips would be needed to remove the equipment from the site as the work is completed.
About 60 truckloads would be needed to bring dry bentonite to the site, likely from the Sacramento area; and 100 truckloads would be needed to bring aggregate base and asphalt materials from the local sources.

About 600 haul truck trips per day for 60 days would be required to transport material between the on-site borrow areas or off-site borrow source and the levee construction area. Another 500 haul truck trips are be needed to transport demolition debris, construction debris, and other materials to the Yolo County Central Landfill.

Construction Equipment

The equipment planned for use in construction includes haul trucks, excavators, dump trucks, front-end loaders, dozers, scrappers, and water trucks. Actual equipment use may vary, depending on construction schedule, contractor capabilities and preferences, and equipment availability.

Construction Schedule and Labor Force

The project is anticipated to be constructed in a single phase of about 24 months during the spring, summer, and fall construction windows (non-rain season) within the next 6 years.

Work, including equipment operation, would generally occur Monday through Saturday during normal working hours (7 a.m. to 7 p.m.). Equipment maintenance could occur before and after working hours and on Sunday. If necessary, to complete construction before the beginning of the flood season (for the CCSB), work may occur on a 24-hour basis in some areas.

Construction crew sizes would vary depending on the construction activity, but the maximum is anticipated to be 50 workers. Construction workers would most likely come from the local labor force in the Woodland and Sacramento areas.

Operations and Maintenance Activities

Regular O&M activities would include inspections and patrols, levee vegetation management, burrowing animal control and abatement, slope maintenance, erosion protection, and patrol road and ramp maintenance along the levee embankment. The levee crown patrol road and landside toe access road would be used to access the length of the embankment during these activities and during high-flow events for flood-fighting purposes.

Inspections and patrols for levee integrity, debris and trash removal, security, and other purposes would be conducted regularly by one to two persons driving and/or walking the embankment. Vegetation would be managed through common practices including herbicides, burning, and/or animal foraging (i.e., goats). Burrowing animal control and abatement would occur through common practices including fumigation, baiting, poison, and trapping. Burrows would be excavated and backfilled and/or grouted.

Grading and dragging of the embankment and levees would occur as needed to repair erosion, rills, sloughing, burrows, etc. and maintain grades and slopes. It is expected that periodic aggregate replacement would result in replacing all aggregate along the levee crown patrol road, landside toe access road, and access road at the degrade area once every 10 years. Maintenance of the rock slope protection would primarily include vegetation control, repositioning of rock when displaced, and replacement of rock as needed. The proposed drainage canals also need to be maintained regularly. Maintenance of the drainage canal would include vegetation management, debris and trash removal, and sediment removal as needed.

The permanent and temporary components of the proposed closure structures at the railroad and SR 113 crossing also need to be inspected annually to ensure all components are in good repair.

In addition to these regular O&M activities, the embankment would be patrolled during high-flow periods, which have a 10% or less chance of occurring in any given year, to identify and address potential flooding issues. Depending on the water level, the entire length of the embankment would be traveled several times per day until water levels fall below monitoring levels, which would be expected to take 5 days on average.

EXISTING BIOLOGICAL RESOURCES

Vegetation

Five cover-types can currently be found in the project area: riparian forest, scrub shrub, shaded aquatic riverine (SRA) cover, agriculture/ruderal, and orchard. A description of each cover-type follows; however, based on current project information only three cover-types are being impacted by the project; scrub shrub, agriculture/ruderal, and orchard.

Riparian forest cover-type along Cache Creek exists in a fairly narrow band (35 to 75 feet). The riparian habitat occurs along both banks of Cache Creek throughout most of the proposed project area, a distance of about 10 miles. Native trees of the Cache Creek riparian forest include cottonwood, willows, and valley oak. Understory plants include California wild grape, blackberry, poison oak, willows, and elderberry. There are also patches of non-native vegetation including giant reed, tamarisk, and locust.

Scrub shrub cover-type consists of woody trees or shrubs averaging less than 20-feet tall. This cover-type is dominant along the training canal leading into the CCSB. The band of scrub shrub varies from 10 to 120 feet wide, growing wider further downstream. Species within this cover-type are dominated by cottonwood and willow species.

Shaded riverine aquatic (SRA) cover is found along the interface between the creek and adjacent woody riparian habitat. Except immediately under bridges, this cover-type is composed of natural, eroding substrates supporting riparian vegetation that either overhangs or protrudes into the water and variable amounts of instream woody debris, variable water velocities, and water depths. In the project reach of Cache Creek, the SRA cover is typically a narrow band composed of vegetation including small willows, cottonwoods, tamarisk, and giant reed, with some instream woody debris, undercut banks and a few boulders.

Agricultural/ruderal land is the dominant habitat landside of the levees. Typical crops in the area include tomatoes and winter wheat. Ruderal upland habitat can be found on levees and margins of agricultural land. Typically ruderal vegetation occurs as a strip bordering levees and agricultural fields with a width ranging from about 20 to 100 feet or more. Vegetation includes annual grasses interspersed with yellow star-thistle, milk thistle, and teasel.

Orchard habitat is also found commonly landside of the levees. Typical orchard crops in the area include walnuts, plum, olive, and pistachio. Herbaceous ground cover between the rows typically consists of annual grasses, forbs, or bare soil.

Wildlife

Riparian forest and scrub shrub are especially valuable for wildlife. Riparian trees provide nesting habitat for many birds, notably cavity-nesting species and a large assemblage of raptors, including the State-listed Swainson's hawk. Birds which glean insects off of bark, leaves, and leaf tangles such as bushtits, woodpeckers, and nuthatches, also use riparian habitats. Song birds such as the yellow warbler use the scrub shrub cover-type for nesting. Typical mammal species that can be found in riparian and scrub shrub areas include deer, raccoons, beavers, coyotes, and foxes. The multilayered vegetation provides an abundance of insect prey that feed on fresh foliage and stems during the growing season.

SRA cover provides habitat for many native species such as belted kingfisher, wood duck, black-crowned night heron, bank swallow, beaver, and river otter. It also provides a food source for instream invertebrates.

Fallow agricultural fields and ruderal areas support rodent populations, which in turn provide prey for many raptor species in the area. The ruderal areas on the levees and margins of agricultural fields provide habitat for granivorous birds such as western meadowlarks, California quail, sparrows, and finches, and for voles small mammals like and pocket gophers. Orchards provide perching, cover, and some nesting area for birds, as well as some cover for small mammals.

Fisheries

Surveys for fish species in Lower Cache Creek were done in June and July, 1997, by the Cache Creek Conservancy (Pederson 1997). A total of 18 fishes were captured, 5 of which were natives. The non-native red shiner was the most predominately found fish. Native fish include the hitch, Sacramento sucker, Sacramento pikeminnow, speckled dace, and Sacramento blackfish. These fish accounted for 11% of the total number of fish sampled. Lack of deep pools and complex cover likely limits the native fish species.

In 2008, 10 species were observed during the Cache Creek fisheries survey: bluegill, green sunfish, largemouth bass, smallmouth bass, inland silverside, western mosquito fish, Sacramento pikeminnow, Sacramento sucker, common carp, and speckled dace.

A total of 619 fish (365 upstream of Capay Dam and 254 downstream) were observed on Cache Creek during the 2008 surveys. By a considerable margin, common carp was the most abundant species both upstream and downstream of the dam. Species richness was greatest at sites downstream of Capay Dam, yet the majority of species (7 of 9) observed in this reach have been introduced to California. Conversely, 3 of the 5 species observed upstream of Capay Dam are native to California. All of the fish species observed during the 2008 survey except the common carp were previously documented on Cache Creek in a 1997 survey. Several other species, mostly introduced, were observed in 1997, but not seen in 2008.

Chinook salmon, steelhead, and Sacramento splittail once migrated up the creek (USFWS 1978; YCCDA 1995). The limited records that exist do not indicate if the creek supported self-sustaining salmon or steelhead populations, or if the fish observed in the creek originated from other watersheds. Today, impediments to migrating fish species include: construction of upstream migration barriers at the CCSB weir, reduced flows due to upstream storage and diversions, mining impacts to riparian and instream habitat, and entrainment losses of fish into unscreened diversions.

Endangered Species

There are 12 federally listed threatened or endangered species and 1 candidate species that may occur in the project area (Madrone 2019). These include the endangered palmate-bracted bird's-beak (*Chloropyron palmatum*); vernal pool tadpole shrimp (*Lepidurus packardi*); and least Bell's vireo (*Vireo bellii pusillus*). The threatened species include the vernal pool fairy shrimp (*Branchinecta lynchi*); valley elderberry longhorn beetle (*Desmocerus californicus dimorphus)*; steelhead (CA Central Valley ESU) (*Oncorhynchus mykiss*); California tiger salamander (*Ambystoma californiense*); California red-legged frog (*Rana draytonii*); giant garter snake (*Thamnophis gigas*); western snowy plover (*Charadrius alexandrinus nivosus*); and western yellow-billed cuckoo (*Coccyzus americanus occidentalis*). The candidate species is the longfin smelt (*Spirinchus thaleichthys*).

Although candidate species are not protected under the Act, the 1988 amendments require the Service or NOAA Fisheries to monitor their status. If any of these species decline precipitously during the planning of this project, they could be listed on an emergency basis. NOAA Fisheries has responsibility for most marine fish and wildlife, including anadromous salmonids, and should be consulted on activities which may affect any such listed or proposed species in the project area. The Service has consultation responsibility for the remaining species.

The California Department of Fish and Wildlife (CDFW) has responsibility for State listed species and species of concern. The CDFW should be contacted regarding any State listed species or species of concern that may be impacted by project activities.

FUTURE CONDITIONS WITHOUT THE PROJECT

Vegetation

Both the Department of Water Resources and the Yolo County Flood Control and Water Conservation District conduct vegetation clearing on the levees and within the stream channel when vegetation is deemed a hindrance to water flow. As these current policies would continue into the future, riparian and SRA vegetation would be expected to continue in the present condition. Scrub shrub habitat along the training canal would continue to grow providing increasingly better cover and habitat.

Introduced species such as tamarisk and giant reed would continue to be dominant in parts of the riparian zone. These two species thrive in riparian areas which are disturbed, whether by natural events (e.g., flood scouring, channel migration, and sedimentation) or by human activities (e.g., earth-moving or other construction along channels, and vegetation removal) (Rieger and Kreager 1989).

Wildlife

Since little change is expected to occur to the vegetation within the project area, present trends of use by wildlife species would continue. There would likely be no change to the types of wildlife species found in the area under existing conditions and without the project. Normal year-to-year population fluctuations of individual species would continue to occur as now.

Fisheries

The aquatic resources of the project area are not expected to changes significantly from existing conditions. Resident fishes would continue to use the area as they do today.

FUTURE CONDITIONS WITH THE PROJECT

Vegetation

A summary of the acreages of affected cover-types and proposed compensation can be found in Table 3. Table 4 summarizes the number of native and non-native trees affected by the project. The footprint of the Alternative 2A Levee and Conveyence Alternative would affect primarily row crop agricultural land. This impact would be minimized by seeding the new levee with native grasses and forbs. A small amount of orchard habitat would be affected from raising the roads around the Alternative 2A Levee and Conveyence Alternative. Native and non-native trees along the Alternative

2A Levee and Conveyence Alternative and along the I-5 embankment that would be rocked were individually

Table 3. Summary of cover-types, acreage impacted, and proposed compensation for the Lower Cache Creek Flood Reduction Project, California.

Cover-Type	Acres Effected	Compensation Acreage	Net Change in Acres
Scrub shrub	0.28	0.31	0
Agricultural/ruderal	121.9 Agricultural 0.52 Ruderal	121.9 (seed Alternative 2A Levee and Conveyence Alternative) 0.52	0 0

Table 4. Summary of individual tree losses from of the Lower Cache Creek Reduction Project, California.

Tree type	Trees removed	Compensation numbers	Compensation Acreage[1]
Native	54	270	2.47
Non-native	46	46	0.42
Total	100	316	2.89

1. Assumes a planting density of 109 trees/acre.

counted (2000 data). Native tree losses were assigned a 5:1 mitigation ratio and non-natives and orchard a 1:1 ratio. Therefore, a total of 316 trees, planted on 2.89 acres would offset the loss of individual trees.

Habitat along the I-5 embankment consists of ruderal grassland with scattered trees. About 0.52 acre would be covered in riprap under this alternative. The loss of 0.52 acre of ruderal grassland would be offset at a 1:1 ratio and should be planted in conjunction with the 2.89 acres of woodland planted for the loss of individual trees.

About 0.28 acre of scrub shrub would be adversely affected by construction of a haul road from the training levee, through the training canal, and over the west levee. The results from the HEP conducted in 2001/02 showed that replanting the affected area and planting an additional 0.03 acre of scrub shrub would offset the loss of scrub shrub value at that site. Therefore, total of 0.31 acre of scrub shrub would be replanted at a density of 200 plants per acre. The Service has archived HEP data and analysis with the National Archives and Records Administration and can be contacted for any questions regarding the HEP.

Turnout areas along the training canal were selected to avoid any additional effects to scrub shrub in the settling basin. Therefore, no additional mitigation measures, other than the seeding these turn-around areas with native grasses and forbs after construction would be needed.

Wildlife

Loss of 0.28 acre of scrub shrub could adversely affect birds, amphibian, reptile, and small mammal species which use this habitat for cover, nesting, and/or foraging. Construction activities could cause direct mortalities of ground dwelling reptiles, and/or mammals through vehicle or equipment strikes or crushing of burrows, and removal of habitat for escape cover, foraging, and breeding. Animals that survive construction would be displaced; those that are able to move to adjacent areas may increase competition for limited resources in adjoining areas, with subsequent overall loss of individuals.

Fisheries

The only in-water construction work that would occur under this alternative is in the settling basin training canal. A haul route is planned through the canal and culverts would be placed underneath to allow water to continue to flow through. After one construction season the haul route would be removed and the canal would be returned to its original condition.

Endangered and Threatened Species

The effects of the proposed project on threatened and endangered species is being evaluated by the Corps. The Corps should initiate section 7 consultation for any listed species affected by the project with the Service and/or NOAA Fisheries, as appropriate.

DISCUSSION

Fish and Wildlife Service Mitigation Policy

The recommendations provided herein for the protection of fish and wildlife resources are in accordance with the Service's Mitigation Policy as published in the Federal Register (46:15 January 23, 1981).

The Mitigation Policy provides Service personnel with guidance in making recommendations to protect or conserve fish and wildlife resources. The policy helps ensure consistent and effective Service recommendations, while allowing agencies and developers to anticipate Service recommendations and plan early for mitigation needs. The intent of the policy is to ensure protection and conservation of the most important and valuable fish and wildlife resources, while allowing reasonable and balanced use of the Nation's national resources.

Under the Mitigation Policy, resources are assigned to one of four distinct Resource Categories, each having a mitigation planning goal which is consistent with the fish and wildlife values involved. The Resource Categories cover a range of habitat values from those considered to be unique and irreplaceable to those believed to be much more common and of relatively lesser value to fish and wildlife. The Mitigation Policy does not apply to threatened and endangered species, Service recommendations for completed federal projects or projects permitted or licensed prior to enactment of Service authorities, or Service recommendations related to the enhancement of fish and wildlife resources, however.

In applying the Mitigation policy during an impact assessment, the Service first identifies each specific habitat or cover-type that may be impacted by the project. Evaluation species which utilize each habitat or cover-type are then selected for Resource Category determination. Selection of evaluation species can be based on several rationale, as follows: (1) species known to be sensitive to specific land- and water-use actions; (2) species that play a key role in nutrient cycling or energy flow; (3) species that utilize a common environmental resource; or (4) species that are associated with Important Resource Problems, such as anadromous fish and migratory birds, as designated by the Director or Regional Directors of the Service. (Note: Evaluation species used for Resource Category determinations may or may not be the same evaluation species used in a HEP application, if one is conducted). Based on the relative importance of each specific habitat to its selected evaluation specie, and the habitat's relative abundance, the appropriate Resource Category and associated mitigation planning goal are determined.

Mitigation planning goals range from "no loss of existing habitat value" (i.e., Resource Category 1) to "minimize loss of habitat value" (i.e., Resource Category 4). The planning goal of Resource Category 2 is "no net loss of in-kind habitat value;" to achieve this goal, any unavoidable losses would need to be replaced in-kind. "In-kind replacement" means providing or managing substitute resources to replace the habitat value of the resources lost, where such substitute resources are physically and biologically the same or closely approximate those lost.

In addition to mitigation planning goals based on habitat values, Region 8 of the Service, which includes California, has a mitigation goal of no net loss of acreage for wetland habitat. This goal is applied in all impact analyses.

In recommending mitigation for adverse impacts to any of these habitats, the Service uses the same sequential mitigation steps recommended in the Council on Environmental Quality's regulations. These mitigation steps (in order of preference) are: avoidance, minimizing, rectification measures, measures to reduce or eliminate impacts over time, and compensation measures.

Resource Categories

Scrub Shrub

The riparian scrub shrub cover-type identified in this project is defined as mixed trees and shrubs averaging less than 16 feet tall. Tree and shrub species are comprised predominately of cottonwoods and willows. Migratory songbirds, such as the northern oriole and yellow warbler, were selected to represent the values of the scrub shrub cover-type because of their value as indicator species for many other birds which use the riparian scrub shrub cover-type, their importance in non-consumptive human uses (e.g., bird-watching), and Service responsibilities for their management under the Migratory Bird Treaty Act. The extent of this cover-type has been severely reduced due to agricultural and urban development and it is now relatively scarce in the project area and surrounding lands. Therefore, the Service finds that scrub shrub habitat that would be impacted by the project should have a mitigation planning goal of "no net loss of in-kind habitat value or acreage," Resource Category 2.

Agriculture/Ruderal

The agricultural/ruderal cover-type is common over much of the project area. Evaluation species selected for these cover-types include the raptor guild (including Swainson's hawks, red-tailed hawks, ferruginous hawks, American kestrel, white-tailed kite, and great horned owl) and passerine ground-foraging birds (including western meadowlark and white-crowned sparrow). The value of these habitats vary according with season and crop, much of the agricultural and ruderal habitat adjacent to Cache Creek provides medium value foraging habitat for diverse assemblages of birds of prey adjacent to Cache Creek. Therefore, the Service finds that agricultural and ruderal lands to be affected by the project, should have a mitigation planning goal of "minimize loss of habitat value," Resource Category 4.

Orchard

The orchard cover-type consists of highly managed areas of plum, walnut, pistachio, and olive orchards. The evaluation species for this cover-type include raptors and mourning doves. Orchards provide perching sites for these species as well as cover. This cover-type in the project area is of low to moderate quality and value. The Service designates the orchard habitat as Resource Category 4. Our associated mitigation planning goal of "minimize loss of habitat value."

Pollinators

Plant and pollinator species have been recognized as being increasingly at risk of local and global extinction (Kearns et al. 1998). Climate change and habitat loss, including alterations in land use, have been implicated as factors leading to breakdowns in plant-pollinator relationships (Wall et al. 2003; Weiner et al. 2014). Buchmann and Nabhan (1996) have estimated that animal pollinators are needed for the reproduction of 90% of flowering plants and one third of human food crops. The proposed project mitigation/restoration activities can be designed to benefit local and landscape-level plant-pollinator relationships through the establishment of suitable native plant species.

Table 5 summarizes the evaluation species, resource categories, and mitigation planning goals for the cover-types impacted by the proposed Lower Cache Creek Flood Reduction Project.

Table 5. Evaluation species, resource categories, and mitigation planning goals for the cover-types impacted by the Lower Cache Creek Flood Reduction Project.

COVER-TYPE	EVALUATION SPECIES	RESOURCE CATEGORY	MITIGATION GOAL
Scrub shrub	Migratory songbirds	2	No net loss of in-kind habitat value or acreage
Agriculture/Ruderal	Raptors and ground foraging birds	4	Minimize loss of habitat value
Orchard	Raptors and mourning dove	4	Minimize loss of habitat value

Mitigation Approach

The impacts to the scrub shrub cover type could be offset by replanting the affected area plus an additional 0.03 acre (0.31 acre total). For loss of individual trees and ruderal habitat, 3.41 acres would need to be located and planted with native grasses and forbs, as well as 319 native upland tree species. The impacts to orchard habitat can be off-set by planting 1.5 acres with native tree species, cover-type.

Mitigation Monitoring
A detailed monitoring and remedial action plan should be developed for the chosen alternative. The plan should include: a description of the irrigation system; identification of success criteria for the plantings; a plan for remedial action in the event of planting failure; a description of maintenance (such as non-native removal); and an O&M Manual.

RECOMMENDATIONS

The Service recommends that the Corps implement the following if the project is constructed:

General

1. Avoid impacts to riparian vegetation at all construction sites, staging areas, borrow sites, and haul routes by fencing them with orange construction fencing.

2. Minimize impacts to trees along the construction area by having all trimming performed by a qualified arborist.

3. Minimize impacts to ruderal grassland by reseeding all disturbed areas with appropriate native grass and forb species when construction is complete.

4. Minimize impacts to pollinators by ensuring restoration plantings include species used by and beneficial for native pollinating species. The Service is available to help establish a list of species that are beneficial to native pollinators. Suitable pollinator plant references can be found online at: http://pollinator.org/guides_code.

5. Minimize impacts to fish species by ensuring culverts placed under the haul road in the settling basin are designed to facilitate fish passage.

6. Minimize impacts at borrow, staging, turn-arounds, and any other project disturbed areas by reseeding with native grasses and forbs.

7. Compensate for the adverse effects to scrub shrub by replanting the affected area plus an additional 0.03 acre (0.31 acre total plantings).

8. Compensate for the permanent loss of individual trees and ruderal grassland by acquiring suitable lands and developing 3.41 acres in a combination of woodland and grassland habitats (minimum of 319 native tree species).

9. Compensate for the loss of orchard habitat by planting 1.5 acre with native tree species.

10. Develop a monitoring and remedial action plan and an O&M Manual for the compensation site(s) developed for the project. All phases of plan development should be coordinated with the Service and CDFW.

11. Conduct nesting surveys prior to the removal of any trees or scrub shrub or construction activities to identify active nests of migratory birds and implement measures to minimize impacts on the nests until young have fledged.

12. Determine the effects of the proposed project on federally listed species and initiate section 7 consultation with the federal agencies, as appropriate.

13. Coordinate with CDFW on State listed species and species of concern.

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BIOLOGICAL ASSESSMENT

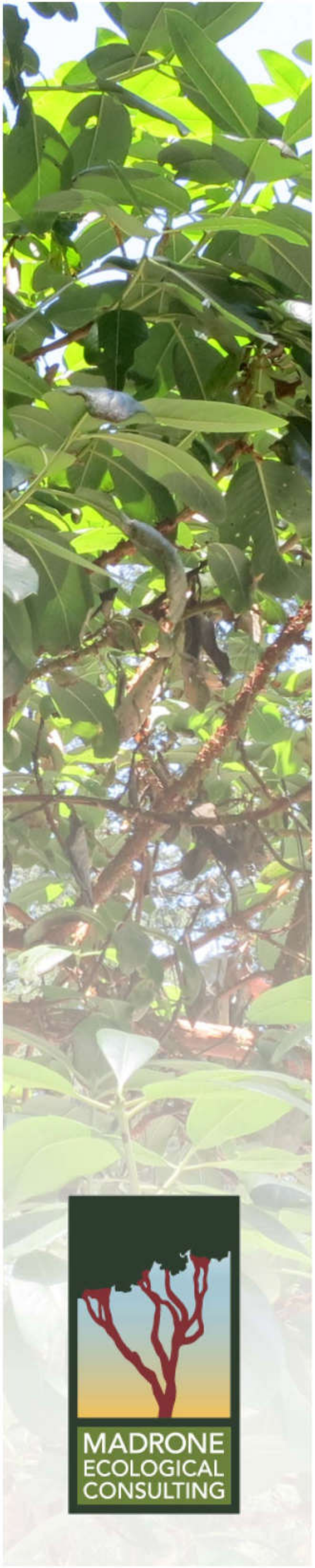
APPENDIX B

LOWER CACHE CREEK FEASIBILITY STUDY

Yolo County, CA

December 2019

United States Army Corps of Engineers
Sacramento District



Biological Assessment

Lower Cache Creek Feasibility Study

Yolo County, California

October 2019

Prepared for:
U.S. Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, CA 95814

US Army Corps of Engineers
BUILDING STRONG®

Recommended Citation:
Madrone Ecological Consulting, LLC (Madrone). 2019. *Biological Assessment for Lower Cache Creek Feasibility Study*. Prepared for U.S. Army Corps of Engineers. Published on 1 October 2019.

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ACRONYMS AND ABBREVIATIONS

ACE	Annual Chance Exceedance
BA	Biological Assessment
BMP	Best Management Practice
BO	Biological Opinion
CCSB	Cache Creek Settling Basin
CDFW	California Department of Fish and Wildlife
CE	California Endangered
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
Corps	U.S. Army Corps of Engineers
CRPR	California Rare Plant Rank
CSC	CDFW Species of Concern
CT	California Threatened
CVFPB	Central Valley Flood Protection Board
DFR	Draft Feasibility Report
DPS	Distinct Population Segment
DWR	California Department of Water Resources
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ESA	Federal Endangered Species Act
FC	Federal Candidate for Listing
FCSA	Feasibility Cost Share Agreement
FE	Federally Endangered
FEMA	Federal Emergency Management Agency
FT	Federally Threatened
GGS	Giant Garter Snake
HEP	Habitat Evaluation Procedures
LBV	Least Bell's Vireo
LPP	Locally Preferred Plan
NFS	Non-Federal Sponsors
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
PBBB	Palmate-Bracted Bird's Beak
SWPPP	Stormwater Pollution Prevention Plan
TSP	Tenatively Selected Plan
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
VELB	Valley Elderberry Longhorn Beetle
VPFS	Vernal Pool Fairy Shrimp
VPTS	Vernal Pool Tadpole Shrimp
WYBC	Western Yellow-Billed Cuckoo

1.0 INTRODUCTION

The U.S. Army Corps of Engineers (Corps) is requesting the initiation of consultation with the U.S. Fish and Wildlife Service (USFWS) under Section 7 of the Federal Endangered Species Act (ESA) to evaluate potential effects associated with new and modified levees proposed by the Lower Cache Creek, Yolo County, Woodland Area, California, Feasibility Study. Section 7 of the ESA requires Federal agencies to conserve listed species and their critical habitat, and to consult with USFWS to ensure that the actions they fund, authorize, or perform do not jeopardize the existence of any listed species or result in the destruction or adverse modification of their designated critical habitat.

Informal consultation began between the Corps and the USFWS in 2001. A Draft Coordination Act Report was sent to the Corps with a habitat evaluation procedures (HEP) analysis in March 2002. A Special Status Species Technical Appendix was drafted for the tentatively selected plan (TSP), the Flood Barrier Alternative, and included in the 2003 Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the Lower Cache Creek, Yolo County, CA, City of Woodland and Vicinity, for Potential Flood Damage Reduction Project. Due to lack of public support for the Potential Flood Damage Reduction Project (Project), the Project was put on pause. A Biological Assessment was never prepared and a Biological Opinion was never requested. Renewed interest in the Project prompted a restart from 2013 to 2015. From 2016-2018, the City of Woodland stopped the Project to pursue a locally preferred plan (LPP). In November 2018, the City of Woodland reengaged with the Corps, initiating reactivation. Since the initial consultation, the western distinct population segment (DPS) of the western yellow-billed cuckoo (*Coccyzus americanus occidentalis*) was Federally-listed as threatened (79 CFR 59992) on November 3, 2014.

The purpose of this Biological Assessment (BA) is to review the Lower Cache Creek Feasibility Study (Study) in sufficient detail to determine if the proposed action may affect federally listed, threatened or endangered species, or those proposed for such listing and their critical habitat (collectively, Federally-Listed Species). This BA has been prepared in accordance with legal requirements set forth under Section 7 of the ESA (Title 16, United States Code [USC], Section 1536[c]) and Corps Engineering Regulation 1105-2-100 (Corps 2000a). This BA describes the current proposed action, evaluates potential effects of the proposed action on Federally-Listed Species and their habitat, and identifies conservation measures to avoid and minimize these potential effects. For the purposes of this BA, the Action Area is defined as the Study Area (**Figure 1**) as well all areas to be affected directly or indirectly by the proposed Action where changes in land, air, and water caused by the Action may elicit a response in a Federally-Listed Species or its critical habitat. The Action Area is defined further in **Section 3.1**.

1.1 Species Considered

The following sections outline the Federally-Listed Species analyzed by this document, as well as a list of species that were excluded from consideration.

The following databases/reports were queried/reviewed in March 2019 to determine the special-status species that have been documented, or were considered to have potential to occur within or in the vicinity of the Study Area:

- All California Natural Diversity Database (CNDDB) Occurrences within a 5-mile radius of the Study Area (CDFW 2019);
- USFWS IPaC Resource Report List for the Study Area (USFWS 2019a); and
- CNPS electronic Inventory of Rare and Endangered Plants of California query for the "Woodland, California" and "Greys Bend, California" 7.5-minute USGS quadrangles, and the ten surrounding USGS topographic quadrangles (CNPS 2019).

Those species that were determined to have no potential to occur within the Action Area are listed in **Table 1**, along with appropriate justification for their exclusion. Those species with potential to occur within the Action Area are listed in **Section 1.1.1**.

Table 1. Federally-Listed Species Potential for Occurrence within the Action Area

Common Name (*Scientific Name*)	Status			Habitat Description	Potential to Occur within Action Area or Otherwise be Affected by Action
	ESA	CESA	Other Status		
Palmate-bracted bird's-beak (*Chloropyron palmatum*)	FE	CE	CRPR 1B.1	Locally found only on Pescadero and Willows soils on side slopes of ditches and ponds in chenopod scrub and valley and foothill grasslands.	**Moderate.** This species has previously been documented immediately south of the Action Area, and Pescadero and Willows soils are present within the Action Area in association with side slopes adjacent to ditches and old waste ponds.
Vernal pool fairy shrimp (*Branchinecta lynchi*)	FT	-	-	Vernal pools.	**Low.** Marginally suitable habitat is present in one depressional wetland within the Action Area.
Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*)	FT	-	-	Dependent upon elderberry *(Sambucus* species) shrubs as primary host species.	**High**. This species has the potential to occur within elderberry shrubs within the Action Area.
Vernal pool tadpole shrimp (*Lepidurus packardi*)	FE	-	-	Vernal pools.	**Low.** Marginally suitable habitat is present in one depressional wetland within the Action Area.
Delta smelt (*Hypomesus transpacificus*)	FT	CE	-	Sac-San Joaquin delta	**No Potential to Occur within Action Area.** The Cache Creek Settling Basin Weir and irrigation canal pump facilities preclude this species' presence.

Table 1. Federally-Listed Species Potential for Occurrence within the Action Area

Common Name (*Scientific Name*)	Status ESA	Status CESA	Status Other Status	Habitat Description	Potential to Occur within Action Area or Otherwise be Affected by Action
Longfin smelt (*Spirinchus thaleichthys*)	FC	CT	CSC	Fresh and salt water estuaries.	**No Potential to Occur within Action Area.** The Cache Creek Settling Basin Weir and irrigation canal pump facilities preclude this species' presence.
California tiger salamander (*Ambystoma californiense*)	FT	CT	CSC	Breeds in ponds or other deeply ponded wetlands, and uses gopher holes and ground squirrel burrows in adjacent grasslands for upland refugia/foraging.	**No Habitat Present.** No large areas of undisturbed annual grassland are present within the Study Area.
California red-legged frog (*Rana draytonii*)	FT	-	CSC	Breeds in permanent to semi-permanent aquatic habitats including lakes, ponds, marshes, creeks, and other drainages.	**No Habitat Present.** Outside of the distributional range of the species.
Giant garter snake (*Thamnophis gigas*)	FT	CT	-	Freshwater ditches, sloughs, and marshes in the Central Valley.	**High.** The irrigation ditches and canals represent suitable aquatic habitat for this species, and adjacent areas represent suitable upland habitat.
Western snowy plover (*Charadrius alexandrinus nivosus*)	FT	-	CSC	Barren to sparsely vegetated open areas near water.	**Low.** This species has been documented as a vagrant in the nearby wastewater treatment ponds, and could forage in the agricultural fields within the Action Area during the winter.
Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)	FT	CE	-	Large tracts (patches greater than 50 acres) of willow-cottonwood or mesquite forest or woodland with high canopy closure.	**High.** The riparian woodlands within the Cache Creek Settling Basin and along Cache Creek represent suitable nesting habitat for this species.

Table 1. Federally-Listed Species Potential for Occurrence within the Action Area

Common Name (*Scientific Name*)	Status: ESA	Status: CESA	Status: Other Status	Habitat Description	Potential to Occur within Action Area or Otherwise be Affected by Action
Least Bell's vireo (*Vireo bellii pusillus*)	FE	CE	-	Structurally diverse cottonwood-willow woodlands, oak woodlands, and mule fat scrub with dense cover close to the ground and dense stratified canopy for foraging.	**Low.** The riparian woodlands within the Cache Creek Settling Basin and along Cache Creek, and the riparian scrub in the nearby irrigation canal represent marginally suitable nesting habitat for this species.

CE - California Endangered
CRPR - California Rare Plant Rank
CSC - CDFW Species of Concern
CT - California Threatened
FC - Federal Candidate for Listing
FE - Federally Endangered
FT - Federally Threatened

1.1.1 Species with Potential to be Affected by the Action

Suitable habitat for the following Federally-Listed Species is present within the Action Area, and as a result, these species may be affected by the proposed Action:

- Palmate-bracted bird's beak (PBBB)
- Valley elderberry longhorn beetle (VELB);
- Vernal pool fairy shrimp (VPFS);
- Vernal pool tadpole shrimp (VPTS);
- Giant garter snake (GGS);
- Western yellow-billed cuckoo (WYBC); and
- Least Bell's vireo (LBV).

Suitable habitat for western snowy plover is also present within the Action Area; however, this species has the potential to forage in the area during the winter months, when no activities are proposed. Therefore, the Action is not expected to affect western snowy plover, and it is not discussed further in this document.

1.2 Critical Habitat

The Study and Action Area, as defined below, are not located within any designated critical habitat.

1.3 Historic and Current Agency Consultation to Date

2003 Lower Cache Creek, Yolo County, CA, City of Woodland and Vicinity, Potential Flood Damage Reduction Project

August 13, 2001 — Informal consultation began between the Corps and the USFWS. A list of threatened and endangered species relating to this project was obtained from USFWS.

January 10, 2002 A list of threatened and endangered species relating to this project was obtained from NMFS.

March 29, 2002 A Draft Coordination Act Report prepared by Jennifer Hobbs was sent to the Corps with a habitat evaluation procedures (HEP) analysis and an updated species list dated March 26, 2002.

March 21, 2003 A Draft Feasibility Report/ Draft EIS/Draft EIS (DFR/DEIS-EIR) for the Lower Cache Creek, Yolo County, CA, City of Woodland and Vicinity, for Potential Flood Damage Reduction Project were submitted for a 45-day public comment period with Appendix B Special Status Species Technical Appendix for the Flood Barrier Alternative.

2019 Lower Cache Creek, Yolo County, Woodland Area, California, Feasibility Study

December 18, 2018 Corps sent the project description to Cathy Johnson at the USFWS.

December 22, 2018 Federal government shutdown began and lasted until January 25, 2019.

February 11, 2019 Cathy Johnson and Jennifer Hobbs of the USFWS attended a site visit with Corps representatives, as well as a variety of City of Woodland staff and private consultants that are working on various components of the Project.

March 1, 2019 Information consultation was initiated.

May 24, 2019 Corps sent Cathy Johnson a revised project description and figures.

August 29, 2019 A Draft Coordination Act Report was sent to the Corps.

1.4 Study Background and Authority

The Lower Cache Creek, Yolo County, Woodland Area, California, Feasibility Study, assesses an array of alternatives that perform to reduce the risk of flooding to the City of Woodland and surrounding agricultural areas. The Lower Cache Creek Feasibility Study is being jointly investigated by the Federal lead agency, the Corps, Sacramento District, and the non-Federal sponsors (NFS), the Central Valley Flood Protection Board (CVFPB) represented by the California Department of Water Resources (DWR), and the City of Woodland.

Cache Creek is a west side tributary of the Sacramento River near Sacramento, California. The main stem of Cache Creek originates with the outflows of Clear Lake in the Coast Range Mountains of Northern California. The north fork of Cache Creek is impounded by Indian Valley Dam and joins the main stem above Capay Valley before flowing out of the foothills into California's Central Valley. Lower Cache Creek is ephemeral; the eastern-most reach dries out during late summer and fall in typical water years. Water reaches the

Woodland area during winter rain events due to natural precipitation patterns, upstream retention and diversions for water supply. The leveed portion of Cache Creek discharges into the Cache Creek Settling Basin (CCSB), which was constructed to prevent sediment carried by Cache Creek from adversely affecting the hydraulic capacity of the Yolo Bypass through excessive sediment deposition and thereby increase the flood risk of the City of Sacramento.

1.4.1 Study Background

The reconnaissance study was completed in 1995 and the feasibility study was undertaken from 2000 to 2003. A tentatively selected plan (TSP) was identified as a large barrier constructed at the northern city boundary, which increased flood depths between the urban city limits and Lower Cache Creek. A DFR/DEIS-EIR for the Lower Cache Creek, Yolo County, CA, City of Woodland and Vicinity, Potential Flood Damage Reduction Project were submitted for a 45-day public comment period on March 21, 2003 (Vol. 68, No. 55, 68 FR 13907). The Yolo County community was divided on whether to accept the TSP. The City of Woodland adopted an ordinance restricting any flood solution that would similarly produce deep floodplains north of the city (City Code Section 10.1, Flood Control Policy). Due to lack of public support for the proposed plan, the NFS did not pursue the study further.

In 2009, the City of Woodland expressed interest in restarting the feasibility study and a feasibility cost share agreement (FCSA) was signed in May 2011. The study was forced to pause for two years due to lack of federal appropriations; however, an amendment to the FCSA was signed March 2013 allowing for non-Federal funding acceleration which facilitated the restart of the study in June 2013. A focused array of alternatives was developed and a public information meeting was held in November 2013 (Report Synopsis May 2014). The study took another pause in May 2014 due to a lack of Federal funding, but was restarted in November. On August 26, 2015, the Corps published the notice of intent (NOI) to prepare the Supplemental EIS for the Lower Cache Creek Flood Risk Management Project, City of Woodland, Yolo County, California (CA) in the Federal Register (Vol. 80, No. 165, 80 FR 51789). Public review of the Feasibility Report/Supplement Draft EIS was anticipated for May 2016. However, in January 2016, the City of Woodland requested the study be put on hold while they developed a locally preferred plan (LPP) to gain support of the community.

The NFS halted their pursuit of the LPP and reengaged with the Corps in the fall of 2018 to restart the feasibility study and ensure public support of the Federal TSP. The study was reactivated on November 13, 2018. The TSP milestone occurred in February 2019.

1.4.2 Study Authority

This study was authorized by Section 209 of the Flood Control Act of 1962 (Public Law 87-874). In the Energy and Water Development Appropriations Act of 1962 (Public Law 102-377), Congress directed the Corps to conduct a "reconnaissance study of flooding problems in the westside tributaries, Putah and Cache Creeks, of Yolo Bypass". At the request of the Yolo County Board of Supervisors the reconnaissance study was initiated in 1993, and Federal interest was found in proceeding with a feasibility level investigation of flood damage reduction along Lower Cache Creek.

2.0 DESCRIPTION OF THE PROPOSED ACTION

2.1 Study Description

Alternative 2A consists, overall, of improving existing levees and constructing a new levee north of the city of Woodland (City) in order to protect the City from flooding emanating from Lower Cache Creek. The United States Army Corps of Engineers (USACE) determined the necessary height of the levee embankment north of the City and the capacity of the project features by modeling a range of flood flow magnitudes/return frequencies, and then estimating the cost and benefits for four incremental heights.
The alternative identified as Alternative 2A provided the height and capacity that maximized the net benefits (annual benefits minus annual costs). Alternative 2A is comprised of six distinct project reaches (Reach N through Reach S). A graphical overview of Alternative 2A is provided on **Figure 2**. Typical sections of the project features, which include levee embankment, seepage berms, drainage channel; cutoff walls; weir, and closure structures; the estimated construction footprint of the project; and profiles for the top-of-levee, 200-year water surface elevation (WSE) and existing ground for the project alignment are included in **Attachment A**. A detailed description of Alternative 2A follows below.

2.1.1 Modifications to Existing Levees / Cache Creek Settling Basin

Alternative 2A would rehabilitate a portion of the southern levee (Reach N) of the Cache Creek Settling Basin (CCSB) by constructing a 60-foot-deep cutoff wall through the levee (**Attachment A - Figure 2**) and the southwest levee (Reach O) of the CCSB by constructing a 45-foot-deep cutoff wall. Along with this cutoff wall installation, a 3,000-foot-long section of the west levee of the settling basin would be degraded to an elevation of 43 feet to accommodate a concrete weir with a height of approximately nine feet above existing adjacent grade (**Attachment A - Figure 3**). The weir would serve to accept floodwater emanating from Cache Creek west of the CCSB, and would prevent backflow from the CCSB to the west during smaller, more frequent flood events. Additionally, the southernmost 3,000-foot portion of the CCSB training levee would be degraded in order to improve the distribution of sediment within the basin before construction begins. The existing outlet weir on the east side of the CCSB would remain unchanged. Please note that all elevations are given in the North American Vertical Datum of 1988 (NAVD 88).

2.1.2 New Levees and Other Proposed Project Features

A new levee with a 20-foot-wide crest and a 30-foot-wide landside seepage berm would begin near the intersection of County Road 20 and County Road 98 and extend east to the CCSB (**Attachment A - Figure 4**). The alignment of the levee would generally follow the northern city limit line west of State Route 113 (SR 113) and Churchill Downs Avenue east of SR 113. The height of the new levee would vary from six feet near County Road 98 to 14 feet at its intersection with the existing west levee of the CCSB. Rock slope protection is proposed on the waterside slope of the new levee from County Road 101 east to the southern end of the proposed inlet weir near County Road 20.

A trapezoidal drainage channel with a design capacity of approximately 350 cubic feet per second (cfs) would be constructed north (waterward) of the new levee in Reaches P through S in order to capture smaller, more frequent events and discharge them to the CCSB, and also to provide the necessary fill material for the project. This drainage channel may vary in width during subsequent design phases in order to create a balanced earthwork for the project.

A total of four closure structures (gates that are assembled by operations and maintenance (O&M) personnel prior to the flood) would be constructed where the embankment crosses the Union Pacific Railroad (UPRR) tracks near Interstate 5 (I-5), the UPRR tracks west of SR 113, SR 113, and the UPRR tracks east of SR 113 (**Attachment A**). Due to the limited distance between the closure structures, short sections of floodwall would be constructed to connect the closure structure at the I-5 crossing to the existing roadway embankment and to connect the closure structures at the SR 113 crossing and the adjacent UPRR crossing to the west.

2.1.3 Internal Drainage

Water impounded by the proposed levee and the west levee of the CCSB would be drained via proposed culverts into the CCSB and to the City's interior drainage system. A detention basin would be located at the downstream end of the proposed drainage channel along Reach P. The detention basin would include an east outlet and a south outlet. The east outlet would provide for gravity drainage into the CCSB and consist of three 60-inch diameter culverts fitted with flap gates. This would allow gravity flow from the detention basin into the CCSB after stages subside below the weir elevation, with reverse flow from the CCSB into the detention basin being prevented by the flap gates. The south outlet would consist of a set of three 60-inch diameter culverts fitted with sluice gates. The culverts would discharge to an existing ditch that terminates at a pump station owned and operated by the City. The sluice gates would control the discharge flow to the pump station until capacity was available to discharge the flows to the Yolo Bypass. The design and operation of these systems has not been fully developed yet, and will be optimized during later phases of the project.

2.1.4 Roadway Improvements

The new levee would require the raising of County Road 98, County Road 99, County Road 101, and County Road 102. Culverts would be installed at each of these raised crossings, as well as under SR 113 and the two UPRR crossings along the alignment. An existing railroad underpass at I-5 would be used to convey flood waters under the interstate. In order to prevent erosion due to high velocities in this area, those portions of the area found to have velocities of over five feet per second (fps) would be lined with concrete. This protection would be installed across the entire project footprint area where flood flows velocities exceed the 5 fps limit. This area includes the existing slopes of the I-5 roadway embankment, the slopes of the proposed Reach R and Reach S levees, the proposed channel (both bottom and slope), and the existing UPRR railway. See **Attachment A - Figure 5** for a graphical representation of the approximate extents.

2.1.5 Summary of Improvements

Table 2 (below) summarizes the features and improvements discussed previously.

Table 2. Project Feature Summary

Feature	Improvement Description	Applicable Reaches	Quantity
New Levee	New Levee with Seepage Berm	Q (Partial), R, S	3.9 Miles
New Levee with RSP	New Levee with Seepage Berm and Rock Slope Protection	P, Q (Partial)	1.7 Miles
Improve Existing Levee	Improve existing levee with cutoff wall	N, O	2.3 Miles
Drainage Channel	New drainage channel and culverts. Also serves as borrow source for levee fill.	P, Q, R, S	5.6 Miles
Elevated Roadways	Elevate Roadway over levee at CR98, CR99, CR101, and CR102	P, Q, R, S	4
Gated Roadway Closure Structure	Gate at SR 113	Q, R	1
Gated Railroad Closure Structures	Gate for Railroad at I-5, West of SR 113, East of SR 113	Q, R, S	3
Cache Creek Settling Basin Inlet Weir	Concrete Inlet Weir	CCSB Inlet Weir	3,000 Feet
Degrade Training Levee	Degrade 3,000 feet of Existing Cache Creek Settling Basin Training Levee	Training Levee	3,000 Feet
Detention Basin and Outlets	New Detention Basin and Outlets	P	1
Improve Existing Drainage Ditch	Utilize Existing drainage ditch from Detention Basin to City of Woodland Pump Station.	O	1 Mile

2.1.6 Footprint / ROW Needs

A fee title will be obtained for areas beneath the physical project features (i.e. embankment, seepage berm, drainage channel, etc.) and for the area fifteen feet beyond the toe of waterside features and twenty feet beyond the toe of landside features. A summary of the land uses impacted by the proposed project footprint and easements is included on **Table 3** below. The estimated footprint impacts are shown on **Attachment A - Figure 7**.

Table 3. Estimated ROW Needs

Land Use Type	Estimated Acreage
Agricultural	283.0
City's Jurisdiction	1.4
Agricultural/Residential Low Density	3.6
Agricultural/Residential Medium Density	18.1
Other Public / ROW / Roadway	12.9
Total	**319.0**

Existing trees and encroachments will be removed to the extent necessary to facilitate construction of the project and to support long-term operation and maintenance.

It may be the case that some trees and other encroachments are not removed from the rights-of-way. These encroachments will be addressed on a case-by-case basis during final design of the project.

2.1.7 Residual Floodplain

The preliminary analysis performed by MBK Engineers, Inc. (MBK) for Alternative 2A in 2016 demonstrated that this alternative is estimated to increase the depth of flooding north of the proposed levee, east of SR 113 by as much as 6.5 feet for the 1/100 or 1% annual chance exceedance (ACE) flood event, and will increase the depth of flooding west of SR 113 by as much as two feet. Additionally, this alternative increases the flood depth on approximately 14 structures during a 1% ACE flood event. It is noted that the duration of residual flooding was not evaluated for this option.

2.2 Construction Methods

2.2.1 Site Preparation

Site preparation would include clearing, grubbing, and stripping activities within the project construction footprint. Up to approximately 319 acres are anticipated to be cleared. Clearing and grubbing activities would involve the removal of larger woody vegetation, including trees, rootballs, and other existing debris within the project footprint. These activities would be completed using excavators and bulldozers, and the debris would be transported by haul truck to a permitted disposal site (possibly the Yolo County Central Landfill which is located approximately 11 miles from the project site). Stripping would involve excavating approximately 6 to 12 inches of topsoil, which consists of organic material from the land surface. The topsoil would be stockpiled at the borrow/staging areas. After levee construction is complete, the topsoil removed from the borrow areas, project footprint, and the maintenance corridor would be placed on the embankment slopes to promote vegetative growth.

2.2.2 Seepage Berm Construction

A seepage berm is a wide embankment structure that consists of soil fill placed landward of the new levee embankment to form a widened prism. Fill would be placed in accordance with USACE construction standards for lift thickness and compaction to achieve the desired height. Each lift would be moisture-conditioned and compacted to the specified density using appropriate compaction equipment. The seepage berm would measure approximately five feet thick and extend up to 30 feet from the landside toe of the levee.

2.2.3 Cutoff Wall Construction

A cutoff wall consists of a deep trench excavated into the foundation soil of the levee embankment along the levee centerline that is backfilled with soil-bentonite slurry. The cutoff wall(s) would extend up to approximately 60 feet deep, as measured from the bottom of the new "select levee fill" cap, and be three feet wide. As the trench is excavated, it would be filled with bentonite slurry to keep the sidewalls from caving in. Adjacent to the trench, the excavated material would be mixed with bentonite slurry in appropriate proportions to achieve the required cutoff wall mix design and permeability properties, and then would be backfilled into the excavated trench.

Cutoff wall construction requires the temporary establishment of an on-site slurry batch plant that would occupy approximately one to two acres. Batch plants would be located at approximate one-mile intervals along the levee in defined staging areas. Each batch plant site would probably contain tanks for water storage, bulk bag supplies of bentonite and bentonite storage silos, a cyclone mixer, pumps, and two generators that meet air quality requirements. The site would also accommodate slurry tanks to store the blended slurries temporarily until they are pumped to the work sites. Slurry ingredients would be mixed with water at the batch plant and the mixture would be pumped from the tanks through pipes to the cutoff wall construction work sites. The batch plant would produce two different slurry mixes, one for trench stabilization and one for the soil backfill mix. Therefore, two slurry pipes or hoses (typically four-inch or six-inch high-density polyethylene pipes) would be laid on the ground and extend to all work sites. An additional pipe may be used to supply water to the work sites.

2.2.4 Levee and Drainage Channel Construction

A trapezoidal drainage channel is proposed to be located on the waterside of the proposed levee in Reaches P through S. An existing trapezoidal channel serves the levee system landward of Reaches N and O. Material excavated from the drainage channel will either be used in the construction of the levee and seepage berm embankments, or will be disposed of in a legal manner.

Levee foundation preparation would include excavating an inspection trench of up to 6 feet deep and 12 feet wide, and be centered under the outer edge of the waterside levee crown. Material excavated for the inspection trench would be stockpiled at the borrow/staging areas.

Most material excavated from the trapezoidal drainage channel would be suitable for levee and seepage berm fill and used in the construction of the levee and seepage berm embankments. If needed, additional embankment fill would be transported from the borrow areas and placed in specified lifts by motor graders (in accordance with accepted levee construction standards for lift thickness and compaction) in order to achieve the desired levee height and configuration. Each lift would be moisture-conditioned and compacted to the specified minimum density using a suitable compactor.

Stockpiled topsoil would be placed on the levee slopes. An all-weather patrol road along the levee crown and an access road along the landside toe of the levee would be constructed for flood fighting and O&M

purposes. After all levee construction is complete, the levee slopes and other disturbed areas would be hydroseeded.

2.2.5 Closure Structure Construction

Closure structures are needed where the proposed levee crosses existing improvements that cannot be raised (i.e., major roads and railroads). The closure structures will consist of permanent components and of temporary components that will be installed only during high-water events. The temporary components will be the property of the City and will be stored by the City in their maintenance yard.

The permanent components of the closure structure will generally consist of:

- Foundation piles
- Concrete retaining walls and steel support structure
- Galvanized metal steel plates to prevent seepage through railroad ballast (at railroad crossings)

Construction of the permanent components of the closure structure are anticipated to be performed within available track curfews (or roadway closures) without physically altering the tracks or roadways. Excavation and construction will occur in close proximity to the tracks, but the tracks are not anticipated to be removed, modified, or disturbed as part of the construction effort.

2.2.6 CCSB West Levee Degrade/Weir Construction

A 3,000-foot-long portion of the existing CCSB West Levee will be degraded to an elevation of 43 feet (NAVD 88) in order to construct a weir (as shown on **Attachment A - Figure 4**). Excavated material will either be stockpiled for use on the project, or will be disposed of legally. Excavated material from the CCSB levees may be used to offset borrow material needs, although this procedure will need to be evaluated by the USACE during design.

2.2.7 Stormwater Pollution Prevention

Temporary erosion/runoff best management control measures would be implemented during construction in order to prevent the discharge of pollutants resulting from erosion and sediment migration from the construction, staging, and borrow areas. These temporary control measures may include secondary containment for storage of fuel and oil; and for management of stockpiles and disturbed areas by means of earthen berms, diversion ditches, straw wattles, straw bales, silt fences, gravel filters, mulching, re-vegetation, and temporary covers as appropriate. Erosion and stormwater pollution control measures would be consistent with National Pollutant Discharge Elimination System (NPDES) permit requirements and would be included in a Stormwater Pollution Prevention Plan (SWPPP). After construction is complete, temporary facilities would be demobilized and the site would be stabilized. Site restoration activities for areas disturbed by construction activities, including borrow areas, may include regrading, reseeding, constructing permanent diversion ditches using straw wattles and bales, and by applying straw mulch and other measures deemed appropriate.

2.2.8 *Structure and Road Demolition*

Structure and road demolition activities would include removing standing structures within the levee and borrow area footprints. All demolition would be done in compliance with existing regulations, including asbestos abatement requirements. These activities would require use of equipment with a percussion hammer attachment for breaking up concrete foundations as needed. Debris would be loaded into waste containers and transported by haul truck to a permitted disposal site (possibly the Yolo County Central Landfill).

2.3 Staging, Site Access, and Construction-Related Traffic

Staging areas will only be provided within the right-of-way and easement limits to be obtained for the project, as shown on **Attachment A - Figure 7**. The contractor may reach agreements with landowners for additional staging locations outside of these limits. Staging areas may be used by the contractor for storage of equipment and materials, project offices, employee parking, and other uses as needed for construction of the project.

Personnel, equipment and imported materials would reach the project site via I-5, SR 113, County Road 102, and County Road 22. Once on site, haul trucks would use the embankment footprint to transport material between borrow and staging areas and the levee construction area. Staging would occur within the construction footprint and defined staging areas as shown on **Attachment A - Figure 7**.

It is expected that approximately 15 trailer ("low-boy") truck round trips would be required to transport the contractor's cutoff wall material batch plant and equipment to the site, and a similar number of round trips would be needed to remove the equipment from the site as the work is completed.

Approximately 60 truckloads would be needed to bring dry bentonite to the site (probably from the Sacramento area). Approximately 100 truckloads would be needed to bring aggregate base and asphalt materials from the local sources.

Approximately 600 haul truck trips per day for approximately 60 days would be required to transport material between the on-site borrow areas or off-site borrow source and the levee construction area. Approximately 500 haul truck trips would be needed to transport demolition debris, construction debris, and other materials to the Yolo County Central Landfill.

2.4 Construction Schedule and Labor Force

Project construction would be completed within the next six years. The project is anticipated to be constructed in a single phase of approximately 24 months during the spring, summer, and fall construction windows (non-rain season). Some work could occur in the winter if the site is dry enough to support construction activities.

Work, including equipment operation, would generally occur Monday through Saturday during normal working hours (7:00 a.m. to 7:00 p.m.). Equipment maintenance could occur before and after working hours and on Sunday. If necessary, to complete construction before the beginning of the flood season (for the CCSB), work may occur on a 24-hour basis in some areas.

Construction crew sizes would vary depending on the construction activity, but the maximum crew is anticipated to be comprised of approximately 50 workers. Construction workers would probably come from the local labor force in the Woodland and Sacramento areas.

2.5 Operations and Maintenance

Regular operations and maintenance (O&M) activities would include inspections and patrols, vegetation management, burrowing animal control and abatement, slope maintenance, erosion protection, and patrol road and ramp maintenance along the levee embankment. The levee crown patrol road and landside toe access road would be used to access the length of the embankment during these activities and during high-flow events for flood-fighting purposes.

Inspections and patrols for levee integrity, debris and trash removal, security, and other purposes would be conducted regularly by one to two persons driving and/or walking the embankment. Vegetation would be managed through common practices including herbicides, burning, and/or animal foraging (e.g.: goats). Burrowing animal control and abatement would occur through common practices including fumigation, baiting, poison, and trapping. Burrows would be excavated and backfilled and/or grouted.

Grading and dragging of the embankment and levees would occur as needed to repair erosion, rills, sloughing, burrows, etc. and to maintain grades and slopes. It is expected that periodic aggregate replacement would result in replacing all aggregate along the levee crown patrol road, landside toe access road, and access road at the degrade area once every 10 years. Maintenance of the rock slope protection would primarily include vegetation control, repositioning of rock when displaced, and replacement of rock as needed. The proposed drainage channels also would need to be maintained regularly. Maintenance of the drainage channel would include vegetation management, debris and trash removal, and sediment removal as needed.

The permanent and temporary components of the proposed closure structures at the railroad and at SR 113 crossings would also need to be inspected annually to ensure all components are in good repair.

In addition to these regular O&M activities, the embankment would be patrolled during high-flow periods (which have a 10% or less chance of occurring in any given year) to identify and address potential flooding issues. Depending on the water levels, the entire length of the embankment would be traveled several times per day until water levels fall below monitoring levels, which would be expected to take an average of approximately five days.

2.6 Conservation Measures

As part of the Proposed Action, the Corps has committed to implementing the following conservation measures to avoid and minimize potential effects on Federally-Listed Species.

2.6.1 General Avoidance and Minimization Measures

- Environmental Awareness Training. Prior to the start of each phase of construction, a biological monitor will conduct a training program for all construction personnel, including contractors and subcontractors. The training will include, at a minimum, a description of all Federally-Listed Species present and their habitats within the action area; an explanation of the species status and protection under state and federal laws; the avoidance and minimization measures to be implemented to reduce take of this species; communication and work stoppage procedures in case a listed species is observed within the Study Area; and an explanation of the importance of the environmentally sensitive areas and Wildlife Exclusion Fencing. A fact sheet conveying this information will be prepared and distributed to all construction personnel. Interpretation for non-English speakers will be provided upon request. The same instruction shall be provided to any new workers before they are authorized to perform work.

- Environmentally Sensitive Areas. Prior to the start of construction, environmentally sensitive areas (defined as areas containing sensitive habitats adjacent to or within construction work areas for which physical disturbance is not allowed) will be clearly delineated using high visibility orange fencing. The environmentally sensitive area fencing will remain in place throughout the duration of the proposed action, while construction activities are ongoing, and will be regularly inspected and fully maintained at all times.

- Biological Monitor. A biological monitor will be onsite during all activities that may result in take of federally listed species. The qualifications of the biological monitor(s) will be submitted to the Corps and USFWS for review and written approval at least thirty (30) calendar days prior to the date earthmoving is initiated in the Study Area.

- Replant, Reseed, and Restore Disturbed Areas. After construction completion, all temporarily affected areas shall be returned to original grade and contours to the maximum extent practicable, protected with proper erosion control materials, and revegetated with native species appropriate for the region and habitat communities on site.

- Best Management Practices (BMPs). Stormwater pollution prevention plans (SWPPP) and erosion control BMPs will be developed and implemented to minimize any wind- or water-related erosion and will be in compliance with the requirements of the Corps. The Corps will include provisions in construction contracts for measures to protect sensitive areas and prevent and minimize stormwater and non-stormwater discharges. Protective measures may include:
  A. No discharge of pollutants from vehicle and equipment cleaning is allowed into any storm drains or watercourses.

B. Vehicle and equipment fueling and maintenance operations must be at least 50 feet away from watercourses, except at established commercial gas stations or at an established vehicle maintenance facility.
C. Concrete wastes are to be collected in washouts and water from curing operations is to be collected and disposed of properly. Neither will be allowed into watercourses.
D. Spill containment kits will be maintained onsite at all times during construction operations and/ or staging or fueling of equipment.
E. Dust control will be implemented, and may include the use of water trucks and nontoxic tackifiers (binding agents) to control dust in excavation and fill areas, blocking temporary access road entrances and exits, and covering of temporary stockpiles when weather conditions require.
F. Graded areas will be protected from erosion using a combination of silt fences, fiber rolls, etc. along toes of slopes or along edges of designated staging areas, and erosion control netting (such as jute or coir) as appropriate on sloped areas. No erosion control materials that use plastic or synthetic monofilament netting will be used.
G. Permanent erosion control measures such as bio-filtration strips and swales to receive storm water discharges from paved roads or other impervious surfaces will be incorporated to the maximum extent practicable.
H. All grindings and asphaltic-concrete waste will be stored within previously disturbed areas absent of habitat and at a minimum of 50 feet from any aquatic habitat, culvert, or drainage feature.

- Construction Site Management Practices. The following site restrictions will be implemented to avoid or minimize effects on the listed species and their habitat:
  A. A reduced speed limit in the project footprint in unpaved areas will be enforced to reduce dust and excessive soil disturbance.
  B. Construction access, staging, storage, and parking areas will be located outside of any designated environmentally sensitive areas. Access routes and the number and size of staging and work areas will be limited to the minimum necessary to construct the proposed Action.
  C. Routes and boundaries of roadwork will be clearly marked prior to initiating construction or grading.
  D. All construction pipes, culverts, or similar structures with a diameter of 4 inches or greater that are stored at a construction site for one or more overnight periods should be thoroughly inspected for wildlife before the pipe is subsequently buried, capped, or otherwise used or moved in any way. If a Federally-Listed Species is discovered inside a pipe, that section of pipe should not be moved until the USFWS has been consulted. If necessary, and under the direct supervision of the biologist, the pipe may be moved once to remove it from the path of construction activity, until the animal has escaped.
  E. To the maximum extent practicable, any borrow material will be certified to be nontoxic and weed free.
  F. At the end of each day all food and food-related trash items will be enclosed in sealed trash containers and properly disposed of offsite.

G. A Spill Response Plan will be prepared. Hazardous materials such as fuels, oils, solvents, etc. will be stored in sealable containers in a designated location that is at least 50 feet from hydrologic features.

- Operations and Maintenance Avoidance and Minimization Measures
  A. All herbicides and pesticides will be applied according to the manufacturer's recommendations and in accordance with federal, state, and local guidelines.

2.6.2 Palmate-Bracted Bird's Beak Conservation Measures

The following measures are proposed to minimize potential impacts to PBBB:

- Surveys. Protocol-level surveys for PBBB will be conducted throughout all areas of suitable habitat within the Study Area and within 100 feet of the Study Area no later than the identifiable season prior to construction.
- Avoidance or Compensation. If PBBB is documented within the Study Area or within 100 feet, a 100-foot avoidance buffer will be established around the plants. If impacts to the plants themselves are unavoidable, or a 100-foot avoidance buffer cannot be established, then the compensation measures detailed in Section 2.4.1 will be implemented.

2.6.3 Valley Elderberry Longhorn Beetle Conservation Measures

Surveys for elderberry shrubs will be conducted in accordance with the *Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle (Desmocerus californicus dimorphus)* (USFWS 2017) ("VELB Framework"). Surveys will be conducted throughout the Study Area and within all accessible areas within 165 feet of the Study Area. The surveys will not be restricted to areas identified as "Potential Habitat" in **Section 4.2**, as isolated shrubs may also occur outside of those areas.

If any elderberry shrubs are identified during the survey described above, the following Avoidance and Minimization measures will be implemented to avoid and minimize effects to VELB and/or its habitat outside of the immediate Study Area, but within 165 feet. If any elderberry shrubs are found within the Study Area, the compensation measures detailed in **Section 2.4.2** will be implemented.

Construction Avoidance and Minimization Measures

- Protective Fencing. All areas to be avoided during construction activities will be fenced and/or flagged.
- Signage. Signs will be placed along the fenced buffer areas with the following information: "NOTICE: This area is habitat of the valley elderberry longhorn beetle, a threatened species, and must not be disturbed. This species is protected by the Endangered Species Act of 1973, as amended. Violators are subject to prosecution, fines, and imprisonment."
- Avoidance Area. An avoidance area will be established of at least 20 feet from the drip-line of all elderberry shrubs; this avoidance area will be fenced and/or flagged.
- Pre-Construction and Post-Construction Surveys. Pre-construction and post-construction surveys will be conducted for all accessible elderberry shrubs within 165 feet of the Study Area. Pre-construction

surveys will document compliance with avoidance and minimization measures (fencing and signage). The post-construction survey will confirm that there was no damage to elderberry shrubs.

- Trimming. Trimming of elderberry shrubs will occur between November and February and only branches and stems less than 1 inch in diameter will be removed.
- Chemical Usage. Herbicides will not be used within 20 feet of an elderberry shrub. Insecticides will not be used within 100 feet of an elderberry shrub. All chemicals will be applied using a backpack sprayer or similar direct application method.
- Mowing. Mechanical weed removal within the drip-line of the shrub will be limited to the season when adults are not active (August - February) and will avoid damaging the elderberry.
- Dust Control. Any areas of bare ground that are disturbed as a result of construction activities, or dirt haul roads within 100 feet of elderberry plants will be watered at least twice a day during the dry season to minimize dust. Haul trucks carrying soil away from the degraded levee will be covered if possible to minimize dust during transport.

Operations and Maintenance Avoidance and Minimization Measures

- Trimming. Trimming of elderberry shrubs will occur between November and February and only branches and stems less than 1 inch in diameter will be removed.
- Chemical Usage. Herbicides will not be used within 20 feet of an elderberry shrub. Insecticides will not be used within 100 feet of an elderberry shrub. All chemicals will be applied using a backpack sprayer or similar direct application method.
- Mowing. Mechanical weed removal within the drip-line of the shrub will be limited to the season when adults are not active (August - February) and will avoid damaging the elderberry.

2.6.4 Vernal Pool Branchiopod Conservation Measures

Construction Avoidance and Minimization Measures

- Protective Fencing. The vernal pool branchiopod habitat within the Action Area is not proposed for impact, and will be fenced with silt fence and signage as far from the feature as possible. A qualified biologist will survey and approve the placement of the fencing prior to commencement of construction.

Operations and Maintenance Avoidance and Minimization Measures

- Herbicides and Pesticides. Herbicide and pesticide spraying in association with maintenance activities within 250 feet of vernal pool branchiopod habitat will not be performed on windy days. Only herbicides or pesticides specifically labeled for use near aquatic resources will be utilized within 50 feet of vernal pool branchiopod habitat.

2.6.5 Giant Garter Snake Conservation Measures

Construction Avoidance and Minimization Measures

- Construction Timing. Any earthwork within 200 feet of GGS aquatic habitat would be completed from May 1 to September 30 during the active season.

- Pre-Construction Surveys and Avoidance. A giant garter snake survey will be conducted by a biological monitor 24 hours prior to construction in any suitable aquatic or upland habitat identified in **Section 4.5** below. Should there be any interruption in work for greater than two weeks; a biological monitor would survey the Study Area again no later than 24 hours prior to the restart of work. If a snake is discovered, no work will occur within a 200-foot radius of the snake discovery location until the snake moves away from construction activities. The snake shall not be harassed or encouraged to leave the construction area, but will be allowed to do so on its own.
- Wildlife Exclusion Fencing. A 32-inch-high silt barrier fence will be installed between GGS aquatic habitat and adjacent Study Areas (including staging areas). The fence will be installed as far from the aquatic habitat (as close to construction impacts) as possible, and a map of proposed fencing locations will be provided to USFWS for review and approval prior to installation. Four inches of the bottom portion of the fence would be buried in a trench to prevent wildlife passage. The silt fence will be maintained throughout construction and will be removed upon completion of the Action.
- Daily Clearance Sweeps. In all areas within GGS upland habitat (as identified in **Section 4.5**), a biological monitor will conduct a clearance-sweep of the proposed work area for each day prior to commencement of work to ensure that no GGS are present if work occurs during the dormant season, October 1 to April 29. This daily clearance sweep will include checking any potential natural earthen burrows, equipment, vehicles and stockpiles, and the wildlife exclusion fencing within the work area.
- Biological Monitor. A biological monitor will be present to monitor all work within GGS aquatic habitat (as identified in **Section 4.5**). If a GGS enters the work area, the monitor will have the authority to halt work until the snake leaves the work area on its own.
- Wildlife Protection in Trenches and Holes. All excavated, steep-walled holes or trenches will be covered with appropriate covers (thick metal sheets or plywood) at the end of each workday. Covers will be placed to ensure that trench edges are fully sealed with rock bags or sand. Alternatively, such trenches may be furnished with one or more escape ramps constructed of earth fill or wooden planks to provide escape ramps for wildlife, approved by the monitoring biologist. Before holes or trenches are filled, sealed, or collapsed, they will be thoroughly inspected for trapped animals. Any animals discovered will be allowed to escape voluntarily, or will be removed by the monitoring biologist.
- Speed Limit. Maintain a 10-mile-per-hour speed limit within potential GGS upland habitat including haul/ access routes, except on county roads and state and federal highways.
- Construction Lighting/Daily Timing. Construction and ground disturbance within potential GGS upland habitat will occur during daytime hours. Work will cease no less than 30 minutes before sunset and will not begin again prior to 30 minutes after sunrise. Nighttime lighting of potential GGS upland habitat should be avoided to the greatest extent practicable.
- Equipment Movement and Stockpiles. Movement of heavy equipment to and from the construction site will be restricted to established roadways. Stockpiling of construction materials will be restricted to designated staging areas, which will be located more than 200 feet away from giant garter snake aquatic habitat wherever possible.

Operations and Maintenance Avoidance and Minimization Measures

- Herbicides and Pesticides. Only herbicides or pesticides specifically labeled for use near aquatic resources will be utilized within 50 feet of GGS aquatic habitat.

- Speed Limit. Maintain a 10-mile-per-hour speed limit within potential GGS upland habitat, except on county roads and state and federal highways.

2.6.6 Western Yellow-Billed Cuckoo and Least Bell's Vireo Conservation Measures

The following measures will be implemented to minimize effects on WYBC and LBV and their potential nesting habitat during construction and maintenance activities.

Construction Avoidance and Minimization Measures

- Pre-Construction Surveys and Avoidance. To the maximum extent practicable, the Corps will avoid construction in areas within 300 feet of potential WYBC or LBV nesting habitat during the period from May 15 through September 30.
- When construction within 300 feet of potential nesting habitat must occur between May 15 and September 30, a USFWS-permitted biologist will conduct a presence/absence survey for WYBC and LBV within all accessible suitable habitat within 300 feet of the proposed construction area. The surveys will be conducted within 14 days prior to the start of construction within each construction season. If any nesting WYBC or LBV are detected within that area, construction will halt within a 300-foot buffer until the young fledge or the biologist determines that the nest is inactive. Additionally, the biologist will monitor the nest daily when work is occurring within 500 feet of the nest to ensure that the work is not altering nesting behavior.

Operations and Maintenance Avoidance and Minimization Measures

- Herbicide and pesticide spraying in association with maintenance activities within 300 feet of potential WYBC or LBV nesting habitat will not be performed on windy days.

2.7 Compensation Measures

Where impacts to Federally-Listed Species are determined to be unavoidable, the Corps has proposed the following measures to compensate for potential effects. **Table 4**, below the species-specific measures, provides a summary.

2.7.1 Palmate-Bracted Bird's Beak

If impacts to PBBB plants are unavoidable, or if a 100-foot buffer cannot be established, then a compensatory conservation plan for impacts to PBBB shall be developed in coordination with USFWS and California Department of Fish and Wildlife (CDFW), with the guidelines stipulated below. Given that surveys have not been conducted yet throughout much of the habitat, for the purposes of this document, we have assumed 10% occupancy throughout potential habitat in **Table 4**.

- The following shall be implemented for any directly impacted plants as well as any indirectly plants (i.e., those within a 100-foot buffer of temporary or permanent impacts). The conservation plan will require the Corps to protect and maintain existing PBBB populations in the vicinity of the Study Area. The Corps shall conserve an equal acreage of PBBB occupied habitat as is indirectly impacted (1:1 conservation).

For direct impacts, conservation acreage shall be 3:1. Conservation shall not be based on the number of plants, as that can be highly variable by year for this annual species.

- If plants are within the Study Area and will be directly impacted, then the conservation plan will include details on the following: seed collection, relocation/ transplant potential, storage, propagation (if deemed appropriate), location and preparation of receptor site, installation, long-term protection and management, monitoring and reporting requirements, and remedial action responsibilities should the initial effort fail to meet compensation requirements.
- The conservation plan shall include the following for populations to be preserved, as well as any proposed off-site plant establishment locations:
  - Monitoring: This shall include both success monitoring for newly-established populations, and long-term monitoring of all PBBB populations set aside or established.
  - Conservation Easements: Dedication of conservation easements, purchase of mitigation credits, or other off-site dedication measures will be detailed in the conservation plan, along with an endowment for management in perpetuity. This endowment must be funded in full before groundbreaking.
  - Long-Term Management: The plan will include information on responsible parties for long-term management, holders of conservation easements, long-term management requirements, and other details, as appropriate, for the preservation of long-term viable populations.
  - Reporting: The plan will include reporting requirements for the results of the short-term success monitoring, the long-term PBBB population monitoring, and the long-term management.

2.7.2 Valley Elderberry Longhorn Beetle

Comprehensive protocol-level surveys for VELB have not been conducted throughout the Study Area; therefore, for the purposes of this document, we have estimated the number of shrubs that may be directly impacted by the Action. Although comprehensive surveys were not conducted throughout the Action Area, a total of 27 elderberry shrubs were incidentally observed during field surveys of accessible areas; two within the Study Area, 15 outside of the Study Area but within 165 feet, and ten shrubs more than 165 feet from the Study Area. Seventeen of these shrubs were within or adjacent to riparian or Valley oak woodlands (communities identified as "potential habitat"), while the remaining shrubs are isolated shrubs that are growing in communities not identified as habitat (such as levees, developed, ruderal, etc). We estimated the number of additional shrubs that may be within the Study Area as follows. The seventeen incidentally observed shrubs were identified in approximately 23 acres of surveyed Potential Habitat; this averages out to approximately one shrub per each 0.75 acre of habitat.

There are approximately 2 acres of Potential Habitat within the Study Area, so assuming equal distribution throughout, it can be extrapolated that one shrub in 0.75 acres equates to 2.67 shrubs (which will be rounded up to three) in that 2 acres. Additional shrubs may be scattered in upland portions of the Study Area, so we have assumed one additional shrub will be impacted outside of Potential Habitat. To summarize, there are two "observed" shrubs within the Study Area, three estimated shrubs in Potential Habitat, and one estimated shrub in non-habitat areas. This yields a total of six elderberry shrubs within the Study Area that will be directly impacted. Given the lack of a protocol-level survey, all of these shrubs are assumed to have exit holes. As no riparian habitat will be impacted by the Action, it can be assumed that none of the impacted shrubs would be located in riparian habitat. Therefore, as recommended by the VELB Framework, the shrubs will be transplanted to a USFWS-approved mitigation bank, to another location on-site, or another suitable mitigation site, and mitigated at a ratio of 1 shrub: 1 credit.

In addition, as noted above, 25 additional shrubs were observed within the Action Area, but outside of the Study Area. It is assumed that an unspecified number of additional shrubs may be located during surveys within 165 feet of the Study Area. These shrubs will be avoided, and no direct impacts are anticipated to any of these elderberry shrubs outside of the Study Area. As a result, the number of these shrubs has not been quantified.

2.7.3 Vernal Pool Fairy Shrimp and Vernal Pool Tadpole Shrimp

If protocol-level surveys are conducted for VPFS and VPTS and neither of these species are documented within the depressional seasonal wetland that represents potential habitat, then no compensation will be required for these species. If the depressional seasonal wetland is assumed to be habitat, but subsequent to Study implementation, it is determined that there is no change in the extent or duration of inundation in the depressional seasonal wetland, then no compensation will be required for these species. However, if the depressional seasonal wetland is assumed to be habitat or protocol-level surveys indicate that one or more of these species is present, and subsequent to Study implementation, it is determined that there is a change in the extent or duration of inundation in the depressional seasonal wetland, then the impacts to that feature will be mitigated at a ratio of 2:1 through purchase of mitigation credits at a USFWS-approved mitigation bank.

2.7.4 Giant Garter Snake

All direct, permanent impacts to GGS upland and aquatic habitat will be mitigated a ratio of 3:1 through purchase of mitigation credits at a USFWS-approved mitigation bank. As all temporary impacts will last no more than one year, no mitigation for temporary impacts are proposed, other than restoration of areas disturbed during construction.

Table 4. Summary of Compensation Measures

	Temporary Impacts			Permanent Impacts			Total
Species	Impacts (acres)	Ratio	Compensation	Impacts (acres)	Ratio	Compensation	Compensation
Palmate-Bracted Bird's Beak	None	N/A	--	0.15 (Indirect) 0.7 (Direct)	1:1 3:1	2.25	2.25 acres
Valley Elderberry Longhorn Beetle	None	N/A	--	6 elderberry shrubs	1:1	6 VELB credits	6 VELB credits
Vernal Pool Fairy Shrimp	0.65 (Indirect)	N/A	None	0.65 (Indirect)	2:1	--	1.3 acres
Vernal Pool Tadpole Shrimp	0.65 (Indirect)	N/A	None	0.65 (Indirect)	2:1	--	1.3 acres
Giant Garter Snake	0.01 (Aquatic) 41.33 (Upland) 1 season	N/A	None	1.04 (Aquatic) 8.78 (Upland)	3:1	29.46 acres	29.46 acres

Table 4. Summary of Compensation Measures

Species	Temporary Impacts: Impacts (acres)	Ratio	Compensation	Permanent Impacts: Impacts (acres)	Ratio	Compensation	Total Compensation
Western Yellow-Billed Cuckoo	None	N/A	None	None	N/A	None	None
Least Bell's Vireo	None	N/A	None	None	N/A	None	None

3.0 ENVIRONMENTAL BASELINE

3.1 Action Area

The Action Area includes those areas that could be directly or indirectly affected by the proposed Action. Direct effects are anticipated to be restricted to the Study Area (which includes all staging areas and the haul route for the training levee degrade); a buffer has been developed to account for the area surrounding the Study Area within which indirect effects to Federally-Listed Species could occur. These indirect effect buffer areas are as follows:

- For PBBB, a buffer of 100 feet was designated based on the potential for indirect impacts to populations on habitat in the vicinity of the Study Area.
- For VELB, a buffer of 165 feet was established based on guidance in the VELB Framework about indirect effects to VELB.
- For VPFS and VPTS, a buffer of 250 feet was designated based on the potential for indirect impacts to the hydrology of vernal pools within that area.
- For GGS, a buffer of 200 feet was designated to identify any GGS aquatic habitat that would indicate GGS upland habitat within the Study Area.
- For WYBC and LBV, a 300-foot buffer was developed to identify any habitat that could potentially support nesting WYBC and LBV that could be indirectly impacted by construction.

The 1,371-acre Action Area shown in **Attachment B** is comprised of the 368-acre Study Area and 1,003 acres within the indirect impact buffer. The indirect impact buffer is 300 feet, the largest of the species-specific buffers listed above. The Action Area is bounded largely by the City of Woodland's Main Street (County Road 22) to the south, County Road 18 C to the north, County Road 97A to the west, and the Cache Creek Settling Basin to the east.

When developing the Action Area, potential indirect effects of the proposed Action associated with hydraulic impacts were considered, but ultimately it was determined that these effects would not have any effect on Federally-Listed Species; as a result, the extent of these effects were not used to define the extent of the Action Area. These hydraulic effects are analyzed and summarized in the *Hydraulic and Civil Design Appendix B – Lower Cache Creek Feasibility Study* (USACE 2019) (Hydraulic Appendix). The two indirect effects with greatest potential to effect federally-listed species are changes in the extent and duration of flooding, and the potential to mobilize mercury-bearing sediments from the bed of the CCSB.

Based on a review of the Hydraulic Appendix, we determined that while there will be some changes in the duration and extent of flooding, those changes would not have an appreciable effect on federally-listed species, due to the relative infrequency and short duration of the flood events that would access the new levees, the fact that the events would only occur in winter, and the minimal amount of federally-listed species habitat that occurs within the areas that would experience increases in flooding (almost exclusively active agricultural fields).

If excessive scour mobilized the sediments in the CCSB, a pulse of mercury-laden sediments could enter downstream waterways and negatively impact aquatic species, including federally-listed fish. Based upon a review of the Hydraulic Appendix, we determined that excessive scour (above and beyond any that occurs under current conditions) is not expected to occur, and that sediment trapping efficiency is actually expected to increase. As a result, no additional sediment should be mobilized from the bed of the CCSB, and no impacts to downstream aquatic species are anticipated.

3.2 Existing Conditions within the Study Area and Action Area

The Study Area is located north of the City of Woodland, and primarily runs through agricultural fields that are occasionally interspersed with rural residential lots and Valley oak woodland windrows. Agricultural crops observed during the field surveys included alfalfa, tomatoes, squash, sunflowers, wheat, soybeans, and tree crops (orchards). In addition, a number of fields had been freshly disked or freshly planted. No rice fields occur within the Action Area. The eastern portion of the Study Area runs along the western levee of the CCSB and the training levee within the CCSB; those portions of the Action Area extend into the extensive Cottonwood Willow Riparian Woodlands within the CCSB. Land cover within the CCSB portion of the Action Area is comprised primarily of a matrix of Fremont's cottonwood (*Populus fremontii*)-red willow (*Salix laevigata*) riparian woodlands; seasonal marshes dominated by smartweed (*Persicaria* species), barnyard grass (*Echinochloa crus-galli*), prickly cocklebur (*Xanthium strumarium*), swamp pricklegrass (*Crypsis schoenoides*), western golden rod (*Euthamia occidentalis*), and annual sunflower (*Helianthus annuus*); and open water. A few small isolated patches of tamarisk (*Tamarix* species) riparian scrub are also present. A broad corridor of sandbar willow (*Salix exigua*) riparian scrub occurs along the irrigation canal to the south of the CCSB. Vegetation communities within the Action Area are shown in **Attachment C**.

Aquatic resources within the Action Area are primarily located along Cache Creek and in the CCSB and include the channel of Lower Cache Creek, the seasonally flooded CCSB, and adjacent irrigation canals. All of the CCSB land cover types discussed above appear to fall within the Ordinary High Water Mark of the CCSB; those areas mapped as "open water" appear to be inundated for at least four months in an average year, but the majority of these areas dry out in the summer months. The channel of Lower Cache Creek is largely similar to other open water areas within the CCSB, although it is somewhat deeper and therefore experiences longer inundation than most other portions of the CCSB. The channel of Lower Cache Creek that runs through the CCSB was constructed when the CCSB was built; a portion of the abandoned channel is present in the northern portion of the Action Area, and is also mapped as "Cache Creek". The irrigation canals that border the CCSB are a matrix of open water, cattails (*Typha* species), tules (*Schoenoplectus acutus*), and northern water plantain (*Alisma triviale*). A number of shallow seasonal wetlands and seasonal wetland swales occur just west of the CCSB, and a larger depressional wetland with an extended hydroperiod occurs to the south of the CCSB (**Attachment D**). This depressional wetland is a seasonal wetland that has a mix of seasonal marsh and seasonal wetland species along the upper fringes, including tubered bulrush

(*Bolboschoenus glaucus*), water plantain (*Alisma lanceolatum*), burhead (*Echinodorus berteroi*), hyssop loosestrife (*Lythrum hyssopifolium*), slender popcorn flower (*Plagiobothrys stipitatus*), bird's foot trefoil (*Lotus corniculatus*), and broad-leaved pepperweed (*Lepidium latifolium*).

3.2.1 Soils

The soils in the western portion of the Action Area are silt loams and silty clay loams (**Figure 3**). The central and eastern portion is somewhat more complex, where a variety of loams are interspersed with clays and saline-alkali soils. Several soil types that occur within the Study Area represent habitat for plant species that are only found on these saline and alkaline soils: (Pb) Pescadero silty clay, saline-alkali; (Wb) Willows clay, and (Wc) Willows clay, alkali.

4.0 SPECIES ACCOUNTS AND STATUS IN ACTION AREA

4.1 Palmate-Bracted Bird's Beak

4.1.1 Status

PBBB was federally listed as endangered in July 1986 (51 FR 23765). This species is included in the *Recovery Plan for the Upland Species of San Joaquin Valley, California* (USFWS 1998). Critical Habitat for this species has not been designated. This species is listed as endangered by the CDFW. The California Native Plant Society has placed it on List 1B (rare or endangered throughout its range).

4.1.2 Historical and Current Distribution

Historical populations of PBBB were scattered throughout the San Joaquin Valley in Fresno and Madera counties, the Livermore Valley in Alameda County, and the Sacramento Valley in Colusa and Yolo counties (CDFG 2000). The extant occurrences of PBBB (CNDDB 2019) are in seven metapopulations in the Sacramento, Livermore, and San Joaquin Valleys. In approximate order from north to south, these are located at (1) the Sacramento National Wildlife Refuge in Glenn County, (2) the Delevan National Wildlife Refuge in Colusa County, (3) the Colusa National Wildlife Refuge in Colusa County, (4) the Woodland area, (5) the Springtown Alkali Sink near Livermore, (6) western Madera County, and (7) the combined Alkali Sink Ecological Reserve and Mendota Wildlife Management Area in Fresno County. The total occupied surface area over the seven metapopulations is estimated at less than 741 acres.

Two CNDDB records for this species occur within two miles of the Action Area (CNDDB 2019). CNDDB Occurrence #1, which is located to the south of the Study Area, is the well-known "Woodland" site noted above. CNDDB Occurrence #3 is located along County Road 102, just south of County Road 20, approximately 0.5 mile southwest of the Action Area. The CNDDB reports this occurrence as "extirpated" due to the heavy disturbance in the area, and the lack of soil with hardpan or salt accumulations.

4.1.3 Habitat Requirements and Life History

This species is restricted to seasonally flooded, saline-alkali soils in lowland plains and basins at elevations of less than 155 meters (500 feet) (USFWS 1998). Small differences in soil topography are critical for seedling establishment, as seedlings establish on banks and sides of raised irrigation ditches and on small berms in areas subject to overland flows (Showers 1988). Extensive soil tests across mound and swale topography at the Springtown population have shown that soil salt concentrations are generally highest in the bottoms of swales and lowest on the tops of mounds (Coats et al. 1988, 1989, 1993). At Springtown, PBBB was found to occur primarily on soils with intermediate salt content along the sides of the swales. The authors concluded that it was generally excluded from the scalds in the swales due to high soil salt content, and it was excluded from the tops of the mounds due to competition from exotic annual grasses (Coats et al. 1988, 1989, 1993). The descriptions of the Woodland population suggest that it also occurs on the sides of small topographic features and that the plants are shaded by dense populations of exotic annual grasses (Foothill Associates 2002; Showers 1988).

According to current data on the species, only perennial plants, such as saltgrass (*Distichlis spicata*), Mojave red sage (*Kochia californica*), and Torrey seepweed (*Suaeda moquinii*), are assumed to function as appropriate host plants for PBBB (Coats et al. 1988; Cypher 1998; EIP Associates 1998). However, in a greenhouse host-preference experiment, Chuang and Heckard (1971) observed that PBBB was vigorous and produced many flowers when grown with common sunflower (*Helianthus annuus*), which is a summer-flowering annual. This finding suggests that common spikeweed, a summer- and fall-flowering annual plant in the same plant family as common sunflower, and which is closely associated with PBBB in its natural habitat, may be a suitable host. Recent research indicates that alkali heath (*Frankenia salina*) is the most important host plant for this species (Cypher 2015).

Individuals in the existing Woodland population are generally found on small topographic features such as old irrigation checks, banks of shallow ditches, along the shoreline of a pond, and along the upper margin of a vernal pool. The entire population is limited to Pescadero silty clay, saline-alkali, and Willows clay soil types (Andrews 1970; Showers 1988, 1996; EIP Associates 1998).

4.1.4 Distribution of Suitable Habitat within the Action Area

The portion of the Action Area that runs from County Road 102 south west to the CCSB levee, and across through the CCSB provides potentially suitable habitat for PBBB (**Figure 4**). This portion of the Action Area runs through the prior waste disposal area. This area was mapped as “Miscellaneous Water” during the last soil survey, which was completed in 1972 when there was a waste treatment pond there. This area is no longer used as a waste treatment pond, and we have assumed that the soil in that area is consistent with the soil units mapped around the prior pond. These surrounding areas are mapped as Pescadero saline alkali and Willows clay soils, which are known to support PBBB. Although the majority of this area was not accessible for field surveys, a small accessible area supported saltgrass and alkali heath, which are known to serve as hosts for this species, as well as common spikeweed (*Centromadia pungens* ssp. *pungens*), which is considered a potential host. Although the actively farmed fields could not support the perennial hosts for this plant species, the surrounding old irrigation ditches, banks, and other undisturbed areas could provide habitat, and are mapped as such (**Figure 4**). The seasonal marshes within the CCSB that occur on Pescadero saline alkali and Willows clay soils do not support any of the known hosts for PBBB apart from occasional saltgrass. As a result, these areas were not considered suitable habitat for PBBB.

4.2 Valley Elderberry Longhorn Beetle

4.2.1 Status

VELB was federally listed as threatened with Critical Habitat on August 8, 1980. A draft revised recovery plan for the species was published on October 22, 2018.

4.2.2 Historical and Current Distribution

The historic range of this beetle is limited to moist Valley oak woodlands along margins of rivers and streams in the lower Sacramento and lower San Joaquin Valleys (USFWS 1984). At the time of its listing, the beetle was known from less than 10 localities in Merced, Sacramento, and Yolo Counties (USFWS 1980). Its current distribution is patchy throughout California's Central Valley and associated foothills (USFWS 1999b).

4.2.3 Habitat Requirements and Life History

The VELB is completely dependent on its host plant, elderberry (*Sambucus* species), which occurs in riparian and other woodland communities in California's Central Valley and the associated foothills (USFWS 1999). Female beetles lay their eggs in crevices on the stems or on the leaves of living elderberry plants. When the eggs hatch, larvae bore into stems with a diameter of one inch or more. The larval stages last for one to two years. The fifth instar larvae create emergence holes in the stems and then plug the holes and remain in the stems through pupation (Talley 2003). Adults emerge through the emergence holes from late March through June. The short-lived adult beetles forage on leaves and flowers of elderberry shrubs.

They are typically associated with elderberry stems and trunks that are greater than one inch in diameter at ground level. The USFWS considers all elderberry shrubs containing stems greater than one inch in diameter at ground level as potential VELB habitat. VELB most commonly occur in areas within, or near, some type of riparian corridor containing other woody plant species such as willow *(Salix* spp.), cottonwood *(Populus fremontii* ssp. *fremontii),* wild grape (*Vitis californica),* and box elder *(Acer negundo)*. Population densities of the VELB are probably naturally low (USFWS 1984), and it has been suggested based on the spatial distribution of occupied shrubs (Barr 1991), that the VELB has limited dispersal capabilities. Low density and limited dispersal capability may cause the VELB to be vulnerable to the adverse effects of the isolation of small subpopulations due to habitat fragmentation.

4.2.4 *Distribution of Suitable Habitat within the Action Area*

Two elderberry shrubs have been documented within the Study Area, and a total of six are estimated to be present within the Study Area based upon Valley oak woodland habitat. An additional 25 shrubs were observed within the Action Area, but outside of the Study Area (**Attachment E**). More shrubs may be present within the unsurveyed Valley oak woodlands, riparian woodlands and scrub, or as isolated shrubs elsewhere. Of the two shrubs documented within the Study Area, one is in a Valley oak woodland windrow, and the other is an isolated shrub adjacent to a levee. Neither of these would be considered riparian in nature, and both appear to be isolated from any large stands of elderberry shrubs. As such, these shrubs represent extremely marginal habitat for VELB. A preliminary exit hole survey of the shrub on the levee did not locate any holes. Exit hole surveys could not be conducted on the western-most shrub due to lack of access.

4.3 Vernal Pool Fairy Shrimp

4.3.1 *Status*

The VPFS was federally listed as a threatened species under the ESA on September 19, 1994. This species was included in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (Vernal Pool Recovery Plan), which was published on December 15, 2005. The Action Area is located in the *Solano-Colusa Vernal Pool Region*, as defined by the Vernal Pool Recovery Plan (USFWS 2005). Critical habitat for VPFS was designated on August 6, 2003.

4.3.2 *Historical and Current Distribution*

Historically, the range of vernal pool fairy shrimp extended throughout the Central Valley of California. Vernal pool fairy shrimp populations have been found in several locations throughout California, with habitat extending from Stillwater Plain in Shasta County through the Central Valley to Pixley in Tulare County, and along the Central Coast range from northern Solano County to Pinnacles National Monument in San Benito County (Eng et al. 1990, Fugate 1992, Sugnet and Associates 1993). Additional populations occur in San Luis Obispo, Santa Barbara, and Riverside counties. The historic and current ranges of vernal pool fairy shrimp are very similar in extent; however, the remaining populations are more fragmented and isolated than during historical times (USFWS 2005a).

4.3.3 *Habitat Requirements and Life History*

Vernal pool fairy shrimp live in vernal pools and ephemeral freshwater habitat. They are ecologically dependent on seasonal fluctuations in their habitat, such as absence or presence of water during specific times of the year, duration of inundation, and other environmental factors that include specific salinity, conductivity, dissolved solids, and pH levels. Water chemistry is one of the most important factors in determining the distribution of fairy shrimp (Belk 1977).

Vernal pools form in regions with Mediterranean climates where shallow depressions fill with water during fall and winter rains and then evaporate in the spring (Collie and Lathrop 1976). Downward percolation is prevented by the presence of an impervious subsurface layer, such as a claypan, hardpan, or volcanic stratum (Holland 1976). Due to local topography and geology, the pools are usually clustered into pool complexes (Holland and Jain 1988). Pools within a complex typically are separated by distances on the order of meters and may form dense, interconnected mosaics of small pools or a sparser scattering of larger pools. Temporary inundation makes vernal pools too wet during the winter for upland plant species adapted to drier soil conditions, while rapid drying during late spring makes pool basins unsuitable for typical marsh or aquatic species that require a more permanent source of water. However, many plant and aquatic invertebrate species have evolved to occupy the extreme environmental conditions found in vernal pool habitats.

Fairy shrimp have delicate elongate bodies, large stalked compound eyes, no carapace, and 11 pairs of swimming legs. They swim or glide gracefully upside down by means of complex beating movements of the legs that pass in a wavelike, anterior-to-posterior direction. Nearly all fairy shrimp feed on algae, bacteria, protozoa, rotifers, and bits of detritus. Female shrimp drop their eggs to the pool bottom or eggs remain in the brood sac until the female dies and sinks. The "resting" or "summer" eggs are capable of withstanding heat, cold, and prolonged desiccation. When the pools refill in the same or subsequent seasons some, but not all, of the eggs may hatch. The egg bank in the soil may be comprised of the eggs from several years of breeding (Donald 1983). The eggs hatch when the vernal pools fill with rainwater.

4.3.4 Distribution of Suitable Habitat within the Action Area

One depressional seasonal wetland with sufficient hydroperiod to support this species occurs in the southern portion of the Action Area, approximately 10 feet south of the Study Area (**Figure 5**). This wetland does not appear to be a vernal pool, but the depressional nature of the feature and its apparent hydroperiod make it marginally suitable habitat for VPFS. Some portion of the water in this basin may come from seepage through the CCSB south levee, which is located immediately to the north of this feature.

4.4 Vernal Pool Tadpole Shrimp

4.4.1 Status

The VPTS was federally listed as an endangered species under the ESA on September 19, 1994. This species was included in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon*, which was published on December 15, 2005. The Action Area is located in the *Solano-Colusa Vernal Pool Region*, as defined by the Vernal Pool Recovery Plan (USFWS 2005). Critical habitat for VPTS was designated on August 6, 2003.

4.4.2 Historical and Current Distribution

The historic range of the vernal pool tadpole shrimp likely extended throughout the Central Valley of California, and has been documented from east of Redding in Shasta County south to Fresno County, and from the San Francisco Bay Wildlife Refuge in Alameda County. The historic and current ranges of vernal pool tadpole shrimp are very similar in extent; however, the remaining populations are more fragmented and isolated than during historical times (USFWS 2005a).

4.4.3 Habitat Requirements and Life History

The life history of the vernal pool tadpole shrimp is linked to the phenology of the vernal pool habitat. After winter rainwater fills the pools, the populations are reestablished from diapaused eggs that lie dormant in the dry pool sediments (Ahl 1991). Tadpole shrimp are primarily benthic animals that swim with their legs down. They climb or scramble over objects, as well as plow along in bottom sediments. Their diet consists of organic detritus and living organisms, such as fairy shrimp and other invertebrates (Pennak 1989).

A female surviving to large size may lay up to six clutches of eggs, totaling about 861 eggs in her lifetime (Ahl 1991). The eggs are sticky and readily adhere to plant matter and sediment particles (Simovich and Fugate 1992). Some of the eggs hatch immediately and the rest enter diapause and remain in the soil to hatch during later rainy seasons (Ahl 1991). Ahl (1991) found that eggs in one pool hatched within three weeks of inundation and matured to sexually reproductive adults in another three to four weeks. Simovich and Fugate (1992) reported sexually mature adults occurred in another pool three to four weeks after the pools had been filled. The vernal pool tadpole shrimp matures slowly and is a long-lived species (Ahl 1991). Adults are often present and reproductive until the pools dry up in the spring (Ahl 1991; Simovich et al. 1992). As they mature slowly, they only occur in vernal pools that have a sufficiently long hydroperiod to remain inundated until tadpole shrimp mature and reproduce.

4.4.4 Distribution of Suitable Habitat within the Action Area

One depressional seasonal wetland with sufficient hydroperiod to support this species occurs in the southern portion of the Action Area, approximately 10 feet south of the Study Area (**Figure 5**). This wetland does not appear to be a vernal pool, but the depressional nature of the feature and its apparent hydroperiod make it marginally suitable habitat for VPTS. Some portion of the water in this basin may come from seepage through the CCSB levee, which is located immediately to the north of this feature.

4.5 Giant Garter Snake

4.5.1 Status

The GGS was federally listed as a threatened species under the ESA on October 20, 1993. A final recovery plan was published for on September 28, 2017. Critical habitat has not been designated for this species.

4.5.2 Historical and Current Distribution

Historically, giant garter snakes inhabited the Sacramento and San Joaquin Valleys from the vicinity of Chico, in Butte County southward to Buena Vista Lake, near Bakersfield in Kern County, California. The eastern and western boundaries of the giant garter snake range from the foothills occurring along each side of the Central Valley - the Coast Range to the west and the Sierra Nevada to the east (USFWS 2017). Though the abundance of giant garter snakes in the Sacramento Valley has declined, the distribution of giant garter snakes in its northern range may still reflect its historical distribution (USFWS 2012; Wylie et al. 2010). Giant garter snakes in the San Joaquin Valley, however, have suffered an extensive reduction in their abundance and distribution compared to historical times (R. Hansen 1980; Paquin et al. 2006; Wylie and Amarello 2007; E. Hansen 2008a).

GGS have been documented relatively frequently in the past ten years in the irrigation canals downstream of those mapped within the eastern portion of the Action Area (CNDDB 2019). The Study Area is located in the Yolo Basin Recovery Unit as defined by the *Recovery Plan for the Giant Garter Snake* (USFWS 2017).

4.5.3 Habitat Requirements and Life History

Habitats occupied by GGS contain permanent or seasonal water, mud bottoms, and vegetated dirt banks (Fitch 1940, Hansen and Brode 1980). Open areas and grassy banks are required for basking. Small mammal burrows and other small crevices at higher elevations provide winter brumation sites and refuge from floodwaters. In some rice-growing areas, GGS have adapted well to vegetated, artificial waterways and the rice fields they supply (Hansen and Brode 1993).

GGS are associated with aquatic habitats characterized by the following features: (1) sufficient water during the snake's active season (typically early spring through mid-fall) to supply cover and food such as small fish and amphibians; (2) emergent, herbaceous wetland vegetation, such as cattails *(Typha* spp.) and bulrushes *(Scirpus* spp.), accompanied by vegetated banks to provide basking and foraging habitat and escape cover during the active season; (3) upland habitat (e.g. bankside burrows, holes, and crevices) to provide short-term refuge areas during the active season; and (4) high ground or upland habitat above the annual high water mark to provide cover and refuge from flood waters during the snake's inactive overwintering period (Hansen and Brode 1980, Hansen 1998). The nature of the home range of GGS in California is not well known; there is likely considerable overlap in the home ranges of neighboring individuals.

GGS typically emerge from winter retreats from late March to early April and remain active through October. The USFWS considers the active season for this species to be from 1 May through 1 October (USFWS 1997). The timing of annual GGS activity is subject to varying seasonal weather conditions. Cool winter months are spent in dormancy or periods of reduced activity. While the GGS is strongly associated with aquatic habitats, individuals have been noted using burrows as far as 50 meters (164 feet) from marsh edges during the active season, and retreating as far as 820 feet from the edge of wetland habitats while overwintering (Wylie *et al.* 1997, USFWS 1999b). The USFWS considers suitable upland areas within 200 feet of suitable aquatic habitats to be GGS upland habitat (USFWS 1997). Suitable upland habitats include grassy banks and other vegetation communities that have ample openings for basking, as well as shrubs such as saltbush (*Atriplex* species) and willows (*Salix* species)] which provide cover from predation (USFWS 1999b).

Irrigation canals and drainage ditches, together with their associated levees and adjacent embankments, are essential components of GGS habitat in the Central Valley. Irrigation canals provide an essential habitat component, but also create dispersal corridors allowing GGS to move from one area to another in search of mates, new territories, summer habitat, etc.

This species appears to be absent from most permanent waters such as large rivers or ponds that support established populations of predatory game fishes. Introduced bass, sunfish, and catfish compete with GGS for prey and undoubtedly prey upon the snake as well (Hansen 1988). Because of the lack of basking areas and the lack of prey populations, riparian woodlands usually do not support GGS (Hansen and Brode 1980). The species also appears to be absent from natural or artificial waterways that undergo routine mechanical or chemical weed control or compaction of bank soils (Hansen 1988, Hansen and Brode 1993). Highly aquatic, GGS forage primarily in and along streams taking fish and amphibians and amphibian larvae (Fitch 1940).

4.5.4 Distribution of Suitable Habitat within the Action Area

Suitable aquatic habitat for GGS occurs in the irrigation ditches and canals in the eastern portion of the Action Area (**Attachment F**). Many of these canals have a mosaic of open water and patches of cattails, tules, and northern water plantain that provide ideal foraging habitat for GGS, and are inundated throughout the active season for GGS. The open water areas within the CCSB, as well as the channel of Lower Cache Creek were not considered suitable aquatic habitat for GGS as most of these areas are often dry throughout much of the GGS active season, they support little to no emergent vegetation, and many portions are heavily shaded with no basking opportunities along the banks.

GGS upland habitat has been mapped in all areas within 200 feet of suitable aquatic habitat that provide at a minimum, suitable habitat for basking. Land cover types that solely provide basking habitat include the CCSB levee, dirt roadways, and some grassy portions of developed areas. Due to the degree of compaction and levee maintenance activities, no soil cracks or rodent burrows appear to be present in these areas, and they are not expected to be used for summer refugia or winter brumation. A number of additional land cover types may provide basking areas, summer refugia, and winter brumation habitat: ruderal, non-native annual grassland, seasonal marsh, and seasonal wetland. Areas considered unsuitable include riparian woodland, riparian scrub, paved industrial areas, and active non-rice agricultural fields. Unplowed ruderal field edges were considered suitable upland habitat.

4.6 Western Yellow-Billed Cuckoo

4.6.1 Status

The WYBC was listed as a federally threatened species on November 3, 2014. A proposed rule for designation of critical habitat for the species was published on August 15, 2014; however, no formal designation for critical habitat has been finalized. This species is also listed as endangered by CDFW.

4.6.2 Historical and Current Distribution

Over the last 100 years, western cuckoo population declined dramatically due to extensive loss of suitable breeding habitat, primarily riparian forests and associated bottomlands dominated by willow (Salix spp.), cottonwood (Populus spp.), or mesquite (Prosopis spp.) (Gaines and Laymon 1984, Laymon and Halterman 1987, Hughes 1999, Halterman et al. 2001). Once considered a common breeder in California, by 1940 the Yellow-billed Cuckoo suffered severe population reduction (Grinnell and Miller 1944) and by 1987 was estimated to occupy only 30 percent of its historical range (Laymon and Halterman 1987). California statewide surveys conducted in 1977 (Gaines and Laymon 1984), 1986/1987 (Laymon and Halterman 1987), and 1999 (Halterman et. al 2001) found Yellow-billed Cuckoo populations were concentrated mostly along the Sacramento River from Red Bluff to Colusa, along the South Fork of the Kern River, and portions of the Lower Colorado River (LCR). Population estimates on the Sacramento and Kern Rivers from the 1999 surveys were similar to those of the 1986/1987 surveys, but lower when compared to the 1977 survey. The Lower Colorado River population appeared to suffer severe declines in the 12 years from the 1986/87 to the 1999 surveys.

The Yolo Habitat Conservation Plan reports nine documented occurrences of WYBC in Yolo County since 1965 (YHC 2018), including one record from the CCSB in July 2005 (Steve Laymon, personal communication 2019). None of these records are considered breeding records. Although there are no confirmed breeding records for Yolo County, they have been documented nesting approximately 11 miles to the northeast in riparian forests along the western toe drain of the Sutter Bypass (eBird 2019).

4.6.3 Habitat Requirements and Life History

Yellow-billed Cuckoos are among the latest arriving Neotropical migrants. They arrive on their breeding grounds in Arizona and California by June (Bent 1940, Hughes 1999). Diet during the breeding season consists primarily of large insects such as grasshoppers, katydids, caterpillars, praying mantids, and cicadas; in addition, they may eat tree frogs and small lizards (Bent 1940, Hamilton and Hamilton 1965, Nolan and Thompson 1975, Laymon 1980, Laymon et al. 1997). Nesting usually occurs between late June and late July, but can begin as early as late May and continue until late September (Hughes 1999). Nests consist of a loose platform of twigs, which are built by both sexes and take one to two days to build (Hughes 1999), though occasionally the nest of another species is used (Jay 1911, Bent 1940, Payne 2005).

Clutch size is 1-5 (Payne 2005), though up to 8 eggs have been found in one nest due to more than one female laying in the nest (Bent 1940). Eggs are generally laid daily until clutch completion (Jay 1911), and incubation begins once the first egg is laid, lasting 9-11 days (Potter 1980, 1981; Hughes 1999). Young hatch asynchronously and are fed mostly large insects (Laymon and Halterman 1985, Laymon et al. 1997, Halterman et al. 2009) similar to the adult diet. Young fledge after 5 to 9 days (6 days average), but may be dependent on adults for at least three weeks (Laymon and Halterman 1985).

Fall migration is thought to begin in late August, with most birds gone by mid-September (Hughes 1999); however, on the Lower Colorado River some individuals appear to begin migrating in early August (McNeil et al. 2011). Their non-breeding range is believed to be the western side of the Andes (Hughes 1999), though little information exists on migration routes and non-breeding range in South America where they can be confused with the endemic pearly-breasted cuckoo (*C. euleri*), their closest relative (Payne 2005).

Habitat for western yellow-billed cuckoo is largely associated with perennial rivers and streams that support the expanse of vegetation characteristics needed by breeding western yellow-billed cuckoos. The range and variation of stream flow frequency, magnitude, duration, and timing that will establish and maintain western yellow-billed cuckoo habitat can occur in different types of regulated and unregulated flow conditions depending on the interaction of the water feature and the physical characteristics of the landscape. Hydrologic conditions at western yellow-billed cuckoo breeding sites can vary remarkably between years. At some locations during low rainfall years, water or saturated soil is not available. At other locations, particularly at reservoir intakes, riparian vegetation can be inundated for extended periods of time in some years and be totally dry in other years.

The USFWS identified the following primary constituent elements for the western yellow-billed cuckoo in their Proposed Critical Habitat documentation (USFWS 2014): (1) Primary Constituent Element 1— Riparian woodlands. Riparian woodlands with mixed willow-cottonwood vegetation, mesquite-thorn forest vegetation, or a combination of these that contain habitat for nesting and foraging in contiguous or nearly contiguous patches that are greater than 325 ft (100 m) in width and 200 ac (81 ha) or more in extent. These habitat patches contain one or more nesting groves, which are generally willow dominated, have above average canopy closure (greater than 70 percent), and have a cooler, more humid environment than the surrounding riparian and upland habitats. (2) Primary Constituent Element 2— Adequate prey base. Presence of a prey base consisting of large insect fauna (for example, cicadas, caterpillars, katydids, grasshoppers, large beetles, dragonflies) and tree frogs for adults and young in breeding areas during the nesting season and in post-breeding dispersal areas. (3) Primary Constituent Element 3— Dynamic riverine processes. River systems that are dynamic and provide hydrologic processes that encourage sediment movement and deposits that allow seedling germination and promote plant growth, maintenance, health, and vigor (e.g. lower gradient streams and broad floodplains, elevated subsurface groundwater table, and perennial rivers and streams). This allows habitat to regenerate at regular intervals, leading to riparian vegetation with variously aged patches from young to old.

At the landscape level, the available information suggests the western yellow-billed cuckoo requires large tracts of willow-cottonwood or mesquite (Prosopis sp.) forest or woodland for their nesting season habitat.

Western yellow-billed cuckoos rarely nest at sites less than 50 acres (ac) (20 hectares (ha) in size, and sites less than 37 ac (15 ha) are considered unsuitable habitat (Laymon and Halterman 1989, p. 275). Habitat patches from 50 to 100 ac (20 to 40 ha) in size are considered marginal habitat (Laymon and Halterman 1989, p.275). Habitat between 100 ac (40 ha) and 200 ac (81 ha), although considered suitable are not consistently used by the species. The optimal size of habitat patches for the species are generally greater than 200 ac (81 ha) in extent and have dense canopy closure and high foliage volume of willows (Salix sp.) and cottonwoods (Populus sp.).

Along the Sacramento River, nesting yellow-billed cuckoos occupied home ranges, which included 25 acres or more of riparian habitat (Laymon et al. 1997). Another study on the same river found riparian patches with yellow-billed cuckoo pairs to average 99 acres (Halterman 1991). Home ranges in the South Fork of the Kern River in California averaged about 42 acres (Laymon et al. 1997). However, the Riparian Bird Conservation Plan outlines that optimal habitat patches should be of 50 to 60 acres with a minimum of 25 acres and the optimal habitat patch size for a pair would be at least 180 acres or more in area, with a width of more than 600 meters (as the habitat block is parallel to a river) (RHJV 2000).

4.6.4 Distribution of Suitable Habitat within the Action Area

No suitable habitat for WYBC occurs within the Study Area; however, portions of the CCSB riparian woodlands occur within the Action Area (**Attachment G**). Although only 104.94 acres of riparian woodland occur within the Action Area (**Attachment C**), this acreage is a small portion of a larger woodland that extends further into the CCSB. The riparian woodland within the CCSB is a willow cottonwood woodland with both a dense understory and large trees in some areas, and high canopy closure in portions. The contiguous riparian woodland within the CCSB is over 250 acres in size, although only approximately 60 acres is comprised of the high canopy closure, high vertical biotic structure woodland that would represent relatively good quality WYBC nesting habitat. The remaining roughly 200 acres is comprised of riparian woodlands and scrub of varying densities, large portions of which may represent more marginal WYBC nesting habitat. One WYBC was documented within the CCSB in July 2005 (Steve Laymon, personal communication 2019), but the species has not been documented nesting in the Action Area. All of the riparian woodland within the CCSB is considered suitable WYBC nesting habitat.

4.7 Least Bell's Vireo

4.7.1 Status

The LBV was listed as a federally endangered species on May 2, 1986. Critical Habitat for the species was designated on February 2, 1994, and a draft recovery plan for LBV was published on May 6, 1998.

4.7.2 Historical and Current Distribution

The least Bell's vireo is one of four subspecies of Bell's vireo and is the only subspecies that breeds entirely in California and northern Baja California. A riparian obligate, the historical distribution of the least Bell's vireo extended from coastal southern California through the San Joaquin and Sacramento valleys as far north as Tehama County near Red Bluff. The Sacramento and San Joaquin valleys were considered the center of the species' historical breeding range supporting 60 to 80 percent of the historical population. The species also occurred along western Sierra foothill streams and in riparian habitats of the Owens Valley, Death Valley, and Mojave Desert (Cooper 1861 and Belding 1878 in Kus 2002a; Grinnell and Miller 1944). The species was reported in Grinnell and Miller (1944) from elevations ranging from -175 feet in Death Valley to 4,100 feet at Bishop, Inyo County. These and other historical accounts described the species as common to abundant, but no reliable population estimates are available prior to the species' federal listing in 1986. The last known nesting pair of LBV in the Sacramento Valley was observed in 1958 (Cogswell 1958, Goldwasser 1978).

During 2010-2013, least Bell's vireo surveys were conducted in the Putah Creek Sinks located in the Yolo Bypass Wildlife Area (Whisler 2013, 2015), approximately 11 miles south of the Study Area. Least Bell's vireos were observed during the 2010 and 2011 breeding seasons; none were detected during 2012, and one individual was observed in May 2013. All individuals were observed in sandbar willow scrub habitat. During 2010, two pairs of least Bell's vireos were observed in the survey area along with one or two additional individuals. Both pairs of vireos were observed performing courtship activities and territorial defense against other least Bell's vireos. On April 26, an adult least Bell's vireo was observed carrying nesting material. There was no evidence of successful nesting by least Bell's vireos. The territories were occupied throughout the typical nesting season (April through mid-August). In 2011, the two 2010 least Bell's vireo territories were occupied by two least Bell's vireo pairs. The male in each pair was observed singing and defending the territory, signs of breeding behavior. Courtship activities were observed in one of the two pairs. One male was also defending its territory from a third adult. There were no further least Bell's vireo detections in late July or August of 2011. There were no least Bell's vireo detections during 2012. Apparently, the birds did not return to the survey area or they were not detected. One vireo was detected in 2013 on May 9, but none were detected after that date. No further surveys have been conducted to determine the status of this species in the area (Whisler, personal communication, 2019).

4.7.3 Habitat Requirements and Life History

The least Bell's vireo is an obligate riparian breeder that typically inhabits structurally diverse woodlands, including cottonwood-willow woodlands/forests, oak woodlands, and mule fat scrub (USFWS 1998). Two features appear to be essential for breeding habitat: (1) the presence of dense cover within 3 to 6 feet (1 to 2 meters) of the ground, where nests are typically placed; and (2) a dense stratified canopy for foraging (Goldwasser 1981; Gray and Greaves 1981; Salata 1981, 1983; RECON 1989). While least Bell's vireo typically nests in willow-dominated areas, plant species composition does not seem to be as important a factor as habitat structure. Early successional riparian habitat typically supports the dense shrub cover required for nesting and a diverse canopy for foraging. While least Bell's vireo tends to prefer early successional habitat, breeding site selection does not appear to be limited to riparian stands of a specific age. If willows and other species are allowed to persist, within five to 10 years they form dense thickets and become suitable nesting habitat (Goldwasser 1981; Kus 1998). Tall canopy tends to shade out the shrub layer in mature stands, but least Bell's vireo will continue to use such areas if patches of understory exist. In mature habitat, understory vegetation consists of species such as California wild rose (*Rosa californica*), poison oak (*Toxicodendron diversilobum*), California blackberry (*Rubus ursinus*), grape (*Vitis californica*), and perennials that can conceal nests. Nests are placed in a wide variety of plant species, but the majority are placed in willows (*Salix* spp.) and mule fat (*Baccharis* species). Nests tend to be placed in openings along the riparian edge, where exposure to sunlight allows the development of shrubs. Nest site characteristics are highly variable and no features have been identified that distinguish nest sites from the remainder of the territory (Hendricks and Rieger 1989; Olson and Gray 1989; RECON 1989).

Least Bell's vireos forage primarily within and at all levels of the riparian canopy (Salata 1983); however, they will also use adjacent upland scrub habitat, in many cases coastal sage scrub. In addition to use as foraging habitat, these areas also provide migratory stopover grounds and dispersal corridors for non-breeding adults and juveniles (Kus and Miner 1989; Riparian Habitat Joint Venture [RHJV] 2004). Vireos along the edges of riparian corridors maintain territories that incorporate both habitat types, and a significant proportion of pairs with territories encompassing upland habitat place at least one nest there (Kus and Miner 1989).

4.7.4 Distribution of Suitable Habitat within the Action Area

No suitable habitat for LBV occurs within the Study Area; however, portions of the CCSB riparian woodlands occur within the Action Area. Although only 104.94 acres of riparian woodland occur within the Action Area (**Attachment C**), this acreage is a small portion of a larger woodland that extends further into the CCSB. The riparian woodland within the CCSB is a willow cottonwood woodland with both a dense understory and large trees in some areas, and high canopy closure in portions. All of the riparian woodland within the CCSB was considered to provide LBV potential nesting habitat. In addition to the CCSB riparian woodland, the sandbar willow riparian scrub along the irrigation canal to the south of the Study Area also represents suitable nesting habitat for LBV (**Attachment G**).

5.0 EFFECTS OF THE PROPOSED ACTION

5.1 Action-Related Effects

5.1.1 Palmate-Bracted Bird's-Beak

PBBB has a low likelihood of occurrence on the old irrigation berms, banks, and other minimally disturbed areas mapped as "Potential Palmate-Bracted Bird's Beak Habitat" on **Figure 4**. If PBBB is located within the Study Area, any plants present would be directly removed or killed through either levee construction or excavation and construction of the new detention basin. Although the seed bank in the vicinity of the occurrence would be harvested and relocated to a suitable nearby location, this species requires a very specific habitat, and the success of any relocation efforts is unknown. Furthermore, suitable habitat is scarce, and this area of habitat would be permanently impacted. As a result, if PBBB is found within the Study Area, the Action may affect and is likely to adversely affect the PBBB.

Permanent Effects

Based on our assumed occupancy of 10%, up to 0.70-acre of permanent direct effects to PBBB could occur (if PBBB is present) during the construction of the project during earth work and the creation of the new detention basin. Up to 0.15-acre of permanent indirect effects to PBBB may occur (if PBBB is present) due to alteration of local hydrology resulting from construction of the levees. The Action may result in PBBB habitat ponding for longer or shorter periods than at present and may result in the killing of PBBB. There is also the potential for increased inundation to create wetland habitat, causing the expansion of suitable habitat for PBBB. Additionally, herbicides used for levee vegetation control may drift into PBBB habitat and result in the killing of PBBB. See **Figure 4** for impacts to PBBB.

Temporary Effects

Temporary (direct and indirect) effects to PBBB will be avoided through the implementation of environmentally sensitive area exclusion fencing, dust abatement, and worker training.

5.1.2 Valley Elderberry Longhorn Beetle

Two elderberry shrubs that represent potential habitat for VELB have been documented within the Study Area, and will be removed during construction. As stated in **Section 2.4.2**, additional shrubs may be found during protocol-level surveys of the Study Area and 165-foot buffer. We have assumed for the purposes of this document that four additional shrubs will be found within the Study Area, for a total of six elderberry shrubs. All elderberry shrubs within the Study Area would be transplanted to a mitigation bank prior to construction, and one mitigation credit would be purchased for each transplanted shrub. Although the removal of the shrub(s) would result in less VELB habitat within the Study Area, none of the elderberry shrubs are riparian in nature, and the shrubs are expected to be widely scattered in an existing agricultural setting, representing very low-quality habitat for the VELB. As a result, the Action may affect, but is not likely to adversely affect the VELB.

Permanent Effects

Permanent direct effects to VELB could occur during the construction of the project. There are two observed elderberry shrubs and four estimated shrubs within the Study Area that may be impacted. If they cannot be avoided, the elderberries will be removed and transplanted during the levee earth work and the creation of the new detention basin. Permanent indirect effects to VELB may occur from ongoing O&M activities such as trimming of elderberry shrubs and the application of herbicides and pesticides for levee vegetation control. The trimming of shrubs and herbicide and/or pesticide drift may result in the killing of VELB. See **Attachment E** for impacts to VELB.

Temporary Effects

Temporary (direct and indirect) effects to VELB will be avoided through the implementation of environmentally sensitive area exclusion fencing, dust abatement, and worker training.

5.1.3 Vernal Pool Fairy Shrimp

Habitat for VPFS does not occur within the Study Area; however, one depressional seasonal wetland that represents suitable habitat for VPFS is present within the Action Area, almost immediately adjacent to a dirt levee maintenance road that will be used for construction access, and beyond that, the levee, where soil will be excavated and concrete slurry will be placed. As a result, no direct impacts to VPFS are anticipated.

Permanent Effects

Permanent direct effects to VPFS will not occur during the construction of the project as the seasonal wetland will be avoided, fenced, and constructions crews will be trained to avoid the feature. Additionally, dust abatement measures will be in effect. Permanent indirect effects to VPFS are possible if the hydrology of the seasonal wetland does in fact come from seepage through the levee. As the intent of the proposed Action is to eliminate seepage through the levee, the proposed Action could result in dewatering of the seasonal wetland and killing of VPFS. Other permanent indirect effects to VPFS may occur from ongoing O&M activities such as the drift of herbicides for levee vegetation control. See **Figure 5** for impacts to VPFS.

Temporary Effects

Temporary (direct and indirect) effects to VPFS will be avoided through the implementation of environmentally sensitive area exclusion fencing, dust abatement, and worker training.

5.1.4 Vernal Pool Tadpole Shrimp

Habitat for VPTS does not occur within the Study Area; however, one depressional seasonal wetland that represents suitable habitat for VPTS is present within the Action Area, almost immediately adjacent to a dirt levee maintenance road that will be used for construction access, and beyond that, the levee, where soil will be excavated and concrete slurry will be placed. As a result, no direct impacts to VPTS are anticipated.

Permanent Effects

Permanent direct effects to VPTS will not occur during the construction of the project as the seasonal wetland will be avoided, fenced, and constructions crews will be trained to avoid the feature. Additionally, dust abatement measures will be in effect. Permanent indirect effects to VPTS are possible if the hydrology of the seasonal wetland does in fact come from seepage through the levee. As the intent of the proposed Action is to eliminate seepage through the levee, the proposed Action could result in dewatering of the seasonal wetland and killing of VPTS. Other permanent indirect effects to VPTS may occur from ongoing O&M activities such as the drift of herbicides for levee vegetation control. See **Figure 5** for impacts to VPTS.

Temporary Effects

Temporary (direct and indirect) effects to VPTS will be avoided through the implementation of environmentally sensitive area exclusion fencing, dust abatement, and worker training.

5.1.5 Giant Garter Snake

A total of 1.05 acres of GGS aquatic habitat is present within the Study Area, and may be directly affected during construction. The irrigation canal along the west side of the CCSB levee that represents the majority of this acreage is not expected to be filled or otherwise manipulated during construction; however, as the basin has not yet been designed, it is possible that construction of the detention basin to the west could result in temporary impacts to the west edge of the channel. A total of 50.11 acres of GGS upland habitat is present within the Study Area. All impacts to GGS Upland Habitat within the CCSB levee and staging areas (41.33 acres) will be temporary, will occur over one construction season, and the habitat will be restored to its prior condition following construction. An additional 4.97 acres of GGS Upland Habitat consisting of a ruderal strip between the irrigation canal and an agricultural field will be impacted by construction of the new detention basin. Following construction, the edges of the detention basin will be revegetated, and are expected to be functionally similar to the existing habitat. As construction is only expected to last one year, this area is also considered to be temporarily impacted for one year. Lastly, 3.81 acres of GGS Upland Habitat will be permanently impacted by construction of the new levee that will tie into the existing levee. Although GGS will be able to utilize the new levee for basking following construction, the new levee will be regularly maintained, and the soil cracks and rodent burrows that currently provide refugia for the snakes in the existing habitat will not be available on the new levee. As the majority of impacts are temporary in nature, are expected to last no more than one construction season, and will employ the avoidance and minimization measures detailed in **Section 2.3.5** to avoid mortality of individual GGS, the Action may affect and is likely to adversely affect GGS.

Permanent Effects
Permanent direct effects to GGS could occur during the construction of the project from grading and crushing by vehicles. GGS also may be disturbed during the construction by vibrations and human activity. These direct effects will be minimized by only allowing work within GGS habitat during the active season (May 1 through September 30), the installation of GGS exclusion fencing, the installation of escape ramps, worker training, biological monitoring, and preconstruction avoidance surveys. Additionally, the proposed Action will permanently impact 8.78-acres of upland and 1.04-acres of aquatic GGS habitat. See **Attachment F** for impacts to GGS habitat. Ongoing O&M activities including mechanical vegetation management may result in the killing of GGS. Additionally, vehicles used to patrol the levees and detention basin may crush GGS.

Several permanent indirect effects to GGS were considered but were determined to have no potential to occur. Specifically, the following determinations were made. There would be no increase of trash, herbicides and/or pesticides applications, hazardous waste, or additional off-road vehicle use due to increased human presence. The Action would not result in development or increased access to GGS habitat.

Temporary Effects
The Action will temporarily impact approximately 41.33-acres of upland and 0.01-acre of aquatic GGS habitat. Earthwork, grading, equipment and materials staging, and vehicle movement may result in the crushing and killing of GGS. The avoidance and minimization measures listed above will minimize the

potential of take of GGS. Upon completion of the project all temporarily impacted GGS habitat will be restored to pre-project conditions. There will be no temporary indirect effects to GGS by the proposed Action.

We anticipate the take of two GGS by the proposed Action described above.

5.1.6 Western Yellow-Billed Cuckoo

Habitat for WYBC does not occur within the Study Area, but suitable nesting habitat is present immediately to the east and north of the CCSB levee (**Attachment G**). Pre-construction surveys will be conducted if construction is initiated after April 1 in any given year, and if any WYBC nests are found, a minimum 300-foot buffer will be established, along with regular nest monitoring to ensure the nest buffer is sufficiently large to avoid adverse effects on nesting birds. As a result, birds that may already be nesting within the Action Area are not expected to be impacted by the Action. However, as WYBC does not typically arrive for nesting until late May or early June, construction may already be underway at the time the birds arrive in the area to nest. If that was the case, the noise and activity associated with construction could deter them from utilizing the riparian woodlands near the Study Area for nesting. This would be a temporary impact, and is expected to last no more than one nesting season. Therefore, the Action may affect, but is not likely to adversely affect the WYBC.

Permanent Impacts
Because no suitable habitat for WYBC will be impacted by the Action, there will be no direct permanent effects. Several permanent indirect effects to WYBC were considered but were determined to have no potential to occur. Specifically, the following determinations were made. There would be no increase of trash, herbicides and/or pesticides applications, hazardous waste, or additional off-road vehicle use due to increased human presence. The Action would not result in development or increased access to WYBC habitat.

Temporary Impacts
Approximately 45.40-acres of suitable habitat for WYBC lies within 300 feet of the Study Area. Indirect effects by construction noise and human activity may lead to nest abandonment and take of WYBC if present. Potential indirect effects to WYBC will be avoided by implementing the avoidance measures for the species including pre-construction surveys.

5.1.7 Least Bell's Vireo

Habitat for LBV does not occur within the Study Area, but suitable nesting habitat is present immediately to the east and north of the CCSB levee (**Attachment G**). Pre-construction surveys will be conducted if construction is initiated after April 1 in any given year, and if any LBV nests are found, a minimum 300-foot buffer will be established, along with regular nest monitoring to ensure the nest buffer is sufficiently large to avoid adverse effects on nesting birds. As a result, birds that may already be nesting within the Action Area are not expected to be impacted by the Action. However, if Project construction is already underway if and when they arrive in the area to nest, the noise and activity associated with construction could deter them from utilizing the riparian habitat near the Study Area for nesting. This would be a temporary impact, and is expected to last no more than one nesting season. Therefore, the Action may affect, but is not likely to adversely affect the LBV.

Permanent Impacts

Because no suitable habitat for LBV will be impacted by the Action, there will be no direct permanent effects. Several permanent indirect effects to WYBC were considered but were determined to have no potential to occur. Specifically, the following determinations were made. There would be no increase of trash, herbicides and/or pesticides applications, hazardous waste, or additional off-road vehicle use due to increased human presence. The Action would not result in development or increased access to WYBC habitat.

Temporary Impacts

Approximately 49.88-acres of suitable habitat for LBV lies within 300 feet of the Study Area. Indirect effects by construction noise and human activity may lead to nest abandonment and take of LBV if present. Potential indirect effects to LBV will be avoided by implementing the avoidance measures for the species including pre-construction surveys.

5.2 Interrelated and Interdependent Effects

An interrelated activity is an activity that is part of the proposed Action and depends on the proposed Action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification.

The Non-federal sponsor (NFS) intends to augment the Proposed Action after its construction. The Proposed Action is not dependent upon these additional non-structural actions. These features may include raising or flood-proofing structures in the floodplain to avoid or minimize any potential flood damage that these structures would incur as compared to the existing condition. The NFS may also include an option to subsidize flood insurance or purchase flowage easements for properties that have an increase in flood depth or duration. As these additional actions have not been defined or located, it is not possible to determine how they could affect federally-listed species at this time.

5.3 Cumulative Effects

The Endangered Species Handbook (USFWS and NMFS 1998) states that cumulative effects under ESA include all future, nonfederal actions "reasonably certain to occur" in the Action Area. Future federal actions are not considered in the cumulative effects analysis because these actions would be analyzed in future Section 7 consultations. Due to the presence of sensitive species within or adjacent to the Study Area, any private sector project applicants would be required to consult with the USFWS and/or NOAA under Section 7 or Section 10 of the ESA prior to project implementation. For the purposes of this BA, the area of cumulative effects analysis is defined as the Cache Creek Watershed.

Operations and Maintenance of the final Study will be assumed by the DWR. Ongoing maintenance may include mechanical and chemical vegetation management, management of levee access roads such as application of aggregate and rolling of the access road, and the maintenance of fences and gates. Potential effects of the operations and maintenance have been addressed in this document.

A number of non-federal actions have been proposed within the Cache Creek Watershed recently. The following potential actions have been identified:

- Yolo County Flood Control & Water Conservation District has proposed to divert up to 200 CFS of Cache Creek winter flows at the Capay Diversion Dam for groundwater recharge.
- Updates to the Cache Creek Area Plan, which may include increasing the in-channel aggregate removal limit from 210,000 tons to 690,800 tons, and identifying additional areas that may be rezoned for aggregate mining
- Aggregate mining of the proposed Teichert Shifler Mining & Reclamation Project just south of Cache Creek west of Woodland
- The City of Woodland's North Regional Pond & Pump Station Project
- Development to the east of County Road 98, where the City of Woodland General Plan has identified "New Growth Area 3B". In this area, existing agricultural land is proposed to be developed into industrial land (City of Woodland 2017).

Cumulative impacts to federally-listed species associated with the above-listed projects are expected to be primarily restricted to VELB impacts resulting from removal of elderberry shrubs, especially where elderberry shrubs grow along Cache Creek in areas proposed for aggregate mining. One large block of riparian habitat along Cache Creek between Highway 505 and County Road 94B may provide marginal habitat for WYBC and/or LBV; if updates to the Cache Creek Area Plan resulted in impacts to that riparian habitat, it could result in a reduction in WYBC or LBV nesting habitat. In addition, the City of Woodland's North Regional Pond & Pump Station Project could result in temporary impacts to GGS habitat during construction and potential mortality of individual snakes. However, it does not appear that a substantial quantity of GGS aquatic habitat will be lost as a result of implementation of that project.

6.0 CONCLUSION AND DETERMINATIONS

This BA represents an assessment of the effects of the Proposed Action on the federally listed PBBB, VELB, VPFS, VPTS, GGS, western snowy plover, WYBC, and LBV in accordance with Section 7 of ESA of 1973, as amended. Based on the information presented in this BA, the following effect determinations were made for the species listed above.

Species	Federal Status[1]	Determination
Palmate-bracted bird's beak	FE	May affect and is likely to adversely affect
Valley elderberry longhorn beetle	FT	May affect but is not likely to adversely affect
Vernal pool fairy shrimp	FT	May affect and is likely to adversely affect
Vernal pool tadpole shrimp	FE	May affect and is likely to adversely affect
Giant garter snake	FT	May affect and is likely to adversely affect
Western snowy plover	FT	No effect
Western yellow-billed cuckoo	FT	May affect but is not likely to adversely affect

Species	Federal Status[1]	Determination
Least Bell's vireo	FE	May affect but is not likely to adversely affect
[1] FE-Federally Endangered, FT-Federally Threatened		

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Figures

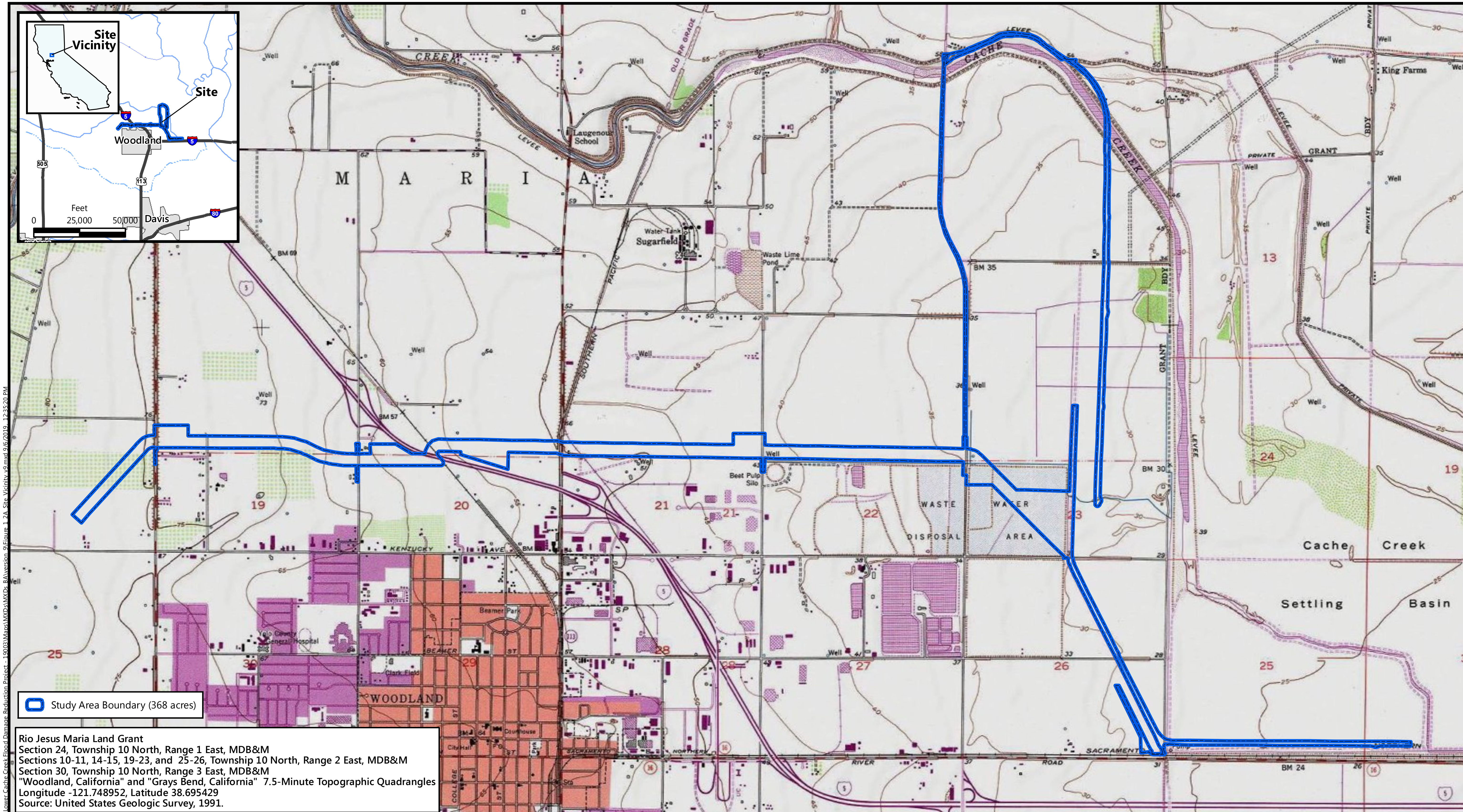
Figure 1. Site and Vicinity Map

Figure 2. Proposed Action

Figure 3. NRCS Soils Map

Figure 4. Impacted and Avoided Palmate-Bracted Bird's Beak Habitat within the Action Area

Figure 5. Impacted and Avoided Vernal Pool Branchiopod Habitat within the Action Area



N

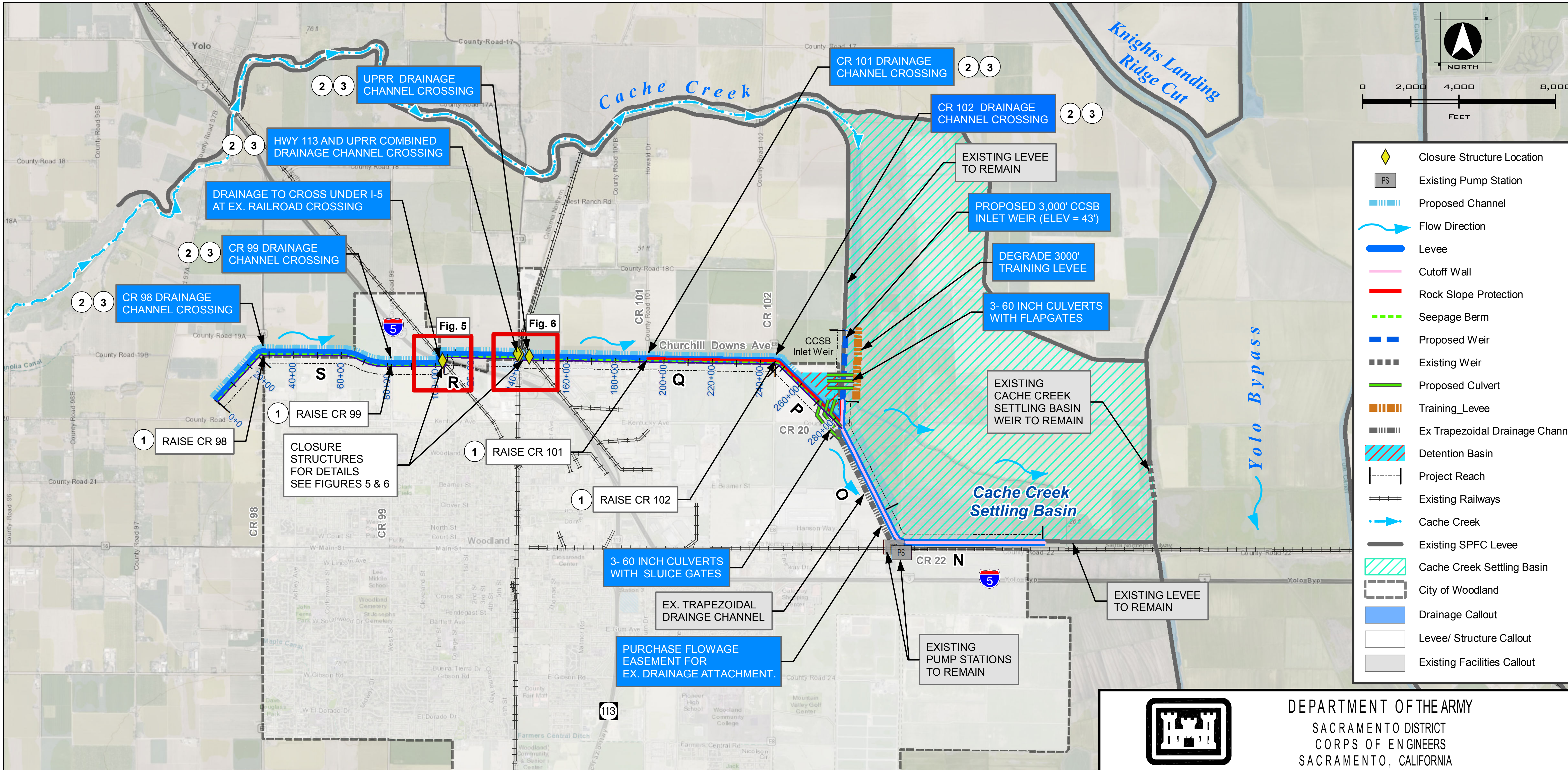
Feet
0 1,200 2,400

Basemap: ESRI, USGS, 2019.

Figure 1
Site Vicinity

Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING



FLOOD IMPROVEMENT PROTECTION SUMMARY TABLE

REACH	LENGTH	IMPROVEMENT DESCRIPTION [1]
S	12,100 ft	6' Tall Levee with 30' W x 5' H Seepage Berm
REACH	3,000 ft	7' Tall Levee with 30' W x 5' H Seepage Berm
Q	10,600 ft	11' Tall Levee with 30' W x 5' H Seepage Berm. Install Rock Slope Protection [2]
P	3,900 ft	14' Tall Levee with 30' W x 5' H Seepage Berm. Install Rock Slope Protection [2]
O	5,000 ft	Levee with 45' Deep Cutoff Wall
N	7,400 ft	Levee with 60' Deep Cutoff Wall

NOTES:
1. All dimensions are approximate
2. Rock Slope Protection to be placed between CR 101 and CCSB only.

NOTES:

1. COUNTY ROADS (CR) TO BE RAISED TO LEVEE CROWN ELEVATION AT 5% GRADE.
2. ROAD AND RAIL CROSSINGS OF THE DRAINAGE DITCH WILL BE COMPRISED OF 3 60" CULVERTS AT EACH LOCATION. SEE FIGURE 4 FOR TYPICAL SECTION.
3. CULVERTS FOR DRAINAGE DITCH CROSSINGS ARE NOT SHOWN AT THIS SCALE FOR CLARITY.

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CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO CALIFORNIA

LOWER CACHE CREEK FEASIBILITY STUDY ALTERNATIVE 2A OVERALL PROJECT MAP

PRELIMINARY

FIGURE 2

DATE:	SCALE:	SHEET NO.
AUGUST 2019	1"=4000'	1 OF 8

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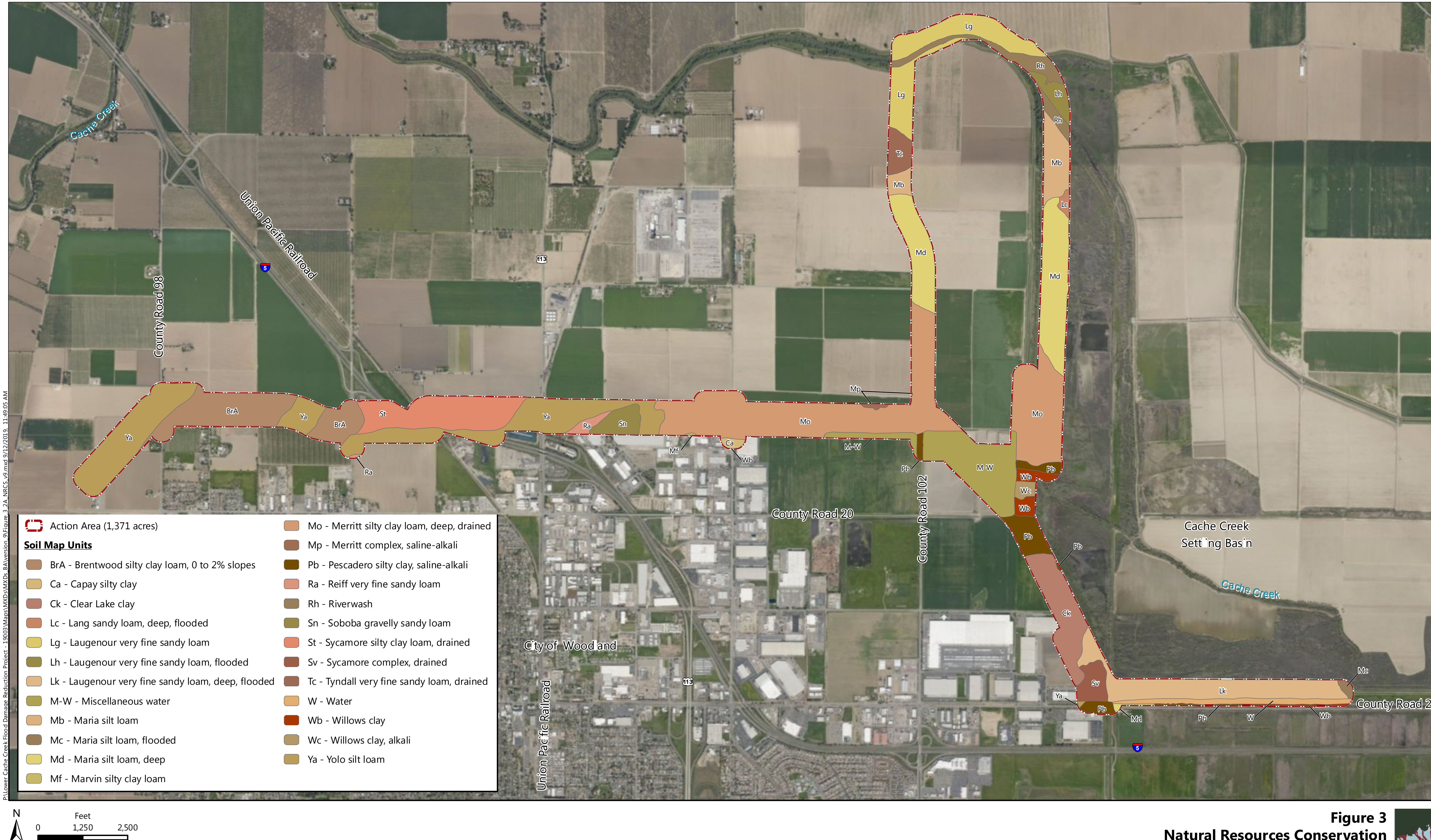

Figure 3
Natural Resources Conservation Service Soils Map

Lower Cache Creek Feasibility Study
Yolo County, California

Soil Survey Source: USDA, *Soil Conservation Service.*
Soil Survey Geographic (SSURGO) database for Yolo County, California
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.

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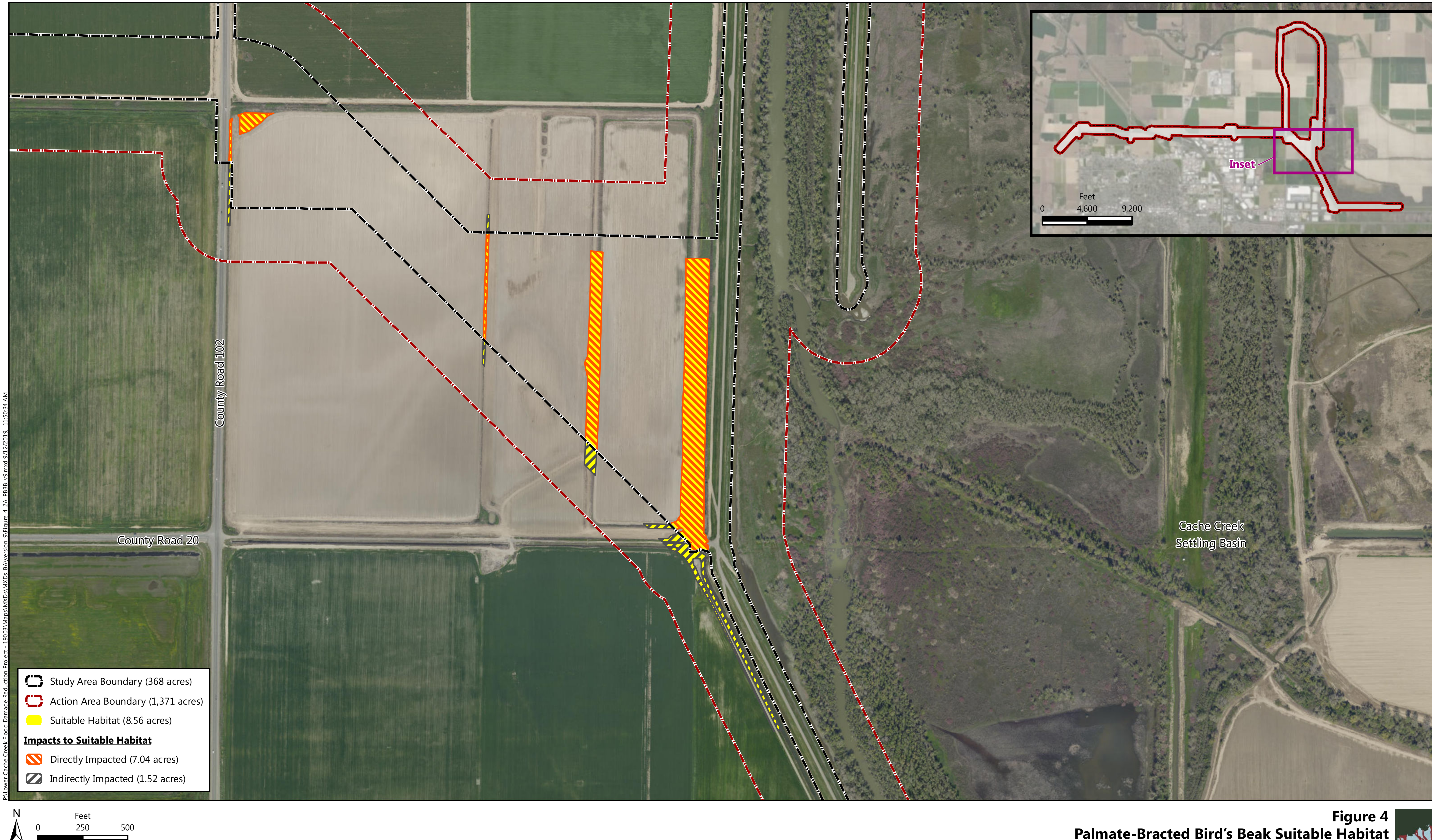


Figure 4
Palmate-Bracted Bird's Beak Suitable Habitat
Impacts Within the Action Area

Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING

Survey Data Source: Madrone Ecological Consulting, LLC., 2019 Survey Data.
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.

N

Feet
0 100 200

Figure 5
Vernal Pool Branchiopod Habitat Impacts Within the Action Area

Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING

Survey Data Source: Madrone Ecological Consulting, LLC., 2019 Survey Data.
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.

Attachments

Attachment A: Study Design Drawings

Attachment B: Action Area

Attachment C: Vegetation Communities within the Action Area

Attachment D: Aquatic Resources Mapped within the Action Area

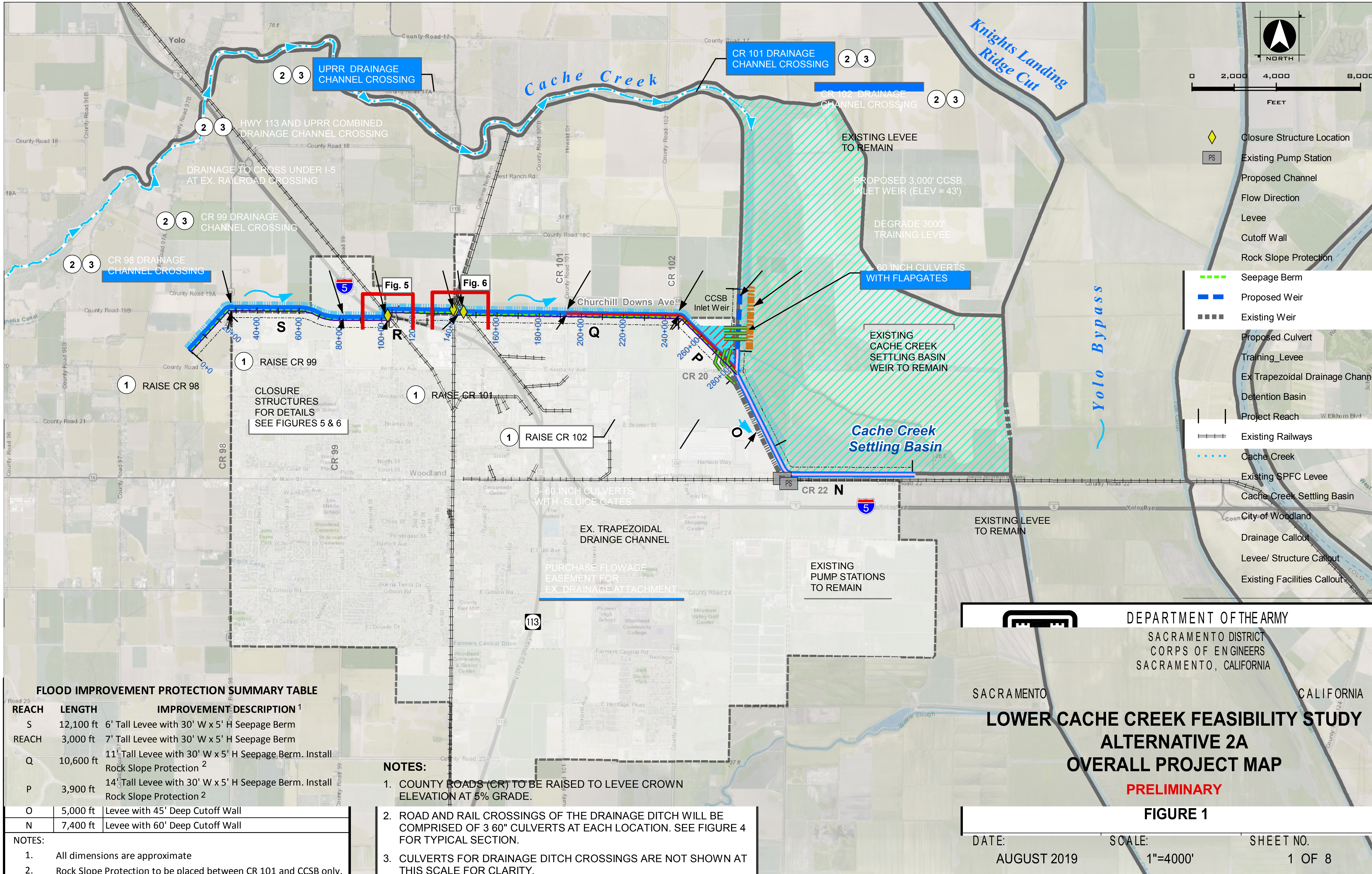
Attachment E: Impacted and Avoided VELB Habitat within the Action Area

Attachment F: Impacted and Avoided Giant Garter Snake Habitat within the Action Area

Attachment G: Western Yellow-Billed Cuckoo and Least Bell's Vireo Habitat within the Action Area

Attachment A

Study Design Drawings



FLOOD IMPROVEMENT PROTECTION SUMMARY TABLE

REACH	LENGTH	IMPROVEMENT DESCRIPTION [1]
S	12,100 ft	6' Tall Levee with 30' W x 5' H Seepage Berm
REACH	3,000 ft	7' Tall Levee with 30' W x 5' H Seepage Berm
Q	10,600 ft	11' Tall Levee with 30' W x 5' H Seepage Berm. Install Rock Slope Protection [2]
P	3,900 ft	14' Tall Levee with 30' W x 5' H Seepage Berm. Install Rock Slope Protection [2]
O	5,000 ft	Levee with 45' Deep Cutoff Wall
N	7,400 ft	Levee with 60' Deep Cutoff Wall

NOTES:
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NOTES:
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3. CULVERTS FOR DRAINAGE DITCH CROSSINGS ARE NOT SHOWN AT THIS SCALE FOR CLARITY.

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LOWER CACHE CREEK FEASIBILITY STUDY
ALTERNATIVE 2A
OVERALL PROJECT MAP

PRELIMINARY

FIGURE 1

DATE:	SCALE:	SHEET NO.
AUGUST 2019	1"=4000'	1 OF 8

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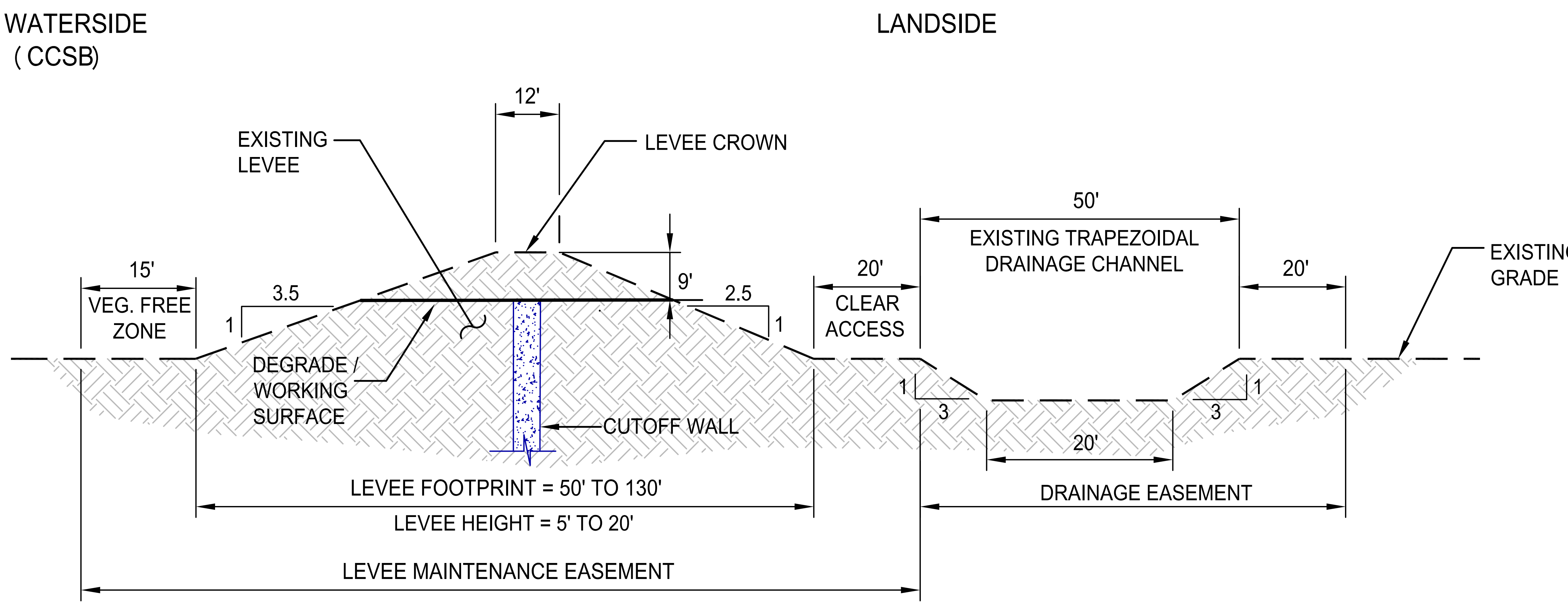

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LOWER CACHE CREEK FEASIBILITY STUDY ALTERNATIVE 2A

TYPICAL CUTOFF WALL SECTION (REACH N & O)

PRELIMINARY

FIGURE 2

DATE:	SCALE:	SHEET NO.
AUGUST 2019	NOT TO SCALE	2 OF 8

PLOT BY: JPRIEST – Aug 15, 2019 – 5:59:12pm
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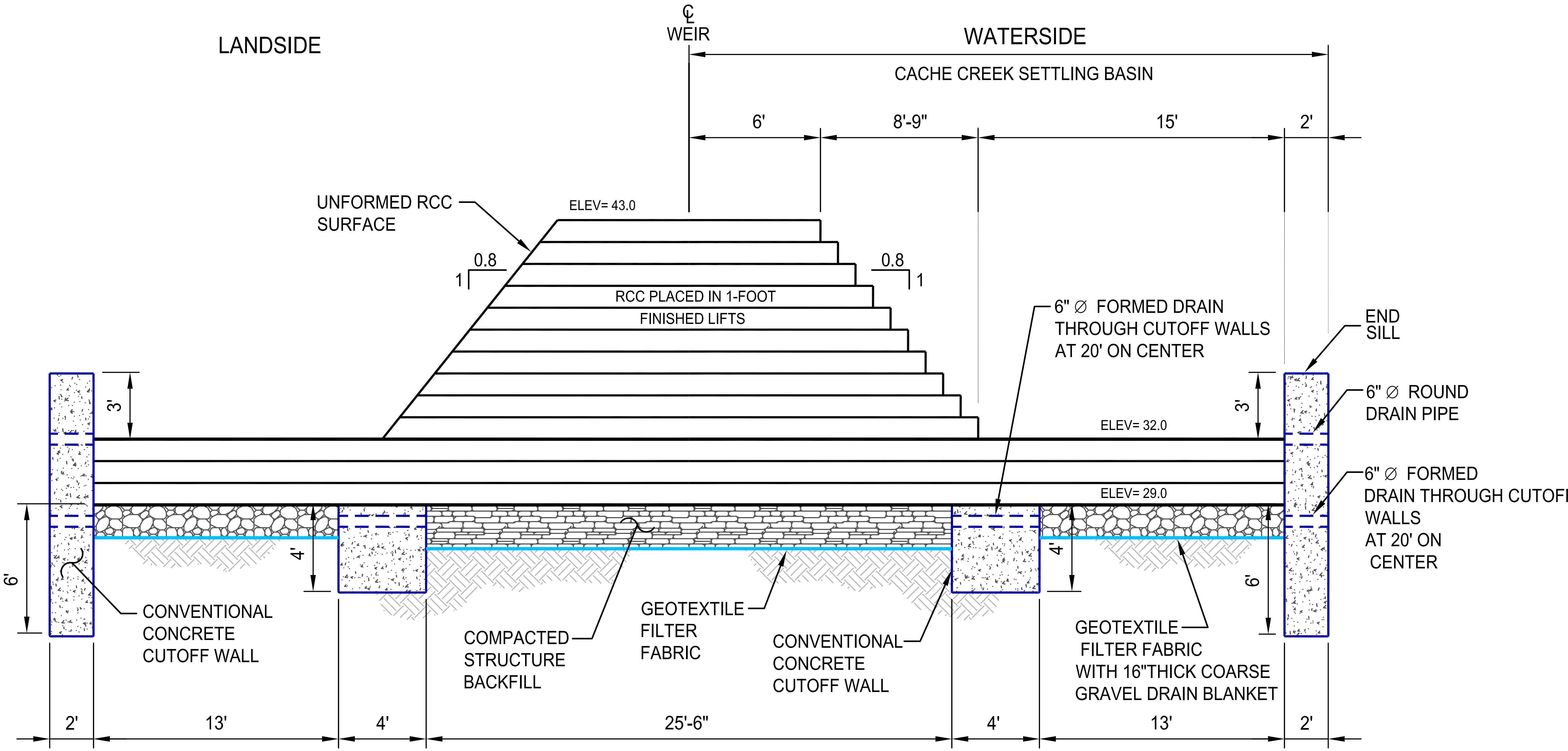

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SACRAMENTO, CALIFORNIA

SACRAMENTO CALIFORNIA

LOWER CACHE CREEK FEASIBILITY STUDY ALTERNATIVE 2A

CCSB INLET WEIR TYPICAL SECTION

PRELIMINARY

FIGURE 3

DATE:	SCALE:	SHEET NO.
AUGUST 2019	NOT TO SCALE	3 OF 8

PLOT BY: JPRIEST – Aug 15, 2019 – 6:00:05pm
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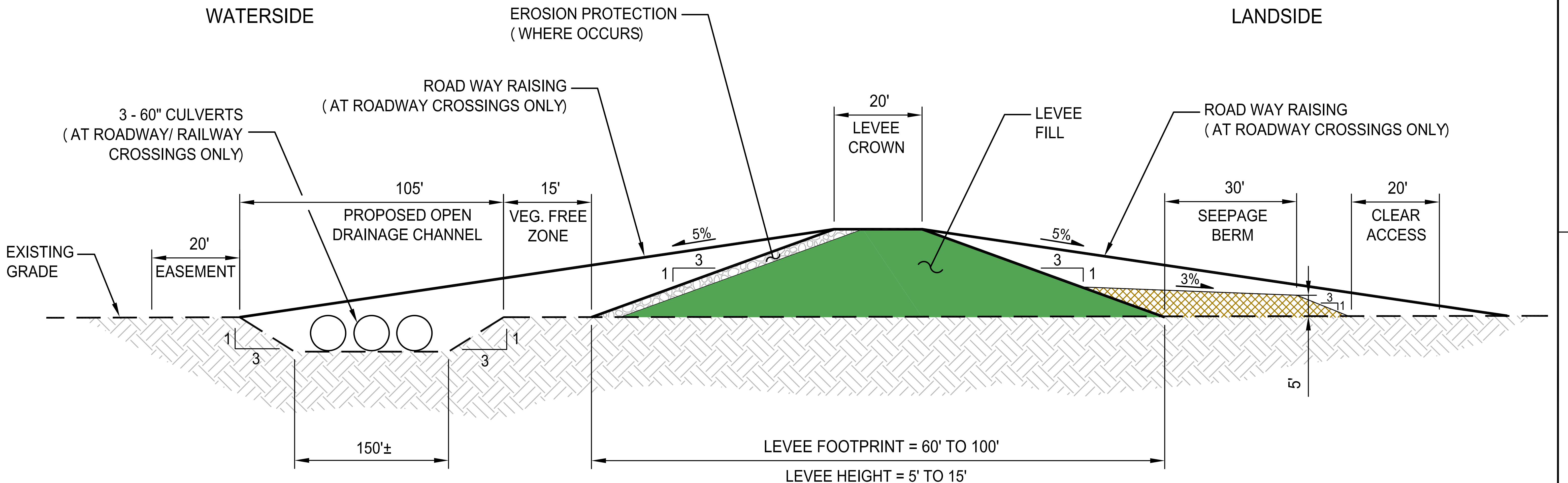

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CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO CALIFORNIA

LOWER CACHE CREEK FEASIBILITY STUDY ALTERNATIVE 2A

TYPICAL LEVEE WITH BERM SECTION (REACH P, Q, R & S)

PRELIMINARY

FIGURE 4

DATE:	SCALE:	SHEET NO.
AUGUST 2019	NOT TO SCALE	4 OF 8

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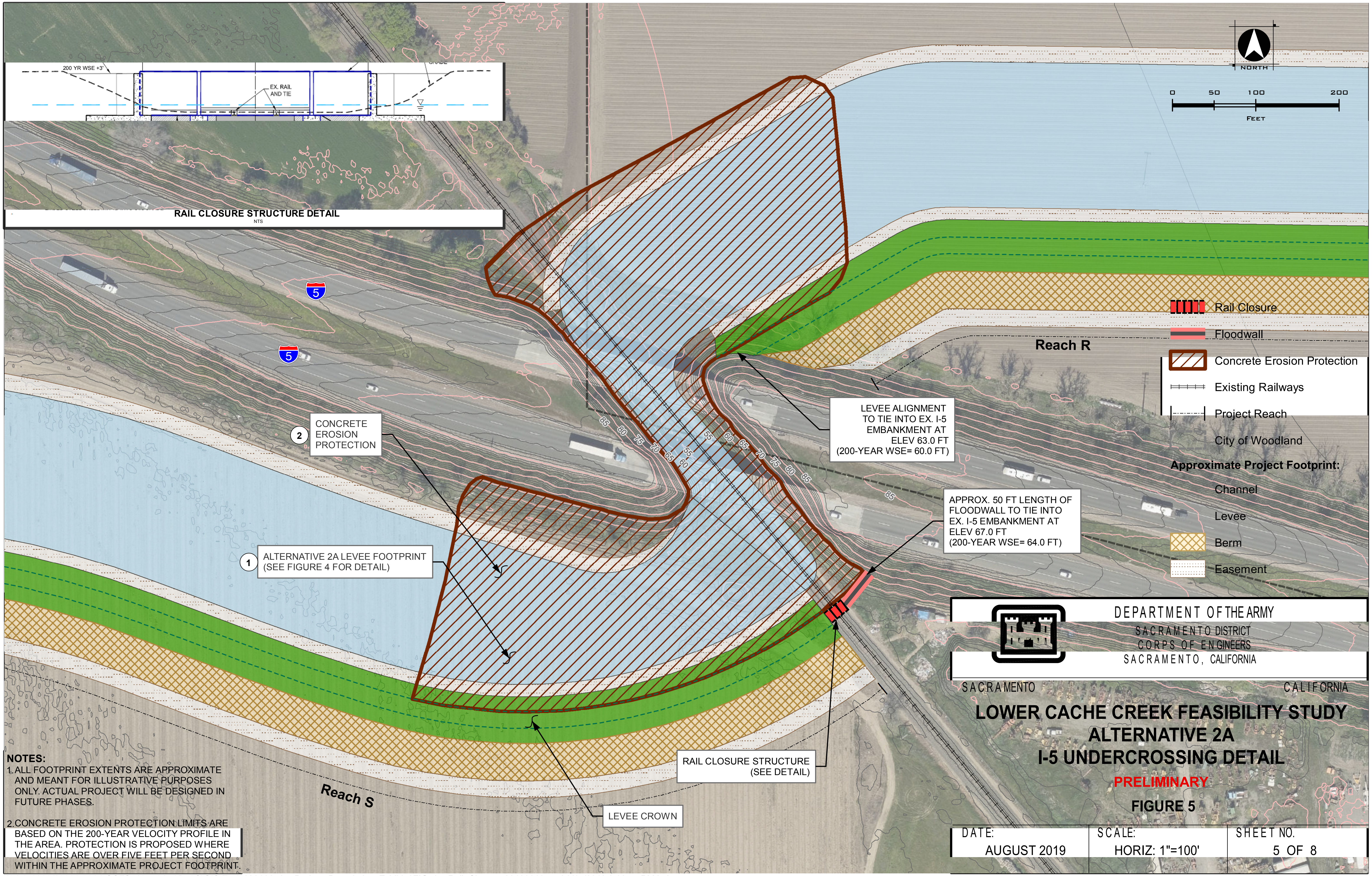

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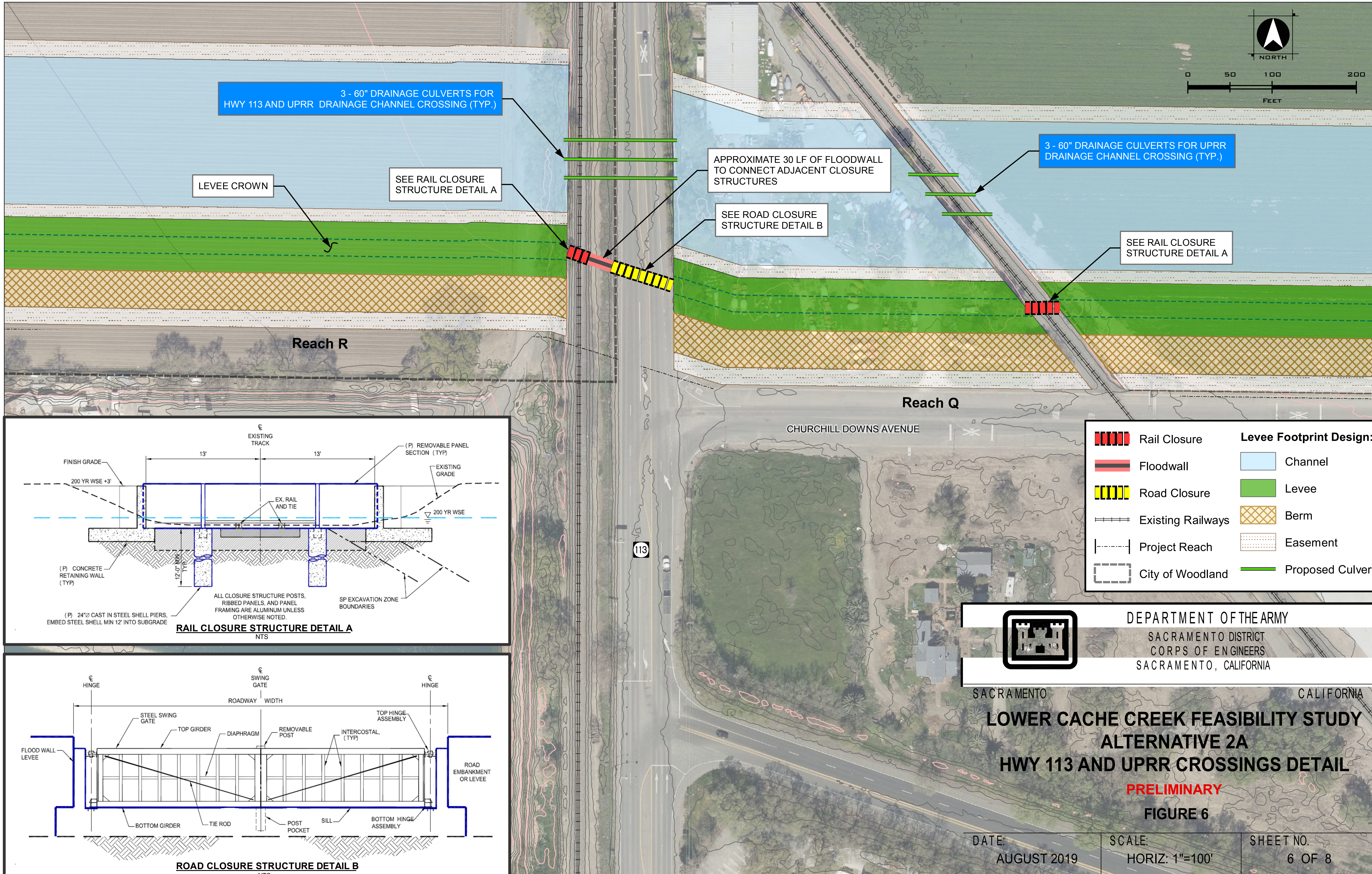

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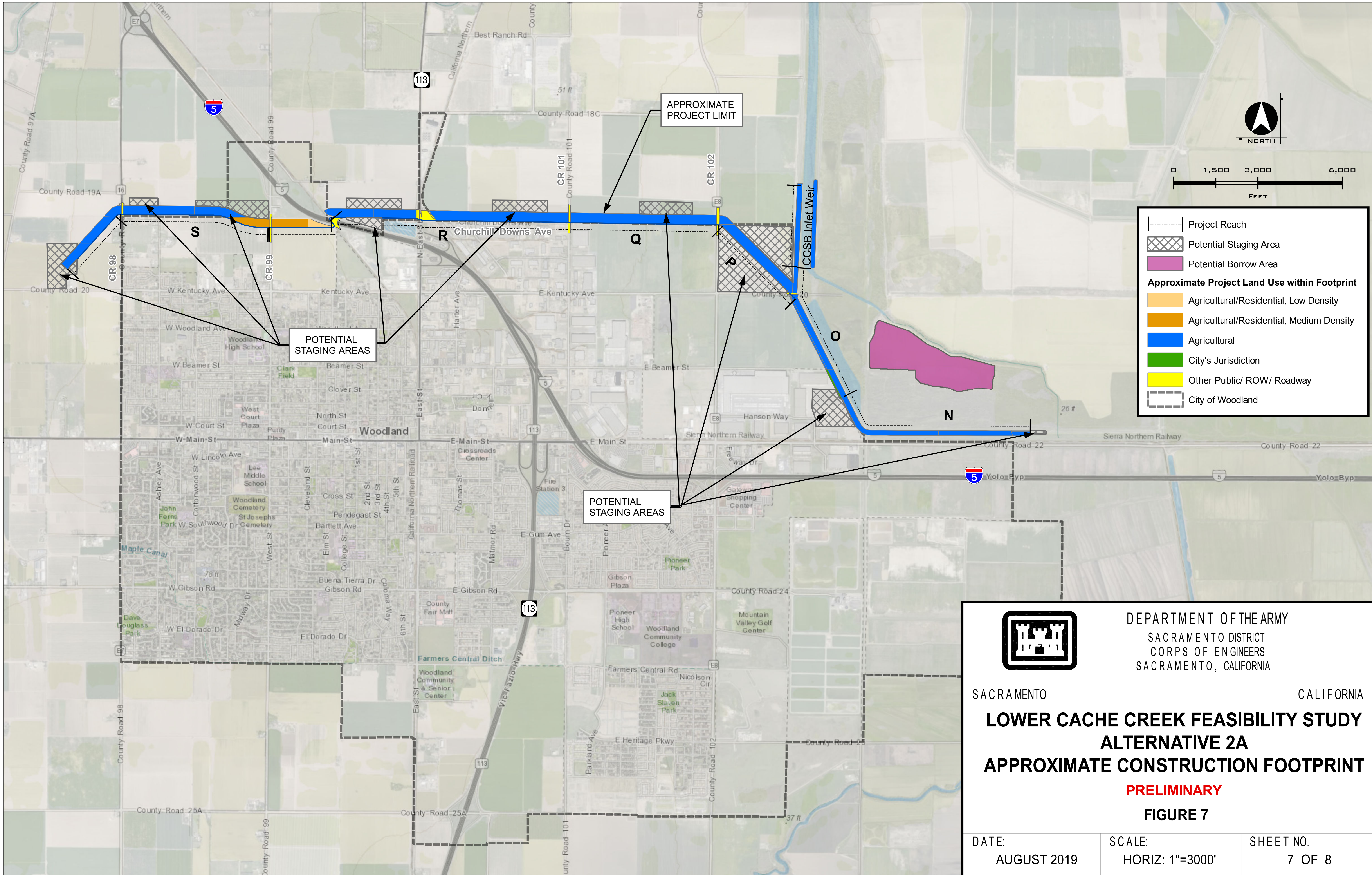

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SACRAMENTO, CALIFORNIA

SACRAMENTO CALIFORNIA

LOWER CACHE CREEK FEASIBILITY STUDY
ALTERNATIVE 2A
APPROXIMATE CONSTRUCTION FOOTPRINT

PRELIMINARY

FIGURE 7

DATE:	SCALE:	SHEET NO.
AUGUST 2019	HORIZ: 1"=3000'	7 OF 8

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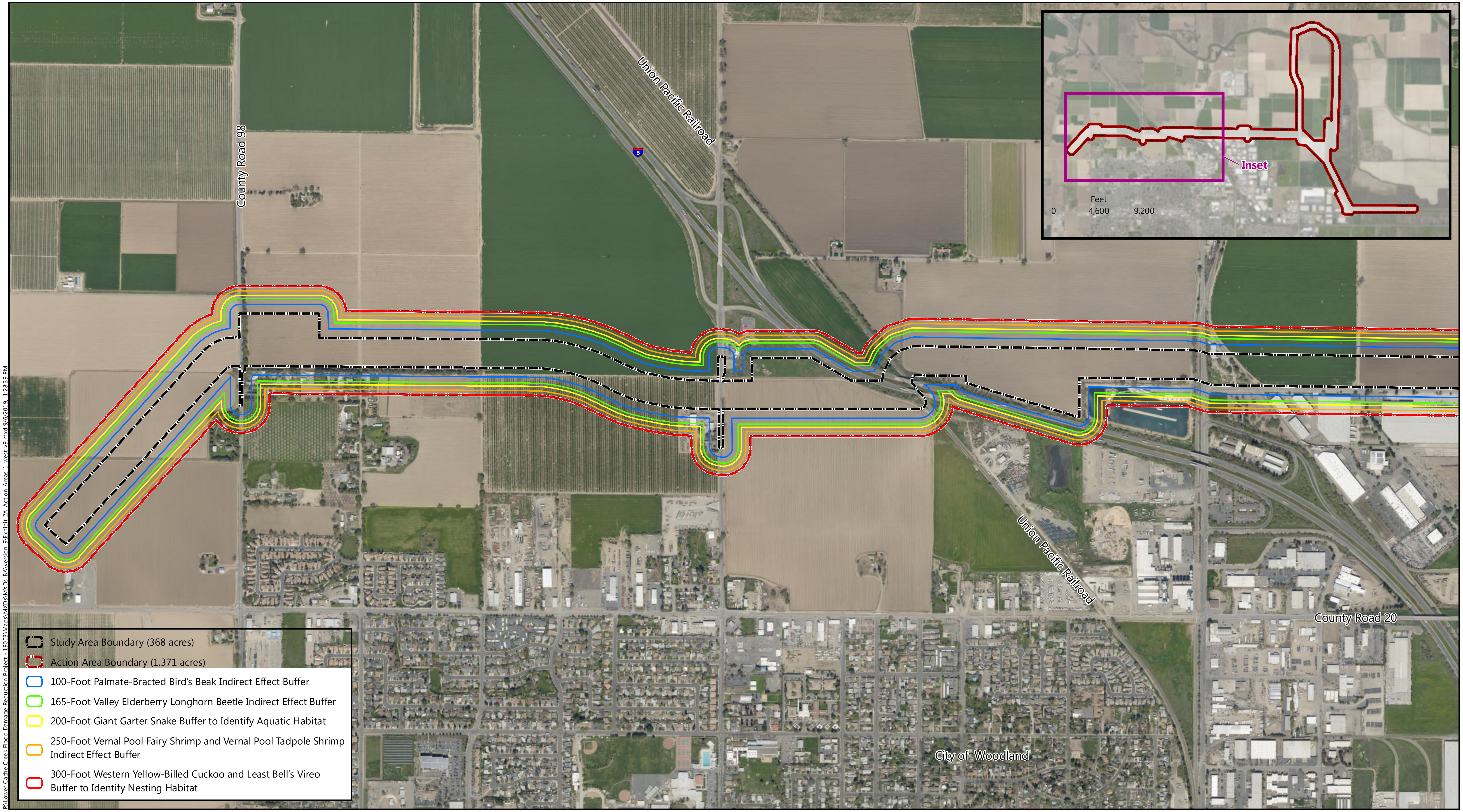
Attachment B

Action Area



N

Feet
0 500 1,000

Action Area - Western Side

Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING

Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.

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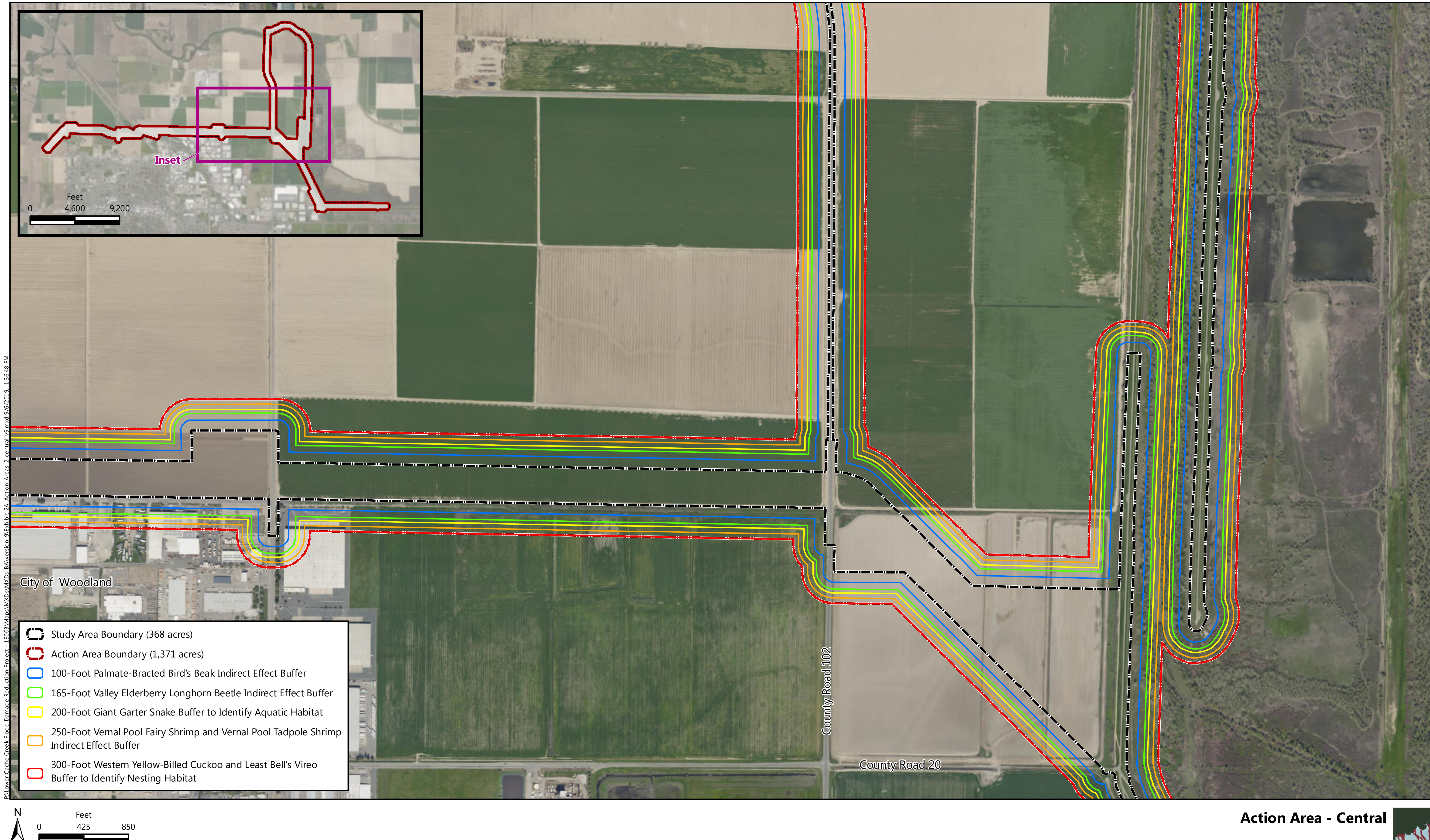

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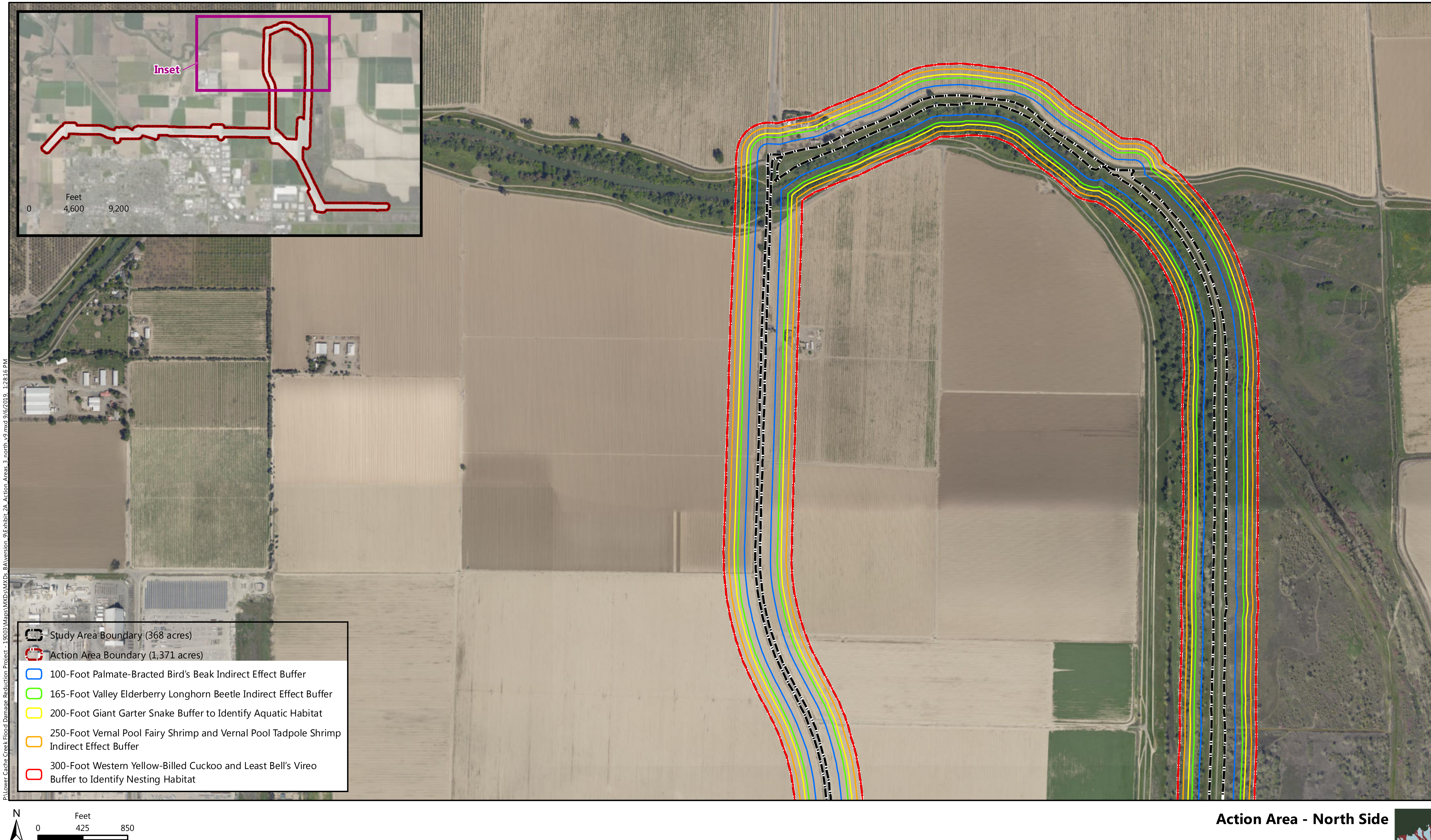
Action Area - Central

Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING

Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.



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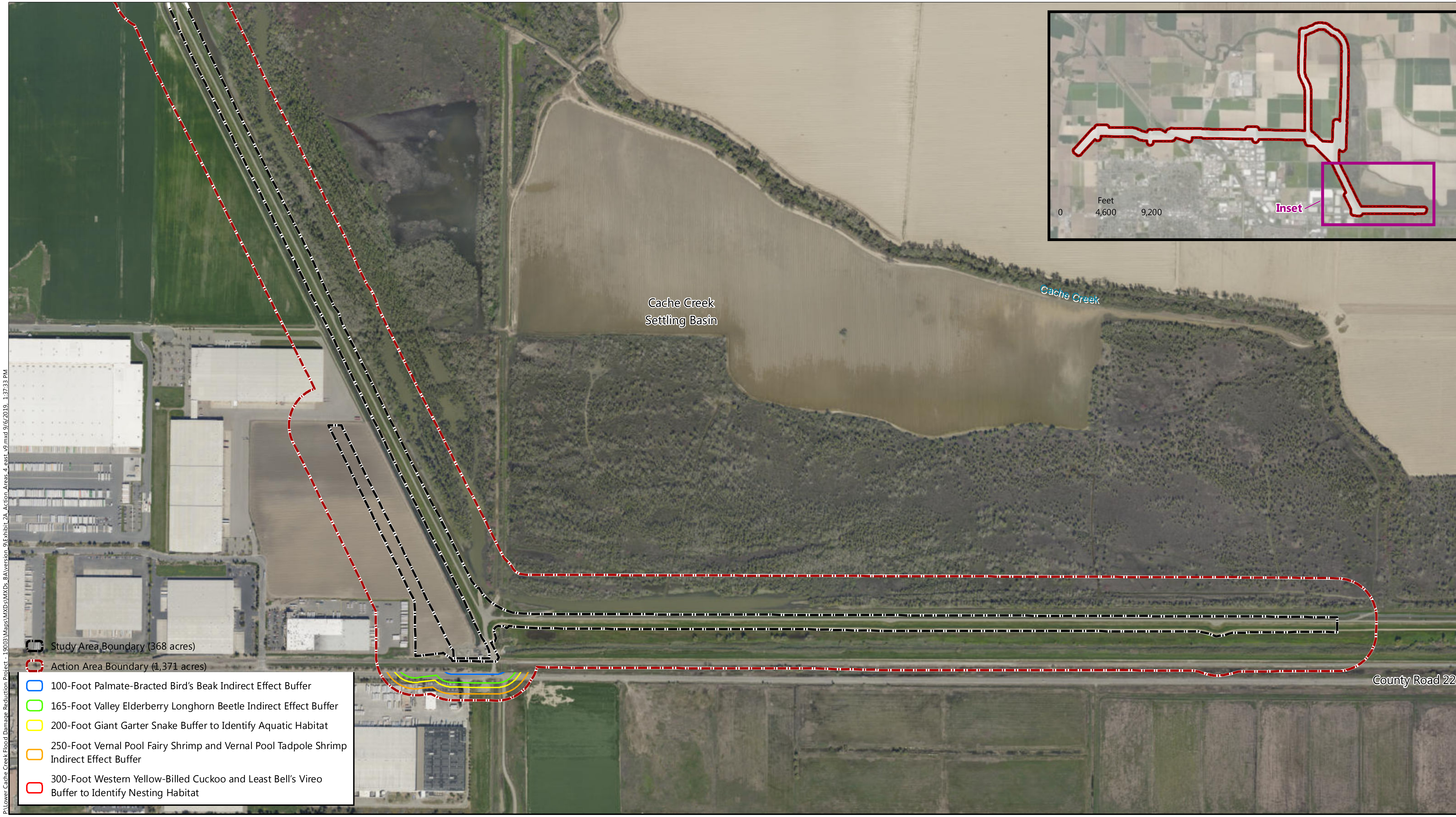
Action Area - North Side

Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING

Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.



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N

Feet
0 350 700

Action Area - East Side

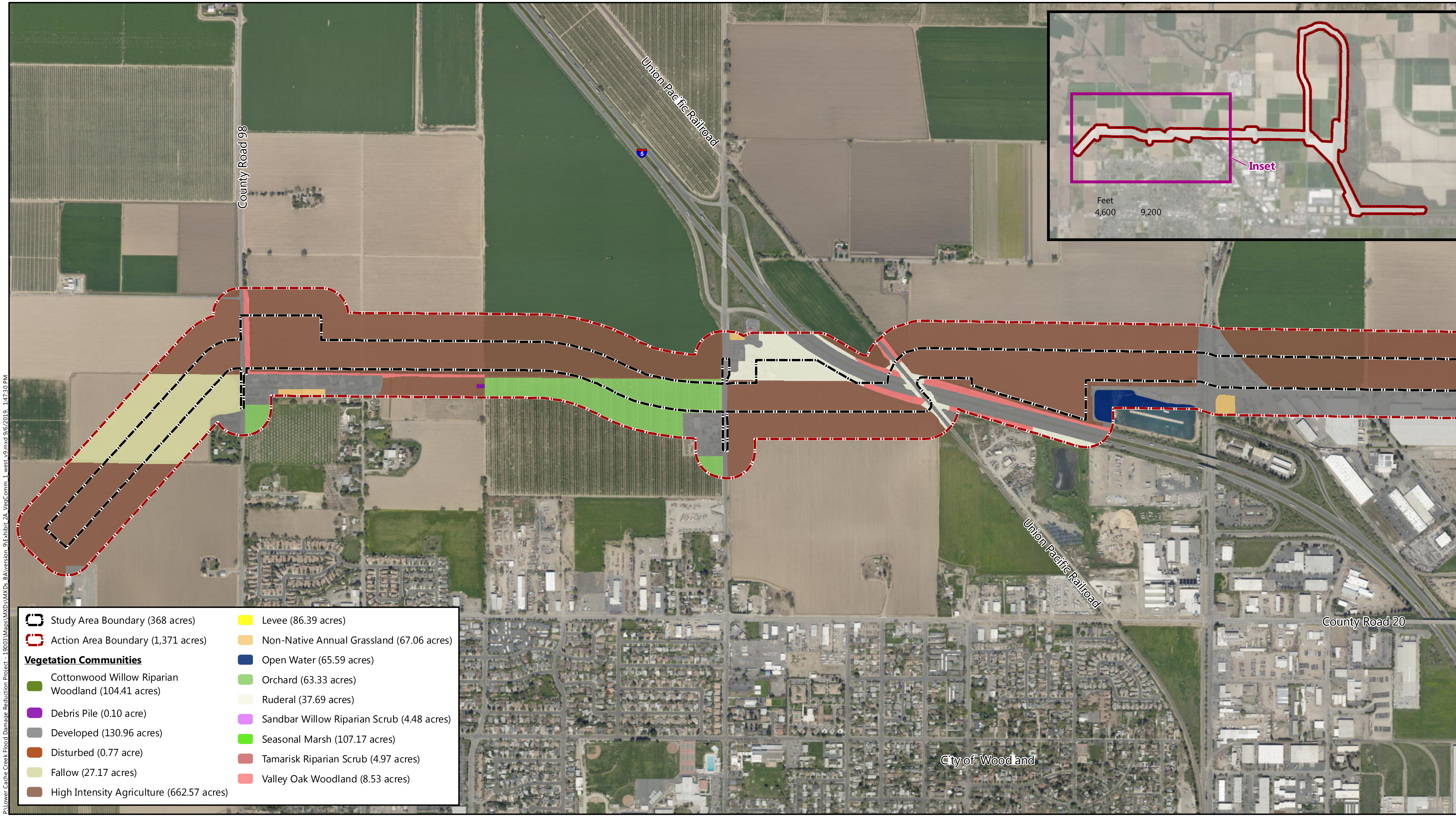
Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING

Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.

Attachment C

Vegetation Communities within the Action Area



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N

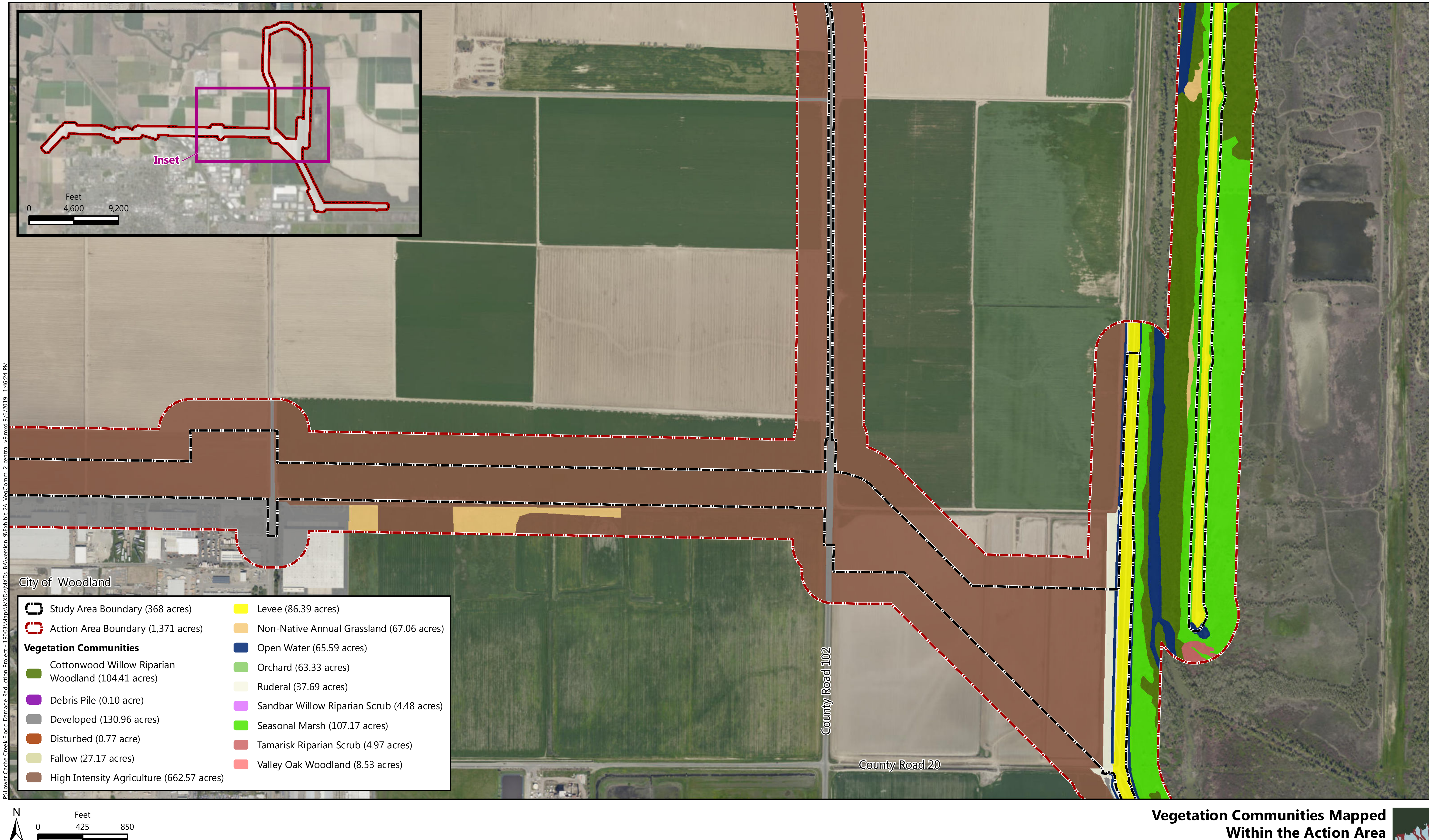
Feet
0 500 1,000

Vegetation Communities Mapped Within the Action Area West Side

Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING

Survey Data Source: Madrone Ecological Consulting, LLC., 2019 Survey Data.
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.

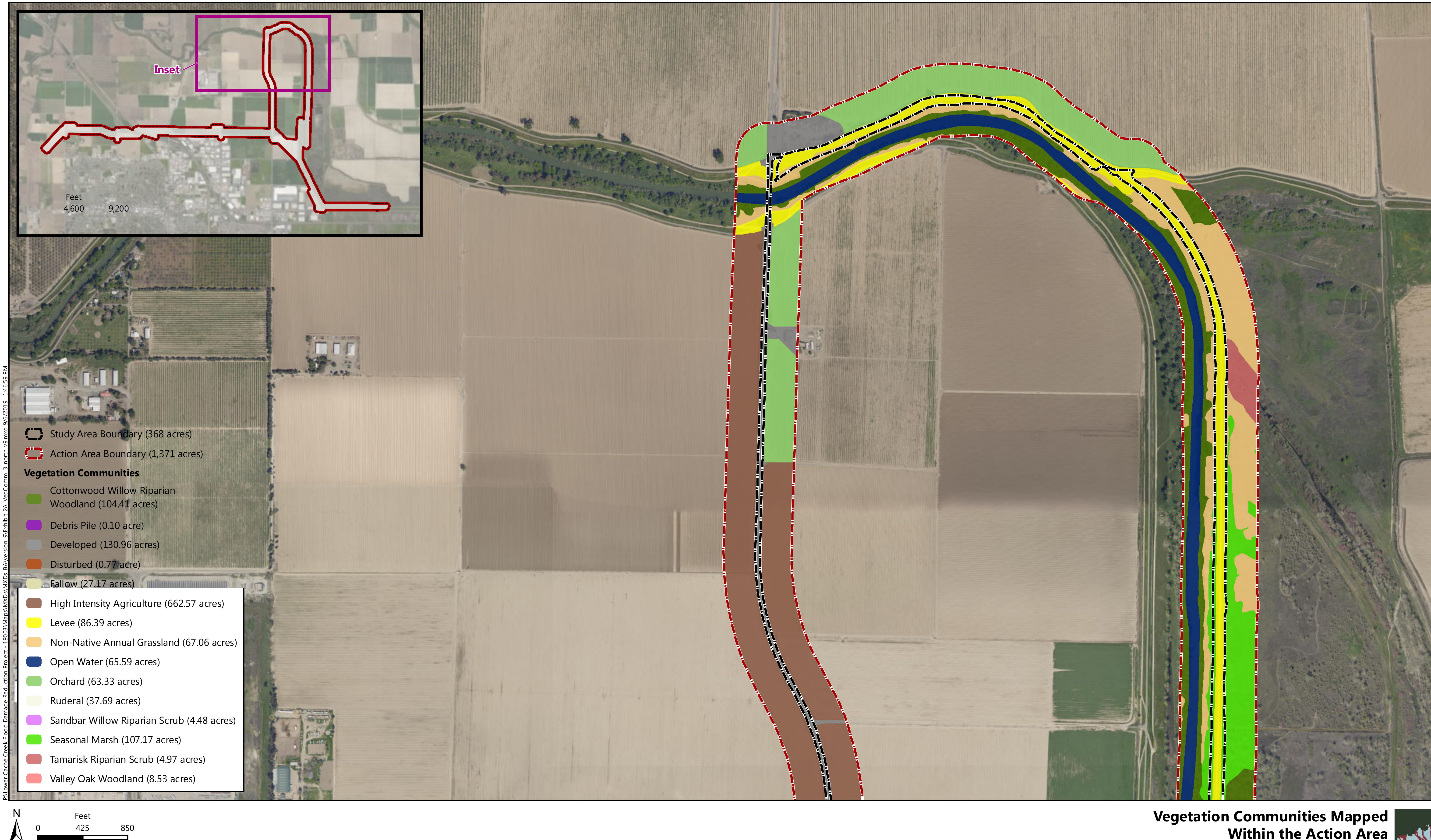


Vegetation Communities Mapped Within the Action Area Central

Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING

Survey Data Source: Madrone Ecological Consulting, LLC., 2019 Survey Data.
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.



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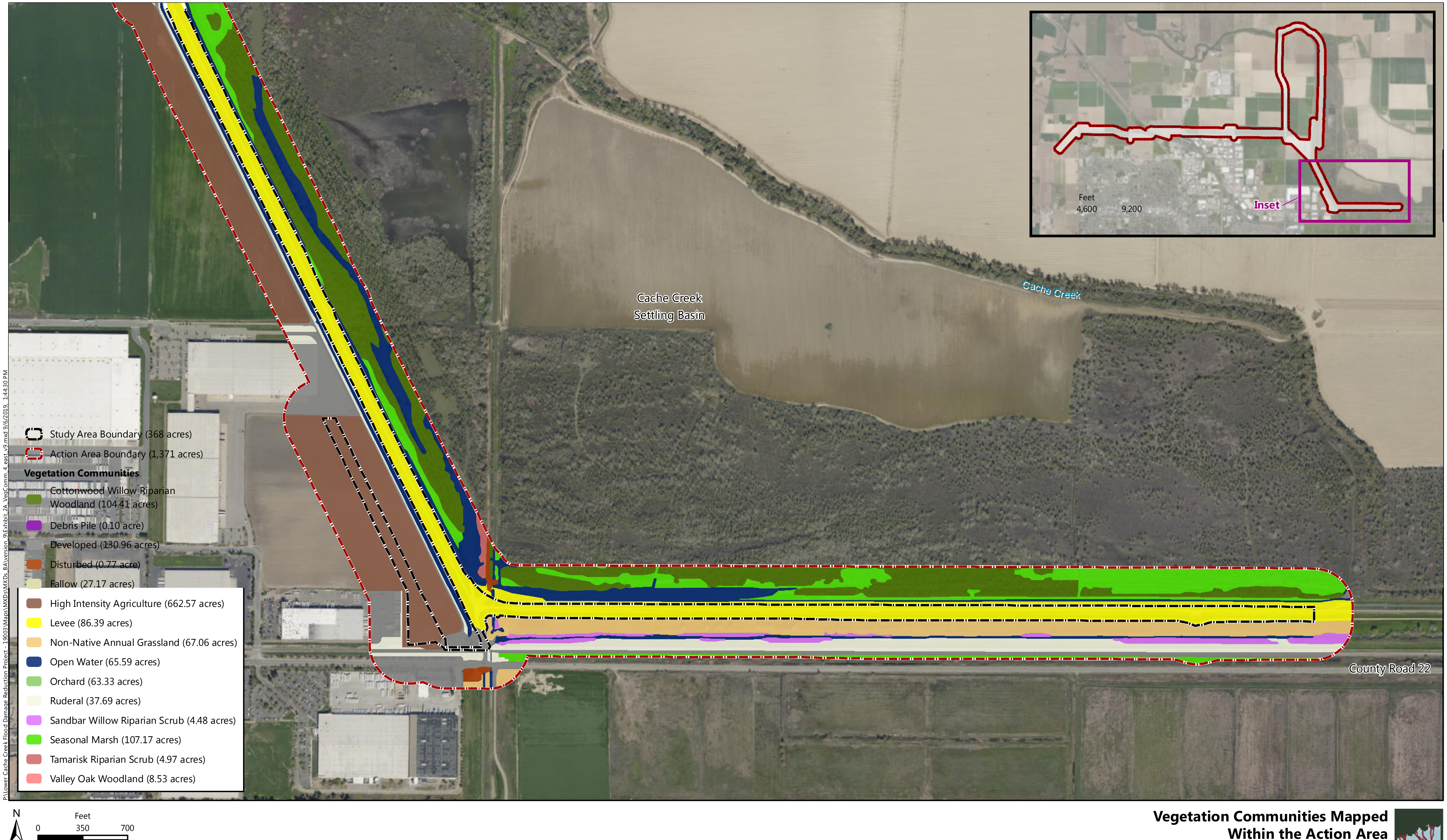
Vegetation Communities Mapped Within the Action Area North Side

Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING

Survey Data Source: Madrone Ecological Consulting, LLC., 2019 Survey Data.
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.



Vegetation Communities Mapped Within the Action Area East Side

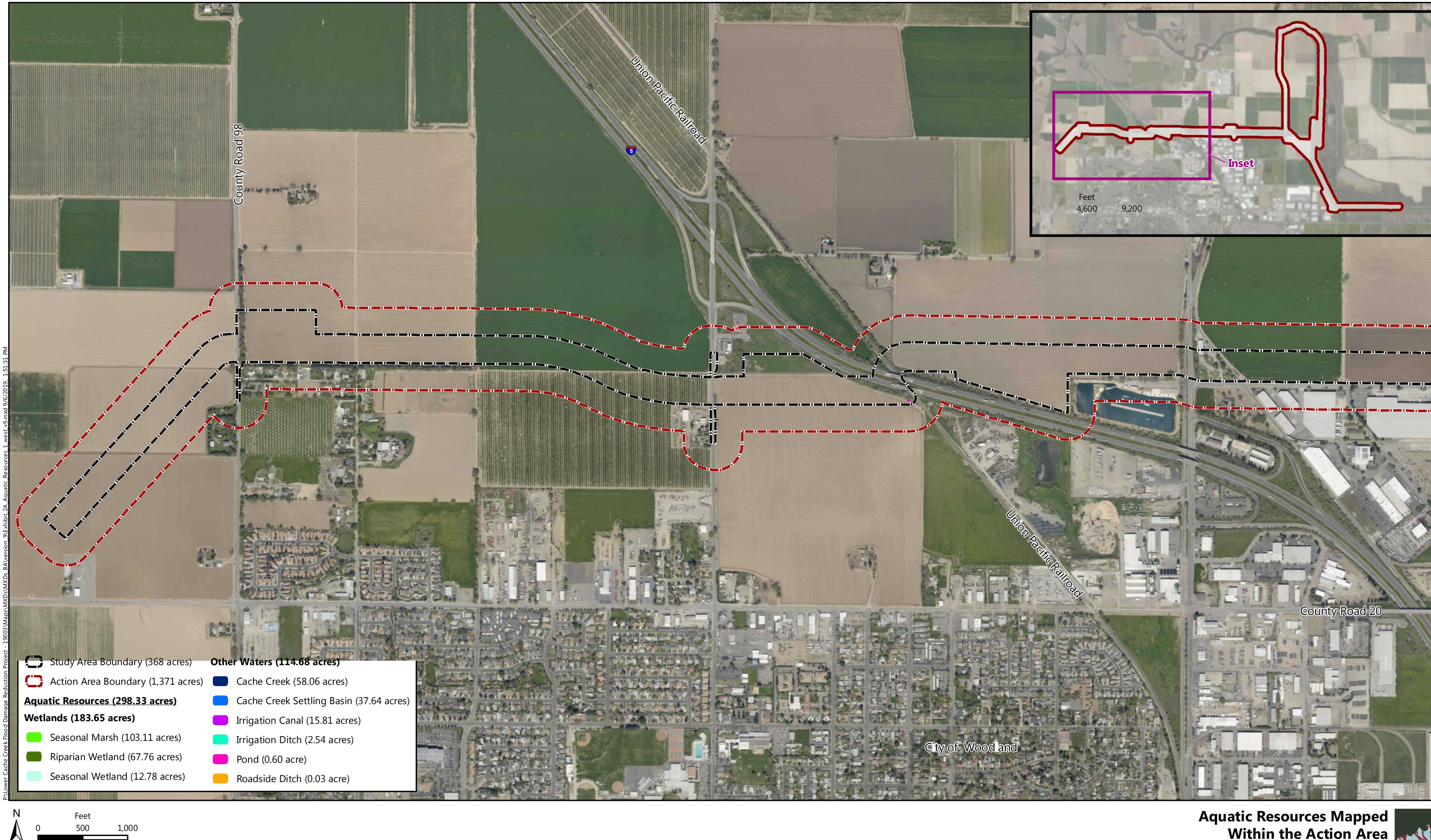
Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING

Survey Data Source: Madrone Ecological Consulting, LLC., 2019 Survey Data.
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.

Attachment D

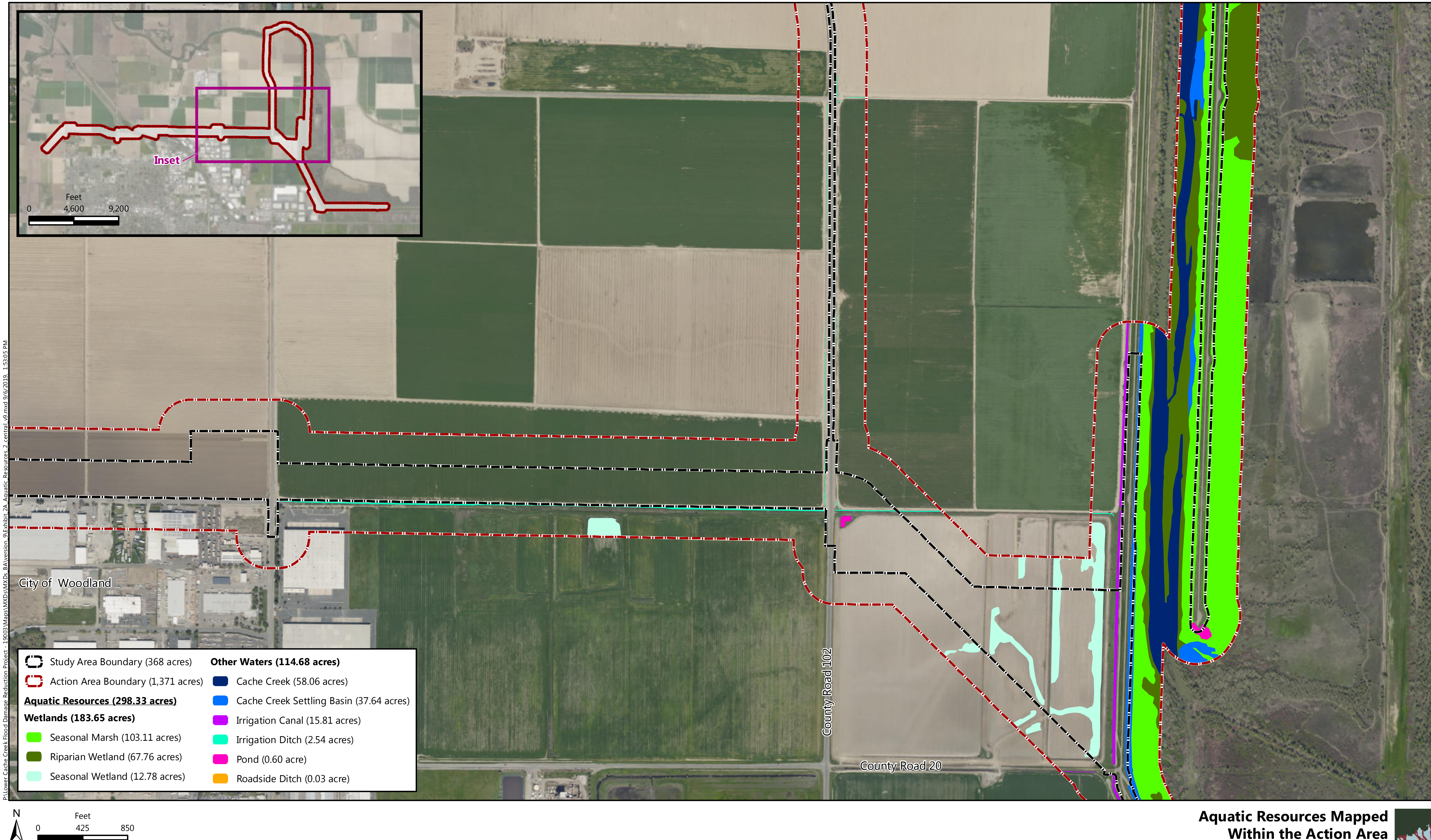
Aquatic Resources Mapped within the Action Area



Aquatic Resources Mapped Within the Action Area West Side

Lower Cache Creek Feasibility Study
Yolo County, California

Survey Data Source: Madrone Ecological Consulting, LLC., 2019 Survey Data.
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.



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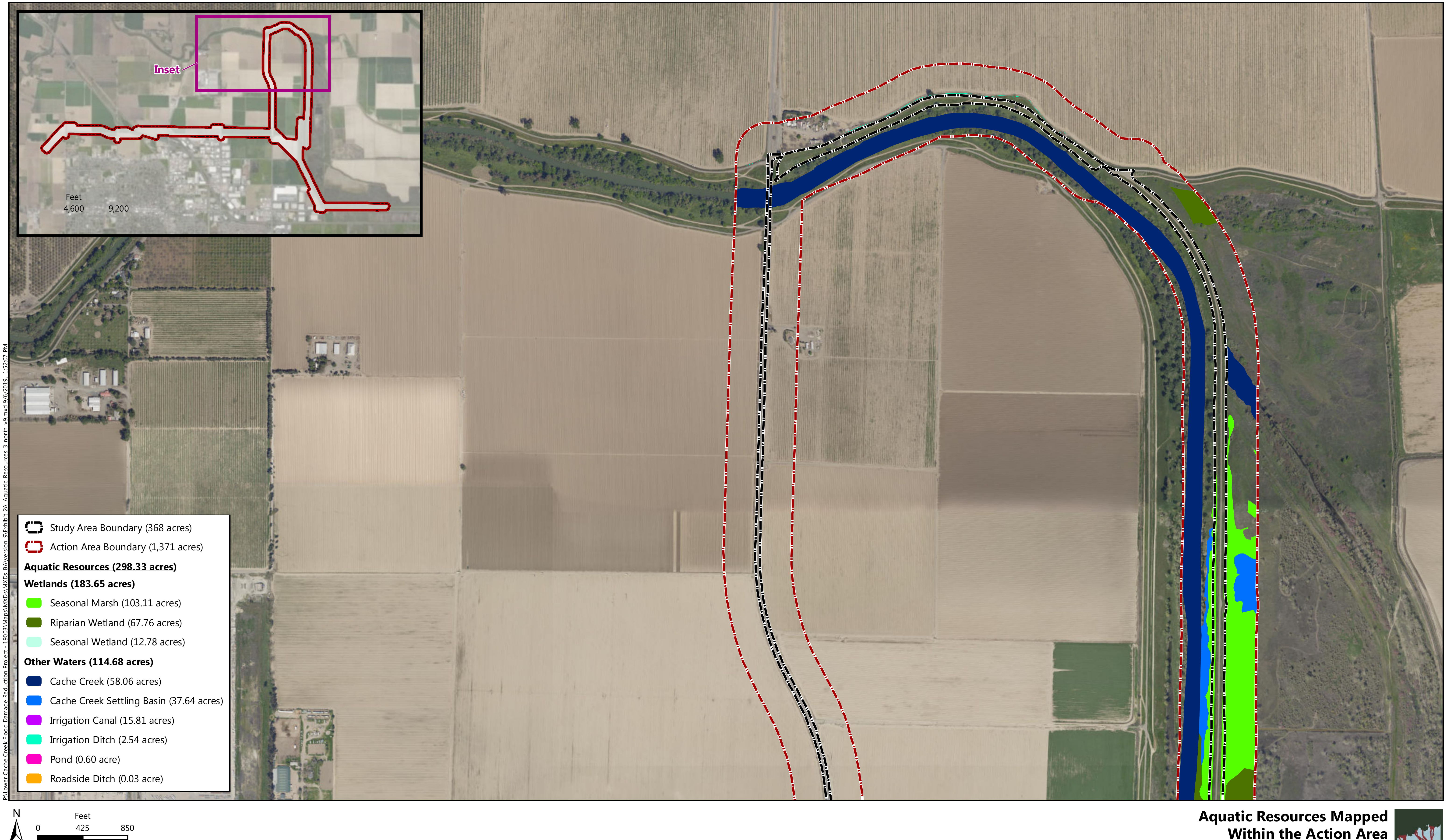
Aquatic Resources Mapped Within the Action Area Central

Survey Data Source: Madrone Ecological Consulting, LLC., 2019 Survey Data.
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.

Lower Cache Creek Feasibility Study
Yolo County, California

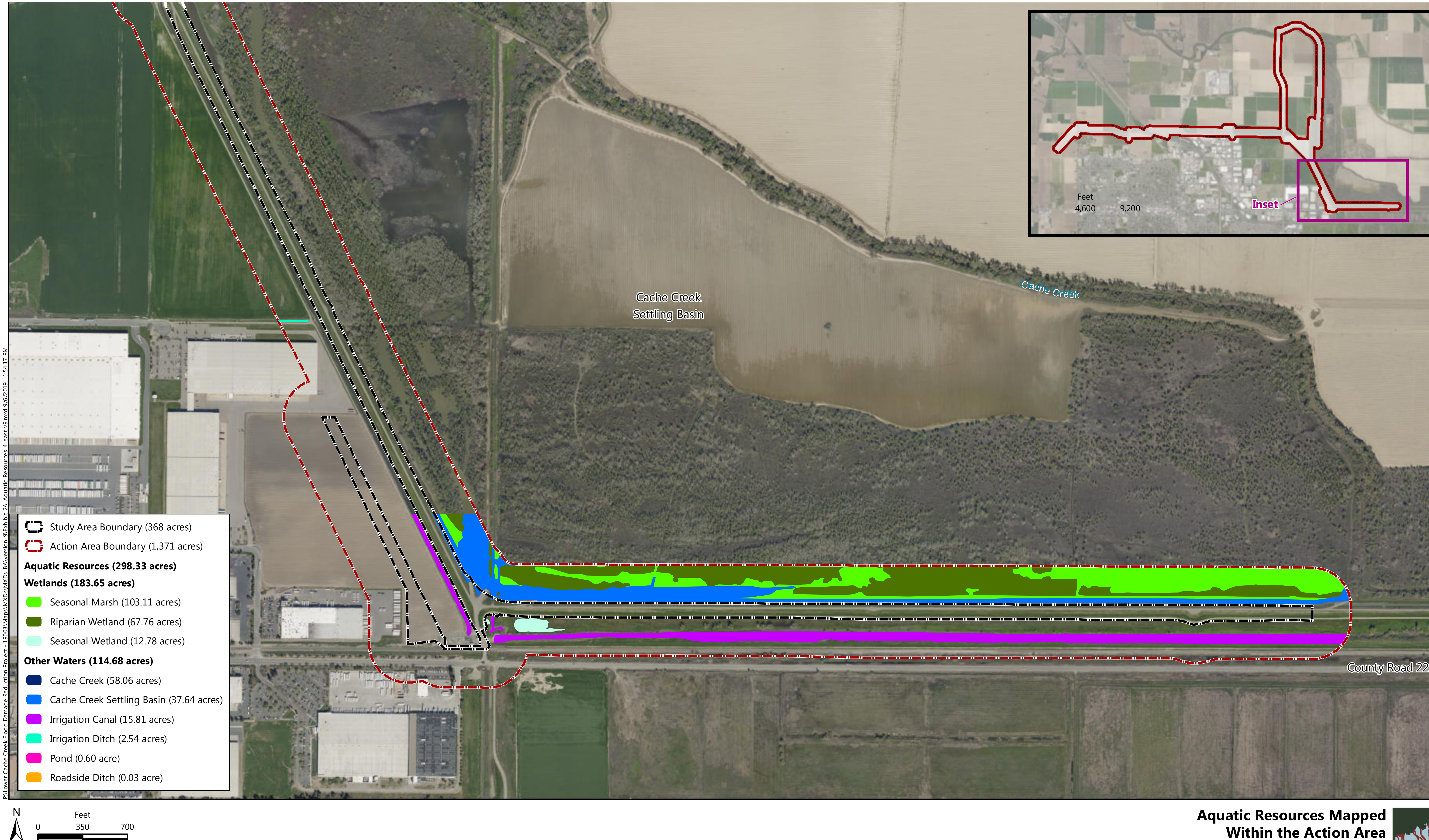
MADRONE ECOLOGICAL CONSULTING



Aquatic Resources Mapped Within the Action Area North Side

Lower Cache Creek Feasibility Study
Yolo County, California

Survey Data Source: Madrone Ecological Consulting, LLC., 2019 Survey Data.
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.



Aquatic Resources Mapped Within the Action Area East Side

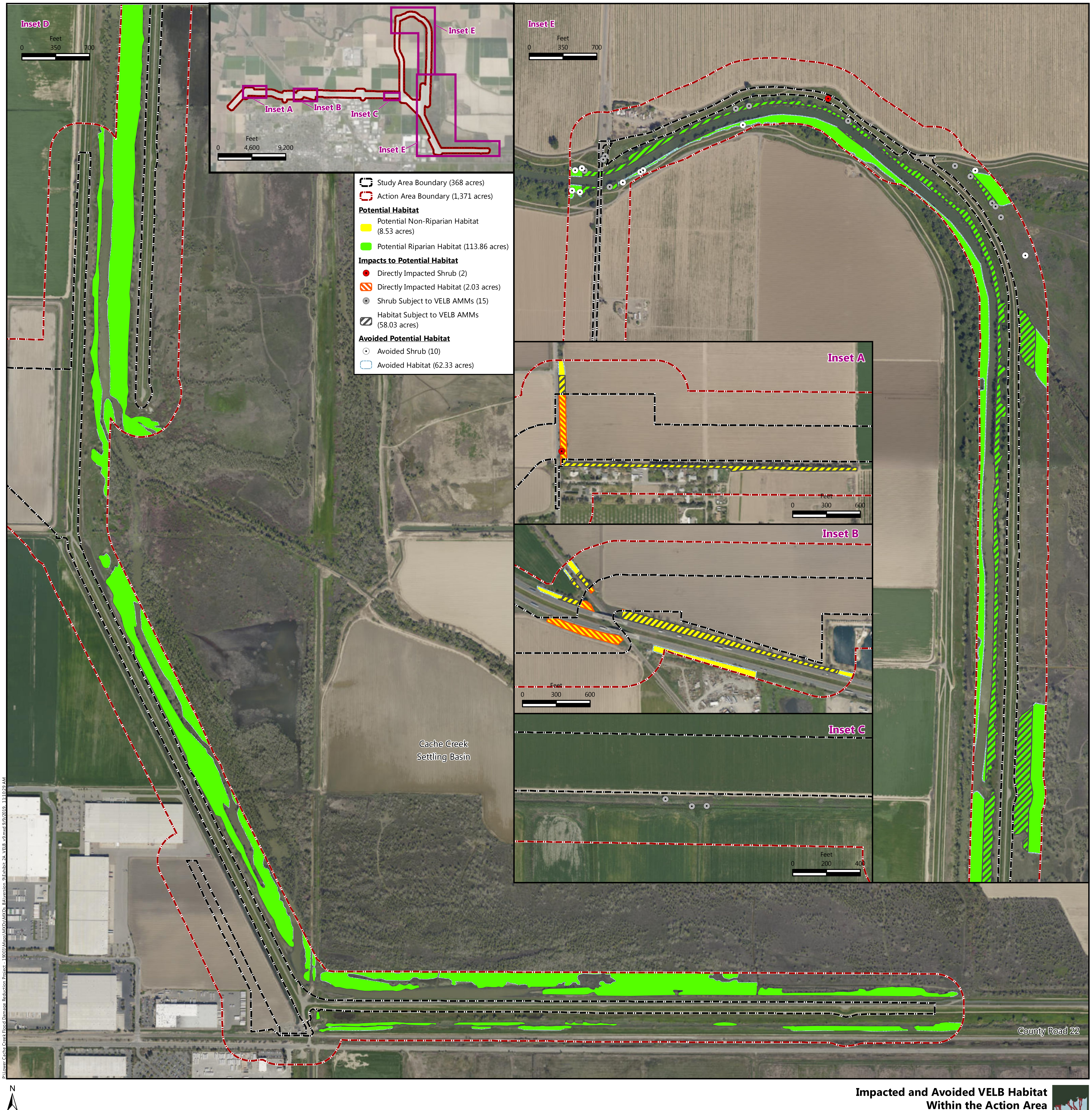
Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING

Survey Data Source: Madrone Ecological Consulting, LLC., 2019 Survey Data.
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.

Attachment E

Impacted and Avoided
VELB Habitat
within the Action Area



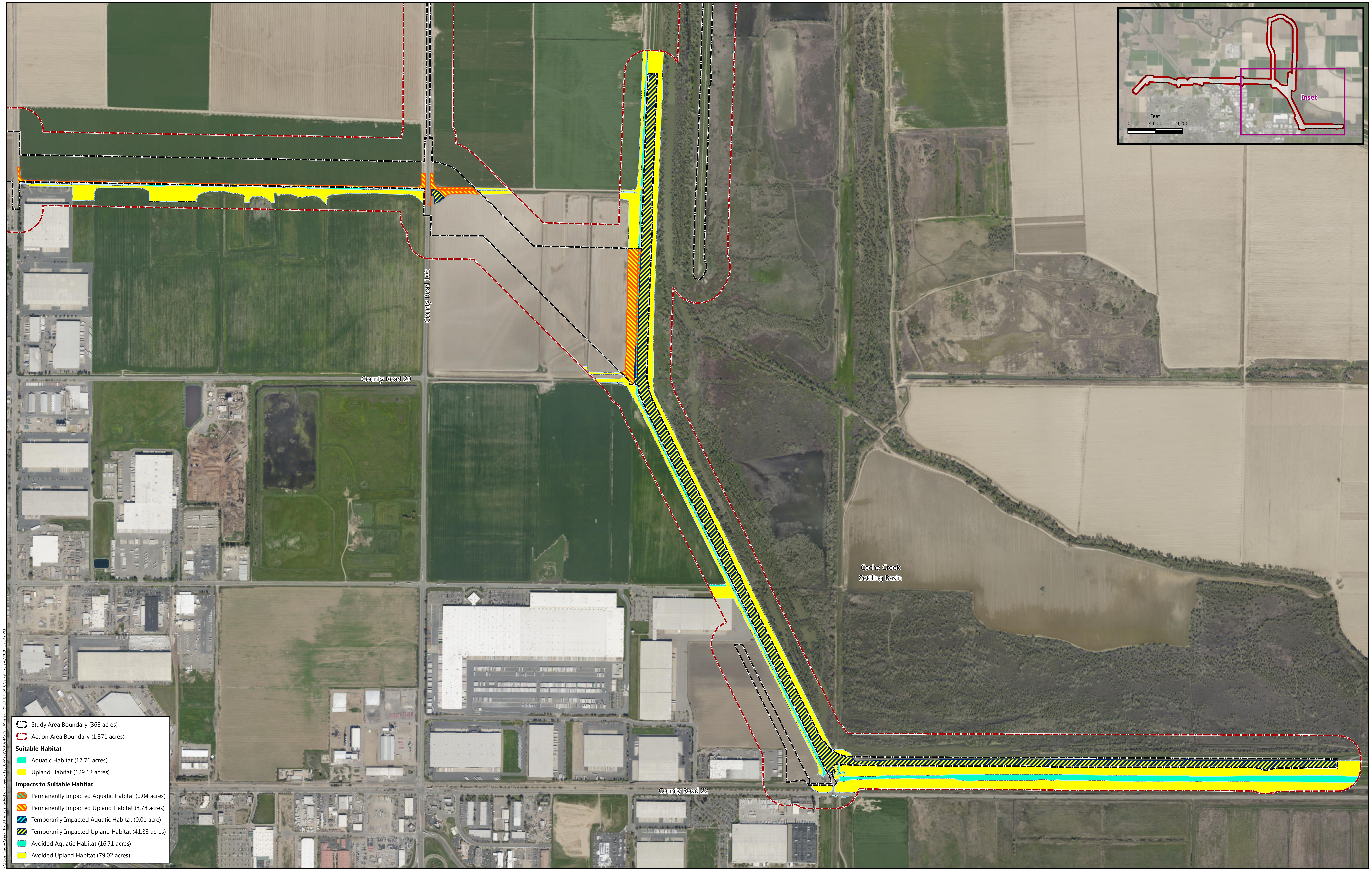
Impacted and Avoided VELB Habitat
Within the Action Area

Lower Cache Creek Feasibility Study
Yolo County, California

Survey Data Source: Madrone Ecological Consulting, LLC., 2019 Survey Data.
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.

Attachment F

Impacted and Avoided
Giant Garter Snake Habitat
within the Action Area



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Impacted and Avoided Giant Garter Snake Habitat Within the Action Area

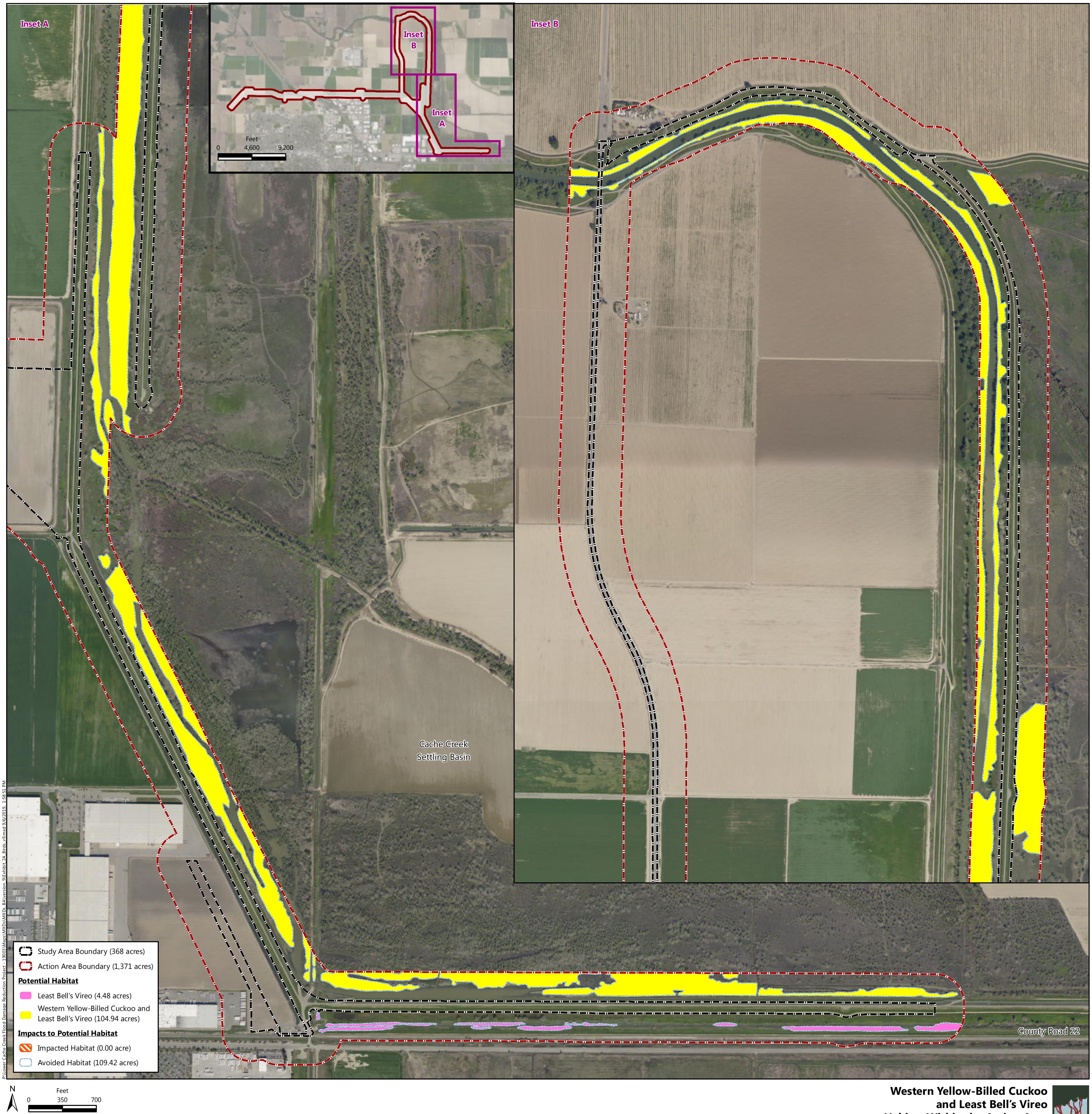
Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING

Survey Data Source: Madrone Ecological Consulting, LLC., 2019 Survey Data.
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.

Attachment G

Western Yellow-Billed Cuckoo and Least Bell's Vireo Habitat within the Action Area



Western Yellow-Billed Cuckoo and Least Bell's Vireo Habitat Within the Action Area

Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING

Survey Data Source: Madrone Ecological Consulting, LLC., 2019 Survey Data.
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.

DRAFT PROGRAMMATIC AGREEMENT

APPENDIX C

LOWER CACHE CREEK FEASIBILITY STUDY

Yolo County, CA

December 2019

United States Army Corps of Engineers
Sacramento District

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO, CA 95814-2922

OCT 0 2 2019

Environmental Resources Branch

Subject: Continuing Section 106 Consultation for the Lower Cache Creek Feasibility Study in Yolo County, California regarding the Programmatic Agreement (COE020207A).

Julianne Polanco
State Historic Preservation Officer
Office of Historic Preservation
1725 23rd Street, Suite 100
Sacramento, CA 95816

Dear Ms. Polanco:

The U.S. Army Corps of Engineers, Sacramento District (Corps) is writing you to continue consultation on the Cache Creek feasibility study (Study), Yolo County, California (COE020207A). The Corps is undertaking this Study under the Flood Control Act of 1962 (Public Law 87-874). The study has been ongoing since 1995, and a Tentatively Selected Plan (TSP), was identified in 2015 from a range of alternative plans. The TSP would improve existing levees and construct a new levee that would prevent floodwaters from Lower Cache Creek from entering the built-up area of the City of Woodland and town of Yolo. In accordance with Section 106 of the National Historic Preservation Act (NHPA), the Corps is requesting your comments on the draft Programmatic Agreement (PA) (Enclosure). The PA guides implementation of, and adherence to, the Section 106 process and defines the roles of the different project proponents (36 CFR § 800.14[b][3]).

On March 27, 2019, the Corps sent out sent out consultation letters regarding the Area of Potential Effects (APE) and the development a PA for the Study. In a letter dated May 13, 2019, the SHPO concurred with the Corps delineation of the APE and agreed to participate in the development of a PA to guide the Corps section 106 compliance for the Study. On March 27, 2019, a letter was sent to the Advisory Council on Historic Preservation (ACHP) requesting their participation in the PA. The ACHP did not respond within 15 days with a decision regarding participation, but did request that the Corps file the final PA and related documentation with the ACHP at the conclusion of the consultation process. The filing of the PA and supporting documentation with the ACHP is required in order to complete the requirements of Section 106 of the NHPA.

On April 23, 2019, the Corps received a letter from Yocha Dehe Wintun Nation (Yocha Dehe) requesting to initiate formal consultation and set up a meeting with the Corps. They also requested that the Corps provide their Cultural Resources Department with a project timeline, detailed project information and the latest feasibility study. The Corps responded by email on May 23, 2019, stating that project description and timelines were still being finalized. The Corps also provided Yocha Dehe with a map of the revised APE and asked if the Tribe had any knowledge of locations of archaeological sites, traditional cultural properties, or areas of traditional cultural value or concern in or near this project's APE. The Corps received a phone call from Yocha Dehe on September 12, 2019, requesting the latest revised APE map and will provide any known sites within the APE for the Corps identification efforts.

We respectfully request any written comments you may have on the draft PA within 30 days of receipt of this letter. Please send comments or questions to Robert Gudiño, Archaeologist, U.S. Army Corps of Engineers, Sacramento District, 1325 J St. Sacramento, CA, 95814-2922, or by phone at (916) 557-5104 and by email at Robert.Gudino@usace.army.mil.

Sincerely,

Mark T. Ziminske

Mark T. Ziminske
Chief, Environmental Resources Branch

Enclosure

PROGRAMMATIC AGREEMENT BETWEEN THE U.S. ARMY CORPS OF ENGINEERS AND THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER REGARDING THE LOWER CACHE CREEK FEASIBILITY STUDY PROJECT, YOLO COUNTY, CALIFORNIA

WHEREAS, the U.S. Army Corps of Engineers (Corps) has been conducting a study of flood protection systems on the Lower Cache Creek in the vicinity of Woodland and Yolo, in Yolo County, California in accordance with Section 209 of the Flood Control Act of 1962 (Public Law 87-874); and

WHEREAS, the purpose of the study was to determine if there is Federal interest in providing increased flood protection that is adaptable to future physical and environmental conditions and in implementing any necessary flood protection improvements in the study areas as soon as possible; and

WHEREAS, the study has identified a set of construction and management measures that when approved and implemented (the Project, described at **Attachment 1**), would provide sufficient flood protection meeting Federal requirements for taking part in the Project, such measures including modifications to existing levees and the Cache Creek Settling Basin; adding new levees, drainage features and gates; improving interior drainage; raising roadways and installing culverts; and addressing residual floodplain effects; and

WHEREAS, the Project area is along the Lower Cache Creek north and east of the city of Woodland, Yolo County, and maps of the Project's Area of Potential Effects (APE) are included as Attachment 1, Figure 1 to this Programmatic Agreement (Agreement); and

WHEREAS, the Corps is proceeding with the Project and has determined that the Project, when approved, will constitute an Undertaking as defined in the Advisory Council on Historic Preservation Procedures, 36 CFR § 800.16(y) and therefore is subject to Section 106 of the National Historic Preservation Act of 1966, 54 U.S.C. § 306108 (NHPA); and

WHEREAS, the Corps has determined that effects on properties that are either included in, or are eligible for inclusion in the National Register of Historic Places (NRHP) cannot be fully determined prior to final approval of the Project; and

WHEREAS, pursuant to 36 C.F.R. § 800.4(b) (2), the Corps may implement the Project in phases as funding is available and construction authority is provided and, as a result, efforts to identify and evaluate Historic Properties and the determination of effects pursuant to 36 C.F.R. § 800.14(b) (1) (ii); for all phases and segments of the Project may be deferred until more specific information for each project phase is known; and

WHEREAS, a determination of effect and, if necessary, an Historic Properties Treatment

Plan (HPTP), cannot be developed until after approval and execution of this Agreement because the specific project designs that may alter the levees and their appurtenances will not be developed until after the Project has been approved for design; and

WHEREAS, this Agreement will establish the processes the Corps will follow for compliance with 54 U.S.C. *§* 306108 (formerly 16 U.S.C. *§* 470f, referred to hereinafter as "Section 106"), taking into consideration the views of the Signatory and Concurring Parties; and

WHEREAS, a total of 10 recorded potentially historic resources are known to be present adjacent to or within levee footprints in a portion of the Project study area, and although archaeological inventories have been completed within parts of the Project study area through other projects, substantial portions of the Project study area have not been inventoried; and

WHEREAS, alluvial deposition, levees and other built environment features have obscured historic properties and a full assessment of archaeological sites cannot be made in advance of construction, and there is a high probability for buried potentially historic resources that may not be identified prior to construction and that also may be eligible for inclusion in the NRHP, and therefore this Agreement documents a framework for managing post-review discoveries per 36 C.F.R. *§* 800.13(a)(l) as necessary; and

WHEREAS, the Corps has consulted with the California State Historic Preservation Officer (SHPO) pursuant to Section 106 and the implementing regulations described under 36 CFR Part 800; and

WHEREAS, the Corps has consulted with the Yolo County Flood Control and Water Conservation District and the State of California Central Valley Flood Protection Board and has invited them to participate as Concurring Parties; and

WHEREAS, in accordance with 36 C.F.R. §§ 800.2(c)(2)(ii)(A), 800.3(t)(2), and 800.14(b)(2)(i), the Corps has consulted with and invited the Yocha Dehe Wintun Nation to be a Concurring Party to this agreement and will continue to consult with them on its implementation; and

WHEREAS, the Corps will make the terms and conditions of this Agreement part of the conditions of any contracts issued by the Corps for this Project; and

WHEREAS, in accordance with 36 C.F.R. § 800.14(b)(3), the Corps notified and invited the Advisory Council on Historic Preservation (ACHP) on April 4, 2019, per 36 C.F.R. § 800.6(a)(l)(C) to participate in consultation to resolve potential adverse effects of the Project, including development of this Agreement, and the ACHP has declined to participate in a letter dated June 14, 2019; and

WHEREAS, in accordance with 36 C.F.R. § 800.6(a)(4) and 36 C.F.R. § 800.l 4(b)(2)(ii), the Corps has notified the public of the Project and provided an opportunity for members of the public to comment during the National Environmental Policy Act (NEPA) public review (public review comment period ended on DATE) on the Project and the Section 106 process as outlined in this Agreement;

NOW, THEREFORE, the Signatories agree that the Undertaking will be implemented in accordance with the following stipulations in order to take into account the effects of the Undertaking on historic properties and to satisfy the Corps' Section 106 responsibilities for all individual aspects of the Undertaking.

The Corps will ensure that the following measures are carried out:

STIPULATIONS

I. REVIEW PROCEDURES AND TIME FRAMES

For all documents and deliverables produced in accordance with the stipulations of this Agreement, the Corps shall provide a draft document to the SHPO, Concurring Parties, and Native American interested parties and Tribes for review. Any written comments provided by the SHPO, Concurring Parties, and Native American interested parties and Tribes, within thirty (30) calendar days from the date of receipt, shall be considered in the revision of the document or deliverable. The Corps shall document and report the written comments received for the document or deliverable and how comments were addressed. The Corps shall provide a revised final document or deliverable to the SHPO for concurrence. The SHPO shall have fifteen (15) calendar days to respond. The Corps will also provide a revised final document or deliverable to Concurring Parties, and Native American interested parties and Tribes for their project record.

Failure of the SHPO, Concurring Parties, and Native American interested parties and Tribes to respond within the timeframes specified above shall not preclude Corps from moving to the next step in this Agreement.

If the SHPO offers a comment that is an object or initiates a dispute, the SHPO and the Corps shall proceed in accordance with **Stipulation XV** below. The timeframe to consult to resolve a disagreement or objection may be extended by mutual consent of the Corps and the SHPO.

II. QUALIFICATIONS

A. Professional Qualifications: All technical work required for historic preservation activities implemented pursuant to this Agreement will be carried out by or under the direct supervision of a person or persons meeting, at a minimum, the Secretary of Interior's Professional Qualifications Standards for archaeology, architectural history, or history, as appropriate (48 FR 44739). "Technical work" here means all efforts to inventory, evaluate, and perform subsequent treatment of potential Historic Properties that is required under this Agreement. This stipulation will not be construed to limit peer review, guidance, or editing of documents by SHPO and associated Project consultants.

B. Historic Preservation Standards: Historic preservation activities carried out pursuant to this Agreement will meet the Secretary of Interior's Standards and Guidelines for Archaeology and Historic Preservation (48 FR 44716-44740), as well as standards and guidelines for historic preservation activities established by the SHPO. The Corps will ensure that all reports prepared pursuant to this Agreement will be provided to the Signatories, Concurring Parties, and Native American interested parties and Tribes and are distributed in accordance with **Stipulation XIV,** and meet published standards of the California Office of Historic Preservation, specifically, Preservation Planning Bulletin Number 4(a), "Archaeological Resources Management Reports (ARMR): Recommended Contents and Format" (December 1989).

A. Archaeological Monitor Standards: The Archaeological Monitor must individually meet the Secretary of the Interior's Professional Qualifications Standards for Archaeology and additional qualifications as follows: A graduate degree in archaeology, anthropology, or closely related field plus:

1. At least one year of full-time professional archaeological experience;
2. At least four months of supervised field and analytic experience in general North American archaeology;
3. Demonstrated ability to carry research to completion;
4. Demonstrated ability to complete National Register of Historic Places (NRHP) evaluations for cultural resources;
5. Demonstrated ability to identify and assess subsurface and surface archaeological deposits

III. AREA OF POTENTIAL EFFECTS

An overall APE map for the Project is included as **Attachment 1**, Figure 2. Because the Project will occur in phases, each phase APE will be consulted on separately. Prior to activities under **Stipulation V,** the Corps will submit to the SHPO, Concurring Parties, and Native American interested parties and Tribes a map of the revised phase APE for the current phase and a description of the Project activities occurring for that phase, in accordance with **Stipulation l**. Revision of the APE will not necessitate modifications to this Agreement.

A. For purposes of this Agreement, the APE for each phase will include the levee segment and a corridor extending not less than 300 meters to either side of the centerline of the levee and will take into account the likelihood of direct and indirect effects to Historic Properties resulting from the Project.

B. The APE for each phase also will include:

1. The extent of all Project construction and excavation activity required to construct flood control facilities and to modify irrigation and drainage infrastructure; and

2. The additional right-of-way/easements obtained by the Corps as part of the Project's features; and

3. All areas used for excavation of borrow material and habitat creation (environmental mitigation); and

4. All construction staging areas, access routes, spoil areas, and stockpiling areas; and

C. After a revised APE has been defined and consulted on in accordance with **this stipulation,** construction or other Project activities may require revisions to the APE. If an APE is revised, the Corps will consult on each revision in accordance with **Stipulation I**, and the Corps will determine the potential for Project activities in a revised APE to affect potential Historic Properties, in accordance with **Stipulation V**.

IV. HISTORIC PROPERTIES MANAGEMENT PLANNING

A. Historic Property Management Plan: The Corps, in consultation with the SHPO, Concurring Parties, and Native American interested parties and Tribes, shall develop a Historic Property Management Plan (HPMP). HPMP requirements are listed in **Attachment 3**. The HPMP shall be appended to this Agreement (**Attachment 4**) and will form the basis for any Historic Property Treatment Plans (HPTPs) that may be required for one or more phases of the Project. The HPMP shall be developed after execution of the Agreement, but before construction commences. For the overall Project and individual phases, the HPMP shall be the means for the Corps to comply with 36 C.F.R. § 800.6 and provide standardized methods for dealing with unanticipated discoveries in accordance with 36 C.F.R. § 800.13(a).

B. Historic Property Treatment Plans: The Corps will consult the SHPO, pursuant to 36 C.F.R. § 800.5, when the Corps has determined that a Project activity will result in adverse effects to a Historic Property. The Corps will prepare a HPTP specific to the phase of the Project or a particular Historic Property to describe how the Corps intends to resolve adverse effects. HPTP requirements are listed in **Attachment 3**. The HPTP(s) may be appended to the HPMP.

1. Historic Context, Recording, Evaluation and Treatment of Levees: No known - NRHP-eligible levees are within the Project APE. Only the Cache Creek Levee has been recorded, but has yet to be evaluated for its eligibility for listing in the NRHP. However, no overall historic context, identification or evaluation of the levee system has been developed. In order to document the levees for evaluation, the Corps will develop an historic context and evaluation plan for recording of the Lower Cache Creek levees as historic structures within the Project APE to support evaluation of Project effects. If an historic context and/or evaluation plan for the levees within a Project APE is subsequently developed, the Corps may incorporate it as needed. The Evaluation Plan shall consider the levees in the context of the entire Lower Cache Creek levee system. Additionally, the evaluation plan shall require the development of clear and specific criteria for determining: (1) recording guidelines for the levees within the APE; (2) contributing and non-contributing elements of the levee system; (3) thresholds of adverse effect; and (4) general planning for treatment of adverse effects. The evaluation plan shall be developed after execution of the Agreement and before construction commences. The Corps shall submit the evaluation plan for review, in accordance with **Stipulation I.**

2. **Review:** HPTPs will be submitted and reviewed in accordance with **Stipulation I**, except for those HPTPs developed for Historic Properties discovered during construction activities, which will follow the review timeframes identified in **Stipulation VIII**. Circulation of an HPTP will not include a recirculation of the HPMP.

3. **Amendments/Addendums/Revisions:** If an Historic Property type that is not covered by an existing HPTP is discovered within the APE subsequent to an initial inventory effort for a phase, or if there are previously unexpected effects to an Historic Property, and the Corps and SHPO agree that the Project may adversely affect the Historic Property, the Corps will submit an addendum to the HPTP or a new HPTP to the SHPO, Concurring Parties and Native American interested parties and Tribes for review and comment, and will follow the provisions of **Stipulation VIII**. The HPTP may cover multiple discoveries for the same property type.

4. **Final Phase Report Documenting Implementation of the Historic Properties Treatment Plan(s):** Within one year after the completion of all work for each phase of the Project, the Corps will submit to the SHPO, Signatory Parties, Concurring Parties, and Native American interested parties and Tribes, a Final Phase Report documenting the results of all work prepared for that phase under the HPTPs, and the information learned from each of the Historic Properties.. The submittal of the Final Phase Report shall be in accordance with **Stipulation I**.

V. IDENTIFICATION AND EVALUATION BEFORE HPMP APPROVAL

Should the HPMP not be finalized at the time that a phase of the Project may be proceeding to design and construction, the Corps will comply with **Stipulation V A, B, and C** and, as necessary, **Stipulation VI** until the HPMP is finalized following the procedures in **Stipulation I**, at which time the Corps will follow the HPMP. The Corps will complete any identification and evaluation, and as necessary, any assessment of effects to Historic Properties prior to proceeding with construction and review will be in accordance with **Stipulation I**.

A. Identification of Potential Historic Properties: The Corps will initiate an inventory of Historic Properties within the APE, consistent with the Secretary of Interior's Standards and

Guidelines for Archeology and Historic Preservation (48 FR 44716-44740) for the Project, or for individual phases of the Project, as construction details become available.

1. The Corps will acquire a current and complete records and literature search from the Northwest California Information Center at Sonoma State University, prior to conducting archaeological surveys of the APE. Records and literature searches will be considered complete and current if they occurred five years or less prior to construction.

2. The Corps will maintain ongoing consultation with Native American Tribes and individuals, as described in **Stipulation XI,** to identify properties that are of religious and cultural significance to them and that may be eligible for the NRHP. Traditional Cultural Properties will be inventoried and evaluated in accordance with the guidance presented in *National Register Bulletin 38: Guidelines for Evaluating and Documenting Traditional Cultural Properties* and consistent with the ACHP guidance documents *Native American Traditional Cultural Landscapes and the Section 106 Review Process: Questions and Answers* and *Native American Traditional Cultural Landscapes Action Plan.*

3. The Corps will complete and report the results of all required potential Historic Properties inventories of the Undertaking's APE in a manner consistent with the "Secretary of the Interior's Standards and Guidelines for Identification" (48 FR 44720-23) and take into account the National Park Service's publication, "The Archeological Survey: Methods and Uses" (1978: GPO stock #024-016-00091). Inventories will include archaeological surveys and inventories of historic buildings, structures, districts, and landscapes. The Corps will include a geoarchaeological investigation of the APE in its survey and will undertake subsurface reconnaissance as needed. Surveys will include areas not previously surveyed and those where the Corps, in consultation with SHPO, deems previous surveys to be inadequate, e.g. areas with changes in landscape due to fire, erosion, flooding episodes which may have exposed previously unknown potential Historic Properties. The Corps will also include additional areas that may be affected by changes in the project design, borrow areas, haul roads, staging areas, extra work space, mitigation sites, and other ancillary areas related to the Undertaking. If identified potential Historic Properties can be evaluated for the NRHP based on the results of survey, context statements, and historic documentation, then the Corps may request SHPO concurrence with those eligibility determinations without further study.

4. The Corps will include in its site recording documents all unrecorded archaeological sites, linear features, and isolates encountered in the course of the survey. The Corps will prepare updated records of previously recorded sites if there has not been an update in the past two years. The Corps' survey will record all prehistoric sites and all historical sites, structures, buildings, and engineering features greater than forty-five (45) years of age. Historic sites to be recorded will include, but not be limited to: commercial, residential, and ecclesiastical buildings, roads, trails, railways, bridges, levees, culverts, and agricultural features, including ditches.

5. The Corps will use the California Department of Parks and Recreation (DPR) Form 523 to record all newly discovered historic or prehistoric archaeological sites and isolates, previously recorded archaeological sites, and where necessary, will create updated site records using the DPR 523 Form. Isolates will be numbered sequentially, plotted on a map, and recorded on a single table within the report. The Corps will examine non-linear sites that extend outside of the APE in their entirety unless access to land is prohibited or the scale of the resource makes doing so prohibitive. In the event access cannot be gained, the Corps will consult with SHPO regarding appropriate means of evaluating a given site.

B. Property Types Exempt from Evaluation: Attachment 5 to this Agreement lists the property types that the Signatories agree will be exempt from evaluation as determined by the Corps in consultation with the SHPO. The Corps will evaluate all other identified properties in accordance with **Stipulation V C.**

C. Evaluation of Potential Historic Properties: The Corps, in consultation with SHPO, other parties to the Agreement, and Native American Tribes, as appropriate, will ensure that determinations of eligibility are made for all potential Historic Properties within Project APE **(Stipulation III**) Potential Historic Properties will be evaluated by a qualified professional, per **Stipulation II**, for their eligibility for listing in the NRHP consistent with the Secretary of Interior's Standards for Evaluation, 36 C.F.R. § 60.4. In accordance with **Stipulation I**, the Corps will submit a completed inventory and evaluation for each phase of Project work.

1. Eligibility Determination: After completing evaluations on Potential Historic Properties, if the Corps and the SHPO cannot agree on the eligibility of a property for the NRHP, the Corps will obtain a determination from the Secretary of the Interior in accordance with 36 CFR Part 63. The determination of the Secretary will be final for purposes of this Agreement. Any other disputes will be settled following the procedure set forth under **Stipulation XV**.

VI. ASSESSMENT OF EFFECTS

Avoidance of adverse effects to Historic Properties is the preferred treatment approach. The Corps will consider redesign of Project elements in order to avoid Historic Properties and Project effects that may be adverse. However, it may not be possible to redesign the Project in order to avoid adverse effects to Historic Properties.

The Corps will apply the criteria of adverse effect by project phase, pursuant to 36 C.F.R. § 800.5 (a)(l), to all Historic Properties within the APE. The Corps will submit findings of effects in accordance with **Stipulation I**.

If effects to Historic Properties are found to be adverse, the Corps will follow provisions at **Stipulation IV B**.

VII. NOTICES TO PROCEED WITHCONSTRUCTION

The Corps may issue Notices to Proceed for individual construction segments or phases, defined by the Corps in its construction specifications, after an Historic Properties inventory including that segment has been completed (per **Stipulation IV** or **Stipulation V**), and before treatment of adverse effects on Historic Properties within the phase APE provided that:

A. The Corps has prepared a plan to respond to inadvertent archaeological discoveries for that phase of the Project, reviewed in accordance with the provisions **Stipulation I**, and approved by the SHPO; and

B. Project actions do not encroach within 30 meters (100 feet) of the known boundaries of any potential Historic Property as determined from archaeological site record forms, other documentation, or as otherwise defined in consultation with the SHPO, Concurring Parties, and Native American interested parties and Tribes, as appropriate; and

C. A monitor meeting the professional qualifications as described in **Stipulation II**, will be present when any new ground disturbance occurs. For the purpose of Archaeological Monitoring, new ground disturbing activities include clearing, grubbing, stripping, vegetation removal, levee degrade, cutoff wall excavation, utility relocation or installation work deeper than 6 inches into the soil, equipment and materials staging, site preparation, or other activities with potential to disturb soil beyond preconstruction conditions reasonably visible to archaeologists.

Multiple concurrent construction operations in discontiguous areas require one Archaeological Monitor present on-site at each active construction area. Any new ground disturbing activities are prohibited if an Archaeological Monitor(s) is not present.

VIII. GEOTECHNICAL INVESTIGATIONS

For the purposes of gathering engineering data for Project planning and design, it may be necessary for the Corps to conduct limited geotechnical investigations at areas within the Project before all inventory and evaluation of Historic Properties within the Project is completed.

A. The Corps may conduct geotechnical investigations (e.g., borings, potholing, or trenches) for planning and exploratory efforts. The Corps will follow **Stipulation VIII (A1)** and **(2),** or may follow **Stipulation VIII (A) (3)** if unable to follow Stipulation **VIII (A1)** and **(2)**:

1. A records and literature search and consultation with Native Americans has been conducted and there is a determination that no known potential Historic Properties are within 50 feet of the areas identified for geotechnical investigations, and an archaeological field survey of the areas identified for geotechnical investigations has been conducted and there is a determination that no known potential Historic Properties are present;

2. A potential Historic Property is identified during the records and literature search or field survey and consultation process as being within an area where geotechnical investigation will occur, and the geotechnical investigation is relocated at least 50 feet outside the site boundaries; or

3. Provisions for an archaeological monitor meeting the qualifications described in

Stipulation II C are included in the contract specifications for the geotechnical investigations. As appropriate, or when geotechnical activities may occur in sensitive areas, an archaeological monitor will be present for all ground disturbing activities.

B. If potential Historic Properties are discovered during geotechnical investigations, the Corps will follow **Stipulation IX**.

C. The Corps will prepare a Memorandum for Record (MFR) for each phase of geotechnical investigations. The MFR of documenting the results of the records and literature search, the archaeological field survey, any decisions to relocate geotechnical investigation areas, the determination for inclusion of an archaeological monitor for ground disturbing activities, and a record of communication with Native American interested parties and Tribes, as appropriate.

IX. DISCOVERY OF UNKNOWN POTENTIAL HISTORIC PROPERTIES

The Corps is responsible for complying with 36 C.F.R. § 800.13(a) in the event of inadvertent discoveries of potential Historic Properties at any time during implementation of the Project. The HPMP will provide compliance procedures for post review and inadvertent discoveries of potential Historic Properties. If the Corps authorizes work before the HPMP is finalized and there is a discovery of a previously unknown potential Historic Property, the Corps will follow 36 C.F.R. § 800.13(b). Additionally, the Corps will apply the following procedures:

A. Workforce Training: During implementation of Project activities, the Corps, or archaeologists meeting the professional qualifications as described in **Stipulation II**, will provide training to all construction personnel, before they begin work, regarding proper procedures and conduct in the event that archaeological materials are encountered during construction.

B. Human Remains: Treatment of human remains is governed by **Stipulation XII**.

X. CURATION

There are no Federal lands within the Project. The Project must acquire real estate rights from the underlying landowners sufficient to allow construction, including rights sufficient to manage potential Historic Properties that may be affected by construction, operation and maintenance of the project. The rights to be taken will not convey ownership of artifacts or other materials to the Federal government, but will provide for Federal custody of such artifacts and materials until analyses specified in planning documents called for in the stipulations of this Agreement are completed. Federal custody during that time will be in accordance with the provisions at 36 C.F.R. § 79. At the end of the studies, as agreed upon by consultation among the Parties to this Agreement, the Corps will relinquish custody of the artifacts and other materials to the owner.

The Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. § 3001 *et seq.)* does not apply to this Project as there is no Federal land but this Agreement incorporates by reference the definitions for "human remains" and "funerary objects" set forth in 43 C.F.R § 10.2(d), which will apply to actions under this Agreement. Further treatment of Human remains is addressed in **Stipulation XII**.

Although artifacts and other materials will not be Federal property, all original data and records concerning those items are Federal property and will be archived in accordance with 36 C.F.R. § 79 and other Federal regulations. To assure that the objectives of Federal preservation law may be met, copies of all information specific to a discrete collection of artifacts and other materials will be provided to an owner when Federal custody of the artifacts and other materials is extinguished. If a collection from a single site is relinquished among multiple owners, owners will be provided with only the information that pertains to their portion of the collection.

XI. TRIBAL INVOLVEMENT

A. In consultation with Native American interested parties and Tribes the Corps will make a reasonable and good-faith effort to identify historic properties of religious and cultural significance to Indian tribes. The Corps will ensure that consultation with Native American Tribes is initiated early with respect to the Project and continues throughout the Section 106 process.

B. In accordance with the guidance provided in National Register Bulletin 38 and Preservation Brief 36, the Corps will seek comments from all potentially interested Native American interested parties and Tribes in making determinations of NRHP eligibility for any Traditional Cultural Properties.

C. TCPs and Cultural Landscapes will be defined in accordance with Bulletin 38 and Preservation Brief 36, and in accordance with guidance in *Native American Traditional Cultural Landscapes and the Section 106 Review Process: Questions and Answers* and *Native American Traditional Cultural Landscapes Action Plan.* Review of documentation will be consistent with **Stipulation I**.

D. Pursuant to 36 C.F.R. § 800.6(c)(2)-(3), the Corps will consider requests by Native American Tribes to become Concurring Parties to this Agreement. In accordance with **Stipulation XV**, Concurring Parties to this Agreement will receive documents produced under this Agreement, as appropriate.

E. Native American Tribes may choose not to sign this Agreement as a Concurring Party. Native American Tribes and individuals not acting as Concurring Parties to the Agreement will be contacted when the Corps identifies potential interest in a specific phase or action of the project or is contacted by a Native American individual or Native American Tribe expressing interest in the Project. The Corps will make a good faith effort to identify any Native American organizations and individuals with interest in the proposed treatment of Historic Properties. The Corps will contact each identified organization and individual by mail, inviting them to consult about the specific treatment of Historic Properties. If interest from the contacted parties is received by the Corps, the Corps will proceed to consult in accordance with **Stipulation XI.** Further consultation may also be carried out through either letters of notification, public meetings, site visits, and/or other method requested by a Native American interested party and Tribe. Where consultation is carried out outside of the normal Section 106 process, the Corps will clearly state to the Tribes that the NEPA process includes compliance with Section 106. Failure of any contacted group to comment within thirty (30) calendar days will not preclude the Corps from proceeding with the Project.

F. The Corps will make a reasonable and good-faith effort to ensure that Native American Tribes, acting as either Concurring Parties or those expressing interest in the project, will be invited to participate in the development and implementation of the terms of this Agreement, including, but not limited to, the identification and definition of the APE, identification of potential Historic Properties, determinations of eligibility, findings of effect, the resolution of adverse effect for those Historic Properties and consultation on confidentiality issues under **Stipulation XV**. Review periods will be consistent with **Stipulation I** except in situations involving unanticipated discoveries and treatment, which will follow the review schedules of **Stipulation IX**. The Corps will ensure that all interested Native American reviewers will receive copies of all final survey and evaluation reports

XII. TRIBAL CONSULTATION AND TREATMENT OF HUMAN REMAINS

There is no federally owned property within the designated APE, therefore NAGPRA would not apply. The CVFPB and landowner shall ensure that Native American human remains and grave goods encountered during the Undertaking that are located on state or private land are treated in accordance with the requirements in California State Health and Safety Code, Section 7050.5 and Public Resources Code 5097.98. If Native American human remains are encountered within the context of a National Register eligible archaeological site, a clear means of identifying those remains and grave goods will be described in the HPMP. Any procedures described in the HPTP regarding the handling or treatment of human remains will be coordinated with the landowner to ensure that they are consistent with Public Resources Code 5097.98. In the event that any Native American human remains or associated funerary items are identified, the Most Likely Descendant (MLD), as identified by the Native American Heritage Commission, shall be invited to advise the Yolo County Flood Control and Water Conservation and landowner in the treatment of any Native American human remains and items associated with Native American burials.

XIII. PUBLIC CONSULTATION AND PUBLIC NOTICE

A. Pursuant to 36 C.F.R. § 800.6(c) (2)-(3), the Corps will consider requests by interested parties to become Concurring Parties to this Agreement.

B. The Corps will invite the interested public to provide input on the identification, evaluation, and proposed treatment of Historic Properties. This may be carried out through either letters of notification, public meetings, and/or site visits. Where consultation is carried out outside of the normal Section 106 process, the Corps will clearly state to the public that the NEPA process includes compliance with Section 106. The Corps will ensure that any comments received from members of the public are taken under consideration and incorporated where appropriate. Review periods will be consistent with **Stipulation I**. In seeking input from the interested public, locations of Historic Properties will be handled in accordance with **Stipulation XV**. .

XIV. REPORTING AND CONFIDENTIALITY

The Corps will distribute technical reports and data pertaining to the inventory, evaluation, and treatment of effects on Historic Properties to SHPO, Concurring Parties to this Agreement, Native American Tribes, and other members of the public unless parties have indicated through consultation that they do not want to receive a report or data. Information regarding the nature and location of the archaeological sites and any other potential Historic Properties discussed in this Agreement will be kept confidential and limited to appropriate Corps personnel, Corps contractors, Native American tribes, the SHPO, and those parties involved in planning, reviewing and implementing this Agreement to the extent allowed by Section 304 of the NHPA (54 U.S.C. § 307103).

XV. DISPUTE RESOLUTION

Should any Signatory Party to this Agreement object in writing to any action proposed or carried out pursuant to this Agreement, the Corps will immediately notify the SHPO and the Concurring Parties of the objection, invite their participation, and proceed to consult with the objecting party for a period of time, not to exceed thirty (30) calendar days, to resolve the objection. If the objection is resolved through consultation, the Corps may authorize the disputed action to proceed in accordance with the terms of such resolution. If the Corps determines that the objection cannot be resolved, the Corps will notify Signatory and Concurring Parties and forward all documentation relevant to the dispute to the ACHP. Within forty-five calendar days after receipt of all pertinent documentation, the ACHP will either:

1. Advise the Corps that the ACHP concurs in the Corps' proposed response to the objection, whereupon the Corps will respond to the objection accordingly; or

2. Provide the Corps with recommendations, which the Corps will consider in reaching a final decision regarding the objection; or

3. Notify the Corps that the ACHP will comment in accordance with the requirements of Section 106 of the NHPA, and proceed to comment. Any ACHP comment provided in response will be considered by the Corps, pursuant to the requirements of Section 106 of the NHPA.

A. Should the ACHP not exercise one of the options under **Stipulation XV A** within forty-five (45) calendar days after receipt of all submitted pertinent documentation, the Corps' responsibilities under Section 106 of the NHPA are fulfilled upon implementation of the proposed response to the objection.

B. The Corps will consider any ACHP recommendation or comment and any comments from the SHPO to this Agreement provided in accordance with this stipulation with reference only to the subject of the objection; the Corps' responsibility to carry out all actions under this Agreement that are not the subjects of the objection will remain unchanged.

C. The Corps will provide the Signatories and Concurring Parties with a written copy of its final decision regarding any objection addressed pursuant to **Stipulation XV A.**

D. At any time during implementation of the measures stipulated in this Agreement should an objection pertaining to the Agreement be raised by a Concurring Party, Native American Tribe, or a member of the public, the Corps will notify the Signatory and Concurring Parties and take the objection under consideration, consulting with the objecting party and, should the objecting party request, any of the Signatory and Concurring Parties to this Agreement, for no longer than fifteen (15) calendar days. The Corps will consider the objection, and in reaching its decision, will consider all comments provided by the other parties. Within fifteen (15) calendar days following closure of the comment period, the Corps will render a decision regarding the objection and respond to the objecting party. The Corps will promptly notify the other parties of its decision in writing, including a copy of the response to the objecting party. The Corps' decision regarding resolution of the objection will be final. Following issuance of its final decision, the Corps may authorize the action that was the subject of the dispute to proceed in accordance with the terms of that decision. The Corps' responsibility to carry out all other actions under this Agreement will remain unchanged.

XVI. NOTICES

A. All notices, demands, requests, consents, approvals or communications from all parties to this Agreement to other parties to this Agreement will be personally delivered, sent by United States Mail, or emailed. For communications sent by United States Mail, all parties will be considered in receipt of the materials five (5) calendar days after deposit in the United States mail, certified and postage prepaid, return receipt requested. For communications sent by electronic mail, all parties will be considered in receipt of the materials the day after sending.

B. Signatory and Concurring Parties agree to accept facsimiles or copies of signed documents and agree to rely upon such facsimiles or copies as if they bore original signatures.

XVII. AMENDMENT, REVIEW, TERMINATION AND DURATION

A. Amendment: Any Signatory Party to this Agreement may propose that the Agreement be amended, including but not limited to extending the duration of the Agreement, whereupon the Signatories will consult for 30 days to consider such amendment. The Agreement may be amended only upon written concurrence of all Signatories.

All attachments to this Agreement, and other instruments prepared pursuant to this agreement including, but not limited to, the Project's description, initial inventory report and maps of the APE, the HPMP, HPTPs, and monitoring and discovery plans, may be individually revised or updated through consultation consistent with **Stipulation I** and agreement in writing of the Signatories without requiring amendment of this Agreement, unless the Signatories through such consultation decide otherwise. In accordance with **Stipulations X and XII,** the Concurring Parties, interested Native American Tribes, and interested members of the public, will receive amendments to the Project's description, initial inventory report and maps of the APE, the HPMP, HPTPs, and monitoring and discovery plans, as appropriate, and copies of any amendment(s) to the Agreement.

B. Termination: Only the Signatories may terminate this Agreement. If this Agreement is not amended as provided for in **Stipulation XVII A,** or if any Signatory proposes termination of this Agreement for other reasons, the Signatory proposing termination will notify the other Signatory in writing, explain the reasons for proposing termination, and consult with the other Signatory to seek alternatives to termination, within thirty (30) calendar days of the notification.

Should such consultation result in an agreement on an alternative to termination, the Signatories will proceed in accordance with that agreement.

Should such consultation fail, the Signatory proposing termination may terminate this Agreement by promptly notifying the other Signatory and Concurring Parties in writing.

Beginning with the date of termination, the Corps will ensure that until and unless a new agreement is executed for the actions covered by this Agreement, such undertakings will be reviewed individually in accordance with 36 C.F.R. § 800.4-800.6.

C. Duration: This Agreement will remain in effect for five (5) years from the date of execution unless amended in accordance with **Stipulation XVII.**

XVIII. ANNUAL REPORTING

At the end of every calendar year following the execution of this Agreement, the Corps shall provide all parties to this Agreement a summary report detailing work carried out pursuant to its terms, if any. Such report shall describe progress made implementing the terms of the Agreement as well as include any scheduling changes proposed, any problems encountered, and any disputes and objections received in the Corps' efforts to carry out the terms of this Agreement. Any Signatory party may request to meet with the other Signatories to discuss implementation of this Agreement.

XIX. EFFECTIVE DATE

This Agreement will take effect on the date that it has been fully executed by the Corps and the SHPO.

EXECUTION of this Agreement by the Corps and the SHPO, its transmittal to the ACHP, and subsequent implementation of its terms evidence that the Corps has afforded the ACHP an opportunity to comment on the undertaking and its effects on Historic Properties, that the Corps has taken into account the effects of the undertaking on Historic Properties, and that the Corps has satisfied its responsibilities under Section 106 of the NHPA and applicable implementing regulations for all aspects of the undertaking.

PROGRAMMATIC AGREEMENT BETWEEN THE U.S. ARMY CORPS OF ENGINEERS AND THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER REGARDING THE LOWER CACHE CREEK FEASIBILITY STUDY PROJECT, YOLO COUNTY, CALIFORNIA

SIGNATORIES TO THIS AGREEMENT:

U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT

BY:____DATE :___________
James J. Handura, Colonel, U.S. Army Corps of Engineers, District Commander

CALIFORNIA STATE HISTORIC PRESERVATION OFFICER

BY:____DATE:____________
Julianne Polanco, State Historic Preservation Officer

PROGRAMMATIC AGREEMENT BETWEEN THE U.S. ARMY CORPS OF ENGINEERS AND THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER REGARDING THE LOWER CACHE CREEK FEASIBILITY STUDY PROJECT, YOLO COUNTY, CALIFORNIA

CONCURRING PARTY:

THE CENTRAL VALLEY FLOOD PROTECTION BOARD

BY______________________________________DATE_______

PROGRAMMATIC AGREEMENT BETWEEN THE U.S. ARMY CORPS OF ENGINEERS AND THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER REGARDING THE LOWER CACHE CREEK FEASIBILITY STUDY PROJECT, YOLO COUNTY, CALIFORNIA

CONCURRING PARTY:

YOLO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

BY____________________________________DATE_________

PROGRAMMATIC AGREEMENT BETWEEN THE U.S. ARMY CORPS OF ENGINEERS AND THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER REGARDING THE LOWER CACHE CREEK FEASIBILITY STUDY PROJECT, YOLO COUNTY, CALIFORNIA

CONCURRING PARTY:

YOCHA DEHE WINTUN NATION

BY____DATE________________

ATTACHMENT 1

PROJECT DESCRIPTION: MEASURES AND AREAS

Introduction

This Programmatic Agreement (Agreement) is designed to support a Federal action as described in the following paragraphs, specifically an undertaking that has been formulated by a multi-year feasibility study as described below. When authorized and funded, the undertaking would modify flood control structures. The actions comprising the undertaking are described as of August 15, 2019.

Background

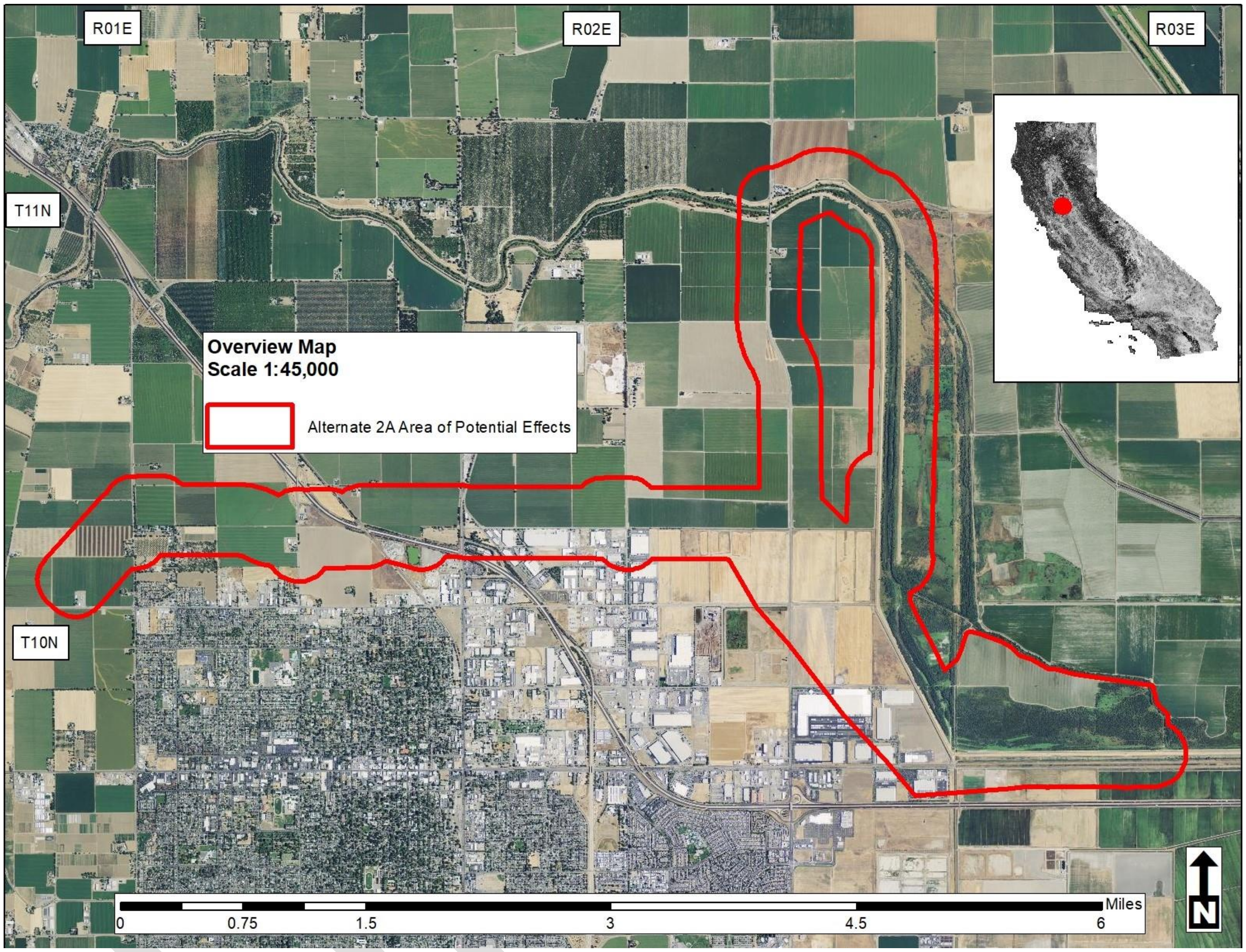
Cache Creek originates in Northern California's Coastal Range before flowing into the state's Central Valley and discharging into the Sacramento River. The creek meanders through highly productive farmland and passes just north of the City of Woodland (pop. 56,000) and south of the town of Yolo (pop. 450). An extensive flood risk management system exists in the study area, including 19 miles of levees along the banks of Lower Cache Creek; the Yolo Bypass, which routes water from the Sacramento River away from the City of Sacramento; the Cache Creek Settling Basin, built to prevent sediment from impacting the hydraulic capacity of the Yolo Bypass; the Colusa Basin Drain; and numerous other Federal and non-Federal levees.

Lower Cache Creek has a history of flooding. Four major flood periods have been documented for the Cache Creek basin during the last half of the 20th century, and 20 severe floods have occurred since 1900. The existing Lower Cache Creek levees were built as one part of a basin-wide flood protection system that was to include the construction of an upstream reservoir, Wilson Valley Dam. The dam, however, was not constructed due to seismic and sedimentation concerns. In the absence of the dam that would have provided upstream flood regulation, the existing levee system leaves the City of Woodland, town of Yolo, and surrounding areas at risk of flood. The flooding that results from the overtopping or upstream flanking of the levees poses a risk to human life and safety in the City of Woodland, town of Yolo, and surrounding areas. Flooding also poses significant risk of economic damage to property. Interstate 5, a major economic artery and an evacuation route, passes through the Lower Cache Creek floodplain near the City of Woodland.

Project Location

The project is located in Yolo County, California, on the Lower Cache Creek floodplain west of the Yolo Bypass. Parts of the project are in GLO-platted lands in Township 10 North T10N), Range 1 East (R1E), Section 25; T10N, R2E, Sections 13, 19, 20, 21, 22, 23, 24, 25, 26, 27, 29, 30, 35, and 36; and T10N, R2E, Sections 30, 31 and 32, Mt. Diablo Meridian. However, most of the project is in land within the Rancho Rio Jesus Maria Mexican land grant area of 1843.

Figure 1. Area of Potential Effects, with Construction Element Footprints.



General

Alternative 2A consists, overall, of improving existing levees and constructing a new levee north of the city of Woodland (City) in order to protect the City from flooding emanating from Lower Cache Creek. The United States Army Corps of Engineers (USACE) determined the necessary height of the levee embankment north of the City and the capacity of the project features by modeling a range of flood flow magnitudes/return frequencies, and then estimating the cost and benefits for four incremental heights.

Modifications to Existing Levees / Cache Creek Settling Basin

Alternative 2A would rehabilitate a portion of the southern levee (Reach N) of the Cache Creek Settling Basin (CCSB) by constructing a 60-foot-deep cutoff wall through the levee (Figure 2) and the southwest levee (Reach O) of the CCSB by constructing a 45-foot-deep cutoff wall. Along with this cutoff wall installation, a 3,000-foot-long section of the west levee of the settling basin would be degraded to an elevation of 43 feet to accommodate a concrete weir with a height of approximately nine feet above existing adjacent grade (Figure 3). The weir would serve to accept floodwater emanating from Cache Creek west of the CCSB, and would prevent backflow from the CCSB to the west during smaller, more frequent flood events. Additionally, the southernmost 3,000-foot portion of the CCSB training levee would be degraded in order to improve the distribution of sediment within the basin before construction begins.[1] . The existing outlet weir on the east side of the CCSB would remain unchanged. Please note that all elevations are given in the North American Vertical Datum of 1988 (NAVD 88).

New Levees and Other Proposed Project Features

A new levee with a 20-foot-wide crest and a 30-foot-wide landside seepage berm would begin near the intersection of County Road 20 and County Road 98 and extend east to the CCSB. The alignment of the levee would generally follow the northern city limit line west of State Route 113 (SR 113) and Churchill Downs Avenue east of SR 113. The height of the new levee would vary from six feet near County Road 98 to 14 feet at its intersection with the existing west levee of the CCSB. Rock slope protection is proposed on the waterside slope of the new levee from County Road 101 east to the southern end of the proposed inlet weir near County Road 20.

A trapezoidal drainage channel with a design capacity of approximately 350 cubic feet per second (cfs) would be constructed north (waterward) of the new levee in Reaches P through S in order to capture smaller, more frequent events and discharge them to the CCSB, and also to provide the necessary fill material for the project. This drainage channel may vary in width during subsequent design phases in order to create a balanced earthwork for the project.

A total of four closure structures (gates that are assembled by operations and maintenance (OandM) personnel prior to the flood) would be constructed where the embankment crosses the Union Pacific Railroad (UPRR) tracks near Interstate 5 (I-5), the UPRR tracks west of SR 113, SR 113, and the UPRR tracks east of SR 113. Due to the limited distance between the closure structures, short sections of floodwall would be constructed to connect the closure structure at the I-5 crossing to the existing roadway embankment and to connect the closure structures at the SR 113 crossing and the adjacent UPRR crossing to the west.

Internal Drainage

Water impounded by the proposed levee and the west levee of the CCSB would be drained via proposed culverts into the CCSB and to the City's interior drainage system. A detention basin would be located at the downstream end of the proposed drainage channel along Reach P. The detention basin would include an east outlet and a south outlet. The east outlet would provide for gravity drainage into the CCSB and consist of three 60-inch diameter culverts fitted with flap gates. This would allow gravity flow from the detention basin into the CCSB after stages subside below the weir elevation, with reverse flow from the CCSB into the detention basin being prevented by the flap gates. The south outlet would consist of a set of three 60-inch diameter culverts fitted with sluice gates. The culverts would discharge to an existing ditch that terminates at a pump station owned and operated by the City. The sluice gates would control the discharge flow to the pump station until capacity was available to discharge the flows to the Yolo Bypass. The design and operation of these systems has not been fully developed yet, and will be optimized during later phases of the project.

Roadway improvements

The new levee would require the raising of County Road 98, County Road 99, County Road 101, and County Road 102. Culverts would be installed at each of these raised crossings, as well as under   SR 113 and the two UPRR crossings along the alignment. An existing railroad underpass at I-5 would be used to convey flood waters under the interstate. In order to prevent erosion due to high velocities in this area, those portions of the area found to have velocities of over five feet per second (fps) would be lined with concrete. This protection would be installed across the entire project footprint area where flood flows velocities exceed the five fps limit. This area includes the existing slopes of the I-5 roadway embankment, the slopes of the proposed Reach R and Reach S levees, the proposed channel (both bottom and slope), and the existing UPRR railway. See Figure 5 for a graphical representation of the approximate extents.

Summary of Improvements

Table 1 (below) summarizes the features and improvements discussed previously.

Table 1 – Project Feature Summary

Feature	Improvement Description	Applicable Reaches	Quantity
New Levee	New Levee with Seepage Berm	Q (Partial), R, S	3.9 Miles
New Levee with RSP	New Levee with Seepage Berm and Rock Slope Protection	P, Q (Partial)	1.7 Miles
Improve Existing Levee	Improve existing levee with cutoff wall	N, O	2.3 Miles
Drainage Channel	New drainage channel and culverts. Also serves as borrow source for levee fill.	P, Q, R, S	5.6 Miles
Elevated Roadways	Elevate Roadway over levee at CR98, CR99, CR101, and CR102	P, Q, R, S	4
Gated Roadway Closure Structure	Gate at SR 113	Q, R	1
Gated Railroad Closure Structures	Gate for Railroad at I-5, West of SR 113, East of SR 113	Q, R, S	3
Cache Creek Settling Basin Inlet Weir	Concrete Inlet Weir	CCSB Inlet Weir	3,000 Feet
Degrade Training Levee	Degrade 3,000 feet of Existing Cache Creek Settling Basin Training Levee	Training Levee	3,000 Feet
Detention Basin and Outlets	New Detention Basin and Outlets	P	1
Improve Existing Drainage Ditch	Utilize Existing drainage ditch from Detention Basin to City of Woodland Pump Station.	O	1 Mile

Footprint / ROW Needs

A fee title will be obtained for areas beneath the physical project features (i.e. embankment, seepage berm, drainage channel, etc.) and for the area fifteen feet beyond the toe of waterside features and twenty feet beyond the toe of landside features. A summary of the land uses impacted by the proposed project footprint and easements is included on Table 2 below.

Table 2 – Estimated ROW Needs

Land Use Type	Estimated Acreage
Agricultural	283.0
City’s Jurisdiction	1.4
Agricultural/Residential Low Density	3.6
Agricultural/Residential Medium Density	18.1
Other Public / ROW / Roadway	12.9
Total	**319.0**

Existing trees and encroachments will be removed to the extent necessary to facilitate construction of the project and to support long-term operation and maintenance.

It may be the case that some trees and other encroachments are not removed from the rights-of-way. These encroachments will be addressed on a case-by-case basis during final design of the project.

Residual Floodplain

The preliminary analysis performed by MBK Engineers, Inc. (MBK) for Alternative 2A in 2016 demonstrated that this alternative is estimated to increase the depth of flooding north of the proposed levee, east of SR 113 by as much as 6.5 feet for the 1/100 or 1% annual chance exceedance (ACE) flood event, and will increase the depth of flooding west of SR 113 by as much as two feet. Additionally, this alternative increases the flood depth on approximately 14 structures during a 1% ACE flood event. It is noted that the duration of residual flooding was not evaluated for this option.

Attachment 2
Recorded Resources within the Area of Potential Effects

A records and literature search was conducted on September 5, 2019 at the Northwest Information Center at Sonoma State University. Ten resources were located within a quarter mile of the area of potential effects (APE). The Cache Creek Levee, site CA-YOL-246H, is located on the north bank of Cache Creek. The levee segment is 11.81 miles long and is named Unit 1 of "Unit No. 126" in the 1961 Supplemental O and M Manual. The levee is approximately 10 feet high, 12 feet wide at the crown, and about 50 feet wide at the base. Both the water and landside of the levee is covered in riparian vegetation. The levee was constructed prior to 1938 and later modified to bring it up to USACE Flood Control Levee specifications. It was incorporated into the USACE Sacramento River Flood Control Project in 1943.

Site P-57-000751 is the Dinsdale Ranch located at the southwestern end of the APE. The Dinsdale Ranch was owned by John Dinsdale and Sofi Wallace Dinsdale. It was built c.l890s and operated as a 160+ acre beet sugar field. The Dinsdale Ranch sold its crops to the Spreckles processing plant in Yolo County. The ranch included all of the NE¼ of Sec. 35 and was sold in pieces beginning in 1978. The buyers included RC Collett and Carl Panatoni and Buzz Oats. RC Collett was a road construction firm, which used the ranch-proper for its office and equipment yard. The south side of the property, south of I-5, is part of the Bronze Star Retail Center, east of CR 102. Directly behind the Collett property are a motel and a fitness center. Directly across from the ranch was the grade for the Northern Electric RR, currently operating as the Sierra Northern RR (SERA). To the east of the Collett property is Mazda parts warehouse and the Walgreens Distribution Center, which was built over alkaline soil. The barn (still standing) and the home (razed c.late-1960s) were built in c.1890s.

Site P-57-000764 consists of the Woodland Racetrack, which is no longer in existence, was located on Kentucky Ave (previously named Racetrack Road). The entrance to the track was on the north side of then-Racetrack Road, at the intersection with College Street. When the racetrack closed and the SP tracks were relocated to East Street; the street was renamed Kentucky.

Site P-57-000847 consists of Adams Grain #1, a rice mill started c.1920s. It is located on the north side of the SERA RR tracks, bordering East Main Street at the northwest corner of CR 102.

Site P-57-000920 is the Pacific Rice Mill, a multi-dryer/silo facility, with both truck and train access. It is located just west of the California Northern RR tracks, at the northwest corner of Kentucky Avenue and North East Street.

Site P-57-000970 consists of the California-Pacific RR Route through Yolo County. The original route of the California-Pacific RR coursed through Yolo County, from Davisville (Davis) to Knight's Landing, with a spur running from Knight's Landing northeast to a currently defunct sugar beet farm. The tracks through Woodland were removed in 1872 and replaced on East Street, where they are currently owned and operated by the California-Northern RR.

Site P-57-000977 consists of the Central-Pacific RR Route thru Yolo County. The original route of the Central-Pacific RR coursed through Yolo County, from Davisville (Davis) to Woodland, with a spur running to Knight's Landing and another spur running northeast to a currently defunct sugar-beet farm. The original tracks through Woodland were removed in 1872 and replaced on East Street, where they are currently owned and operated by the California-Northern RR, under a long-term lease with the Union Pacific RR. A second set of rails went northwest from near the intersection of current-day Kentucky Avenue (CR 20 back in the 1800s and Racecourse Avenue near the early 1900s); across Kentucky Avenue; then across present-day I-5 (built c.1974). The line travels on the northwest side of old Hwy. 99 west towards the Yolo/Colusa County Line, just north of Dunnigan, CA. The line passes through the towns of Yolo and Zamora.

Site P-57-000986 consists of a wooden 19th Century "A" frame barn. The barn has a center door, flanked by an additional door and the upper overhang once held a boom. An ad for a Yuba City (Sutter County) water well drilling company covers the loft door. The barn is located on the west side of CR-98; north of West Kentucky Avenue/CR-20.

Site P-57-001095 consists of the Aoki Farm Fields. George Aoki and his family have farmed these fields since the 1950s. George was born April 11, 1925 and passed away July 1, 2008. The fields are located west of CR 16 between West Kentucky Ave and West Main Street.

Site P-57-001272 consists of the Northern Electric Railway Route. The Northern Electric Railway started at the Woodland Depot, located on the southweat corner of the intersection of 2nd Street and Main Street in c.1912. It remained operational until Halloween 1940. The building remained vacant until c.1960 when it was razed. In 1986, local businessman and County Supervisor Tom Stallard rebuilt a replica depot using the original blueprints. The tracks were moved c.1960 to a point just east of East and Main Streets, where the tracks are still operational. The Northern Electric was replaced by the Sacramento Northern in 1940. Sacramento Northern continued to haul passengers and freight to Sacramento until c.1960. The line was sold to Western Pacific, then to Union Pacific. In 1991, the Yolo Shortline restarted freight serve to West Sacramento. They also started the Sacramento River Train. In 2012, the Yolo Shortline merged with the Sierra Railroad and was renamed the SERA. The line still travels approximately 16-miles from Woodland to West Sacramento, but on an as needed basis.

Because virtually none of the study area has been systematically examined for historic or prehistoric resources due to real estate constraints, and because many of the structures have not been evaluated for the NRHP, a this Programmatic Agreement stipulates the steps that would be taken to be in compliance with Section 106 of the NHPA and 36 CFR 800.

Attachment 3
Standards and Guidelines for Historic Property Management Planning Documents

A. Historic Property Management Plan

At a minimum, the HPMP or its supporting materials will contain the following:

- Documentation of the APE and its segments, and description of how APE segments were determined.
- A Research Design that provides an historic context for property evaluation for eligibility to the National Register of Historic Places (NRHP). The Research Design will define research domains or historic themes applicable to the area, define characteristics of property types associated with historic themes, identify data gaps, and identify data requirements to address important research questions. The Research Design will consider the needs of Historic Property Treatment Plans (HPTP) and Evaluation Plans (EP) and should be readily adaptable for use in those documents without extensive adaptation.
- A summary of significant past investigation and management activities, and a list of associated products.
- A list of known properties, with their NRHP eligibility status indicated.
- A list of potential property types.
- Information about historic property types present or likely to be present.
- Discussion of the nature and source of how the Project affects resources.
- Further actions needed to identify, evaluate, and manage historic properties. General long term priorities will be identified.
- A process for integrating investigations of Traditional Cultural Properties, Historic Properties of Religious and Cultural Significance to Indian Tribes, and Traditional Cultural Landscapes with the archaeological and historical site identification and evaluation activities.
- Inventory and evaluation strategies for all potential historic property types. If the timing is right, the HPMP may include actual Inventory and Evaluation Plans.
- Historic property management and treatment strategies that might be used, consistent with the treatment/recovery plan principles described below. If the timing is right, the HPMP may include actual HPTPs.
- A plan to address the requirements of **Stipulation IX**.
- A plan to address how emergency management actions (such as responses during floods and follow-on levee rehabilitation) within the Project will be managed during the life of the Project.
- A process to update records to reflect new data developed during the course of the

Project.

- Any Standard Protection Plans or measures that will be employed to ensure effects to historic properties are avoided or minimized.
- A process for determining when and how to conduct peer review of Project investigation reports or educational products.
- A process for public outreach and education.
- General standards for field work, analysis, reporting, and site treatment.
- For a version of the HPMP that will be reviewed and approved by Corps higher authority, a complete and detailed cost estimate with proper funding allocations for all of the compliance actions proposed, including a schedule for implementation.

B. Historic Property Treatment Plans

HPTPs will be consistent with the HPMP and may incorporate by reference historic contexts, methods, procedures, and research designs from the HPMP, as appropriate. When incorporating portions of the HPMP by reference, the HPTP will at a minimum include the date of the HPMP and where the HPMP is available to be viewed. HPTPs will address, at a minimum:

- The historic properties, portions of historic properties, or multiple properties where treatment will be implemented;
- Any historic properties or portions of historic properties that will be destroyed or altered without treatment;
- If the property or properties are eligible under criteria A-D, a mitigation plan other than data recovery may be considered. These may include, but are not limited to HABS/HAER recording, oral history, historic markers, exhibits, interpretive brochures or publications.
- The methods to be used for managing and disseminating data, including a schedule;
- The proposed disposition and archiving of materials and records from data recovery and other methods, in accordance with **Stipulation X**;
- Proposed methods for disseminating results of all treatment work to cultural resources professionals and separately to the interested public;
- Specifications (including content and number of copies) for publication of brochures, pamphlets, reports, or other products;
- Proposed methods by which interested Native American Tribes and individuals, local governments, and other interested persons will be kept informed about the

implementation of the HPTP and afforded an opportunity to comment;

- A proposed schedule for submission of progress reports to the Corps, SHPO, Concurring Parties, Native American Tribes, and the ACHP, consistent with the Agreement;
- Methods and procedures for the recovery, analysis, treatment, and disposition of human remains, associated grave goods, and objects of cultural patrimony that reflect any concerns and/or conditions identified as a result of consultations between the Corps, State agency and any affected Native American Group (see **Stipulation XII)**;
- Qualifications of consultants employed to undertake the implementation of the HPTP, will meet, at minimum, those standards described in **Stipulation II**.

If the property or properties are eligible under criterion (D) and data recovery is selected, a Research Design must be prepared. Content would include, but not be limited to:

- A list and discussion of the property, or properties, or portions of properties where data recovery is to be carried out;
- A list and discussion of any property, or properties or portions of properties that will be destroyed with data recovery;
- The research questions to be addressed through data recovery, with an explanation of their relevance and importance;
- The field methods to be used, with an explanation of their relevance to the research questions;
- Identification of appropriate groups that may contribute to the analysis, such as Native American Tribes, other ethnic groups, or historic societies;

o

- Consistent with the "Recommended Approach for Consultation on Recovery of Significant Information from Archaeological Sites" (ACHP, May 18, 1999) and 36 C.F.R. § 800.6(b)
- All other HPTP content required above.

Avoidance of adverse effects on historic properties is the preferred treatment approach. The HPTP will discuss and justify the chosen approaches to the treatment of project historic properties and those treatment options considered, but rejected. If preservation of part or all of any historic properties is proposed, the treatment plan will include discussion of the following:

- Description of the area or portions of the historic properties to be preserved in-place, and an explanation of why those areas or portions of sites were chosen;
- Explanation of how the historic properties will be preserved in-place, including both legal and physical mechanism for such preservation;
- A plan for monitoring and assessing the effectiveness of mechanisms to preserve

the historic properties; and

- A plan for minimizing or mitigating future adverse effects on the historic properties, if preservation in-place mechanisms prove to be ineffective.

C. Standard Protection Plan

A Standard Protection Plan will include (but not be limited to):

- A clear description of the class or classes of resources covered; and
- The specific actions that the Corps will take to avoid or address adverse effects to those resources.

D. Evaluation Plan

An Evaluation Plan will include (but not be limited to):

- A historic context and Research Design (addressing relevant topics identified in specification **B** preceding), if the elements of the Research Design provided in the HPMP are not sufficient;
- Discussion of the categories of potentially eligible historic properties to which the plan will apply;
- Methods and techniques that would be used to determine the boundaries and data potential of the site;
- For archaeological testing, discussion of the sampling intensity, and rationale for exceeding four (4) cubic meters of soil or five percent (5%) of the surface of the site, along with a request for SHPO concurrence;
- Discussion of disposition of artifacts and materials retained for the study, in accordance with **Stipulation X;** and
- Analysis and reporting requirements and schedules.

Attachment 4
Historic Property Management Plan

(to be attached)

Attachment 5

Property Types Exempt from Evaluation

This attachment defines categories of properties that do not warrant evaluation pursuant to **Stipulation V B** of this Agreement. Only individuals meeting the Secretary of the Interior's Professional Qualification Standards pursuant to **Stipulation Il** of this agreement are authorized to determine whether properties meet the requirements of this attachment and are therefore exempt from evaluation and consultation with SHPO. Exempted properties may be documented, if documentation is warranted, at a level commensurate with the nature of the property (e.g., DPR 523 Primary Form, Location Map, memo). The Corps Cultural Resources staff will make any final determinations on level of documentation required under this agreement.

Exempt Property Type 1: Archaeological Property Types and Features

- Isolated prehistoric finds consisting of fewer than three items per 100 m^2
- Isolated historic finds consisting of fewer than three artifacts per 100 m^2 (several fragments from a single glass bottle, and similar vessels are to be counted as one artifact)
- Refuse scatters less than 50 years old; this includes scatters containing no material that can be dated with certainty as older than 50 years old
- Features less than 50 years old (those known to be less than 50 years old through map research, inscribed dates, etc.)
- Isolated refuse dumps and scatters over 50 years old that lack specific associations
- Isolated mining prospect pits
- Placer mining features with no associated structural remains or archaeological deposits
- Foundations and mapped locations of buildings or structures more than 50 years old with few or no associated artifacts or ecofacts, and with no potential for subsurface archaeological deposits

Exempt Property Type 2: Minor, Ubiquitous, or Fragmentary Infrastructure Elements

The following list does not apply to properties 50 years old or older that have been determined eligible for the NRHP. The list does not apply to properties determined to be contributing elements of larger historic properties such as districts or cultural landscapes.

Water Conveyance and Control Features

- Natural bodies of water providing a water source, conveyance, or drainage
- Modified natural waterways
- Concrete-lined canals less than 50 years old and fragments of abandoned canals

- Roadside drainage ditches and secondary agricultural ditches
- Small drainage tunnels
- Flood storage basins
- Reservoirs and artificial ponds
- Levees and weirs
- Gates, valves, pumps, and other flow control devices
- Pipelines and associated control devices
- Water supply and waste disposal systems
- Rip-rap

Recent Transportation or Pedestrian Facilities

- Railroad grades converted to other uses, such as roads, levees, or bike paths
- Bus shelters and benches
- Vista points and rest stops
- Bike paths, off-road vehicle trails, equestrian trails, and hiking trails
- Parking lots and driveways

Highway and Roadside Features

- Isolated segments of bypassed or abandoned roads
- Retaining walls
- Highway fencing, sound walls, guard rails, and barriers
- Drains and culverts, excluding culverts assigned a Caltrans bridge number
- Cattle crossing guards
- Roadside landscaping and associated irrigation systems
- Signs and reflectors
- Telecommunications services, including towers, poles, dishes, antennas, boxes, lines, cables, transformers, and transmission facilities
- Utility services, including towers, poles, boxes, pipes, lines, cables, and transformers
- Oil and gas pipelines and associated control devices

Adjacent Features

- Fences, walls, gates, and gateposts

- Isolated rock walls and stone fences
- Telephone booths, call boxes, mailboxes, and newspaper receptacles
- Fire hydrants and alarms
- Markers, monuments, signs, and billboards
- Fragments of bypassed or demolished bridges
- Temporary roadside structures, such as seasonal vendors' stands
- Pastures, fields, crops, and orchards
- Corrals, animal pens, and dog runs
- Open space, including parks and recreational facilities
- Building and structure ruins and foundations less than 50 years old

Movable or Minor Objects

- Movable vehicles
- Stationary vehicles less than 50 years old or moved within the last 50 years
- Agricultural, industrial and commercial equipment and machinery
- Sculpture, statuary, and decorative elements less than 50 years old or moved within the last 50 years

CORRESPONDENCE WITH THE NATURAL RESOURCE CONSERVATION DISTRICT

APPENDIX D

LOWER CACHE CREEK FEASIBILITY STUDY

Yolo County, CA

December 2019

United States Army Corps of Engineers
Sacramento District

Duey, Keleigh L CIV USARMY CESPK (USA)

From: Duey, Keleigh L CIV USARMY CESPK (USA)
Sent: Tuesday, July 9, 2019 11:11 AM
To: phil.hogan@ca.usda.gov
Subject: Lower Cache Creek Feasibility Study Form AD-1006
Attachments: Lower Cache Creek Feasibility Study Form AD-1006.pdf; LCCFS Project Footprint - Farmland Conversion.kmz

Hi Mr. Hogan,

I have attached Form AD-1006 for the conversion of farmland from the U.S. Army Corps of Engineers, Lower Cache Creek Feasibility Study proposed study footprint. The project would occur in the Woodland, CA area. It is a flood risk management project that involves construction of a new levee along the northern extent of the city limit in the City of Woodland and levee improvements along the west and south of the Cache Creek Settling Basin, operated by the state Department of Water Resources.

I have attached a kmz. The green lines are the entire project footprint, red polygons are staging areas (indirect conversion), and blue polygons are indirect conversions resulting from blocked access. Will this format work?

Thank you,

Keleigh Duey
Environmental Manager
U.S. Army Corps of Engineers
1325 J Street Sacramento, CA 95814
☎ 916.557.5131

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*		Date Of Land Evaluation Request	
Name of Project Lower Cache Creek Feasibility Study		Federal Agency Involved U.S. Army Corps of Engineers	
Proposed Land Use Levee Improvements / Flood Risk		County and State Yolo County, CA	
PART II *(To be completed by NRCS)*		Date Request Received By NRCS	Person Completing Form:
Does the site contain Prime, Unique, Statewide or Local Important Farmland? *(If no, the FPPA does not apply - do not complete additional parts of this form)*	YES ☐ NO ☐	Acres Irrigated	Average Farm Size
Major Crop(s)	Farmable Land In Govt. Jurisdiction Acres: %	Amount of Farmland As Defined in FPPA Acres: %	
Name of Land Evaluation System Used	Name of State or Local Site Assessment System	Date Land Evaluation Returned by NRCS	

		Alternative Site Rating			
PART III *(To be completed by Federal Agency)*		Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly		217			
B. Total Acres To Be Converted Indirectly		34.9			
C. Total Acres In Site		324			
PART IV *(To be completed by NRCS)* Land Evaluation Information					
A. Total Acres Prime And Unique Farmland					
B. Total Acres Statewide Important or Local Important Farmland					
C. Percentage Of Farmland in County Or Local Govt. Unit To Be Converted					
D. Percentage Of Farmland in Govt. Jurisdiction With Same Or Higher Relative Value					
PART V (To be completed by NRCS) Land Evaluation Criterion Relative Value of Farmland To Be Converted (Scale of 0 to 100 Points)					
PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(Criteria are explained in 7 CFR 658.5 b. For Corridor project use form NRCS-CPA-106)*	**Maximum Points**	Site A	Site B	Site C	Site D
1. Area In Non-urban Use	(15)				
2. Perimeter In Non-urban Use	(10)				
3. Percent Of Site Being Farmed	(20)				
4. Protection Provided By State and Local Government	(20)				
5. Distance From Urban Built-up Area	(15)				
6. Distance To Urban Support Services	(15)				
7. Size Of Present Farm Unit Compared To Average	(10)				
8. Creation Of Non-farmable Farmland	(10)				
9. Availability Of Farm Support Services	(5)				
10. On-Farm Investments	(20)				
11. Effects Of Conversion On Farm Support Services	(10)				
12. Compatibility With Existing Agricultural Use	(10)				
TOTAL SITE ASSESSMENT POINTS	160	0	0	0	0
PART VII ***(To be completed by Federal Agency)***					
Relative Value Of Farmland *(From Part V)*	100	0	0	0	0
Total Site Assessment *(From Part VI above or local site assessment)*	160	0	0	0	0
TOTAL POINTS ***(Total of above 2 lines)***	260	0	0	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? YES ☐ NO ☐

Reason For Selection:

Name of Federal agency representative completing this form: DUEY.KELEIGH.L.1534429912 Digitally signed by DUEY.KELEIGH.L.1534429912 Date: 2019.10.02 14:42:31 -07'00' | Date:

(See Instructions on reverse side) **Form AD-1006 (03-02)**

STEPS IN THE PROCESSING THE FARMLAND AND CONVERSION IMPACT RATING FORM

Step 1 - Federal agencies (or Federally funded projects) involved in proposed projects that may convert farmland, as defined in the Farmland Protection Policy Act (FPPA) to nonagricultural uses, will initially complete Parts I and III of the form. For Corridor type projects, the Federal agency shall use form NRCS-CPA-106 in place of form AD-1006. The Land Evaluation and Site Assessment (LESA) process may also be accessed by visiting the FPPA website, http://fppa.nrcs.usda.gov/lesa/.

Step 2 - Originator (Federal Agency) will send one original copy of the form together with appropriate scaled maps indicating location(s)of project site(s), to the Natural Resources Conservation Service (NRCS) local Field Office or USDA Service Center and retain a copy for their files. (NRCS has offices in most counties in the U.S. The USDA Office Information Locator may be found at http://offices.usda.gov/scripts/ndISAPI.dll/oip_public/USA_map, or the offices can usually be found in the Phone Book under U.S. Government, Department of Agriculture. A list of field offices is available from the NRCS State Conservationist and State Office in each State.)

Step 3 - NRCS will, within 10 working days after receipt of the completed form, make a determination as to whether the site(s) of the proposed project contains prime, unique, statewide or local important farmland. (When a site visit or land evaluation system design is needed, NRCS will respond within 30 working days.

Step 4 - For sites where farmland covered by the FPPA will be converted by the proposed project, NRCS will complete Parts II, IV and V of the form.

Step 5 - NRCS will return the original copy of the form to the Federal agency involved in the project, and retain a file copy for NRCS records.

Step 6 - The Federal agency involved in the proposed project will complete Parts VI and VII of the form and return the form with the final selected site to the servicing NRCS office.

Step 7 - The Federal agency providing financial or technical assistance to the proposed project will make a determination as to whether the proposed conversion is consistent with the FPPA.

INSTRUCTIONS FOR COMPLETING THE FARMLAND CONVERSION IMPACT RATING FORM

(For Federal Agency)

Part I: When completing the "County and State" questions, list all the local governments that are responsible for local land use controls where site(s) are to be evaluated.

Part III: When completing item B (Total Acres To Be Converted Indirectly), include the following:

1. Acres not being directly converted but that would no longer be capable of being farmed after the conversion, because the conversion would restrict access to them or other major change in the ability to use the land for agriculture.
2. Acres planned to receive services from an infrastructure project as indicated in the project justification (e.g. highways, utilities planned build out capacity) that will cause a direct conversion.

Part VI: Do not complete Part VI using the standard format if a State or Local site assessment is used. With local and NRCS assistance, use the local Land Evaluation and Site Assessment (LESA).

1. Assign the maximum points for each site assessment criterion as shown in § 658.5(b) of CFR. In cases of corridor-type project such as transportation, power line and flood control, criteria #5 and #6 will not apply and will, be weighted zero, however, criterion #8 will be weighed a maximum of 25 points and criterion #11 a maximum of 25 points.

2. Federal agencies may assign relative weights among the 12 site assessment criteria other than those shown on the FPPA rule after submitting individual agency FPPA policy for review and comment to NRCS. In all cases where other weights are assigned, relative adjustments must be made to maintain the maximum total points at 160. For project sites where the total points equal or exceed 160, consider alternative actions, as appropriate, that could reduce adverse impacts (e.g. Alternative Sites, Modifications or Mitigation).

Part VII: In computing the "Total Site Assessment Points" where a State or local site assessment is used and the total maximum number of points is other than 160, convert the site assessment points to a base of 160.
Example: if the Site Assessment maximum is 200 points, and the alternative Site "A" is rated 180 points:

$$\frac{\text{Total points assigned Site A}}{\text{Maximum points possible}} = \frac{180}{200} \text{ X } 160 = 144 \text{ points for Site A}$$

For assistance in completing this form or FPPA process, contact the local NRCS Field Office or USDA Service Center.

NRCS employees, consult the FPPA Manual and/or policy for additional instructions to complete the AD-1006 form.

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*		Date Of Land Evaluation Request 07/09/2019	
Name of Project Lower Cache Creek Feasibility Study		Federal Agency Involved U.S. Army Corps of Engineers	
Proposed Land Use Levee Improvements / Flood Risk		County and State Yolo County, CA	
PART II *(To be completed by NRCS)*		Date Request Received By NRCS: 07/09/2019	Person Completing Form: Peter Fahnestock
Does the site contain Prime, Unique, Statewide or Local Important Farmland? *(If no, the FPPA does not apply - do not complete additional parts of this form)*	YES ☑ NO ☐	Acres Irrigated 229,901	Average Farm Size 456
Major Crop(s) forage, truck, rice, wheat	Farmable Land In Govt. Jurisdiction Acres: 306,914 %: 47.0	Amount of Farmland As Defined in FPPA Acres: 352,555 %: 54.0	
Name of Land Evaluation System Used California Agricultural LESA	Name of State or Local Site Assessment System Storie	Date Land Evaluation Returned by NRCS 07/16/2019	

PART III *(To be completed by Federal Agency)*		Alternative Site Rating			
		Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly		217			
B. Total Acres To Be Converted Indirectly		34.9			
C. Total Acres In Site		324			
PART IV *(To be completed by NRCS)* Land Evaluation Information		Site A	Site B	Site C	Site D
A. Total Acres Prime And Unique Farmland		234.5			
B. Total Acres Statewide Important or Local Important Farmland		7.6			
C. Percentage Of Farmland in County Or Local Govt. Unit To Be Converted		0.082			
D. Percentage Of Farmland in Govt. Jurisdiction With Same Or Higher Relative Value		82.4			
PART V (To be completed by NRCS) Land Evaluation Criterion Relative Value of Farmland To Be Converted (Scale of 0 to 100 Points)		64			
PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(Criteria are explained in 7 CFR 658.5 b. For Corridor project use form NRCS-CPA-106)*	**Maximum Points**	Site A	Site B	Site C	Site D
1. Area In Non-urban Use	(15)				
2. Perimeter In Non-urban Use	(10)				
3. Percent Of Site Being Farmed	(20)				
4. Protection Provided By State and Local Government	(20)				
5. Distance From Urban Built-up Area	(15)				
6. Distance To Urban Support Services	(15)				
7. Size Of Present Farm Unit Compared To Average	(10)				
8. Creation Of Non-farmable Farmland	(10)				
9. Availability Of Farm Support Services	(5)				
10. On-Farm Investments	(20)				
11. Effects Of Conversion On Farm Support Services	(10)				
12. Compatibility With Existing Agricultural Use	(10)				
TOTAL SITE ASSESSMENT POINTS	160	0	0	0	0
PART VII ***(To be completed by Federal Agency)***					
Relative Value Of Farmland *(From Part V)*	100	64	0	0	0
Total Site Assessment *(From Part VI above or local site assessment)*	160	0	0	0	0
TOTAL POINTS ***(Total of above 2 lines)***	260	64	0	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? YES ☐ NO ☐

Reason For Selection:

Name of Federal agency representative completing this form:	Date:

(See Instructions on reverse side) **Form AD-1006 (03-02)**

Duey, Keleigh L CIV USARMY CESPK (USA)

From: Feit, Sheryl - NRCS, Davis, CA <sheryl.feit@usda.gov>
Sent: Thursday, August 1, 2019 10:54 AM
To: Duey, Keleigh L CIV USARMY CESPK (USA)
Cc: Hogan, Phil - NRCS, Woodland, CA; Rolfes, Tony - NRCS, Davis, CA
Subject: [Non-DoD Source] RE: Lower Cache Creek Feasibility Study Form AD-1006 Complete

Follow Up Flag: Follow up
Flag Status: Flagged

Hello Keleigh,

Since the project footprint is likely to change, you may need to either re-submit your original request w/the new area listed as an alternative, or submit a brand new request.

I have a meeting on Monday with our regional FPPA specialist, and will get clarification on how to proceed further.

Thanks for checking on this.

Sheryl

Sheryl R. Feit
NRI State Resource Inventory Coordinator USDA-Natural Resources Conservation Service
430 G Street
Davis, CA 95616
530-792-5660
sheryl.feit@ca.usda.gov
Blockedhttp://www.ca.nrcs.usda.gov

-----Original Message-----
From: Duey, Keleigh L CIV USARMY CESPK (USA) <keleigh.L.Duey@usace.army.mil>
Sent: Thursday, August 1, 2019 10:10 AM
To: Feit, Sheryl - NRCS, Davis, CA <sheryl.feit@usda.gov>
Cc: Houdeshell, Carrie-Ann - NRCS, Davis, CA <carrie-ann.houdeshell@usda.gov>; Hogan, Phil - NRCS, Woodland, CA <phil.hogan@usda.gov>; Fahnestock, Peter - NRCS, Victorville, CA <peter.fahnestock@usda.gov>
Subject: RE: Lower Cache Creek Feasibility Study Form AD-1006 Complete

Good morning Sheryl,

Just checking in on the status of the Lower Cache Creek Form AD-1006. Tomorrow will have been 2 weeks since I sent the complete form.

Am I awaiting any further action from you at this time? Or does this conclude compliance with FPPA? I imagine between the Draft EIS and Final EIS we will have to go through the process again, as the project footprint is likely to change.

Thank you,

Keleigh Duey

Environmental Manager
U.S. Army Corps of Engineers
1325 J Street Sacramento, CA 95814
☎ 916.557.5131

-----Original Message-----
From: Duey, Keleigh L CIV USARMY CESPK (USA)
Sent: Friday, July 19, 2019 3:40 PM
To: Feit, Sheryl - NRCS, Davis, CA <sheryl.feit@usda.gov>
Cc: Houdeshell, Carrie-Ann - NRCS, Davis, CA <carrie-ann.houdeshell@usda.gov>; Hogan, Phil - NRCS, Woodland, CA <phil.hogan@usda.gov>; Fahnestock, Peter - NRCS, Victorville, CA <peter.fahnestock@usda.gov>
Subject: Lower Cache Creek Feasibility Study Form AD-1006 Complete

Hi Sheryl,

I have attached the signed completed version of the form. I didn't see a signature box specifically so I made one.

Let me know if it needs adjustments. Thank you!

Keleigh Duey
Environmental Manager
U.S. Army Corps of Engineers
1325 J Street Sacramento, CA 95814
☎ 916.557.5131

-----Original Message-----
From: Feit, Sheryl - NRCS, Davis, CA [mailto:sheryl.feit@usda.gov]
Sent: Tuesday, July 16, 2019 10:29 AM
To: Duey, Keleigh L CIV USARMY CESPK (USA) <keleigh.L.Duey@usace.army.mil>
Cc: Houdeshell, Carrie-Ann - NRCS, Davis, CA <carrie-ann.houdeshell@usda.gov>; Hogan, Phil - NRCS, Woodland, CA <phil.hogan@usda.gov>; Fahnestock, Peter - NRCS, Victorville, CA <peter.fahnestock@usda.gov>
Subject: [Non-DoD Source] RE: Lower Cache Creek Feasibility Study Form AD-1006

HI Keleigh,

Please disregard the previous copy. The return date was incorrect. Attached is the corrected copy.

Let me know if you have any questions,

Sheryl

Sheryl R. Feit
NRI State Resource Inventory Coordinator USDA-Natural Resources Conservation Service
430 G Street
Davis, CA 95616
530-792-5660
sheryl.feit@ca.usda.gov
BlockedBlockedhttp://www.ca.nrcs.usda.gov

-----Original Message-----
From: Feit, Sheryl - NRCS, Davis, CA
Sent: Tuesday, July 16, 2019 10:20 AM
To: Duey, Keleigh L CIV USARMY CESPK (USA) <keleigh.L.Duey@usace.army.mil>
Cc: Houdeshell, Carrie-Ann - NRCS, Davis, CA <carrie-ann.houdeshell@usda.gov>; Hogan, Phil - NRCS, Woodland, CA <phil.hogan@usda.gov>; Fahnestock, Peter - NRCS, Victorville, CA <peter.fahnestock@usda.gov>
Subject: RE: Lower Cache Creek Feasibility Study Form AD-1006

Hello Keleigh,

Attached is the AD-1006 with the NRCS portion completed.

Would you please send us the final signed version once the selection section has been completed?

Thank you, and let us know if you have any questions.

Sheryl

Sheryl R. Feit
NRI State Resource Inventory Coordinator USDA-Natural Resources Conservation Service
430 G Street
Davis, CA 95616
530-792-5660
sheryl.feit@ca.usda.gov
BlockedBlockedhttp://www.ca.nrcs.usda.gov

-----Original Message-----
From: Duey, Keleigh L CIV USARMY CESPK (USA) <keleigh.L.Duey@usace.army.mil>
Sent: Wednesday, July 10, 2019 6:31 AM
To: Feit, Sheryl - NRCS, Davis, CA <sheryl.feit@usda.gov>
Cc: Houdeshell, Carrie-Ann - NRCS, Davis, CA <carrie-ann.houdeshell@usda.gov>; Hogan, Phil - NRCS, Woodland, CA <phil.hogan@usda.gov>
Subject: RE: Lower Cache Creek Feasibility Study Form AD-1006

Thank you Sheryl.

Keleigh Duey
Environmental Manager
U.S. Army Corps of Engineers
1325 J Street Sacramento, CA 95814
☎ 916.557.5131

-----Original Message-----
From: Feit, Sheryl - NRCS, Davis, CA [mailto:sheryl.feit@usda.gov]
Sent: Tuesday, July 9, 2019 4:01 PM
To: Duey, Keleigh L CIV USARMY CESPK (USA) <keleigh.L.Duey@usace.army.mil>

Cc: Houdeshell, Carrie-Ann - NRCS, Davis, CA <carrie-ann.houdeshell@usda.gov>; Hogan, Phil - NRCS, Woodland, CA <phil.hogan@usda.gov>
Subject: [Non-DoD Source] FW: Lower Cache Creek Feasibility Study Form AD-1006

Hello Keleigh,

We've received your request for evaluation of the Lower Cache Creek Feasibility Study and will be reviewing your submittals shortly.

I'll contact you if we need any further documentation.

Thank you,

Sheryl

Sheryl R. Feit
NRI State Resource Inventory Coordinator USDA-Natural Resources Conservation Service
430 G Street
Davis, CA 95616
530-792-5660
sheryl.feit@ca.usda.gov
BlockedBlockedBlockedhttp://www.ca.nrcs.usda.gov

-----Original Message-----
From: Hogan, Phil - NRCS, Woodland, CA
Sent: Tuesday, July 9, 2019 12:35 PM
To: Feit, Sheryl - NRCS, Davis, CA <sheryl.feit@usda.gov>
Subject: FW: Lower Cache Creek Feasibility Study Form AD-1006

Sheryl:

Attached is a request for an AD-1006 form from the Corps of Engineers for a flood protection project in Woodland.

Please let me know if you need anything else.

PHIL

-----Original Message-----
From: Duey, Keleigh L CIV USARMY CESPK (USA) <keleigh.L.Duey@usace.army.mil>
Sent: Tuesday, July 9, 2019 11:11 AM
To: Hogan, Phil - NRCS, Woodland, CA <phil.hogan@usda.gov>
Subject: Lower Cache Creek Feasibility Study Form AD-1006

Hi Mr. Hogan,

I have attached Form AD-1006 for the conversion of farmland from the U.S. Army Corps of Engineers, Lower Cache Creek Feasibility Study proposed study footprint. The project would occur in the Woodland, CA area. It is a flood risk management project that involves construction of a new levee along the northern extent of the city limit in the City of Woodland and levee improvements along the west and south of the Cache Creek Settling Basin, operated by the state Department of Water Resources.

I have attached a kmz. The green lines are the entire project footprint, red polygons are staging areas (indirect conversion), and blue polygons are indirect conversions resulting from blocked access. Will this format work?

Thank you,

Keleigh Duey
Environmental Manager
U.S. Army Corps of Engineers
1325 J Street Sacramento, CA 95814
☎ 916.557.5131

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*		Date Of Land Evaluation Request 07/09/2019	
Name of Project Lower Cache Creek Feasibility Study		Federal Agency Involved U.S. Army Corps of Engineers	
Proposed Land Use Levee Improvements / Flood Risk		County and State Yolo County, CA	
PART II *(To be completed by NRCS)*		Date Request Received By NRCS: 07/09/2019	Person Completing Form: Peter Fahnestock
Does the site contain Prime, Unique, Statewide or Local Important Farmland? *(If no, the FPPA does not apply - do not complete additional parts of this form)*	YES ☑ NO ☐	Acres Irrigated 229,901	Average Farm Size 456
Major Crop(s) forage, truck, rice, wheat	Farmable Land In Govt. Jurisdiction Acres: 306,914 %: 47.0	Amount of Farmland As Defined in FPPA Acres: 352,555 %: 54.0	
Name of Land Evaluation System Used California Agricultural LESA	Name of State or Local Site Assessment System Storie	Date Land Evaluation Returned by NRCS 07/16/2019	

PART III *(To be completed by Federal Agency)*		Alternative Site Rating			
		Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly		217			
B. Total Acres To Be Converted Indirectly		34.9			
C. Total Acres In Site		324			
PART IV *(To be completed by NRCS)* Land Evaluation Information		Site A	Site B	Site C	Site D
A. Total Acres Prime And Unique Farmland		234.5			
B. Total Acres Statewide Important or Local Important Farmland		7.6			
C. Percentage Of Farmland in County Or Local Govt. Unit To Be Converted		0.082			
D. Percentage Of Farmland in Govt. Jurisdiction With Same Or Higher Relative Value		82.4			
PART V (To be completed by NRCS) Land Evaluation Criterion Relative Value of Farmland To Be Converted (Scale of 0 to 100 Points)		64			
PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(Criteria are explained in 7 CFR 658.5 b. For Corridor project use form NRCS-CPA-106)*	**Maximum Points**	Site A	Site B	Site C	Site D
1. Area In Non-urban Use	(15)	10			
2. Perimeter In Non-urban Use	(10)	10			
3. Percent Of Site Being Farmed	(20)	16			
4. Protection Provided By State and Local Government	(20)	20			
5. Distance From Urban Built-up Area	(15)	0			
6. Distance To Urban Support Services	(15)	0			
7. Size Of Present Farm Unit Compared To Average	(10)	4			
8. Creation Of Non-farmable Farmland	(10)	7			
9. Availability Of Farm Support Services	(5)	1			
10. On-Farm Investments	(20)	10			
11. Effects Of Conversion On Farm Support Services	(10)	1			
12. Compatibility With Existing Agricultural Use	(10)	0			
TOTAL SITE ASSESSMENT POINTS	160	79	0	0	0
PART VII ***(To be completed by Federal Agency)***					
Relative Value Of Farmland *(From Part V)*	100	64	0	0	0
Total Site Assessment *(From Part VI above or local site assessment)*	160	79	0	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	143	0	0	0

Site Selected: Site A	Date Of Selection February 27, 2019	Was A Local Site Assessment Used? YES ☑ NO ☐

Reason For Selection:

Site A is the only alternative being considered in the Lower Cache Creek Feasibility Study Supplemental EIS and Feasibility Report, as all other alternatives were screened out as infeasible due to the low cost benefit ratios or substantial environmental impacts.

Name of Federal agency representative completing this form: Keleigh Duey Kel.D Date: 7-19-2019

(See Instructions on reverse side) **Form AD-1006 (03-02)**

TRANSPORTATION CALCULATIONS

APPENDIX E

LOWER CACHE CREEK FEASIBILITY STUDY

Yolo County, CA

December 2019

United States Army Corps of Engineers
Sacramento District

Year 1 5 months, 26 working days per month										
	Project Phase	Duration of phase, months	Duration of phase, days	Quantity of import material	Quantiy of off-site export material	Material tranported per day	Vehicle trips per day	Round-trip mileage	Vehicle miles traveled per day	Notes
Soil Transport	Grubbing/Land Clearing	1	26	0	182170	7006.538462	351	22	7722	
	Grading/Excavation	3	78	288089	0	3693.448718	185	6	1110	Grading and excavation of soils not included in Year 1 totals; assumed transportation within project footprint
	Rock Placement	0.5	13	15000	0	1153.846154	58	20	1160	
	Paving	0.5	13	37559	0	2889.153846	145	10	1450	
Asphalt Transport	Grubbing/Land Clearing	1	26	0	14	0.538461538	1	22	22	
	Grading/Excavation	3	78	0	0	0	0	6	0	
	Rock Placement	0.5	13	0	0	0	0	20	0	
	Paving	0.5	13	54323	0	4178.692308	209	10	2090	
Worker Commute	Grubbing/Land Clearing	1	26				19	40	760	
	Grading/Excavation	3	78				50	40	2000	
	Rock Placement	0.5	13				19	40	760	
	Paving	0.5	13				15	40	600	
Water Truck	Grubbing/Land Clearing	1	26				20	8	160	4 water trucks
	Grading/Excavation	3	78				20	8	160	4 water trucks
	Rock Placement	0.5	13				10	8	80	2 water trucks
	Paving	0.5	13				10	8	80	2 water trucks

Year 1 Totals		
	Trips per day	VMT per day
Grubbing/Land Clearing	391	8664
Grading/Excavation*	70	2160
Rock placement	87	2000
Paving	379	4220

Year 2 5 months, 26 working days per month										
	Project Phase	Duration of phase, months	Duration of phase, days	Quantity of import material	Quantiy of export material (off-site only)	Material tranported per day	Vehicle trips per day	Round-trip mileage	Vehicle miles traveled per day	Notes
Soil	Grubbing/Land Clearing	1	26	0	55348	2128.769231	107	22	2354	
	Grading/Excavation	3.5	91	66310	0	728.6813187	37	6	222	Grading and excavation of soils not included in Year 2 totals; assumed transportation within project footprint
	Rock Placement	0	0	0	0	0	0	20	0	
	Paving	0.5	13	34962	506	2728.307692	137	10	1370	
Asphalt Transport	Grubbing/Land Clearing	1	26	0	11	0.423076923	1	22	22	
	Grading/Excavation	3.5	91	0	0	0	0	6	0	
	Rock Placement	0	0	0	0	0	0	20	0	
	Paving	0.5	13	308	0	23.69230769	2	10	20	
Worker Commute	Grubbing/Land Clearing	1	26				19	40	760	
	Grading/Excavation	3.5	91				50	40	2000	
	Rock Placement	0	0				0	40	0	
	Paving	0.5	13				15	40	600	
Water Truck	Grubbing/Land Clearing	1	26				35	8	280	7 water trucks
	Grading/Excavation	3.5	91				35	8	280	7 water trucks
	Rock Placement	0	0				0	8	0	
	Paving	0.5	13				10	8	80	2 water trucks

Year 2 Totals		
	Trips per day	VMT per day
Grubbing/Land Clearing	162	3416
Grading/Excavation*	85	2280
Rock placement	0	0
Paving	164	2070

AIR QUALITY CALCULATIONS

APPENDIX F

LOWER CACHE CREEK FEASIBILITY STUDY

Yolo County, CA

December 2019

United States Army Corps of Engineers
Sacramento District

Road Construction Emissions Model **Version 9.0.0**

Data Entry Worksheet

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells D10 through D24, E28 through G35, and D38 through D41 for all project types.
Please use "Clear Data Input & User Overrides" button first before changing the Project Type or begin a new project.

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Input Type

Project Name	LCCSB, Alt 2A, Year 1	
Construction Start Year	2023	Enter a Year between 2014 and 2040 (inclusive)
Project Type For 4: Other Linear Project Type, please provide project specific off-road equipment population and vehicle trip data	4	1) New Road Construction : Project to build a roadway from bare ground, which generally requires more site preparation than widening an existing roadway 2) Road Widening : Project to add a new lane to an existing roadway 3) Bridge/Overpass Construction : Project to build an elevated roadway, which generally requires some different equipment than a new roadway, such as a crane 4) Other Linear Project Type: Non-roadway project such as a pipeline, transmission line, or levee construction
Project Construction Time	5.00	months
Working Days per Month	26.00	days (assume 22 if unknown)
Predominant Soil/Site Type: Enter 1, 2, or 3 (for project within "Sacramento County", follow soil type selection instructions in cells E18 to E20 otherwise see instructions provided in cells J18 to J22)	2	1) Sand Gravel : Use for quaternary deposits (Delta/West County) 2) Weathered Rock-Earth : Use for Laguna formation (Jackson Highway area) or the Ione formation (Scott Road, Rancho Murieta) 3) Blasted Rock : Use for Salt Springs Slate or Copper Hill Volcanics (Folsom South of Highway 50, Rancho Murieta)
Project Length	3.29	miles
Total Project Area	65.42	acres
Maximum Area Disturbed/Day	16.36	acres
Water Trucks Used?	1	1. Yes 2. No

Please note that the soil type instructions provided in cells E18 to E20 are specific to Sacramento County. Maps available from the California Geologic Survey (see weblink below) can be used to determine soil type outside Sacramento County.

http://www.conservation.ca.gov/cgs/information/geologic_mapping/Pages/googlemaps.aspx#regionalseries

Material Hauling Quantity Input

Material Type	Phase	Haul Truck Capacity (yd^3) (assume 20 if unknown)	Import Volume (yd^3/day)	Export Volume (yd^3/day)
Soil	Grubbing/Land Clearing	20.00		1401.31
	Grading/Excavation	20.00	2216.07	5335.08
	Drainage/Utilities/Sub-Grade	20.00	57.69	
	Paving	20.00	288.92	
Asphalt	Grubbing/Land Clearing	20.00		0.11
	Grading/Excavation	20.00		1.98
	Drainage/Utilities/Sub-Grade			
	Paving	20.00	417.87	

Mitigation Options

On-road Fleet Emissions Mitigation		Select "2010 and Newer On-road Vehicles Fleet" option when the on-road heavy-duty truck fleet for the project will be limited to vehicles of model year 2010 or newer
Off-road Equipment Emissions Mitigation		Select "20% NOx and 45% Exhaust PM reduction" option if the project will be required to use a lower emitting off-road construction fleet. The SMAQMD Construction Mitigation Calculator can be used to confirm compliance with this mitigation measure (http://www.airquality.org/Businesses/CEQA-Land-Use-Planning/Mitigation). Select "Tier 4 Equipment" option if some or all off-road equipment used for the project meets CARB Tier 4 Standard

The remaining sections of this sheet contain areas that require modification when 'Other Project Type' is selected.

Note: The program's estimates of construction period phase length can be overridden in cells D50 through D53, and F50 through F53.

Construction Periods	User Override of Construction Months	Program Calculated Months	User Override of Phase Starting Date	Program Default Phase Starting Date
Grubbing/Land Clearing	1.00	0.50	1/1/2023	1/1/2023
Grading/Excavation	3.00	2.25	2/1/2023	2/1/2023
Drainage/Utilities/Sub-Grade	0.50	1.50	5/4/2023	5/4/2023
Paving	0.50	0.75	5/20/2023	5/20/2023
Totals (Months)		5		

Note: Soil Hauling emission default values can be overridden in cells D61 through D64, and F61 through F64.

Soil Hauling Emissions / **User Input**	User Override of Miles/Round Trip	Program Estimate of Miles/Round Trip	User Override of Truck Round Trips/Day	Default Values Round Trips/Day	Calculated Daily VMT
Miles/round trip: Grubbing/Land Clearing	22.00			71	1562.00
Miles/round trip: Grading/Excavation	6.00			378	2268.00
Miles/round trip: Drainage/Utilities/Sub-Grade	20.00			3	60.00
Miles/round trip: Paving	10.00			15	150.00

Emission Rates	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Grubbing/Land Clearing (grams/mile)	0.03	0.40	2.98	0.11	0.05	0.02	1,714.99	0.00	0.27	1,795.36
Grading/Excavation (grams/mile)	0.03	0.40	2.98	0.11	0.05	0.02	1,714.99	0.00	0.27	1,795.36
Draining/Utilities/Sub-Grade (grams/mile)	0.03	0.40	2.98	0.11	0.05	0.02	1,714.99	0.00	0.27	1,795.36
Paving (grams/mile)	0.03	0.40	2.98	0.11	0.05	0.02	1,714.99	0.00	0.27	1,795.36
Grubbing/Land Clearing (grams/trip)	0.00	0.00	4.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grading/Excavation (grams/trip)	0.00	0.00	4.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Draining/Utilities/Sub-Grade (grams/trip)	0.00	0.00	4.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving (grams/trip)	0.00	0.00	4.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hauling Emissions	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Pounds per day - Grubbing/Land Clearing	0.10	1.39	10.96	0.38	0.17	0.06	5,905.78	0.00	0.93	6,182.53
Tons per const. Period - Grubbing/Land Clearing	0.00	0.02	0.14	0.00	0.00	0.00	76.78	0.00	0.01	80.37
Pounds per day - Grading/Excavation	0.15	2.02	18.60	0.56	0.24	0.08	8,575.10	0.01	1.35	8,976.94
Tons per const. Period - Grading/Excavation	0.01	0.08	0.73	0.02	0.01	0.00	334.43	0.00	0.05	350.10
Pounds per day - Drainage/Utilities/Sub-Grade	0.00	0.05	0.42	0.01	0.01	0.00	226.85	0.00	0.04	237.49
Tons per const. Period - Drainage/Utilities/Sub-Grade	0.00	0.00	0.00	0.00	0.00	0.00	1.47	0.00	0.00	1.54
Pounds per day - Paving	0.01	0.13	1.13	0.04	0.02	0.01	567.14	0.00	0.09	593.71
Tons per const. Period - Paving	0.00	0.00	0.01	0.00	0.00	0.00	3.69	0.00	0.00	3.86
Total tons per construction project	0.01	0.10	0.88	0.03	0.01	0.00	416.36	0.00	0.07	435.88

Note: Asphalt Hauling emission default values can be overridden in cells D91 through D94, and F91 through F94.

Asphalt Hauling Emissions / **User Input**	User Override of Miles/Round Trip	Program Estimate of Miles/Round Trip	User Override of Truck Round Trips/Day	Default Values Round Trips/Day	Calculated Daily VMT
Miles/round trip: Grubbing/Land Clearing	22.00			1	22.00
Miles/round trip: Grading/Excavation	6.00			1	6.00
Miles/round trip: Drainage/Utilities/Sub-Grade	0.00			0	0.00
Miles/round trip: Paving	10.00			21	210.00

Emission Rates	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Grubbing/Land Clearing (grams/mile)	0.03	0.40	2.98	0.11	0.05	0.02	1,714.99	0.00	0.27	1,795.36
Grading/Excavation (grams/mile)	0.03	0.40	2.98	0.11	0.05	0.02	1,714.99	0.00	0.27	1,795.36
Draining/Utilities/Sub-Grade (grams/mile)	0.03	0.40	2.98	0.11	0.05	0.02	1,714.99	0.00	0.27	1,795.36
Paving (grams/mile)	0.03	0.40	2.98	0.11	0.05	0.02	1,714.99	0.00	0.27	1,795.36
Grubbing/Land Clearing (grams/trip)	0.00	0.00	4.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grading/Excavation (grams/trip)	0.00	0.00	4.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Draining/Utilities/Sub-Grade (grams/trip)	0.00	0.00	4.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving (grams/trip)	0.00	0.00	4.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emissions	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Pounds per day - Grubbing/Land Clearing	0.00	0.02	0.15	0.01	0.00	0.00	83.18	0.00	0.01	87.08
Tons per const. Period - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00	1.08	0.00	0.00	1.13
Pounds per day - Grading/Excavation	0.00	0.01	0.05	0.00	0.00	0.00	22.69	0.00	0.00	23.75
Tons per const. Period - Grading/Excavation	0.00	0.00	0.00	0.00	0.00	0.00	0.88	0.00	0.00	0.93
Pounds per day - Drainage/Utilities/Sub-Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Sub-Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Paving	0.01	0.19	1.59	0.05	0.02	0.01	793.99	0.00	0.12	831.20
Tons per const. Period - Paving	0.00	0.00	0.01	0.00	0.00	0.00	5.16	0.00	0.00	5.40
Total tons per construction project	0.00	0.00	0.01	0.00	0.00	0.00	7.13	0.00	0.00	7.46

Note: Worker commute default values can be overridden in cells D121 through D126.

Worker Commute Emissions User Input	User Override of Worker Commute Default Values	Default Values	Calculated Daily Trips	Calculated Daily VMT
Miles/ one-way trip	20			
One-way trips/day	2			
No. of employees: Grubbing/Land Clearing	19		38	760.00
No. of employees: Grading/Excavation	50		100	2,000.00
No. of employees: Drainage/Utilities/Sub-Grade	19		38	760.00
No. of employees: Paving	15		30	600.00

Emission Rates	ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Grubbing/Land Clearing (grams/mile)	0.02	0.91	0.07	0.05	0.02	0.00	317.66	0.00	0.01	319.68
Grading/Excavation (grams/mile)	0.02	0.91	0.07	0.05	0.02	0.00	317.66	0.00	0.01	319.68
Draining/Utilities/Sub-Grade (grams/mile)	0.02	0.91	0.07	0.05	0.02	0.00	317.66	0.00	0.01	319.68
Paving (grams/mile)	0.02	0.91	0.07	0.05	0.02	0.00	317.66	0.00	0.01	319.68
Grubbing/Land Clearing (grams/trip)	1.04	2.75	0.29	0.00	0.00	0.00	68.26	0.07	0.03	79.50
Grading/Excavation (grams/trip)	1.04	2.75	0.29	0.00	0.00	0.00	68.26	0.07	0.03	79.50
Draining/Utilities/Sub-Grade (grams/trip)	1.04	2.75	0.29	0.00	0.00	0.00	68.26	0.07	0.03	79.50
Paving (grams/trip)	1.04	2.75	0.29	0.00	0.00	0.00	68.26	0.07	0.03	79.50
Emissions	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Pounds per day - Grubbing/Land Clearing	0.11	1.76	0.15	0.08	0.03	0.01	537.96	0.01	0.01	542.29
Tons per const. Period - Grubbing/Land Clearing	0.00	0.02	0.00	0.00	0.00	0.00	6.99	0.00	0.00	7.05
Pounds per day - Grading/Excavation	0.30	4.63	0.38	0.20	0.08	0.01	1,415.69	0.03	0.04	1,427.09
Tons per const. Period - Grading/Excavation	0.01	0.18	0.01	0.01	0.00	0.00	55.21	0.00	0.00	55.66
Pounds per day - Drainage/Utilities/Sub-Grade	0.11	1.76	0.15	0.08	0.03	0.01	537.96	0.01	0.01	542.29
Tons per const. Period - Drainage/Utilities/Sub-Grade	0.00	0.01	0.00	0.00	0.00	0.00	3.50	0.00	0.00	3.52
Pounds per day - Paving	0.09	1.39	0.12	0.06	0.03	0.00	424.71	0.01	0.01	428.13
Tons per const. Period - Paving	0.00	0.01	0.00	0.00	0.00	0.00	2.76	0.00	0.00	2.78
Total tons per construction project	0.01	0.22	0.02	0.01	0.00	0.00	68.46	0.00	0.00	69.01

Note: Water Truck default values can be overridden in cells D153 through D156, I153 through I156, and F153 through F156.

Water Truck Emissions User Input	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Round Trips/Vehicle/Day	Default Values Round Trips/Vehicle/Day	Calculated Trips/day	User Override of Miles/Round Trip	Default Values Miles/Round Trip	Calculated Daily VMT
Grubbing/Land Clearing - Exhaust	4		5.00			8.00		160.00
Grading/Excavation - Exhaust	4		5.00			8.00		160.00
Drainage/Utilities/Subgrade	2		5.00			8.00		80.00
Paving	2		5.00			8.00		80.00

Emission Rates	ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Grubbing/Land Clearing (grams/mile)	0.03	0.40	2.98	0.11	0.05	0.02	1,714.99	0.00	0.27	1,795.36
Grading/Excavation (grams/mile)	0.03	0.40	2.98	0.11	0.05	0.02	1,714.99	0.00	0.27	1,795.36
Draining/Utilities/Sub-Grade (grams/mile)	0.03	0.40	2.98	0.11	0.05	0.02	1,714.99	0.00	0.27	1,795.36
Paving (grams/mile)	0.03	0.40	2.98	0.11	0.05	0.02	1,714.99	0.00	0.27	1,795.36
Grubbing/Land Clearing (grams/trip)	0.00	0.00	4.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grading/Excavation (grams/trip)	0.00	0.00	4.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Draining/Utilities/Sub-Grade (grams/trip)	0.00	0.00	4.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving (grams/trip)	0.00	0.00	4.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emissions	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Pounds per day - Grubbing/Land Clearing	0.01	0.14	1.25	0.04	0.02	0.01	604.95	0.00	0.10	633.29
Tons per const. Period - Grubbing/Land Clearing	0.00	0.00	0.02	0.00	0.00	0.00	7.86	0.00	0.00	8.23
Pounds per day - Grading/Excavation	0.01	0.14	1.25	0.04	0.02	0.01	604.95	0.00	0.10	633.29
Tons per const. Period - Grading/Excavation	0.00	0.01	0.05	0.00	0.00	0.00	23.59	0.00	0.00	24.70
Pounds per day - Drainage/Utilities/Sub-Grade	0.01	0.07	0.62	0.02	0.01	0.00	302.47	0.00	0.05	316.65
Tons per const. Period - Drainage/Utilities/Sub-Grade	0.00	0.00	0.00	0.00	0.00	0.00	1.97	0.00	0.00	2.06
Pounds per day - Paving	0.01	0.07	0.62	0.02	0.01	0.00	302.47	0.00	0.05	316.65
Tons per const. Period - Paving	0.00	0.00	0.00	0.00	0.00	0.00	1.97	0.00	0.00	2.06
Total tons per construction project	0.00	0.01	0.07	0.00	0.00	0.00	35.39	0.00	0.01	37.05

Note: Fugitive dust default values can be overridden in cells D183 through D185.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing	16.36		163.60	2.13	34.03	0.44
Fugitive Dust - Grading/Excavation	16.36		163.60	6.38	34.03	1.33
Fugitive Dust - Drainage/Utilities/Subgrade	16.36		163.60	1.06	34.03	0.22

Values in cells D195 through D228, D246 through D279, D297 through D330, and D348 through D381 are required when 'Other Project Type' is selected.

Off-Road Equipment Emissions

Grubbing/Land Clearing Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Mitigation Option Override of Default Equipment Tier (applicable only when "Tier 4 Mitigation" Option Selected)	Default Equipment Tier	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	SOx pounds/day	CO2 pounds/day	CH4 pounds/day	N2O pounds/day	CO2e pounds/day
0.00			Model Default Tier	Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Cranes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.00			Model Default Tier	Crawler Tractors	1.78	8.97	20.50	0.79	0.73	0.03	3,033.09	0.98	0.03	3,065.80
0.00			Model Default Tier	Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.00			Model Default Tier	Excavators	0.75	13.03	6.19	0.30	0.28	0.02	2,000.42	0.65	0.02	2,021.99
0.00			Model Default Tier	Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Graders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.00			Model Default Tier	Off-Highway Trucks	1.51	9.87	10.70	0.39	0.36	0.04	3,839.67	1.24	0.03	3,881.00
0.00			Model Default Tier	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Other General Industrial Equipm	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.00			Model Default Tier	Other Material Handling Equipm	0.77	11.27	6.29	0.34	0.31	0.02	1,679.03	0.54	0.02	1,697.13
0.00			Model Default Tier	Pavers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Rollers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.00			Model Default Tier	Scrapers	1.57	12.27	16.57	0.65	0.60	0.03	2,940.26	0.95	0.03	2,971.94
7.00			Model Default Tier	Signal Boards	0.40	2.11	2.52	0.10	0.10	0.00	345.20	0.04	0.00	346.95
0.00			Model Default Tier	Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.00			Model Default Tier	Tractors/Loaders/Backhoes	0.61	8.93	6.14	0.30	0.28	0.01	1,206.31	0.39	0.01	1,219.29
0.00			Model Default Tier	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Welders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

User-Defined Off-road Equipment If non-default vehicles are used, please provide information in 'Non-default Off-road Equipment' tab

Number of Vehicles	Equipment Tier	Type		ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	SOx pounds/day	CO2 pounds/day	CH4 pounds/day	N2O pounds/day	CO2e pounds/day
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

		ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Grubbing/Land Clearing	pounds per day	7.39	66.45	68.91	2.88	2.65	0.16	15,043.98	4.79	0.14	15,204.10
Grubbing/Land Clearing	tons per phase	0.10	0.86	0.90	0.04	0.03	0.00	195.57	0.06	0.00	197.65

Grading/Excavation	Default Number of Vehicles	Mitigation Option Override of Default Equipment Tier (applicable only when "Tier 4 Mitigation" Option Selected)	Default Equipment Tier	Type	ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Override of Default Number of Vehicles	*Program-estimate*				pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
0.00			Model Default Tier	Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.00			Model Default Tier	Cranes	1.05	5.50	11.45	0.48	0.44	0.02	1,676.46	0.54	0.02	1,694.53
4.00			Model Default Tier	Crawler Tractors	1.78	8.97	20.50	0.79	0.73	0.03	3,033.09	0.98	0.03	3,065.80
0.00			Model Default Tier	Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.00			Model Default Tier	Excavators	1.13	19.55	9.29	0.45	0.42	0.03	3,000.64	0.97	0.03	3,032.98
0.00			Model Default Tier	Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.00			Model Default Tier	Graders	1.53	6.77	18.61	0.60	0.55	0.03	2,563.42	0.83	0.02	2,591.04
0.00			Model Default Tier	Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.00			Model Default Tier	Off-Highway Trucks	3.02	19.73	21.41	0.77	0.71	0.08	7,679.34	2.48	0.07	7,762.00
0.00			Model Default Tier	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Other General Industrial Equipn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Other Material Handling Equipm	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Pavers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00			Model Default Tier	Rollers	0.77	9.26	8.05	0.44	0.41	0.01	1,270.54	0.41	0.01	1,284.23
0.00			Model Default Tier	Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00			Model Default Tier	Scrapers	3.93	30.69	41.42	1.62	1.49	0.08	7,350.65	2.38	0.07	7,429.86
7.00			Model Default Tier	Signal Boards	0.40	2.11	2.52	0.10	0.10	0.00	345.20	0.04	0.00	346.95
0.00			Model Default Tier	Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00			Model Default Tier	Tractors/Loaders/Backhoes	0.76	11.16	7.68	0.38	0.35	0.02	1,507.88	0.49	0.01	1,524.11
0.00			Model Default Tier	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Welders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

User-Defined Off-road Equipment If non-default vehicles are used, please provide information in 'Non-default Off-road Equipment' tab

Number of Vehicles	Equipment Tier	Type		ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
				pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

			ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Grading/Excavation	pounds per day		14.38	113.74	140.92	5.65	5.21	0.30	28,427.21	9.12	0.26	28,731.50
Grading/Excavation	tons per phase		0.56	4.44	5.50	0.22	0.20	0.01	1,108.66	0.36	0.01	1,120.53

Drainage/Utilities/Subgrade Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Mitigation Option Override of Default Equipment Tier (applicable only when "Tier 4 Mitigation" Option Selected)	Default Equipment Tier		ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	SOx pounds/day	CO2 pounds/day	CH4 pounds/day	N2O pounds/day	CO2e pounds/day
0.00			Model Default Tier	Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Cranes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00			Model Default Tier	Crawler Tractors	2.22	11.22	25.62	0.99	0.91	0.04	3,791.36	1.23	0.03	3,832.25
0.00			Model Default Tier	Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Excavators	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Graders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00			Model Default Tier	Off-Highway Trucks	0.50	3.29	3.57	0.13	0.12	0.01	1,279.89	0.41	0.01	1,293.67
0.00			Model Default Tier	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Other General Industrial Equipm	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Other Material Handling Equipm	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Pavers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Rollers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00			Model Default Tier	Tractors/Loaders/Backhoes	0.76	11.16	7.68	0.38	0.35	0.02	1,507.88	0.49	0.01	1,524.11
0.00			Model Default Tier	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Welders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

User-Defined Off-road Equipment If non-default vehicles are used, please provide information in 'Non-default Off-road Equipment' tab

Number of Vehicles	Equipment Tier	Type		ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	SOx pounds/day	CO2 pounds/day	CH4 pounds/day	N2O pounds/day	CO2e pounds/day
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

		ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Drainage/Utilities/Sub-Grade	pounds per day	3.48	25.66	36.87	1.50	1.38	0.07	6,579.13	2.13	0.06	6,650.02
Drainage/Utilities/Sub-Grade	tons per phase	0.02	0.17	0.24	0.01	0.01	0.00	42.76	0.01	0.00	43.23

Paving	Default Number of Vehicles	Mitigation Option Override of	Default		ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Override of Default Number of Vehicles	*Program-estimate*	Default Equipment Tier (applicable only when "Tier 4 Mitigation" Option Selected)	Equipment Tier	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
0.00			Model Default Tier	Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00			Model Default Tier	Cement and Mortar Mixers	0.06	0.31	0.37	0.01	0.01	0.00	50.52	0.01	0.00	50.77
1.00			Model Default Tier	Concrete/Industrial Saws	0.33	3.66	2.58	0.13	0.13	0.01	592.67	0.03	0.00	594.72
0.00			Model Default Tier	Cranes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00			Model Default Tier	Crawler Tractors	0.44	2.24	5.12	0.20	0.18	0.01	758.27	0.25	0.01	766.45
0.00			Model Default Tier	Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00			Model Default Tier	Excavators	0.19	3.26	1.55	0.08	0.07	0.01	500.11	0.16	0.00	505.50
0.00			Model Default Tier	Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00			Model Default Tier	Generator Sets	0.31	3.67	2.72	0.13	0.13	0.01	623.04	0.03	0.00	625.12
0.00			Model Default Tier	Graders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.00			Model Default Tier	Off-Highway Trucks	1.01	6.58	7.14	0.26	0.24	0.03	2,559.78	0.83	0.02	2,587.33
0.00			Model Default Tier	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
				0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
				0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Grubbing/Land Clearing			pounds per day	7.39	66.45	68.91	2.88	2.65	0.16	15,043.98	4.79	0.14	15,204.10
	Grubbing/Land Clearing			tons per phase	0.10	0.86	0.90	0.04	0.03	0.00	195.57	0.06	0.00	197.65
Grading/Excavation	Default Number of Vehicles	Override of	Default		ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Override of Default Number of Vehicles	*Program-estimate*	Default Equipment Tier (applicable only when "Tier 4 Mitigation" Option Selected)	Equipment Tier	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
0.00			Model Default Tier	Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.00			Model Default Tier	Cranes	1.05	5.50	11.45	0.48	0.44	0.02	1,676.46	0.54	0.02	1,694.53
4.00			Model Default Tier	Crawler Tractors	1.78	8.97	20.50	0.79	0.73	0.03	3,033.09	0.98	0.03	3,065.80
0.00			Model Default Tier	Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.00	0	Model Default Tier	Model Default Tier	Excavators	1.13	19.55	9.29	0.45	0.42	0.03	3,000.64	0.97	0.03	3,032.98
0.00		Model Default Tier	Model Default Tier	Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00 Number of Vehicles		Model Default Tier Equipment Tier	Model Default Tier	Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.00 0.00	0	Model Default Tier N/A	Model Default Tier	Graders	1.53	6.77	18.61	0.60	0.55	0.03	2,563.42	0.83	0.02	2,591.04
0.00 0.00		Model Default Tier N/A	Model Default Tier	Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.00 0.00		Model Default Tier N/A	Model Default Tier	Off-Highway Trucks	3.02	19.73	21.41	0.77	0.71	0.08	7,679.34	2.48	0.07	7,762.00
0.00 0.00		Model Default Tier N/A	Model Default Tier	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00 0.00		Model Default Tier N/A	Model Default Tier	Other General Industrial Equipm	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00 0.00		Model Default Tier N/A	Model Default Tier	Other Material Handling Equipm	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00 0.00		Model Default Tier N/A	Model Default Tier	Pavers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00		Model Default Tier	Model Default Tier	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00		Model Default Tier	Model Default Tier	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00		Model Default Tier	Model Default Tier	Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00		Model Default Tier	Model Default Tier	Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00	0	Model Default Tier	Model Default Tier	Rollers	0.77	9.26	8.05	0.44	0.41	0.01	1,270.54	0.41	0.01	1,284.23

Equipment default values for horsepower and hours/day can be overridden in cells D403 through D436 and F403 through F436.

Equipment	User Override of Horsepower	Default Values Horsepower	User Override of Hours/day	Default Values Hours/day
Aerial Lifts		63		8
Air Compressors		78		8
Bore/Drill Rigs		221		8
Cement and Mortar Mixers		9		8
Concrete/Industrial Saws		81		8
Cranes		231		8
Crawler Tractors		212		8
Crushing/Proc. Equipment		85		8
Excavators		158		8
Forklifts		89		8
Generator Sets		84		8
Graders		187		8
Off-Highway Tractors		124		8
Off-Highway Trucks		402		8
Other Construction Equipment		172		8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		168		8
Pavers		130		8
Paving Equipment		132		8
Plate Compactors		8		8
Pressure Washers		13		8
Pumps		84		8
Rollers		80		8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		247		8
Rubber Tired Loaders		203		8
Scrapers		367		8
Signal Boards		6		8
Skid Steer Loaders		65		8
Surfacing Equipment		263		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		97		8
Trenchers		78		8
Welders		46		8

END OF DATA ENTRY SHEET

Road Construction Emissions Model, Version 9.0.0

Daily Emission Estimates for -> LCCSB, Alt 2A, Year 1

Project Phases (Pounds)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	SOx (lbs/day)	CO2 (lbs/day)	CH4 (lbs/day)	N2O (lbs/day)	CO2e (lbs/day)
Grubbing/Land Clearing	7.62	69.77	81.42	166.98	3.38	163.60	36.90	2.87	34.03	0.22	22,175.84	4.81	1.19	22,649.29
Grading/Excavation	14.83	120.54	161.20	170.05	6.45	163.60	39.58	5.55	34.03	0.40	39,045.63	9.16	1.74	39,792.56
Drainage/Utilities/Sub-Grade	3.60	27.55	38.06	165.21	1.61	163.60	35.46	1.43	34.03	0.08	7,646.42	2.14	0.16	7,746.45
Paving	7.03	78.87	63.59	2.92	2.92	0.00	2.70	2.70	0.00	0.17	16,162.71	3.10	0.39	16,356.90
Maximum (pounds/day)	14.83	120.54	161.20	170.05	6.45	163.60	39.58	5.55	34.03	0.40	39,045.63	9.16	1.74	39,792.56
Total (tons/construction project)	0.75	6.30	8.01	9.90	0.33	9.57	2.27	0.28	1.99	0.02	1,965.82	0.45	0.09	2,003.02

Notes:

Project Start Year ->	2023
Project Length (months) ->	5
Total Project Area (acres) ->	65
Maximum Area Disturbed/Day (acres) ->	16
Water Truck Used? ->	Yes

	Total Material Imported/Exported Volume (yd^3/day)		Daily VMT (miles/day)			
Phase	Soil	Asphalt	Soil Hauling	Asphalt Hauling	Worker Commute	Water Truck
Grubbing/Land Clearing	1401	0	1,562	22	760	160
Grading/Excavation	7,551	2	2,268	6	2,000	160
Drainage/Utilities/Sub-Grade	58	0	60	0	760	80
Paving	289	418	150	210	600	80

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns G and H. Total PM2.5 emissions shown in Column I are the sum of exhaust and fugitive dust emissions shown in columns J and K.

CO2e emissions are estimated by multiplying mass emissions for each GHG by its global warming potential (GWP), 1 , 25 and 298 for CO2, CH4 and N2O, respectively. Total CO2e is then estimated by summing CO2e estimates over all GHGs.

Total Emission Estimates by Phase for -> LCCSB, Alt 2A, Year 1

Project Phases (Tons for all except CO2e. Metric tonnes for CO2e)	ROG (tons/phase)	CO (tons/phase)	NOx (tons/phase)	Total PM10 (tons/phase)	Exhaust PM10 (tons/phase)	Fugitive Dust PM10 (tons/phase)	Total PM2.5 (tons/phase)	Exhaust PM2.5 (tons/phase)	Fugitive Dust PM2.5 (tons/phase)	SOx (tons/phase)	CO2 (tons/phase)	CH4 (tons/phase)	N2O (tons/phase)	CO2e (MT/phase)
Grubbing/Land Clearing	0.10	0.91	1.06	2.17	0.04	2.13	0.48	0.04	0.44	0.00	288.29	0.06	0.02	267.11
Grading/Excavation	0.58	4.70	6.29	6.63	0.25	6.38	1.54	0.22	1.33	0.02	1,522.78	0.36	0.07	1,407.88
Drainage/Utilities/Sub-Grade	0.02	0.18	0.25	1.07	0.01	1.06	0.23	0.01	0.22	0.00	49.70	0.01	0.00	45.68
Paving	0.05	0.51	0.41	0.02	0.02	0.00	0.02	0.02	0.00	0.00	105.06	0.02	0.00	96.45
Maximum (tons/phase)	0.58	4.70	6.29	6.63	0.25	6.38	1.54	0.22	1.33	0.02	1522.78	0.36	0.07	1,407.88
Total (tons/construction project)	0.75	6.30	8.01	9.90	0.33	9.57	2.27	0.28	1.99	0.02	1965.82	0.45	0.09	1,817.13

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns G and H. Total PM2.5 emissions shown in Column I are the sum of exhaust and fugitive dust emissions shown in columns J and K.

CO2e emissions are estimated by multiplying mass emissions for each GHG by its global warming potential (GWP), 1 , 25 and 298 for CO2, CH4 and N2O, respectively. Total CO2e is then estimated by summing CO2e estimates over all GHGs.

The CO2e emissions are reported as metric tons per phase.

Road Construction Emissions Model **Version 9.0.0**

Data Entry Worksheet

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells D10 through D24, E28 through G35, and D38 through D41 for all project types.
Please use "Clear Data Input & User Overrides" button first before changing the Project Type or begin a new project.

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Input Type

Project Name	LCCSB, Alt 2A, Year 2	
Construction Start Year	2024	Enter a Year between 2014 and 2040 (inclusive)
Project Type For 4: Other Linear Project Type, please provide project specific off-road equipment population and vehicle trip data	4	1) New Road Construction : Project to build a roadway from bare ground, which generally requires more site preparation than widening an existing roadway 2) Road Widening : Project to add a new lane to an existing roadway 3) Bridge/Overpass Construction : Project to build an elevated roadway, which generally requires some different equipment than a new roadway, such as a crane 4) Other Linear Project Type: Non-roadway project such as a pipeline, transmission line, or levee construction
Project Construction Time	5.00	months
Working Days per Month	26.00	days (assume 22 if unknown)
Predominant Soil/Site Type: Enter 1, 2, or 3 (for project within "Sacramento County", follow soil type selection instructions in cells E18 to E20 otherwise see instructions provided in cells J18 to J22)	2	1) Sand Gravel : Use for quaternary deposits (Delta/West County) 2) Weathered Rock-Earth : Use for Laguna formation (Jackson Highway area) or the Ione formation (Scott Road, Rancho Murieta) 3) Blasted Rock : Use for Salt Springs Slate or Copper Hill Volcanics (Folsom South of Highway 50, Rancho Murieta)
Project Length	5.02	miles
Total Project Area	132.96	acres
Maximum Area Disturbed/Day	33.24	acres
Water Trucks Used?	1	1. Yes 2. No

Please note that the soil type instructions provided in cells E18 to E20 are specific to Sacramento County. Maps available from the California Geologic Survey (see weblink below) can be used to determine soil type outside Sacramento County.

http://www.conservation.ca.gov/cgs/information/geologic_mapping/Pages/googlemaps.aspx#regionalseries

Material Hauling Quantity Input

Material Type	Phase	Haul Truck Capacity (yd^3) (assume 20 if unknown)	Import Volume (yd^3/day)	Export Volume (yd^3/day)
Soil	Grubbing/Land Clearing	20.00		425.75
	Grading/Excavation	20.00	510.08	3762.85
	Drainage/Utilities/Sub-Grade			
	Paving	20.00	315.09	3.89
Asphalt	Grubbing/Land Clearing	20.00		0.08
	Grading/Excavation	20.00		1.65
	Drainage/Utilities/Sub-Grade			
	Paving	20.00	2.37	

Mitigation Options

On-road Fleet Emissions Mitigation		Select "2010 and Newer On-road Vehicles Fleet" option when the on-road heavy-duty truck fleet for the project will be limited to vehicles of model year 2010 or newer
Off-road Equipment Emissions Mitigation		Select "20% NOx and 45% Exhaust PM reduction" option if the project will be required to use a lower emitting off-road construction fleet. The SMAQMD Construction Mitigation Calculator can be used to confirm compliance with this mitigation measure (http://www.airquality.org/Businesses/CEQA-Land-Use-Planning/Mitigation). Select "Tier 4 Equipment" option if some or all off-road equipment used for the project meets CARB Tier 4 Standard

The remaining sections of this sheet contain areas that require modification when 'Other Project Type' is selected.

Note: The program's estimates of construction period phase length can be overridden in cells D50 through D53, and F50 through F53.

Construction Periods	User Override of Construction Months	Program Calculated Months	User Override of Phase Starting Date	Program Default Phase Starting Date
Grubbing/Land Clearing	1.00	0.50	1/1/2024	1/1/2024
Grading/Excavation	3.50	2.25	2/1/2024	2/1/2024
Drainage/Utilities/Sub-Grade	0.00	1.50	5/18/2024	5/18/2024
Paving	0.50	0.75	5/19/2024	5/18/2024
Totals (Months)	5			

Note: Soil Hauling emission default values can be overridden in cells D61 through D64, and F61 through F64.

Soil Hauling Emissions / **User Input**	User Override of Miles/Round Trip	Program Estimate of Miles/Round Trip	User Override of Truck Round Trips/Day	Default Values Round Trips/Day	Calculated Daily VMT
Miles/round trip: Grubbing/Land Clearing	22.00			22	484.00
Miles/round trip: Grading/Excavation	6.00			214	1284.00
Miles/round trip: Drainage/Utilities/Sub-Grade	0.00			0	0.00
Miles/round trip: Paving	10.00			16	160.00

Emission Rates	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Grubbing/Land Clearing (grams/mile)	0.03	0.41	3.02	0.11	0.05	0.02	1,693.55	0.00	0.27	1,772.92
Grading/Excavation (grams/mile)	0.03	0.41	3.02	0.11	0.05	0.02	1,693.55	0.00	0.27	1,772.92
Draining/Utilities/Sub-Grade (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving (grams/mile)	0.03	0.41	3.02	0.11	0.05	0.02	1,693.55	0.00	0.27	1,772.92
Grubbing/Land Clearing (grams/trip)	0.00	0.00	4.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grading/Excavation (grams/trip)	0.00	0.00	4.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Draining/Utilities/Sub-Grade (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving (grams/trip)	0.00	0.00	4.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hauling Emissions	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Pounds per day - Grubbing/Land Clearing	0.03	0.44	3.44	0.12	0.05	0.02	1,807.09	0.00	0.28	1,891.77
Tons per const. Period - Grubbing/Land Clearing	0.00	0.01	0.04	0.00	0.00	0.00	23.49	0.00	0.00	24.59
Pounds per day - Grading/Excavation	0.08	1.16	10.65	0.32	0.14	0.05	4,794.00	0.00	0.75	5,018.66
Tons per const. Period - Grading/Excavation	0.00	0.05	0.48	0.01	0.01	0.00	218.13	0.00	0.03	228.35
Pounds per day - Drainage/Utilities/Sub-Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Sub-Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Paving	0.01	0.14	1.22	0.04	0.02	0.01	597.38	0.00	0.09	625.38
Tons per const. Period - Paving	0.00	0.00	0.01	0.00	0.00	0.00	3.88	0.00	0.00	4.06
Total tons per construction project	0.00	0.06	0.54	0.02	0.01	0.00	245.50	0.00	0.04	257.01

Note: Asphalt Hauling emission default values can be overridden in cells D91 through D94, and F91 through F94.

Asphalt Hauling Emissions / **User Input**	User Override of Miles/Round Trip	Program Estimate of Miles/Round Trip	User Override of Truck Round Trips/Day	Default Values Round Trips/Day	Calculated Daily VMT
Miles/round trip: Grubbing/Land Clearing	22.00			1	22.00
Miles/round trip: Grading/Excavation	6.00			1	6.00
Miles/round trip: Drainage/Utilities/Sub-Grade	0.00			0	0.00
Miles/round trip: Paving	10.00			1	10.00

Emission Rates	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Grubbing/Land Clearing (grams/mile)	0.03	0.41	3.02	0.11	0.05	0.02	1,693.55	0.00	0.27	1,772.92
Grading/Excavation (grams/mile)	0.03	0.41	3.02	0.11	0.05	0.02	1,693.55	0.00	0.27	1,772.92
Draining/Utilities/Sub-Grade (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving (grams/mile)	0.03	0.41	3.02	0.11	0.05	0.02	1,693.55	0.00	0.27	1,772.92
Grubbing/Land Clearing (grams/trip)	0.00	0.00	4.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grading/Excavation (grams/trip)	0.00	0.00	4.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Draining/Utilities/Sub-Grade (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving (grams/trip)	0.00	0.00	4.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emissions	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Pounds per day - Grubbing/Land Clearing	0.00	0.02	0.16	0.01	0.00	0.00	82.14	0.00	0.01	85.99
Tons per const. Period - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00	1.07	0.00	0.00	1.12
Pounds per day - Grading/Excavation	0.00	0.01	0.05	0.00	0.00	0.00	22.40	0.00	0.00	23.45
Tons per const. Period - Grading/Excavation	0.00	0.00	0.00	0.00	0.00	0.00	1.02	0.00	0.00	1.07
Pounds per day - Drainage/Utilities/Sub-Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Sub-Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Paving	0.00	0.01	0.08	0.00	0.00	0.00	37.34	0.00	0.01	39.09
Tons per const. Period - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.25
Total tons per construction project	0.00	0.00	0.00	0.00	0.00	0.00	2.33	0.00	0.00	2.44

Note: Worker commute default values can be overridden in cells D121 through D126.

Worker Commute Emissions	User Override of Worker			
User Input	Commute Default Values	Default Values		
Miles/ one-way trip	20		Calculated	Calculated
One-way trips/day	2		Daily Trips	Daily VMT
No. of employees: Grubbing/Land Clearing	19		38	760.00
No. of employees: Grading/Excavation	50		100	2,000.00
No. of employees: Drainage/Utilities/Sub-Grade	0		0	0.00
No. of employees: Paving	15		30	600.00

Emission Rates	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Grubbing/Land Clearing (grams/mile)	0.01	0.84	0.06	0.05	0.02	0.00	306.70	0.00	0.01	308.54
Grading/Excavation (grams/mile)	0.01	0.84	0.06	0.05	0.02	0.00	306.70	0.00	0.01	308.54
Draining/Utilities/Sub-Grade (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving (grams/mile)	0.01	0.84	0.06	0.05	0.02	0.00	306.70	0.00	0.01	308.54
Grubbing/Land Clearing (grams/trip)	0.98	2.66	0.27	0.00	0.00	0.00	65.99	0.07	0.03	76.61
Grading/Excavation (grams/trip)	0.98	2.66	0.27	0.00	0.00	0.00	65.99	0.07	0.03	76.61
Draining/Utilities/Sub-Grade (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving (grams/trip)	0.98	2.66	0.27	0.00	0.00	0.00	65.99	0.07	0.03	76.61
Emissions	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Pounds per day - Grubbing/Land Clearing	0.10	1.63	0.13	0.08	0.03	0.01	519.41	0.01	0.01	523.38
Tons per const. Period - Grubbing/Land Clearing	0.00	0.02	0.00	0.00	0.00	0.00	6.75	0.00	0.00	6.80
Pounds per day - Grading/Excavation	0.28	4.28	0.34	0.20	0.08	0.01	1,366.87	0.03	0.03	1,377.32
Tons per const. Period - Grading/Excavation	0.01	0.19	0.02	0.01	0.00	0.00	62.19	0.00	0.00	62.67
Pounds per day - Drainage/Utilities/Sub-Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Sub-Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Paving	0.08	1.29	0.10	0.06	0.03	0.00	410.06	0.01	0.01	413.20
Tons per const. Period - Paving	0.00	0.01	0.00	0.00	0.00	0.00	2.67	0.00	0.00	2.69
Total tons per construction project	0.01	0.22	0.02	0.01	0.00	0.00	71.61	0.00	0.00	72.16

Note: Water Truck default values can be overridden in cells D153 through D156, I153 through I156, and F153 through F156.

Water Truck Emissions	User Override of	Program Estimate of	User Override of Truck	Default Values	Calculated	User Override of	Default Values	Calculated
User Input	Default # Water Trucks	Number of Water Trucks	Round Trips/Vehicle/Day	Round Trips/Vehicle/Day	Trips/day	Miles/Round Trip	Miles/Round Trip	Daily VMT
Grubbing/Land Clearing - Exhaust	7		5.00			8.00		280.00
Grading/Excavation - Exhaust	7		5.00			8.00		280.00
Drainage/Utilities/Subgrade	0		0.00			0.00		0.00
Paving	4		5.00			8.00		160.00

Emission Rates	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Grubbing/Land Clearing (grams/mile)	0.03	0.41	3.02	0.11	0.05	0.02	1,693.55	0.00	0.27	1,772.92
Grading/Excavation (grams/mile)	0.03	0.41	3.02	0.11	0.05	0.02	1,693.55	0.00	0.27	1,772.92
Draining/Utilities/Sub-Grade (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving (grams/mile)	0.03	0.41	3.02	0.11	0.05	0.02	1,693.55	0.00	0.27	1,772.92
Grubbing/Land Clearing (grams/trip)	0.00	0.00	4.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grading/Excavation (grams/trip)	0.00	0.00	4.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Draining/Utilities/Sub-Grade (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving (grams/trip)	0.00	0.00	4.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emissions	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Pounds per day - Grubbing/Land Clearing	0.02	0.25	2.21	0.07	0.03	0.01	1,045.42	0.00	0.16	1,094.41
Tons per const. Period - Grubbing/Land Clearing	0.00	0.00	0.03	0.00	0.00	0.00	13.59	0.00	0.00	14.23
Pounds per day - Grading/Excavation	0.02	0.25	2.21	0.07	0.03	0.01	1,045.42	0.00	0.16	1,094.41
Tons per const. Period - Grading/Excavation	0.00	0.01	0.10	0.00	0.00	0.00	47.57	0.00	0.01	49.80
Pounds per day - Drainage/Utilities/Sub-Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Sub-Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Paving	0.01	0.14	1.26	0.04	0.02	0.01	597.38	0.00	0.09	625.38
Tons per const. Period - Paving	0.00	0.00	0.01	0.00	0.00	0.00	3.88	0.00	0.00	4.06
Total tons per construction project	0.00	0.02	0.14	0.00	0.00	0.00	65.04	0.00	0.01	68.09

Note: Fugitive dust default values can be overridden in cells D183 through D185.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing	33.24		332.40	4.32	69.14	0.90
Fugitive Dust - Grading/Excavation	33.24		332.40	15.12	69.14	3.15
Fugitive Dust - Drainage/Utilities/Subgrade	0.00		0.00	0.00	0.00	0.00

Values in cells D195 through D228, D246 through D279, D297 through D330, and D348 through D381 are required when 'Other Project Type' is selected.

Off-Road Equipment Emissions

Grubbing/Land Clearing Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Mitigation Option Override of Default Equipment Tier (applicable only when "Tier 4 Mitigation" Option Selected)	Default Equipment Tier	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	SOx pounds/day	CO2 pounds/day	CH4 pounds/day	N2O pounds/day	CO2e pounds/day
0.00			Model Default Tier	Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Cranes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00			Model Default Tier	Crawler Tractors	2.12	11.01	23.74	0.92	0.85	0.04	3,793.26	1.23	0.03	3,834.17
0.00			Model Default Tier	Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7.00			Model Default Tier	Excavators	1.26	22.86	9.82	0.48	0.44	0.04	3,501.86	1.13	0.03	3,539.62
0.00			Model Default Tier	Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Graders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00			Model Default Tier	Off-Highway Trucks	2.49	16.25	16.64	0.60	0.55	0.07	6,401.76	2.07	0.06	6,470.68
0.00			Model Default Tier	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Other General Industrial Equipm	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.00			Model Default Tier	Other Material Handling Equipm	0.74	11.31	5.83	0.31	0.29	0.02	1,679.03	0.54	0.02	1,697.13

Number of Vehicles	Equipment Tier
0.00	N/A
0.00	N/A
0.00	N/A
0.00	N/A
0.00	N/A
0.00	N/A
0.00	N/A

Grading/Excavation	Default Number of Vehicles	Mitigation Option Override of	Default		ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Override of Default Number of Vehicles	*Program-estimate*	Default Equipment Tier (applicable only when "Tier 4 Mitigation" Option Selected)	Equipment Tier	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
0.00			Model Default Tier	Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.00			Model Default Tier	Cranes	1.99	10.65	21.03	0.87	0.80	0.03	3,352.85	1.08	0.03	3,388.99
7.00			Model Default Tier	Crawler Tractors	2.97	15.42	33.24	1.29	1.19	0.06	5,310.56	1.72	0.05	5,367.83
0.00			Model Default Tier	Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9.00			Model Default Tier	Excavators	1.62	29.39	12.63	0.62	0.57	0.05	4,502.39	1.46	0.04	4,550.94
0.00			Model Default Tier	Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.00			Model Default Tier	Generator Sets	0.57	7.33	5.09	0.22	0.22	0.01	1,246.07	0.05	0.01	1,250.12
7.00			Model Default Tier	Graders	2.48	11.60	29.09	0.94	0.87	0.05	4,483.56	1.45	0.04	4,531.87
0.00			Model Default Tier	Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8.00			Model Default Tier	Off-Highway Trucks	3.98	26.00	26.62	0.96	0.88	0.11	10,242.81	3.31	0.09	10,353.08
0.00			Model Default Tier	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Other General Industrial Equipn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Other Material Handling Equipn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Pavers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.00			Model Default Tier	Pumps	0.61	7.44	5.16	0.23	0.23	0.01	1,246.07	0.05	0.01	1,250.23
8.00			Model Default Tier	Rollers	1.17	14.80	12.19	0.65	0.59	0.02	2,033.17	0.66	0.02	2,055.07
0.00			Model Default Tier	Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00			Model Default Tier	Scrapers	3.80	29.84	38.48	1.52	1.40	0.08	7,345.50	2.38	0.07	7,424.66
10.00			Model Default Tier	Signal Boards	0.57	3.01	3.59	0.14	0.14	0.01	493.14	0.05	0.00	495.64
0.00			Model Default Tier	Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8.00			Model Default Tier	Tractors/Loaders/Backhoes	1.15	17.88	11.59	0.53	0.49	0.02	2,414.14	0.78	0.02	2,440.11
0.00			Model Default Tier	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Welders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

User-Defined Off-road Equipment	If non-default vehicles are used, please provide information in 'Non-default Off-road Equipment' tab			ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Number of Vehicles	Equipment Tier	Type		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

			ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
	Grading/Excavation	pounds per day	20.91	173.35	198.70	7.98	7.39	0.44	42,670.24	12.99	0.38	43,108.55
	Grading/Excavation	tons per phase	0.95	7.89	9.04	0.36	0.34	0.02	1,941.50	0.59	0.02	1,961.44

Drainage/Utilities/Subgrade	Default Number of Vehicles	Mitigation Option Override of Default Equipment Tier (applicable only when "Tier 4 Mitigation" Option Selected)	Default Equipment Tier		ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Override of Default Number of Vehicles	*Program-estimate*				pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
0.00			Model Default Tier	Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Cranes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Excavators	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Graders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Other General Industrial Equipn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Other Material Handling Equipn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Pavers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Rollers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Welders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

User-Defined Off-road Equipment If non-default vehicles are used, please provide information in 'Non-default Off-road Equipment' tab

Number of Vehicles	Equipment Tier	Type		ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
				pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

		ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Drainage/Utilities/Sub-Grade	pounds per day	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Drainage/Utilities/Sub-Grade	tons per phase	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Paving Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Mitigation Option Override of Default Equipment Tier (applicable only when "Tier 4 Mitigation" Option Selected)	Default Equipment Tier	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	SOx pounds/day	CO2 pounds/day	CH4 pounds/day	N2O pounds/day	CO2e pounds/day
0.00			Model Default Tier	Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Cranes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Excavators	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Graders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.00			Model Default Tier	Off-Highway Trucks	0.99	6.50	6.66	0.24	0.22	0.03	2,560.70	0.83	0.02	2,588.27
0.00			Model Default Tier	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Other General Industrial Equipn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.00			Model Default Tier	Other Material Handling Equipr	0.49	7.54	3.88	0.21	0.19	0.01	1,119.35	0.36	0.01	1,131.42
2.00			Model Default Tier	Pavers	0.37	5.79	3.48	0.16	0.15	0.01	910.33	0.29	0.01	920.14
2.00			Model Default Tier	Paving Equipment	0.33	5.14	2.99	0.14	0.13	0.01	788.93	0.26	0.01	797.44
0.00			Model Default Tier	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.00			Model Default Tier	Pumps	0.61	7.44	5.16	0.23	0.23	0.01	1,246.07	0.05	0.01	1,250.23
2.00			Model Default Tier	Rollers	0.29	3.70	3.05	0.16	0.15	0.01	508.29	0.16	0.00	513.77
0.00			Model Default Tier	Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.00			Model Default Tier	Signal Boards	0.57	3.01	3.59	0.14	0.14	0.01	493.14	0.05	0.00	495.64
0.00			Model Default Tier	Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8.00			Model Default Tier	Tractors/Loaders/Backhoes	1.15	17.88	11.59	0.53	0.49	0.02	2,414.14	0.78	0.02	2,440.11
0.00			Model Default Tier	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00			Model Default Tier	Welders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

User-Defined Off-road Equipment

If non-default vehicles are used, please provide information in 'Non-default Off-road Equipment' tab

Number of Vehicles	Equipment Tier	Type		ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	SOx pounds/day	CO2 pounds/day	CH4 pounds/day	N2O pounds/day	CO2e pounds/day
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

		ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Paving	pounds per day	4.81	57.00	40.40	1.82	1.71	0.11	10,040.95	2.79	0.09	10,137.03
Paving	tons per phase	0.03	0.37	0.26	0.01	0.01	0.00	65.27	0.02	0.00	65.89
Total Emissions all Phases (tons per construction period) =>		1.13	9.61	10.61	0.43	0.40	0.02	2,316.91	0.71	0.02	2,340.79

Equipment default values for horsepower and hours/day can be overridden in cells D403 through D436 and F403 through F436.

Equipment	User Override of Horsepower	Default Values Horsepower	User Override of Hours/day	Default Values Hours/day
Aerial Lifts		63		8
Air Compressors		78		8
Bore/Drill Rigs		221		8
Cement and Mortar Mixers		9		8
Concrete/Industrial Saws		81		8
Cranes		231		8
Crawler Tractors		212		8
Crushing/Proc. Equipment		85		8
Excavators		158		8
Forklifts		89		8
Generator Sets		84		8
Graders		187		8
Off-Highway Tractors		124		8
Off-Highway Trucks		402		8
Other Construction Equipment		172		8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		168		8
Pavers		130		8
Paving Equipment		132		8
Plate Compactors		8		8
Pressure Washers		13		8
Pumps		84		8
Rollers		80		8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		247		8
Rubber Tired Loaders		203		8
Scrapers		367		8
Signal Boards		6		8
Skid Steer Loaders		65		8
Surfacing Equipment		263		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		97		8
Trenchers		78		8
Welders		46		8

END OF DATA ENTRY SHEET

Road Construction Emissions Model, Version 9.0.0

Daily Emission Estimates for -> LCCSB, Alt 2A, Year 2				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust					
Project Phases (Pounds)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	SOx (lbs/day)	CO2 (lbs/day)	CH4 (lbs/day)	N2O (lbs/day)	CO2e (lbs/day)
Grubbing/Land Clearing	11.38	106.29	106.48	336.81	4.41	332.40	73.07	3.94	69.14	0.28	27,311.87	7.62	0.69	27,707.61
Grading/Excavation	21.29	179.04	211.95	340.97	8.57	332.40	76.78	7.64	69.14	0.51	49,898.94	13.03	1.33	50,622.39
Drainage/Utilities/Sub-Grade	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
Paving	4.92	58.58	43.06	1.97	1.97	0.00	1.77	1.77	0.00	0.12	11,683.11	2.80	0.29	11,840.07
Maximum (pounds/day)	21.29	179.04	211.95	340.97	8.57	332.40	76.78	7.64	69.14	0.51	49,898.94	13.03	1.33	50,622.39
Total (tons/construction project)	1.15	9.91	11.31	19.91	0.46	19.45	4.46	0.41	4.04	0.03	2,701.40	0.71	0.07	2,740.48

Notes:

Project Start Year ->	2024
Project Length (months) ->	5
Total Project Area (acres) ->	133
Maximum Area Disturbed/Day (acres) ->	33
Water Truck Used? ->	Yes

	Total Material Imported/Exported Volume (yd^3/day)		Daily VMT (miles/day)			
Phase	Soil	Asphalt	Soil Hauling	Asphalt Hauling	Worker Commute	Water Truck
Grubbing/Land Clearing	426	0	484	22	760	280
Grading/Excavation	4,273	2	1,284	6	2,000	280
Drainage/Utilities/Sub-Grade	0	0	0	0	0	0
Paving	319	2	160	10	600	160

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns G and H. Total PM2.5 emissions shown in Column I are the sum of exhaust and fugitive dust emissions shown in columns J and K.

CO2e emissions are estimated by multiplying mass emissions for each GHG by its global warming potential (GWP), 1 , 25 and 298 for CO2, CH4 and N2O, respectively. Total CO2e is then estimated by summing CO2e estimates over all GHGs.

Total Emission Estimates by Phase for -> LCCSB, Alt 2A, Year 2				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust					
Project Phases (Tons for all except CO2e. Metric tonnes for CO2e)	ROG (tons/phase)	CO (tons/phase)	NOx (tons/phase)	PM10 (tons/phase)	PM10 (tons/phase)	PM10 (tons/phase)	PM2.5 (tons/phase)	PM2.5 (tons/phase)	PM2.5 (tons/phase)	SOx (tons/phase)	CO2 (tons/phase)	CH4 (tons/phase)	N2O (tons/phase)	CO2e (MT/phase)
Grubbing/Land Clearing	0.15	1.38	1.38	4.38	0.06	4.32	0.95	0.05	0.90	0.00	355.05	0.10	0.01	326.77
Grading/Excavation	0.97	8.15	9.64	15.51	0.39	15.12	3.49	0.35	3.15	0.02	2,270.40	0.59	0.06	2,089.56
Drainage/Utilities/Sub-Grade	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
Paving	0.03	0.38	0.28	0.01	0.01	0.00	0.01	0.01	0.00	0.00	75.94	0.02	0.00	69.82
Maximum (tons/phase)	0.97	8.15	9.64	15.51	0.39	15.12	3.49	0.35	3.15	0.02	2270.40	0.59	0.06	2,089.56
Total (tons/construction project)	1.15	9.91	11.31	19.91	0.46	19.45	4.46	0.41	4.04	0.03	2701.40	0.71	0.07	2,486.15

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns G and H. Total PM2.5 emissions shown in Column I are the sum of exhaust and fugitive dust emissions shown in columns J and K.

CO2e emissions are estimated by multiplying mass emissions for each GHG by its global warming potential (GWP), 1 , 25 and 298 for CO2, CH4 and N2O, respectively. Total CO2e is then estimated by summing CO2e estimates over all GHGs.

The CO2e emissions are reported as metric tons per phase.

LIST OF SPECIAL STATUS SPECIES FROM

THE U.S. FISH AND WILDLIFE SERVICE

APPENDIX G

LOWER CACHE CREEK FEASIBILITY STUDY

Yolo County, CA

December 2019

United States Army Corps of Engineers
Sacramento District

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
Phone: (916) 414-6600 Fax: (916) 414-6713

In Reply Refer To: December 03, 2019
Consultation Code: 08ESMF00-2019-SLI-0770
Event Code: 08ESMF00-2020-E-01430
Project Name: Lower Cache Creek Alt 2A

Subject: Updated list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, under the jurisdiction of the U.S. Fish and Wildlife Service (Service) that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Please follow the link below to see if your proposed project has the potential to affect other species or their habitats under the jurisdiction of the National Marine Fisheries Service:

http://www.nwr.noaa.gov/protected_species/species_list/species_lists.html

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

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Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
(916) 414-6600

This project's location is within the jurisdiction of multiple offices. Expect additional species list documents from the following office, and expect that the species and critical habitats in each document reflect only those that fall in the office's jurisdiction:

San Francisco Bay-Delta Fish And Wildlife
650 Capitol Mall
Suite 8-300
Sacramento, CA 95814
(916) 930-5603

Project Summary

Consultation Code: 08ESMF00-2019-SLI-0770

Event Code: 08ESMF00-2020-E-01430

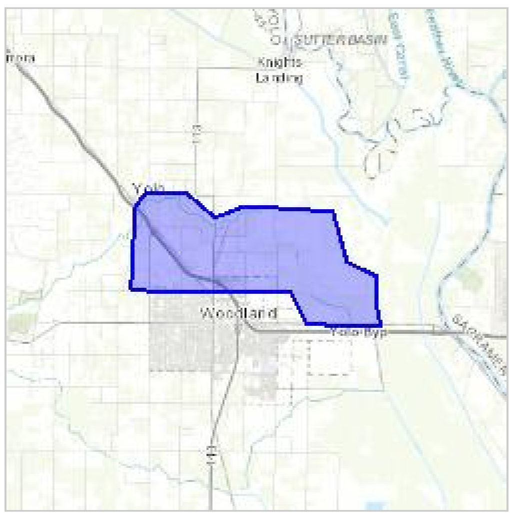
Project Name: Lower Cache Creek Alt 2A

Project Type: STREAM / WATERBODY / CANALS / LEVEES / DIKES

Project Description: Flood risk reduction project protecting the City of Woodland by constructing new levees, cutoff walls within existing levees, seepage berms, drainage canals, and improving flows to the settling basin.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/38.706470820423924N121.7501524940937W



Counties: Yolo, CA

Endangered Species Act Species

There is a total of 10 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. 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.

Birds

NAME	STATUS
Western Snowy Plover *Charadrius nivosus nivosus* Population: Pacific Coast population DPS-U.S.A. (CA, OR, WA), Mexico (within 50 miles of Pacific coast) There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8035	Threatened
Yellow-billed Cuckoo *Coccyzus americanus* Population: Western U.S. DPS There is **proposed** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3911	Threatened

Reptiles

NAME	STATUS
Giant Garter Snake *Thamnophis gigas* No critical habitat has been designated for this species. Species profile: 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. Species profile: https://ecos.fws.gov/ecp/species/2891 Species survey guidelines: https://ecos.fws.gov/ipac/guideline/survey/population/205/office/11420.pdf	Threatened
California Tiger Salamander *Ambystoma californiense* Population: U.S.A. (Central CA DPS) There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: 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. Species profile: https://ecos.fws.gov/ecp/species/321	Threatened

Insects

NAME	STATUS
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Crustaceans

NAME	STATUS
Vernal Pool Fairy Shrimp *Branchinecta lynchi* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: 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. Species profile: https://ecos.fws.gov/ecp/species/2246	Endangered

Flowering Plants

NAME	STATUS
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Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
San Francisco Bay-Delta Fish And Wildlife
650 Capitol Mall
Suite 8-300
Sacramento, CA 95814
Phone: (916) 930-5603 Fax: (916) 930-5654
http://kim_squires@fws.gov

In Reply Refer To: December 03, 2019
Consultation Code: 08FBDT00-2020-SLI-0042
Event Code: 08FBDT00-2020-E-00103
Project Name: Lower Cache Creek Alt 2A

Subject: Updated list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

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Project Summary

Consultation Code: 08FBDT00-2020-SLI-0042

Event Code: 08FBDT00-2020-E-00103

Project Name: Lower Cache Creek Alt 2A

Project Type: STREAM / WATERBODY / CANALS / LEVEES / DIKES

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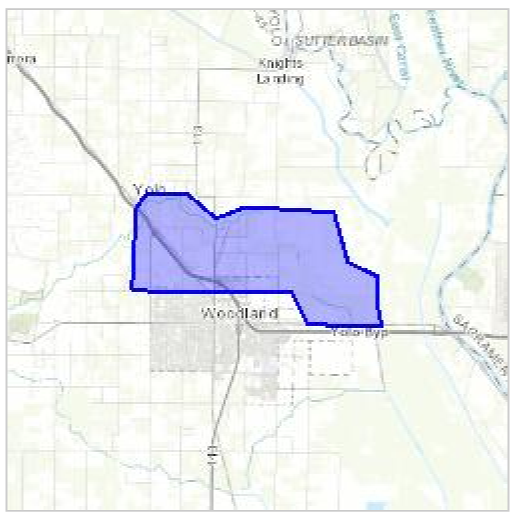

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THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

HABITAT MITIGATION MONITORING AND ADAPTIVE MANAGEMENT PLAN

APPENDIX H

LOWER CACHE CREEK FEASIBILITY STUDY

Yolo County, CA

December 2019

United States Army Corps of Engineers
Sacramento District

HABITAT MITIGATION MONITORING AND ADAPTIVE MANAGEMENT PLAN

LOWER CACHE CREEK FEASIBILITY STUDY

Photo courtesy of Tim Busch, City of Woodland Principal Utilities Civil Engineer

Cache Creek nearly overtops the levee in February 2019, near County Road 102, Woodland, CA.

US Army Corps of Engineers®

December 2019

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ACRONYMS AND ABBREVIATIONS

AEP	annual exceedance probability
BO	Biological Assessment
CAR	Coordination Act Report
CCSB	Cache Creek Settling Basin
cfs	cubic feet per second
CNDDB	California Natural Diversity DataBase
Corps	U.S. Army Corps of Engineers
CR	county road
CVFPB	Central Valley Flood Protection Board
DWR	Department of Water Resources
EIS-EIR	environmental impact statement-environmental impact report
ESA	Endangered Species Act
GGS	giant garter snake
HMMAMP	Habitat Mitigation, Monitoring, and Adaptive Management Plan
LBV	least Bell's vireo
LCCFS	Lower Cache Creek Feasibility Study
LCP	Levee and Conveyance Alternative
NED	national economic development
NMFS	National Marine Fisheries Service
PBBB	palmate-bracted bird's beak
PL	Public Law
SEIS	Supplemental Environmental Impact Statement
SRA	shaded riverine aquatic
SRFCP	Sacramento River Flood Control Project
TSP	tentatively selected plan
UPRR	Union Pacific Railroad
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
VELB	valley elderberry longhorn beetle
VPB	vernal pool branchiopod
VPFS	vernal pool fairy shrimp
VPTS	vernal pool tadpole shrimp
WRDA	Water Resources Development Act
WYBC	western Yellow-billed cuckoo

1.0 INTRODUCTION

1.1 Purpose and Goals

Mitigation for habitat loss is a requirement to compensate for the loss of habitat due to a Federal action. Section 906(d) of the Water Resources Development Act (WRDA) of 1986 states that project alternatives must support recommendations with a specific plan to mitigate fish and wildlife losses. Additionally, the Endangered Species Act (ESA) states that the purpose of compensatory mitigation is to offset environmental losses resulting from unavoidable impacts.

This Habitat Mitigation, Monitoring and Adaptive Management Plan (HMMAMP) describes the types of habitats that will be impacted, the potential impacts caused by the project, and the types and amounts of mitigation that would be established in order to compensate for habitat losses. This alternatives analysis is a living document and may be modified as part of an adaptive management strategy to allow for goals and requirements to be accomplished in a constantly changing environment. An updated alternative analysis will accompany the final Supplemental Environmental Impact Statement (SEIS) as part of the project addenda, and will continuously be updated throughout the project design phase as detailed design efforts allow for finalizing the mitigation plans.

The goal is to ensure that the conservation values of the mitigation sites are maintained in good condition in perpetuity. The plan's biological goals are to: (1) preserve the abundance and diversity of native species (particularly special status species) in the established habitats in the project area; (2) protect the habitat features from the effects of indiscriminate land use changes that may adversely impact mitigation habitats; and (3) mitigate any adverse impacts within the project areas.

The primary purpose of habitat monitoring is to determine the level of ecological function at each mitigation site as a part of an overall plan to create sites that offset the loss of habitat affected by construction of the proposed project. Monitoring would be conducted in a manner compatible with the type of mitigation site. Mitigation requirements are provided by the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) through biological opinions (BOs) received through the Endangered Species Act Section 7 consultation process. Additional mitigation recommendations from USFWS are included in the project's Fish and Wildlife Coordination Act Report (CAR).

This HMMAMP would be implemented by U.S. Army Corps of Engineers (Corps) staff through coordination with USFWS and NMFS. Monitoring would be conducted by qualified biologists from the Corps, in coordination with the USFWS, the City of Woodland, the California Department of Water Resources (DWR), and the Central Valley Flood Protection Board (CVFPB).

1.2 Study Authority

This study was authorized by Section 209 of the Flood Control Act of 1962, Public Law (Pub. L.) 87-874, § 209, 76 Stat. 1196 (1962), which states as follows for the Sacramento River Basin:

> "The Secretary of the Army is hereby authorized and directed to cause surveys for flood control and allied purposes, including channel and major drainage improvements, and floods aggravated by or due to wind or tidal effects, to be made under the direction of the Chief of Engineers, in drainage areas of the United States and its territorial possessions, which include the following named localities:

Provided, That after the regular or formal reports made on any survey are submitted to Congress, no supplemental or additional report or estimate shall be made unless authorized by law except that the Secretary of the Army may cause a review of any examination or survey to be made and a report thereon submitted to Congress, if such review is required by the national defense or by changed physical or economic conditions: Provided further, That the Government shall not be deemed to have entered upon any project for the improvement of any waterway or harbor mentioned in this title until the project for the proposed work shall have adopted by law:...

…Sacramento River Basin and streams in northern California draining into the Pacific Ocean for the purposes of developing, where feasible, multiple-purpose water resource projects, particularly those which be eligible under the provisions of title III of Public Law 85-500…"

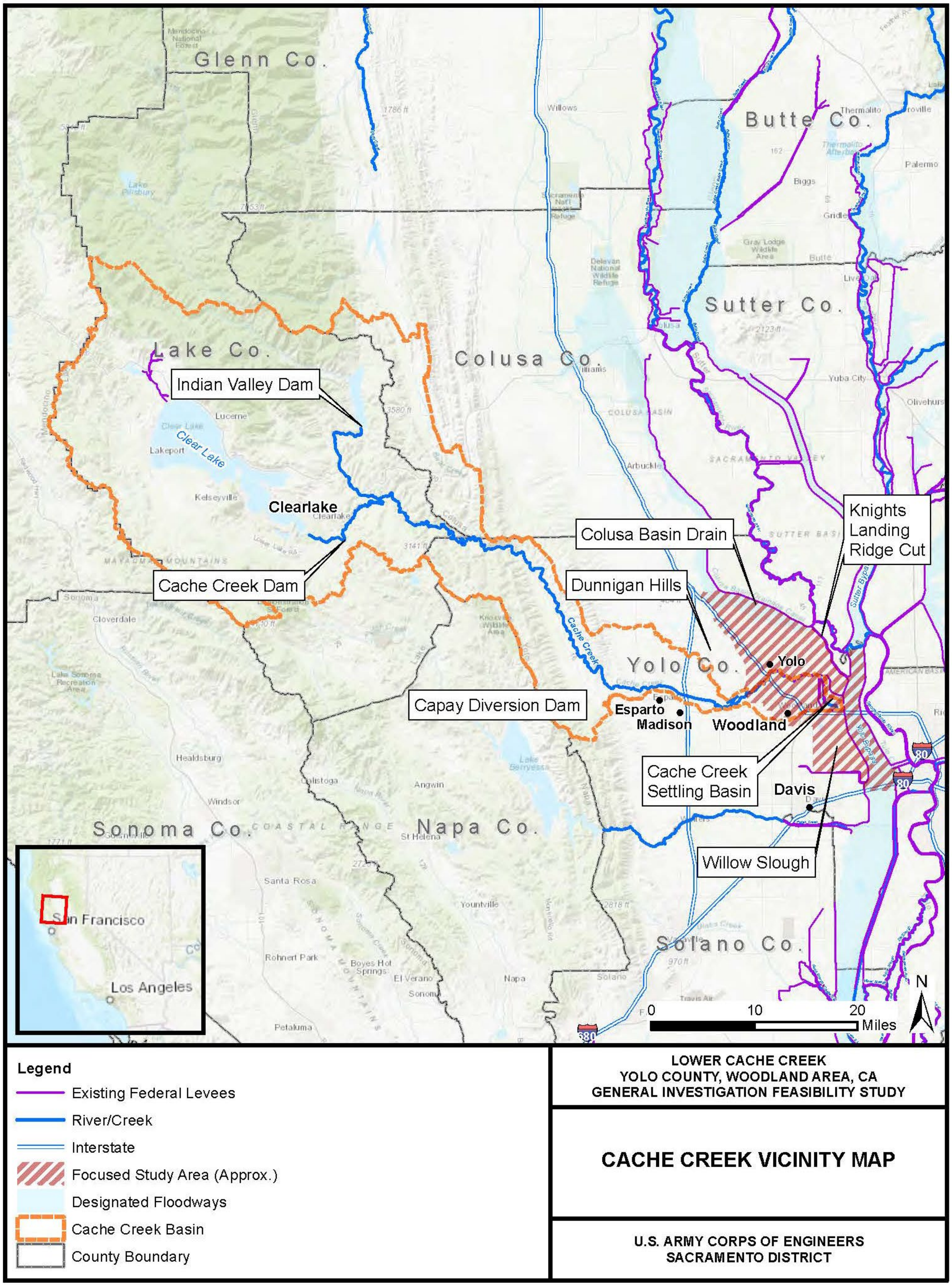
Per Section 1203 of America's Water Infrastructure Act of 2018, Pub. L. 115-270, § 1203, 132 Stat 3803, the "Secretary shall expedite the completion of a feasibility study" for Lower Cache Creek, subject to the availability of funding.

1.3 Study Area

The study area addressed in this report includes the downstream segment of Cache Creek in Yolo County, California. Cache Creek is a west side tributary of the Sacramento River near Sacramento, California. The main stem of Cache Creek originates within the outflows of Clear Lake in the Coast Range Mountains of Northern California. The north fork of Cache Creek is impounded by Indian Valley Dam and joins the main stem above Capay Valley before flowing out of the foothills into California's Central Valley. The creek is ephemeral; water only reaches the Woodland area at certain times of the year due to natural precipitation patterns, upstream retention and diversions for water supply. Figure 1-1 provides a map of the entire Cache Creek watershed.

The focused study area encompasses the City of Woodland and surrounding agricultural areas (Figure 1-2). The proposed measures in the array of alternatives are roughly bounded by the city limit line to the south, County Road 97 to the west, Cache Creek to the north, and the Yolo Bypass to the east. The channel passes north of the City of Woodland through levees constructed by USACE in 1958 as part of the Federally-authorized Sacramento River Flood Control Project (SRFCP). Construction of a flood storage reservoir was anticipated upstream (Wilson Valley Dam and Reservoir); however, the reservoir was never constructed due to seismic concerns. The existing Cache Creek levee profile was designed to provide a freeboard of at least 3 feet above an adopted flood profile calculated using a project design flood of 30,000cfs (USACE, 1961). Based on current analysis presented in this report, the existing levee profile would pass a 10% (1/10) annual exceedance probabilty (AEP) event (30,000 cubic feet per second (cfs)) with 90% assurance, if the levee is assumed to not fail prior to overtopping. However, including the probability of geotechnical failure prior to overtopping, the existing levee project would pass a 50% (1/2) AEP event (10,800cfs) with 90% assurance.

Figure 1-1 Cache Creek Watershed Vicinity Map



The leveed portion of Cache Creek discharges into the Cache Creek Settling Basin (CCSB), which was also constructed by USACE as a separately authorized component of the SRFCP. Cache Creek has historically carried a large sediment load, and the Cache Creek watershed is a dominant source of mercury to the San Francisco Bay-Delta. Mercury laden sediments passing through Cache Creek are resultant of legacy mercury mines in the Coast Range (DWR, 2018). Erosion and groundwater discharge from marine sediments and marine sedimentary rocks have resulted in releases of naturally occurring, high boron and mercury concentrations to the Cache Creek watershed (Yolo Habitat Conservancy, 2018) The settling basin was constructed to prevent sediment carried by Cache Creek from adversely affecting the hydraulic capacity of the Yolo Bypass through excessive sediment deposition and thereby increase the flood risk of the City of Sacramento. Water from the CCSB flows through either a 400 cfs low-flow culvert in moderate flow conditions, or the overflow concrete weir, during high flow events. Those waters are discharged into the Yolo Bypass, which flow directly into the Sacramento River.

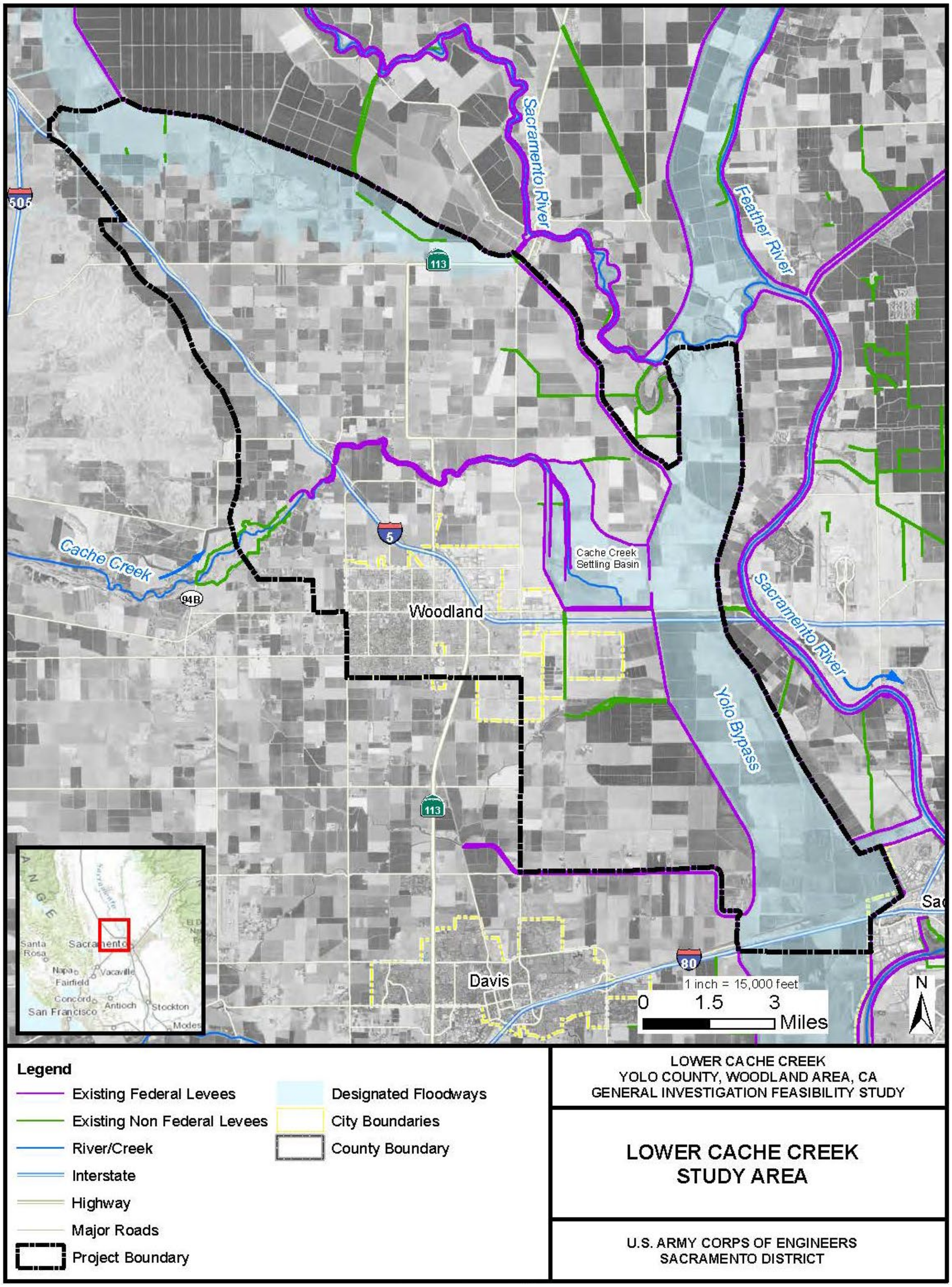
1.4 Purpose and Need for the Action

The purpose and need of the Lower Cache Creek Feasibility Study (LCCFS) is to reduce the overall flood risk to the City of Woodland. Flood risk in the City of Woodland is primarily related to, rainfall rates, infiltration rates, reservoir storage, topography, ground subsidence, channel dimensions and roughness, channel bed and erosion, and levee performance. The threat of flooding to the City of Woodland includes potential impacts to both residential and commercial property, disruption of two major transportation routes (Interstate 5 and the Union Pacific Railroad), and potential damages to agricultural production.

The study area (Figure 1-2) has experienced multiple flood events since the mid-1900s, with twenty severe floods occurring since 1990. The most recent flood events occurred in 1983, 1995, 1997, 2006, 2011, spring 2017 and February 2019. In 1983 overland flows inundated areas in the easterly part of what is now within the Woodland city limits. According to the U.S. Geological Survey (USGS), the peak flow in January 1983 at the Rumsey gage was estimated to be 53,000 cfs, which is estimated to be a 2% (1/50) AEP event. There was a levee break downstream from County Road CR 102 during this flood. Federal, State, and local agencies patched levee boils at that time to prevent additional levee breaks along both sides of the Cache Creek levee system. In 1995, flooding from Cache Creek came within 1 block of the city. The total flow (approximately 48,000 cfs, peak) represents a 2.5% (1/40) AEP event. In 2006, floodwaters came within six inches of overtopping the Lower Cache Creek levees causing the Governor to declare a state of emergency forcing emergency evacuations. Following the severe storm event, extensive requests for levee repairs under the PL 84-99 program came to the Corps, and numerous roadway repairs were undertaken.

Flooding from Lower Cache Creek poses a risk of economic damage to property and critical infrastructure within the City of Woodland and surrounding areas. The anticipated total damageable property within the 0.2% (1/500) AEP floodplain is valued at $2.1 billion (October 2019 price levels). Future without project (FWOP) expected annual damages are estimated to be $22.2 million per year (October 2019 price levels). Damages are based on floodplain modeling and current valuations of the assets, including homes, businesses, roads, etc., and based upon historical damages. Other losses or adverse effects would continue to include the potential for flood-related loss of life, contamination from sanitary sewage and hazardous materials, and the extended closure of the section of I-5 east of the city of Woodland.

Figure 1-2. Lower Cache Creek Focused Study Area



2.0 STUDY ALTERNATIVES

Based upon a comparison of net benefits and ability to meet the planning criteria, The LCP was selected for further study as the national economic development (NED) plan and the tentatively selected plan (TSP). This plan, as well as the No Action Alternative are considered in detail and retained for effects analysis in the Draft SEIS.

2.1 No Action Alternative

Under the No Action Alternative, the Corps would not conduct any additional work to address overtopping, seepage, or levee stability concerns along Lower Cache Creek. The Cache Creek levee system would continue to provide protection from a flood that has a 1 in 10 (1/10 AEP event) of occurring in any given years. Damages to real property from overflows from Cache Creek would be expected to be about $22 million annually. The City of Woodland would remain at risk of severe flooding from upstream overtopping. Other losses or adverse effects include the potential flood-related loss of life, contamination from sewage and hazardous materials, and the closure of sections of I-5 both north and east of the City of Woodland preventing residents from easily escaping rising floodwaters.

The existing levees would continue to require improvements to meet FEMA's minimum acceptable level of flood protection. Regular operations and maintenance of the existing Cache Creek channel levees would continue as currently executed by the local maintaining entities.

The Cache Creek Settling Basin (CCSB) would undergo O&M depending upon the sediment trap efficiency. The USACE 2007 CCSB Draft O&M Manual, states the outlet weir is to be raised an additional 6-feet at year 25 (2018) of the project, or when the trap-efficiency becomes less than 30%. Beginning in year 25 of the project, 400-foot sections of the training levee would be removed every five years, starting with a section 1100 feet upstream from the current terminus of the training channel. Each subsequent section would be removed 1100 feet upstream from the last removed section. The sediment trap efficiency values are within 37.5 to 65.4 percent for the historical conditions, which remain above the 30% value requiring O&M (DWR 2018). Within the life of the Federal project, mandated O&M is likely to occur within the CCSB. These modifications would not impact the performance of the Levee and Conveyance Alternative.

In the No Action Alternative, there is the potential that the City of Woodland could propose their own structural and non-structural measures to reduce the life safety risk and economic damage that may occur during a relatively frequent flood event. However, the City of Woodland would still be at risk of flooding.

2.2 Levee and Conveyance Plan

The Levee and Conveyance Plan (LCP) includes improvements to existing CCSB levees and construction of a new levee north of the City of Woodland. The LCP is comprised of six distinct project reaches (Reach N through Reach S) shown in Figure 2-1. Project summary table, Table 1-1, shows each Reach and the corresponding improvements.

Levee Improvements. The southwest levee of the CCSB would be rehabilitated by constructing a 45-foot deep cutoff wall through an approximately 5,000 linear foot length of the existing levee in Reach O. An approximately 7,400 linear foot long portion of the southern CCSB levee would be improved by constructing a 60-foot deep cutoff wall in Reach N. The cutoff wall installation would prevent seepage from passing through the CCSB levees and would occur within 2.3 miles of existing CCSB levee.

Weir Installation. Within the CCSB west levee, a 3,000 foot-long section of levee would be degraded to an elevation of 43 feet (NAVD 88) to accommodate a concrete inlet weir with a height of approximately 9-feet above existing adjacent grade. The weir would serve to accept floodwater emanating from Cache Creek west of the CCSB, and would prevent backflow from the CCSB to the west during small, more frequent events. The existing outlet CCSB weir on the east levee would remain in place. The outlet weir passes floodwaters from Cache Creek into the Yolo Bypass.

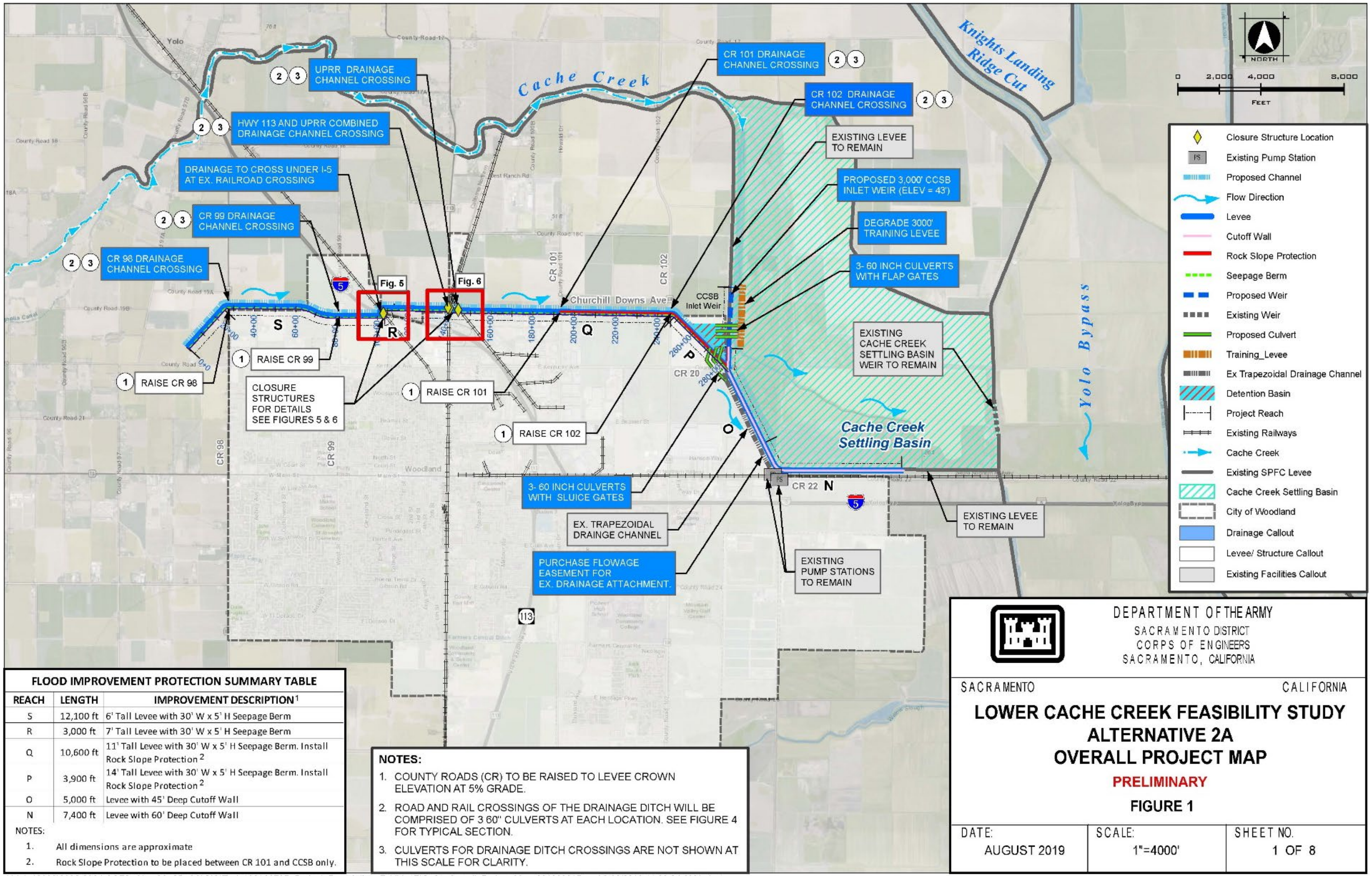
Training Levee. The interior training levee to the east of the Cache Creek channel within the CCSB would be degraded to prevent backflow. Approximately a 3,000 foot length would be degraded in geographical alignment with the new concrete inlet weir. Training levee degrade is authorized as a portion of the USACE O&M Manual. Because the settling basin is not at expected capacity with year 25 occurring in 2018, the O&M date cannot be anticipated. Without degrading the height of the training levee, floodwaters gravity spilling over the new weir may overflow and flood back into the agricultural plain north of the City of Woodland. If excavated materials are suitable to use as fill per USACE levee requirements, the material would be hauled north on the training levee, east towards County Road 102, over the County Road 102 bridge, and south towards the project footprint.

New Levee. A new levee with a 20-foot wide crest would begin near the intersection of County Road 20 and County Road 98. The levee would extend east until the intersection with the CCSB. The new alignment of the new levee would generally follow the northern City limit line west of State Highway 113 and Churchill Downs Avenue east of High 113. The new levee height would vary from six feet near County Road 98 to 14 feet at its intersection with the CSSB near the newly proposed inlet weir. Rock slope protection is proposed on the waterside slope of the new levee from County Road 101 to the southern end of the proposed inlet weir near County Road 20.

Conveyance Improvements. A trapezoidal drainage canal with a design capacity of 350 cubic feet per second (cfs) would be excavated north (waterside) of the new levee to capture smaller, more frequent events and discharge them to the CCSB. With a canal width of approximately 150 feet, flood waters would not be expected to overwhelm the canal capacity. The excavated material from the canal would be used as fill material for the new levee and seepage berm. The exact width of the drainage canal may vary. A seepage berm would be constructed on the landside of the new levee as a resiliency measure.

Closure Structures. Closures structures (gates that are automatically raised or manually assembled by operations and maintenance personnel prior to a flood event) would be constructed where the embankment crosses the Union Pacific Railroad (UPRR) tracks near I-5, the UPRR tracks west of SR 113, SR 113, and the UPRR tracks east of SR 113 (Figure 2-7). Short sections of floodwall may need to be constructed to connect the closure structure at the I-5 crossing to the existing roadway embankment and to connect the closure structures at the SR 113 crossing and the adjacent UPPR crossing to the west.

Figure 2-1. Levee and Conveyance Plan Overall Project Map



FLOOD IMPROVEMENT PROTECTION SUMMARY TABLE

REACH	LENGTH	IMPROVEMENT DESCRIPTION[1]
S	12,100 ft	6' Tall Levee with 30' W x 5' H Seepage Berm
R	3,000 ft	7' Tall Levee with 30' W x 5' H Seepage Berm
Q	10,600 ft	11' Tall Levee with 30' W x 5' H Seepage Berm. Install Rock Slope Protection[2]
P	3,900 ft	14' Tall Levee with 30' W x 5' H Seepage Berm. Install Rock Slope Protection[2]
O	5,000 ft	Levee with 45' Deep Cutoff Wall
N	7,400 ft	Levee with 60' Deep Cutoff Wall

NOTES:

1. All dimensions are approximate
2. Rock Slope Protection to be placed between CR 101 and CCSB only.

NOTES:

1. COUNTY ROADS (CR) TO BE RAISED TO LEVEE CROWN ELEVATION AT 5% GRADE.
2. ROAD AND RAIL CROSSINGS OF THE DRAINAGE DITCH WILL BE COMPRISED OF 3 60" CULVERTS AT EACH LOCATION. SEE FIGURE 4 FOR TYPICAL SECTION.
3. CULVERTS FOR DRAINAGE DITCH CROSSINGS ARE NOT SHOWN AT THIS SCALE FOR CLARITY.

Internal Drainage. Floodwaters that have overtopped existing Cache Creek levees would be impounded by the proposed new levee, gravity drain into the drainage canal and flow east. Water would pond in a constructed 15 acre detention basin. The detention basin would include an east outlet and south outlet. The east outlet would provide for gravity drainage to the CCSB and consist of a set of three 60 inch diameter culverts fitted with flap gates. This would allow the gravity flow of water into the CCSB after the water surface elevation in the CCSB had fallen below the inlet weir crest. Reverse flow from the CCSB into the detention basin would be prevented by the flap gates. The gated culverts would discharge to a ditch that terminates at a pump station owned and operated by the City of Woodland. The south outlet would consist of a set of three 60 inch diameter culverts fitted with sluice gates. The sluice gate outlet, in combination with the detention basin, would allow for temporary detention of drainage until the pump station had available capacity to discharge the floodwaters to the Yolo Bypass.

Roadway Improvements. The alignment of the new levee would require road raising of County Road 98, County Road 99, County Road 101, and County Road 102. Culverts would be installed at each of these raised crossings, and under Highway 113 to provide drainage. In order to convey floodwaters along the railroad underpass at I-5 without damages, rock revetment and concrete lining would be placed to prevent scour and undermining of the underpass structure. It is estimated that flows may exceed 5 feet per second (fps) through the underpass. Other areas that would be armored with concrete lining or rock slope protection includes existing slopes of the I-5 roadway embankment, the slopes of the proposed Reach R and Reach S levees, the proposed channel (both bottom and slope), and the existing UPRR railway berm and bridge abutments.

<u>Construction Details</u>

Project construction is anticipated to be completed within the next six years. Construction may begin as soon as 15 April 2025 and would take two full years to complete. Construction activities are expected to occur year-round. Certain construction activities would be limited by a giant garter snake (GGS) work window of May 1 to October 1 in areas considered GGS suitable habitat. Most of the project area is not GGS habitat. Construction that includes degrade of the CCSB levees, including the installation of the concrete inlet weir and cutoff walls, would need to be completed in the dry season. All work areas must be winterized and levees floodworthy by November 15 of each year. Any tree or shrub removal would be completed in the winter months to avoid migratory bird nesting season.

<u>Year 1.</u>
Construct Reach P Channel, Detention Basin, Levee, and seepage berm. Construct South gated culvert from detention basin and integrate into levee. This levee is constructed first because it mitigates flood risk associated with later CCSB levee degrade for inlet weir. Degrade 3000 feet of Cache Creek Settling Basin west levee along alignment of inlet weir and stockpile at detention basin site. Degrade 3000 feet of Cache Creek Settling Basin training levee adjacent to inlet weir and stockpile at detention basin site. Construct CCSB inlet weir. Construct Reach Q Channel, levee and closure structures. Use CCSB levee degrade material as levee fill.

<u>Year 2.</u>
Construct Reach R Channel, Levee, Seepage Berm, and closure structures. Construct Reach S Channel, Levee, Seepage Berm, and closure structures. Construct Reach O improve levee with cutoff wall. Improve Reach N levee with cutoff wall. Site stabilization and restoration of temporary impacts.

Table 1-1. Summary of the LCP features.

Project Feature Summary			
Feature	**Improvement Description**	**Applicable Reaches**	**Quantity**
New Levee	New Levee with Seepage Berm	Q (Partial), R, S	3.9 Miles
New Levee with RSP	New Levee with Seepage Berm and Rock Slope Protection	P, Q (Partial)	1.7 Miles
Improve Existing Levee	Improve existing levee with cutoff wall	N, O	2.3 Miles
Drainage Channel	New drainage channel and culverts. Also serves as borrow source for levee fill.	P, Q, R, S	5.6 Miles
Elevated Roadways	Elevate Roadway over levee at CR98, CR99, CR101, and CR102	P, Q, R, S	4
Gated Roadway Closure Structure	Gate at SR 113	Q, R	1
Gated Railroad Closure Structures	Gate for Railroad at I-5, West of SR 113, East of SR 113	Q, R, S	3
Cache Creek Settling Basin Inlet Weir	Concrete Inlet Weir	CCSB Inlet Weir	3,000 Feet
Degrade Training Levee	Degrade 3,000 feet of Existing Cache Creek Settling Basin Training Levee	Training Levee	3,000 Feet
Detention Basin and Outlets	New Detention Basin and Outlets	P	1
Improve Existing Drainage Ditch	Utilize Existing drainage ditch from Detention Basin to City of Woodland Pump Station.	O	1 Mile

3.0 HABITAT AND SPECIAL STATUS SPECIES IMPACTED

3.1 Habitat

A variety of different habitat types occur within the study area that would be impacted by the LCP and high quality habitat would require mitigation to compensate for project impacts. Habitats that would be mitigated for include: cottonwood willow riparian, oak woodland, orchard, seasonal marsh, and grassland/ruderal. These habitats are briefly described below, as well as potential habitat that is low quality or urbanized and would not require mitigation.

Natural Communities

Cottonwood Willow Riparian Habitat. The overstory of the riparian habitat consists primarily of mature, well-established trees: Fremont cottonwood valley oak (*Quercus lobata*), and box elder (*Acer negundo var. californicum*). The shrub layer consists of smaller trees and shrubs; representative species observed were poison oak (*Toxicodendron diversilobum*), sandbar willow, and Himalayan blackberry (*Rubus discolor*). Elderberry shrubs (*Sambucus mexicana*), the host plant of the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), which is federally listed as threatened, were observed in the riparian habitat along Cache Creek. There are 0.05 acres of cottonwood willow riparian habitat in the study area.

Non-Native Annual Grassland/Ruderal. The non-native annual grassland is dominated by naturalized annual grasses with intermixed perennial and annual forbs. Grasses commonly observed in the study area are foxtail barley (*Hordeum murinum* ssp. *leporinum*), ripgut brome (*Bromus diandrus*), Italian ryegrass (*Lolium multiflorum*), and soft chess (*Bromus hordeaceus*). Other grasses observed were wild oats (*Avena* spp.), Bermuda grass (*Cynodon dactylon*), and rattail fescue (*Vulpia myuros* var. *myuros*). Forbs commonly observed in annual grasslands in the study area are yellow star-thistle (*Centaurea solstitialis*), bristly ox-tongue (*Picris echioides*), and sweet fennel (*Foeniculum vulgare*). Other forbs observed are perennial peppergrass (*Lepidium latifolium)*, Italian thistle (*Carduus pycnocephalus), horseweed (Conyza canadensis), and black mustard (Brassica nigra). There are approximately* 1.44 acres of non-native annual grassland and 9.26 acres of ruderal habitat. The annual grasslands in the study area contain a relatively large proportion of ruderal species, likely because of substantial disturbance from human activities.

Seasonal Marsh and Open Water. Seasonal wetland habitat can be found within the CCSB totaling 9.95 acres. This habitat can contain emergent vegetation including tules (*Scirpus sp.*), cattails (*Typha sp.*), and rushes (*Juncus sp.*). Seasonal marshes dominated by smartweed, barnyard grass, prickly cocklebur, swamp pricklegrass, western golden rod, and annual sunflower. Within the seasonal marshes of the CCSB there exists about 1.64 acres of open water habitat.

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Valley oak woodland. Small patches of valley oak woodland are found throughout the study area including at the intersection of SR 113, the I-5 overpass, and CR 98 and the new levee alignment. Oak woodlands comprise 1.97 acres in the study area. Woodlands have an open canopy with few shrubs in the understory.

Other Land Cover Types

Developed areas. There are approximately 21.48 acres of developed land in the study area that generally include roads, interstates, and structures. Some of these lands area vacant or lacking vegetation.

Fallow farmland. There are 9.58 acres of fallow farmland in the study area. These areas were once row crops. These lands have not been farmed in the last few years, but can be planted and harvested at any time.

High intensity agriculture. Agricultural crops observed during the field surveys included alfalfa, tomatoes, squash, sunflowers, wheat, and soybeans. In addition, a number of fields had been freshly disked or freshly planted. Most of the land cover in the study area consists of high intensity, active farmland. There are approximately 233.54 acres of farmland in the study area. No rice fields occur within the study area.

Levee. There are approximately 70.95 acres of levee in the study area. This land cover type consists of the levee crown, prism, and the levee toes maintenance roads. Levees occur along Cache Creek and within the study area along the CCSB.

Orchards. Deciduous orchards are confined to just south of the I-5 overpass towards the west end of the study area. Orchards encompass approximately 8.28 acres and likely consist of almonds, walnuts, pears, peaches, or plums.

3.2 Special Status Species

Based on the records search and results of the field surveys, the species with the potential to be present within the project area are: palmate-bracted bird's beak (*Cordylanthus palmatus*, PBBB), valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*, VELB), vernal pool branchiopods (VPB) including vernal pool fairy shrimp (*Branchinecta lynchi*, VPFS) and vernal pool tadpole shrimp (*Lepidurus packardi*, VPTS), giant garter snake (*Thamnophis gigas*, GGS), western yellow-billed cuckoo (*Coccyzus americanus occidentalis*, WYBC), and Least Bell's vireo (*Vireo bellii pusillus*, LBV). Table 3-1 shows the habitat requirements, distribution and occurrences in the area of these species.

Table 3-1. Federally listed Species with Potential to occur in the project area

Species	Status	Habitat Requirements	Distribution	Occurrences in Project Area
Birds				
Least Bell's vireo *Vireo bellii pusillus*	E	Breeds in diverse riparian (occasionally non-riparian) woodlands with dense shrub layer. Forages in shrub canopy and upland vegetation adjacent to riparian corridors.	Breeds chiefly in the eight southernmost counties of California south to Baja California, but has been known to occur northward to central California during breeding season. Winters in southern California and Baja California.	The riparian woodlands within the CCSB, and the riparian scrub in the nearby irrigation canal represent marginally suitable nesting habitat for this species. Presence unlikely.
Western yellow-billed cuckoo *Coccyzus americanus*	T	Large tracts (patches greater than 50 acres) of willow-cottonwood or mesquite forest or woodland with high canopy closure.	Sacramento Valley portion of the Sacramento River, the Feather River in Sutter County, the south fork of the Kern River in Kern County, and along the Santa Ana, Amargosa, and lower Colorado Rivers.	The riparian woodlands within the CCSB represent suitable nesting habitat for this species. High potential to occur near project area.
Reptiles				
Giant garter snake *Thamnophis gigas*	T	Permanent freshwater, especially sloughs and marshes overgrown with tules of willows	Central Valley including Butte, Colusa, Yolo, Sacramento, Solano, San Joaquin, Stanislaus, Merced, and Fresno counties.	This species has been documented as a vagrant in the nearby wastewater treatment ponds, and could forage in the agricultural fields during the winter. High potential to occur in project area.
Invertebrates				
Valley elderberry longhorn beetle, *Desmocerus californicus dimorphus*	T	Elderberry shrubs in moist valley oak woodlands along the margins of streams and rivers	Northern San Joaquin and southern Sacramento valleys	Evidence (emergence holes) of this species has been seen in the project area.

Vernal pool tadpole shrimp *Lepidurus packardii*	E	Vernal pools and swales containing clear to highly turbid water	Sacramento Valley from Butte County to south of the Sacramento area in Sacramento County and west to the Jepson Prairie region of Solano County.	Marginally suitable habitat is present near project footprint. Low potential to occur.
Vernal pool fairy shrimp *Branchinecta lynchi*	T	Vernal pools in grass or mud bottomed swales, earth sumps, or basalt flow depression pools in unplowed grasslands	Tehama County south through most of the Central Valley and along the south and central Coast Ranges to Santa Barbara County.	Marginally suitable habitat is present near project footprint. Low potential to occur.
Plants				
Palmate-bracted bird's beak *Cordylanthus palmatus*	E	Saline-alkaline soils and is a component of alkali sink scrub vegetation in relatively undisturbed, seasonally flooded lowlands	Populations occur at Delevan, Colusa, and Sacramento National Wildlife Refuges. Also in Yolo, Madera, Alameda, and Fresno counties.	Documented occurrence southeast of Woodland.

4.0 ENVIRONMENTAL BASELINE

Lower Cache Creek primarily runs through agricultural fields that are occasionally interspersed with rural residential lots and Valley oak woodland windrows. Agricultural crops grown in the study area include alfalfa, tomatoes, squash, sunflowers, wheat, soybeans, and tree crops (orchards). Most agricultural fields in the study area are actively planted and harvested. The majority of the study area footprint occurs in active farmland. No rice fields occur within the LCP study area. Agricultural fields provide foraging and resting areas for Swainson's hawk, red-tailed hawk, Brewer's blackbird, and black-tailed hare. Agricultural fields also provide habitat for western fence lizards, gopher snakes, California ground squirrel, California quail, coyote, skunk, and fox.

Riparian vegetation along Cache Creek largely consists of willow, elderberry, cottonwood, blackberry, and the nonnative tamarisk and giant reed. Vegetation between the existing Cache Creek levees consists of wild rose, tamarisk, giant reed, sandbar willow, elderberry, wild grape, and cottonwoods. In low water years, Lower Cache Creek is dry part of the year resulting from the Capay Diversion Dam upstream of the study area. Water availability in the channel limits the amount of riparian vegetation. The riparian corridor widens and narrows and can range from 30 feet to 200 feet wide on either side of the channel. Generally, the vegetation grows in relatively narrow strips of less than 100 feet. The riparian canopy consists of willow, Fremont and black cottonwoods, valley oak, and interior live oak. The riparian vegetation is dense, with vines like grape and blackberry, snaking up the tree canopy.

The land within the CCSB is multi-purpose. While primarily constructed as wetland/riparian swales and berms to slow Cache Creek velocities, allowing sediments to deposit in the settling basin, currently some of the lands are farmed. Land cover within the CCSB portion of the study area is comprised primarily of a matrix of Fremont's cottonwood (*Populus fremontii*), red willow (*Salix laevigata*) riparian woodlands; seasonal marshes dominated by smartweed (*Persicaria* sp.), barnyard grass (*Echinochloa crus-galli*), prickly cocklebur (*Xanthium strumarium*), swamp pricklegrass (*Crypsis schoenoides*), western golden rod (*Euthamia occidentalis*), and annual sunflower (*Helianthus annuus*); and open water. A few small isolated patches of tamarisk (*Tamarix* sp.) riparian scrub are also present. A broad corridor of sandbar willow (*Salix exigua*) riparian scrub occurs along the irrigation canal to the south of the CCSB.

The irrigation canals that border the CCSB are a matrix of open water, cattails (*Typha* sp.), tules (*Schoenoplectus acutus*), and northern water plantain (*Alisma triviale*). A number of shallow seasonal wetlands and seasonal wetland swales occur just west of the CCSB, and a larger depressional wetland with an extended hydroperiod occurs to the south of the CCSB. This depressional wetland is a seasonal wetland that has a mix of seasonal marsh and seasonal wetland species along the upper fringes, including tubered bulrush (*Bolboschoenus glaucus*), water plantain (*Alisma lanceolatum*), burhead (*Echinodorus berteroi*), hyssop loosestrife (*Lythrum hyssopifolium*), slender popcorn flower (*Plagiobothrys stipitatus*), bird's foot trefoil (*Lotus corniculatus*), and broad-leaved pepperweed (*Lepidium latifolium*).

Typically, riparian forest, valley oak woodland, and freshwater marsh are highly productive wildlife areas. Avian species found in these areas include house finch, scrub jay, acorn woodpecker, egret, owl, red-tailed hawk, and Swainson's hawk. Mammalian species found here include deer, coyote, opossum, gray fox, raccoon, western gray squirrel, and muskrat. Migratory waterfowl and raptors use the study area during the winter. Grassland and riparian scrub areas are used by species that feed on seed and vegetation such as the California ground squirrel, California vole, California quail, and American goldfinch. Vertebrate predators in the area include the gopher snake, red-tailed hawk, striped skunk, and fox. Reptilian species include garter and gopher snakes and western fence lizards.

5.0 POTENTIAL PROJECT IMPACTS

The proposed LCP would impact approximately 370 acres of land (Table 4-1). Some would be permanent impacts, like the new levee and drainage channel. Some impacts would be temporary and consist of road easements, haul roads, and staging areas. Urban areas and low quality habitat would not require habitat mitigation. These land types include: developed and tamarisk riparian scrub. Tamarisk is an invasive plant and removal of this vegetation type would be beneficial to the local ecosystem. High intensity agriculture and fallow fields mitigation would be purchased at fair market value and would not be included in the Real Estate mitigation plan.

Table 5-1. Vegetation communities and land cover types impacted by the LCP.

Land Use and Vegetation Communities	LCP Footprint (acres)
Cottonwood Willow Riparian	0.05
Developed	21.48
Fallow	9.58
High Intensity Agriculture	233.54
Levee	70.95
Non-Native Annual Grassland	1.44
Open Water	1.64
Orchard	8.28
Ruderal	9.26
Seasonal Marsh	9.95
Tamarisk Riparian Scrub	0.05
Valley Oak Woodland	1.97

Table 5-2. Mitigation for Vegetation Communities

Habitat Type	Potential Impacts	Basis of Mitigation	Duration of Impact	Mitigation
Cottonwood Willow Riparian	0.05 acres	3:1	Permanent	0.15 acres
Oak Woodland	2 acres	3:1	Permanent	6 acres
Orchard	8 acres	1:1	Permanent	8 acres
Seasonal Marsh	10 acres	1:1	Permanent	10 acres
Grassland/ Ruderal	82 acres	1:1	Single Construction Season	82 acres Hydroseed with native mix

Note: Grassland/Ruderal include non-native annual grassland, ruderal and levee impacts.

Project effects on special-status species would be both temporary and permanent. Temporary effects would result from construction activities, while permanent effects would result from new flood control structures. The proposed project would be considered to have a significant effect on special-status species if it would result an adverse effect, either directly or through habitat modification, to any threatened, endangered, or candidate species under the Federal Endangered Species Act. The effects to federally listed species with potential to occur in the project area are discussed below.

Table 5-3. Mitigation for Special-Status Species

Species	Temporary Impacts	Permanent Impacts		Total Compensation
	Impacts (acres)	Impacts (acres)	Ratio	
Palmate-Bracted Bird's Beak	None	0.15 (Indirect)	1:1	2.25 acres
		0.7 (Direct)	3:1	
Valley Elderberry Longhorn Beetle	None	6 elderberry shrubs	1:1	6 VELB credits
Vernal Pool Fairy Shrimp	0.65 (Indirect)	0.65 (Indirect)	2:1	1.3
Vernal Pool Tadpole Shrimp	0.65 (Indirect)	0.65 (Indirect)	2:1	1.3
Giant Garter Snake	0.01 (Aquatic)	1.04 (Aquatic)	3:1	29.46 acres
	41.33 (Upland)	8.78 (Upland)		
Western Yellow-Billed Cuckoo	None	None	N/A	None
Least Bell's Vireo	None	None	N/A	None

6.0 MITIGATION

6.1 Mitigation recommended by U.S. Fish and Wildlife Service

Under the provisions of the Fish and Wildlife Coordination Act, the U.S. Fish and Wildlife Service (USFWS) has prepared a draft Coordination Act Report (CAR) to assess project-related effects to biological resources in the project area. According to the CAR there are five cover-types in the project area: riparian forest, scrub-shrub, shaded aquatic riverine (SRA) cover, agricultural/ruderal, and orchard. Compensation measures recommended by USFWS include:

- Compensate for the adverse effects to scrub shrub by replanting the affected are plus an additional 0.03 acre (0.31 acre total plantings).
- Compensate for the permanent loss of individual trees and ruderal grassland by acquiring suitable lands and developing 3.41 acres in a combination of woodland and grassland habitats (minimum of 319 native tree species).

- Compensate for the loss of orchard habitat by planting 1.5 acres with native tree species.

Table 6-1. Summary of cover-types, acreage impacted, and proposed compensation.

Cover-type	Acres Effected	Compensation Acreage	Net Change in Acres
Scrub-shrub	0.28	0.31	0
Agricultural/ruderal	121.9 Agricultural; 0.52 Ruderal	121.9 0.52	0

Table 6-2. Summary of individual tree losses.

Tree Type	Trees removed	Compensation numbers	Compensation Acreage
Native	54	270	2.47
Non-native	46	46	0.42
Total	100	316	2.89

The USFWS recommendations on compensation acreages vary from the LCP as several design features were not incorporated by USFWS. The scrub-shrub habitat would not be impacted as the haul route to the training levee in the CCSB includes existing roads and levee roads (CR 102). In the 2003 Environmental Impact Statement-Environmental Impact Report (EIS-EIR) the TSP included an access/haul route over Cache Creek, the low-flow channel, which would involve culverts and placement of material to form a bridge. For these reasons, there would not be compensation for the loss of scrub-shrub habitat resulting from the LCP. Tree counts were not completed due to lack of property rights in nearly 90% of the project area. Loss of trees due to the LCP were included in the oak woodland and orchard mitigation. Upon greater design details, tree counts would be included in the mitigation proposal for the Final SEIS.

6.2 Mitigation Strategy

The updated 2019 CAR did not contain a Habitat Evaluation Procedure (HEP) analysis. The 2003 EIS-EIR did propose using five sites for the habitat losses associated with that TSP.

1. Mitigation Site 1 included roughly 200 acres of land currently owned by DWR within the northwest corner of the CCSB.
2. Mitigation Site 2 included roughly 83 acres of land privately owned along the right bank of Cache Creek where it turns south in the CCSB.
3. Mitigation Site 3 included lands owned by the County along the upstream banks of Cache Creek that were near ongoing ecosystem restoration projects.
4. Mitigation Site 4 includes land owned by DWR in the northwest corner of the CCSB.
5. Mitigation Site 5 includes conducting all mitigation activities off-site at two mitigation banks.

The City of Woodland did not propose any potential mitigation sites. For this reason it was preferred that all mitigation be purchased from mitigation banks. If lands adjacent to the project area become available for mitigation, a Cost Effectiveness/Incremental Cost Analysis would be conducted. Mitigation lands within the CCSB may become available and would be preferred.

6.3 Mitigation Cost

Costs for mitigation was estimated based on September 2019 costs. Costs were used from American River Common Features, the West Sacramento General Reevaluation Report, and the Lower San Joaquin Feasibility Study for habitat and special status species. These 2015 costs were increased per inflation to 2019 prices (Table 6-3 and Table 6-4).

Westervelt Ecological Services was contacted regarding vernal pool fairy shrimp and vernal pool tadpole shrimp mitigation costs. Westervelt advised $150,000 per acre for vernal pool creation and floodplain mosaic wetland habitat and recommended Cosumnes and Van Vleck preserve both had availability. Wildlands Inc. advised that preservation credits for both listed shrimp species were $100,000 per acre and recommended the Dolan Ranch Conservation Bank in Colusa County. Compensation for loss of valuable habitat for special-status species and other wildlife was incorporated into Table 6-5 below. The mitigation strategy would cost approximately $3.3 million.

Neither creation nor preservation credits are available for loss of habitat for Palmate-bracted bird's beak. However, it is proposed to create/enhance 2.25 acres of PBBB habitat or provide educational enhancement at the Woodland Regional Park. The park is a 159-acre property located just beyond a new residential development along roads 102 and 25 on the east end of Woodland. The park has a variety of rare habitats including vernal pool, alkali prairie, annual grassland, and riparian forest due to an undisturbed claypan layer and unique alkali sink soils. California Natural Diversity Database (CNDDB) shows records of extant plants at this Woodland park (Occurrence #1) (CNDDB 2019). There are no soils types in or adjacent to the project area (that won't be disturbed by the LCP), that have soil types needed for PBBB. These soils include Pescadero silty clay, saline-alkali, and Willows clay soil types. For this reason, the Corps proposes compensation for potential loss of PBBB be allocated towards suitable habitat at the Woodland Regional Park.

There would be no additional environmental cost for the loss of non-native annual grassland or ruderal areas as they would be replaced with higher quality habitat. All lost grassland/ruderal habitat would be hydroseeded and planted with native grasses and forbs increasing local ecological diversity and improving ecosystem function.

Table 6-3. Mitigation costs per special-status species habitat types using inflated 2015 costs.

	GGS Upland	GGS Aquatic	Elderberry Shrubs (VELB)
Mitigation Cost at a Bank	$56,300	$56,300	$5,000/credit
Mitigation Created			$95,710

Table 6-4. Mitigation costs for habitat types using inflated 2015 costs.

	Riparian	Vernal Pools	Oak Woodland	Wetlands
Mitigation Cost at a Bank	$84,450	$309,650	$84,450	$146,380
Mitigation Created	$61,930		$56,300	

Table 6-5. Total Mitigation Costs for the LCP

Impact Type	Potential Impacts	Duration of Impact	Mitigation	Cost
Palmate-Bracted Bird's Beak	0.15 acres (Indirect)	Permanent	2.25 acres - Education/Habitat Enhancement at Woodland Regional Park	$50,000.00
	0.7 acres (Direct)			
Valley Elderberry Longhorn Beetle	6 elderberry shrubs	Permanent	6 VELB credits - $5,500 per credit	$33,500.00
Giant Garter Snake	1.04 acres (Aquatic)	Permanent	30 acres - $22,500 per acre	$660,000.00
	8.78 acres (Upland)			
Vernal Pool Fairy Shrimp	1.3 acres (Indirect)	Permanent	2.6 acres - $100,000 acre	$260,000.00
Vernal Pool Tadpole Shrimp	1.3 acres (Indirect)			
Cottonwood Willow Riparian	0.05 acres	Permanent	0.15 acres - $85,000	$12,750.00
Oak Woodland	2 acres	Permanent	6 acres - $55,000 per acre	$330,000.00
Orchard	8 acres	Permanent	8 acres - $55,000 per acre	$450,500.00
Seasonal Marsh	10 acres	Permanent	10 acres - $150,000 per acres	$1,500,000.00
Grassland/ Ruderal	82 acres	Single Construction Season	67 acres Hydroseed with native mix	No additional environmental cost
Sub-Total				**$3,296,750.00**
Contingency				**$1,153,862.50**
Total				**$4,450,612.50**

7.0 PBBB MITIGATION, MONITORING, ADAPTIVE MANAGEMENT STRATEGY

The purpose of this HMMAMP is to present conceptual mitigation proposals, establish performance standards, and outline adaptive management tasks and costs. Conceptual mitigation proposals are based on the habitat impacts described above. Performance standards are established below for each habitat type, and monitoring would be conducted with the intent of meeting those standards. Over the 3 to 5 year site establishment period, improvements in field and analytic techniques may lead to changes in the monitoring methodology. While this vegetation and habitat monitoring methodology protocol builds on past years' experiences, it is likely that other opportunities for improvement will be identified in the future that should be incorporated into the protocol. In the future, there may be a determination that specific performance standards have been met and that associated monitoring tasks could cease. Similarly, it could be determined that a monitoring task was not returning useful information, and therefore not worth the expense of continuation.

Monitoring must be closely integrated with the adaptive management. The application of adaptive management principles to mitigation projects by modifying mitigation objectives during the monitoring period is a reasonable and foreseeable alternative. Unrealistic expectations or inaccurate assumptions can lead to the establishment of inappropriate project objectives. It is possible that a decision to modify success criteria might be reached based on results after several years of monitoring. In addition to modifying project objectives, there is a potential for changes to or adaptation of management actions based on monitoring results. The purpose of adaptive management is to enable strategic changes to improve the mitigation sites to functioning habitat.

Vegetation and habitat variable monitoring and data collection would occur by a qualified biologist, botanist, or habitat restoration specialist using the protocol described below and shown in Table 7-1 to determine the success of riparian revegetation plantings and overall habitat development.

Table 7-1. Summary of Habitat Types and Monitoring Recommendations

Habitat	Monitoring Variable	Method to be Used	Spacing/Number of Samples	Date to be Collected	Success Criteria
Palmate-bracted bird's beak (PBBB)	Total Herbaceous Species Cover	Visual estimates of cover within 1 sqare meter (m^2) sampling quadrats	One quadrate randomly located in each planting zone/along transect	Herbaceous species composition, total cover, and observation of PBBB	Meeting 75% native species present, with percent cover of PBBB and host plants above 50%

7.1 PBBB Mitigation Strategy

7.1.1 Objectives and Implementation Strategy

The primary objective of the mitigation would be to restore habitat for palmate-bracted bird's beak (*Chloropyron palmatum*) (PBBB). This species is restricted to seasonally flooded, saline-alkali soils in lowland plains and basins at elevations of less than 155 meters (500 feet)

(USFWS 1998). Small differences in soil topography are critical for seedling establishment, as seedlings establish on banks and sides of raised irrigation ditches and on small berms in areas subject to overland flows (Showers 1988). According to current data on the species, only perennial plants, such as saltgrass (*Distichlis spicata*), Mojave red sage (*Kochia californica*), and Torrey seepweed (*Suaeda moquinii*), are assumed to function as appropriate host plants for PBBB (Coats et al. 1988; Cypher 1998; EIP Associates 1998). The entire population is limited to Pescadero silty clay, saline-alkali, and Willows clay soil types (Andrews 1970).

Restoring or creating new habitat at Woodland Regional Park (Figure 7-1) would include minimizing of potential impact of project activities to existing habitat. Surveys would be conducted prior to restoration to identify current locations of PBBB to avoid. Since the species flowers in summertime, primarily June, and the plants are annuals, any ground disturbance would be outside the floristically appropriate season to prevent damage to existing plants.

Figure 7-1. Image of Woodland Regional Park and PBBB (Dean 2009).

Options for restoration include collecting seeds from the existing population and planting in new suitable habitat. The primary threat to PBBB in Woodland is loss and degradation of suitable habitat due to the spread of invasive species, primarily perennial pepperweed (*Lepidium latifolium*) and Italian rye grass (*Lolium multiflorum*) (Dean 2009; . Primary goals of restoration would be mechanical or hand removal of invasive species that are rapidly colonizing PBBB habitat, and successfully outcompeting PBBB. After invasive plants removal, restablishment of native plants would be needed to prevent invasive seed spread. Perennial hosts of PBBB would be planted including salgrass and seepweed both have been present on site during past surveys. Additional native plant seeds consistent with adjacent habitat may be used at the discretion of USACE and USFWS. Permanent irrigation would not need to be established for this habitat type.

7.1.2 Success Criteria

Monitoring of PBBB habitat would focus on: (1) percentage cover of native species, and (2) percentage cover of overall vegetation cover. The restored habitat would be considered successful if 75% of the vegetation on site consists of native species. Additionally, the overall PBBB cover with host plants must exceed 50% by year 3.

7.1.3 Mitigation Monitoring Strategy

Restored habitat should be monitored for five years following implementation. Surveys would involve a general overview of the condition of the site, an estimate of ground cover, and a PBBB count survey to determine potential habitat use. A ground cover survey would occur to determine the ground cover percent of native and non-native species. Ground cover surveys, if determined by the Corps to be needed to evaluate the success of the mitigation area, would involve the use of a one square meter quadrat placed randomly along transects across the restored area. Once placed, all herbaceous vegetation within the quadrat would be recorded to species level. The percent of cover by native and non-native species would be determined in addition to the percent of total cover.

Monitoring reports documenting the restoration effort would be submitted to USFWS upon completion of the restoration implementation and each year after from restoration implementation. Monitoring reports would include photos, the timing of the completion of the restoration, what materials were used in the restoration, plantings (if specified), and justification of any substitutions to USFWS recommended guidelines. Monitoring reports would also include recommendations for additional remedial actions, if necessary.

7.1.4 Adaptive Management Strategy

If the habitat is not meeting the success criteria established above, then adaptive management would be implemented in order to ensure that the habitat establishment is successful. The following subsections identify triggers that would indicate the need to implement adaptive management measures and the measures that would be implemented accordingly:

- Desired Outcome: Decrease percent of non-native, invasive species that outcompete natives
    - Trigger: Non-native percent cover of more than 25% within one year
- Desired Outcome: Increase percent cover of PBBB and associated host plants
    - Trigger: Percent cover of PBBB and host plants falls below 50% in Year 3

If the triggers established above occur, the following measures would be implemented for PBBB habitat in order to adaptively manage the site for success:

- If the performance criteria are not met within one year, additional plantings and monitoring would be implemented in order to ensure that the site is successful.
- If non-native species are outcompeting the native species, measures would be implemented to manage presence of invasive species, including mowing and selective removal of non-native species at optimal times for native growth.
- If non-native species are outcompeting the native species and targets for PBBB and host plant cover are not being met by Year 3, then revegetation of native species would occur.

7.2 PBBB Monitoring and Adaptive Management Costs

As most of the mitigation would be purchased from banks and not created on site there are few monitoring and adaptive management requirements. PBBB is the exception. If managers at Woodland Regional Park would prefer habitat enhancement or creation for PBBB then monitoring and adaptive management would be required. The cost for implementing the monitoring plan proposed above is approximately $125,000 for five years (Table 7-2). The costs are proposed to be cost-shared rather than an O&M cost, because the mitigation being created is associated with requirements set by USFWS. The cost of adaptive management would be approximately $331,250 over five years. The combined cost of monitoring and adaptive management is approximately $456,250 for five years (Table 7-3).

Table 7-2. Monitoring Costs for PBBB

Monitoring	Assumed Tasks	Frequency	Cost Assumptions	Cost /Yr
Vegetation Monitoring	Assume monitoring of mitigation site, including transects for percent cover of natives and non-natives, structural diversity using transect/plot monitoring. Assume vegetation mapping, inventories of wildlife, and observations of damage to habitat would be recorded.	Annually every 5 years	Cost estimate based on standard establishment contract, including monitoring cost and annual report from contractor. Assume $25,000 per year for 2 biologists to survey the mitigation site.	$25,000
			Total Cost 5 Years	**$125,000**

Table 7-3. Adaptive Management Costs for PBBB

Adaptive Management Measures	Assumed Tasks for Adaptive Management	Cost Assumptions	Total Cost for 5 Years
Re-planting	Assume that 50% of vegetation may require replanting over 5 years.	Cost of vegetation was estimated at $5,000 per acre.	$62,500
Removal of invasive species	Annual mowing of invasive plants	Cost of mowing $7,500 per acre.	$93,750
Annual report	Produce annual report	Assume $35,000 per report, annually for 5 years	$175,000
		Total Adaptive Management	**$331,250**
		Total Monitoring and Adaptive Management	**$456,250**

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SECTION 404(B)(1) CLEAN WATER ACT COMPLIANCE ANALYSIS

APPENDIX I

LOWER CACHE CREEK FEASIBILITY STUDY

Yolo County, CA

December 2019

United States Army Corps of Engineers
Sacramento District

Section 404(b)(1) Clean Water Act Compliance Analysis

Lower Cache Creek Feasibility Study

Yolo County, California

November 2019

Prepared for:
U.S. Army Corps of Engineers
Sacramento District
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US Army Corps of Engineers
BUILDING STRONG

Recommended Citation:
Madrone Ecological Consulting, LLC (Madrone). 2019. *Section 404(b)(1) Clean Water Act Compliance Analysis – Lower Cache Creek Feasibility Study.* Prepared for U.S. Army Corps of Engineers. Published on 18 November 2019.

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ACRONYMS AND ABBREVIATIONS

AEP	Annual Exceedance Probability
BA	Biological Assessment
BMP	Best Management Practice
CCSB	Cache Creek Settling Basin
CE	California Endangered
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
City	City of Woodland
CNDDB	California Natural Diversity Database
CT	California Threatened
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FE	Federally Endangered
FEMA	Federal Emergency Management Agency
FESA	Federal Endangered Species Act
FT	Federally Threatened
FRM	Flood Risk Managment
FWOP	Future Without Project
GGS	Giant Garter Snake
LEDPA	Least Environmentally Damaging Practicable Alternative
NED	National Economic Development
NFS	Non-Federal Sponsors
NPDES	National Pollutant Discharge Elimination System
PED	Preconstruction Engineering and Design
PBBB	Palmate-Bracted Bird's Beak
Study	Lower Cache Creek Feasibility Study
SWPPP	Stormwater Pollution Prevention Plan
TMDL	Total Maximum Daily Load
TSP	Tenatively Selected Plan
ULOP	California State Urban Level of Protection
UPRR	Union Pacific Railroad
USC	United States Code
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
VELB	Valley Elderberry Longhorn Beetle
WOUS	Waters of the United States

1.0 INTRODUCTION

This report evaluates alternatives for the Lower Cache Creek Feasibility Study (Study) in order to comply with the guidelines implementing Section 404(b)(1) of the federal Clean Water Act (33 US Code Section 1344). The guidelines state that: the U.S. Army Corps of Engineers (USACE) may not pursue Congressional authorization or funding of a federal project if:

". . .there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences.

(1) For the purpose of this requirement, practicable alternatives include, but are not limited to:

(i) Activities which do not involve a discharge of dredged or fill material into the waters of the United States or ocean waters;

(ii) Discharges of dredged or fill material at other locations in waters of the United States or ocean waters." (40 CFR Section 230.10(a)(1))."

This standard means that the USACE cannot construct an alternative if the there is a practicable option that either has a lesser adverse effect on the aquatic environment or a lesser adverse effect on other environmental resources. This means that the USACE may only construct the least damaging practicable alternative, commonly called the "LEDPA" alternative. Practicable is defined as:

". . .available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes (40 CFR Section 230.10(a)(2).

Per this standard, only alternatives that fulfill the overall project purpose are considered practicable. Accordingly, this document defines the basic and overall project purpose in **Section 4**.

The guidelines further state that the first step is to examine alternatives that do not involve discharging fill to waters of the U.S. and considering a variety of practicable alternatives to identify ones that would minimize damaging environmental consequences (40 CFR Section 230.5(c)). This standard means that USACE must first demonstrate that there are no practicable alternatives that would avoid discharging fill to waters of the United States (WOUS), prior to discharging fill.

This standard is reinforced by the language in same regulations that states that where a project does not require discharging to a special aquatic site to fulfill its basic project purpose alternatives that would avoid discharging to special aquatic sites are presumed to be available (40 CFR Section 230.10(a)(3)). Special aquatic sites are defined at 40 CFR Section 230.40 to 230.45:

- Sanctuaries and refuges
- Wetlands
- Mud flats
- Vegetated shallows
- Coral reefs, and;
- Riffle and pool complexes

Wetlands are the only special aquatic site that the selected alternative may fill or otherwise impact. Accordingly, this document analyzes the feasibility of a "no-fill" alternative in **Section 7.1** to demonstrate why avoiding waters of the United States, and wetlands in particular, is not feasible.

This report first describes the purpose and need for this work, the basis of the USACE's authority to conduct this study, and the basic and overall project purpose. This report then provides a brief review of the alternatives development process that produced the two action alternatives under consideration. This report then analyzes these two alternatives to determine which is the least environmentally damaging practicable alternative (commonly referred to as the "LEDPA") in **Section 8**. **Section 9** summarizes this analysis and proposes a LEDPA alternative.

The regulations implementing Section 404 of the Clean Water Act also require the following elements which are included in this report:

- Measures to minimize, avoid, or mitigate impacts (included in Section 10 per 40 CFR Section 230.10(d)), discussed in **Section 10;**
- Factual Determination (included in Section 11 per 40 CFR Section 230.11), discussed in **Section 11**, and;
- Findings of Compliance or Non-Compliance (included in Section 12 per 40 CFR Section 230.10(b)), discussed in **Section 12**.

2.0 PURPOSE AND NEED

The purpose and need of the Study is to reduce the overall flood risk to the City of Woodland (City). Flood risk in the City is primarily related to, rainfall rates, infiltration rates, reservoir storage, topography, ground subsidence, channel dimensions and roughness, channel bed and erosion, and levee performance. The existing Cache Creek levee profile was designed to provide a freeboard of at least 3 feet above an adopted flood profile calculated using a project design flood of 30,000 cfs (USACE, 1961). Based on current analysis presented in this report, the existing levee profile would pass a 10% (1/10) Annual Exceedance Probability (AEP) event (30,000 cfs) with 90% assurance, if the levee is assumed to not fail prior to overtopping. However, including the probability of geotechnical failure prior to overtopping, the existing levee project would pass a 50% (1/2) AEP event (10,800cfs) with 90% assurance. On average, a flood event or series of flood events in a single year would cause $22.2 million worth of damages, in the future without project (FWOP) scenario (USACE 2019b).

Lower Cache Creek has a history of flooding (USACE 2003a). Twenty severe floods have occurred in the Cache Creek basin since 1900. The most severe floods of recent years in the cache Creek basin downstream from Clear Lake occurred in 1939, 1955, 1956, 1958, 1964, 1965, 1970, 1983, 1995, 1997, 2005. The most recent high flow event was on February 27, 2019. A flow of 26,400 cfs resulted in overtopping of left bank levee downstream of Yolo upstream and overtopping of the right banks upstream of the project levees. Though there was overtopping upstream and downstream of the community of Yolo, the peak stage was 4-5 feet below the top of levee adjacent to the community. During this event there were also numerous boils and seepage concerns along both banks of the Cache Creek levees downstream to CA 113. DWR and local agencies performed emergency flood fight sandbagging to raise the top of levee along Cache Creek.

3.0 AUTHORITY

This Study was authorized by Section 209 of the Flood Control Act of 1962 (Public Law 87-874). This section states:

"The Secretary of the Army is hereby authorized and directed to cause surveys for flood control and allied purposes...Sacramento River Basin and streams in northern California draining into the Pacific Ocean for the purposes of developing, where feasible, multiple-purpose water resource projects, particularly those which be eligible under the provisions of title III of Public Law 85-500…"

In the Energy and Water Development Appropriations Act of 1993 (Public Law 102-377), Congress directed the Corps to conduct a "reconnaissance study of flooding problems in the westside tributaries, Putah and Cache Creeks, of Yolo Bypass". At the request of the Yolo County Board of Supervisors the reconnaissance study was initiated in 1993, and Federal interest was found in proceeding with a feasibility level investigation of flood damage reduction along Lower Cache Creek.

4.0 PROJECT PURPOSE AND PROJECT OBJECTIVES/CONSTRAINTS

4.1 Basic Project Purpose

The basic project purpose is to reduce flood risk to public health and safety, property, and critical infrastructure.

4.2 Overall Project Purpose

The overall project purpose is to reduce risk to public health, life, and safety, to reduce risk of damages to property, and to reduce risk of damages to critical infrastructure from flooding of Lower Cache Creek in the City of Woodland, and surrounding areas, to the fullest extent consistent with Federal participation and community financial capabilities; the project must maximize the use of existing flood damage reduction facilities prior to constructing new facilities, while protecting existing environmental resources and mitigating potential adverse effects to the maximum practical extent.

4.3 Non-Federal Project Objectives

The non-Federal sponsor (NFS) has an additional objective to meet the California State Urban Level of Protection (ULOP) requirement defined in California Government Code 65007(I). In general, to comply, levees and floodwalls in the Sacramento-San Joaquin Valley are to provide FRM protection against a flood that has a 0.5 % (1/200) AEP event (1-in-200 chance of occurring in any given year). The NFS would also seek Federal Emergency Management (FEMA) accreditation of any new or strengthened levees. Neither the ULOP nor FEMA accreditation are a Federal planning objective or requirement. However, USACE and the NFS are sharing hydrologic and hydraulic modeling alternatives analyses and results, particularly associated with the National Economic Development (NED) plan, to allow the NFS to independently assess how the alternatives address ULOP or FEMA requirements (USACE 2019b).

4.4 Planning Constraints

The Study identified a planning constraint related to mercury-laden sediments that occur in Lower Cache Creek. Under existing conditions, mercury deposits into the CCSB from mercury-laden sediment in Lower Cache Creek become methylated as a result of natural processes. Methylmercury is a potential hazard to downstream receptors in the Sacramento/San Joaquin delta. The Study did not seek to remedy the methylmercury situation in CCSB. However, proposed alternatives must avoid or mitigate any interference with the State of California's obligation to maintain compliance with the Total Maximum Daily Load (TMDL) of mercury-laden sediment in the Yolo Bypass, as mandated by the Environmental Policy Agency (EPA) in accordance with the Clean Water Act. USACE will follow all applicable Federal, State, and local law and policies (including TMDLs for pollution and sediment), as stated in ER1105-2-100 (USACE2019a).

5.0 GENERAL PROJECT DESCRIPTION AND ELEMENTS OF THE ALTERNATIVES

The two alternatives under consideration consist of Alternative 2A and Alternative 6B. These alternatives both occur due north of the City of Woodland, as depicted in **Figure 1**. Alternative 6B follows the alignment of the south bank of Cache Creek with minor deviations from the course of the creek. Alternative 2A occurs just south of 6B.

The Tentatively Selected Plan (TSP) is Alternative 2A, Levee and Conveyance Plan (LCP, a version of the South Bypass alternatives. It consists of constructing a new levee that would prevent floodwaters from Lower Cache Creek from entering the urban areas of the City of Woodland, as well as improving existing CCSB levees. This plan would reduce the surface flows that drive the risk of economic damages, as well as decrease the flooding of roadways that drives life safety risk.

The study area addressed in this report includes the downstream segment of Cache Creek in Yolo County, California. Cache Creek is a west side tributary of the Sacramento River near Sacramento, California. The main stem of Cache Creek originates with the outflows of Clear Lake in the Coast Range Mountains of Northern California. The north fork of Cache Creek is impounded by Indian Valley Dam and joins the main stem above Capay Valley before flowing out of the foothills into California's Central Valley.

5.1 Alternative 2A

Alternative 2A consists, overall, of improving existing levees and constructing a new levee north of the city of Woodland in order to reduce the flood risk to the City from flooding emanating from Lower Cache Creek. The USACE determined the necessary height of the levee embankment north of the City and the capacity of the project features by modeling a range of flood flow magnitudes/return frequencies, and then estimating the cost and benefits for four incremental heights.

5.1.1 Modifications to Existing Levees / Cache Creek Settling Basin

Alternative 2A would rehabilitate a portion of the southern levee of the Cache Creek Settling Basin (CCSB) by constructing a 60-foot-deep cutoff wall through the levee and the southwest levee of the CCSB by constructing a 45-foot-deep cutoff wall. Along with this cutoff wall installation, a 3,000-foot-long section of the west levee of the settling basin would be degraded to an elevation of 43 feet to accommodate a concrete inlet weir with a height of approximately nine feet above existing adjacent grade. The weir would serve to accept floodwater emanating from Cache Creek west of the CCSB, and would prevent backflow from the CCSB to the west during smaller, more frequent flood events. Additionally, the southernmost 3,000-foot portion of the CCSB training levee would be degraded in order to improve the distribution of sediment within the basin before construction begins. The existing outlet weir on the east side of the CCSB would remain unchanged. Please note that all elevations are given in the North American Vertical Datum of 1988 (NAVD 88).

5.1.2 New Levees and Other Proposed Project Features

A new levee with a 20-foot-wide crest and a 30-foot-wide landside seepage berm would begin near the intersection of County Road 20 and County Road 98 and extend east to the CCSB. The alignment of the levee would generally follow the northern city limit line west of State Route 113 (SR 113) and Churchill Downs Avenue east of SR 113. The height of the new levee would vary from six feet near County Road 98 to 14 feet at its intersection with the existing west levee of the CCSB. Rock slope protection is proposed on the waterside slope of the new levee from County Road 101 east to the southern end of the proposed inlet weir near County Road 20.

A trapezoidal drainage channel with a design capacity of approximately 350 cubic feet per second (cfs) would be constructed north (waterward) of the new levee in order to capture smaller, more frequent events and discharge them to the CCSB, and also to provide the necessary fill material for the project. This drainage channel may vary in width during subsequent design phases in order to create a balanced earthwork for the project.

A total of four closure structures (gates that are assembled by operations and maintenance personnel prior to the flood) would be constructed where the embankment crosses the Union Pacific Railroad (UPRR) tracks near Interstate 5 (I-5), the UPRR tracks west of SR 113, SR 113, and the UPRR tracks east of SR 113. Due to the limited distance between the closure structures, short sections of floodwall would be constructed to connect the closure structure at the I-5 crossing to the existing roadway embankment and to connect the closure structures at the SR 113 crossing and the adjacent UPRR crossing to the west.

5.1.3 Internal Drainage

Water impounded by the proposed levee and the west levee of the CCSB would be drained via proposed culverts into the CCSB and to the City's interior drainage system. A 15-acre detention basin would be constructed at the downstream end of the proposed drainage channel along Reach P. The detention basin would include an east outlet and a south outlet. The east outlet would provide for gravity drainage into the CCSB and consist of three 60-inch diameter culverts fitted with flap gates. This would allow gravity flow from the detention basin into the CCSB after stages subside below the weir elevation, with reverse flow from the CCSB into the detention basin being prevented by the flap gates. The south outlet would consist of a set of three 60-inch diameter culverts fitted with sluice gates. The culverts would discharge to an existing ditch that terminates at a pump station owned and operated by the City. The sluice gates would control the discharge flow to the pump station until capacity was available to discharge the flows to the Yolo Bypass. The design and operation of these systems has not been fully developed yet, and will be optimized during later phases of the project.

5.1.4 Roadway Improvements

The new levee would require the raising of County Road 98, County Road 99, County Road 101, and County Road 102. Culverts would be installed at each of these raised crossings, as well as under SR 113 and the two UPRR crossings along the alignment. An existing railroad underpass at I-5 would be used to convey flood waters under the interstate. In order to prevent erosion due to high velocities in this area, those portions of the area found to have velocities of over five feet per second (fps) would be lined with concrete. This protection would be installed across the entire project footprint area where flood flows velocities exceed the 5 fps limit. This area includes the existing slopes of the I-5 roadway embankment, the slopes of the proposed levees in two reaches, the proposed channel (both bottom and slope), and the existing UPRR railway.

5.1.5 Net Economic Benefits

During the alternatives screening process, Alternative 2A was estimated to provide $17.8 million in annual benefits (2019 prices), with $8.2 million in annualized costs, yielding $9.6 million in net economic development (NED) benefits.

5.2 Alternative 6B

Alternative 6B would involve raising the existing levees along approximately 8 miles of Cache Creek from CR 97A to the CCSB. Levees would be raised on both sides of the creek, and new levees would be constructed on the south bank of the levee from 97A upstream 2 miles. On the north bank of the levee upstream from CR 97A, 1 mile of project levee would be raised, and approximately 1 mile would be newly constructed. This plan would involve bridge replacement and slope protection where required.

5.2.1 Net Economic Benefits

During the alternatives screening process, Alternative 6B was estimated to provide $19.5 million in annual benefits (2019 prices), with $13.5 million in annualized costs, yielding $6.0 million in net economic development (NED) benefits.

6.0 PREVIOUSLY REJECTED ALTERNATIVES AND ALTERNATIVES DEVELOPMENT PROCESS

This section summarizes the USACE's consideration and rejection of alternatives considered in the planning process. The purpose of this section is to demonstrate the depth of the USACE alternatives development process and the failure of previously considered alternatives to meet the basic and overall project purpose or project objectives or planning criteria. The primary source for this section is the USACE's *Lower Cache Creek, Yolo County, CA, City of Woodland and Vicinity Draft Feasibility Report for Potential Flood Damage Reduction Project* (USACE 2003a). This section also relies upon the *Report Summary, Lower Cache Creek Feasibility Study* (USACE 2019a).

The alternatives development process started with consideration of a wide array of structural and non-structural measures. Structural here means flood risk reduction mechanisms that rely on creating physical structures such as levees or storage facilities such as reservoirs created by dams or excavation. Non-structural means mechanisms such as a reverse 911 system that would allow flood management agencies to contact residents. This process is framed by the planning objectives, constraints, and evaluation criteria (USACE 2003a).

USACE planning objectives consisted of maximizing the use of existing flood damage reduction facilities prior to constructing new facilities in order to reduce flood damage in the City of Woodland, while protecting environmental resources and mitigating adverse effects to the maximum extent practical (USACE 2003a).
Planning constraints consisted of minimizing the cost of flood damage reduction and minimizing adverse effects on area residents and environmental and agricultural resources (USACE 2003a).

Planning evaluation criteria consisted of:

- Completeness: the degree to which a plan achieves desired outputs and avoids need for further action while mitigating adverse environmental effects and avoiding or offsetting adverse hydraulic effects on other areas (USACE 2003a).
- Effectiveness: the level and reliability of flood risk reduction achieved while addressing planning objectives and the capability of being implemented (USACE 2003a).
- Efficiency: the extent to which a plan is cost effective while addressing or alleviating flood risk (USACE 2003a).

- Acceptability: the degree to which non-federal sponsors and local jurisdictions support the plan combined with the ability to avoid or minimize environmental effects and obtain relevant permits and certifications (USACE 2003a).

Table 1 provides a summary of measures that were considered when the study was reactivated in 2018. Grayed-out measures were screened out for cost, socioeconomic and environmental concerns.

Table 1. Summary of Measures Carried Forward During the 2018-2019 Plan Formulation Iteration

	CURRENT MEASURES USED TO DETERMINE 2019 TSP				
Non-Structural	Enhance Educational Outreach	Reservoir Reoperation	Flood Warning System	Flood Response Plans	Flood Proofing
	Raising Structures	Removing Structures	Relocating Structures	Preserve Floodplain	Floodplain Management
Containment	Strengthen Levees		Raise Levees	New Levees	Floodwalls
	Levee Superiority	Upstream Detention/ Retention		Storm water Detention	
Channel Modification	Vegetation Clearing	Sediment Removal/Channel Deepening	Channel Straightening	Channel Widening	Bank and/or Bed Protection
Transportation Infrastructure	Raise Roadbeds	Lower Roadbed	Raise Railroad Bed		Bridging/ Culverts
Use Existing Floodplain	Bypass/ floodway	Floodplain Contouring		Modification of CCSB Outlet Weir	

6.1 Non-Structural Measures Considered

USACE considered the following non-structural measures:

- Enhance Educational Outreach
- Raising/flood-proofing structures,
- Preserving the Floodplain
- Floodplain Management
- Removing/Relocating structures, and;

Raising or flood proofing structures was rejected because of prohibitive costs and socioeconomic effects (disruption of residents' lives while structural work was in progress). At the time of the 2003 Study it was assumed that approximately 4,000 homes in the 100-year floodplain needed to be raised. At an average cost of $60,000 per home, the total cost for structural work alone was estimated at $240 million (USACE 2003a). This cost would likely be much higher today.

Relocating structures was rejected for similar reasons. Assuming 4,000 homes would be relocated at an estimated cost of $100,000 each, the total cost would be $400 million (USACE 2003a).

The implementation of a flood warning system was retained for consideration with other measures, but by itself would not reduce flood risk or flood damages (USACE 2003a). The City of Woodland has since implemented a flood warning system to protect its residents.

6.2 Structural Measures Considered

6.2.1 Storage Measures

Storage measures were considered by the USACE. Storage consists of dams or off-stream reservoirs that can be used to hold floodwater and thus attenuate peak flow events. All storage measures were rejected because they do not achieve desired outcomes while avoiding the need for further action (they fail the completeness criterion). All of these sites were eventually deemed infeasible due to storage limitations, foundation or seismic problems, construction or operational difficulties, high costs, or lack of local support.

- The Blue Ridge site occurs just upstream of Rumsey. This site for a potential dam was rejected because it exists at the intersection of five seismic faults (USACE 2003a).
- The Bear Creek site occurs within the boundaries of the State Department of Water Resources Eel River Project. The site would only attenuate downstream flows on lower Cache Creek by 9 percent even when 100 percent of runoff upstream of the site was captured (USACE 2003a).
- The Wilson Valley site occurs on Cache Creek five miles downstream of the confluence with the North Fork of Cache Creek. This site could only store up to 37,000-acre feet due to weak foundations at the location and would be filled with sediment in 80 to 90 years. In addition, this site would not attenuate a 50-year flood below the threshold at which damage would occur on lower Cache Creek (USACE 2003a).
- The Capay site occurs downstream from Capay Dam on Cache Creek. The project would involve construction of off stream detention ponds adjacent to Cache Creek. This site would require 75,000-acre feet of storage to attenuate a 100-year flood below the threshold for damage at the town of Yolo. Assuming a storage depth of 20 feet 5.9 square miles of reservoirs would be needed making the real estate, construction, and operational logistics infeasible (USACE 2003a).

6.2.2 Other Structural Measures

Initial Screening identified the following array of structural measures involving levee construction, levee improvement, or channel work for further consideration after storage measures and non-structural measures such as raising homes or relocating homes were rejected. These measures consisted of the following:

- Channel clearing (removing vegetation) or enlargement would both increase conveyance capacity (USACE 2003a). These measures would have effects on riparian vegetation and would also require bank protection to mitigate scour caused by greater water velocity (USACE 2003a). Channel clearing was rejected because it would require extensive vegetation removal with an attendant loss of riparian habitat along Cache Creek (USACE 2003a). This effect makes this option unacceptable (it fails the acceptability criterion) because Cache Creek with its associated riparian habitat is considered an important environmental resource and an environmentally sensitive area (USACE 2003a).
- Levee raising would increase the conveyance capacity of the existing system but may also require bank armoring to mitigate scour during high flow events (USACE 2003a). Levee raising would be required for eight miles along Cache Creek, from County Road 97A to the Cache Creek settling basin. Levee raising for the existing levees that follow the contours of Cache Creek would create significant effects on riparian habitat and may potentially fail the acceptability criterion (USACE 2003a). Note that levee raising has the benefit of increasing protection to undeveloped lands between Woodland and Cache Creek.
- Setback levees would increase conveyance capacity by constructing levees at some distance from the existing levees and bank, and degrading all or some of the existing levee. These features avoid the need for armoring because water velocity is not increased, and thus would avoid riparian vegetation effects (USACE 2003a). Setback levee plans considered would reliably pass a flow for a 200-year event and would avoid channel effects on riparian vegetation (USACE 2003a). High-water events would flow over the bank into uplands for at least 1,000 feet and would mimic natural flooding processes, thus avoiding scour associated with a narrow high-velocity channel (USACE 2003a). These plans would have some loss of agricultural land on the waterside of setback levees. This concept was retained for further study.
- Backup Levees are set away from the channel at even greater distance than setback levees. In these scenarios existing levees are retained, thus leveraging the protection of existing levees while also adding additional protection to landside communities near backup levees (USACE 2003a). Backup levees are also described as "flood barriers" in the screening process. These plans would provide protection to the town of Woodland from a 200-year event. Because existing facilities would be retained this plan would leverage and maximize the utility of existing facilities (USACE 2003a). Because work in the channel would be avoided, riparian habitat would not be disturbed, and would mercury-laden sediment in the channel would not be mobilized (USACE 2003a). Some loss of agricultural land would occur, but not to the extent associated with setback levees (USACE 2003a).

The major conclusion of the 2003 *Lower Cache Creek, Yolo County, CA, City of Woodland and Vicinity Draft Feasibility Report for Potential Flood Damage Reduction Project* is that backup levees, also described as the Lower Cache Creek Flood Barrier Protection Plan, was tentatively recommended because it had the lowest estimate cost ($41 million) and minimized environmental effects to agricultural land and riparian vegetation (USACE 2003a). The setback levee scheme, in the form of the Modified Wide Setback Levee Plan, was comparatively costly (estimated at $152.6 million) and would have greater effects on riparian vegetation and agricultural land. However, the local community was divided on whether to support the Flood Barrier Plan. Due to lack of public support for the proposed plan, the NFS did not pursue the study further.

6.3 Focused Array of Alternatives

The study was reactivated in winter 2018 by request of the City. The TSP milestone occurred in February 2019. Plan formulation for the current iteration of the study included development of a list of management measures, many of which had been considered in the 2003 study. In January 2019, the USACE developed a document titled *Report Summary, Lower Cache Creek Feasibility Study*, based on new input from non-federal sponsors (USACE 2019a). This report developed a focused array of alternatives that provide a means of selecting variations on the workable approaches to reducing flood risk in the 2003 report. The array of alternatives considered consisted of the following:

- Alternative 1A: This consists of strengthening the right (south) bank of Cache Creek and also causing the overtopping of the left bank levees using adjacent lands as a bypass. This was rejected because other alternatives have a higher benefit (USACE 2019a).
- Alternative 1B: This consists of strengthening the right (south) bank of Cache Creek and also causing the overtopping of the left bank levees using adjacent lands as a bypass. Flowage easements would be purchased to ensure floodwaters reach the Colusa basin. Seepage mitigation and rock bank protection are included in this plan. This was rejected because other alternatives have a higher benefit (USACE 2019a.
- Alternative 1C: This alternative is similar to Alternative 1B. Levees would channelize water and convey it to the Colusa basin. This was rejected because other alternatives have a higher benefit (USACE 2019a.
- Alternative 1D: This is similar to Alternative 1A. A right bank levee extension would be constructed upstream of I-5. The left bank levee upstream of I-5 would be degraded. No strengthening of levees would occur on the right bank downstream of I-5. This was rejected because other alternatives have a higher benefit (USACE 2019a).
- Alternative 2A: Levees would be constructed in upland areas to reduce risk of floodwaters entering urban Woodland. The floodwaters would pass into the CCSB via a cut in the western levee of the basin. It may include a weir at the cut to control waters escaping the settling basin during small flood events. This plan represents an evolution of the plan recommended in the 2003 Study (USACE 2003). This alternative was carried forward for consideration (USACE 2019a).
- Alternative 2B: This is similar to Alternative 2A but with additional features to address localized induced flooding around I-5 and Highway 113. It also minimizes impacts to the CCSB by limiting excavation necessary to move out-of-bank floodwaters around the basin into Yolo Bypass. This was not carried forward because these features were incorporated into Alternative 2C (USACE 2019a).
- Alternative 2C: This is similar to Alternative 2A. A channel would convey floodwaters south of the settling basin rather than degrading the levee of the CCSB. This would move a portion of the settling basin east levee farther east to avoid an industrial complex. The railroad line along the south side of the CCSB would require extensive modifications. This alternative was not carried forward because it is not economically justified (USACE 2019a).
- Alternative 2D: This alternative is similar to Alternative 2C. It would strengthen the right and left bank of Cache Creek along the town of Yolo. It would include seepage mitigation and rock bank protection. This alternative was not carried forward because the cost is not warranted relative to the benefit (USACE 2019a).

- Alternative 6A: This alternative is a "strengthen-in-place" plan. The right (south) bank levee of Cache Creek as well as the left bank along the town of Yolo would be reinforced. This includes seepage mitigation and bank protection. Because this does not address overtopping it was abandoned (USACE 2019a).
- Alternative 6B: This increases the height of the right and left bank levees near Yolo. This would significantly reduce the risk of flooding to the south of Cache Creek. Seepage mitigation and bank protection is included. This alternative was carried forward (USACE 2019a).
- Alternative 6C: This would strengthen or increase the height of both the left and right levees along their entire length. This would remove the left bank levee upstream of I-5 and construct new levees adjacent to I-5, forcing floodwaters north so they are conveyed under I-5 via culverts. This alternative would include seepage mitigation and bank protection. This alternative was abandoned because raising the left bank is not economically justified (USACE 2019a).
- Alternative 7A: This alternative would construct levees along the right bank only and extend the right bank levee upstream to prevent overtopping at I-5. The outlet weir at the CCSB would be modified to allow these flows. This alternative was not carried forward because of construction costs associated with TMDL compliance (USACE 2019a).
- Alternative 7B: This alternative be similar to Alternative 7A but varies from 7A because it would include a levee or channel to divert overbank flow to the north of CCSB instead of increasing the weir capacity of the CCSB. Flowage easements would be purchased to accommodate these flows This alternative was not carried forward because of construction costs associated with TMDL compliance (USACE 2019a).

This screening process produced the current action alternatives under consideration: Alternative 2A and Alternative 6B.

The current SEIS is not considering Alternative 6B as it was screened out in the 2003 EIS-EIR. Studies have shown that hydraulic impacts associated with Alt 6B would include higher channel velocities and increased peak flows entering the settling basin, which may reduce the trap efficiency of the CCSB. Increased mobilization of sediments could result in mercury methylation above the TDML standards set by the EPA. It was also anticipated that high-quality oak woodland and cottonwood-willow riparian habitat would be removed and require costly mitigation for the habitat itself and for Federally-listed species, like yellow-billed cuckoo.

7.0 PRATICABILITY OF A NO-FILL ALTERNATIVE, PRACTICABILITY OF AVOIDING SPECIAL AQUATIC SITES, AND PRACTICABILITY OF OFF-SITE ALTERNATIVES

7.1 No Action Alternative

The no action alternative is the same as the future without project (FWOP) condition identified in the Study. The FWOP condition is the most likely condition expected to exist in the future, absent the proposed Federal water resources project. The FWOP condition constitutes the benchmark against which the EIS alternatives must be compared for Federal planning purposes. Other adopted plans in the Study area and local planning efforts with high potential for implementation have been considered as part of the forecasted FWOP condition (USACE 2019b).

Under the FWOP condition, loss of life would be expected, as well as injuries, illnesses, and other public health and safety problems. Flooding in the City could trigger releases of hazardous and toxic contaminants into the waterways surrounding the floodplain, and potentially the failure of liquid petroleum gas tanks and underground storage tanks. Post-flood cleanup of these substances could be a major undertaking (USACE 2019b).

Transportation through Woodland and the surrounding area would be severely hampered by a major flood. Woodland is intersected by Interstate 5 (I-5) and California State Route 113 (SR 113) running north-south. Flooding on I-5 occurred in 1983 and emergency routes were blocked. Without a flood risk management project, a major flood could trap residents from escaping dangerous flood waters on the major transportation corridors (USACE 2019b).

Critical infrastructure would be rendered non-functional for an extended period of time after a flood. Power, sewer, and fresh water supply could be interrupted for a substantial time period. Emergency costs associated with evacuation, flood fighting, fire and police, and government disruptions would occur. After floodwaters have receded, debris cleanup would be a substantial undertaking (USACE 2019b).

The No Action Alternative is not the LEDPA because it does not meet the overall project purpose.

7.2 No Fill Alternative

The guidelines implementing Section 404(b)(1) of the Clean Water Act create a presumption that a no-fill alternative (an alternative that avoids filling WOUS is feasible (40 CFR Section 230.10(a)(1)(i)).

A practicable no-fill alternative for this project would consist of an alternative that meets the overall project purpose and would also entirely avoid any fills to WOUS. Several factors make such an alternative infeasible. Flood water flows cannot typically be controlled without constructing physical features adjacent to the locations where waters occur or adjacent to the locations where flood risk reduction is desired. Improving the existing structures inevitably requires some fill to WOUS because these structures are adjacent to Cache Creek and the CCSB. New levees that are constructed in uplands in order to improve risk in Woodland in turn necessarily bisect other waters that traverse the landscape, such as irrigation canals. A geographically winding flood risk management (FRM) structure that was constructed to avoid all waters would have a larger footprint than either Alternative 2A or Alternative 6B, would be economically infeasible, and would generate greater environmental effects. For this reason, such an alternative is not the LEDPA because it is not logistically feasible or cost effective and therefore fails to be *"capable of being done in after taking into consideration cost, existing technology, and logistics, in light of overall project purposes"* (40 CFR Section 230.10(l)).

7.3 Avoidance of Special Aquatic Sites

The guidelines also create a presumption that special aquatic sites may be avoided (40 CFR Section 230.10(a)(3) unless the project depends on water to fulfill its basic project purpose. Special aquatic sites are defined as the following waterbody types (40 CFR Section 230.40 to 230.45):

- Sanctuaries and refuges
- Wetlands
- Mud flats
- Vegetated shallows
- Coral reefs, and;
- Riffle and pool complexes

While levees and other FRM infrastructure exist to manage water flows, they are not water dependent in the same sense as wharves, piers, or other works that exist solely to move resources via water. For this reason, this analysis assumes the project is not water dependent. The avoidance of all special aquatic sites (wetlands in this case) is not feasible for the same reasons that avoidance of all waters is not feasible. Wetlands are distributed across the landscape in association with natural hydrology, as well as artificial hydrology associated with agricultural irrigation systems and the existing FRM works. FRM features by nature consist of long, linear works that bisect wetlands and other waters. Constructing FRM structures that avoid all wetlands would require taking a circuitous path that would reduce or potentially even negate the efficacy of the features. In the case of the training levee degrade, this work cannot occur but for impacts to a small portion of the seasonal marsh habitat located within the CCSB. For this reason, an alternative that would avoid all special aquatic sites is not the LEDPA because it is not *". . . capable of being done after taking into consideration cost, existing technology, and logistics in light of overall purposes"* (40 CFR Section 230.3(l).

7.4 Off-Site Alternatives

The guidelines assume that practicable alternatives include discharges of dredge and fill at other locations than the preferred alternative (40 CFR Section 230.10(a)(1)(ii). These alternatives are informally called "off-site alternatives" because they typically occur on locations other than those controlled or owned by the project proponent. For the purposes of this analysis offsite alternatives would consist of alternatives that do not intersect with, expand upon, or leverage existing FRM works along Cache Creek. These alternatives are infeasible for the following reasons:

- The overall project purpose emphasizes utilizing existing works in order to leverage rather than abandon the significant capital investments these works represent.
- True off-site alternatives would require enormous capital expenditures to both acquire right-of-way and to construct because they would not build upon existing investments.
- Offsite alternatives also may have significantly greater environmental effects because they would require much larger disturbance footprints and construction windows due to the need to construct new works "from the ground up" rather than by using existing works.

- Off-site alternatives do not meet the project purpose of reducing flood risks to the City of Woodland.

Because the overall project purpose emphasizes utilizing existing works and leveraging the capital investments required to create those works, true offsite alternatives which would not use existing features (directly or indirectly) do not meet the overall project purpose and are thus impracticable.

8.0 ANALYSIS OF PRACTICABLE ALTERNATIVES

This section analyzes the relative effect that the two action alternatives would have on aquatic resources and other key environmental resources. The purpose of this analysis is to satisfy the requirements of 40 CFR Section 230.10(a):

"Except as provided under section 404(b)(2), no discharge of dredged or fill shall be permitted if there is an alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences."

This section means that USACE may only construct the alternative that either has the least adverse effect on aquatic resources or the alternative that avoids other significant adverse environmental effects. The regulations do not provide a precise method for making this determination. This section summarizes and compares key environmental data to determine which alternative satisfies this requirement. The methodology is described below.

8.1 Methodology

8.1.1 Aquatic Resources

In order to assess the relative effect that each alternative has on aquatic resources, all aquatic resources in each alternative's footprint were mapped (**Figure 2**). See also **Attachment A** for larger-scale maps. In addition, vernal pools within 250 feet of the project footprint were mapped because these waterbody types may be sensitive to loss of hydrology from work in the footprint. Resources were described by type (i.e. riverine waters, wetlands, and constructed features such as drainage ditches, canals, and retention or detention basins). Mapping was completed largely by remote sensing, with some limited field inspection (the preliminary level of design and lack of access to the entire footprint limited the nature of the mapping).

The mapping exercise also ranked resource quality for aquatic resources. Resources were assigned the status of low, medium, or high quality based on the following factors:

- Whether the resource was natural or constructed (natural waterbodies were ranked higher than constructed resources typically because natural waterbodies typically have higher ecological function and value than constructed features, and;

- Whether the natural feature had adjacent vegetation or was in an otherwise undisturbed location (natural waterbodies occurring in a fragmented or disturbed context are of less value than pristine resources in natural habitat).

Geographic information systems (GIS) was used to overlay the Alternative 2A and Alternative 6B project footprints with mapped resources and the results were summarized in table form. This exercise has two components:

- Mapped aquatic resources in the direct project footprint were summarized by acreage. Note that this does not correspond exactly to the locations where fill will occur and thus which features would be subject to loss or otherwise regulated under Section 404 of the Clean Water Act. This method instead provides a proxy for fill by directly comparing the total quantity of waters across both project footprints. This method is the best means of comparing the potential effect of each alternative on aquatic resources given the preliminary level of design.
- Mapped vernal pools within a 250-foot buffer were also mapped and tabulated since the USFWS typically considers vernal pools within 250 feet of grading activities to be indirectly impacted.

8.1.2 Other Biological Resources

The LEDPA standard cited above (40 CFR Section 230.10(a)) requires comparison of other key environmental resources; it does not rely solely on impacts on aquatic resources. For this reason, this report also summarizes effects on biological resources other than aquatic habitat.

8.1.2.1 Vegetation Communities

To estimate effects on vegetation communities, the potential impacts footprint for each alternative was intersected with mapped habitats and vegetation community data (**Figure 3**). See also **Attachment B** for larger-scale maps.

This report compares the acreage of all vegetation communities in the footprint of each alternative. While not all of this acreage would be affected, the early stage of design makes fine-grained comparison of impacts impracticable. Therefore, in order to provide an equivalent comparison this analysis simply quantifies the vegetation communities in the footprint of each alternative.

8.1.2.2 Special-Status Species Habitat

In order to assess each alternative's potential impacts to special-status species, the mapped vegetation and natural community layers were associated with special-status species identified as potentially occurring in the area. For the purposes of this analysis only, species regulated under the and federal Endangered Species Act (FESA) were used. This analysis considered:

- Species listed as threatened (CT) or endangered (CE) under the CESA and candidate species for listing, and;
- Species listed as threatened (FT) or endangered (FE) under the FESA.

In order to identify relevant species that may be affected, analysts first queried the California Natural Diversity Database (CNDDB) for the alternative footprints and a five-mile radius from the impact areas. These results were then parsed to determine which species actually have the potential to occur in the project footprint. These species were then correlated with suitable habitat types based on vegetation. Like the comparison of aquatic features and vegetation communities, this analysis does not assume that the entire acreage will be lost for these habitats, but instead simply compares the total acreage in the footprint of each alternative as the best means of comparing the relative effect of the alternatives given the preliminary level of design.

8.2 Comparison of Effects on Aquatic Resources, Vegetation Communities, and Special-Status Species

8.2.1 Aquatic Resources Data

This section compares the relative quantity of impacts on aquatic resources using the methods described above. Note that this comparison does not precisely identify exactly where all fills to WOUS would occur, but instead estimates the WOUS that would be adversely affected by each alternative. **Table 2** and **Table 3** below provide a comparison of all mapped aquatic resources for each alternative, both those that will be directly impacted within the footprint and those that will be indirectly impacted within a 50-foot buffer, along with their ranking for quality of the habitat. These tables thus provide a proxy means of estimating the relative potential effect that each alternative would have on WOUS.

Table 2. Estimated Aquatic Resource Impacts for Alternative 2A

Aquatic Resource	Direct Impact (acres)	Indirect Impact (acres)	Total (acres)	Quality	Note
Cache Creek	0.19		0.19	High	
Cache Creek Settling Basin	5.17		5.17	Low	
Irrigation Canal	0.94		0.94	Medium	
Irrigation Ditch	0.19		0.19	Medium	
Pond	0.33		0.33	Low	
Riparian Wetland	0.003		0.00	High	
Roadside Ditch	0.02		0.02	Low	
Seasonal Marsh	9.94		9.94	Low	Temporary Impact
Seasonal Wetland (agricultural)	6.82		6.82	Low	
Seasonal Wetland (natural)	0	0.65	0.65	High	Listed Shrimp Habitat
TOTAL:	**23.60**	**0.65**	**24.25**		

Table 3. Estimated Aquatic Resource Impacts for Alternative 6B

Aquatic Resource	Direct Impact (acres)	Indirect Impact (acres)	Total (ac)	Quality	Note
Cache Creek	7.22		7.22	High	
Cache Creek Settling Basin	12.09		12.09	Low	
Irrigation Canal	0.20		0.20	Medium	
Irrigation Ditch	0.11		0.11	Medium	
Pond	0		0	Low	
Riparian Wetland	0.26		0.26	High	
Roadside Ditch	0		0	NA	
Seasonal Marsh	0.64		0.64	Low	
Alkaline Seasonal Wetland	5.57	3.25	8.82	Low	
Seasonal Wetland (agricultural)	0.02	0.04	0.06	Low	
Seasonal Wetland (natural)	0	0.65	0.65	High	Listed Shrimp Habitat
TOTAL:	**26.11**	**3.94**	**30.05**		

8.2.2 Aquatic Resources Impacts: Discussion

Alternative 6B has higher total potential impacts on WOUS than Alternative 2A (30.05 acres versus 24.25 acres).

The majority of the aquatic habitat impact acreage from Alternative 2A comes from low-quality open water and seasonal marsh habitat impacts to the CCSB, as well as impacts to low-quality agricultural wetlands. The CCSB is a constructed feature that allows sediment to fall out of the water column as high velocity water slows down in the expanse of the basin. While there is riparian habitat adjacent to the settling basin, this habitat would not be affected. The CCSB itself consists of open water and seasonal marsh habitat that provide low function and value on a quality rating. The affected agricultural wetlands are ranked low quality because they are subject to periodic disturbance for purposes of cultivation and do not provide significant function and value as habitat or other ecosystem services.

The seasonal marsh habitat impacts from Alternative 2A would be considered temporary, as they would result from construction equipment driving on the toe roads to transport training levee material to the staging area near the detention basin. The training levee degrade to adjacent grade would also result in the creation of additional seasonal marsh habitat within the CCSB. This means that the permanent impacts to WOUS from Alternative 2A would be approximately 14.31 acres.

In addition to having higher overall impacts to WOUS as compared to Alternative 2A, Alternative 6B would have greater impacts on high quality aquatic features than Alternative 2A. Alternative 2A would affect only 0.84 acres of features ranked as high-quality waters, while Alternative 6B would affect 8.13 acres. The high-quality aquatic features that would be affected by Alternative 6B consist of Cache Creek, riparian wetlands and seasonal wetlands that are potential habitat for the federally-listed vernal pool shrimp species. These are relatively pristine waterbodies with significant habitat value. Cache Creek itself consists of a natural watercourse with adjacent riparian habitat that provides a rare example of a natural stream on the valley floor.

8.2.3 Other Biological Resources Data

This section compares effects on vegetation communities and special-status species habitats using the methods described above.

8.2.3.1 Vegetation Communities Data

Table 4 and **Table 5** provide a list of vegetation community types and acreages identified within each alternative's footprint.

Table 4. Estimated Vegetation Community Impacts for Alternative 2A

Vegetation Community	Total Impact (ac)
Cottonwood Willow Riparian	0.05
Developed	21.48
Fallow	9.58
High Intensity Agriculture	233.54
Levee	70.95
Non-Native Annual Grassland	1.44
Open Water	1.64
Orchard	8.28
Ruderal	9.26
Seasonal Marsh	9.95
Tamarisk Riparian Scrub	0.05
Valley Oak Woodland	1.97

Table 5. Estimated Vegetation Community Impacts for Alternative 6B

Vegetation Community	Total Impact (ac)
Cottonwood Willow Riparian	23.91
Developed	27.54
Disturbed	8.02
Dryland Pasture	1.13
Elderberry Savannah	2.09
Fallow	4.95
High Intensity Ag	192.92
Levee	53.68
Non-Native Annual Grassland	89.92
Open Water	7.66
Orchard	93.92

Vegetation Community	Total Impact (ac)
Ruderal	5.71
Seasonal Marsh	0.64
Valley Oak Woodland	18.79

8.2.3.2 Vegetation Communities Impacts: Discussion

Alternative 6A affects more gross acreage of vegetation communities than Alternative 2A (±162 acres more than 2A). In addition, the majority of the vegetation communities affected by Alternative 2A (approximately 93%) consists of vegetation communities that do not provide high biological function. These communities were categorized as Developed, High Intensity Agriculture, Levee, Ruderal, Disturbed, and Orchard. For Alternative 6B, these communities make up approximately 72% of the vegetation communities impacted.

A significant difference between the two alternatives is in their potential impacts to oak woodland and riparian habitats. Alternative 6B includes ±17 more acres of impacts on valley oak woodland than Alternative 2A (18.79 acres vs. 1.97 acres). Alternative 6B would also impact ±24 acres more cottonwood willow riparian habitat than Alternative 2A (23.91 acres vs. 0.05 acre), and would impact 2.09 acres of elderberry savannah, a habitat type that was not identified within the Alternative 2A footprint. Alternative 2A would impact one riparian vegetation community not found within the Alternative 6B footprint (tamarisk riparian scrub); however, the total area of impact to this community would be only 0.05 acre. The greater impact to riparian and oak woodland habitats by Alternative 6B is because its footprint follows the south bank of Cache Creek for the majority of its length. The Alternative 2A footprint does intersect with the south bank of Cache Creek, but primarily is located within agricultural lands.

8.2.3.3 Special-Status Species Data

Table 6 and **Table 7** below summarize the relative quantity of suitable habitat for each species contained in the footprint of each alternative.

Table 6. Estimated Special-Status Species Habitat Impacts for Alternative 2A

Species	Direct Impacts		Indirect Impacts	Total Habitat
	Permanent	Temporary		
Palmate-Bracted Bird's Beak	0.70 acres	NA	0.15 acre	0.85 acre
Valley Elderberry Longhorn Beetle	2.03 acres potential non-riparian habitat; 2 shrubs	NA	NA	2.03 acres potential non-riparian habitat; 2 shrubs
Vernal Pool Fairy Shrimp	0	NA	0.65 acre	0.65 acre
Vernal Pool Tadpole Shrimp	0	NA	0.65 acre	0.65 acre

Species	Direct Impacts Permanent	Direct Impacts Temporary	Indirect Impacts	Total Habitat
Giant Garter Snake	1.04 acres aquatic habitat; 8.78 acres upland habitat	0.01 acre aquatic habitat; 41.33 acres upland habitat	NA	1.05 acres aquatic habitat; 50.11 acres upland habitat
Western Yellow-Billed Cuckoo	0	0	NA	0
Least Bell's Vireo	0	0	NA	0
Swainson's Hawk	90.28 acres High 125.50 acres Medium	118.80 acres Low	N/A	90.28 acres High 125.50 acres Medium 118.80 acres Low

Table 7. Estimated Special-Status Species Habitat Impacts for Alternative 6B

Species	Direct Impacts Permanent	Direct Impacts Temporary	Indirect Impacts	Total Habitat
Palmate-Bracted Bird's Beak	0.54 acre	NA	NA	0.54 acre
Valley Elderberry Longhorn Beetle	44.79 acres potential habitat; 45 shrubs	NA	NA	44.79 acres potential habitat; 45 shrubs
Vernal Pool Fairy Shrimp	0	NA	0.65 acre	0.65 acre
Vernal Pool Tadpole Shrimp	0	NA	0.65 acre	0.65 acre
Giant Garter Snake	0.2 acres aquatic habitat; 37.83 acres upland habitat	0 acres aquatic habitat; 13.53 acres upland habitat	NA	0.2 acres aquatic habitat; 37.83 acres upland habitat
Western Yellow-Billed Cuckoo	0	NA	NA	0
Least Bell's Vireo	0	NA	NA	0
Swainson's Hawk	136.38 acres High 158.90 acres Medium 53.68 acres Low	N/A	N/A	136.38 acres High 158.90 acres Medium 53.68 acres Low

8.2.3.4 Special-Status Species Impacts: Discussion

Generally, Alternative 2A has fewer impacts to special-status species habitat than Alternative 6B. Alternative 2A would impact slightly more potential habitat for palmate-bracted birds' beak (PBBB)(FE, CE) than Alternative 6B (0.85 acre vs. 0.54 acre); however, it should be noted that the actual amount of impact to PBBB is unknown since focused surveys have not been performed in the suitable habitat areas. Alternative 2A would also impact more giant garter snake (GGS)(FT, CT) aquatic habitat (1.04 acres vs. 0.20 acre), but would impact significantly less GGS upland habitat (8.78 acres vs. 37.83 acres).

Alternative 6B would impact more elderberry shrubs than Alternative 2A (45 vs. 2), which are habitat for the Valley elderberry longhorn beetle (VELB)(FT). In addition, the elderberry shrubs within the Alternative 2A footprint would potentially be considered non-riparian, while the elderberry shrubs within the Alternative 6B footprint are located within an elderberry savannah along Cache Creek, and therefore much more likely to be occupied or become colonized by VELB (USFWS 2017).

Alternative 2A would impact slightly less Swainson's hawk foraging habitat than Alternative 6B (334.58 acres vs. 348.96 acres). It should be noted that the Swainson's hawk foraging habitat impacted by either alternative would continue to be Swainson's hawk foraging habitat post-construction; however, the quality of the habitat would be considered low. Therefore, impacts to existing low-quality foraging habitat would be considered a temporary impact, and impact to medium- and high-quality foraging habitat would be considered a permanent impact. Alternative 2A would impact less high- and medium-quality foraging habitat than Alternative 6B (218.78 acres vs. 295.28 acres).

8.3 Summary Comparison of Effects to Biological Resources

Considered collectively, Alternative 6B has greater impacts on biological resources than Alternative 2A. Alternative 6B has greater impacts to aquatic features overall, as well as greater impacts to high-quality aquatic resources such as Cache Creek and riparian wetlands. Alternative 6B also has greater impacts to habitat for special-status species habitat overall, including VELB, GGS upland habitat, and Swainson's hawk foraging habitat.

9.0 PROPOSED LEAST ENVIRONMENTALLY DAMAGING PRACTICABLE ALTERNATIVE

The USACE has determined that Alternative 2A, Levee and Conveyance Plan, is the LEDPA and the Tentatively Selected Plan (TSP).

This finding considers available data relative to the LEDPA standard:

"Except as provided under section 404(b)(2), no discharge of dredged or fill shall be permitted if there is an alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences [40 CFR Section 230.10(a)]*."*

USACE makes this determination for the following reasons:

- Alternative 2A would reduce the surface flows that drive the risk of economic damages, as well as decrease the flooding of roadways that drives life safety risk;
- Alternative 2A does not interfere with the State of California's obligation to maintain compliance with the Total Maximum Daily Load (TMDL) of mercury-laden sediment in the Yolo Bypass;
- Alternative 2A provides a higher net benefit (benefits exceed the costs) than Alternative 6B;
- LCP converts approximately 16.4 acres of upland training levee habitat to wetland habitat, negating impacts to seasonal marsh habitat.

- Alternative 2A has less impact to Cache Creek and associated high-quality riparian habitat and valley oak woodland than Alternative 6B; and
- Alternative 2A has less potential impact to the threatened valley elderberry longhorn beetle.

10.0 AVOIDANCE, MINIMIZATION, AND MITIGATION OF IMPACTS

The USACE may not permit discharge of dredged or fill material without complying with the requirement for avoidance, minimization, and mitigation (40 CFR Section 230.10(d)). Subpart H of the 404(b)(1) Guidelines defines the components of this analysis.

10.1 Actions Concerning the Location of the Discharge (40 CFR Section 230.70)

The material to be discharged will primarily be obtained from excavation of the trapezoidal drainage canal on the north side of the new levee. Excavated material from the CCSB training levee degrade may be used to offset borrow material needs, if excavated materials are deemed suitable to use as fill per USACE levee requirements. The material being discharged will be similar to the substrate that will be impacted.

Any excess fill material that is not used for TSP features will be disposed of at the Yolo County General Landfill or other legal location.

Discharge into waters of the U.S. will primarily occur when the aquatic features are dry. Discharges into the CCSB would occur along the upper portion of the banks that are currently riprapped, as well as on existing roadways within the seasonal marsh area at the training levee; these areas would be dry at the time of construction. It is likely the existing irrigation ditch along the CCSB west levee will be conveying water south to the pump plant on E. Main Street at the time construction occurs. A cofferdam would likely be installed to prevent sediment from entering the irrigation ditch and causing increased turbidity. It is also possible that other minor irrigation ditches may be in use during the construction period. Measures will be taken in this case, such as routing the irrigation water around the work area.

10.2 Actions Concerning the Material to be Discharged (40 CFR Section 230.71)

Treatment of the fill material is not expected to be necessary. Appropriate erosion control measures will be utilized to prevent erosion of the fill material.

10.3 Actions Controlling the Material After Discharge (40 CFR Section 230.72)

Discharge into waters of the U.S. will primarily occur when the aquatic features are dry. Discharges into the CCSB would occur along the upper portion that is currently riprapped, as well as on existing roadways within the seasonal marsh area at the training levee; these areas would be dry at the time of construction. It is possible that some irrigation ditches may be in use during the construction period. Measures will be taken in this case, such as routing the irrigation water around the work area.

Temporary erosion/runoff best management control measures would be implemented during construction in order to minimize effects of the discharge that may occur due to erosion and sediment migration from the construction, staging, and borrow areas. These temporary control measures may include management of stockpiles and disturbed areas by means of earthen berms, diversion ditches, straw wattles, straw bales, silt fences, gravel filters, mulching, revegetation, and temporary covers as appropriate. Erosion and stormwater pollution control measures would be consistent with National Pollutant Discharge Elimination System (NPDES) permit requirements and would be included in a Stormwater Pollution Prevention Plan (SWPPP). After construction is complete, temporary facilities would be demobilized and the site would be stabilized. Site restoration activities for areas disturbed by construction activities, including borrow areas, may include regrading, reseeding, constructing permanent diversion ditches using straw wattles and bales, and by applying straw mulch and other measures deemed appropriate.

10.4 Actions Affecting the Method of Dispersion (40 CFR Section 230.73)

Discharge into waters of the U.S. will primarily occur when the aquatic features are dry. Discharges into the CCSB would occur along the upper portion that is currently riprapped, as well as on existing roadways within the seasonal marsh area at the training levee; these areas would be dry at the time of construction. It is possible that some irrigation ditches may be in use during the construction period. Measures will be taken in this case, such as routing the irrigation water around the work area.

10.5 Actions Related to Technology (40 CFR Section 230.74)

The TSP will minimize adverse environmental impacts by utilizing appropriate equipment and machinery, and will employ appropriate maintenance and operation of the equipment, including adequate staffing, training, and working procedures.

10.6 Actions Affecting Plant and Animal Populations (40 CFR Section 230.75)

The TSP will employ a variety of measures to minimize adverse effects on plant and animal populations. The following general measures identified in the Biological Assessment (BA) prepared for the TSP will minimize adverse effects to federally-listed species and non-listed species. A number of additional species-specific measures were also identified in the BA that will be implemented within and in the vicinity of habitat for federally-listed species:

- <u>Environmental Awareness Training</u>. Prior to the start of each phase of construction, a biological monitor will conduct a training program for all construction personnel, including contractors and subcontractors. The training will include, at a minimum, a description of all Federally-Listed Species present and their habitats within the action area; an explanation of the species status and protection under state and federal laws; the avoidance and minimization measures to be implemented to reduce take of this species; communication and work stoppage procedures in case a listed species is observed within the Study Area; and an explanation of the importance of the environmentally sensitive areas and Wildlife Exclusion Fencing. A fact sheet conveying this information will be prepared and distributed to all construction personnel. Interpretation for non-English speakers will be provided upon request. The same instruction shall be provided to any new workers before they are authorized to perform work.

- Environmentally Sensitive Areas. Prior to the start of construction, environmentally sensitive areas (defined as areas containing sensitive habitats adjacent to or within construction work areas for which physical disturbance is not allowed) will be clearly delineated using high visibility orange fencing. The environmentally sensitive area fencing will remain in place throughout the duration of the proposed action, while construction activities are ongoing, and will be regularly inspected and fully maintained at all times.
- Biological Monitor. A biological monitor will be onsite during all activities that may result in take of federally-listed species. The qualifications of the biological monitor(s) will be submitted to the USACE and USFWS for review and written approval at least thirty (30) calendar days prior to the date earthmoving is initiated in the Study Area.
- Replant, Reseed, and Restore Disturbed Areas. After construction completion, all temporarily affected areas shall be returned to original grade and contours to the maximum extent practicable, protected with proper erosion control materials, and revegetated with native species appropriate for the region and habitat communities on site.
- Best Management Practices (BMPs). Stormwater pollution prevention plans (SWPPP) and erosion control BMPs will be developed and implemented to minimize any wind- or water-related erosion and will be in compliance with the requirements of the Corps. The Corps will include provisions in construction contracts for measures to protect sensitive areas and prevent and minimize stormwater and non-stormwater discharges. Protective measures may include:
  A. No discharge of pollutants from vehicle and equipment cleaning is allowed into any storm drains or watercourses.
  B. Vehicle and equipment fueling and maintenance operations must be at least 50 feet away from watercourses, except at established commercial gas stations or at an established vehicle maintenance facility.
  C. Concrete wastes are to be collected in washouts and water from curing operations is to be collected and disposed of properly. Neither will be allowed into watercourses.
  D. Spill containment kits will be maintained onsite at all times during construction operations and/ or staging or fueling of equipment.
  E. Dust control will be implemented, and may include the use of water trucks and nontoxic tackifiers (binding agents) to control dust in excavation and fill areas, blocking temporary access road entrances and exits, and covering of temporary stockpiles when weather conditions require.
  F. Graded areas will be protected from erosion using a combination of silt fences, fiber rolls, etc. along toes of slopes or along edges of designated staging areas, and erosion control netting (such as jute or coir) as appropriate on sloped areas. No erosion control materials that use plastic or synthetic monofilament netting will be used.
  G. Permanent erosion control measures such as bio-filtration strips and swales to receive storm water discharges from paved roads or other impervious surfaces will be incorporated to the maximum extent practicable.
  H. All grindings and asphaltic-concrete waste will be stored within previously disturbed areas absent of habitat and at a minimum of 50 feet from any aquatic habitat, culvert, or drainage feature.

- Construction Site Management Practices. The following site restrictions will be implemented to avoid or minimize effects on the listed species and their habitat:
  A. A reduced speed limit in the project footprint in unpaved areas will be enforced to reduce dust and excessive soil disturbance.
  B. Construction access, staging, storage, and parking areas will be located outside of any designated environmentally sensitive areas. Access routes and the number and size of staging and work areas will be limited to the minimum necessary to construct the proposed Action.
  C. Routes and boundaries of roadwork will be clearly marked prior to initiating construction or grading.
  D. All construction pipes, culverts, or similar structures with a diameter of 4 inches or greater that are stored at a construction site for one or more overnight periods should be thoroughly inspected for wildlife before the pipe is subsequently buried, capped, or otherwise used or moved in any way. If a Federally-Listed Species is discovered inside a pipe, that section of pipe should not be moved until the USFWS has been consulted. If necessary, and under the direct supervision of the biologist, the pipe may be moved once to remove it from the path of construction activity, until the animal has escaped.
  E. To the maximum extent practicable, any borrow material will be certified to be nontoxic and weed free.
  F. At the end of each day all food and food-related trash items will be enclosed in sealed trash containers and properly disposed of offsite.
  G. A Spill Response Plan will be prepared. Hazardous materials such as fuels, oils, solvents, etc. will be stored in sealable containers in a designated location that is at least 50 feet from hydrologic features.
- Operations and Maintenance Avoidance and Minimization Measures
  A. All herbicides and pesticides will be applied according to the manufacturer's recommendations and in accordance with federal, state, and local guidelines.

10.7 Actions Affecting Human Use (40 CFR Section 230.76)

Public access to the portion of the Study Area that runs along Cache Creek and the CCSB is limited. Access is restricted as a result of private lands bordering the creek to the north and south, and locked gates at the entrances of the levees. As a result, current public use of the Study Area in the vicinity of Cache Creek and the CCSB is primarily restricted to pedestrian use of the levee top for hiking and birdwatching, and to access portions of Cache Creek that are outside of the Study Area for fishing. TSP construction is expected to have negligible short-term construction-related adverse effects to recreational resources in the Study Area, primarily Velocity Island Park, which is located approximately 1.5 miles south of Lower Cache Creek, and is the only designated recreational facility in the Study Area (USACE 2019). Pedestrian use of the levees, would be restricted during construction as well. However, long-term beneficial effects resulting from the proposed TSP include lowered risk of flooding potential for multiple recreational facilities within the current 100 ACE event floodplain. Additionally, the new levee would be used for passive recreation including walking and bike-riding.

10.8 Other Actions (40 CFR Section 230.77)

During construction, there is a potential for hazardous materials such as fuels, oils, or paints to be accidentally spilled or released into the environment, including waters of the U.S. Prior to construction, a hazardous materials management plan (HMMP) would be prepared and implemented. The HMMP would include measures to reduce the potential for spills of toxic chemicals and other hazardous materials during construction. The HMMP would also describe a specific protocol for the proper handling and disposal of these hazardous materials, as well as contingency procedures to follow in the event of an accidental spill. As a result, construction of the TSP is not expected result in any adverse effects due to hazardous or toxic materials.

11.0 FACTUAL DETERMINATIONS (Section 230.11)

The permitting authority shall determine in writing the potential short-term or long-term effects of a proposed discharge of dredged or fill material on the physical, chemical, and biological components of the aquatic environment in light of subparts C through F. Such factual determinations shall be used in §230.12 in making findings of compliance or non-compliance with the restrictions on discharge in §230.10. The evaluation and testing procedures described in §230.60 and §230.61 of subpart G shall be used as necessary to make, and shall be described in, such determination. The determinations of effects of each proposed discharge shall include the following:

11.1 Physical Substrate Determinations (40 CFR Section 230.11(a))

The TSP will result in the permanent impact to seasonal wetlands, pond, and irrigation channels due to levee and detention basin construction and other improvements. These aquatic features are associated with current farming practices of the area and are disturbed in nature. Impacts to the CCSB would occur in the upper portion that is currently riprapped. Impacts to seasonal marsh habitat within the CCSB may occur in association with the training levee degrade.

A detailed aquatic resources delineation will be completed in the preconstruction engineering and design (PED) phase of the TSP prior to construction to quantify the acreage of impact and to ensure the TSP complies with all necessary wetland regulations, including compensatory mitigation requirements.

Measures identified in Section 10.3 above will help ensure that impacts to aquatic features are confined to the proposed fill area.

The TSP is not expected to appreciably impact the function of the CCSB in terms of temperature, depth, fluctuation, and aquatic organism utilization.

11.2 Water Circulation, Fluctuation, and Salinity Determinations (40 CFR Section 230.11(b))

The TSP is designed to modify water circulation during high water events, and would prevent sheet flow of flood waters over agricultural lands and developed areas of Woodland south of the proposed levee. This water would instead be directed into the CCSB. The TSP would not result in a reduction in capacity of the CCSB.

11.3 Suspended Particulate/Turbidity Determinations (40 CFR Section 230.11 (c))

The TSP will not involve the discharge of fill material into open waters, with the possible exception of irrigation ditches that may be in operation at the time of construction. It is likely the existing irrigation ditch along the CCSB west levee will be conveying water south to the pump plant on E. Main Street at the time construction occurs. A cofferdam would likely be installed to prevent sediment from entering the irrigation ditch and causing increased turbidity.

As stated in Section 10.1 above, measures to prevent sedimentation in other minor irrigations ditches may include routing the water around the work area.

11.4 Contaminant Determinations 40 CFR Section 230.11 (d))

The fill material will be excavated on-site from the agricultural lands at the site of the trapezoidal drainage canal on the north side of the new levee and potentially from material removed from the CCSB training levee, and should not introduce, relocate, or increase contaminants in the aquatic environment. The mercury TMDL is not expected to increase above current baseline conditions during any flood event.

11.5 Aquatic Ecosystem and Organism Determinations (40 CFR Section 230.11 (e))

The TSP will involve only a minor amount of fill in existing disturbed roadways within the CCSB, and is not expected to have a significant effect on aquatic organisms that utilize this feature. The irrigation canals are routinely maintained and receive agricultural runoff containing herbicides and pesticides, and are not expected to support significant populations of aquatic organisms.

The measures outlined in Section 10.4 above will ensure that potential impacts to aquatic organisms are avoided and minimized during construction. The BA prepared for the TSP contains additional conservation measures to protect federally-listed aquatic species such as the giant garter snake (*Thamnophis gigas*), vernal pool fairy shrimp (*Branchinecta lynchi*), and vernal pool tadpole shrimp (*Lepidurus packardi*).

11.6 Proposed Disposal Site Determinations (40 CFR Section 230.11 (f))

The TSP does not involve the disposal of dredged material into open waters.

11.7 Determination of Cumulative Effects on the Aquatic Ecosystem (40 CFR Section 230.11 (g))

The RWQCB is concerned about activity in the Cache Creek watershed that could result in disturbance of mercury-contaminated sediments. Although future projects within the Cache Creek watershed, such as mining, could mobilize mercury-laden sediments and cause cumulative effects, analysis associated with the TSP shows no significant increase in the net loading of contamination into the system. Therefore, the TSP is not anticipated to contribute to a cumulative effect on mercury-contamination and would have an insignificant effect on water quality overall (USACE 2019).

11.8 Determination of Secondary Effects on the Aquatic Ecosystem (40 CFR Section 230.11 (h))

Secondary effects are effects on the aquatic ecosystem that are associated with the discharge of dredged or fill materials, but do not result from the actual placement of the material. Secondary effects to the CCSB are not anticipated since the TSP would not increase flow velocities to or decrease the capacity of the settling basin. Maintenance activities are currently conducted on the settling basin levee, and proposed maintenance activities are largely similar to what is currently occurring. As a result, additional effects from maintenance of the improved levee are not anticipated.

A potential beneficial secondary effect of the TSP is in regard to mercury. Under existing conditions, mercury-laden sediments originating in Cache Creek upstream of the study area become deposited in the Cache Creek Settling Basin. Naturally-occurring bacteria can metabolically process mercury, causing methylation. Methylmercury is a potential hazard to downstream ecological receptors in the Sacramento/San Joaquin River Delta.

A sediment trap efficiency study conducted by UC Davis supports this conclusion. The UC Davis study determined that trap efficiencies increase for all flood events under the Levee and Conveyance Alternative scenario (Wood Rogers, 2016). The models UC Davis used predicted that Alternative 2A results in better trap efficiency in the settling basin. After construction, less sediment transport is predicted to occur into the Yolo Bypass, and since mercury is typically sediment bound, less mercury loading would occur into the Delta.

12.0 FINDINGS OF COMPLIANCE OR NON-COMPLIANCE WITH THE RESTRICTIONS ON DISCHARGE

The 404(b) Guidelines require that the USACE make findings of compliance or non-compliance with the restrictions on discharge (40 CFR Section 230.10(b).

- **Will the project cause or contribute, after consideration of disposal site dilution and dispersion, to violations of any applicable State water quality standard (40 CFR Section 230.10(b)(1)?**
  Alternative 2A is not expected to violate State water quality standards. An NPDES permit would be obtained prior to initiation of construction activities. For any discharges that would be exempt from the NPDES permit, Waste Discharge Requirements would be followed. Required monitoring and BMP's

would be enforced to ensure that the TSP is within compliance throughout the duration of construction. BMPs would include preparation and implementation of a Storm Water Pollution Prevention Plan (SWPPP) in accordance with local and state policy, with a portion of the SWPPP to address erosion control. Erosion controls would include features such as hay bales, water bars, covers, sediment fences, and sensitive-area access restrictions where necessary and appropriate before initiating extensive clearing and grading.

- **Will the project violate any applicable toxic effluent standard or prohibition under section 307 of the Act (40 CFR Section 230.10(b)(2)?**
  The TSP would not violate State water quality standards. The appropriate authorizations under Sections 404 and 401 of the Clean Water Act will be obtained prior to initiation of construction.

- **Will the project cause jeopardy to a species listed under the federal Endangered Species Act or adversely modify critical habitat (40 CFR Section 230.10(b)(3)?**
  The BA prepared for the TSP concludes that the TSP may affect and is likely to adversely affect the palmate-bracted bird's beak (*Chloropyron palmatum*), giant garter snake, vernal pool fairy shrimp, and vernal pool tadpole shrimp, and may affect but is not likely to adversely affect the Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), western yellow-billed cuckoo (*Coccyzus americanus occidentalis*) and least Bell's vireo (*Vireo bellii pusillus*). The TSP will not jeopardize the continued existence of any federally-listed species, and will not adversely modify critical habitat.

- **Will the project violate protections for marine sanctuaries (40 CFR Section 230.10(b)(4))?** There are no marine sanctuaries within the TSP vicinity, and the TSP will not violate protections for any marine sanctuaries.

- **Will the discharge cause significant adverse effects on human health or welfare, including but not limited to effects on municipal water supplies, plankton, fish, shellfish, wildlife, and special aquatic sites (40 CFR Section 230.10(c)(1)?**
  There are no expected impacts to Cache Creek and associated fish populations, as the levee improvements are set back from the natural channel and riparian corridor. Impacts to special aquatic sites (wetlands) will be minimal and will affect primarily disturbed wetlands associated with agricultural fields.

  Cache Creek is not utilized as a municipal water supply; the TSP will not affect the existing municipal water supply system for the area.

- **Will the discharge cause significant adverse effects on the life stages of aquatic life and other wildlife dependent on aquatic ecosystems, including the transfer, concentration, and spread of pollutants or their byproducts outside of the disposal site through biological, physical, and chemical processes (40 CFR Section 230.10(c)(2)?**

The TSP will not cause the transfer, concentration, and spread of pollutants or their byproducts outside of the disposal site, and would not cause significant adverse effects on the life stages of aquatic life and other wildlife dependent on aquatic ecosystems.

- **Will the discharge cause significant adverse effects on aquatic ecosystem diversity, productivity, and stability? Such effects may include, but are not limited to, loss of fish and wildlife habitat or loss of the capacity of a wetland to assimilate nutrients, purify water, or reduce wave energy (40 CFR Section 230.10(c)(3).**

  The TSP is not expected to cause significant adverse effects to aquatic ecosystem diversity, productivity, and stability. Impacts to federally-listed aquatic species are minor and will be mitigated via avoidance and minimization measures, as well as compensatory mitigation if required by the U.S. Fish & Wildlife Service. Impacts to the Cache Creek Settling Basin are expected to be minimal.

- **Will the discharge cause significant adverse effects on recreational, aesthetic, and economic values?**

  Section 3.2.3 of the SEIS addresses the TSP's impacts to recreation, and concludes that while the TSP is expected to have negligible short-term construction-related adverse effects to recreational resources in the TSP area, long-term beneficial effects resulting from the TSP include providing lowered risk of flooding potential for multiple recreational facilities within the current 100 ACE event floodplain and the new levee being used for passive recreation.

  The TSP would create a view block to residents, and aesthetic effects were determined to be significant. As a mitigation measure, the levees will be re-seeded with native grasses and forbs, but this will not reduce the aesthetic impacts to a less than significant level (USACE 2019).

  Flooding from Lower Cache Creek poses a risk of economic damage to property and critical infrastructure within the City of Woodland and surrounding areas. The anticipated total damageable property within the 0.2% (1/500) AEP floodplain is valued at $2.1 billion (October 2019 price levels). On average, a flood event or series of flood events in a single year would cause an estimated $22.2 (October 2019 price levels) million worth of damages, in the future without Plan (FWOP) scenario (USACE 2019). Damages are based on floodplain modeling and current valuations of the assets, including homes, businesses, roads, etc., and based upon historical damages. Other losses or adverse effects would continue to include the potential for flood-related loss of life, contamination from sanitary sewage and hazardous materials, and the extended closure of the section of I-5 east of the city of Woodland. Construction of the TSP would provide economic benefit to the community in the form of reduced property damage from flooding.

13.0 LITERATURE CITED

Madrone Ecological Consulting, LLC (Madrone). 2019. *Biological Assessment for Lower Cache Creek Feasibility Study*. Prepared for U.S. Army Corps of Engineers. Published on 1 October 2019.

U.S. Army Corps of Engineers (USACE). 2003a. *Lower Cache Creek, Yolo County, CA City of Woodland and Vicinity Draft Feasibility Report for Potential Flood Damage Reduction Project.* U.S. Army Corps of Engineers, Sacramento District. March 2003.

U.S. Army Corps of Engineers (USACE). 2003b. *Lower Cache Creek, Yolo County, CA City of Woodland and Vicinity Draft Environmental Impact Statement (EIS) / Environmental Impact Report (EIR) for Potential Flood Damage Reduction Project.* U.S. Army Corps of Engineers, Sacramento District. March 2003.

U.S. Army Corps of Engineers (USACE). 2019a. *Report Summary, Lower Cache Creek Feasibility Study.* Published January 2019.

U.S. Army Corps of Engineers (USACE). 2019b. *Supplemental Environmental Impact Statement, Lower Cache Creek Feasibility Study*. Published November 2019.

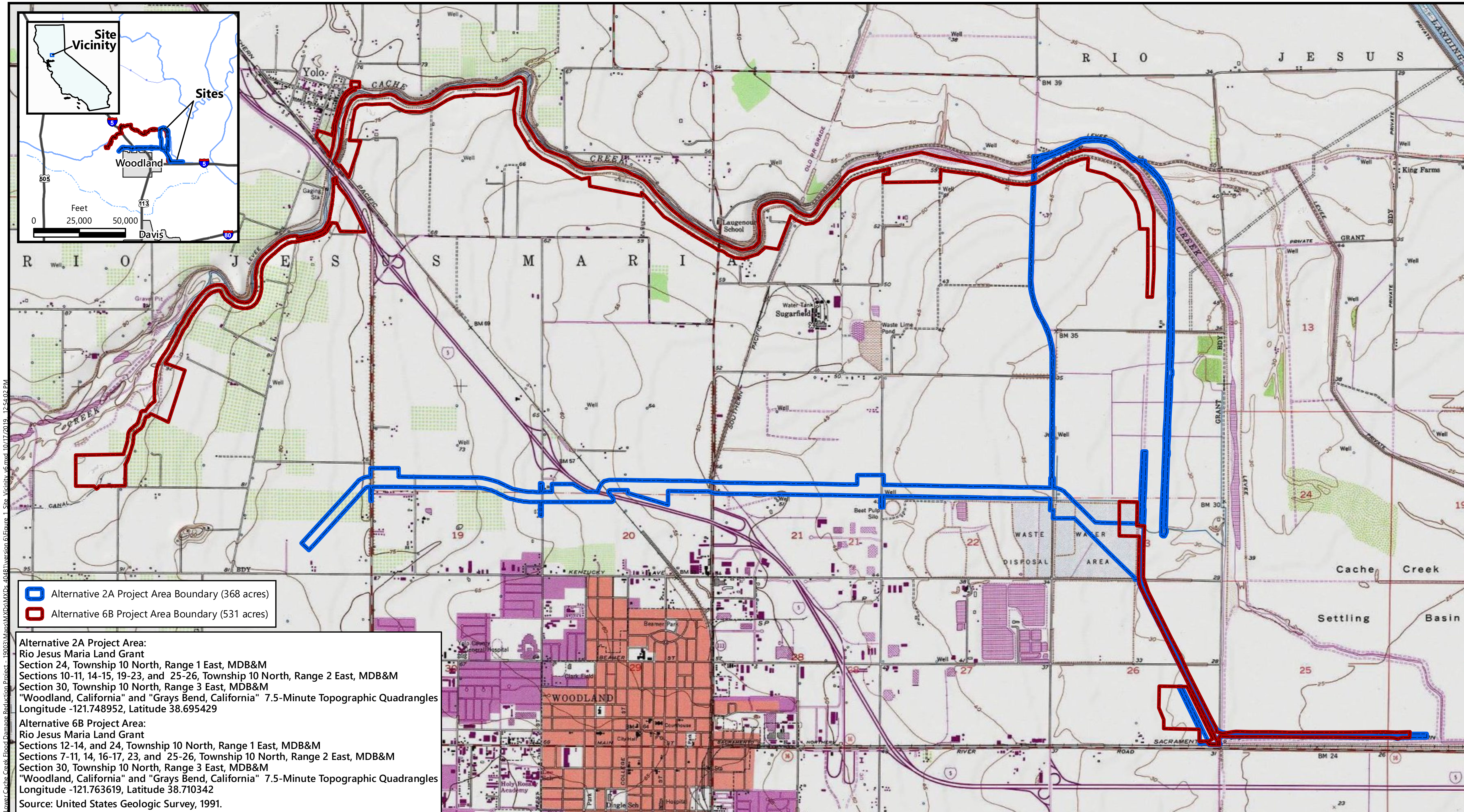
U.S. Department of the Interior, Fish and Wildlife Service (USWFS). 2017. *Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle (Desmocerus californicus dimorphus)*. U.S. Fish and Wildlife Service; Sacramento, California. 28 pp. Published May 2017.

Figures

Figure 1. Site and Vicinity Map

Figure 2. Aquatic Resources

Figure 3. Vegetation Communities



Alternative 2A Project Area:
Rio Jesus Maria Land Grant
Section 24, Township 10 North, Range 1 East, MDB&M
Sections 10-11, 14-15, 19-23, and 25-26, Township 10 North, Range 2 East, MDB&M
Section 30, Township 10 North, Range 3 East, MDB&M
"Woodland, California" and "Grays Bend, California" 7.5-Minute Topographic Quadrangles
Longitude -121.748952, Latitude 38.695429

Alternative 6B Project Area:
Rio Jesus Maria Land Grant
Sections 12-14, and 24, Township 10 North, Range 1 East, MDB&M
Sections 7-11, 14, 16-17, 23, and 25-26, Township 10 North, Range 2 East, MDB&M
Section 30, Township 10 North, Range 3 East, MDB&M
"Woodland, California" and "Grays Bend, California" 7.5-Minute Topographic Quadrangles
Longitude -121.763619, Latitude 38.710342

Source: United States Geologic Survey, 1991.

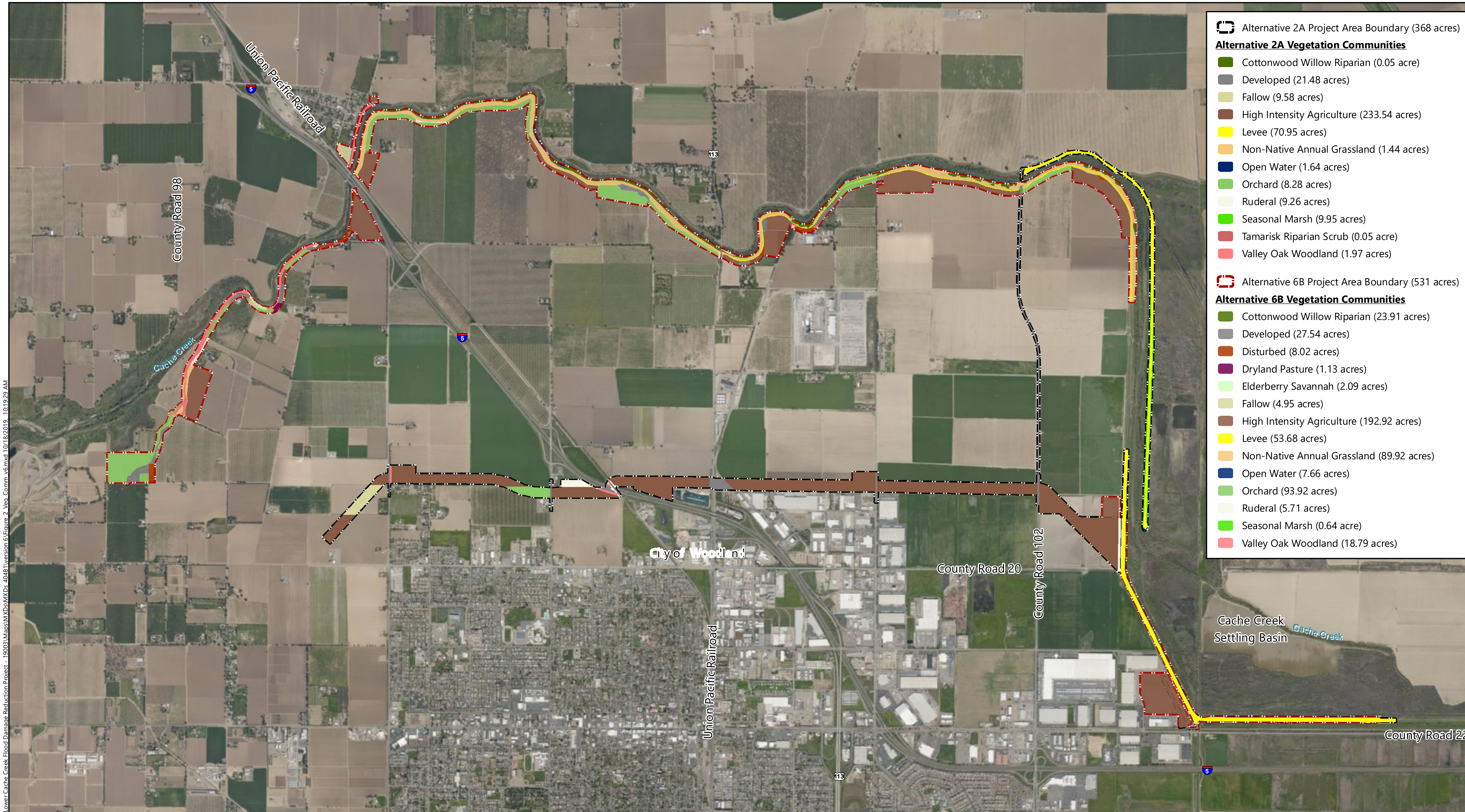
N
Feet
0 1,200 2,400

Basemap: ESRI, USGS, 2019.

Figure 1
Site Vicinity

Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING



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Feet

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Survey Data Source: Madrone Ecological Consulting, LLC., 2019 Survey Data.
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.

Figure 2
Vegetation Communities

Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING

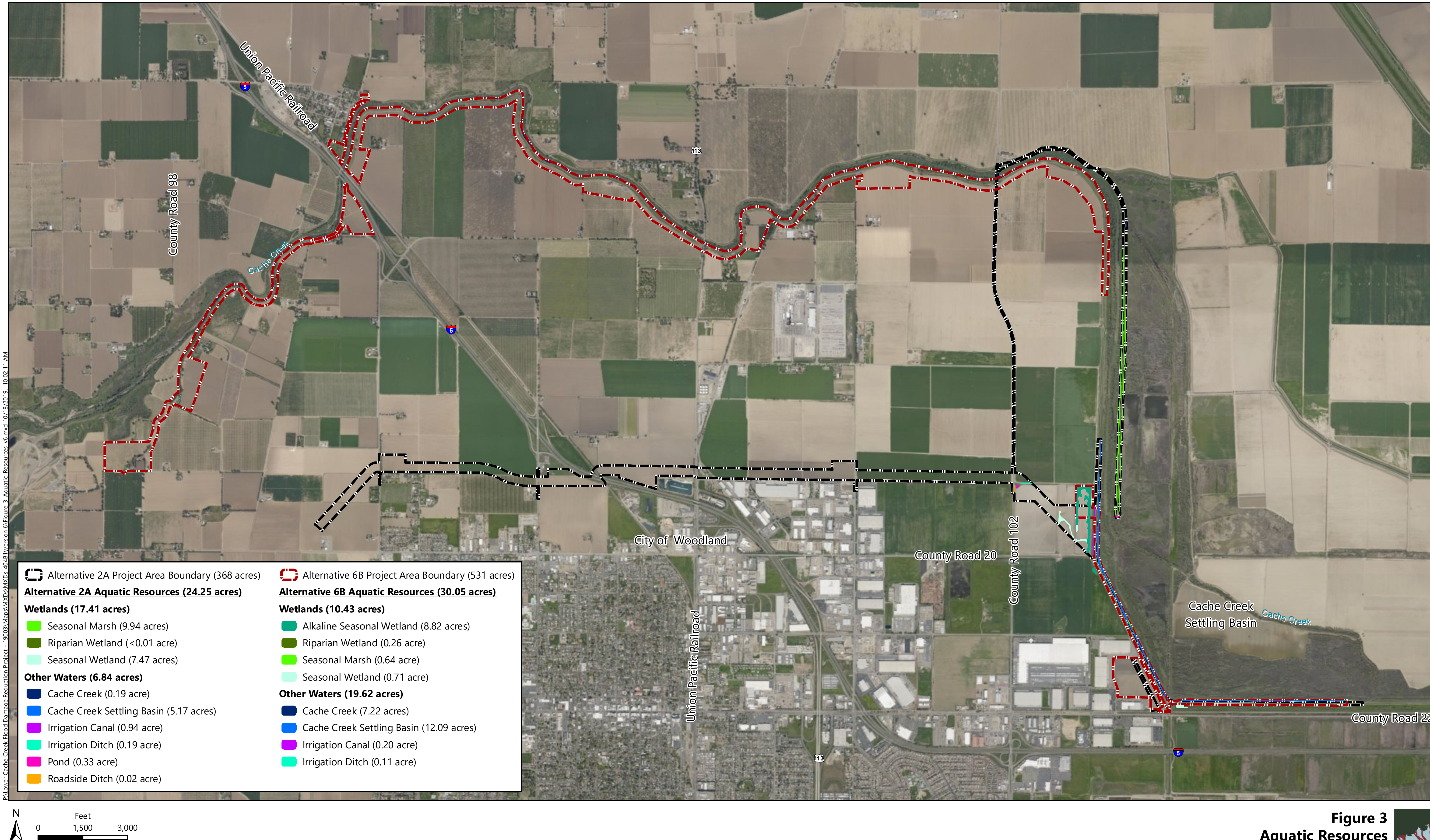


Figure 3
Aquatic Resources

Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING

Survey Data Source: Madrone Ecological Consulting, LLC., 2019 Survey Data.
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.

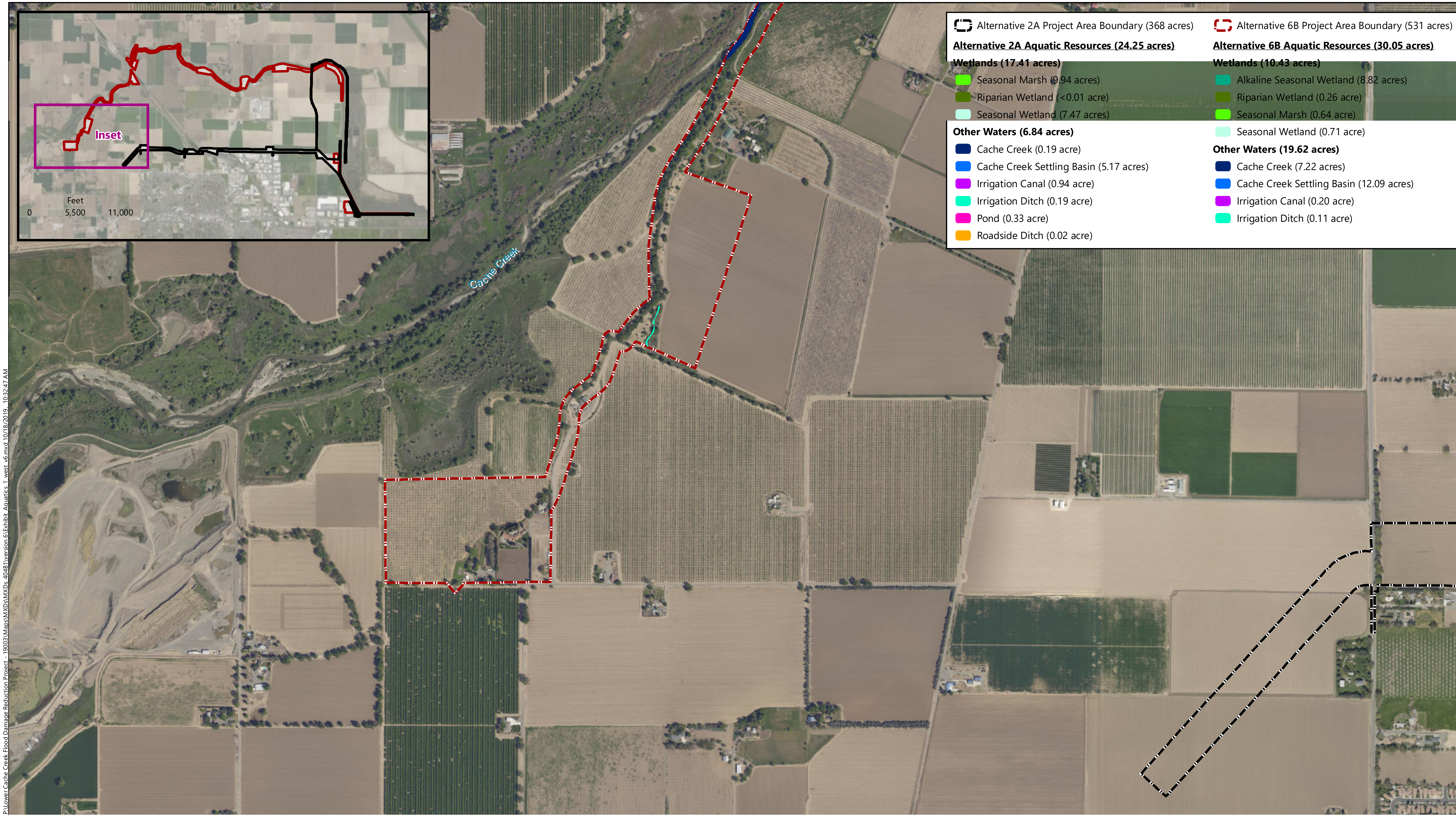
Attachments

Attachment A: Aquatic Resources Mapped within Alternative 2A and Alternative 6B

Attachment B: Vegetation Communities within Alternative 2A and Alternative 6B

Attachment A

Aquatic Resources Mapped within Alternative 2A and Alternative 6B



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Aquatic Resources
West

Survey Data Source: Madrone Ecological Consulting, LLC., 2019 Survey Data.
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.

Lower Cache Creek Feasibility Study
Yolo County, California

N

Feet
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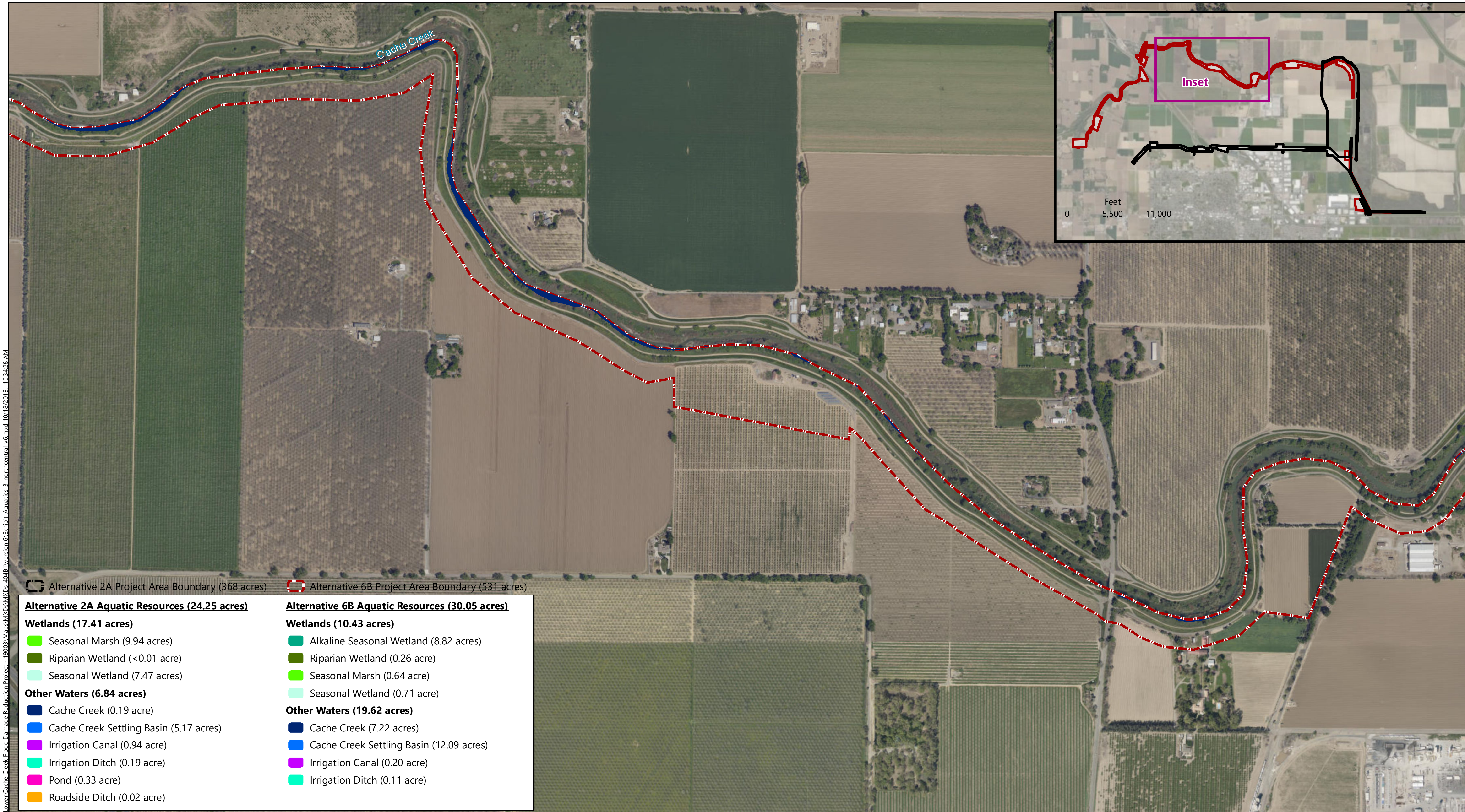
Survey Data Source: Madrone Ecological Consulting, LLC., 2019 Survey Data.
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.

Aquatic Resources North Central

Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING



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Aquatic Resources
North Central

Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING

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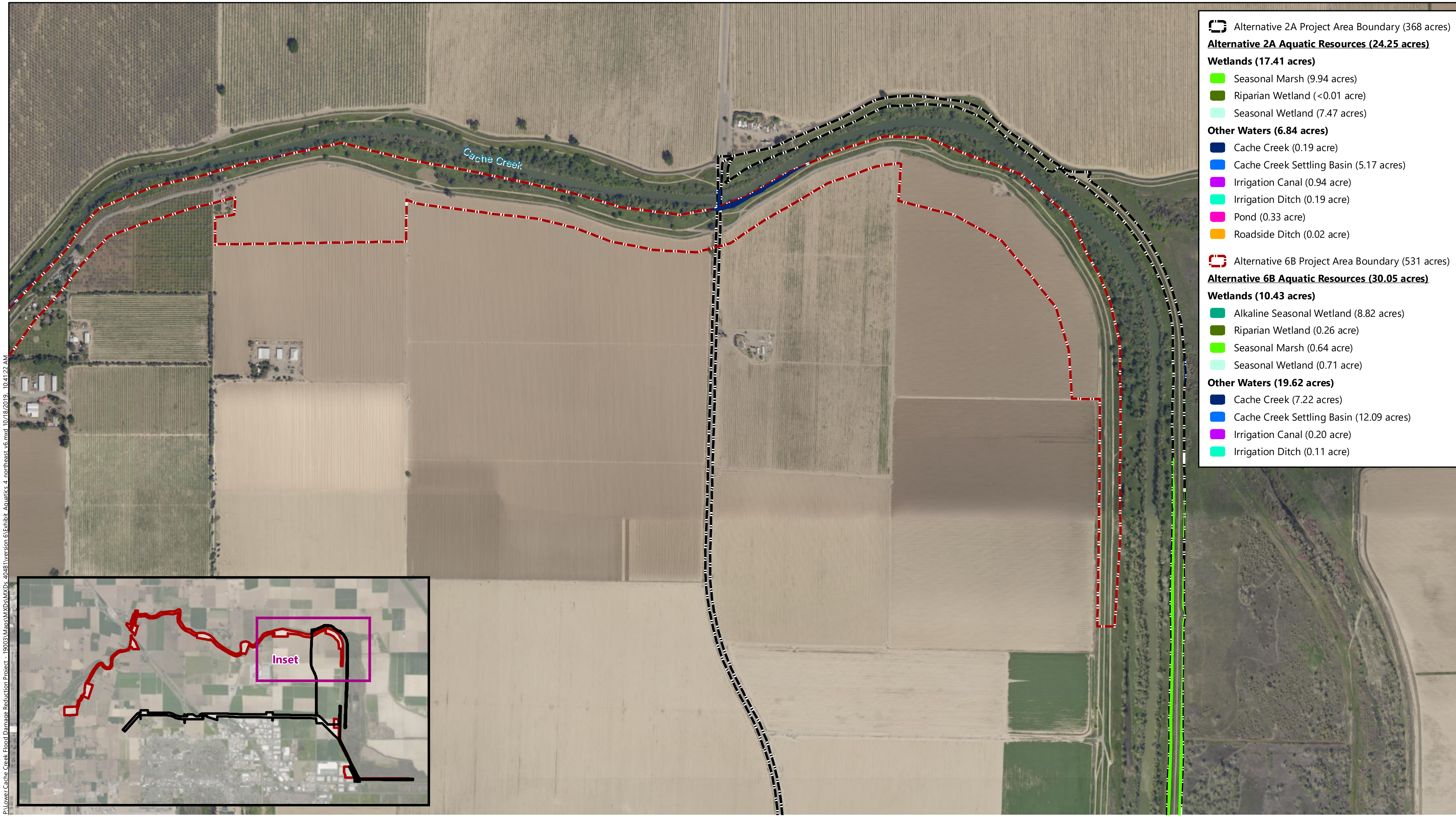
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.



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Aquatic Resources Northeast

Lower Cache Creek Feasibility Study
Yolo County, California

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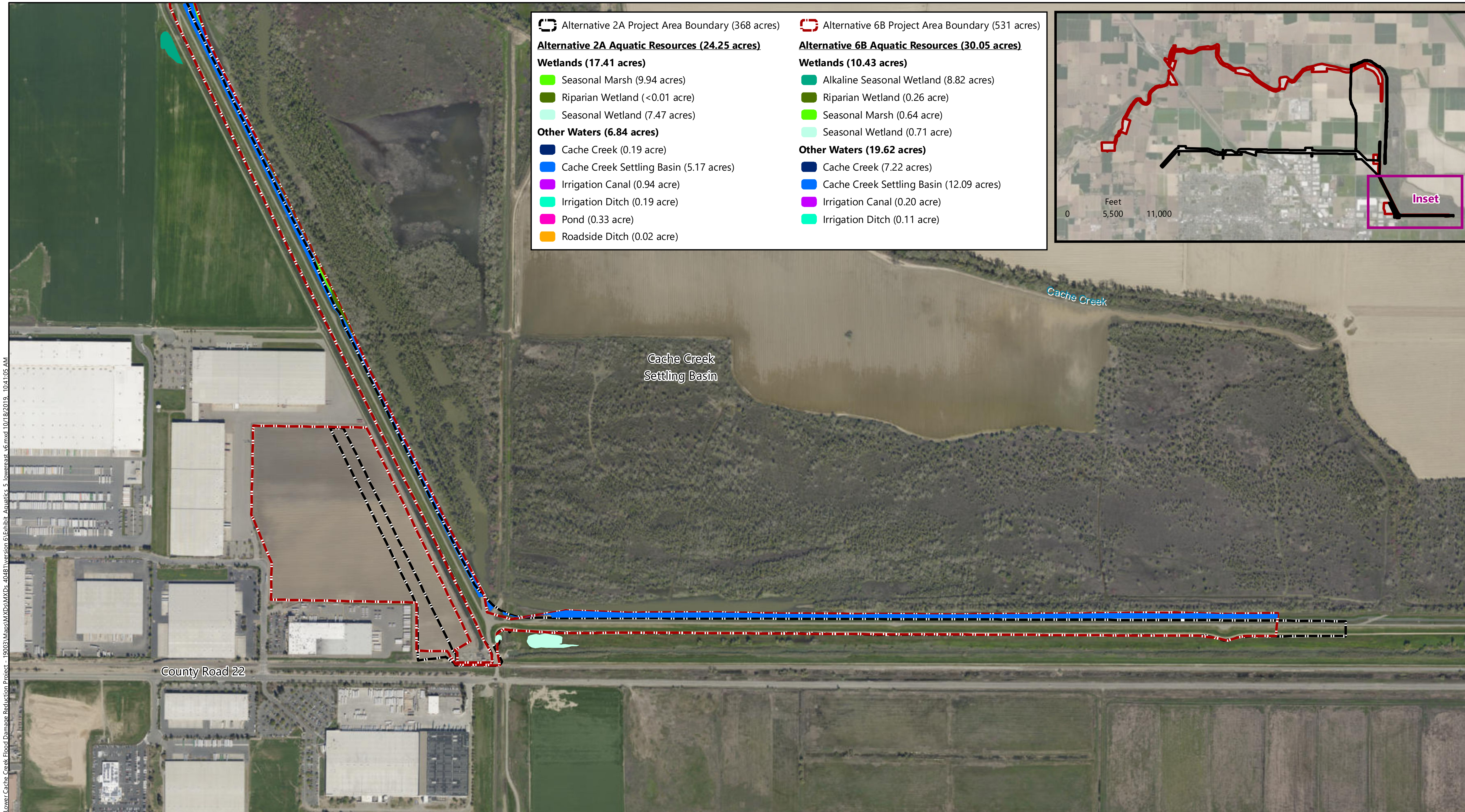

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Feet

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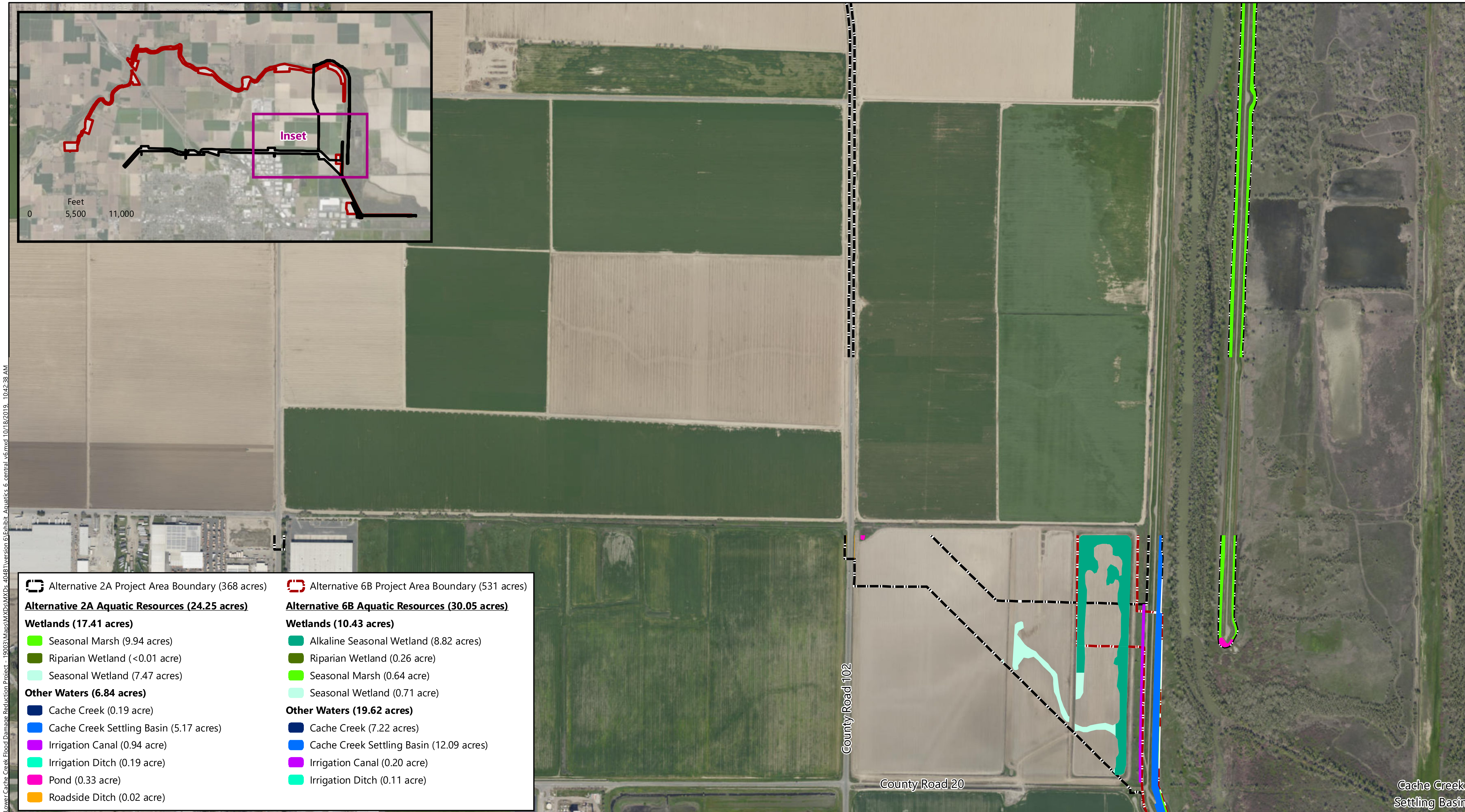
Aquatic Resources
Lower East

Survey Data Source: Madrone Ecological Consulting, LLC., 2019 Survey Data.
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.

Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING



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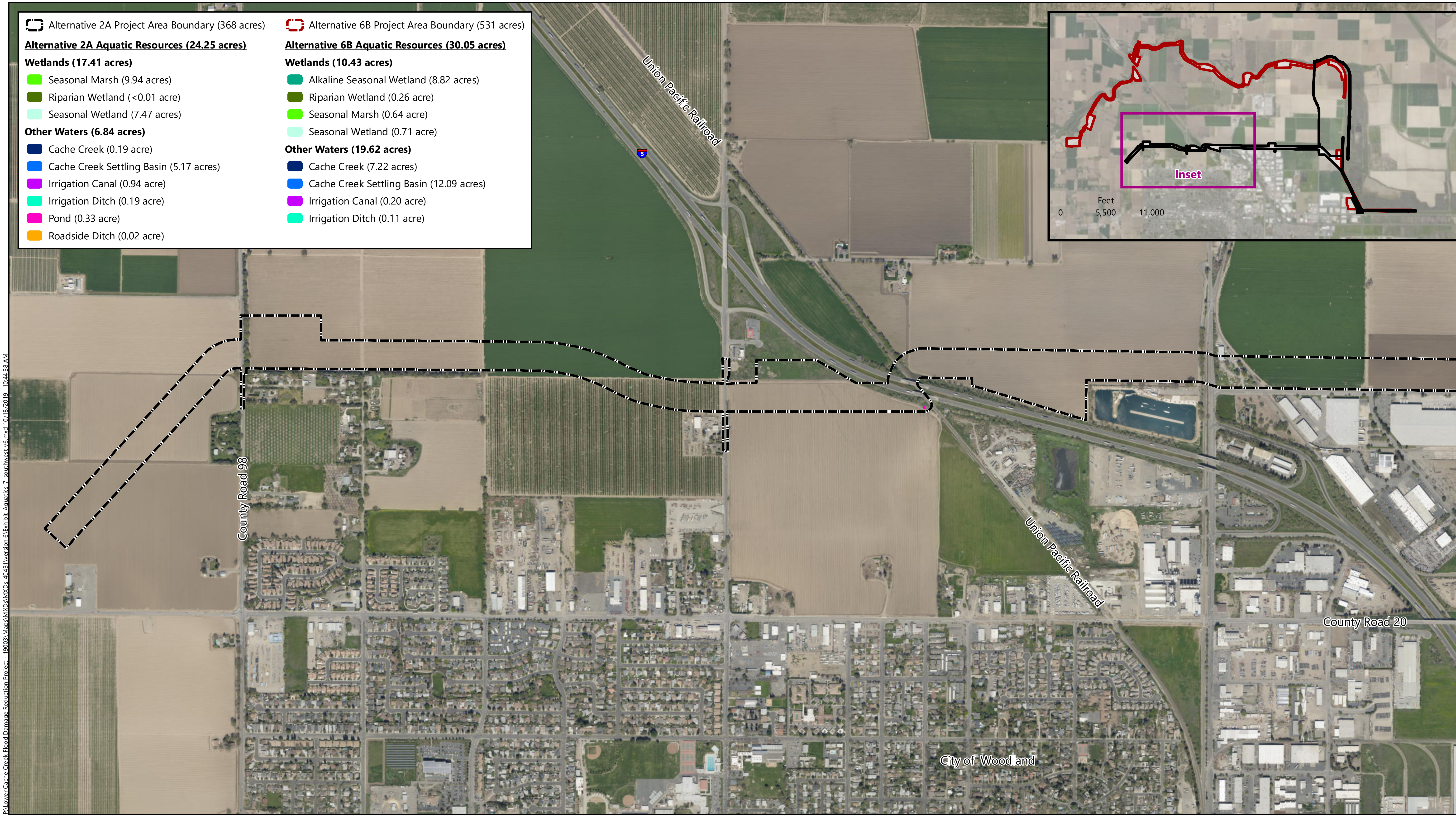
Aquatic Resources Central

Survey Data Source: Madrone Ecological Consulting, LLC., 2019 Survey Data.
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.

Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING



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Aquatic Resources Southwest

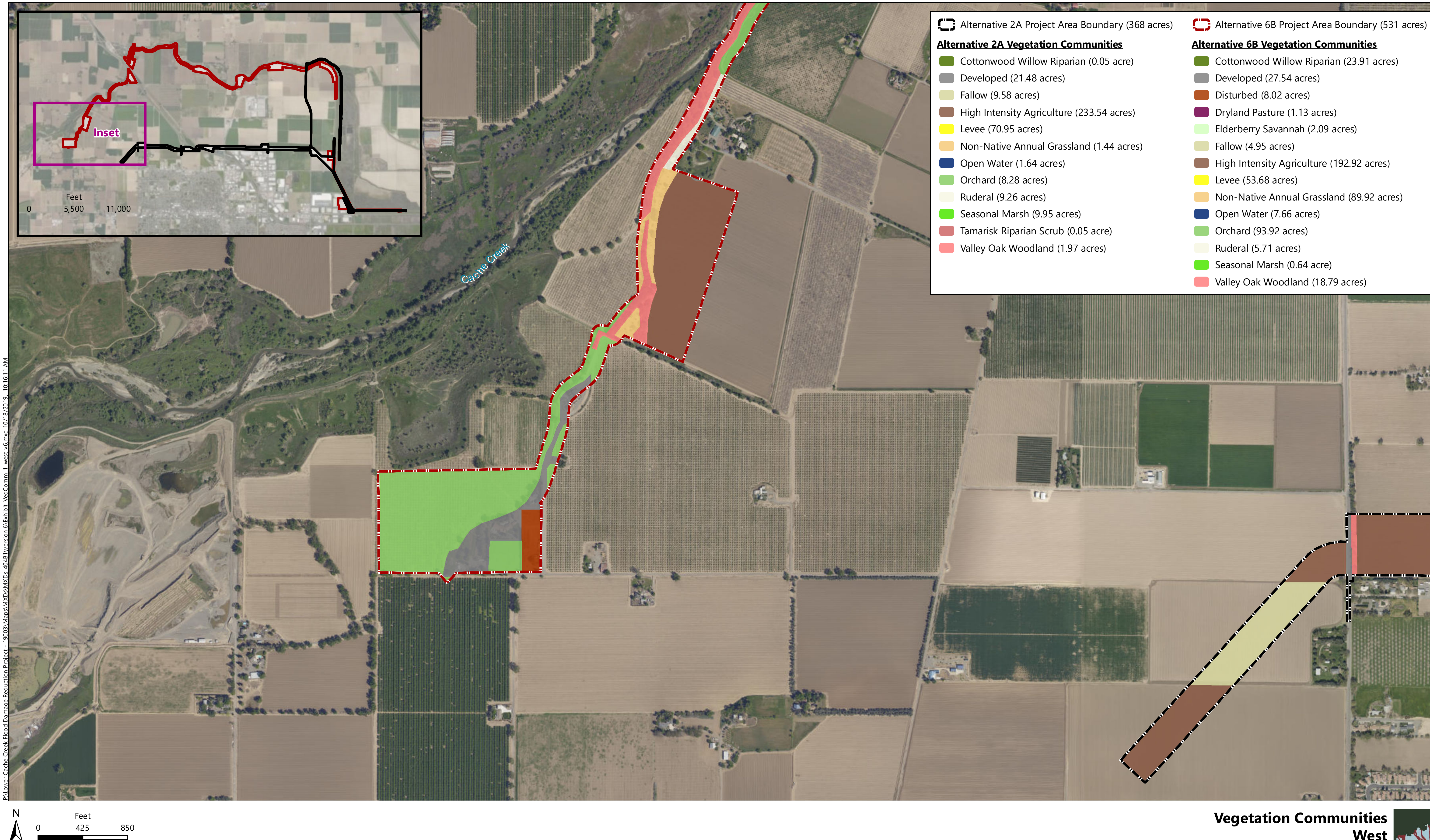
Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING

Survey Data Source: Madrone Ecological Consulting, LLC., 2019 Survey Data.
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.

Attachment B

Vegetation Communities within Alternative 2A and Alternative 6B



Vegetation Communities West

Lower Cache Creek Feasibility Study
Yolo County, California

Survey Data Source: Madrone Ecological Consulting, LLC., 2019 Survey Data.
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.

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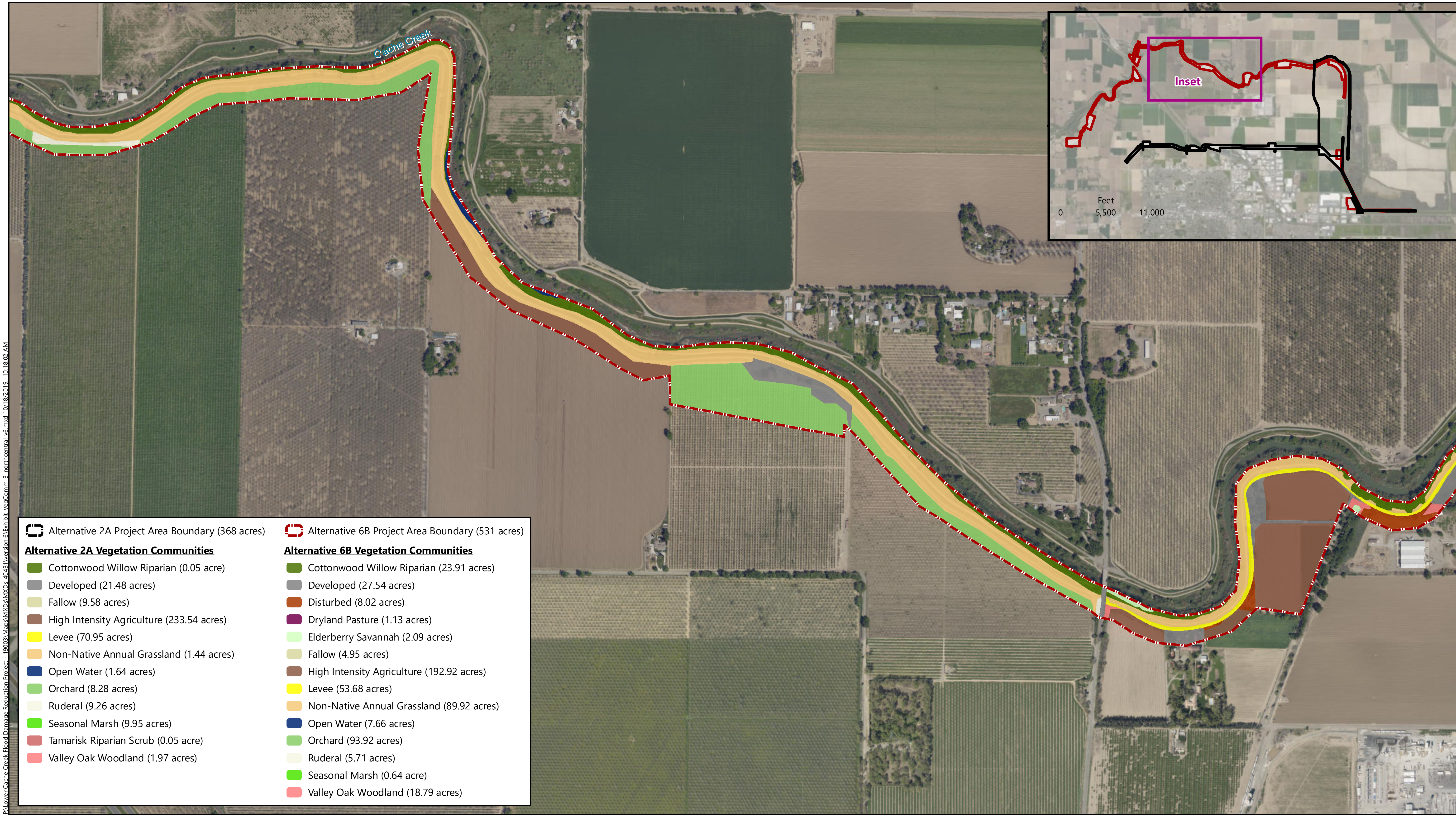
Survey Data Source: Madrone Ecological Consulting, LLC., 2019 Survey Data.
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.

Vegetation Communities
North Central

Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING



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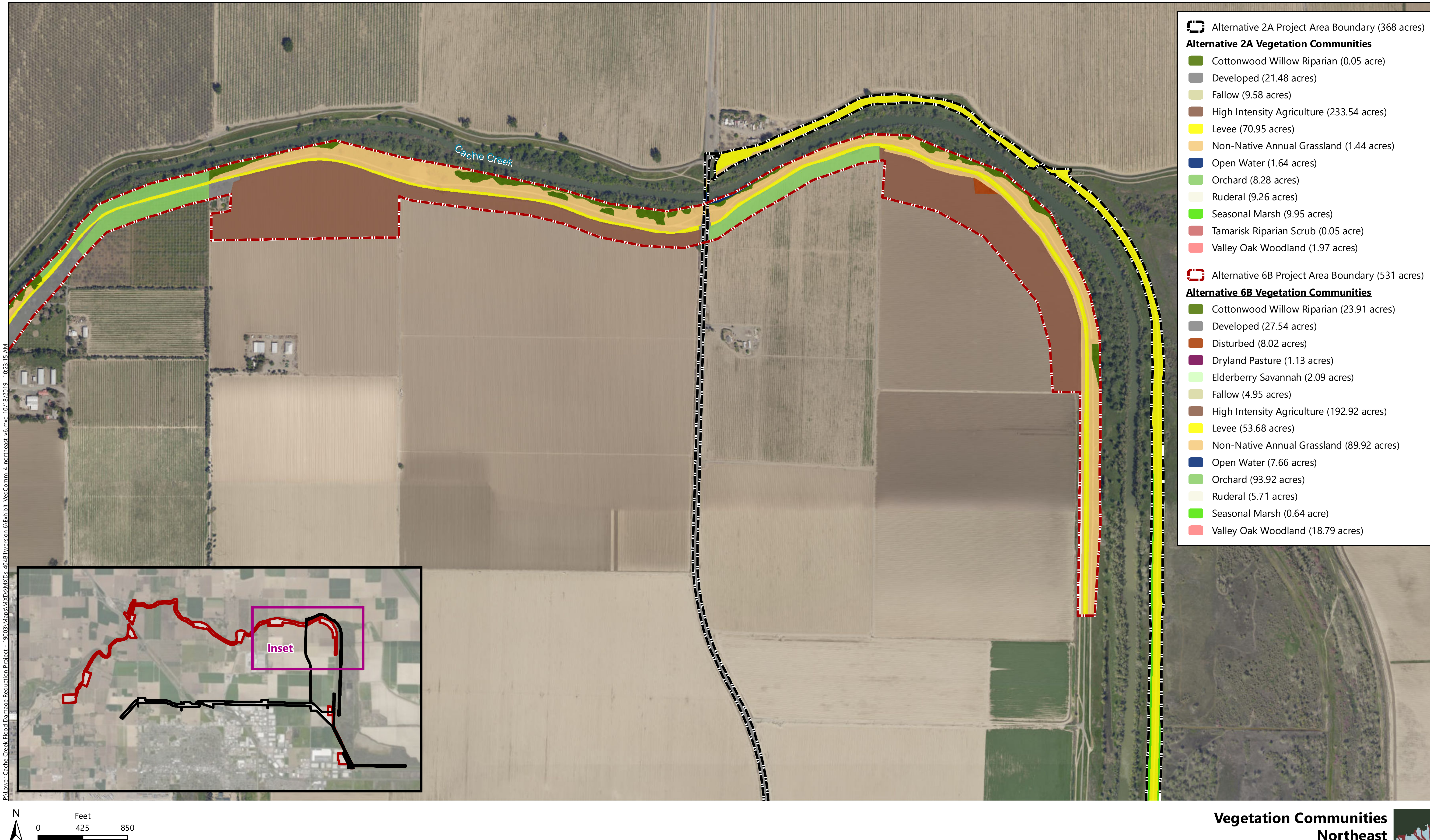
Vegetation Communities
North Central

Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING



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Vegetation Communities Northeast

Lower Cache Creek Feasibility Study
Yolo County, California

Survey Data Source: Madrone Ecological Consulting, LLC., 2019 Survey Data.
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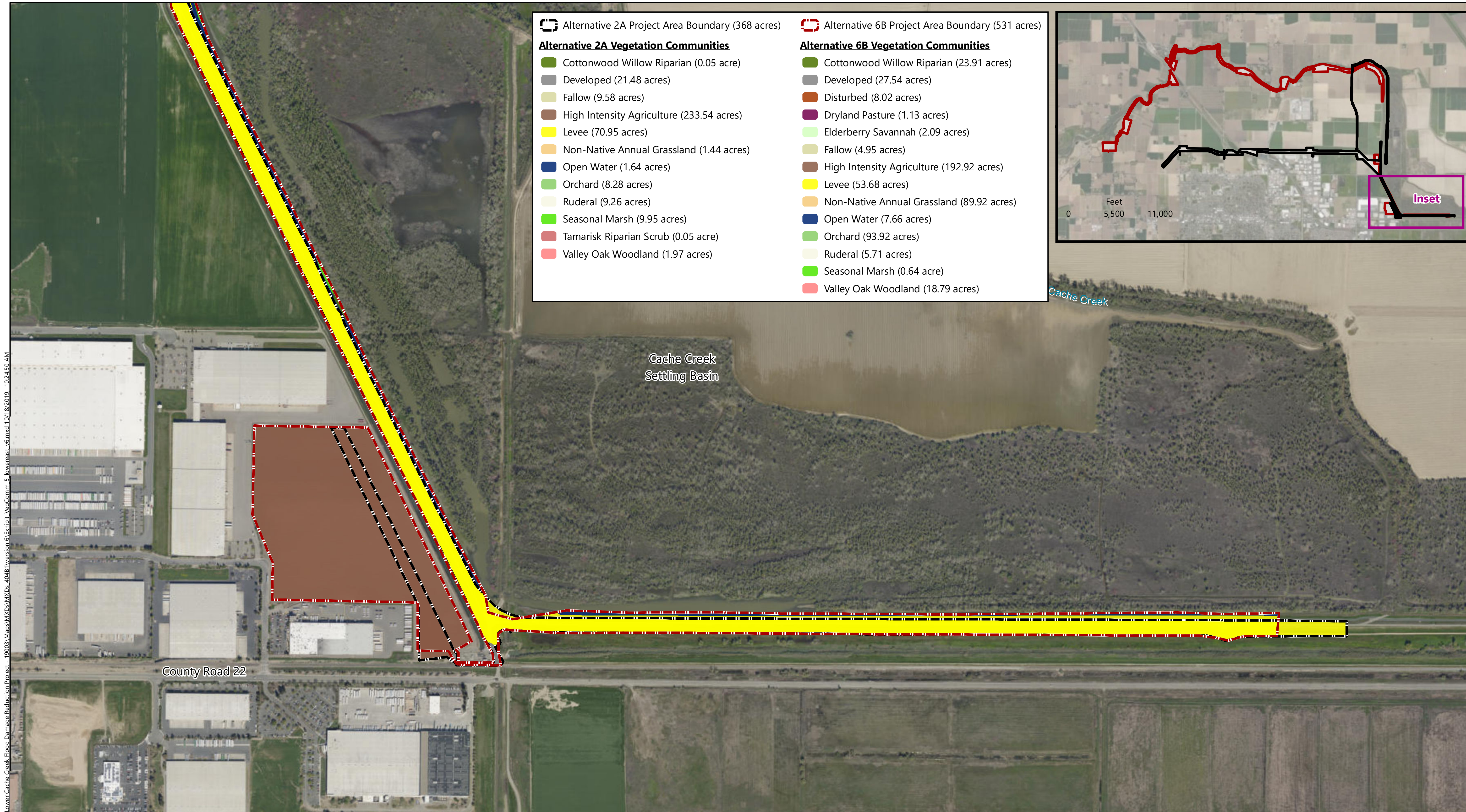

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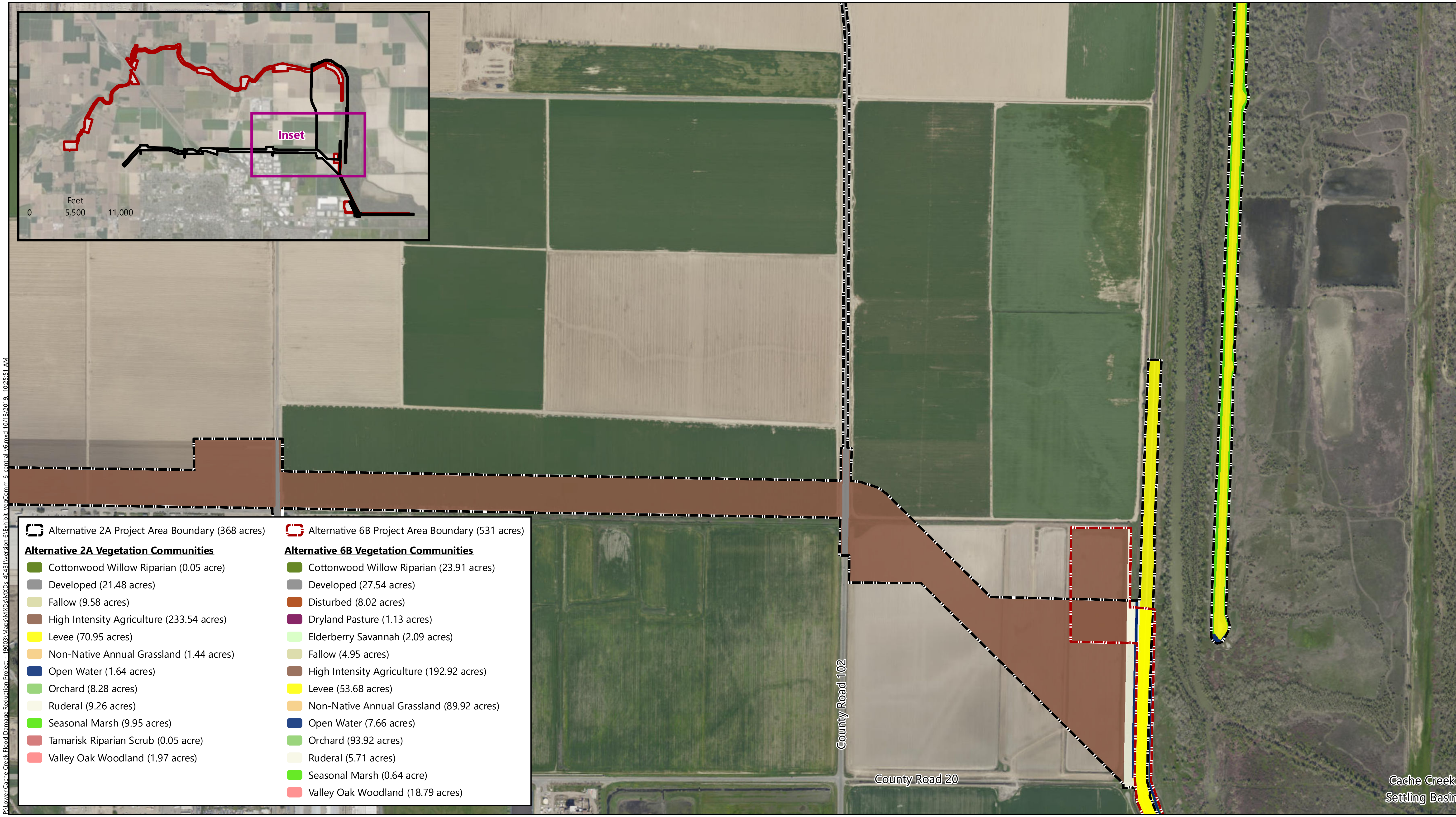
Vegetation Communities
Lower East

Survey Data Source: Madrone Ecological Consulting, LLC., 2019 Survey Data.
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.

Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING



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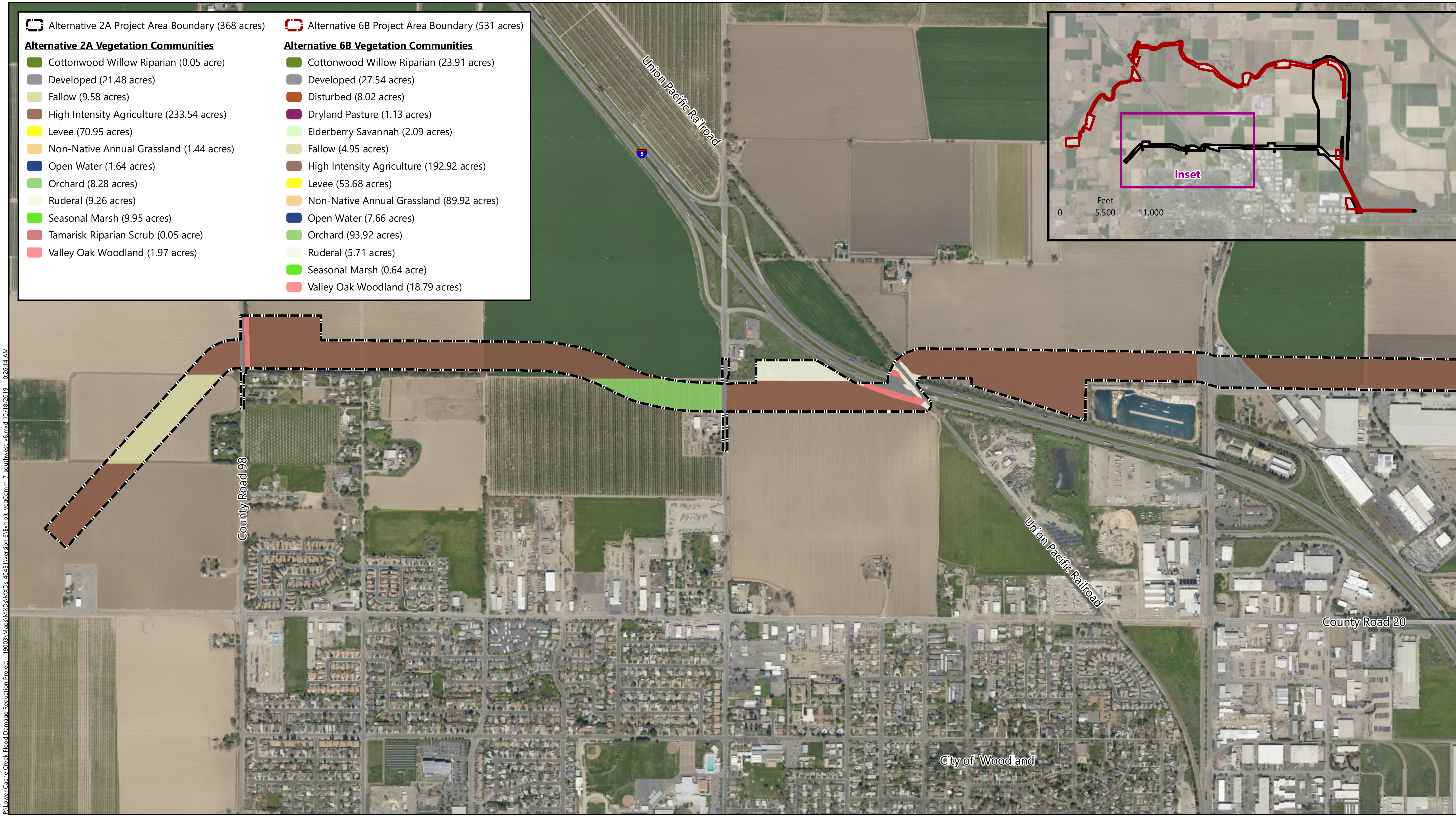
Vegetation Communities Central

Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING



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Feet
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Survey Data Source: Madrone Ecological Consulting, LLC., 2019 Survey Data.
Aerial Sources: City of Woodland, 13 April 2018 and Yolo County, 13 April 2018.

Vegetation Communities
Southwest

Lower Cache Creek Feasibility Study
Yolo County, California

MADRONE ECOLOGICAL CONSULTING

PUBLIC INVOLVEMENT

APPENDIX J

LOWER CACHE CREEK FEASIBILITY STUDY

Yolo County, CA

December 2019

United States Army Corps of Engineers
Sacramento District

From: Nancy Lea [nancylea.ca@gmail.com]
Sent: Tuesday, September 29, 2015 1:04 PM
To: Parker, Mario G SPK
Subject: [EXTERNAL] Lower Cache Creek Project

Nancy F. Lea
P.O. Box 8667
Woodland, CA 95776

September 29, 2015

Mr. Mario Parker
U.S. Army Corps of Engineers
1325 J Street
Sacramento, CA 95814

Re: Comments: Lower Cache Creek Project

Dear Mr. Parker:

First, I would like to thank the Army Corps of Engineers (Corps) for providing the opportunity to make comments at the Scoping session which was held on September 3, 2015. I do note, however, that I would have preferred an opportunity to make these comments in the context of a public forum. My conclusion based on discussions of the meeting format with other attendees is that its effectiveness for communication to decision makers was perceived to be limited. I would suggest that in the future, if the Corps deems the "poster sessions" to be of value, that a public forum with opportunity to make verbal comments to the Corps and the public be also part of the meeting and be "time set".

I am one of the individuals who entered into a protracted period of examining the North Woodland Flood Barrier with Woodland City officials and the Corps of Engineers back in 2003-4. Our efforts culminated in "Residents for Responsible Flood Control" and the passage of "Measure S" in 2004: "Shall the ordinance establishing a Regional Flood Control Project Policy for the City of Woodland and prohibiting the City from funding or taking any action that supports the Lower Cache Creek Flood Barrier or a substantial similar structure be adopted".

The issues which brought the owners of approximately 6000 acres north of Woodland to the point of community activism were that the proposed flood wall, supported by many City politicians, envisioned creating an "institutionalized floodplain" that would reduce our land values, our ability to farm, and our ability to obtain farm financing.

And, we reasonably concluded that ongoing maintenance of the south levee of Cache Creek would be perceived as an expensive luxury since the City of Woodland would be protected behind its flood wall: we anticipated that the levee which protects us would become degraded.

Since Measure S passed, overwhelmingly, I might add , a flood wall is "off the table" and so is any structure or flood control mechanism which is "substantially similar. A casual reading of the description of the north Woodland Floodway could lead to a conclusion that it has some similarities.

Over the years I have had many conversations with engineers and City officials regarding flood solutions: we all recognize that in some years flood waters can escape from Cache Creek and come across the land lying north of Woodland. The 2004 proposed flood barrier made any flooding on the land north of Woodland worse by impounding, increasing depths, and increasing flood duration. I would support a flood control engineered solution that moved the water from west to east. I would support a flood solution that made our flood situation better - rather than worse.

Over the years in my conversations I noted that earthwork should be oriented to "directing flows" and not impounding floodwaters. I think the use of the word "levee" is simplistic: the language and emphasis needs to be on directing flows. I have stated that I would not support a flood control structure that had any berm at the north channel edge - the channels must be designed to receive waters along its/their length and remove them- not hold them to the north of Woodland.

Please feel free to contact me if you have any questions or seek further information.

Very truly yours,

Nancy F. Lea

Sent via email to mario.g.parker@usace.army.mil

YOCHA DEHE
CULTURAL RESOURCES

September 21st, 2015

Mario Parker
Army Corps of Engineers
1325 J Street
Sacramento, CA 95814

RE: Lower Cache Creek Project

Dear Mr. Parker:

Thank you for your project notification letter dated August 28, 2015 regarding cultural information on or near the proposed Lower Cache Creek Project, Yolo County, CA. We appreciate your effort to contact us and wish to respond.

The Cultural Resources Department has reviewed the project and concluded that it is within the aboriginal territories of the Yocha Dehe Wintun Nation. Therefore, we have a cultural interest and authority in the proposed project area. We wish to initiate consultation with Army Corps of Engineers.

Please provide our Cultural Resources Department with a project timeline, detailed project information and the latest cultural study for the proposed project, as well as specific APEs for all alternatives including borrow site locations. As the project progresses, if any new information or cultural items are found, we do have a process to protect such important and sacred artifacts. Upon such a finding, please contact the following individual:

Mr. James Sarmento
Cultural Resources Manager
Yocha Dehe Wintun Nation
Office: (530) 723-0452, Email: jsarmento@yochadehe-nsn.gov

Please refer to identification number YD – 11012013-01 in any correspondences concerning this project.

Thank you for providing us with project information and the opportunity to comment. Please contact Mr. Sarmento at your earliest convenience to coordinate a date and time for the consultation meeting.

Sincerely,

James Kinter
Tribal Secretary
Tribal Historic Preservation Officer

COLUSA BASIN DRAINAGE DISTRICT

COLUSA BASIN DRAINAGE DISTRICT

P.O. Box 390
Willows, CA 95988-0390

September 11, 2015

Mario Parker
1325 J St.
Sacramento, CA 95814

RE: Lower Cache Creek Project

Dear Mr. Parker;

The Colusa Basin Drainage District has followed the process to address flooding problems within this area, and has considered the array of alternatives presented at the scoping meeting for the Lower Cache Creek Flood Risk Management Project Feasibility Study held on September 3, 2015, in Woodland. The District offers the following comments.

Our area of interest concerns the Alternative listed as Number 1—a northern bypass into the Colusa Drain. This alternative puts more water into the Drain during flood events. We request that detailed analysis be done to ascertain that the Drain can accommodate these additional flows should this alternative be considered further. The integrity of the levees also needs to be considered along the Colusa Drain and further downstream along the Ridge Cut Canal.

The Colusa Basin Drainage District was formed in 1987 by act of the California legislature to address problems of flooding and winter drainage, irrigation drainage, and subsidence within the Colusa Basin. The District is comprised of 600,000 acres in Glenn, Colusa and Yolo Counties. It is governed by a nine-member board of directors representing landowners, reclamation and water districts, and county governments from the three affected counties.

We ask that the Colusa Basin Drainage District be kept informed of future meetings regarding this project.

Thank you for the opportunity to submit these comments.

Sincerely,

Eugene Massa

Eugene Massa,
General Manager

Parker, Mario G SPK

From: Rod Buchignani [rodbook@pacbell.net]
Sent: Tuesday, September 08, 2015 11:55 AM
To: Parker, Mario G SPK
Subject: [EXTERNAL] Lower Cache Creek Flood Risk Management

Dear Mr. Parker,

I am a property owner near Cache Creek. I have not received any notification of public meetings nor environmental impact reports. I request to be placed on all email and mailing lists pertaining to this study and Flood Control issues.

Property: 14835 County Road 100B, Woodland.
Mailing Address: 7583 Meadowlark Drive, Sebastopol, CA 95472
Email: rodbook@gmail.com, inquiry@bypistachios.com
Phone: 707.318.5002

Sincerely,

Rod J. Buchignani, Ed.D.

Parker, Mario G SPK

From: Judith Lamare [swainsonshawk@sbcglobal.net]
Sent: Thursday, September 10, 2015 2:25 PM
To: Parker, Mario G SPK
Subject: [EXTERNAL] notice -Lower Cache Creek Project

Dear Mr. Parker

Your notice re Lower Cache Creek to Friends of the Swainson's Hawk was addressed to an old address.

May we request that USACE address all correspondence to Friends of the Swainson's Hawk to our email address (see below), and that any postal address associated with our name be deleted?

Would you be so kind as to forward this request to the keeper of public notice mailing lists in the Sacramento Region?

Thank you.

Judith Lamare, President
Friends of the Swainson's Hawk
www.swainsonshawk.org
swainsonshawk@sbcglobal.net
916 769 2857

DUCK CLUBS • FARMS • BUSINESS PROPERTY • COMMERCIAL

WILLIAM T. MORGAN REAL ESTATE

10 N. EAST STREET, SUITE 103 | WOODLAND, CA 95776 | BUS: 530.662.8696 | FAX: 530.662.8589

WILLIAM T. MORGAN
License #00318291
Cell 530.867.2662
Res. 530.662.8466

MARIA MANDUJANO
Office Manager
530.662.8696
Maria@wtmorgan.com

OCT 01 2015

Department of the Army
U.S. Army Corps of Engineers, Sacramento District
1325 J Street
Sacramento, CA. 95814-2922

RE: Lower Cache Creek Flood risk Management

Gentlemen,

Let me qualify myself, I have lived in Woodland since 1952 doing commercial harvesting and land Real Estate. I have been doing Real Estate for 55 years. In my time here I had a real good friend he was a California DWR water engineer.

Here is Robert Rooney (my dear friend) idea's on what you are making a big issue of at Stephens bridge north of the Flier club put a hydraulic gate on the West side of the bridge that way you can control the water coming down Cache Creek, back the water up fill the creek and big holes where gravel has been mined. That way you could meter the water out and prevent flooding Woodland and surrounding area. By doing this you would fill the aquafers all along Cache Creek raise the water level in Wells from Esparto, Madison, Winters, Woodland and Davis and all surrounding areas.

Let Teichert Construction clean out the creek from Stephens Bridge to the Bypass and not back up the water as there are several places along Cache Creek that need cleaned. Then down in the lower end where the water goes into the bypass there is a line of trees that serve as a dam, holding back all creek waters, but then with the bypass bank full, the water from Cache Creek and the Sacramento River, where does it go! In 1983 Yolo Flood Control told me that three million acre feet of water was going thru the bypass a day. So I've seen deep water.

It is time the environmentalists are asked do you want to pay for all flood damage to Woodland and surrounding areas? Or are we going to protect Woodland with these changes?

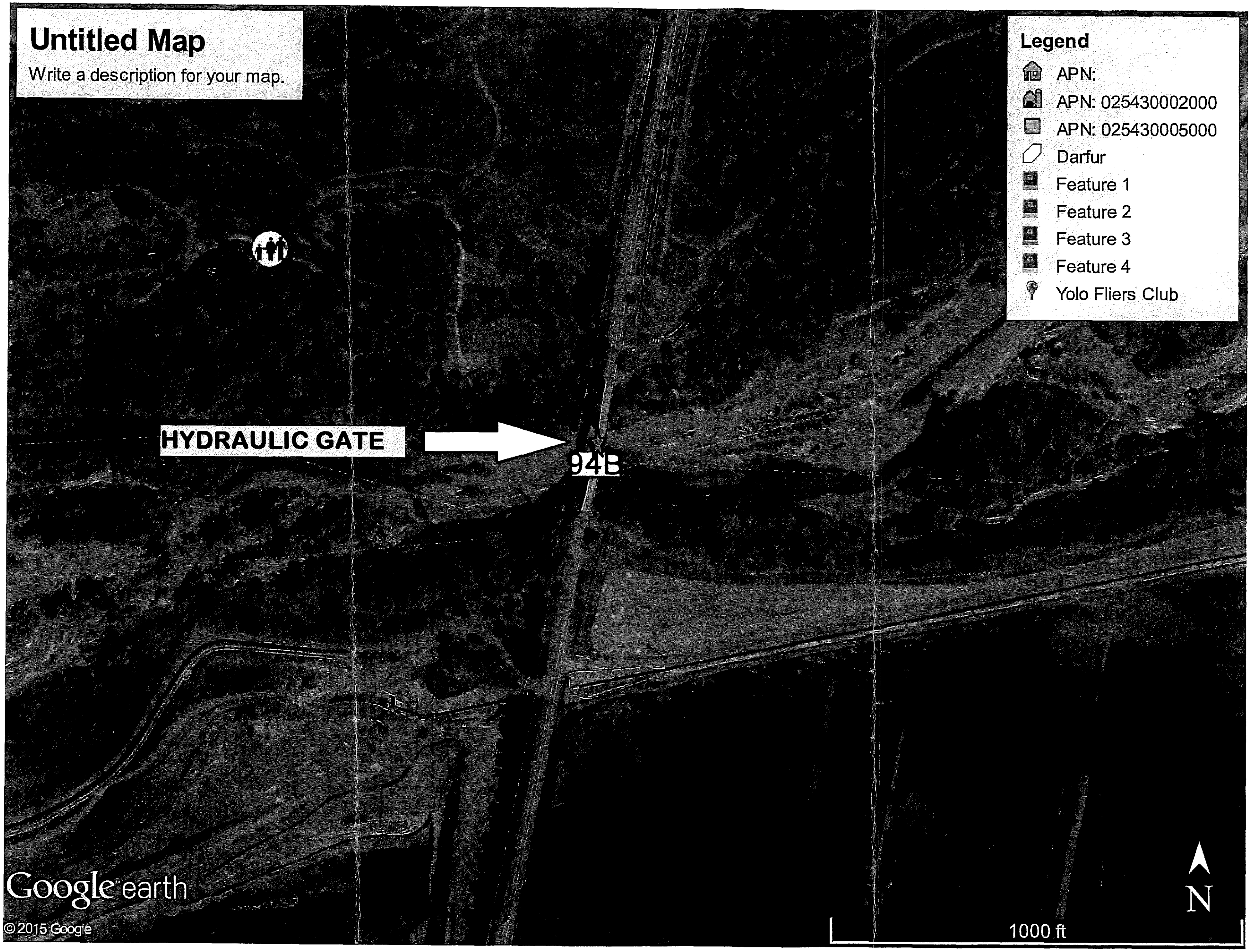
In closing I will say I'm passing a long Robert Rooney's Idea, a DWR water engineer (now gone from a tragic accident).

You can contact me at 530-662-8696 and I will go out and show you the area I'm talking about.

Thanks,

William T Morgan

William T Morgan Ca
RE license 00318291


Untitled Map
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Legend
APN:
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Darfur
Feature 1
Feature 2
Feature 3
Feature 4
Yolo Fliers Club
HYDRAULIC GATE
94B
Google earth
© 2015 Google
1000 ft
N

Parker, Mario G SPK

From:	Matt Jones [MJones@ysaqmd.org]
Sent:	Wednesday, September 02, 2015 10:09 AM
To:	Parker, Mario G SPK
Subject:	[EXTERNAL] Lower Cache Creek Project - Comments
Attachments:	YSAQMD Comments - Lower Cache Creek Project.docx

Mr. Parker -

The Yolo Solano Air Quality Management District has received the letter regarding the preparation of the environmental analysis for the Lower Cache Creek Flood Risk Management project. I have attached the District's comments in MS Word format. Thank you for the opportunity to comment on the project.

Regards,

Matt Jones

Planning Manager

Yolo Solano Air Quality Management District

530-757-3668

mjones@ysaqmd.org

September 1, 2015

Dear Mr. Parker:

The Yolo-Solano Air Quality Management District (District) has received the letter from the U.S. Army Corps of Engineers (Corps) stating that the Corps will prepare a joint integrated Feasibility Report/Supplemental Draft Environmental Impact Statement/Environmental Impact Report (Document) to evaluate several alternatives for the Lower Cache Creek Flood Risk Management Project. The District has several comments regarding this project:

- The Document should analyze potential fugitive dust impacts from the construction of the project for each alternative. The Document should also discuss how these impacts will be mitigated by the lead agency.
- Since the District is in a federal nonattainment area for ozone, the Document should quantify emissions of reactive organic gases (ROG) and nitrogen oxides (NOx), which are ozone precursors, for each alternative and compare annual emissions to the Districts CEQA thresholds of significance. The Document should also discuss general conformity and whether the project will exceed conformity thresholds. If thresholds will be exceeded, the Document should discuss how the conformity criteria will be met.

The District appreciates the opportunity to comment on the DEIR for this project. If you have any questions about the comments included in this letter, please feel free to contact me at 530-757-3668 or email me at mjones@ysaqmd.org

Mailing Address:

Yolo Solano Air Quality Management District
1947 Galileo Court, Suite 103
Davis, CA 95618
Attn: Matt Jones

US Army Corps of Engineers ®
Sacramento District

Public Comment Sheet

Name: KEVIN COWAN **Phone:** 530-681-5642

Address: 228 SAN LUIS ST., WOODLAND CA 95695

E-Mail: KEVIN-COWAN @ LPL.COM

Comment/Question:

THANK YOU FOR CONSIDERING OUR INPUT.

AT THIS POINT THE SOUTH BYPASS SEEMS TO BE THE MOST REASONABLE SET OF MEASURES TO ADDRESS ISSUES BOTH IN THE CITY AND RURAL AREAS.

I AM LOOKING FORWARD TO FURTHER OPPORTUNITIES TO ENGAGE IN SHAPING THE OUTCOME.

US Army Corps of Engineers ®
Sacramento District

Public Comment Sheet

Name: PHIL HOGAN **Phone:** (530) 662-2037 x111

Address: USDA NRCS 221 West Court St Ste. 1
Woodland 95695

E-Mail: phil.hogan@ca.usda.gov

Comment/Question:

Please send me the AD-1006 Form, Farmland Conversion Impact Rating to address the Farmland Protection Policy Act

US Army Corps of Engineers ®
Sacramento District

Public Comment Sheet

Name: Linda Osborne Phone: 530-666-2257

Address: 14778 CR 100B Woodland

E-Mail: 0

Comment/Question:

I feel that option #3 would best suit my neighbors and I. The properties on our Road has has been held by our families for 75 years and under. We would not like a levee blocking us in as of option #4.

US Army Corps of Engineers ®
Sacramento District

Public Comment Sheet

Name: Nancy Ullrey **Phone:** 661-1070

Address:

E-Mail: nullrey@ cachecreek conservancy

Comment/Question:

Disappointed in this form of outreach. It does not help provide context for people unfamiliar with the alternatives or process. Lack of handouts compounds the inability to see the posters because so crowded, or to hear questions + answers.

Public Comment Sheet

US Army Corps of Engineers®
Sacramento District

Name: Domingo Ricardo **Phone:** 530-662-0195

Address: 39577 Co Rd 17A, Woodland CA 95695

E-Mail: bugsdiane@gmail.com

Comment/Question:

(1) Short notice of meeting by design? Same as a few years ago! Rec'd letter Tues for Meeting on Thurs.

(2) Why can't you a) clean out and deepen creek and b) raise levees so no one's homes are impacted.

If the highest flow was 53,000 cfs in 1995 and your goal is to accommodate 60,000 cfs cleaning/deeping creek and raising levees should attain that goal.

(3) Who is deciding where set back levees will be built? Existing homes should not be impacted if solution can be reached using farm land.

(4) Why bottleneck instead of widening bridge at Hwy 113?

over →

(5) Will properties still be considered to be in a floodplain after "fix" is done? Will flood insurance rates go down?

(6) Provide handouts of proposed options.

(5) Will properties still be considered to be in a floodplain after "fix" is done? Will flood insurance rates go down?

(6) Provide handouts of proposed options.

US Army Corps of Engineers®
Sacramento District

Public Comment Sheet

Name: Lynn Perani **Phone:** 530-666-7074

Address: 15285 Co. Rd. 97A Woodland

E-Mail: trailhorse55@gmail.com

Comment/Question:

We oppose any plan that would make our situation ~~worst~~. worst. Or that we would lose our home. Think about water storage and not just getting rid of the water.

Parker, Mario G SPK

From:	Chad Roberts [recp@cal.net]
Sent:	Tuesday, September 01, 2015 11:51 AM
To:	Parker, Mario G SPK
Cc:	'Stefan Lorenzato'
Subject:	[EXTERNAL] Lower Cache Creek Project
Attachments:	RCR letter to USACE re Scoping for alternatives - 01 Sep 2015.docx

Dear Mr. Parker,

Attached please find comments (in Word) intended as input for the Scoping Session for the above-cited EIS. It's unlikely that I will be able to attend Thursday's Scoping session.

Please send me a separate copy of the public notice for this scoping session, as the attachment for the scanned copy that I received is illegible.

Also, please include the contact information in the box below for all future USACE contacts about this project. If you have any questions, please feel free to contact me at this email address or the other contact information in the box.

Thanks,

Chad

Chad Roberts, Ph.D., PWS, ESA Senior Ecologist

Conservation Ecologist

P.O. Box 2173, Davis CA 95617

(530) 219-1288 (mobile) / recp@cal.net <mailto:recp@cal.net>

CHAD ROBERTS, PH.D.
SENIOR ECOLOGIST (ESA), PROFESSIONAL WETLAND SCIENTIST (SWS)

01 September 2015

Mario Parker
US Army Corps of Engineers
1325 J Street
Sacramento, CA 95814

Subject: Lower Cache Creek Project

Dear Mr. Parker:

I'm submitting these comments in lieu of attending the public Scoping session in Woodland, scheduled for Thursday, 03 September, as I'm personally scheduled to be out of Yolo County then.

I also request that you send me, at the address at the bottom of this page, a separate copy of the 28 Aug 2015 notice about this Scoping session, as the copy that I received from a third party was a scanned copy and the attachment was illegible.

The comments that I am making about this project to the Corps, initially, are identical to the comments that I sent in a letter to Mr. Tim Busch of the City of Woodland, acting as Conservation Chair for the Yolo Audubon Society (YAS), in response to a Notice of Preparation from the City about this project. These comments are attached (Attachment 1).

If you wish you can enter the YAS as a separate commenter, but my intent is that all relevant materials about the Corps NEPA document are to be sent to me as an individual at my personal address (the one in this letter, and also in the transmittal email).

My initial preference for this project is that the selected alternative be the fourth option, setback levees along Cache Creek. In any event that alternative should be fully addressed in the EIS, as elements from this alternative may be added to other alternatives.

If you have questions, please feel free to direct them to me in an email or call my mobile number (below).

Sincerely,

(signature not included in Word document)

Chad Roberts

P.O. BOX 2173 • DAVIS, CA 95617 • 530-219-1288 (MOBILE)

ATTACHMENT 1

Yolo Audubon Society
P.O. Box 886 Davis, CA 95617

21 July 2015

Mr. Tim Busch
Principal Utilities Civil Engineer
City of Woodland
300 First Street
Woodland, CA 95695
timbusch@cityofwoodland.org

Subject: Comments on Notice of Preparation for Project Environmental Impact Report, Woodland Flood Risk Management Project

Dear Mr. Busch:

The following comments are provided on behalf of the Board of Directors of the Yolo Audubon Society (YAS), a 501(c)(3) nonprofit educational corporation that functions as a chapter of the National Audubon Society for Yolo County. The YAS generally supports the development of flood risk management solutions for citizens of the City of Woodland, as we have similarly supported the development of flood risk management solutions for the City of West Sacramento. In a general way we support the proposed drainage conveyance project identified as the subject of the Environmental Impact Report (EIR) in the Notice of Preparation (NOP).

However, as the NOP did not include any maps or other detailed identification of the physical location of the proposed structure, the specific environmental resources that would be affected by the project, or any mitigation measures that the City will include to avoid, reduce, or offset those impacts (and no depiction of the proposed project exists on any City of Woodland websites that we have been able to locate), our support can only be considered as general support for the project. We believe that the NOP does not conform with the requirements for notice included in the California Environmental Quality Act (CEQA), and that the NOP requires more detailed project information in order to support informed participation by Yolo County citizens. The CEQA Guidelines [§15082(a)(1)] requires sufficient information to allow responsible and trustee agencies and other affected parties to make informed comments:

> "(1) The notice of preparation shall provide the responsible and trustee agencies and the Office of Planning and Research with sufficient information describing the project and the potential environmental effects to enable the responsible agencies to make a meaningful response. At a minimum, the information shall include:
>
> "(A) Description of the project,
>
> "(B) Location of the project (… by attaching a specific map, preferably a copy of a U.S.G.S. 15' or 7½' topographical map identified by quadrangle name) …"

ATTACHMENT 1

Yolo Audubon Society

P.O. Box 886 Davis, CA 95617

21 July 2015

Mr. Tim Busch
Principal Utilities Civil Engineer
City of Woodland
300 First Street
Woodland, CA 95695
timbusch@cityofwoodland.org

Subject: Comments on Notice of Preparation for Project Environmental Impact Report, Woodland Flood Risk Management Project

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> "(A) Description of the project,
>
> "(B) Location of the project (... by attaching a specific map, preferably a copy of a U.S.G.S. 15' or 7½' topographical map identified by quadrangle name) ..."

Because we can't tell what the actual project elements are, we're limited in our ability to respond to the NOP. Further, we may find in the future that we can't support some elements because of currently unanticipated environmental effects.

Specific Comments Regarding the Proposed Project

The NOP project synopsis identifies three elements in the proposed project, summarized:

1. A new diversion channel and an associated earth levee about 10 miles long, to be located somewhere north of the city, which would route possible flood overflows from Cache Creek eastward toward the Cache Creek Settling Basin (CCSB) and the Yolo Bypass;
2. Modifications (of unknown type) within or adjacent to the CCSB to accommodate the increased flows within the CCSB and their delivery to the Bypass; and
3. Alterations in local surface transportation routes and disturbances of local transportation, to accommodate the construction and operation of the new diversion channel.

As a regional conservation organization our concerns for the proposed project are generally related to environmental resources in two potential impact categories, (a) *Biological Resources* and (b) *Hydrology and Water Quality*. The two categories are closely interrelated for this project.

<u>Surface Transportation Effects</u>. In considering the three basic project elements summarized above, the YAS Board is neutral about effects on surface transportation (element 3); this comment does not identify significant concerns for element 3 that should be addressed in the EIR.

<u>Diversion Channel and Levee Effects</u>. Because we don't know where the diversion channel and levee will be located we're not able to address specific issues that may be raised by these elements. However, in general the Board would be concerned about the environmental effects of having those elements cross, intersect, or remove existing stream alignments, residual oak trees or groves, or other natural features that have developed significant habitat values. Such habitat types in the area north of Woodland are used by a number of environmentally sensitive species, including Swainson's Hawk and giant garter snake, among others. Any impacts to such habitats need to be identified on the basis of adequate biological studies, with mitigation measures provided that avoid, reduce, and/or offset the impacts according to the requirements of state and federal law. Similarly, if the channel and levee affect water flows or amounts in natural water features that could affect existing habitat values, these effects need to be identified in the EIR and suitable mitigation provided.

<u>Cache Creek Settling Basin Effects</u>. The Board's most significant environmental concerns for the proposed project are related to impacts to habitat values and hydrology in the CCSB. The proposed project includes "modification/realignment of a segment of the existing CCSB," but there's no description of what this includes, where the modifications or realignments would occur, or what the anticipated effects would be on the habitat values in the CCSB. This represents a potentially significant impact to one of the major areas of "riparian"[1] habitat in Yolo

---

[1] The meaning of "riparian" extends well beyond the woody vegetation that is typically identified as "riparian habitat." See the *Appendix* for additional considerations. The concepts incorporated into this definition are intended

County, an area that has shown promise of hosting Yellow-billed Cuckoos (YBCU), a federally listed bird species that is very uncommon in the Central Valley. Any changes in habitat values in the CCSB need to be fully identified on the basis of sufficient biological studies to categorize effects throughout the annual cycle, as the habitat is also valuable for numerous migratory and wintering species.

Broader Questions of Habitat Issues and Flood Management in Yolo County

The YAS Board's members recall the earlier discussion of flood management options for the City of Woodland. At one time an option was identified that addressed flood protection from Cache Creek flooding north of the city by the construction of setback levees adjacent to Cache Creek that would constrain flows within an enlarged channel system with expanded riparian zones. This option would be highly beneficial for a variety of habitat purposes, and would help address water quality concerns in Cache Creek in addition to flood issues. The Board believes that this alternative needs full evaluation in the EIR, including consideration of the relative impacts and required mitigation in parallel with those of the proposed project.

The Board also has questions as to the timing of the current proposal, as the NOP acknowledges that the Corps of Engineers has been re-engaged in studying the feasibility of flood management options for Cache Creek. The NOP will need to explain fully why the current project is proposed prior to the completion of the Corps' feasibility study in 2017. (We note in passing that any mitigation measures enacted for the current project must be considered as "permanent" changes in conditions, to be maintained in perpetuity even if the Corps study recommends a different approach.)

The YAS Board is aware that the CCSB is an element in a larger flood-management framework for the Central Valley pursuant to the Central Valley Flood Protection Plan, including potentially rerouting flood flows in the Sacramento River system, with possibly significant alterations to the Yolo Bypass. In addition the YAS Board is aware that modifications in the Bypass are required in order to comply with the Biological Opinion for Central Valley salmonids, which could also affect the CCSB. The YAS Board is aware of the elements included in the "Yolo Bypass/Cache Slough Integrated Water Management Plan" as an element of the Regional Flood Management Plan for the lower Sacramento River and the northern part of the Delta (the LSDN RFMP), which considers necessary modifications to local flood management elements in Yolo County, including the CCSB and the Yolo Bypass.

Given the potential inclusion of the CCSB in these several broadly focused planning efforts involving state and federal flood and water management agencies, the Board is unclear precisely how the proposed changes in the CCSB for the City's project fit into the larger framework. The Board believes that it would be environmentally inappropriate for the City to pursue a project within the CCSB that adversely affects or prejudices decisions made for the Sacramento River

by the YAS Board to be invoked in full whenever this term is mentioned in this letter, although for CEQA purposes the majority of the comments in this letter refer to the narrower meaning of "habitat," given the primary focus of the YAS as a conservation organization.

system, the Delta, and the Bypass, and requests that the City's EIR fully address coordination among these planning efforts as part of the required consideration of alternatives.

The YAS Board is not intrinsically opposed to alterations in the CCSB, even to the extent of abandoning the CCSB entirely and changing the flow patterns in lower Cache Creek and the Bypass. The Board is aware of the water quality (mercury) issues related to the CCSB, and of the ultimate limitation on sediment storage available in the CCSB. The Board recommends that the City, other local planning agencies, the Department of Water Resources, and the Corps jointly and severally consider alternative options for the long-term future of the CCSB that address the plethora of issues known to exist about this facility. The Board would be concerned that the City not adopt a short-term solution inconsistent with the achievement of longer-term goals.

The Board's primary concerns in any such considerations will continue to be focused on the habitat values associated with flood management options in eastern Yolo County. The Board will want to see a clear demonstration in the EIR that any impacts to the "riparian" habitat in the CCSB are fully offset by whatever project is approved. This will need to include the "temporal" loss of habitat values involved by the destruction of higher-quality existing habitat and its replacement by habitat that requires a period of development to show similar value, and the "area mitigation ratio" will need to exceed 1:1.

In the larger framework of flood planning for the Yolo Bypass, the YAS Board would consider supporting a project that resulted in enhancing the overall habitat values in this region. In previous discussions of these topics we've considered what it would take to enhance riparian habitat within the Bypass region, perhaps by doing extraordinary things like moving the levees in order to increase conveyance capacity and add habitat values. Alternatively this habitat result could be achieved by creating additional protected habitat areas outside of and immediately adjacent to the Bypass. The YAS Board could consider supporting options that do all of the following three things, if they can be assembled from the various agency elements:

1. Abandons/removes the settling basin.
2. Enhances/expands the area of riparian habitat, and the degree of protection afforded to it, along Cache Creek north of Woodland, with the same kinds of habitat benefits noted in the next item.
3. Increases the amount/quality of riparian habitat within or immediately adjacent to the Bypass, as mitigation for project-related impacts and as a separate habitat enhancement for riparian-dependent species in Yolo County. In addition to YBCU, that would include Least Bell's Vireo, Yellow-breasted Chat, Modesto Song Sparrow, and other riparian-related species that we didn't even know have occurred here.

Thank you for considering Yolo County's environmental resources in your planning for flood protection for the City. If you have questions about the comments in this letter, please don't hesitate to get back to us.

Sincerely,

(signature not included in Word document)

Chad Roberts
Conservation Chair

Copies: Stefan Lorenzato, FESSRO, Department of Water Resources
Bill Marble, Yolo Water Resources Association
Petrea Marchand, Yolo Habitat Conservancy

APPENDIX

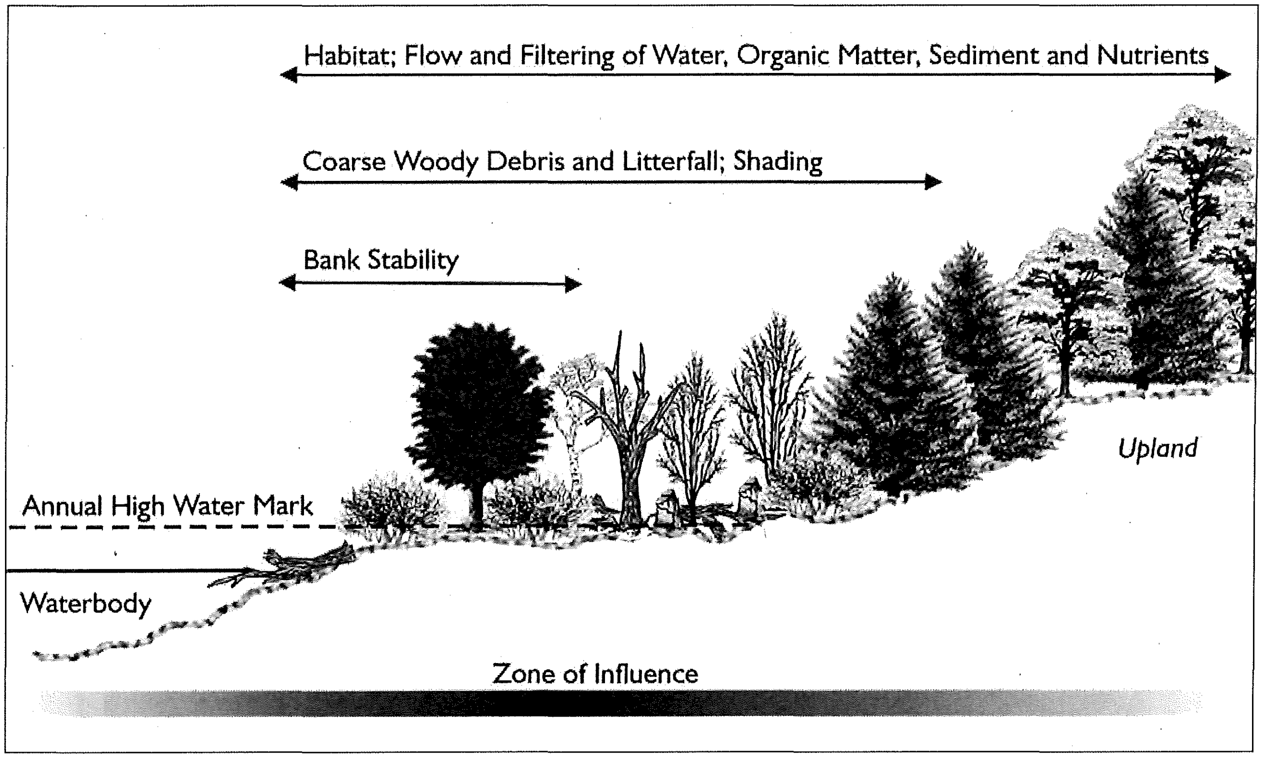
Interpreting "Riparian" for Cache Creek and the Yolo Bypass

The term "riparian" as used in this comment letter is explicitly intended to apply to habitats associated with aquatic features, primarily streams, in Yolo County. In a larger sense, the term includes a variety of additional functions and the associated services provided to society.

The following glossary term from the 2012 Central Valley Flood Protection Plan (see URL: http://www.water.ca.gov/cvfmp/docs/CVFPP_VolI_Att4_Glossary_201201.pdf) restates the definition developed in 2002 by the National Research Council:

> "Riparian areas are transitional between terrestrial and aquatic ecosystems and are distinguished by gradients in biophysical conditions, ecological processes, and biota. They are areas through which surface and subsurface hydrology connect water bodies with their adjacent uplands. Riparian areas include portions of terrestrial ecosystems that significantly influence exchanges of energy and matter with aquatic ecosystems (i.e., a zone of influence). Riparian areas are adjacent to perennial, intermittent, and ephemeral streams, lakes, and estuarine-marine shorelines."

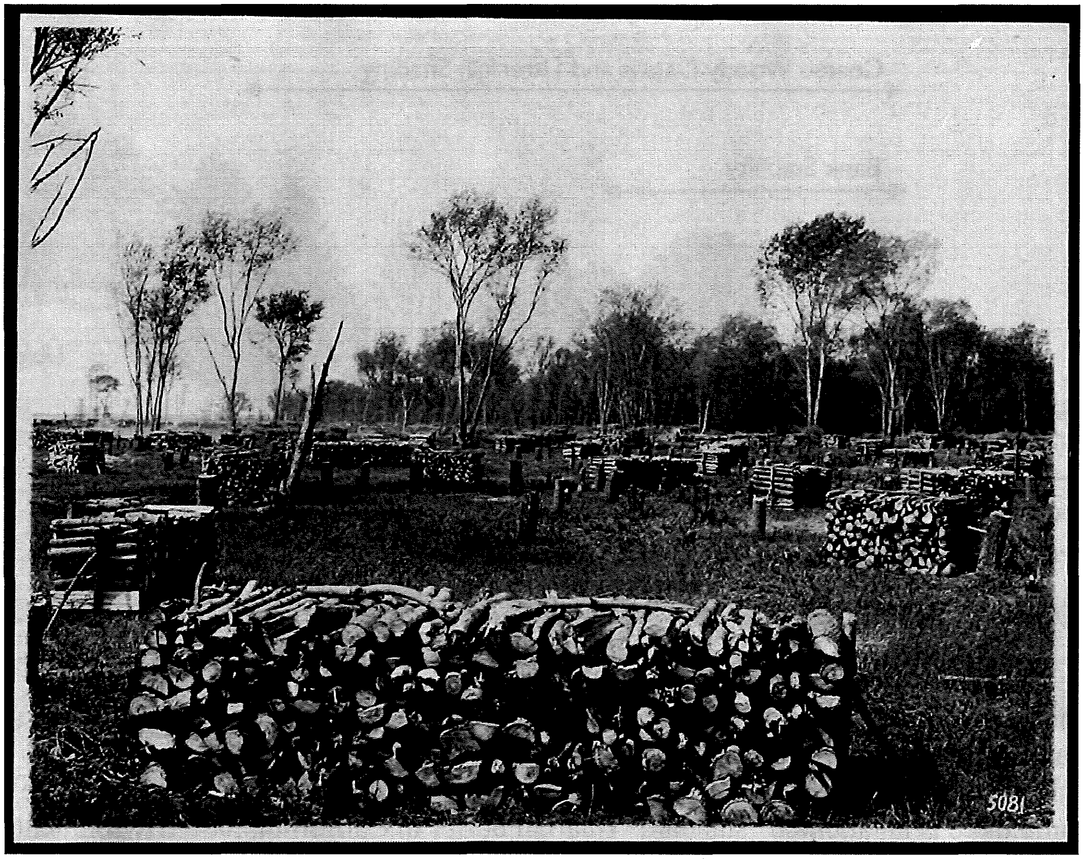
The following diagram illustrates the extent of the functions and services provided by riparian areas (note that the illustrated aquatic feature is not restricted to being a stream, and ponds, lakes, and vernal pools all have riparian areas, which differ in dimensions as well as in functions and services provided).



In this context it should be noted that "riparian habitat" includes influences from both the aquatic features and adjacent non-aquatic or "upland" areas. In consequence of this, riparian areas intrinsically require considerations of buffers along the margins of aquatic features. At the present time there is no adopted "standard" riparian buffer in California,[2] and environmental evaluations must consider the *functions* (i.e., ecological, hydrological, water quality-related, and geomorphological relationships among the aquatic areas and other ecosystem elements) and *services* (attributes valuable to people, such as sensitive species habitat, water quality enhancement, and bank stabilization) in arriving at appropriate buffer identification.

[2] A commonly adopted riparian buffer setback adopted by many local agencies is 100 feet from the "transition line" marking the edge of the aquatic feature. This is a "default" approach, as it does not consider actual functions or services. However, a variety of studies have indicated that many riparian functions are adequately addressed by 100-foot riparian buffers.

At the current time it's an open question as to the nature of the riparian habitat types that are most historically relevant for the region including the CCSB and the Yolo Bypass. Historical



Photograph of vegetation clearing in an area identified as "West Sacramento" in approximately 1910. The cleared forest was dominated by willow trees approximately 20 meters (65 feet) tall; most likely these were all Goodding willows (*Salix gooddingii*), a dominant willow species in the Central Valley. California State Library 26 2010-1853_000066935.

ecology treatments (e.g., the SFEI Delta Historical Ecology Study, found at URL: http://www.sfei.org/DeltaHEStudy) indicate that a large part of the historical Bypass region was a basin dominated by tule (*Schoenoplectus acutus* var. *occidentalis*). However, there is substantial evidence that large areas of willow forest occurred in higher parts of what's now the Bypass. The photo above is identified as having been taken in "West Sacramento;" other photos from the same source indicate that this likely shows the area of what is today Bryte. To the extent that the region in Yolo County including lower Cache Creek (i.e., near the Sacramento River in the northern Bypass) exhibited similar elevations and hydrology in 1910, the extensive willow forest that was present in this photo is a valid historical model for riparian forests in the vicinity of the CCSB today.

At the current time it's an open question as to the nature of the riparian habitat types that are most historically relevant for the region including the CCSB and the Yolo Bypass. Historical

Photograph of vegetation clearing in an area identified as "West Sacramento" in approximately 1910. The cleared forest was dominated by willow trees approximately 20 meters (65 feet) tall; most likely these were all Goodding willows (*Salix gooddingii*), a dominant willow species in the Central Valley. California State Library 26 2010-1853_000066935.

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A similar conclusion results from considering the forest in the following photograph, also from the West Sacramento album. This photo depicts a road along the shore of Lake Washington leading to a commercial campground then present at the lake. Lake Washington is a meander scroll of the Sacramento River, located just west of the Port in West Sacramento about a half-mile from the present channel. As above, the photo illustrates a nearly closed canopy (except where cleared for the road) of tall willows, suggesting again the nature of the willow riparian forest present at higher ground surface elevations in the vicinity of the Bypass during the settlement era.

Photograph of riparian forest along west shore of Lake Washington, West Sacramento, approximately 1910 (note man standing by road for scale). California State Library 26 2010-1671_000066818.

Parker, Mario G SPK

From: Christine Asiata [Christine.Asiata@OPR.CA.GOV]
Sent: Tuesday, September 01, 2015 5:06 PM
To: Parker, Mario G SPK
Subject: [EXTERNAL] Lower Cache Creek Flood Rish Management Feasibility Study

Hello Mario,

The State Clearinghouse received one copy of the above mentioned notice to hold a public scoping meeting. We have researched our database to match this notice with the correct project and are uncertain which it belongs to.
Would you be able to confirm if this project was sent to the State Clearinghouse for state agency review? Also, below is what we came across and are wondering if either of these are the same project to the notice. Any response is appreciated, thank you.

Christine Asiata Rodriguez
Governor's Office of Planning and Research
State Clearinghouse
P.O. Box 3044
Sacramento, CA 95812
916 445-0613
Fax: 916 323-3018

<Blockedhttp://www.saveourwater.com/>

Parker, Mario G SPK

From: Parker, Mario G SPK
Sent: Monday, October 05, 2015 2:36 PM
To: Christine Asiata
Subject: RE: Lower Cache Creek Flood Rish Management Feasibility Study

Hi Christine,
Sorry for the late reply and confusion.
Yes, our Lower Cache Creek project is the same project referenced in the City of Woodland's NOP, and yes, they did send their June 2015 NOP to the State Clearinghouse. It was a last minute decision for the City to be a co-participant of our public meeting and that our public meeting would also serve under their requirement to hold a public meeting under CEQA. In other words, it was a joint NEPA/CEQA public scoping meeting held for Lower Cache Creek project.

Mario

-----Original Message-----
From: Christine Asiata [mailto:Christine.Asiata@OPR.CA.GOV]
Sent: Tuesday, September 01, 2015 5:06 PM
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Hello Mario,

The State Clearinghouse received one copy of the above mentioned notice to hold a public scoping meeting. We have researched our database to match this notice with the correct project and are uncertain which it belongs to.
Would you be able to confirm if this project was sent to the State Clearinghouse for state agency review? Also, below is what we came across and are wondering if either of these are the same project to the notice. Any response is appreciated, thank you.

Christine Asiata Rodriguez
Governor's Office of Planning and Research
State Clearinghouse
P.O. Box 3044
Sacramento, CA 95812
916 445-0613
Fax: 916 323-3018

<Blockedhttp://www.saveourwater.com/>

Dear Mr. Parker,

I would like to be noticed as an interested party for the "Lower Cache Creek Project".

My mailing address is:

John Thomas

6825 Winding Way

Fair Oaks, CA 95628

I would appreciate being noticed when the EIR or EIS completed and presented to the public for review.

Sincerely,

John Thomas

John Thomas

Parker, Mario G SPK

From: Thomas Swett <tswett@hthjlaw.com>
Sent: Monday, October 12, 2015 8:42 AM
To: Parker, Mario G SPK
Subject: [EXTERNAL] Lower Cache Creek Project

Mr. Parker:

I was unable to attend the September 3 scoping meeting for the Lower Cache Creek Project and need to get up to speed on where things stand. Can you please send me the materials distributed and/or reviewed during that meeting along with any other information that would be useful? Also, please add this email address to any lists that have been compiled for the purpose of future communications regarding the Project. Thank you for your assistance.

THOMAS M. SWETT, ASSOCIATE

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

September 23, 2015

Tyler Stalker
US Army Corps of Engineers, Sacramento District
Attn: Public Affairs Office (CESPK-PAO)
1325 J Street
Sacramento, California 95814

Subject: Scoping Comments for the Lower Cache Creek Flood Risk Management Project, City of Woodland, Yolo County, California

Dear Mr. Stalker,

The U.S. Environmental Protection Agency has reviewed the Notice of Intent to prepare a Supplemental Draft Environmental Impact Statement for the Lower Cache Creek Flood Risk Management Project. Our comments are provided pursuant to the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1508), and our NEPA review authority under Section 309 of the Clean Air Act.

EPA reviewed the DEIS for the Lower Cache Creek Flood Risk Management Project and provided comments to the U.S. Army Corps of Engineers in a letter dated May 29, 2003 (enclosed). We rated the DEIS as Environmental Concerns – Insufficient Information (EC-2). Our comments expressed concerns that an evaluation of system-wide impacts was not conducted on the Sacramento/San Joaquin River Basins to include analysis of project impacts on air quality, water quality, sediment loading, and other direct impacts of future operations. We understand that the non-federal local sponsors of the project, the City of Woodland and the Central Valley Flood Protection Board, decided to pause the feasibility study after assessing public comments and after determining the need for additional technical, environmental, and economic evaluation of project impacts. The DEIS was never finalized and no Record of Decision was prepared.

The Corps, in cooperation with the City of Woodland and the Central Valley Flood Protection Board, is continuing a cost-shared feasibility study on alternative flood risk reduction measures for the City of Woodland, adjacent unincorporated areas and agricultural lands. A reconnaissance study of flooding problems in the west side tributaries, including Putah, Cache Creek, and the Yolo Bypass was conducted in 1993-1994 under the authorization of the Energy and Water Development Appropriations Act of 1993. Recommendations from the reconnaissance study resulted in the pursuit of the present feasibility study. The SDEIS will help inform the Corp's decision, in consultation with the local sponsors, whether to pursue a combination of one or more proposed flood control measures and any associated mitigation.

We have the following comments for your consideration in preparing the SDEIS.

Flood Protection (Executive Order 13690)

On January 30, 2015 President Obama issued Executive Order 13690 – Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input, which amends Executive Order 11988 – Floodplain Management. The SDEIS should adhere to Section 6(c) of Executive Order 13690, which requires that, rather than basing the floodplain on the area subject to a one percent or greater chance of flooding in any given year, the floodplain be established using one of the following approaches:

> *(1) Unless an exception is made under paragraph (2), the floodplain shall be:*
>
> *(i) the elevation and flood hazard area that result from using a climate-informed science approach that uses the best-available, actionable hydrologic and hydraulic data and methods that integrate current and future changes in flooding based on climate science. This approach will also include an emphasis on whether the action is a critical action as one of the factors to be considered when conducting the analysis;*
>
> *(ii) the elevation and flood hazard area that result from using the freeboard value, reached by adding an additional 2 feet to the base flood elevation for non-critical actions and by adding an additional 3 feet to the base flood elevation for critical actions;*
>
> *(iii) the area subject to flooding by the 0.2 percent annual chance flood; or*
>
> *(iv) the elevation and flood hazard area that result from using any other method identified in an update to the Federal Flood Risk Management Standards.*

The SDEIS should identify how alternatives would meet the goals of Executive Order 13690, and discuss any changes to the project necessary to meet the stated goals. For more information go to: https://www.fema.gov/federal-flood-risk-management-standard-ffrms.

We understand that the methods for determining flood risk, appropriate flood protection levels, and management of levee vegetation have been evolving over the years. We recommend the SDEIS provide a detailed description of the current Federal Emergency Management Agency floodplain management and insurance regulations and how they may influence land management decisions in the project area. Furthermore, we recommend the Corps contact FEMA's Region IX Mitigation Division, Map Modernization Unit to ensure that the latest regulation guidelines are integrated into the SDEIS.

Environmental Justice

The Department of Defense is signatory to the August 4, 2011 Memorandum of Understanding (MOU) on Environmental Justice and Executive Order 12898. In keeping with E.O. 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, the SDEIS should describe the measures taken by the Corps to: 1) fully analyze the environmental effects of the proposed Federal action on minority communities, and 2) present opportunities for affected communities to provide input into the NEPA process. The intent and requirements of EO 12898 are clearly illustrated in the President's February 11, 1994 Memorandum for the Heads of all Departments and Agencies.

Loss of Riparian Habitat and Adequacy of Mitigation

We recommend the SDEIS provide a clear and detailed description of proposed avoidance, minimization, and compensatory mitigation measures. Mitigation ratios for specific habitat types should be based upon science and recommendations from the U.S. Fish and Wildlife Service or National Marine Fisheries Service. Furthermore, the same mitigation ratios should be used for all alternatives. The SDEIS should consider direct and cumulative loss of riparian habitat and ensure any proposed mitigation adequately offsets the impacts. Also include direct impacts from future operation and maintenance of existing levees, risks from reasonably foreseeable flooding, and the costs of residual flood risk.

Climate Change

We believe the Council on Environmental Quality's December 2014 revised *draft guidance for Federal agencies' consideration of GHG emissions and climate change impacts in NEPA*[1] outlines a reasonable approach to analyzing climate change issues, and we recommend that the Corps use that draft guidance to help outline the framework for its analysis of these issues. Accordingly, if applicable, we recommend the DEIS include an estimate of the GHG emissions associated with the project, qualitatively describe relevant climate change impacts, and analyze reasonable alternatives and/or practicable mitigation measures to reduce project-related GHG emissions. In addition, we recommend that the NEPA analysis address the appropriateness of considering changes to the design of the proposal to incorporate resilience to foreseeable climate change. The SDEIS and FEIS should make clear whether commitments have been made to ensure implementation of design or other measures to adapt to climate change impacts.

More specifically, we suggest that the "Affected Environment" section of the SDEIS include a summary discussion of climate change and ongoing and reasonably foreseeable climate change impacts relevant to the project, based on U.S. Global Change Research Program[2] assessments, to assist with identification of potential project impacts that may be exacerbated by climate change and to inform consideration of measures to adapt to climate change impacts. Among other things, this will assist in identifying resilience-related changes to the proposal that should be considered.

Species Viability

The SDEIS should describe measures that will be taken to protect critical wildlife habitat from potential adverse effects of the proposed flood control activities. The feasibility of proposed mitigation measures should be fully demonstrated.

Funding and Administration

The SDEIS should provide full disclosure and discussion of funding, implementation, enforcement, and monitoring commitments, assurances, and mechanisms for the flood control proposal. Include a description of the current State/Federal cost-share policies. If this information (e.g., funding agreements) is in the appendices, we recommend it be summarized in the main body of the SDEIS.

We appreciate the opportunity to make additional comments on the preparation of the SDEIS and acknowledge that our previous comments on the DEIS will be also be further considered in support of

---

[1] www.whitehouse.gov/sites/default/files/docs/nepa_revised_draft_ghg_guidance_searchable.pdf
[2] www.globalchange.gov/

this project. Once the SDEIS is released for public review, please send one hard copy and one electronic copy to the address above (specify Mail Code ENF-4-2) at the same time it is officially filed with our Washington, D.C. Office. If you have any questions, please contact me at 415-972-3210 or lopez.phillip@epa.gov.

Sincerely,

Phillip Lopez

Phillip Lopez
Environmental Review Section

Enclosures: DEIS Comment Letter

INLAND HYRDOLOGY AND CLIMATE CHANGE ANALYSIS

APPENDIX K

LOWER CACHE CREEK FEASIBILITY STUDY

Yolo County, CA

December 2019

United States Army Corps of Engineers
Sacramento District

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Executive Summary

Situation

The California Department of Water Resources (DWR) and the US Army Corps of Engineers, Sacramento District (Corps) are involved in a collaborative effort, the Central Valley Hydrology Study (CVHS), to develop flood flow frequency relationships at various analysis points in California's Central Valley. In most cases, these flow-frequency relationships can be defined through analyses that use historical streamflow data. However, for some streams where historical streamflow data are poor or unavailable, rainfall-runoff modeling must be used to characterize flood flow-frequency. These locations and their respective watersheds are listed in Table 1 of *Central Valley Hydrology Study: Ungaged watershed analysis procedures*, dated November 14, 2011. The *Ungaged watershed analysis procedures* document also outlines the analysis approach used to develop frequency curves at these locations. In addition, FloodSafe Yolo, which includes the city of Woodland, has entered into a cost sharing agreement with the U.S Army Corps of Engineers (USACE) to evaluate flood damage reduction alternatives for lower Cache Creek. This is called the Lower Cache Creek Feasibility Study.

This report describes our analysis of the Cache Creek watershed (ungaged watershed 11 of Table 1 from the *Ungaged watershed analysis procedures*).

Task

Wood Rodger's developed the Cache Creek HEC-HMS model and peak unregulated flow frequency curve at the Rumsey gage. The U.S Army Corp of Engineer's Hydrology Section is tasked to review their hydrology model and frequency curve to determine if the work performed could be adopted for the CVHS study and/or the USACE feasibility study. The final product produced for both studies are the regulated annual exceedence probability (AEP) hydrographs for the two analysis points. Changes to the frequency curve and the hydrology model are made providing sufficient reasons and documented in this report. Plate 1 shows a map of the watershed and location of the analysis points.

Action

To develop the required flow frequency curves, the following steps are followed:

1. Review the Wood Rodgers report, unregulated peak flow frequency curve, and HEC-HMS model
2. Derive an independent, unregulated peak flow frequency curve
3. Perform additional analyses to include 1-day and 3-day unregulated flow frequencies curves.
4. Revise the hypothetical storm duration, temporal pattern, and precipitation depth such that the hydrographs produced matches the AEP peak, 1-day, and 3-day frequency curves at Rumsey gage
5. Simulate the design storms
6. Adopt the resulting regulated flow hydrographs and regulated flow frequency curves at analysis points CAC-12 and CAC-14.

Yolo FloodSafe contracted with Wood Rodgers to analyze the flow frequency on Cache Creek in 2009 (Yolo FloodSafe, 2009). Although their procedures did not utilize CVHS procedures, it does use the Rumsey unregulated flow frequency curves to adjust the model, which can produce acceptable hydrographs for CVHS and the USACE Feasibility Study. In this study, adherence to the CVHS procedures is of secondary importance.

After reviewing the Yolo FloodSafe peak flow frequency curve, USACE has concerns with the methodology used to unregulate the peak flows. In addition, large floods in the Central Valley, California tend to be the result of several days of rain. Therefore, to ensure proper peak flows and volume in the hydrographs, the USACE has decided to derive its own peak, 1-day, and 3-day curves.

The task for this study is summarized in Figure 1

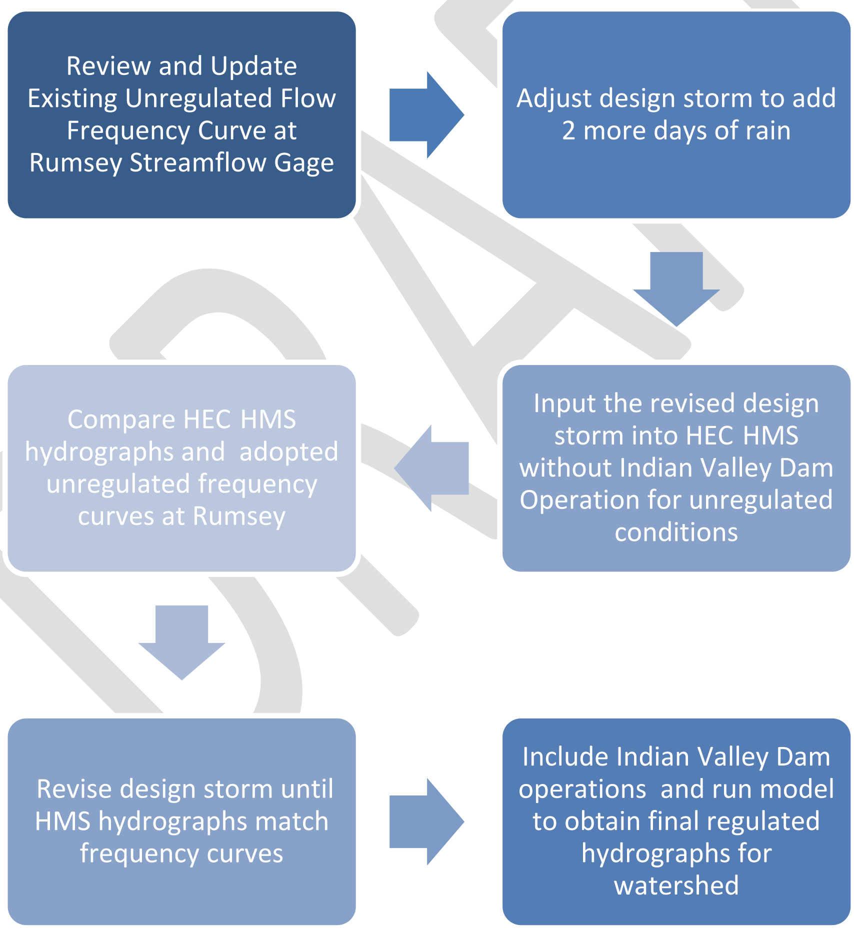

Figure 1 Overview of Method for developing unregulated –regulated flow frequency curves

Results
The USACE unregulated peak flow frequency curve is similar to the Yolo FloodSafe curve for the 10% through 0.2% AEP events at the Rumsey gage, as seen in Plate 2. The adopted unregulated and regulated AEPs at Road 94b are presented in Table 1 and Table 2.

Table 1 Unregulated runoff peak at each analysis point (flow, in cfs)

AEP	**CAC-12 Cache Creek at Road 94B (Drainage Area 1,130 sq mi)**			**CAC-14 Cache Creek near Capay (Drainage Area 1,074 sq mi)**		
	Peak	**1-Day**	**3-Day**	**Peak**	**1-Day**	**3-Day**
0.1	39,700	29,600	21,500	39,700	29,200	21,000
0.02	63,400	46,900	33,700	63,400	46,200	32,800
0.01	74,200	54,800	39,200	74,200	54,000	38,300
0.005	83,000	61,700	45,400	82,600	60,500	44,000
0.002	94,300	70,100	51,500	93,800	68,600	49,900

Table 2 Regulated runoff peak at each analysis point (flow, in cfs)

AEP	**CAC-12 Cache Creek at Road 94B (Drainage Area 1,130 sq mi)**			**CAC-14 Cache Creek near Capay (Drainage Area 1,074 sq mi)**		
	Peak	**1-Day**	**3-Day**	**Peak**	**1-Day**	**3-Day**
0.1	31,500	24,500	18,700	32,100	24,200	18,200
0.02	49,900	38,600	29,200	50,900	38,000	28,400
0.01	58,300	45,000	34,000	59,500	44,300	33,000
0.005	65,400	50,800	39,300	66,300	49,700	38,000
0.002	74,200	57,500	45,000	75,300	56,300	43,400

Study Purpose

The document *Central Valley hydrology study: Ungaged watershed analysis procedures* dated November 14, 2011, describes the procedures to be used for locations in which rainfall-runoff modeling must be used to characterize flood flow-frequency. The watersheds that contain analysis points that fall into this analysis category are listed in Table 1 of the *Ungaged watershed analysis procedures* document. The Cache Creek watershed is one of the identified ungaged watersheds. Thus, the purpose of this study is to review Wood Rodger's HEC-HMS model and peak frequency curve, and compute flood flow-frequency relationships for the Cache Creek watershed at 2 analysis points for floods of various exceedence probabilities and durations. A third analysis point, CAC-0, will have its exceedence probabilities calculated through HEC-RAS since the river section is bounded by levees with a limited channel capacity of 36,000 to 38,000 cfs. The routing is beyond the scope of the current hydrologic analysis.

Watershed Description

Watershed Overview

Cache Creek basin is located approximately 100 miles northeast of San Francisco in the coastal mountain ranges and drains about 1,139 square miles. Clear Lake, the most prominent feature of the basin, is the largest natural body of fresh water within California. Cache Creek originates at the outlet of Clear Lake, which flows generally northeast about 8.5 miles to the confluence with its North Fork, through Capay Valley, south to the irrigation dam at Capay, north past the town of Yolo, and east and south into the Cache Creek settling basin before finally flowing into the Yolo Bypass. The watershed contains many diversion dams and reservoirs of various sizes. Clear Lake Reservoir and Indian Valley Dam contain the two largest bodies of water in the watershed and have a significant influence on the flows on Lower Cache Creek.

The outlet of Clear Lake is the start of Cache Creek and is a narrow, confined channel that meanders approximately five miles before reaching Clear Lake Dam. Clear Lake Dam began storing water in 1915. Even before the dam was built, the outflow from Clear Lake had always been limited to less than 10% of the potential Clear Lake inflow due to a natural "weir-like" structure called the "Griggsby Riffles," seen in Plate 3. During large inflows, the constrained outflow causes the shallow lake to rise rapidly, sometimes resulting in flooding along the rim of the lake.

Clear Lake Dam can release more water than can physically pass over the riffles. The riffles control the volume of water that can reach the dam and consequently, long-duration maximum outflow. The maximum flow passing over the riffles during large floods has been about 5,000 cfs. There is no designated flood control space upstream of Clear Lake Dam, although the limited channel capacity of Griggsby Riffles in combination with the considerable storage capacity of Clear Lake provides significant flood damage reduction benefits to downstream communities.

Indian Valley Dam lies on the North Fork of Cache Creek and is operated by the Yolo County Flood Control and Water Conservation District. The reservoir serves dual purposes for both irrigation supply and flood control. Flood control releases are made in accordance with rules and regulations determined by the U.S. Army Corps of Engineers in the authorized Water Control Manual. The total volume of space set aside for flood control is 40,000 ac-ft. Two major objectives of the reservoir are to a.) Release no more than 10,000 cfs immediately downstream of the dam b.) Maintain a downstream objective flow of no more than 20,000 cfs at the Rumsey gage (combined outflow and downstream local runoff)

Watershed Properties

The general description of the properties of the Cache Creek watershed, such as climate, elevation information, vegetation, land use, and geology, are presented in Table 3

Table 3 Cache Creek Watershed General Properties

Watershed Characteristics	Description
Climate	The climate of the Cache Creek Basin is characterized by cool wet winters and hot dry summers. Temperatures range from slightly below freezing in winters to highs of over 100 degrees Fahrenheit at times during the summer. Normal annual precipitation varies from a minimum of about 17 inches near the community of Yolo, and averages about 32 inches over the watershed. The major portion of the annual rainfall occurs from October through April. Snowfall is very rare and has no significant effect on the streamflow in the basin.
Elevation Range	The topography of the basin varies from steep, rugged hill slopes of the Coast Ranges to the gentle slopes of the valley floor, beginning near Capay, located on the western edge of a large alluvial plain. The elevation ranges from 6,120 feet at Goat Mountain on the northern basin perimeter to nearly sea level near Yolo.
Vegetation	Vegetation in upper Cache Creek consists mainly of deciduous trees and brush, such as blue oaks and chaparral. In middle elevations, riparian forest and valley oaks predominate.
Land Use	Irrigated crops, orchards, and vineyards occupy the lower elevations. Most of the basin is undeveloped. Primary land use includes national forest, recreation, grazing and agriculture. Future development of the watershed is not expected to be significant.
Geology	The geology of the basin consists of the Franciscan formation, which forms the core of much of the Coast Ranges. Rock outcrops of this formation can only be found in the upper part of Cache Creek Basin and consist of marine sedimentary and volcanic rock. To the east of Clear Lake and in the central portion of the basin, rocks are predominantly of

	massive sandstone with imbedded conglomerates and silty shales. Continental deposits in the lower portion of the basin consist of clay, sand, and gravel, and occur as discreet units and heterogeneous mixtures. The younger overlying alluvium is similar and generally not as coarse as the continental deposits. Underground aquifers underlie the valley portion of the basin downstream from Rumsey. The size and extent of these aquifers are not known. Intensive agriculture, and to a lesser degree the seasonal recreation industry, comprise the main economic features of the basin. State Highways 16, 20, 29, 53 and Interstate Highway 5 are the main traffic arteries.

(USACE, 2001)

Table 4 Previous Studies of the Cache Creek Watershed

Cache Creek Basin, California; Standard Project Floods (USACE, May 1974)	The purpose of this report is to present the standard project floods computed for streams at selected index points in Cache Creek Basin. The document describes the criteria and procedures used to develop the standard project flood. Contains subbasin map of Cache Creek
Cache Creek Basin, California: Hydrology Review Report (USACE, March 1985)	This report reviews the results presented in the Cache Creek Basin California, Feasibility Report, dated February 1979. The review includes: an update of historical stream flow data, an evaluation of the January 1983 storm and flood, a check on the storm centering, and an evaluation of the standard project centering based on the January 1983 storm
Hydrology for Cache Creek Yolo County, California; Reconnaissance Study Office Report (USACE, August 1995)	The purpose of this study was to provide hydrographs to support an evaluation of potential flooding and environmental restoration on Cache Creek. Existing hydrologic data and the Cache Creek HEC-1 model is reviewed. 50, 100, 200, and 500 year flood hydrographs were computed for Cache Creek at Rumsey and Capay.
Appendix C Hydrology Appendix for Lower Cache Creek Feasibility Study Yolo County, California (USACE, March 2001)	The purpose of this appendix is to provide a feasibility level analysis of the hydrology for Lower Cache Creek, Yolo County, California. The study reach extends from Cache Creek at Road 94B down to the Cache Creek Settling Basin, where Cache Creek has its confluence with the Yolo Bypass of the Sacramento River, about 17 river miles. Key products of the analysis include: a) a family of regulated frequency curves for Cache Creek at Road 94B, and b) synthetic hydrographs of the 2%-, 1%-, 0.5%-, and 0.2%-chance flows (50-, 100-, 200-, and 500-year) on Cache Creek at Road 94B.
Cache Creek Hydrology Study Review; City of Woodland (DFC, 2007)	This report reviews the USACE storm centering location, which was used in the 2001 Cache Creek feasibility study, and determines whether the location of the centering was appropriate.
Cache Creek Hydrology Update: Flood Safe Yolo Pilot Program (Wood Rodgers, October 2009)	This report was tasked under the floodSAFE YOLO Pilot Program and provides an update to the Cache Creek hydrology.

Development of Flow Frequency Curve

Overview

Wood Rodgers developed an unregulated peak flow frequency curve for the Cache Creek basin at the Rumsey gage, which is used to validate the peak hydrographs produced from the HEC-HMS model. The Yolo FloodSafe report (Yolo FloodSafe, 2009) describes the development of the peak flow frequency curve. However, Wood Rodgers did not develop duration flow frequency curves, which are used to validate computed hydrograph volumes. Flow volumes, such as the 1-day and 3-day, are important to flood analyses since it determines the amount of water that may cause flooding to a city in reaches with extensive, flat floodplain storage areas. For this reason, the U.S Army Corps of Engineers Hydrology Section will update their 2001 unregulated peak, 1-day, and 3-day flow frequency curves to validate the hydrograph peak and volume.

Flow Frequency Development Strategy

Since the 2001 study, an additional 11 years of annual maximum flows are incorporated into the new unregulated flow frequency statistics. The Capay station (USGS, 11452000, 1,044 sq. mi – inactive) located approximately 8 miles downstream of Rumsey, is combined with the Rumsey station (DWR, RUM, 955 sq. mi) to extend the flow record for the peak, 1-day, and 3-day volumes at Rumsey gage. This is done by applying a MOVE1 regression for the overlapping period between the two stations (1961-1971).

Since Indian Valley Dam started operating June of 1974, for flows after 1974 the incremental "change in storage" at Indian Valley Dam (converted to cfs) is added to the observed, regulated annual maximum daily flows. Recorded instantaneous peak flows are not available at Indian Valley Dam, except for the 1997 event. Previous USACE studies, using a calibrated HEC-1 model, estimated peak unregulated flow at Rumsey for the 1983 and 1995 floods (USACE, 2001). The remainder of the peak flows are estimated using the Ordinary Least Squares regression equation (OLS) which is developed to describe the relationship between unregulated 1-day flows (determined by the volume estimate using incremental storage) to unregulated peak flows.

The 2001 study did not incorporate regional skews in the weighting of the adopted skews in the final unregulated flow frequency curves. Additionally, the USGS recently published peak and duration regional skews ((USGS, 2010), (USGS, 2011)), respectively and will be incorporated into the weighting of the skews for this study.

Flow Data Collection

Rumsey, Capay, and Indian Valley Dam data are collected from the U.S Geological Survey (USGS), California Data Exchange Center (CDEC), Water Data Library (WDL), and US. Army Corp of Engineer's data server. Rumsey gage began operating in 1961 and is maintained by the Department of Water Resources (DWR). The Capay gage had been maintained by the USGS from 1943 to 1976; however, the gage is no longer operating. Indian Valley Dam began storing water June 1974 and is operated by the Yolo County Flood Control and Water Conservation District. Daily storage flows are available from 1974 to present.

Regression Equation

The MOVE1 regression equation maintains the variance and mean between the overlapping water years and is appropriate to use when correlating between two gage stations in the same watershed. The Move1 regression equation is as follows:

$$\hat{y}(i) = m(y_1) + \frac{S(y_1)}{S(x_1)} * (x(i) - m(x_1))$$

Where: $\hat{y}(i)$ = short record station
$m(y_1)$ = mean short record
$S(y_1)$ = standard deviation short record
$S(x_1)$ = standard deviation base record
$x(i)$ = base record station
$m(x_1)$ = mean of base station

The Ordinary Least Squared regression equation minimizes the squared errors of the predicted value and is used to estimate the unregulated peak flows from unregulated daily maximum flows. The OLS equation is as follows:

$$\hat{y}(i) = m(y_1) + r * \frac{S(y_1)}{S(x_1)} * (x(i) - m(x_1))$$

Where: r = correlation coefficient

Regional Skew

Bulletin 17B recommends that at-site skews calculated from recorded data be weighted with regional skews (USACE, 2010). The generalized skew (the station skew weighted with the regional skew) is the final skew used for the frequency curve. The variance of prediction, which corresponds to the mean square error (MSE), describes the precision of the generalized skew and is part of the final skew calculation. The following equations calculate the peak and duration regional skews given the average basin elevation of 2,050 ft.:

Peak Regression Equation: $\hat{y} = \beta_0 + \beta_2\{1 - \exp[-\left(\frac{ELEV}{6,500}\right)^2\}$$\hat{y} = \beta_0 + \beta_2\{1 - \exp[-\left(\frac{ELEV}{6,500}\right)^2]$

Where β_0 β_0= -0.62
β_2 β_2= 1.3
ELEV = Average elevation of watershed

Duration Regression Equation: $\hat{y} = \beta_0 + \beta_1[1 - \exp\left\{-\left(\frac{ELEV}{3,600}\right)^{12}\right\}]$

Where β_0 = -0.7346 for 1-Day and -0.6905 for 3-Day durations
$\beta_1$$\beta_1$ = 0.6859 for 1-Day and 0.6822 for 3-Day durations

Table 5 and Table 6 list the peak and duration Variance of prediction (VPnew) for different elevations:

Table 5 Variance of Prediction for Peak Skews

Elevation (ft)	VPnew
0	0.14
1,000	0.14
2,000	**0.14**
3,000	0.13
4,000	0.13
5,000	0.13
6,000	0.14
7,000	0.14
8,000	0.15
9,000	0.16
10,000	0.16
11,000	0.17

*Variance of Prediction (VPnew) for peak skews
* Table is obtained from Peak Regional Skew USGS report (USGS, 2010)
*bolded value is used as MSE

Table 6 Variance of Prediction for Duration Skews

Elevation	1-Day	3-Day
<2,500	**0.058**	**0.059**
3,000	0.055	0.056
3,200	0.052	0.053
3,400	0.047	0.049
3,600	0.043	0.044
3,800	0.04	0.042
4,000	0.039	0.041
>4,500	0.039	0.04

*Variance of Prediction (VPnew) for 1-Day and 3-Day skews
*Table is obtained from Duration Regional Skew USGS report (USGS, 2011)
*Bolded values used as MSE

Flow Frequency Results

The Move1 and OLS regression inputs are listed in Table 7. The statistics are developed from the overlapping period (WY 1961-1973) between Rumsey and Capay gage. WY 1965 peak is removed from the regression calculations since the flow may have been overestimated as stated in the 1985 Hydrology report (USACE, 1985), which notes that the 1965 high flow is possibly due to the "extension of low flow rating table and slope-area measurements" (USACE, 1985). Although the 2001 study incorporates the 1965 flow, due to the uncertainty of this value, the 1965 peak flow is removed from the regression analysis. The final annual maximum flows used to compute the frequency curve statistics are listed in Table 8.

Table 7 MOVE1 and OLS Statistical Values

Statistics	Move1	OLS
r	0.94	0.91
$m(x_1)$	20,461	34,772
$m(y_1)$	24,600	17,449
$S(y_1)$	9,114	19,138
$S(x_1)$	8,545	9,406

*overlapping years from WY 1961-1973, OLS includes 1983, 1995, and 1997
*missing WY 1962, 1963, 1964, 1972
*WY 1965 removed from correlation
*WY 1977 low outlier across durations

Table 8 Unregulated Peak, 1-day, and 3-day Annual Maximum Flows at Rumsey

WATER YEAR	PEAK	1-DAY	3-DAY
1943	**40,106**	**17,388**	**12,819**
1944	**13,443**	**6,386**	**3,733**
1945	**9,390**	**5,020**	**3,828**
1946	**14,936**	**7,319**	**5,966**
1947	**8,217**	**2,653**	**1,511**
1948	**6,510**	**3,488**	**2,188**
1949	**13,059**	**6,926**	**5,083**
1950	**8,441**	**4,195**	**3,411**
1951	**17,922**	**7,957**	**5,125**
1952	**18,989**	**12,181**	**9,103**
1953	**24,855**	**14,048**	**9,570**
1954	**21,655**	**12,771**	**5,759**
1955	**5,156**	**1,886**	**944**
1956	**36,693**	**24,068**	**19,598**
1957	**12,867**	**6,562**	**4,753**
1958	**57,810**	**21,317**	**17,495**
1959	**19,095**	**9,598**	**8,444**
1960	**22,402**	**10,060**	**7,256**
1961	13,200	3,420	2,197
1962	**20,482**	13,000	8,570
1963	**30,827**	**15,030**	**10,775**
1964	**11,000**	**4,725**	**2,382**
1965	**50,238**	**20,433**	**17,110**
1966	23,000	11,600	7,610
1967	30,000	17,800	9,260
1968	23,200	8,970	5,433
1969	20,200	15,600	10,710
1970	43,400	23,600	16,800
1971	18,000	10,200	7,313
1972	**3,787**	677	546
1973	25,800	12,300	9,033
1974	**32,960**	**15,816**	**11,070**
1975	-	-	-
1976	*3,415*	513	375
1977	*2,582*	63	47

WATER YEAR	PEAK	1-DAY	3-DAY
1978	*22,927*	11,051	9,327
1979	*7,877*	2,923	2,483
1980	*31,555*	15,711	13,397
1981	*11,938*	5,116	3,933
1982	*24,586*	11,947	9,309
1983	63,321*	27,088	20,137
1984	*37,682*	19,020	13,328
1985	*8,360*	3,184	1,951
1986	*71,326*	37,191	25,794
1987	*7,455*	2,695	1,990
1988	*14,054*	6,259	3,856
1989	*7,796*	2,879	1,968
1990	*5,618*	1,703	1,288
1991	*13,147*	5,769	3,402
1992	*6,107*	1,967	1,571
1993	*35,588*	17,889	12,013
1994	*7,063*	2,483	1,398
1995	65,820*	-	-
1996	*27,981*	13,781	8,533
1997	56,556	27,645	17,039
1998	*44,727*	22,825	17,801
1999	*18,314*	8,560	5,229
2000	*14,139*	6,305	4,515
2001	*13,128*	5,759	4,433
2002	*18,905*	8,879	-
2003	*28,746*	14,194	-
2004	*39,354*	19,923	-
2005	-	-	-
2006	*61,150*	31,695	17,888
2007	*6,437*	2,145	1,693
2008	*21,207*	10,122	6,941
2009	*9,003*	3,531	2,895
2010	*16,378*	7,514	5,850
2011	*31,151*	15,493	10,958

Bolded values estimated from MOVE1, Italics values estimated from OLS, "" estimated from HEC-1and underlined values unregulated from Indian Valley Dam. WY 1977 low outlier

The peak, 1-day, and 3-day annual maximum flows are input into Statistical Software Program (HEC-SSP) (USACE, 2012) to calculate mean, standard deviation, and station skew. The regional skew and VPnew (Mean Squared Error) values are also entered into SSP. Table 9 list the computed statistics while Table 10 shows the AEP flows for the 0.50 to 0.002. Plate 4 shows the peak, 1-day, and 3-day flow frequency curves.

Table 9 Bulletin 17B Flow Frequency Statistics at Rumsey gage

Statistics	Peak	1-Day	3-Day
Mean	4.243	3.868	3.669
Std Dev	0.327	0.418	0.446
Skew	-0.291	-0.758	-0.699

Table 10 AEP Flows Extracted from Frequency Curves at Rumsey gage

AEP	Peak (cfs)	1-Day (cfs)	3-Day (cfs)
0.5	18,200	8,300	5,300
0.2	33,300	16,800	11,300
0.1	44,800	22,800	15,700
0.05	56,600	28,500	20,100
0.02	72,900	35,400	25,800
0.01	85,800	40,300	29,900
0.005	99,200	44,800	33,800
0.002	118,000	50,300	38,700

Plate 2 compares the USACE peak flow frequency curve with the Wood Rodgers curve, which shows similarity toward the lower frequency events but divergence toward the higher frequency events. The peak frequency curves do not exactly match since the unregulated peak flows are calculated differently. Wood Rodgers added daily annual maximum change in storage flows from Indian Valley Dam to the regulated peak flows recorded at Rumsey gage (Yolo FloodSafe, 2009), while USACE computed unregulated peak flows using the HEC-1 model and the OLS regression equation.

Watershed delineation for Modeling

The watershed and subbasin have been delineated during the development of the HEC-1 model. A subbasin map, found in the Cache Creek Standard Project Flood report (USACE, 1974), does show where the subbasins originated from, but does not describe how the subbasins have been delineated. Efforts have been made by Wood Rodgers, David Ford Consulting (DFC), and USACE to match the subbasin areas. The watershed has been digitally re-created by DFC and can be seen in Figure 2 of the Yolo FloodSafe report (Yolo FloodSafe, 2009).

Required Model Parameters, Transforms, and Routings

The following steps below were performed by Wood Rodgers for the 2009 Study.

Runoff Volume

The initial and constant loss rates have been transferred from the 2004 USACE HEC-1 model

Channel Losses

Wood Rodgers determined Cache Creek "…loses significant water after it reaches the channel along some creek reaches…due to a significant groundwater/surface water interface downstream of Rumsey…mostly coinciding with large gravel deposits and gravel mining operations…" (Yolo FloodSafe, 2009). Wood Rodgers used the WRIME program to evaluate potential channel losses due to infiltration. Flow diversions have been established in the HEC-HMS model to account for the infiltrative losses. More information can be found in the Yolo FloodSafe report (Yolo FloodSafe, 2009).

Transform

The unit hydrographs have been initially copied from the HEC-1 model but have been shown to "…delay[ing] and suppress[ing] the peak flow as well as produce[ing] fatter shaped hydrographs" which do not reflect observed conditions (Yolo FloodSafe, 2009). Wood Rodgers revised the unit hydrograph using the U.S Bureau of Reclamation's Dimensionless Unit Hydrograph, which resulted in a faster runoff response.

Flow Routing

The routing inputs have been transferred over from the 2004 HEC-1 model.

Computation Time Step

The computation time step for the HEC-HMS model is 1 hour

Reservoir Regulation

The regulating affect of Clear Lake Dam during large floods has been modeled in the 2004 HEC-1 with a stage-rating curve for the Griggsby Riffles. The starting elevation used for Clear Lake in the HEC-1 model has been the same elevation that occurred just one day prior to the March 9, 1995 storm (one of the two largest floods of record on Lower Cache Creek since 1941, assuming no regulation from Indian Valley Dam). This starting storage is suitable for simulating large storm events such as the 0.01 AEP since it accounts for the antecedent saturated soil condition typically associated with large storms. The Clear Lake HEC-1 stage-rating curve and starting elevation have been imported into HEC-HMS.

The starting storage at Indian Valley Dam has been set to the bottom of the flood control space (260,000 ac-ft). An elevation-storage discharge curve, imported from the HEC-1, has been used to model operations at Indian Valley Dam; however, the dam is removed from the HEC-HMS model to simulate unregulated flow conditions.

Calibration of Model using Historical Data

Calibration Strategy

Wood Rodgers calibrated the model using the 2006 flood event and validated the model using the 1997 flood event. The Rumsey gage, maintained by the California Department of Water Resources (DWR), provides flow records during the selected storm events and is used to calibrate and check the model. The 2006 flood event, which occurred from December 30th, 2005 to January 1st, produced a peak of 34,876 cfs at Rumsey gage. The peak is the fourth largest recorded flow event within the last 32 years and "considered statistically infrequent[cy] and large enough for use in calibration" (Yolo FloodSafe, 2009). More information on model calibration can be found in the Yolo FloodSafe report and HEC-HMS model.

Hydro-meteorological Data Collection

For the 2006 event, Wood Rodgers obtained radar rainfall data through OneRain (www.onerain.com), while for the 1997 event Wood Rodgers collected surrounding hourly rainfall gages from the California Data Exchange Center (CDEC). A map of the rainfall gages used in the validation can be seen in Figure 15 of the Wood Rodgers report. OneRain provided 32 days of rainfall data from December 7th, 2005 to January 8, 2006 in gridded 2 km x 2 km resolution in 15 minute time steps.

Calibration Simulations

The 2006 calibration storm event has been defined between midnight December 30, 2005 and noon January 1, 2006. The antecedent conditions have been characterized as wet since there has been rainfall recorded days prior to the event (Yolo FloodSafe, 2009). The initial and constant loss values, unit hydrographs, and routing parameters from the HEC-1 model have been used as the initial input into the model. Changes have been made to the input parameters to match observed flows at Rumsey gage during the flood event.

Calibration Results

As stated in the "Transform" section, the HEC-1 unit hydrographs produced hydrographs that delayed and suppressed the observed peak flow. The unit hydrographs have been revised using the U.S Bureau of Reclamation's Dimensionless Unit Hydrograph, which resulted in a faster runoff response. Routing parameters have been "…slightly adjusted to match the timing of the peak flow measured at Rumsey..." (Yolo FloodSafe, 2009). The initial and constant loss rates have been lowered for some of the subbasins to match the observed peak and volume. Table 1 in the Wood Rodgers report compares the initial and constant loss for the HEC-1 model and the calibrated HEC-HMS model. Figure 14 in the Yolo FloodSafe report shows the 2006 calibrated HEC-HMS flow compared to the observed flow (Yolo FloodSafe, 2009).

Wood Rodgers ran the 1997 storm through the 2006 calibrated HEC-HMS model. Results showed that the parameters calibrated for the 2006 storm have been reasonable and no further calibrations have been necessary to the HEC-HMS model (Yolo FloodSafe, 2009).

Development of Design Precipitation

Overview
Wood Rodgers developed a 24-hr, 48-hr, and 96-hr temporal rainfall distribution and calculated AEP rainfall depths using DFC's precipitation depth analysis (Yolo FloodSafe, 2009). Storm pattern, depth calculations, and results can be viewed in the Wood Rodgers report and Cache Creek HEC-HMS model (Yolo FloodSafe, 2009). Depths used in this study are compared to NOAA 14 precipitation frequency depths with applied aerial reduction factor at subbasin 805 and INDVLY for the 0.01 AEP event. The DFC depths at 805 are 1.054 inches, 1.864 inches, 2.269 inches, and 3.890 inches for the 1HR, 3HR, 6HR, 24HR durations, respectively, while NOAA 14 depths at 805 are 0.801 inches, 1.384 inches, 1.980 inches, and 4.309 inches for the 1HR, 3HR, 6HR, and 24HR durations, respectively. DFC depths are greater than NOAA 14 depths by as much as 26% except for the 24 HR depth where NOAA 14 depths were greater by 11%. At higher elevations near Indian Valley Dam, the DFC depths are 1.384 inches, 2.449 inches, 2.982 inches, and 5.111 inches for the 1HR, 3HR, 6HR, and 24HR durations, respectively, while the NOAA 14 depths are 1.007 inches, 1.760 inches, 2.610 inches, and 5.953 inches for the 1HR, 3HR, 6HR, and 24HR durations, respectively. Again, DFC depths are greater than NOAA 14 depths for the 1 to 6 HR durations, but less than the 24HR duration.

The 24-hr storm pattern has been designed using the SCS Type IA storm imbedded in the HEC-HMS software. The 24-hr storm pattern and 0.01 AEP depth produced a hydrograph peak flow that matched well with the 2012 USACE peak and 1-day unregulated flow frequency curve. However, since the design storm lasted only 24 hours, the resulting hydrograph volume fell short of the 3-day frequency curve. To add additional flow volume to the analysis, this study added two days of precipitation at the end of the Wood Rodger's 24-hour storm. The two days of precipitation are patterned after Wood Rodger's 48 hr temporal storm pattern. The temporal pattern and 3-day storm depths are adjusted such that the 3-day hydrograph volumes matched closely to the 3-day unregulated flow frequency curve. For the above effort, Indian Valley Dam operation is removed in HEC-HMS to mimic unregulated watershed conditions. Since Clear Lake Dam operation mimics historic outflows from Clear Lake before the dam had been built, no modifications are done to Clear Lake Dam operations. The constant loss rates for each subbasin are increased by 27.5% such that the 0.01 hydrograph peak matches the 0.01 peak flow frequency curve.

Design Storm Adjustments

As stated above, an additional 48 hours of precipitation is added to Wood Rodger's 24 hour design storm. The additional rain uses the same pattern as the Wood Rodger's 48-hour design storm, but the actual depths are lower. The rising limb of the Wood Rodger's 48-hour hyetograph in the 2009 report, seen in Figure 2, is adjusted iteratively such that the resulting1-day hydrograph volume produced in HEC-HMS stays within 10-15% of the 1-day unregulated flow frequency value, and the resulting 3-day volume has a good match to the 3-day frequency curve value. The final 72-hr design storm combines the 24-hr rainfall pattern with the 48-hr pattern, as seen in Figure 3. The 0.01 and 0.005 AEP 24 hour precipitation depths are calculated using DFC's AEP depth analysis (DFC, 2007), while the 0.01 and 0.005 AEP 72 hour depths are adjusted until the computed hydrograph's 3-day volume matches the 3-day frequency curve; consequently, the storms are no longer the 0.01 and 0.005 AEP 72 hr design storms. The 0.01 AEP 72 hr is adjusted to 89% of the original depth while the 0.005 AEP 72 hr is adjusted to 90% of the original depth. The final 24- hr and 72-hr precipitation depths are presented in Table 11.

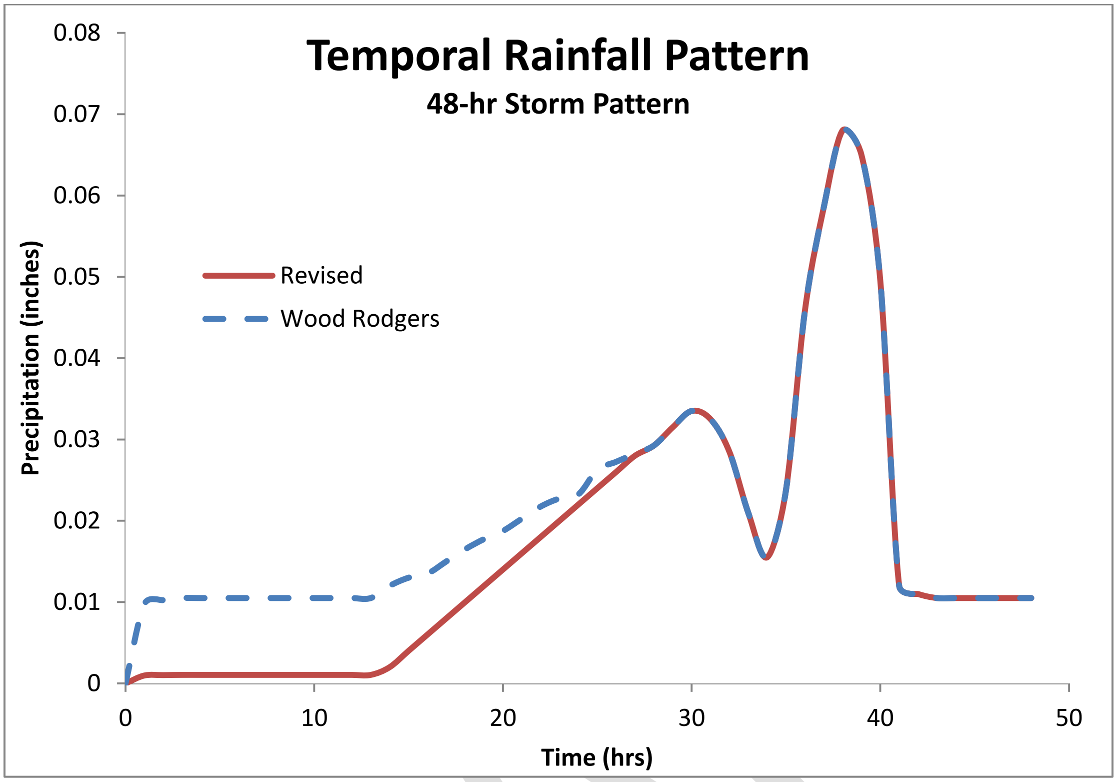

Figure 2: 48-hr Adjusted Rainfall Pattern

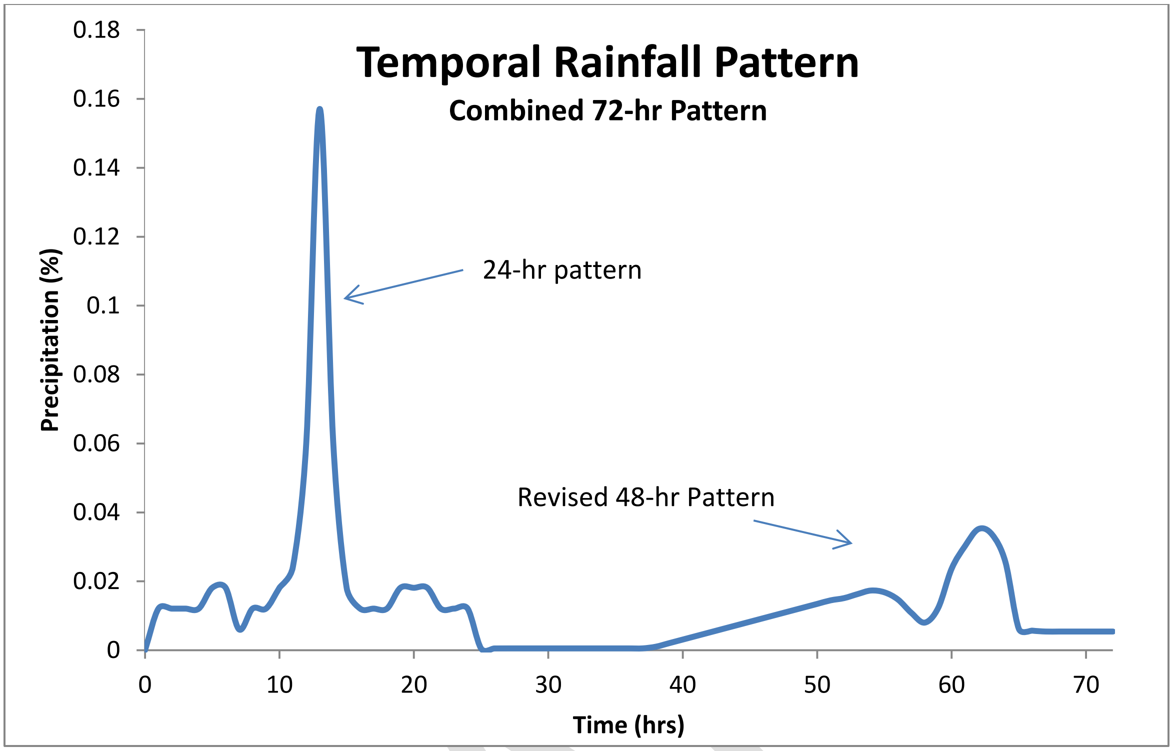

Figure 3: USACE 72-hr Rainfall Pattern

Table 11 24-hr AEP design and modified 72-hr storm precipitation depths

Subbasin	100 yr 24 hr	200 yr 24 hr	89% of 100yr 72 hr	90% of 200yr 72 hr
101	5.789	6.275	9.800	10.850
102	5.720	6.201	9.684	10.721
1041	5.720	6.201	9.684	10.721
1042	5.720	6.201	9.684	10.721
1031	5.720	6.201	9.684	10.721
1032	5.720	6.201	9.684	10.721
1033	5.720	6.201	9.684	10.721
1034	5.720	6.201	9.684	10.721
1052	5.720	6.201	9.684	10.721
1051	5.720	6.201	9.684	10.721
106	5.720	6.201	9.684	10.721
107	5.720	6.201	9.684	10.721
108	5.720	6.201	9.684	10.721
109	5.720	6.201	9.684	10.721
100	5.720	6.201	9.684	10.721
201	6.466	7.009	10.947	12.120
202	5.720	6.201	9.684	10.721
203	5.720	6.201	9.684	10.721
200	5.720	6.201	9.684	10.721
CLEAR	4.758	5.158	8.055	8.918
4012	4.942	5.357	8.366	9.263
403	4.942	5.357	8.366	9.263
4567	4.942	5.357	8.366	9.263
501	5.248	5.689	8.884	9.836
502	5.248	5.689	8.884	9.836

500	5.248	5.689	8.884	9.836
301	7.119	7.717	12.052	13.343
302	5.248	5.689	8.884	9.836
303	5.248	5.689	8.884	9.836
300	5.248	5.689	8.884	9.836
304	5.248	5.689	8.884	9.836
305	5.248	5.689	8.884	9.836
306	5.248	5.689	8.884	9.836
4890	5.649	6.123	9.563	10.588
4110	5.649	6.123	9.563	10.588
4234	5.649	6.123	9.563	10.588
701	5.649	6.123	9.563	10.588
702	5.427	5.883	9.188	10.173
700	4.658	5.050	7.886	8.731
800	5.324	5.772	9.014	9.980
801	5.063	5.488	8.571	9.490
804	4.052	4.392	6.860	7.595
805	4.874	5.284	8.252	9.136
806	3.610	3.913	6.111	6.766
807	3.687	3.997	6.242	6.911
808	3.077	3.336	5.210	5.768

Results

Hypothetical model results are often inconsistent with actual stream gage results for common events. Possible reasons for inconsistencies include 1) the starting storage assumptions at reservoirs can vary 2) the model strictly follows flood control reservoir operation rules while operators may deviate from operation rules during easily controlled events 3) possible agricultural diversions to water crops. To produce a more realistic 0.5 through 0.05 AEP (2-yr through 20-yr) events, a graphical regulated frequency curve is produced from historic data (post-Indian Valley Dam construction) at the Cache Creek at Yolo gage, shown in Plate 5. For events more rare than a 0.05 AEP (20-yr), the HEC-HMS model results are adjusted to provide a good match with the Cache Creek at Rumsey gage unregulated peak, 1-day and 3-day curve quantiles.

Overall, the AEP computed hydrographs match well with the duration frequency curve flows at Rumsey. Table 12 compares the computed HEC-HMS flows with extracted AEP frequency flows. Additionally, Table 13 compares the regulated HMS model computed flows at the outlet of Cache Creek with the graphical frequency curve at Yolo gage. The 1-day maximum flows from the hydrologic model are expected to be slightly higher than the maximum 1-day flows in the unregulated frequency curve since the flows from the hydrologic model is a 24-hr maximum flow. The flows used to compute the 1-day frequency curve are obtained from gages that measure flow from 12AM to 12AM, which can effectively cut off some portion of the maximum 24 hours of a hydrograph.

The computed 0.01 event hydrographs are scaled by 0.15, 0.36, 0.52, 0.58, and 0.85 in HEC-HMS to get the 0.5, 0.2, 0.1, 0.05, and 0.02 AEP hydrographs, respectively, while the 0.005 hydrographs are scaled by 1.14 to get the 0.002 hydrographs. Scaling the 0.005 AEP hydrographs to produce a 0.002 AEP hydrographs resulted in a better match to the peak, 1-day, and 3-day volumes of the Rumsey gage frequency curve when compared to scaling the .01 AEP event. The less common event ratios (0.02, 0.01, 0.005, and 0.002) are adjusted to match the unregulated frequency curve at Rumsey while the more common event ratios (0.5, 0.2, 0.1, and 0.05) are adjusted to match the regulated frequency curve at the Yolo gage. The Cache Creek at Yolo gage reflects actual regulated flow values, which is of interest to this study; therefore, the hydrographs for the more common events are calibrated to the regulated Yolo curve. However, the limited channel capacity leading to the Yolo gage confines the calibration to just the common events. The less frequent events are calibrated to the unregulated Rumsey gage since the channel contains flows greater than 38,000 cfs and statistics can be calculated to determine the 0.005, and 0.002 AEPs. Although the peak 0.005 and 0.002 AEPs do not exactly match the peak flow frequency curve, the computed volumes are within reason to the duration curves. More confidence is given to the duration curves than the peak flow frequency curve for such rare frequencies.

Table 12 AEP flows extracted from the unregulated Rumsey frequency curves and simulated hydrographs

AEP	Duration	Frequency Curve	HEC-HMS Hydrograph	% Difference
0.50	**Peak**	**18,200**	**14,915**	**-18%**
	1-Day	**8,300**	**9,068**	**9%**
	3-Day	**5,300**	**6,420**	**21%**
0.20	**Peak**	**33,300**	**32,411**	**-3%**
	1-Day	**16,800**	**18,395**	**9%**
	3-Day	**11,300**	**12,129**	**7%**
0.10	**Peak**	**44,800**	**45,742**	**2%**
	1-Day	**22,800**	**25,510**	**12%**
	3-Day	**15,700**	**16,508**	**5%**
0.05	**Peak**	**56,600**	**50,741**	**-10%**
	1-Day	**28,500**	**28,180**	**-1%**
	3-Day	**20,100**	**18,151**	**-10%**
0.02	Peak	72,900	73,240	0%
	1-Day	35,400	40,201	14%
	3-Day	25,800	25,574	-1%

0.01	Peak	85,800	85,748	0%
	1-Day	40,300	46,881	16%
	3-Day	29,900	29,721	-1%
0.005	Peak	99,200	93,891	-5%
	1-Day	44,800	51,595	15%
	3-Day	33,800	33,452	-1%
0.002	Peak	118,000	106,709	-10%
	1-Day	50,300	58,500	16%
	3-Day	38,700	37,854	-2%

*0.50 through 0.05 chance events shown in bold font were adjusted to match regulated frequency curve at Yolo gage as shown in Table 13.

Table 13 regulated Yolo gage at Woodland peak flow frequency curve and simulated hydrograph

Regulated AEP	Duration	Frequency Curve	HEC-HMS Hydrograph	% Difference
0.50	Peak	9,900	10,700	8%
0.20		22,000	22,400	2%
0.10		30,000	31,200	4%
0.05		34,000	34,600	2%

Lower Cache Cr Residual Floodplain Analysis:

Because high stages and flows in the lower Cache Creek watershed can be the result of high flow on any of the three major tributaries, Cache Creek, Colusa Drain or the Yolo Bypass, thus a coincident flow and residual floodplain analysis of the Lower Cache Cr Watershed is performed. A detailed description and results of this analysis is found in Attachment 1: Hydrographs for Residual Floodplain Mapping.

2001 USACE Feasibility Study

Table 14 compares the AEP flows computed in the 2001 Feasibility with the flows computed in the 2012 update. Table 15 shows the percent difference in flow.

Table 14 AEP Simulated Regulated Flow Comparisons between previous study to current study at Road 94b

AEP (1)	Peak flow (cfs)(2)		24-hour flow (cfs)(3)		72-hr flow (cfs)(4)	
	USACE 2001	USACE 2012	USACE 2001	USACE 2012	USACE 2001	USACE 2012
0.02	53,000	49,900	43,500	38,600	29,500	29,200

0.01	63,000	58,300	54,500	45,000	36,500	34,000
0.005	70,000	65,400	62,000	50,800	41,500	39,300
0.002	78,500	74,200	72,500	57,500	48,000	45,000

*USACE 2001 statistics obtained from 2001 Feasibility report

Table 15 AEP Regulated Percent Flow Difference

AEP (1)	Difference (%)(2)		
	Peak	24-hour	72-hour
0.02	-6%	-11%	-1%
0.01	-7%	-17%	-7%
0.005	-7%	-18%	-5%
0.002	-5%	-21%	-6%

*Difference = (current study – 2001 study)/2001 study x 100

For the peak and 3-day, the difference in flows are no greater than 10%, while the 24-hr differences range from 12% to 22%. The large differences in the 1-day AEP flows are a result of the changes made to the 1-day flow frequency curve, which incorporates the regional skew. Results show a more negative skew value reducing the flow towards the upper end of the curve. Table 16 compares the 2001 and 2012 frequency statistics. The 2001 unregulated flow frequency curve can be seen in the 2001 Cache Creek Feasibility report on Chart 12 (USACE, 2001).

Table 16 Bulletin 17B Frequency Statistics at Rumsey gage

	Mean		Standard Deviation		Skew	
Duration	2001	2012	2001	2012	2001	2012
Peak	4.233	4.243	0.355	0.327	-0.6	-0.291
1-day	3.895	3.868	0.426	0.418	-0.6	-0.758
3-day	3.741	3.669	0.410	0.446	-0.6	-0.699

*2001 period of record WY 1943-2000
*2012 period of record WY 1943-2012

Possible Impacts of Climate Change on Floods and Droughts

Projections of observed and climate altered hydrology indicate that future conditions will likely be warmer and possibly wetter in the Sacramento River Watershed of which Cache Creek is a major tributary. This means that the area could be subject to larger flood events because of the increase in moisture content of the storms impacting the region. Additionally, droughts could be more severe and longer lasting and this could lead increase frequency of large wildfires in the watershed thereby causing additional increases in runoff from burn scars. More detailed information is presented in the Climate Change Assessment in Attachment 2.

Adoption of Regulated Flow Frequency Curves

After matching the AEP hydrographs to the updated unregulated flow frequency curves at Rumsey, Indian Valley Dam is placed back in operation in the HEC-HMS model and the hydrographs are routed downstream to the selected analysis points to obtain AEP regulated flows. The AEP regulated flows computed at those points are adopted as the flow frequency curves for Central Valley Hydrology Study. The flows at those locations will be further routed downstream through an HEC-RAS model to estimate the AEP flows at the outlet to the Yolo Bypass. The unregulated-regulated flow frequency curves for the 2 analysis points are presented in Table 1 and Table 2 in the Executive Summary for this report.

Equivalent Record Length for Risk Analysis

EM 1110-2-1619 Table 4-5 (in Table 17 below) provides guidance for equivalent record lengths to be used in FDA (Flood Damage Analysis). Equivalent record length provides information needed to create confidence limits to the flow frequency curves. The flow frequency curves with confidence limits are sampled in Monte Carlo simulations in FDA along with stage and damage relationships. The equivalent record lengths for the main index points in the current study are shown in Table 18. A map of the index point location is provided in the Economic Appendix to the Lower Cache Creek Feasibility Study Report. The Cache Creek at Rumsey Frequency unregulated flow frequency curve was computed from 67 years of record. The runoff below the Rumsey gage does not typically add much flow to the peak in the lower watershed. As such, the equivalent record length is assigned as 67 years. The Yolo Bypass downstream of Putah Creek and the Colusa Basin at KRC-7 are assigned equivalent record lengths of 102 years and 25 years, respectively based on Table 4-5 below.

Table 17 Equivalent Record Length Guidelines from EM 1110-2-1619 table 4-5.

Table 4-5
Equivalent Record Length Guidelines

Method of Frequency Function Estimation	Equivalent Record Length[1]
Analytical distribution fitted with long-period gauged record available at site	Systematic record length
Estimated from analytical distribution fitted for long-period gauge on the same stream, with upstream drainage area within 20% of that of point of interest	90% to 100% of record length of gauged location
Estimated from analytical distribution fitted for long-period gauge within same watershed	50% to 90% of record length
Estimated with regional discharge-probability function parameters	Average length of record used in regional study
Estimated with rainfall-runoff-routing model calibrated to several events recorded at short-interval event gauge in watershed	20 to 30 years
Estimated with rainfall-runoff-routing model with regional model parameters (no rainfall-runoff-routing model calibration)	10 to 30 years
Estimated with rainfall-runoff-routing model with handbook or textbook model parameters	10 to 15 years

[1] Based on judgment to account for the quality of any data used in the analysis, for the degree of confidence in models, and for previous experience with similar studies.

Table 18 Index points and Equivalent Record Lengths used in the FDA Models.

Index Point	Analysis Location	Equivalent Record Length
P1	Cache Cr at Rumsey	67
P2	Cache Cr at Rumsey	67
P3	Cache Cr at Rumsey	67
P4	Cache Cr at Rumsey	67
P5	Cache Cr at Rumsey	67
P6	Yolo Bypass downstream of Putah Cr	102
P7	Colusa Basin Drain at point KRC-7	25
P8	Cache Cr at Rumsey	67

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Attachment 1: Hydrographs for Residual Floodplain Analysis.

Memorandum for Record

Date: April 3, 2014

Study: Lower Cache Creek Feasibility Study (LCCFS)

Subject: Hydrographs for residual floodplain mapping

This memo documents the development of upstream boundary hydrographs to support hydraulic modeling of residual floodplains. The hydrographs were developed with the goal of being sufficient to support the study needs while adopting an analysis level of detail consistent with the Corps 3x3x3 framework.

Based on coordination with the Hydraulic Analysis section, hydrographs were needed for the following 3 reaches: Cache Creek, Colusa Drain, and Yolo Bypass. At each location, hydrographs were needed to support development of residual floodplains corresponding to the following annual chance exceedence (ACE) values: 1/2, 1/5, 1/10, 1/20, 1/50, 1/100, 1/200, and 1/500.

High stages in the study area can result from high flow on a tributary, Cache Creek or Colusa Drain, or from a high flow in the Yolo Bypass. The level of effort that would be required to 1) develop relations of coincidence between the bypass and tributaries, and 2) generate composite residual floodplains representing these flow combinations, was considered unnecessary to satisfy the level of detail needed to adequately define the residual floodplains. Therefore, a simplification was made in developing the boundary hydrographs: the peak regulated flows occurring on each of the 3 reaches would have the same ACE. In other words, to support development of the 1/100 residual floodplain, an event having 1/100 peak flow on each of the boundary reaches would be developed.

Hydrographs developed as part of the Central Valley Hydrology Study (CVHS) served as a starting point for developing LCCFS residual floodplain hydrographs. The CVHS had available system-wide simulations of 4 storm patterns, for a wide range of scale factors applied to each event. The scaled events were routed through ResSim in the upper reaches and HEC-RAS in the lower (main stem) portions of the system. At the time, only the ULOP/ULDC levee condition had been simulated. This condition consists of urban levees which do not fail and do not overtop, and non-urban levees which have been restored to design height and overtop without failure.

The general steps for developing LCCFS hydrographs for residual floodplain analysis consisted of:

1. Select one CVHS storm pattern for definition of hydrograph shape at all 3 reaches. The December 1964 event pattern was selected as it provided a simple single-wave shape in both the Yolo Bypass and tributaries (Cache Creek & Colusa Drain).
2. Identify target quantile flows in each reach based on flow-frequency curves obtained from previous or in-process studies.
3. For each location and each target ACE, select CVHS scale factor event hydrograph having peak flow nearest to the target flow.
4. If necessary, further scale the selected hydrographs to provide an improved match to the target (quantile) ACE peak flows.

Details on how these 4 steps were implemented at each for each of the 3 reaches are described below. Flow-frequency curves, which are used here to define the ACE flows on each reach, were developed prior to this effort. The source of each flow-frequency curve is noted.

Location: Cache Creek at Yolo
Source hydrograph: HEC-ResSim hydrographs for 1964 event pattern from CVHS.
Frequency curve: From CVHS rainfall-runoff analysis of Cache Creek, location CAC-12 (Road 9Bb).

Table 1 – Cache Creek at Yolo peak flow summary

1/ACE	Peak flow frequency curve (cfs)	CVHS 1964 event scale factor	Further scaling for LCCFS	Boundary hydrograph peak flow (cfs)
2	9,900[1]	0.60	1.00	10,085
5	22,000[1]	1.30	1.00	19,055
10	31,500[2]	2.40	1.00	30,802
20	35,300[1]	2.60	1.00	38,205
50	49,900[2]	3.40	1.00	49,463
100	58,300[2]	3.40	1.20	59,357
200	65,400[2]	3.40	1.34	66,282
500	74,200[2]	3.40	1.52	75,186

1) Peak flow frequency curve for Yolo gage (Table 13 of 2014 Cache Creek report).
2) Peak flow frequency curve for Cache Creek at Road 94B (Table 2 of 2014 Cache Creek report).

Location: Knights Landing Ridge Cut Slough (upstream end)

Source hydrograph: CVHS local flow hydrographs for 1964 event pattern from CVHS.

Frequency curve: From draft CVHS rainfall-runoff analysis of Colusa Basin, location KRC-7

Table 2 – Knights Landing Ridge Cut Slough peak flow summary

1/ACE	Peak flow frequency curve (cfs)	CVHS 1964 event scale factor	Further scaling for LCCFS	Boundary hydrograph peak flow (cfs)
2	14,246	0.40	0.66	14,174
5	20,041	0.40	1.00	21,476
10	24,827	0.40	1.16	24,912
20	30,213	0.60	0.89	28,670
50	33,804	0.60	1.00	32,214
100	37,541	0.60	1.17	37,690
200	41,262	0.80	1.00	42,951
500	46,135	0.85	1.00	45,636

Location: Yolo Bypass – downstream of Fremont Weir

Source hydrograph: HEC-RAS ULOP hydrographs (STA 56.76) for 1964 event pattern.

Frequency curve (1/ACE = 2 through 50): from draft graphical curve at Yolo Bypass near Woodland.

Frequency curve (1/ACE = 100 through 500): CVHS regulated frequency curve for Yolo Bypass at Putah Creek (PUC-0, HEC-RAS STA 38.522).

Table 3 – Yolo Bypass downstream of Fremont Weir peak flow summary

1/ACE	Peak flow frequency curve (cfs)	Hydrograph peak flow at frequency curve location (cfs)	CVHS 1964 event scale factor	Further scaling for LCCFS	Boundary hydrograph peak flow (cfs)
2	33,266	30,990	0.20	0.789	30,990
5	165,959	156,458	0.40	1.185	156,458
10	228,034	213,682	0.60	1.127	213,682
20	239,883	223,840	0.80	0.870	223,840
50	357,273	332,424	1.00	1.000	332,424
100	532,467	576,423	1.45	1.000	429,231
200	594,769	667,369	1.65	1.000	479,382
500	762,183	753,270	1.80	1.000	534,785

Location: Sacramento Bypass (downstream end)
These hydrographs were scaled to be consistent (same scaling) with hydrographs developed for Yolo Bypass downstream of Fremont Weir. In so doing, a consistent total flow at Yolo Bypass at Putah Creek is preserved. Including this hydrograph is advised if the hydraulic model extends to this location.

Table 4 – Sacramento Bypass peak flow summary

1/ACE	Peak flow frequency curve (cfs)	CVHS 1964 event scale factor	Further scaling for LCCFS	Boundary hydrograph peak flow (cfs)
2	n/a	0.20	0.789	228
5	n/a	0.40	1.185	44,897
10	n/a	0.60	1.127	65,561
20	n/a	0.80	0.870	72,849
50	n/a	1.00	1.000	100,477
100	n/a	1.45	1.000	123,453
200	n/a	1.65	1.000	162,553
500	n/a	1.80	1.000	193,675

Boundary hydrographs to support mapping of LCCFS residual floodplains were provided in HEC-DSS file “Lower Cache resid flood flows 12-19-2013 update.dss”.

Brad Moore, PE

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Attachment 2: Climate Change Impact Assessment.

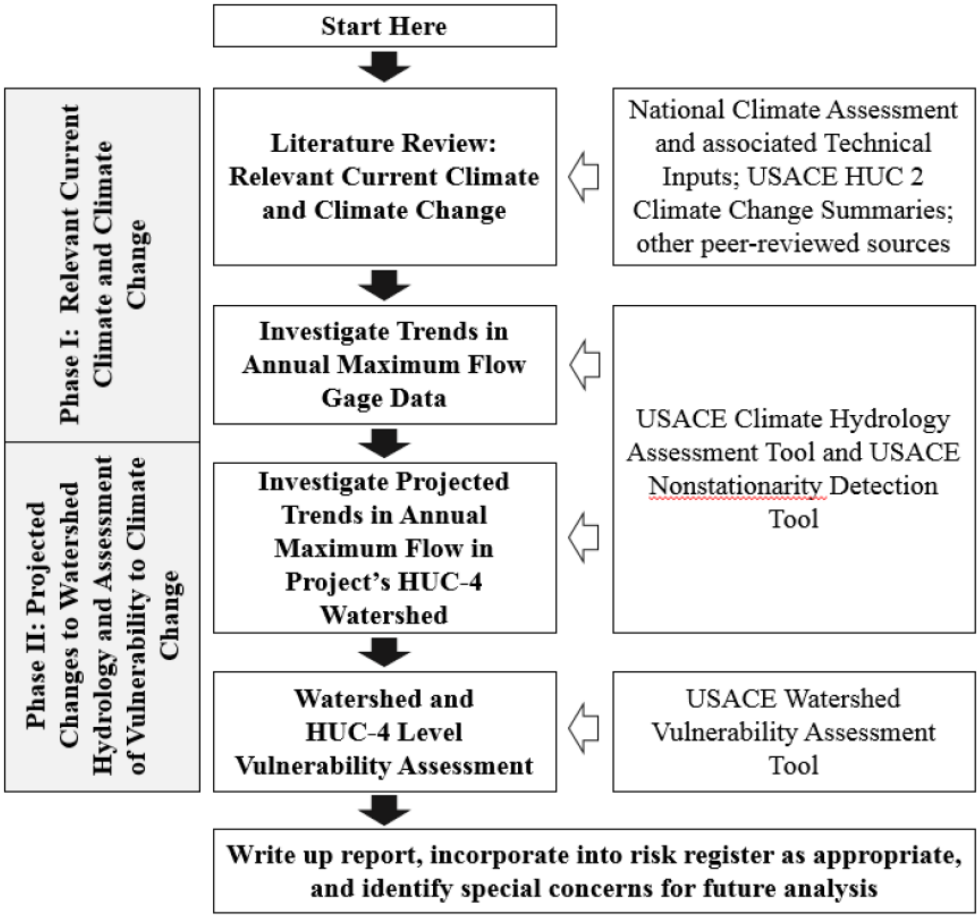
Climate Change Impacts

Overview:

Introduction: ECB No. 2016-252018-14 requires Corps planning studies to provide a qualitative description of climate change impacts to inland hydrology. The objective of ECB 2016-25 is to enhance USACE climate preparedness and resilience and reduce vulnerabilities by incorporating relevant information about climate change impacts in hydrologic analyses for new and existing USACE projects. The purpose of this section is to meet the requirements as set forth in the ECB. This includes applying the qualitative analysis guidance to inland hydrology of the Sacramento River Valley including the Cache Creek Watershed, and facilitating the incorporation of climate change impacts on hydrologic analyses in plans and designs for the Lower Cache Creek Flood Control Project (See Figure 1). Up to the present time, USACE projects and operations have generally proven to be robust in the face of natural climate variability over their operating life spans. However recent scientific evidence shows, that in some geographic locations and for some impacts relevant to USACE operations, climate change is shifting the climatological baseline about which natural climate variability occurs and the range of the variability may be changing as well (USACE 2015, USGCRP 2014). Climate change information for hydrologic analyses includes direct changes to hydrology through changes in temperature, precipitation, evaporation rates, and other climate variables, as well as dependent basin responses to climate drivers, such as sedimentation loadings.

Two phases are required to conduct the qualitative analysis required by the ECB (Figure 1). The analysis includes consideration of both past (observed) changes as well as potential future (projected) changes to relevant hydrologic inputs. The qualitative approach on its own will not produce binding numerical outputs or alter the numerical results of the calculations made for other, non-climate aspects of the required hydrologic analyses. However, the qualitative analysis can inform the decision process related to future without project conditions, formulation and evaluation of the performance of alternative plans, and other decisions related to project planning, engineering, operation, and maintenance. Some examples of how a qualitative assessment may affect a project design include considering whether the project could be modified in the future, whether a strategy should be considered to accommodate projected future conditions, or whether one project alternative can be judged to reduce vulnerabilities or enhance resilience more than the others.

At the time of this study, the methods for incorporating climate change into the planning process are still developing. Additional guidance documents will be published in the future to support quantitative analyses of climate threats and impacts, including the detection of trends, attribution of these trends to climate change, and projections of future trends.


Start Here
Phase I: Relevant Current Climate and Climate Change
Literature Review: Relevant Current Climate and Climate Change
National Climate Assessment and associated Technical Inputs; USACE HUC 2 Climate Change Summaries; other peer-reviewed sources
Investigate Trends in Annual Maximum Flow Gage Data
USACE Climate Hydrology Assessment Tool and USACE Nonstationarity Detection Tool
Phase II: Projected Changes to Watershed Hydrology and Assessment of Vulnerability to Climate Change
Investigate Projected Trends in Annual Maximum Flow in Project's HUC-4 Watershed
Watershed and HUC-4 Level Vulnerability Assessment
USACE Watershed Vulnerability Assessment Tool
Write up report, incorporate into risk register as appropriate, and identify special concerns for future analysis

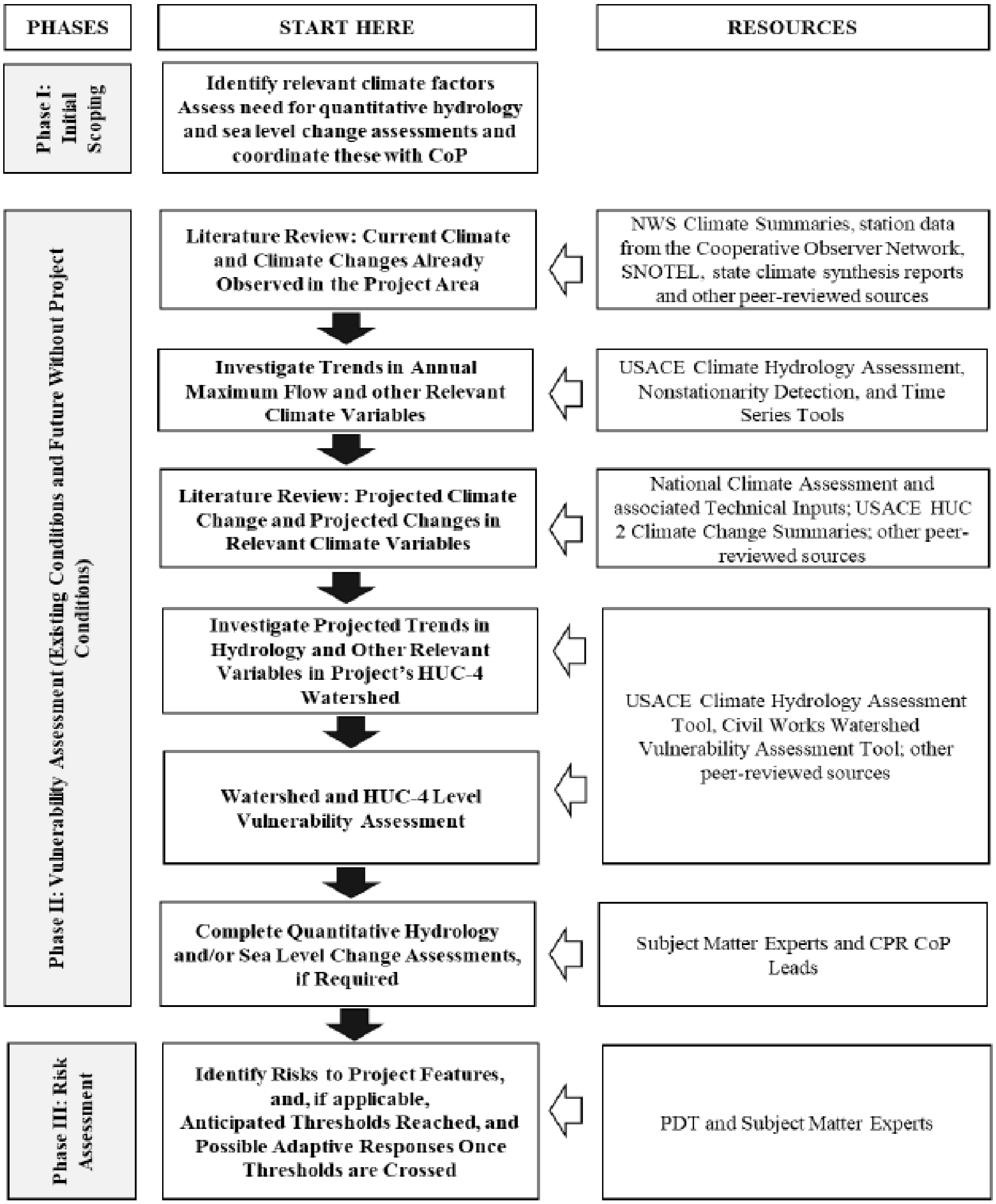


Figure 23. Flow Chart describing the qualitative climate change assessment to be used in Hydrology studies for Corps projects. From ECB 2016-252018-14, Attachment B

Project Description:

The area addressed in this report includes the entire Cache Creek watershed from the eastern foothills of the Coast Range Mountains to the western levees of the Yolo Bypass. (See Figure 2.) The area includes parts of Yolo, Colusa, and Lake Counties. The focus of the report is flood damage reduction opportunities specific to the problem/study area, the city of Woodland, and areas north and east of Woodland. The purpose of this study is to identify economically feasible and environmentally sensitive methods to reduce flood-related damages to Woodland and adjacent areas. Without a flood damage reduction project, average annual flood damages to real property from overflows from Cache Creek are expected to be about $12.4 million, most of which would be in Woodland. Other adverse effects and losses would include the potential for flood-related loss of life, contamination from sanitary sewage and hazardous materials, and the extended closure of the section of Interstate 5 (I-5) east of Woodland.

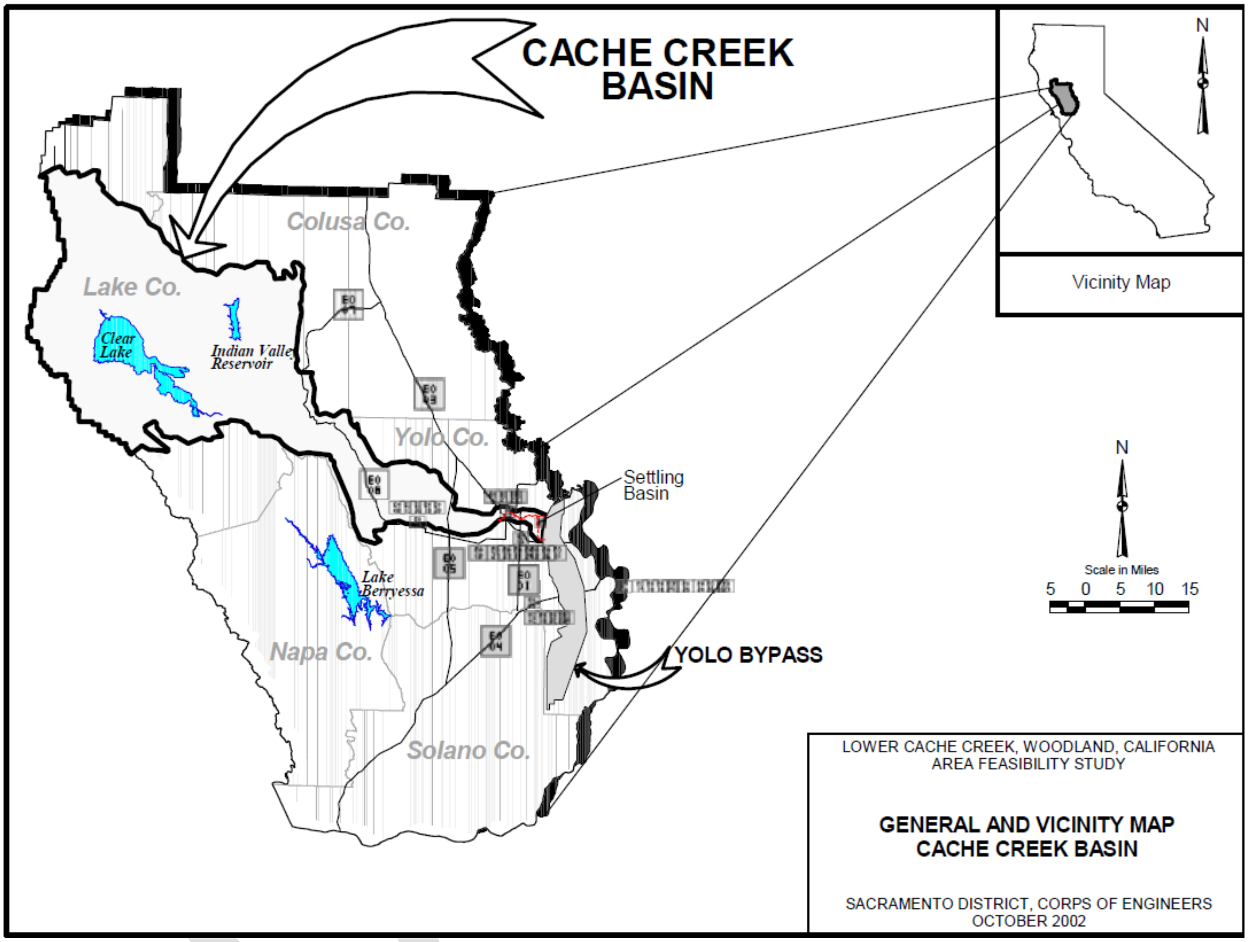


Figure 45. Map of the Study Area showing major reservoirs and watersheds (from USACE 2003).

Literature Synthesis:

Recent surface observations of temperature and precipitation in the southwest United States including the Central Valley of California indicate a significant warming trend starting about 1970 (NOAA, 2013, Goodrich, 2007). This recent warming trend is especially noticeable in the minimum temperatures during the interval from 1990 to about 2005. This warming is in addition to more general warming trends from about 1890 to the present. The reasons cited among scientists include natural multi-decadal oscillations, increased greenhouse gases in the atmosphere, land use changes, and urban heat island effects (NOAA, 2013; Levi, 2008; Barnett et al. 2008; Das et al., 2011). Current reported temperature trends and future climate projections indicate warmer winter temperatures and some changes in precipitation in the Central Valley, and this leads to an increased risk of flooding from large storms (CH2M Hill 2014, NOAA 2013).

Projected changes in future climate contain significant uncertainties related to our understanding and modeling of the earth's systems, as well as our ability to forecast future development and greenhouse gas emission pathways. There are also a great deal of uncertainties associated with simulating changes at a local scale and at a time-step relevant to hydrologic analysis (USACE 2015, USGRP 2014).

USACE Climate Preparedness and Resilience Community of Practice Literature Review:

A 2015 USACE climate literature report synthesizes literature for HUC-2 Region 18 (California Region; **Error! Reference source not found.**), focusing on the identification and detection of climate trends (USACE 2015). The approach at USACE is to consider the questions in need of climate change information at the geospatial scale where the driving climate models retain the climate change signal. As of 2015, USACE judged that the regional, sub-continental climate signals projected by the driving climate models were coherent and useful at the scale of the 2-digit HUC and that confidence in the driving climate model outputs declines below the level of a reasonable trade-off between precision and accuracy for areas smaller than the watershed scale of the 4-digit HUC.

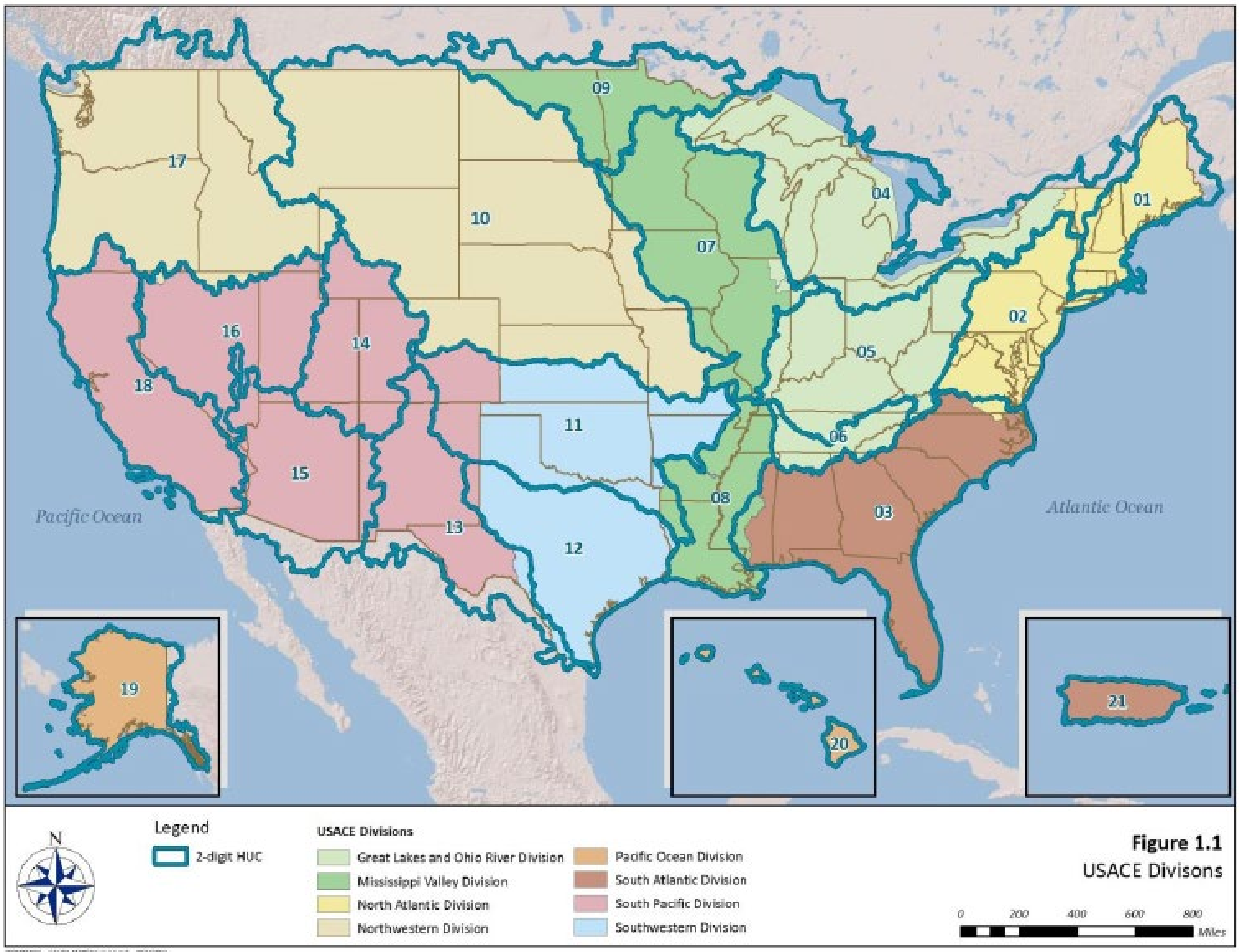


Figure 3: HUC-2 Region for USACE Literature Synthesis (USACE 2015)

Key findings of the USACE literature review are listed below. Figure 4 summarizes the key variables identified in the report and variables for which consensus exists about current or projected trends.

- In general, there appears to be an increasing trend in both minimum and maximum historical temperatures in the California Region with relatively strong consensus in the literature.
- Strong consensus exists in the literature that projected mean, minimum, maximum, and extreme temperatures in the study region show an increasing trend over the next century.
- No consistent trend has been identified in the region's historical precipitation data, with little consensus across the literature.
- Large variability exists, spatially, and across model projections, for future precipitation trends within the California Region. There is little consensus across the literature as to how precipitation trends will change, although many studies recognize this variability.
- Despite the low consensus in precipitation trends, extreme precipitation events are projected to increase in intensity.
- Literature on observed streamflow trends in the California Region have very low consensus. The majority of studies suggest that no statistically significant trends have been identified in the

region's streamflow data for the latter half of the 20th century, although advances in the timing of spring runoff and reductions in April 1 SWE were observed.

The USACE literature synthesis also summarizes potential climate impacts by line of business. For the ecosystem restoration line of business in the California Region, the report lists the following impacts:

- Increased ambient air temperatures and heat wave days will result in increased water temperatures. This may lead to water quality concerns, particularly for the dissolved oxygen levels, which are an important water quality parameter for aquatic life. Increased air temperatures are associated with the growth of nuisance algal blooms and influence wildlife and supporting food supplies.
- Increased storm intensities and frequencies may pose complications to planning for ecosystem needs and lead to variation in flows. This may be particularly true during dry years, when water demands for conflicting uses may outweigh water supply.

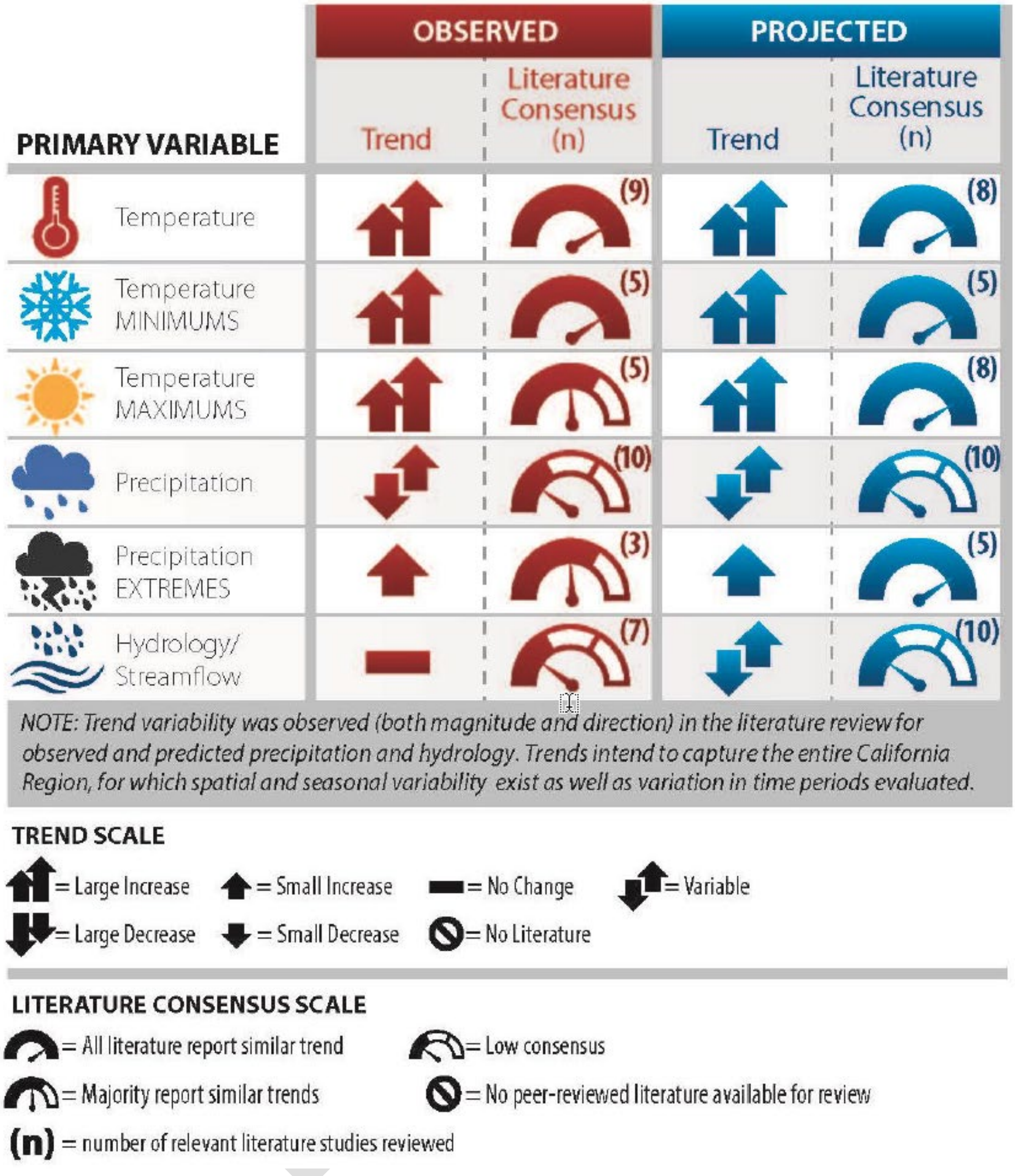


Figure 4. Summary of USACE Literature Synthesis (USACE 2015)

Climate models suggest the projected temperature signal is strong and temporally consistent. It has been projected that air temperatures will increase by over 3 degrees Fahrenheit by the middle of the current century. All projections are consistent in the direction of the temperature change, but vary in terms of other hydrometeorological variables (precipitation, streamflow, seasonality, variability, extremes etc.). For example, annual precipitation projections are not directionally consistent. Multi-decadal variability complicates period precipitation analysis. Regional trends indicate that it is more likely for the upper Sacramento Valley to experience equal or greater precipitation. Extreme precipitation is likely to increase (Das et al., 2013; NOAA, 2013; CH2M HILL, 2014).

Simulations with Global Climatic Models (GCMs) are mostly consistent in predicting that future climate change will cause a general increase in air temperatures in California during the critical months when the most precipitation falls. November through March is the period when the most significant and damaging storms hit this region. The American River, which flows through Folsom, has many high elevation mountains with peaks ranging from 5,000 to 11,000 feet above sea level. Significant portions of these watersheds are covered in snowpack during the winter months. As temperatures warm during the century, it is expected that the snowpack line (demarcation between bare ground and snowpack-covered ground) will recede to higher elevations, and a greater percentage of the drainage area of individual watersheds will incur rainfall, as opposed to snowfall (DWR 2017,USACE, 2015, USGRP 2014, NOAA 2013). This trend is expected to cause significant increases in runoff volume in the high elevation watersheds for large storms. Another impact of warmer air temperatures on the seasonality of flooding in the study area is that the spring snowpack will melt earlier, thus increasing reservoir inflows at a time when spring storms still threaten the region and empty space is still required to attenuate flood inflows. In other words, flood control operations at reservoirs could become more difficult in the spring months. The snowpack typically begins to melt in late March or early April. With the projected increase in temperatures during the coming decades, the snowpack will begin to melt earlier in the year (i.e. early to mid-March or sooner). This will overlap the time in which large atmospheric river storms normally hit the region. Therefore, more rain on snow events are likely to occur. Additionally, more of the watershed will be exposed to rainfall runoff processes because the snowlines on average will be higher than during the base period. The trend towards earlier spring snowmelt has already been observed in the Sierra Nevada Mountains over the last century (DWR 2017, USACE 2015, USGRP, 2014, NOAA 2013).

With less certainty than above, some global climate models indicate that future conditions may increase the amount of moisture in the storms, since warmer air holds more moisture than cold air. When air cools, condensation occurs, which causes precipitation. It is possible that due to increasing temperatures, atmospheric rivers will have higher precipitation depths in the future because the warmer air can hold more moisture than cooler air, and this will lead to an increase in the size of runoff peaks and volumes. The largest storms that typically impact the west coast of the United States are termed “pineapple express” or more recently “atmospheric rivers” by meteorologists. This type of event occurs when a long plume of saturated air moves northeastward from the low-latitudes of the Pacific Ocean and mixes with cold dense air moving southward from the arctic. The mixing of cold and warm air causes a storm front. As these very moist storms move eastward over the Sierra Mountain Range, the air is pushed to higher elevations where more cooling occurs, thus increasing condensation and precipitation. Historically, the largest and most damaging floods in the Central Valley of California are caused by atmospheric rivers (USACE 2015, USGRP 2014, CH2M HILL 2014, NOAA 2013).

Climate projections (CMIP5) consistent with the most recent Intergovernmental Panel on Climate Change (IPCC) Assessment Report 5 (AR5) are available to evaluate future, projected climate (Taylor et al., 2012). Three on-going, DWR-supported research studies were initiated in 2013, which apply CMIP5 data to hydrologic analysis. These include the Climate Variability Sensitivity Study (completed by the Corps in 2014) which evaluated the effects of increasing temperature only (not precipitation) on flood runoff on selected watersheds in the San Joaquin River Valley. The results from this study indicate that warmer temperatures would reduce the volume of the antecedent snowpack and increase the storm runoff due to more precipitation falling as rain and larger portions of the watersheds contributing runoff. The other two include the Atmospheric River Study (led by Scripps Institute of Oceanography/USGS) investigating indices and future projections of the major flood-producing atmospheric processes, and the Watershed Sensitivity Study (led by UC Davis) investigating the atmospheric and watershed conditions that contribute to the extreme flows on several Central Valley watersheds. This study shows that annual runoff and event runoff will occur earlier in the season as a result of increasing temperatures and declining snowpack. The California Department of Natural Resources (DWR) has invested millions of dollars to study climate impacts on the flood control system in the Central Valley. Results were recently published in the *Draft 2017 CVFPP Update– Climate Change Analysis Technical Memorandum* dated March 2017. The results are based on downscaled outputs from a subset of the Coupled Model Intercomparison Project – Phase 5 (CMIP5) global climatic models, which DWR has determined are most suitable for modeling climate change on the west coast of California. The downscaled results are fed into a calibrated variable infiltration capacity (VIC) rainfall runoff model of the Sacramento and San Joaquin River watersheds. The DWR analysis relies upon existing, available climate projections and hydrologic modeling to represent a range of potential future changes to unregulated flow volumes due to climate change. The draft results provided by DWR have projections of volume change for 1-day and 3-day durations at many index points throughout the Sacramento River, including the American River Watershed. DWR results indicate the potential for an increase in 1-day and 3-day streamflow peaks within the study area.

Phase I Current Climate Observations:

Historical Precipitation and Temperature Data

Historical temperature, precipitation, and drought index data for 1895-2018 are available from NOAA National Centers for Environmental Information (Figure 5 - Figure 10). California Climate Division 2 represents Sacramento Drainage (HUC 1802) which includes the Yuba River Watershed (NOAA NCEI 2018).

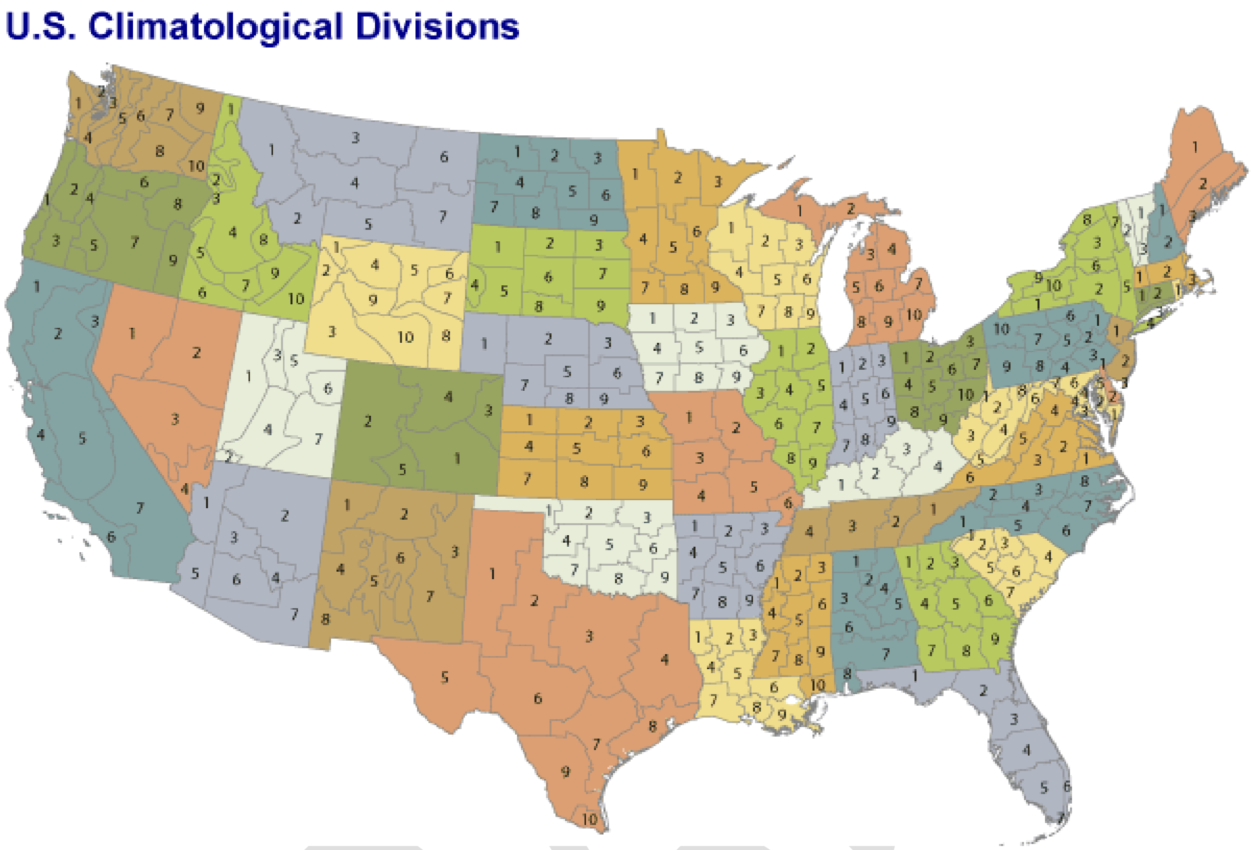


Figure 5 US Climatological Divisions (NOAA NCEI 2018)

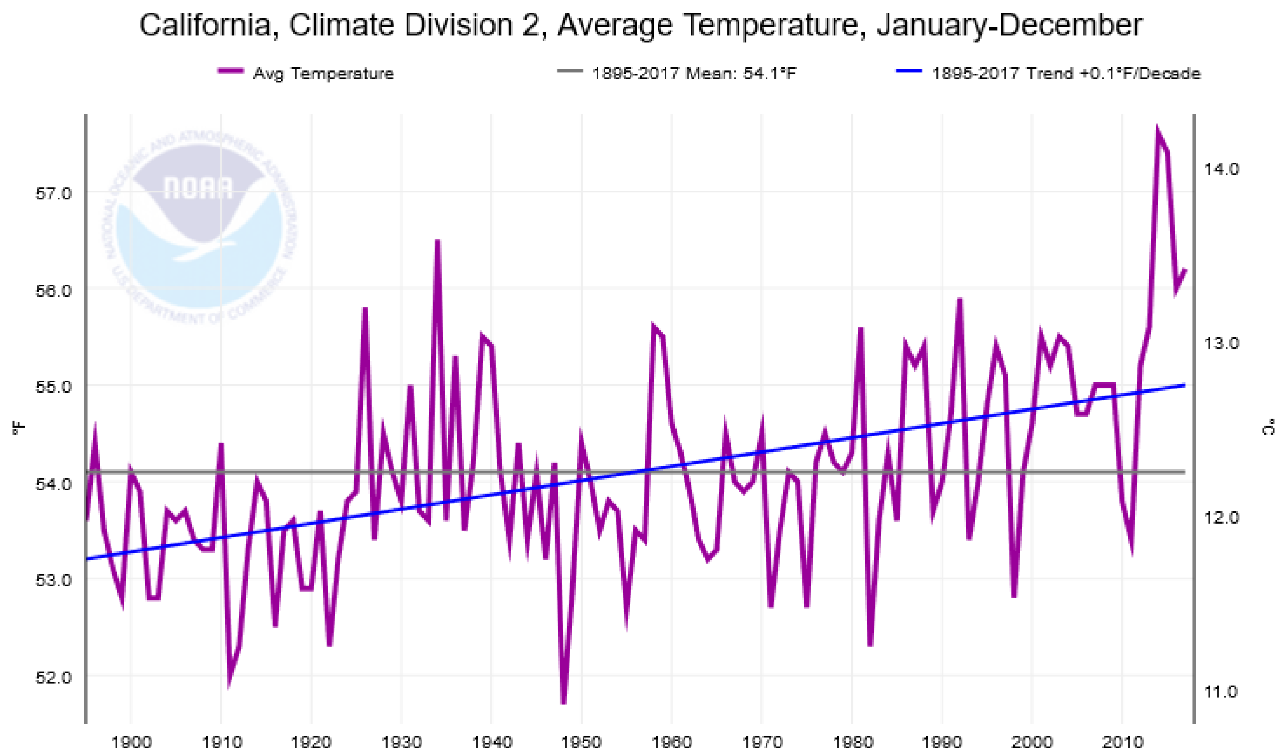


Figure 6: Average Annual Temperature for Sacramento HUC 1802 Watershed

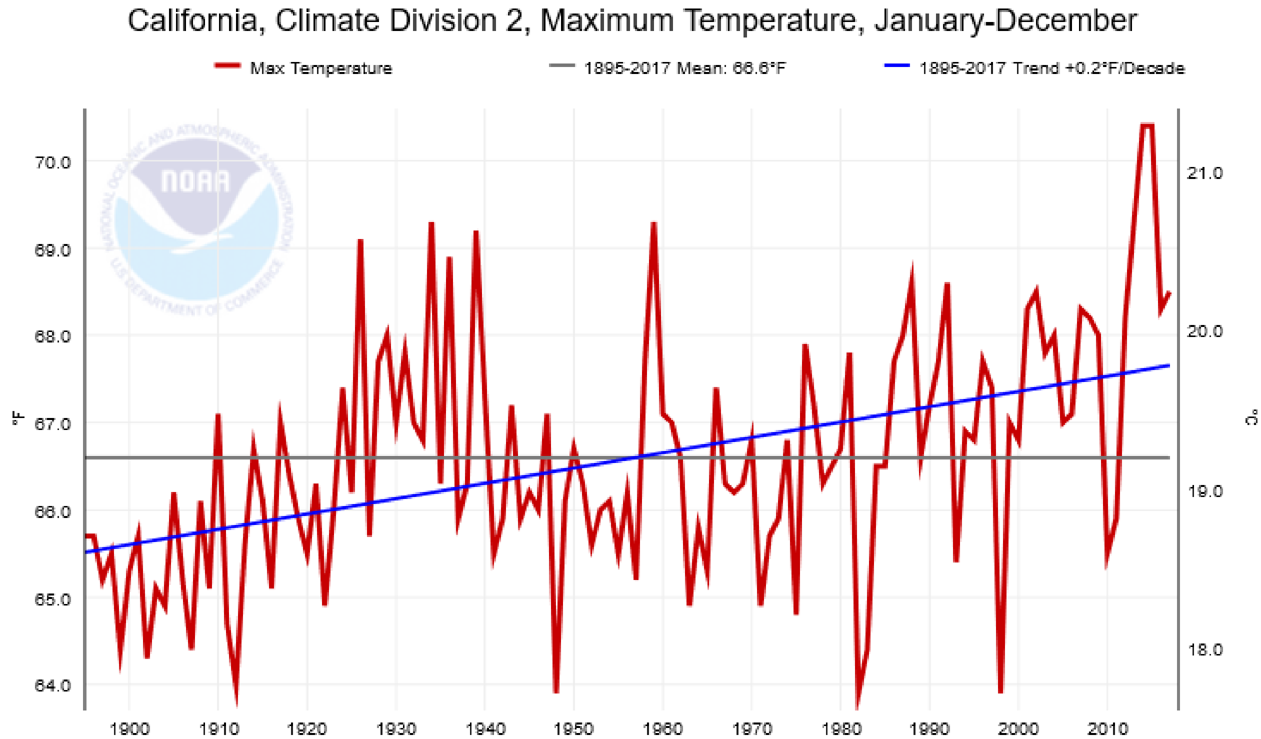


Figure 7: Annual Maximum Temperature for the Sacramento Watershed.

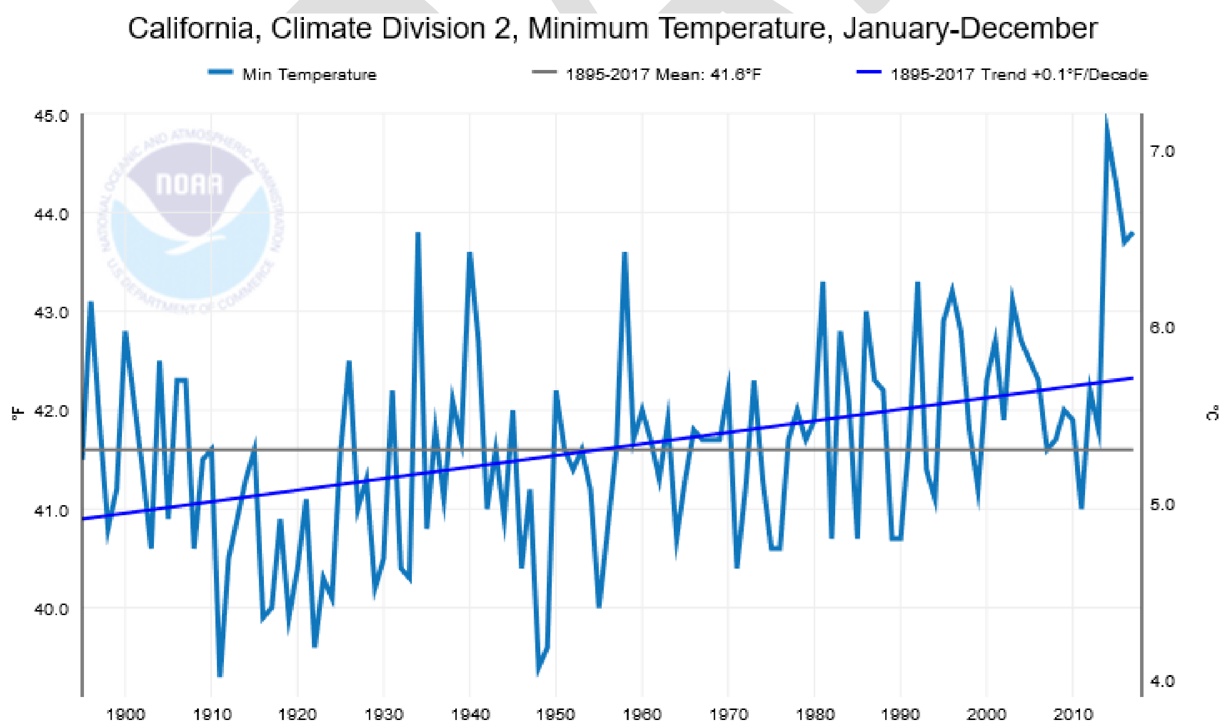


Figure 8: Annual Minimum Temperature for Sacramento Watershed.

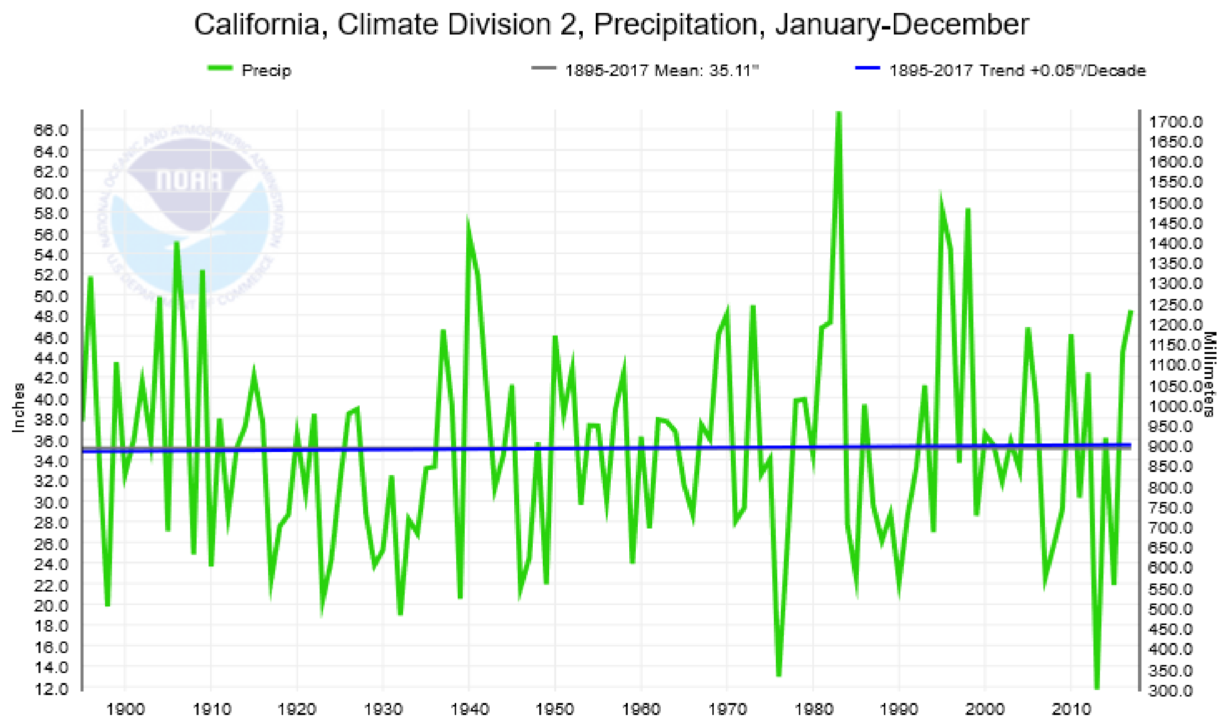


Figure 9: Annual Precipitation in the Sacramento Watershed.

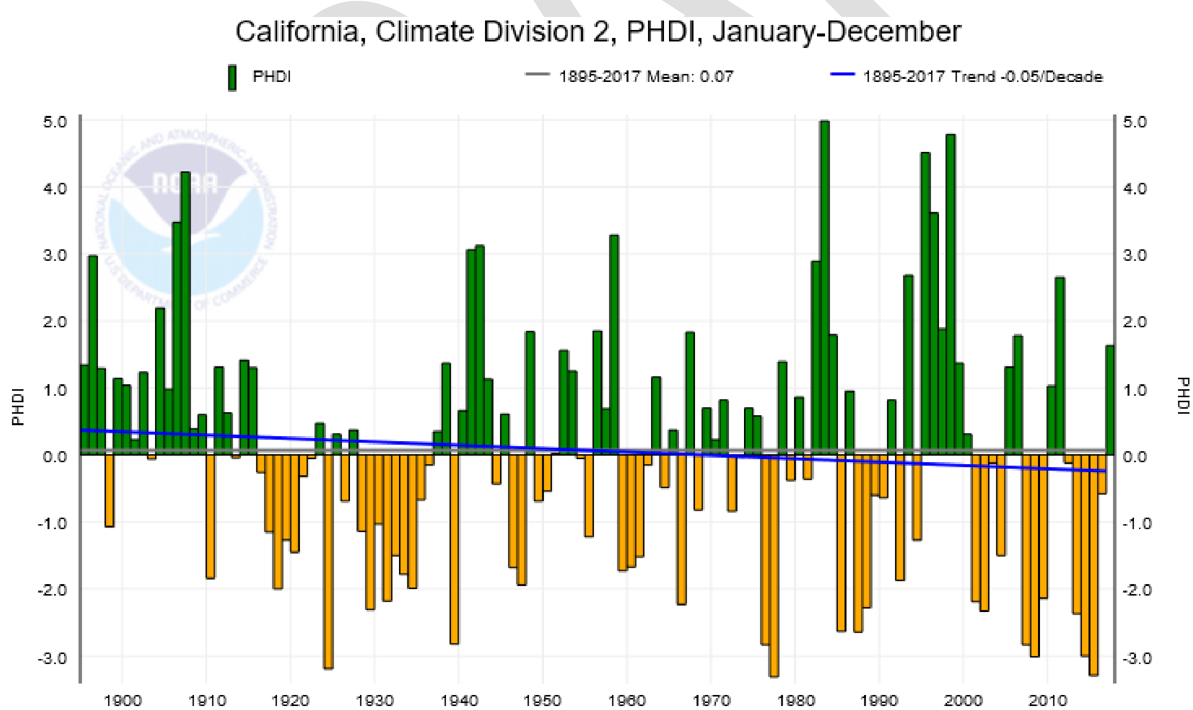


Figure 10: Palmer Hydrologic Drought Index (PHDI) for the Sacramento Watershed.

Annual Maximum Flow Data:

Trends in Annual Peak StreamflowsClimate Hydrology Assessmentand Non-Stationarity Detection:

For the Climate Hydrology and non stationarity analyses, two analysis points were selected: USGS gauge 11451100 North Fork Cache Creek at Hough Spring near Clearlake Oaks, drainage area (DA): 60.20 square miles and USGS gauge 11449500 Kelsey Cr at Kelseyville, DA: 36.60 square miles. These two locations were chosen because they have long periods of record (42 years at the Hough spring gauge and 71 years for the Kelseyville gauge) and because the flow is unregulated and the watershed upstream of each location is primarily rural with no significant land use change during the period of record. Annual maximum flows are examined in this study because the project involves modification of and use of levees in flood risk management. Figures 11 and 12 show the period of record of annual maximum flows at both gages, as well as a linear trend assessment for these two sites.

Neither the North Fork Cache Creek at Hough Spring gauge, nor the Kelsey Creek at Kelseyville guage show a significant trend in peak flows over time. The significance of the trends is determined by the p-values computed for the stations: 0.475 for Hough Spring and 0.647 for Kelseyville. Smaller p-value values indicate greater statistical significance of trends. In practice, a p-value of 0.05 is often used as a threshold for significance. A p-value of 0.05 indicates that there is a 5% chance of type I errors or false positives (USACE, 2016 b).

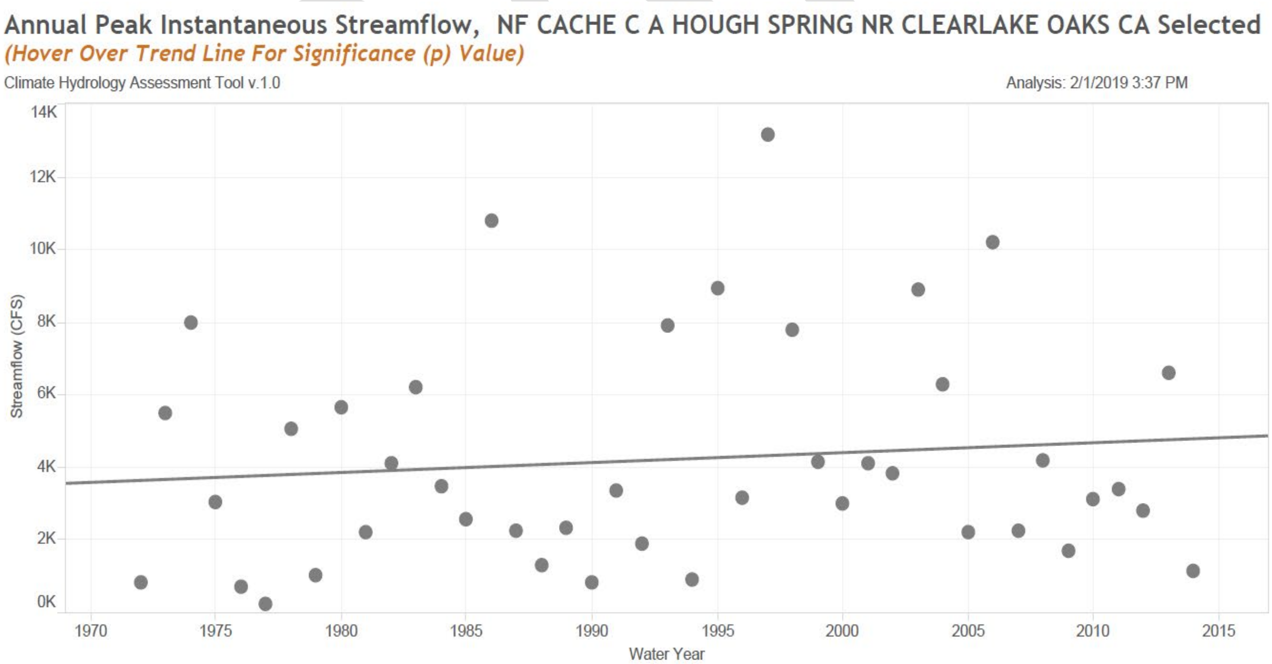


Figure 11 Annual Maximum Flow at the North Fork Cache Cr at Hough Springs Gauge near Clearlake Oaks, CA.

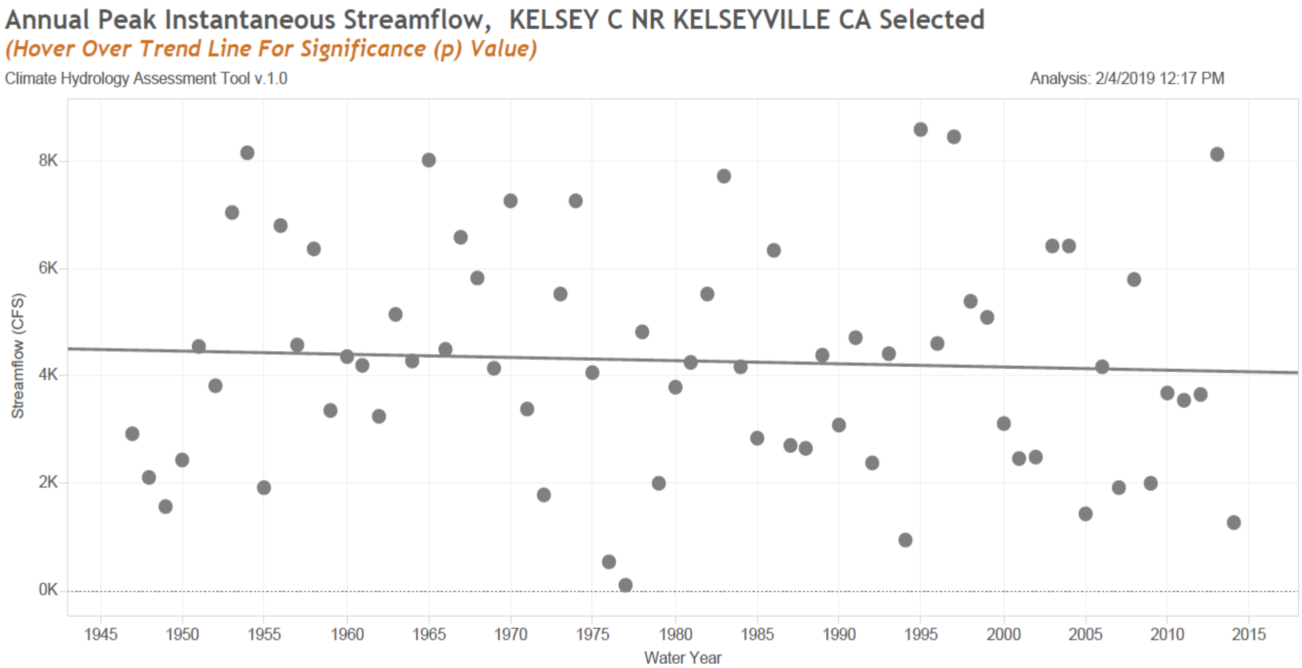


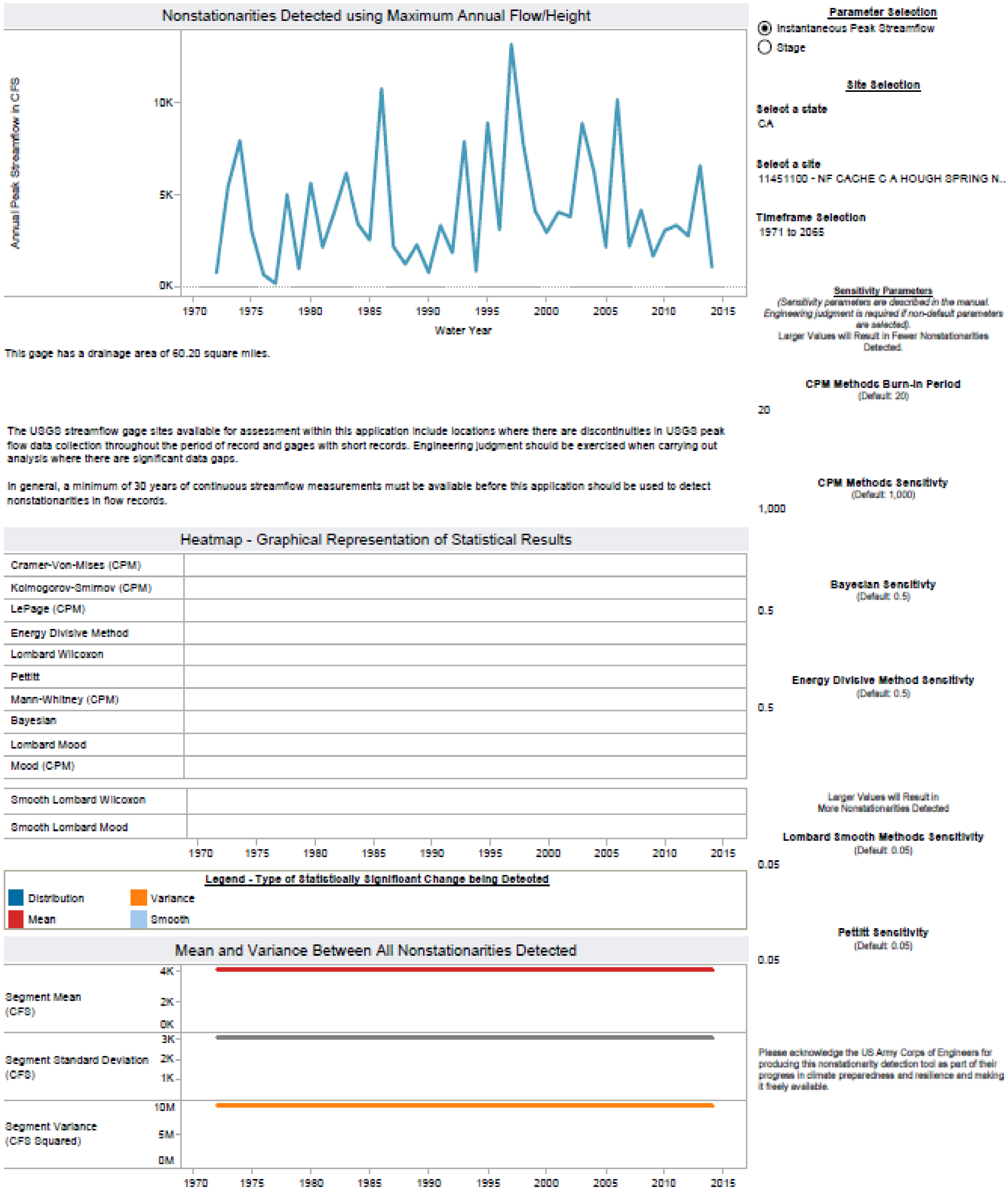
Figure 12 Annual Maximum Flow at the Kelsey Creek near Kelseyville Gauge.

Non-Stationarity Detection

The analysis of trends in observed data continues with an assessment of non-stationarities in annual peak streamflow data carried out in accordance to ETL 1100-2-3 (*Guidance for Detection of Non-stationarities in Annual Maximum Discharges,* USACE 2017) using the USACE Nonstationarity Detection Tool (USACE 2016 c)(http://corpsmapu.usace.army.mil/cm_apex/f?p=257:10:0::NO). This web based tool uses a series of statistical tests to detect changes in the trends (mean, variation and distribution) of the recorded, USGS annual instantaneous peak flow data at each gage. The tests include the Lombard model which identifies breaks in the mean and / or variance; the energy based divisive (ecp) method, a nonparametric test that detects multiple change points in the distribution; and other statistical tests. The levels of significance for each test can be controlled by the user- default setting were applied for this analysis. The same analyses points were selected, as were used for the Climate Hydrology Assessment Tool: North Fork Cache Creek at Hough Spring and Kelsey Creek at Kelseyville, CA. No non-stationarities were detected at either location (See figures 13 and 14). In order for a non-stationarity to be considered strong or robust, a minimum of three methods targeting changes in mean, distributional characteristics or variance are required to detect a non-stationarity during a five year period (at minimum two tests indicating a change in the same statistical property and an additional test indicating a change in a different statistical property). Magnitude of the change is also an indicator of a strong non-stationarity if the difference between the component means and variances before and after the change point is significant (USACE 2017).

Changes in hydrologic processes can occur either abruptly (e.g., through construction of a dam) or gradually (e.g., through watershed development over time) depending on the characteristics of the nonstationarity factors affecting physical processes. Engineering Technical Letter (ETL) 1100-2-3 provides guidance on detecting abrupt and slowly varying changes in annual maximum discharge records that could impact future without-project-condition.

Monotonic trend analysis can be conducted after the change point detection tests have been applied. The change point detection tests divide the record into a series of statistically homogenous subsets. If no abrupt changes were detected, the presence of monotonic trends should be examined using the entire record. Tests for monotonic patterns indicate whether the statistical properties within subsets of data are relatively constant, increasing or decreasing, and provide the user with insight into whether or not the trends exhibited within the dataset are likely to persist. If trends are detected within the identified subsets of flow data, the user should apply engineering judgment when using methods that rely on the stationarity assumption (USACE 2017). Monotonic trend analyses detected no statistically significant trends in either station.



Nonstationarities Detected using Maximum Annual Flow/Height
Annual Peak Streamflow in CFS
10K
5K
0K
1970 1975 1980 1985 1990 1995 2000 2005 2010 2015
Water Year
This gage has a drainage area of 60.20 square miles.
The USGS streamflow gage sites available for assessment within this application include locations where there are discontinuities in USGS peak flow data collection throughout the period of record and gages with short records. Engineering judgment should be exercised when carrying out analysis where there are significant data gaps.
In general, a minimum of 30 years of continuous streamflow measurements must be available before this application should be used to detect nonstationarities in flow records.
Heatmap - Graphical Representation of Statistical Results
Cramer-Von-Mises (CPM)
Kolmogorov-Smirnov (CPM)
LePage (CPM)
Energy Divisive Method
Lombard Wilcoxon
Pettitt
Mann-Whitney (CPM)
Bayesian
Lombard Mood
Mood (CPM)
Smooth Lombard Wilcoxon
Smooth Lombard Mood
1970 1975 1980 1985 1990 1995 2000 2005 2010 2015
Legend - Type of Statistically Significant Change being Detected
Distribution
Mean
Variance
Smooth
Mean and Variance Between All Nonstationarities Detected
Segment Mean (CFS)
4K
2K
0K
Segment Standard Deviation (CFS)
3K
2K
1K
Segment Variance (CFS Squared)
10M
5M
0M
1970 1975 1980 1985 1990 1995 2000 2005 2010 2015
Parameter Selection
Instantaneous Peak Streamflow
Stage
Site Selection
Select a state
CA
Select a site
11451100 - NF CACHE C A HOUGH SPRING N..
Timeframe Selection
1971 to 2065
Sensitivity Parameters
(Sensitivity parameters are described in the manual. Engineering judgment is required if non-default parameters are selected).
Larger Values will Result in Fewer Nonstationarities Detected.
CPM Methods Burn-In Period
(Default: 20)
20
CPM Methods Sensitivity
(Default: 1,000)
1,000
Bayesian Sensitivity
(Default: 0.5)
0.5
Energy Divisive Method Sensitivity
(Default: 0.5)
0.5
Larger Values will Result in More Nonstationarities Detected
Lombard Smooth Methods Sensitivity
(Default: 0.05)
0.05
Pettitt Sensitivity
(Default: 0.05)
0.05
Please acknowledge the US Army Corps of Engineers for producing this nonstationarity detection tool as part of their progress in climate preparedness and resilience and making it freely available.

Figure 13 NF Cache Cr at Hough Spring, CA non-stationarity detection. No non-stationarities are detected.

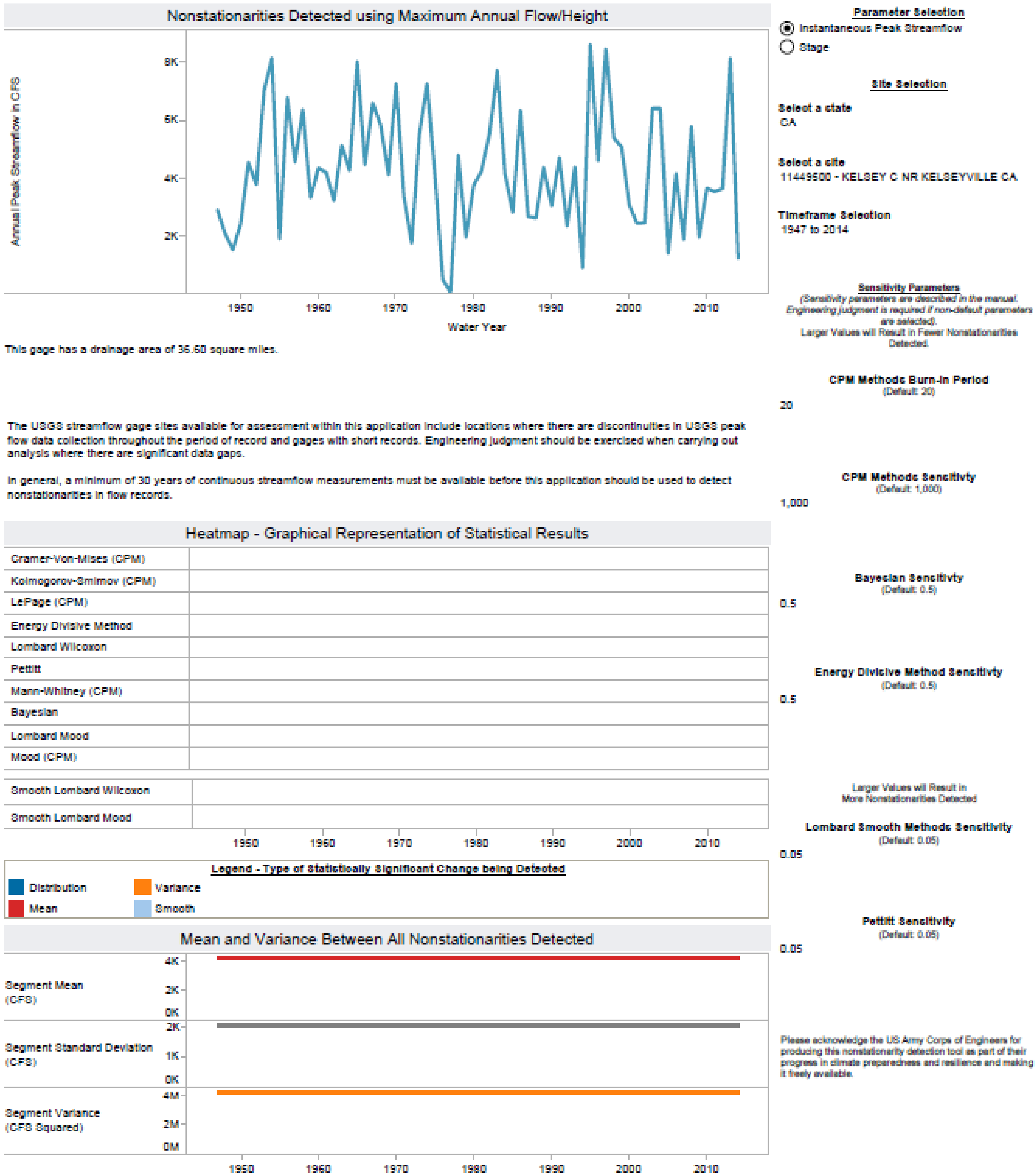
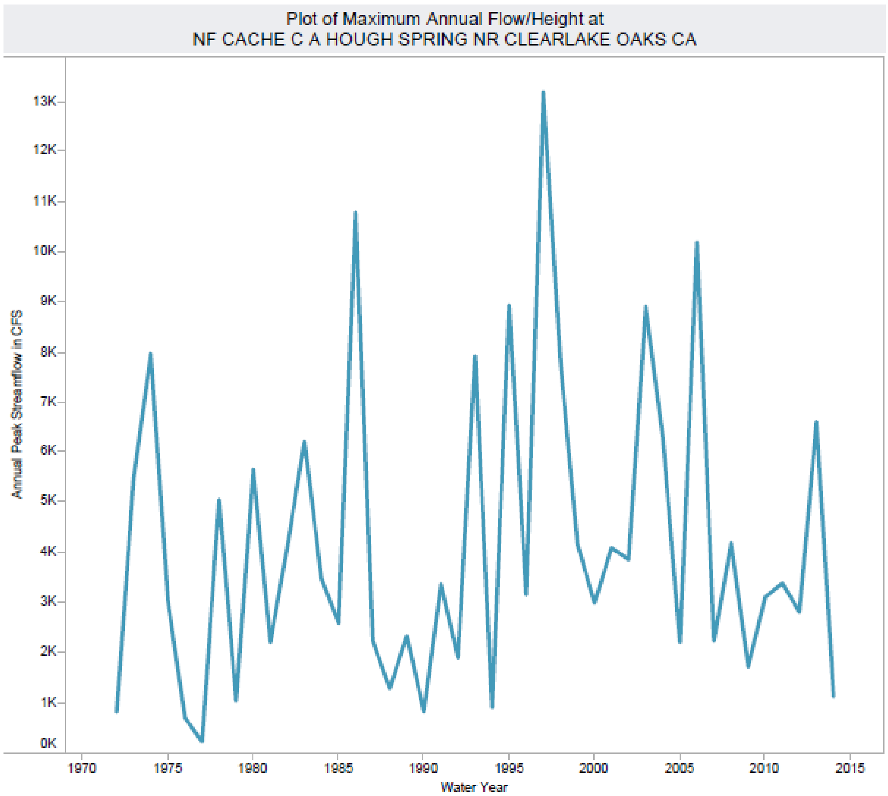


Figure 14 Kelsey Creek at Kelseyville non-stationarity detection results. No non-stationarities were detected.



Timeframe Selection
1946 to 2018

Monotonic Trend Analysis

Is there a statistically significant trend?
No, using the Mann-Kendall Test at the .05 level of significance. The exact p-value for this test was 0.414.
No, using the Spearman Rank Order Test at the .05 level of significance. The exact p-value for this test was Null.

What type of trend was detected?
Using parametric statistical methods, **no trend** was detected.
Using robust parametric statistical methods (Sen's Slope), **no trend** was detected.

Please acknowledge the US Army Corps of Engineers for producing this nonstationarity detection tool as part of their progress in climate preparedness and resilience and making it freely available.

Figure 615 Monotonic Trend analysis at NF Cache Cr at Hough Spring near Clearlake Oaks, CA.

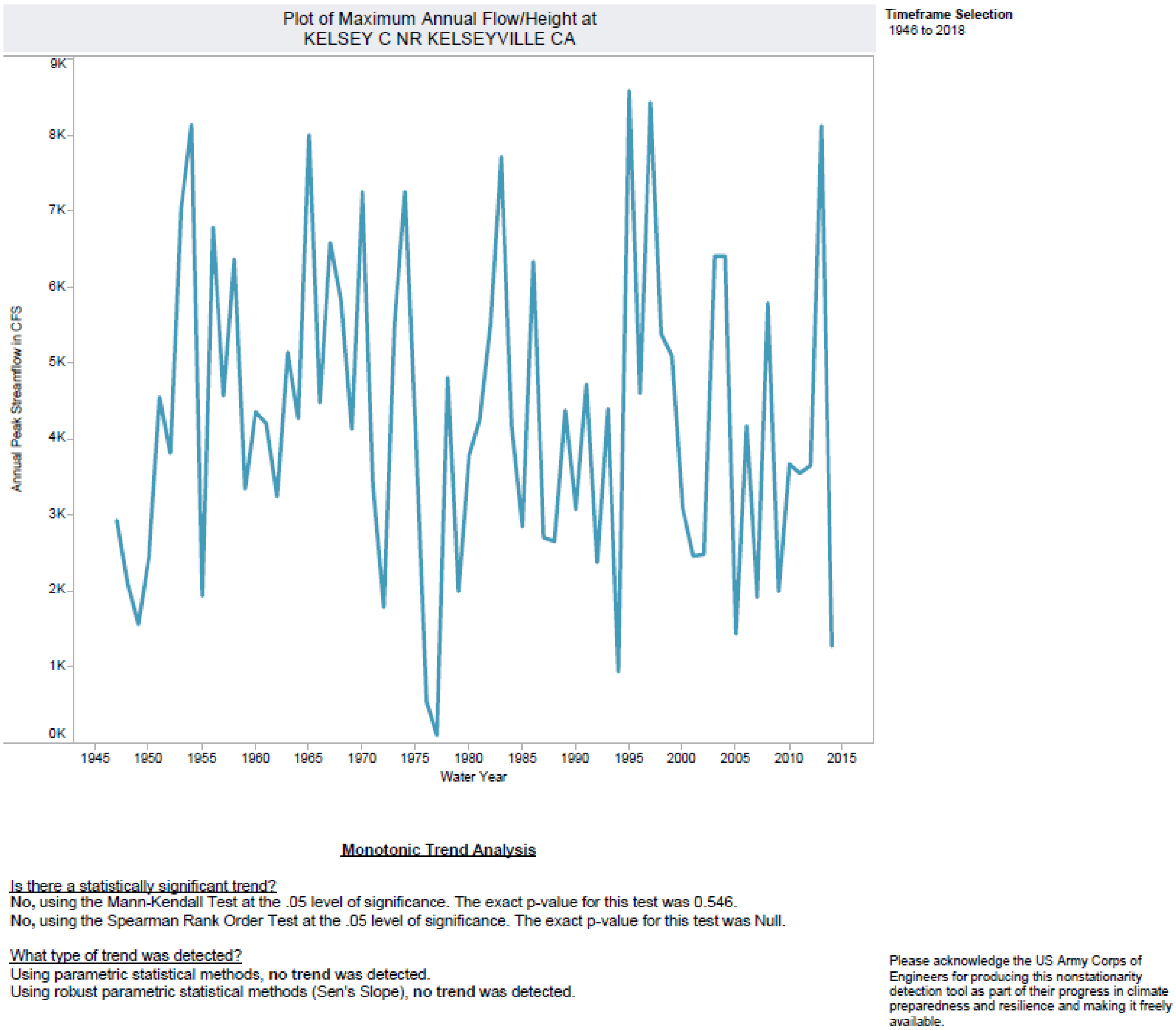


Figure 7 16 Monotonic Trend Analysis of Kelsey Cr near Kelseyville gauge.

Phase II Future Climate Scenarios:

Projected changes in future climate contain significant uncertainties due to limitations in our understanding and modeling of the earth's systems, estimated projections of future development and greenhouse gas emission pathways. Uncertainties are also associated with hydrologic modeling, and translating global climate model outputs to a temporal and spatial scale applicable to hydrologic analysis.

Projected Streamflow Trends in the Sacramento HUC-4 Watershed:

The Corps Climate Hydrology Assessment Tool was used to examine observed and projected trends in watershed hydrology to support the qualitative assessment. As expected, there is considerable and consistent spread in the projected annual maximum monthly flows (Figure 15). The overall projected trend in mean projected annual maximum monthly flows (**Error! Reference source not found.**) increases over time and this trend is statistically significant (p-value <0.0001), suggesting that there may be potential for an increase in flood risk in the future relative to the current time. The tool uses climate data projected by global circulation models translated using a Variable Infiltration Capacity (VIC) model developed for the entire United States. The VIC model does not capture regulatory impacts. The assessment tool facilitates an overall assessment of probable projected trends in climate changed hydrology, but does not provide much insight into the magnitude of these trends. The VIC model is not calibrated to historical values at a study specific scale thus it may not replicate exact historic streamflow within a high degree of accuracy and this adds to the uncertainty with the projected climate changed hydrology.

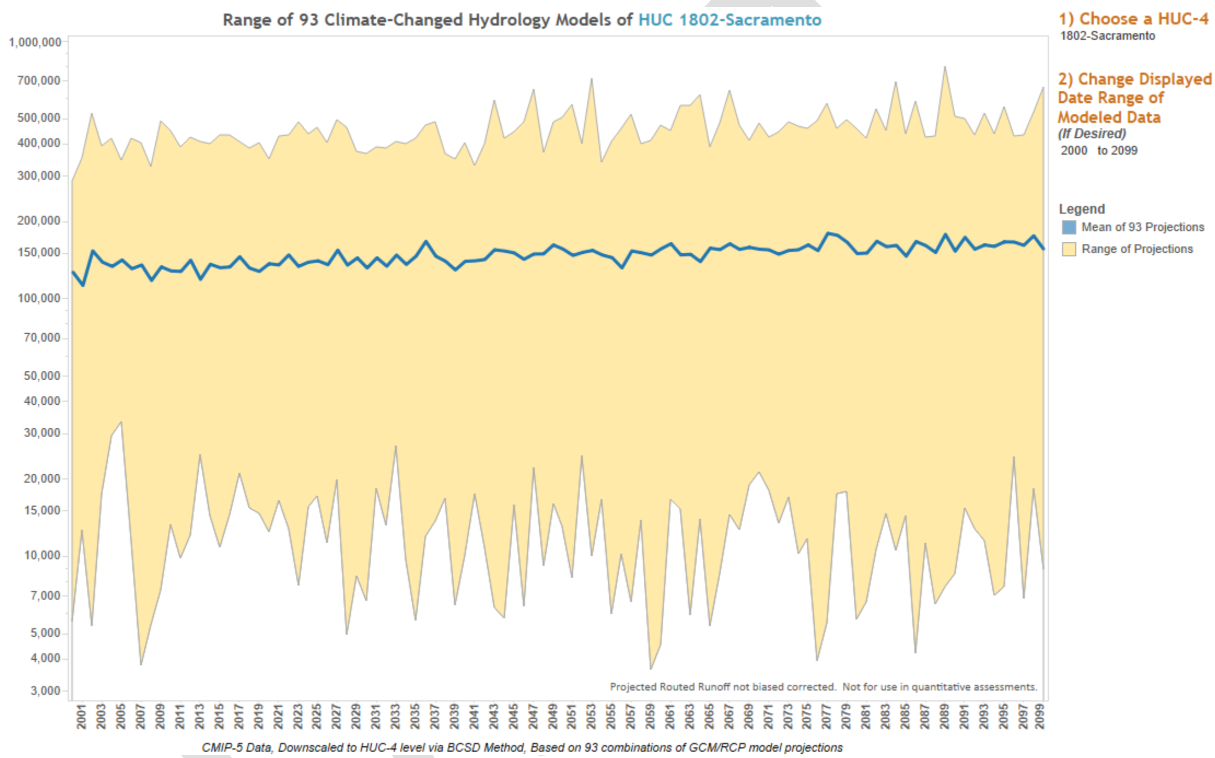


Figure 15 Range of 92 Climate-Altered Hydrology Model Projections of Annual Maximum Monthly Average Flow in HUC 1802 Sacramento. The range itself is indicated by the yellow shading and the mean of the projections is indicated by the blue curve.

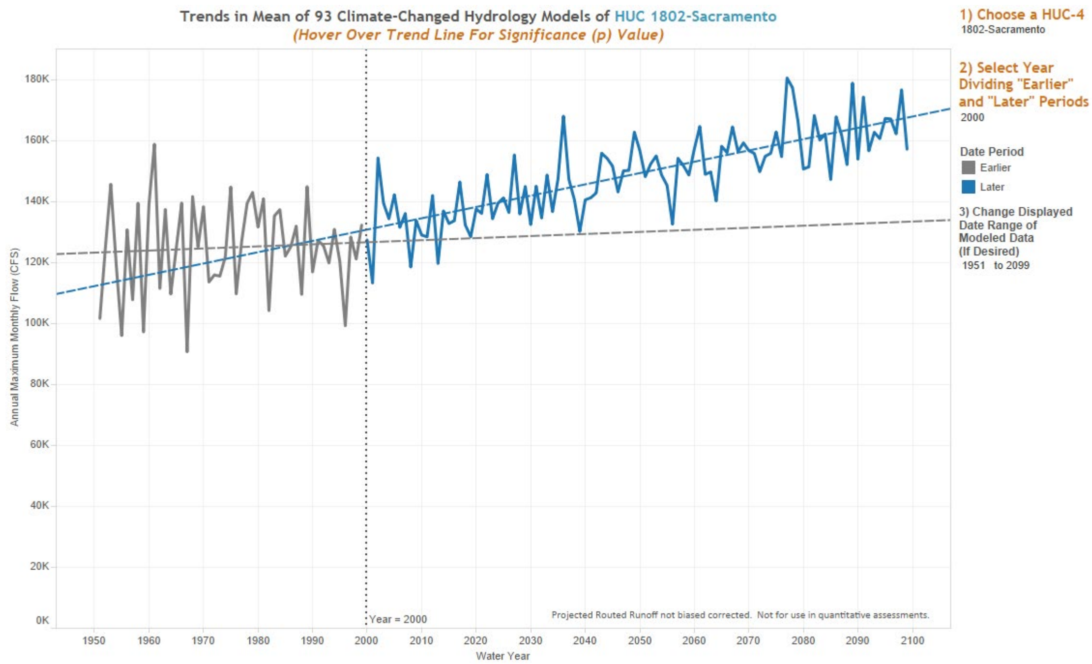


Figure 16 Projected Trend in Annual Maximum Flow for HUC-1802 Sacramento. Dotted line indicates year 2000, grey dashed line indicates present trend from 1950 to 2000 and the blue dashed line indicates projected climate altered trend in streamflow from 2000 to 2100.

Vulnerability Assessment:

The Corps Watershed Vulnerability Assessment Tool (VA Tool) provides nationwide screening level assessment of climate change vulnerability relative to USACE mission, operations, programs and projects (Corps, 2106). The VA tool was used to examine the vulnerability of the project area to future flood risk across the primary business line for which The Lower Cache Creek Flood Protection Project is designed. That business line is flood risk reduction. However because this is a feasibility study, all eight business lines are considered. Like the Climate Hydrology Assessment Tool, this tool uses climate data projected by GCMs translated into runoff using a VIC model, and the vulnerability assessment for inland Hydrology is only qualitative at this time. The results for the Sacramento River watershed are relative to those of the other 201 watersheds in the United States. This vulnerability assessment uses 27 different variables (indicators) and eight business lines to develop vulnerability scores specific to each of the 202 HUC-4 watersheds in the United States for each of the business lines. Indicators reflect stressors related to climate, demographic changes, ecological changes, and other factors relevant to a particular business line. Five of these indicators are relevant to the Flood Risk Management business line (Table). A subjective weight can be used to give more weight to indicators that are more relevant to the issues affecting the vulnerability of a given business line. The least relevant/important indicator is assigned an importance weight of 1, while all other indicators are assigned an importance weight relative to that (e.g., an indicator that is considered 50% more relevant/important is given an importance weight of 1.5).

Table 1: Indicators and Importance Weights for Flood Risk Reduction Business Line.

Indicator Short Name	Indicator Description	Default Importance Weights
175C_ANNUAL_COV	Long-term variability in hydrology: ratio of the standard deviation of annual runoff to the annual runoff mean. Includes upstream freshwater inputs (cumulative).	1.25
277_RUNOFF_PRECIP	Median of: deviation of runoff from monthly mean times average monthly runoff divided by deviation of precipitation from monthly mean times average monthly precipitation.	1.00
568C_FLOOD_MAGNIFICATION	Change in flood runoff: ratio of indicator 571C (monthly runoff exceeded 10% of the time, including upstream freshwater inputs) to 571C in base period.	1.8
568L_FLOOD_MAGNIFICATION	Change in flood runoff: Ratio of indicator 571L (monthly runoff exceeded 10% of the time, excluding upstream freshwater inputs) to 571L in base period.	1.4
590_URBAN_500YRFLOODPLAIN_AREA	Acres of urban area within the 500-year floodplain.	1.75

Table 2: Indicators and Importance Weights for Ecosystem Restoration.

Indicator Short Name	Indicator Description	Default Importance Weights
65L_MEAN_ANNUAL_RUNOFF	Mean runoff: average annual runoff, excluding upstream freshwater inputs (local).	1.3
156_SEDIMENT	The ratio of the change in the sediment load in the future to the present load.	1.5
221C_MONTHLY_COV	Measure of short-term variability in the region's hydrology: 75th percentile of annual ratios of the standard deviation of monthly runoff to the mean of monthly runoff. Includes	1.75
277_RUNOFF_PRECIP	Median of: deviation of runoff from monthly mean times average monthly runoff divided by deviation of precipitation from monthly mean times average monthly precipitation.	1.75
297_MACROINVERTEBRATE	The sum (ranging from 0-100) of scores for six metrics that characterize macroinvertebrate assemblages: taxonomic richness, taxonomic composition, taxonomic diversity, feeding	2
568C_FLOOD_MAGNIFICATION	Change in flood runoff: ratio of indicator 571C (monthly runoff exceeded 10% of the time, including upstream freshwater inputs) to 571C in base period.	1.5
568L_FLOOD_MAGNIFICATION	Change in flood runoff: Ratio of indicator 571L (monthly runoff exceeded 10% of the time, excluding upstream freshwater inputs) to 571L in base period.	1
700C_LOW_FLOW_REDUCTION	Change in low runoff: ratio of indicator 570C (monthly runoff exceeded 90% of the time, including upstream freshwater inputs) to 570C in base period.	1
8_AT_RISK_FRESHLANT	Percentage of wetland and riparian plant communities that are at risk of extinction, based on remaining number and condition, remaining acreage, threat severity, etc.	2

Table 3 Emergency Management Business Line Indicators and Importance Weights.

Indicator Short Name	Indicator Description	Default Importance Weights
65C_MEAN_ANNUAL_RUNOFF	Mean runoff: average annual runoff, including upstream freshwater inputs (cumulative).	1
65L_MEAN_ANNUAL_RUNOFF	Mean runoff: average annual runoff, excluding upstream freshwater inputs (local).	2
130_FLOODPLAIN_POPULATION	Population within the 500-year floodplain.	1.3
156_SEDIMENT	The ratio of the change in the sediment load in the future to the present load.	1.2
175C_ANNUAL_COV	Long-term variability in hydrology: ratio of the standard deviation of annual runoff to the annual runoff mean. Includes upstream freshwater inputs (cumulative).	1.4
175L_ANNUAL_COV	Long-term variability in hydrology: ratio of the standard deviation of annual runoff to the annual runoff mean. Excludes upstream freshwater inputs (local).	1.6
192_URBAN_SUBURBAN	Land area that is urban or suburban as a percentage of the total U.S. land area.	1.85
221C_MONTHLY_COV	Measure of short-term variability in the region's hydrology: 75th percentile of annual ratios of the standard deviation of monthly runoff to the mean of monthly runoff. Includes	1.2
221L_MONTHLY_COV	Measure of short-term variability in the region's hydrology: 75th percentile of annual ratios of the standard deviation of monthly runoff to the mean of monthly runoff. Excludes	1.9
450_FLOOD_INSURANCE_COMMUNITIES	Number of communities enrolled in the National Flood Insurance Program (NFIP).	1.8
568C_FLOOD_MAGNIFICATION	Change in flood runoff: ratio of indicator 571C (monthly runoff exceeded 10% of the time, including upstream freshwater inputs) to 571C in base period.	1.4

Table 4 Regulatory Business Line Indicators and Importance Weights.

Indicator Short Name	Indicator Description	Default Importance Weights
65C_MEAN_ANNUAL_RUNOFF	Mean runoff: average annual runoff, including upstream freshwater inputs (cumulative).	1.4
65L_MEAN_ANNUAL_RUNOFF	Mean runoff: average annual runoff, excluding upstream freshwater inputs (local).	1.3
156_SEDIMENT	The ratio of the change in the sediment load in the future to the present load.	1.5
175C_ANNUAL_COV	Long-term variability in hydrology: ratio of the standard deviation of annual runoff to the annual runoff mean. Includes upstream freshwater inputs (cumulative).	1.7
221C_MONTHLY_COV	Measure of short-term variability in the region's hydrology: 75th percentile of annual ratios of the standard deviation of monthly runoff to the mean of monthly runoff. Includes	1.75
277_RUNOFF_PRECIP	Median of: deviation of runoff from monthly mean times average monthly runoff divided by deviation of precipitation from monthly mean times average monthly precipitation.	1.25
297_MACROINVERTEBRATE	The sum (ranging from 0-100) of scores for six metrics that characterize macroinvertebrate assemblages: taxonomic richness, taxonomic composition, taxonomic diversity, feeding	1.8
568C_FLOOD_MAGNIFICATION	Change in flood runoff: ratio of indicator 571C (monthly runoff exceeded 10% of the time, including upstream freshwater inputs) to 571C in base period.	1.6
568L_FLOOD_MAGNIFICATION	Change in flood runoff: Ratio of indicator 571L (monthly runoff exceeded 10% of the time, excluding upstream freshwater inputs) to 571L in base period.	1.1
700C_LOW_FLOW_REDUCTION	Change in low runoff: ratio of indicator 570C (monthly runoff exceeded 90% of the time, including upstream freshwater inputs) to 570C in base period.	1.5

Table 5 Recreation Indicators Importance Weights

Indicator Short Name	Indicator Description	Default Importance Weights
95_DROUGHT_SEVERITY	Greatest precipitation deficit: The most negative value calculated by subtracting potential evapotranspiration from precipitation over any 1-, 3-, 6-, or 12-month period.	2
156_SEDIMENT	The ratio of the change in the sediment load in the future to the present load.	1
221C_MONTHLY_COV	Measure of short-term variability in the region's hydrology: 75th percentile of annual ratios of the standard deviation of monthly runoff to the mean of monthly runoff. Includes	1.2
277_RUNOFF_PRECIP	Median of: deviation of runoff from monthly mean times average monthly runoff divided by deviation of precipitation from monthly mean times average monthly precipitation.	1
568C_FLOOD_MAGNIFICATION	Change in flood runoff: ratio of indicator 571C (monthly runoff exceeded 10% of the time, including upstream freshwater inputs) to 571C in base period.	1.4
568L_FLOOD_MAGNIFICATION	Change in flood runoff: Ratio of indicator 571L (monthly runoff exceeded 10% of the time, excluding upstream freshwater inputs) to 571L in base period.	1
570L_90PERC_EXCEEDANCE	Low runoff: monthly runoff that is exceeded 90% of the time, excluding upstream freshwater inputs (local).	1.5
571C_10PERC_EXCEEDANCE	Flood runoff: monthly runoff that is exceeded 10% of the time, including upstream freshwater inputs (cumulative).	1
700L_LOW_FLOW_REDUCTION	Change in low runoff: ratio of indicator 570L (monthly runoff exceeded 90% of the time, excluding upstream freshwater inputs) to 570L in base period.	1.3

Table 6 Navigation Indicators and Importance Weights.

Indicator Short Name	Indicator Description	Default Importance Weights
95_DROUGHT_SEVERITY	Greatest precipitation deficit: The most negative value calculated by subtracting potential evapotranspiration from precipitation over any 1-, 3-, 6-, or 12-month period.	1.5
192_URBAN_SUBURBAN	Land area that is urban or suburban as a percentage of the total U.S. land area.	1
221C_MONTHLY_COV	Measure of short-term variability in the region's hydrology: 75th percentile of annual ratios of the standard deviation of monthly runoff to the mean of monthly runoff. Includes	1
277_RUNOFF_PRECIP	Median of: deviation of runoff from monthly mean times average monthly runoff divided by deviation of precipitation from monthly mean times average monthly precipitation.	1.5
441A_0.2AEPFLOODPLAIN_AREA	Area in the 0.2% Annual Exceedance Probability floodplain	1
568C_FLOOD_MAGNIFICATION	Change in flood runoff: ratio of indicator 571C (monthly runoff exceeded 10% of the time, including upstream freshwater inputs) to 571C in base period.	2
570C_90PERC_EXCEEDANCE	Low runoff: monthly runoff that is exceeded 90% of the time, including upstream freshwater inputs (cumulative).	1.75
570L_90PERC_EXCEEDANCE	Low runoff: monthly runoff that is exceeded 90% of the time, excluding upstream freshwater inputs (local).	1.25
700C_LOW_FLOW_REDUCTION	Change in low runoff: ratio of indicator 570C (monthly runoff exceeded 90% of the time, including upstream freshwater inputs) to 570C in base period.	1.5

Table 7 Water Supply Indicators and Importance Weights

Indicator Short Name	Indicator Description	Default Importance Weights
95_DROUGHT_SEVERITY	Greatest precipitation deficit: The most negative value calculated by subtracting potential evapotranspiration from precipitation over any 1-, 3-, 6-, or 12-month period.	2
130_FLOODPLAIN_POPULATION	Population within the 500-year floodplain.	2
156_SEDIMENT	The ratio of the change in the sediment load in the future to the present load.	1.5
192_URBAN_SUBURBAN	Land area that is urban or suburban as a percentage of the total U.S. land area.	1
221C_MONTHLY_COV	Measure of short-term variability in the region's hydrology: 75th percentile of annual ratios of the standard deviation of monthly runoff to the mean of monthly runoff. Includes	1.3

Table 8 Hydropower Indicators and Importance Weights.

Indicator Short Name	Indicator Description	Default Importance Weights
95_DROUGHT_SEVERITY	Greatest precipitation deficit: The most negative value calculated by subtracting potential evapotranspiration from precipitation over any 1-, 3-, 6-, or 12-month period.	2
156_SEDIMENT	The ratio of the change in the sediment load in the future to the present load.	1.2
175C_ANNUAL_COV	Long-term variability in hydrology: ratio of the standard deviation of annual runoff to the annual runoff mean. Includes upstream freshwater inputs (cumulative).	1.5
221C_MONTHLY_COV	Measure of short-term variability in the region's hydrology: 75th percentile of annual ratios of the standard deviation of monthly runoff to the mean of monthly runoff. Includes	1.6
277_RUNOFF_PRECIP	Median of: deviation of runoff from monthly mean times average monthly runoff divided by deviation of precipitation from monthly mean times average monthly precipitation.	1.5
568C_FLOOD_MAGNIFICATION	Change in flood runoff: ratio of indicator 571C (monthly runoff exceeded 10% of the time, including upstream freshwater inputs) to 571C in base period.	1.4
568L_FLOOD_MAGNIFICATION	Change in flood runoff: Ratio of indicator 571L (monthly runoff exceeded 10% of the time, excluding upstream freshwater inputs) to 571L in base period.	1
700L_LOW_FLOW_REDUCTION	Change in low runoff: ratio of indicator 570L (monthly runoff exceeded 90% of the time, excluding upstream freshwater inputs) to 570L in base period.	1

The tool provides an indication of how vulnerable a given HUC-4 watershed is to the potential impacts of climate change relative to the other 201 HUC-4 watersheds in the United States. The business lines are the prisms for the evaluation of vulnerability in a given watershed. The VA tool gives assessments using two scenarios or subsets of traces (wet and dry) for two of three epochs assessed within the tool, 2035-2064 (centered on 2050) and 2070-2099 (centered on 2085). The remaining epoch (base period) covers the current time and uses modeled flows generated from the GCM outputs from the base period (1950-1999). The subset with the lower cumulative runoff projections is used to compute values for the dry scenario and the subset with the higher runoff projections is used to compute values for the wet scenario. These are all equally likely projections of the future and the dry projection could be wetter than the base epoch. For the Sacramento River Watershed (HUC 1802), this tool shows that the area is highly vulnerable to increased flood risk during the twenty-first century for all wet and dry projected scenarios when compared to the other 201 HUC-4 watersheds in the nation. The Vulnerability Assessment Tool uses the following parameters to compute the results: ORness, Integrated Analysis Type (IAT) and Vulnerability Threshold. The ORness parameter describes the level of risk-aversion/risk-tolerance assumed for the analysis. Values range from .5 to 1.0. At the lowest value of ORness, indicators are aggregated using a simple average. At the highest value of ORness, the highest-valued indicator is weighted as 100% and all other indicators are weighted as 0%. The national standards settings uses an ORness of 0.7. The Integrated Analysis Type (IAT) specifies how the vulnerability scores will be calculated. The national standard setting uses an IAT of "each" meaning that a score is calculated for each business line during each scenario and epoch thus there are four sets of WOWA scores for each of the business lines. The assessment was carried out using the national standard settings (ORness set to 0.7, all 202 HUC-4 watersheds are considered, Analysis type is set to "Each" and vulnerability threshold is set at 20%).

Results Based on National Standard Settings:

Figures 17-22 and tables 9-16 show the breakout of indicators for each scenario and epoch combination for each of the eight business lines. For the Flood Risk Management business line, in both the wet and dry subsets, the increase in the area of the 1/500 annual chance exceedance (ACE), particularly in urban areas, is the dominant indicator contributing to the flood risk vulnerability score, followed by changes in the size and timing of flood runoff. This analyses along with the studies discussed in the literature synthesis indicates that in the future warming climate, floods could increase in magnitude over time and that much of the population and economic activity will be in areas which will be vulnerable to floodwaters (at least the 1/500 ACE year floodplain). Floods could be larger and more damaging than in previous times.

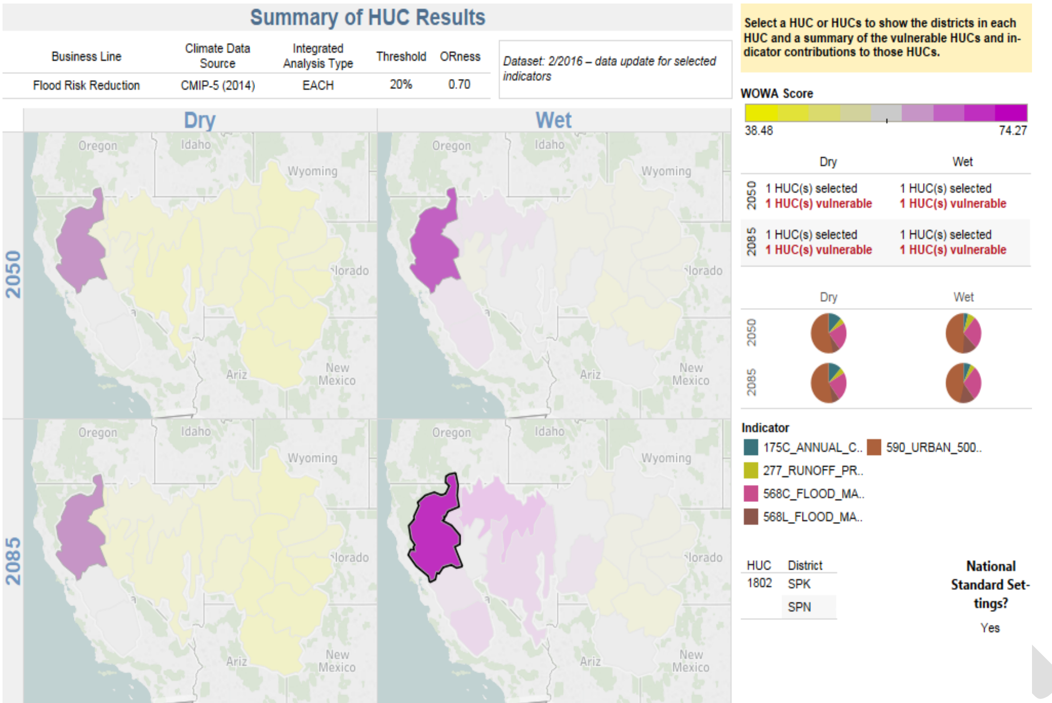


Figure 17 Summary of Flood Risk Reduction Business Line Vulnerability of the Assessment for HUC 1802 – Sacramento River Watershed. **Note: This area is vulnerable to increased flood risk primarily due to increases in the area of the 1/500 ACE floodplain and changes in the magnitude of floods as shown in the pie charts on the right of the figure. The Weighted Order Weighted Average (WOWA) scores are in the range of 59-67 which indicates a high overall vulnerability relative to all other HUC-4 watersheds in the United States. WOWA scores can range from 0 to 100.**

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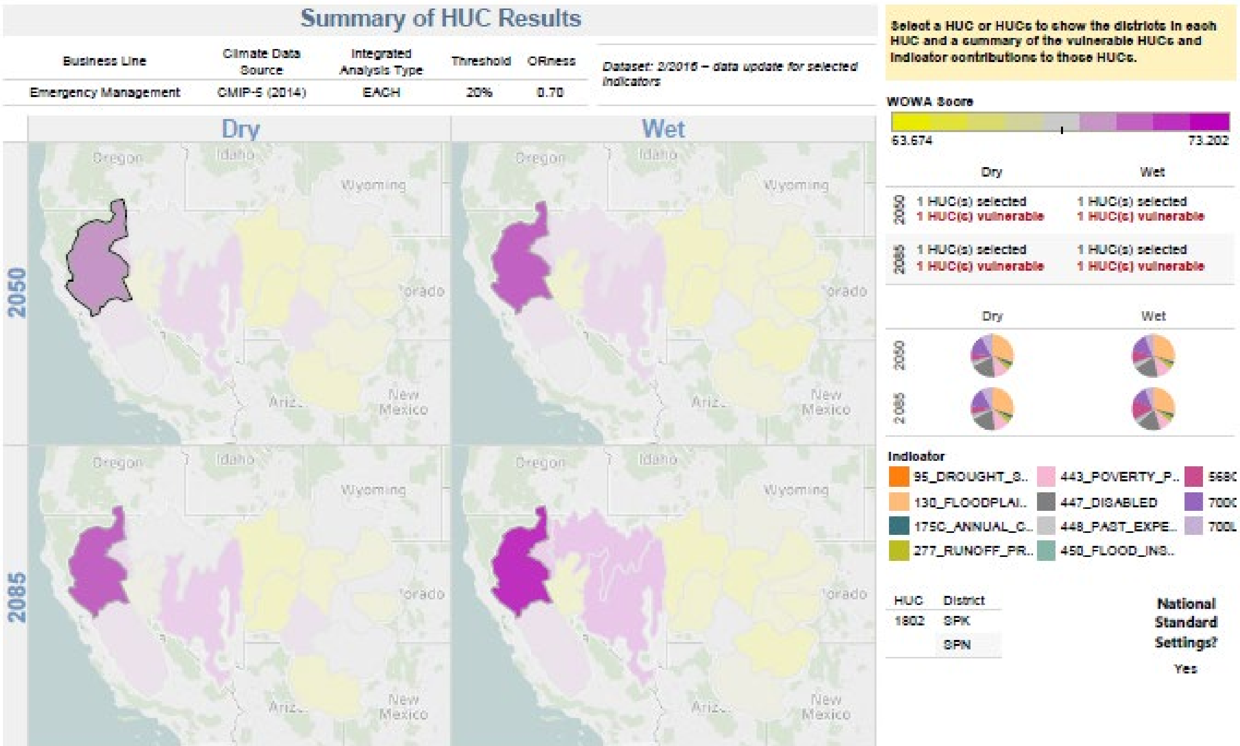

Figure 89 Emergency Management Sumary of Results. Watershed is vulnerable in all epochs and scenarios. Population in floodplain is the dominant indicator.

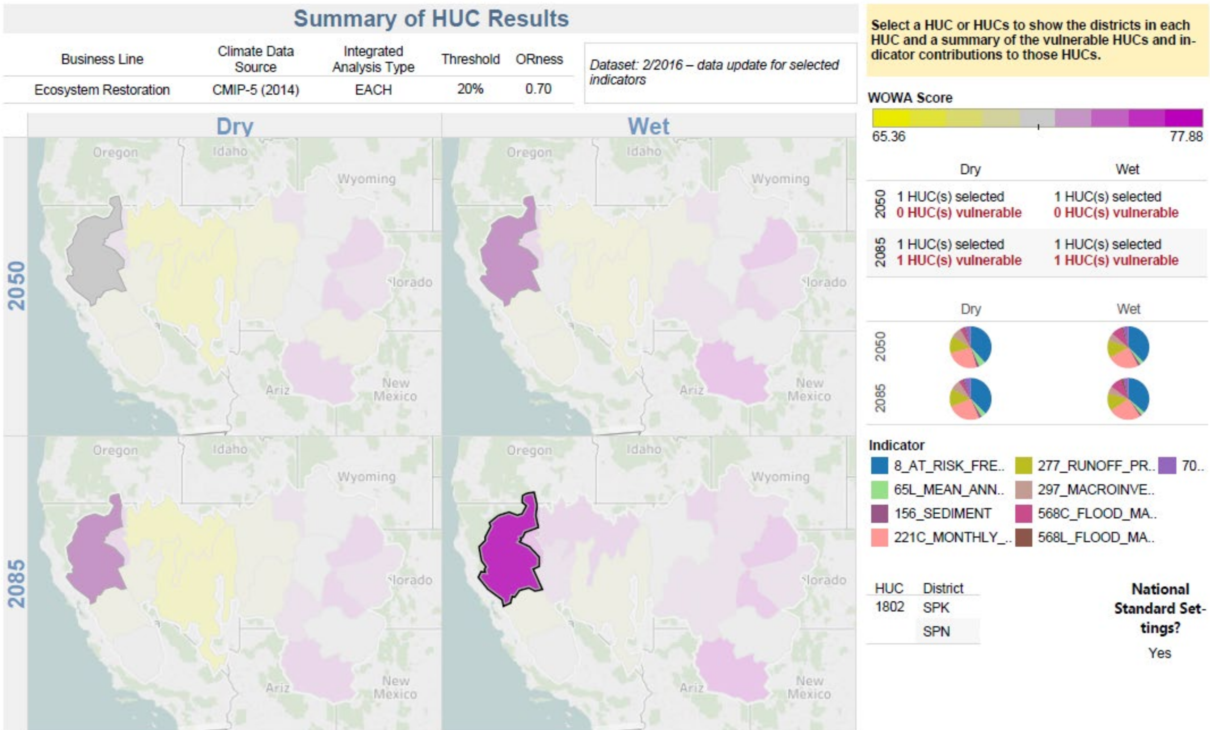

Figure 1011 Summary of Vulnerability to the Ecosystem Restoration Business Line in the Sacramento River HUC-4 Watershed. The watershed is not vulnerable relative to other watersheds during the 2050 epoch but becomes vulnerable in this business line relative to the other watersheds during the 2085 epoch. The dominant indicator appears to be the presence of at risk freshwater plant communities.

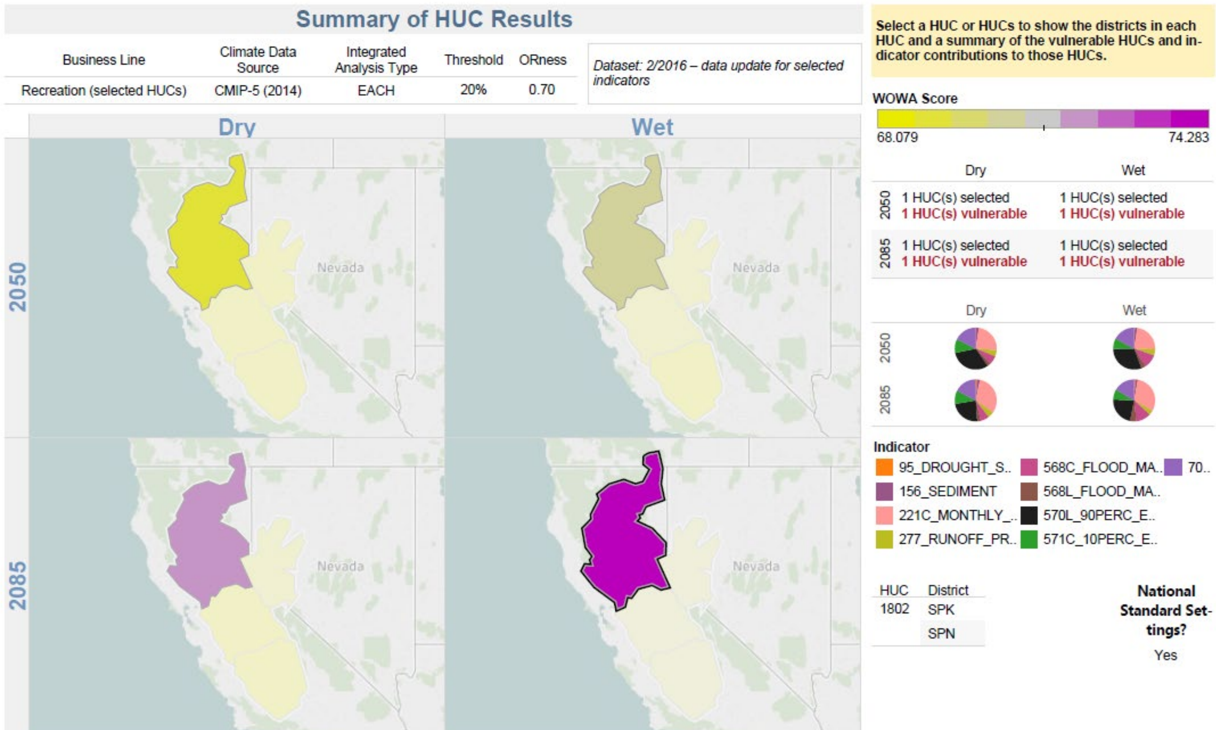

Figure 20 . Relative Vulnerability of the Recreation business line in the Sacramento River HUC-4 watershed. The watershed is vulnerable due to the possibility of decreasing runoff into the rivers as indicated by the change in low flow , monthly covariance and drought severity indicators.

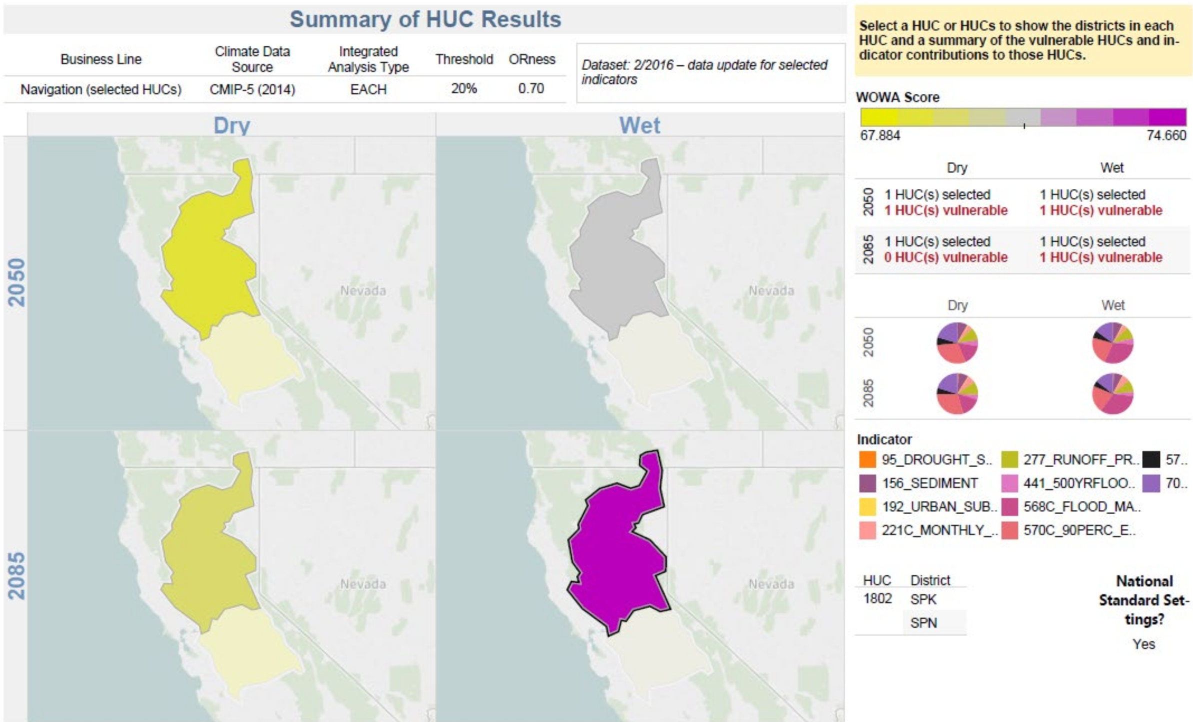

Figure 21 Relative vulnerability of the Navigation business line in the Sacramento River HUC-4 Watershed. The watershed is vulnerable relative to the other watersheds in the nation. Dominant indicators are flood magnification in wet scenarios and decreased runoff in dry scenarios.

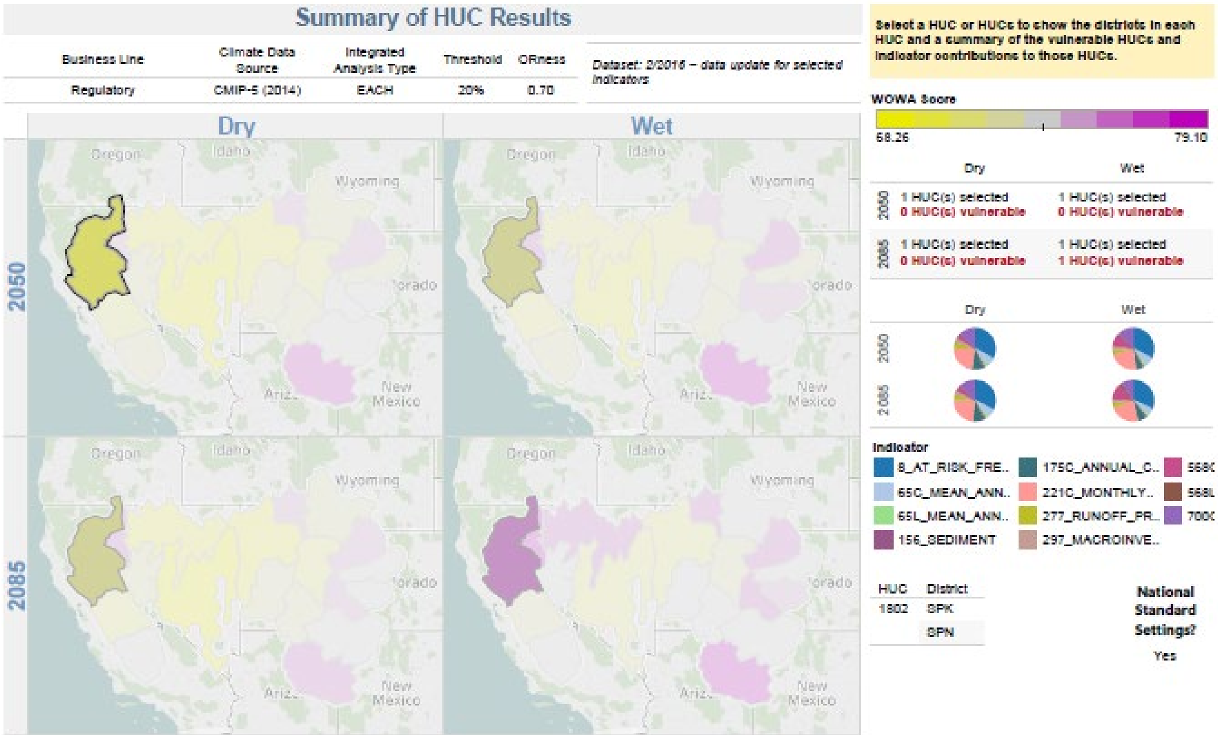

Figure 22 Summary for the Regulatory Business Line. Watershed is vulnerable in the 2085 wet scenario due to changes in monthly and annual covariance.

Note : Water Supply and Hydropower graphical information is not supplied for the Sacramento River Watershed (HUC-1802) in the Vulnerability Assessment Tool.

Table 9 Flood Risk Reduction Vulnerability Scores for the Sacramento Watershed. Flood Risk Reduction is the Primary Business Line for this Project.

Business Line	Flood Risk Reduction									
Epoch and Scenario	Base Period		Dry 2050		Wet 2050		Dry 2085		Wet 2085	
Indicator Short Name	Raw WOWA	% WOWA	Raw WOWA	% WOWA	Raw WOWA	% WOWA	Raw WOWA	%WOWA	Raw WOWA	% WOWA
175C_ANNUAL_COV	4.06	7.24%	7.05	11.88%	2.69	4.16%	6.99	11.77%	4.53	6.70%
277_RUNOFF_PRECIP	2.51	4.47%	2.77	4.67%	4.32	6.68%	2.87	4.83%	2.86	4.23%
568C_FLOOD_MAGNIFICATION	12.42	22.15%	13.53	22.77%	17.31	26.75%	13.74	23.15%	19.30	28.58%
568L_FLOOD_MAGNIFICATION	6.27	11.19%	4.44	7.48%	8.74	13.52%	4.51	7.60%	9.75	14.44%
590_URBAN_500YRFLOODPLAIN_AREA	30.81	54.96%	31.61	53.21%	31.62	48.89%	31.25	52.65%	31.08	46.04%
Total WOWA	56.07	100.00%	59.41	100.00%	64.69	100.00%	59.35	100.00%	67.51	100.00%

Table 10 Ecosystem Restoration Vulnerability Scores.

Business Line	Ecosystem Restoration									
Epoch and Scenario	Base Period		Dry 2050		Wet 2050		Dry 2085		Wet 2085	
Indicator Short Name	Raw WOWA	% WOWA	Raw WOWA	% WOWA	Raw WOWA	% WOWA	Raw WOWA	%WOWA	Raw WOWA	% WOWA
156_SEDIMENT	2.01	2.94%	1.55	2.17%	1.55	2.13%	1.55	2.13%	1.20	1.59%
221C_MONTHLY_COV	15.97	23.39%	17.83	24.95%	17.85	24.45%	18.78	25.72%	18.98	25.15%
277_RUNOFF_PRECIP	8.78	12.85%	9.66	13.52%	9.81	13.43%	10.02	13.73%	10.08	13.36%
297_MACROINVERTEBRATE	5.64	8.26%	5.64	7.90%	4.36	5.97%	5.66	7.76%	4.37	5.79%
568C_FLOOD_MAGNIFICATION	1.54	2.25%	2.16	3.02%	6.08	8.32%	2.20	3.02%	6.84	9.06%
568L_FLOOD_MAGNIFICATION	0.79	1.15%	0.85	1.20%	1.10	1.50%	0.87	1.19%	1.60	2.12%
65L_MEAN_ANNUAL_RUNOFF	3.67	5.38%	3.72	5.20%	2.15	2.95%	2.86	3.92%	2.15	2.85%
700C_LOW_FLOW_REDUCTION	2.67	3.91%	2.83	3.97%	2.82	3.86%	3.74	5.13%	2.84	3.77%
8_AT_RISK_FRESHWATER_PLANT	27.22	39.85%	27.22	38.09%	27.31	37.40%	27.32	37.41%	27.39	36.31%
Total WOWA	68.29	100.00%	71.46	100.00%	73.04	100.00%	73.01	100.00%	75.44	100.00%

Table 19 Vulnerability Assessment Scores for Emergency Management in the Sacramento Watershed.

Business Line	Emergency Management									
Epoch and Scenario	Base Period		Dry 2050		Wet 2050		Dry 2085		Wet 2085	
Indicator Short Name	Raw WOWA	% WOWA	Raw WOWA	% WOWA	Raw WOWA	% WOWA	Raw WOWA	%WOWA	Raw WOWA	% WOWA
130_FLOODPLAIN_POPULATION	23.73	33.53%	20.87	29.84%	20.69	29.43%	20.84	29.60%	20.56	28.89%
175C_ANNUAL_COV	1.41	2.00%	1.98	2.84%	1.43	2.03%	1.96	2.79%	1.94	2.73%
277_RUNOFF_PRECIP	2.40	3.40%	2.65	3.79%	2.66	3.78%	2.74	3.90%	2.71	3.81%
443_POVERTY_POPULATION	8.03	11.35%	8.19	11.71%	8.12	11.55%	8.17	11.61%	6.48	9.11%
447_DISABLED	13.50	19.07%	13.54	19.36%	13.43	19.09%	13.54	19.23%	13.36	18.77%
448_PAST_EXPERIENCE	1.82	2.57%	1.47	2.10%	1.81	2.58%	1.47	2.08%	1.45	2.03%
450_FLOOD_INSURANCE_COMMUNITIES	1.13	1.60%	1.13	1.62%	1.12	1.60%	1.13	1.61%	1.12	1.57%
568C_FLOOD_MAGNIFICATION	3.57	5.05%	3.88	5.55%	6.13	8.72%	3.94	5.60%	10.59	14.89%
700C_LOW_FLOW_REDUCTION	10.10	14.27%	10.74	15.36%	10.57	15.03%	10.88	15.45%	8.49	11.93%
700L_LOW_FLOW_REDUCTION	5.07	7.17%	5.39	7.71%	4.26	6.06%	5.46	7.76%	4.26	5.99%
95_DROUGHT_SEVERITY	0	0%	0.09	0.12%	0.10	0.14%	0.26	0.36%	0.19	0.27%
Total WOWA	70.77	100.00%	69.94	100.00%	70.32	100.00%	70.40	100.00%	71.15	100.00%

Table 20 Vulnerability Sores for Navigation in the Sacramento Watershed.

Business Line	Navigation									
Epoch and Scenario	Base Period		Dry 2050		Wet 2050		Dry 2085		Wet 2085	
Indicator Short Name	Raw WOWA	% WOWA	Raw WOWA	% WOWA	Raw WOWA	% WOWA	Raw WOWA	%WOWA	Raw WOWA	% WOWA
156_SEDIMENT	1.89	3.04%	1.87	2.91%	1.83	2.79%	1.87	2.85%	1.82	2.69%
192_URBAN_SUBURBAN	0.46	0.75%	0.51	0.80%	0.50	0.76%	0.41	0.62%	0.40	0.59%
221C_MONTHLY_COV	3.73	6.01%	4.12	6.42%	4.02	6.14%	5.48	8.37%	5.40	7.95%
277_RUNOFF_PRECIP	5.07	8.17%	8.90	13.84%	6.93	10.58%	9.18	14.02%	7.09	10.44%
441_500YRFLOODPLAIN_AREA	2.89	4.67%	2.87	4.46%	2.80	4.28%	2.86	4.37%	2.80	4.12%
568C_FLOOD_MAGNIFICATION	6.47	10.44%	6.95	10.81%	13.99	21.34%	7.04	10.75%	15.66	23.06%
570C_90PERC_EXCEEDANCE	20.81	33.58%	20.81	32.37%	20.32	31.00%	20.81	31.78%	20.30	29.89%
570L_90PERC_EXCEEDANCE	8.57	13.82%	5.33	8.30%	5.21	7.94%	4.21	6.42%	4.10	6.04%
700C_LOW_FLOW_REDUCTION	12.09	19.51%	12.71	19.77%	9.71	14.82%	12.85	19.61%	9.75	14.35%
95_DROUGHT_SEVERITY	0.00	0%	0.21	0.33%	0.24	0.36%	0.79	1.20%	0.59	0.87%
Total WOWA	61.98	100.00%	64.28	100.00%	65.55	100.00%	65.50	100.00%	67.92	100.00%

Table 21 Vulnerability Results for Recreation in the Sacramento Watershed.

Business Line	Recreation									
Epoch and Scenario	Base Period		Dry 2050		Wet 2050		Dry 2085		Wet 2085	
Indicator Short Name	Raw WOWA	% WOWA	Raw WOWA	% WOWA	Raw WOWA	% WOWA	Raw WOWA	%WOWA	Raw WOWA	% WOWA
156_SEDIMENT	1.79	2.80%	1.37	2.04%	1.36	1.98%	1.39	1.98%	1.38	1.90%
221C_MONTHLY_COV	14.60	22.91%	16.29	24.17%	16.12	23.45%	22.52	32.03%	22.44	30.95%
277_RUNOFF_PRECIP	3.05	4.79%	3.36	4.98%	3.37	4.90%	3.52	5.00%	2.68	3.70%
568C_FLOOD_MAGNIFICATION	4.19	6.57%	4.54	6.73%	7.47	10.87%	4.67	6.64%	11.01	15.18%
568L_FLOOD_MAGNIFICATION	1.36	2.14%	1.92	2.85%	2.43	3.54%	1.98	2.81%	3.59	4.95%
570L_90PERC_EXCEEDANCE	21.32	33.46%	21.57	32.00%	21.36	31.07%	16.88	24.01%	16.64	22.95%
571C_10PERC_EXCEEDANCE	7.27	11.41%	7.32	10.86%	5.71	8.30%	7.43	10.57%	5.83	8.04%
700C_LOW_FLOW_REDUCTION	10.15	15.93%	10.76	15.96%	10.59	15.40%	11.05	15.72%	8.29	11.43%
95_DROUGHT_SEVERITY	0.00	0%	0.29	0.43%	0.33	0.48%	0.86	1.23%	0.65	0.90%
Total WOWA	63.72	100.00%	67.42	100.00%	68.74	100.00%	70.31	100.00%	72.51	100.00%

Table 22 Regulatory Business Line Vulnerability Scores for Sacramento Watershed (HUC-1802).

Business Line Epoch and Scenario Indicator Short Name	Regulatory Base Period Raw WOWA	 % WOWA	 Dry 2050 Raw WOWA	 % WOWA	 Wet 2050 Raw WOWA	 % WOWA	 Dry 2085 Raw WOWA	 %WOWA	 Wet 2085 Raw WOWA	 % WOWA
156_SEDIMENT	1.18	1.73%	1.18	1.65%	0.95	1.32%	1.18	1.63%	0.95	1.27%
175C_ANNUAL_COV	4.43	6.48%	6.18	8.63%	3.62	5.00%	6.13	8.43%	4.92	6.61%
221C_MONTHLY_COV	14.62	21.40%	16.30	22.76%	16.30	22.53%	17.13	23.56%	17.21	23.09%
277_RUNOFF_PRECIP	2.50	3.66%	3.42	4.77%	2.78	3.85%	3.54	4.86%	2.84	3.81%
297_MACROINVERTEBRATE	3.27	4.79%	2.62	3.67%	2.11	2.92%	2.11	2.90%	2.11	2.83%
568C_FLOOD_MAGNIFICATION	1.56	2.28%	2.10	2.93%	6.45	8.92%	2.66	3.65%	8.97	12.04%
568L_FLOOD_MAGNIFICATION	0.69	1.01%	0.75	1.05%	1.19	1.65%	0.76	1.05%	1.66	2.23%
65C_MEAN_ANNUAL_RUNOFF	5.82	8.52%	4.71	6.58%	4.63	6.40%	4.71	6.47%	3.70	4.96%
65L_MEAN_ANNUAL_RUNOFF	1.98	2.91%	1.61	2.25%	1.57	2.17%	1.61	2.21%	1.25	1.68%
700C_LOW_FLOW_REDUCTION	8.39	12.29%	8.89	12.42%	8.84	12.22%	9.02	12.40%	7.12	9.55%
8_AT_RISK_FRESHWATER_PLANT	23.86	34.93%	23.84	33.29%	23.89	33.02%	23.87	32.83%	23.79	31.93%
Total WOWA	68.30	100.00%	71.61	100.00%	72.34	100.00%	72.72	100.00%	74.51	100.00%

Table 23 Vulnerability Results for Hydropower. Note that there are no CORPS projects in the Sacramento Watershed (HUC-1802) which are under this business line.

Business Line	Hydropower									
Epoch and Scenario	Base Period		Dry 2050		Wet 2050		Dry 2085		Wet 2085	
Indicator Short Name	Raw WOWA	% WOWA	Raw WOWA	% WOWA	Raw WOWA	% WOWA	Raw WOWA	%WOWA	Raw WOWA	% WOWA
156_SEDIMENT	2.36	4.09%	2.36	3.70%	1.76	2.70%	2.36	3.56%	1.76	2.53%
175C_ANNUAL_COV	7.80	13.49%	8.76	13.70%	5.91	9.06%	8.68	13.07%	6.49	9.33%
221C_MONTHLY_COV	24.73	42.80%	27.61	43.19%	27.46	42.14%	28.97	43.63%	29.11	41.87%
277_RUNOFF_PRECIP	12.39	21.43%	13.63	21.32%	13.75	21.09%	14.09	21.22%	14.08	20.26%
568C_FLOOD_MAGNIFICATION	3.65	6.32%	3.96	6.19%	9.02	13.84%	4.02	6.05%	10.11	14.55%
568L_FLOOD_MAGNIFICATION	1.46	2.53%	1.58	2.48%	2.70	4.14%	1.61	2.42%	3.03	4.35%
700C_LOW_FLOW_REDUCTION	5.40	9.34%	5.72	8.95%	4.24	6.50%	5.80	8.73%	4.26	6.13%
95_DROUGHT_SEVERITY	0.00	0%	0.30	0.47%	0.34	0.53%	0.88	1.33%	0.68	0.97%
Total WOWA	57.79	100.00%	63.93	100.00%	65.16	100.00%	66.41	100.00%	69.51	100.00%

Table 24 Water Supply vulnerability results. Note that there are no CORPS projects in California which have Water Supply as a project purpose.

Business Line	Water Supply									
Epoch and Scenario	Base Period		Dry 2050		Wet 2050		Dry 2085		Wet 2085	
Indicator Short Name	Raw WOWA	% WOWA	Raw WOWA	% WOWA	Raw WOWA	% WOWA	Raw WOWA	%WOWA	Raw WOWA	% WOWA
156_SEDIMENT	21.76	45.75%	15.51	27.60%	15.51	27.82%	15.51	26.38%	15.51	26.45%
175C_ANNUAL_COV	4.95	10.40%	6.10	10.86%	5.51	9.89%	6.04	10.28%	6.06	10.33%
221C_MONTHLY_COV	13.01	27.36%	24.52	43.65%	24.47	43.90%	25.74	43.78%	25.94	44.24%
277_RUNOFF_PRECIP	7.85	16.49%	9.47	16.86%	9.58	17.19%	9.79	16.66%	9.81	16.74%
95_DROUGHT_SEVERITY	0.00	0%	0.58	1.03%	0.67	1.20%	1.71	2.90%	1.31	2.23%
Total WOWA	47.56	100.00%	56.18	100.00%	55.73	100.00%	58.78	100.00%	58.62	100.00%

Conclusions:

The literature synthesis summarizing trends in observed and projected meteorology and climate changed hydrology indicate that future conditions will be warmer and possibly wetter then present conditions. This lends itself to a possible increased likelihood of large runoff events due to increases in the moisture content of storms. Note: The Cache Cr watershed does not have a significant snowpack and changes in the snowline (demarcation between where precipitation falls as rain versus snow) is not expected to have any significant impact on the hydrology. However, the impact that of the increased moisture content of storms will have on flooding in the Cache Cr Basin is uncertain. At this point, the USACE Nonstationarity Detection Tool is not identifying any significant nonstationarities in either of the datasets analyzed as part of this study, and the Climate Hydrology Assessment Tool is not detecting any trends in the recorded peak flow data at either gage location assessed. However, statistically significant increasing trends are identified in the projected, climate-changed annual maximum monthly streamflow values projected for the HUC 1802 Sacramento River Watershed as part of this analysis. The vulnerability assessment conducted as part of this study indicates that the main indicators of vulnerability in terms of flood damage reduction are flood magnification (ratio of the annual runoff exceeded 10% of the time during the given epoch to the same during the base period) and the urban development in the 0.2% exceedance floodplain. The Sacramento River Watershed is identified as being relatively vulnerable to increased flood risk due to climate change across all subsets of traces and epochs of time analyzed. Droughts are expected to become more common and severe, which could increase the chances of fires and the burning of significant acreage in the watershed in the future. This could lead to increased runoff from the burn areas.

The study evaluated a focused array of alternatives. Including the effects of climate change in the economic analysis would increase the estimated net benefits of all alternatives in the focused array. Alternative 2A is likely to be the least sensitive to climate change because the height is less sensitive to increased water surfaces related to climate change. Alternative 2A is a levee that runs on the north side of the urbanized portion of the City of Woodland. The levee runs through mainly rural areas and could be raised in height to accommodate larger floods if the hydrology changes in the coming decades. The team should consider and evaluate whether there are any further actions that can be taken in the context of the current study to make the community more resilient to higher future flows. Such actions might include flood proofing or acquiring structures, developing evacuation plans, land use planning, changes to levees and levee alignment and adjusting elevation or spacing of mechanical features (e.g., pump stations), among other actions. Climate change risks should be detailed in the project risk register.

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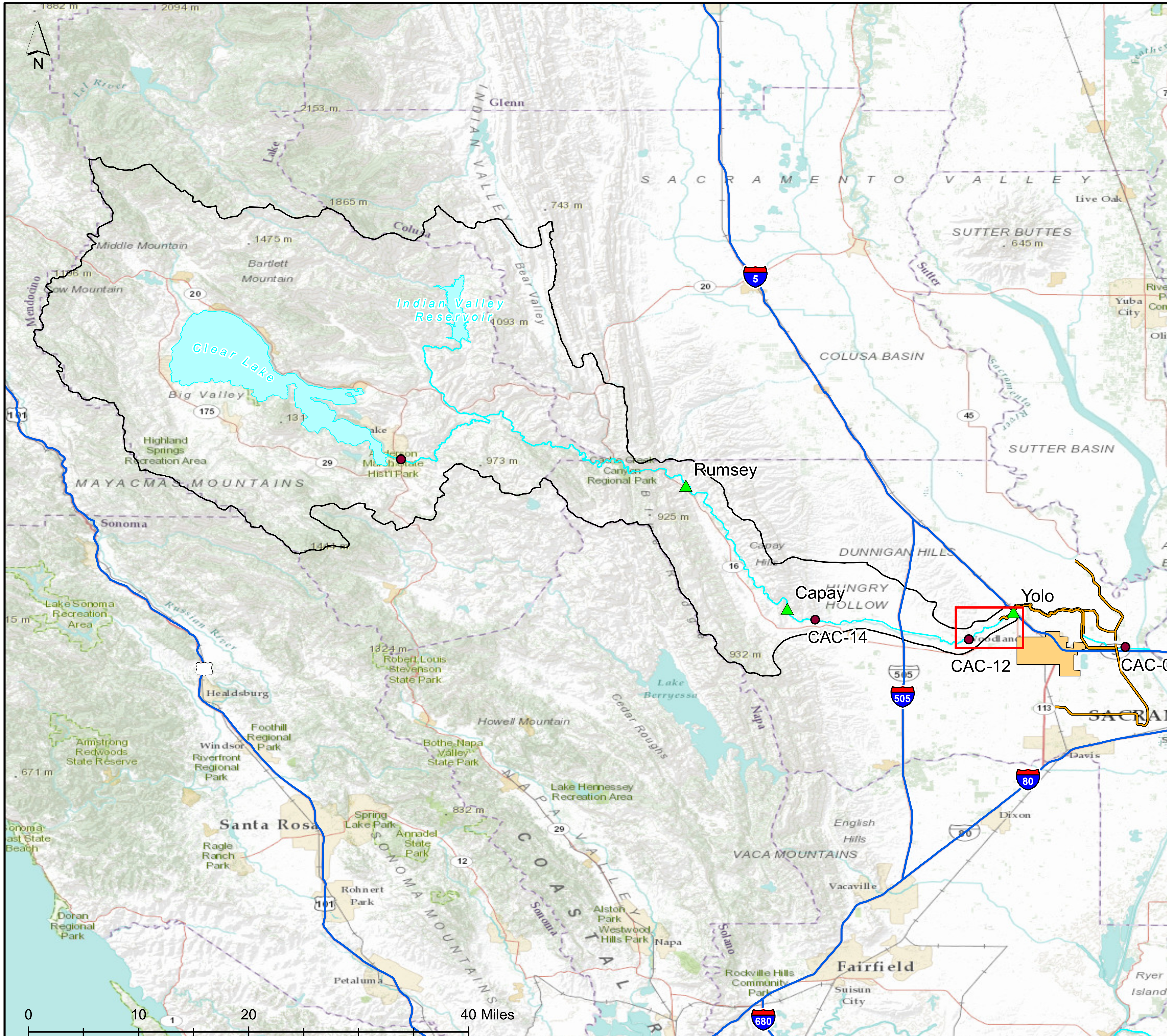
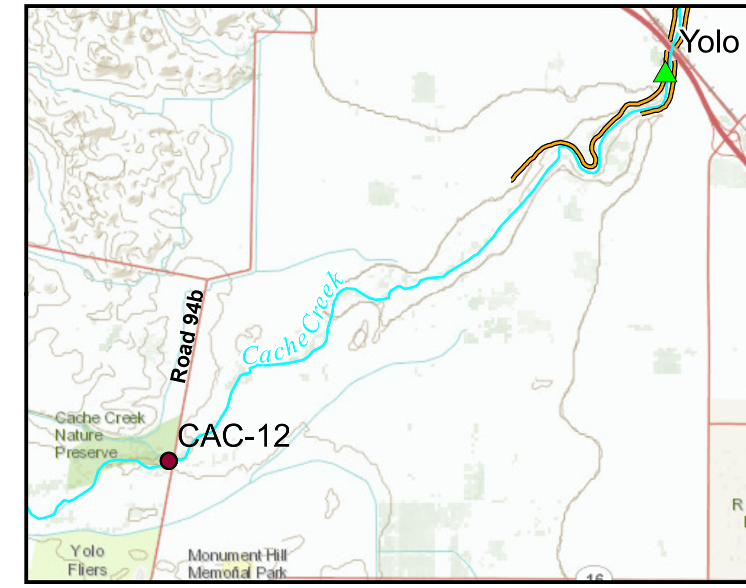




Stream Gages

Analysis Points

Levees

Cache Creek River

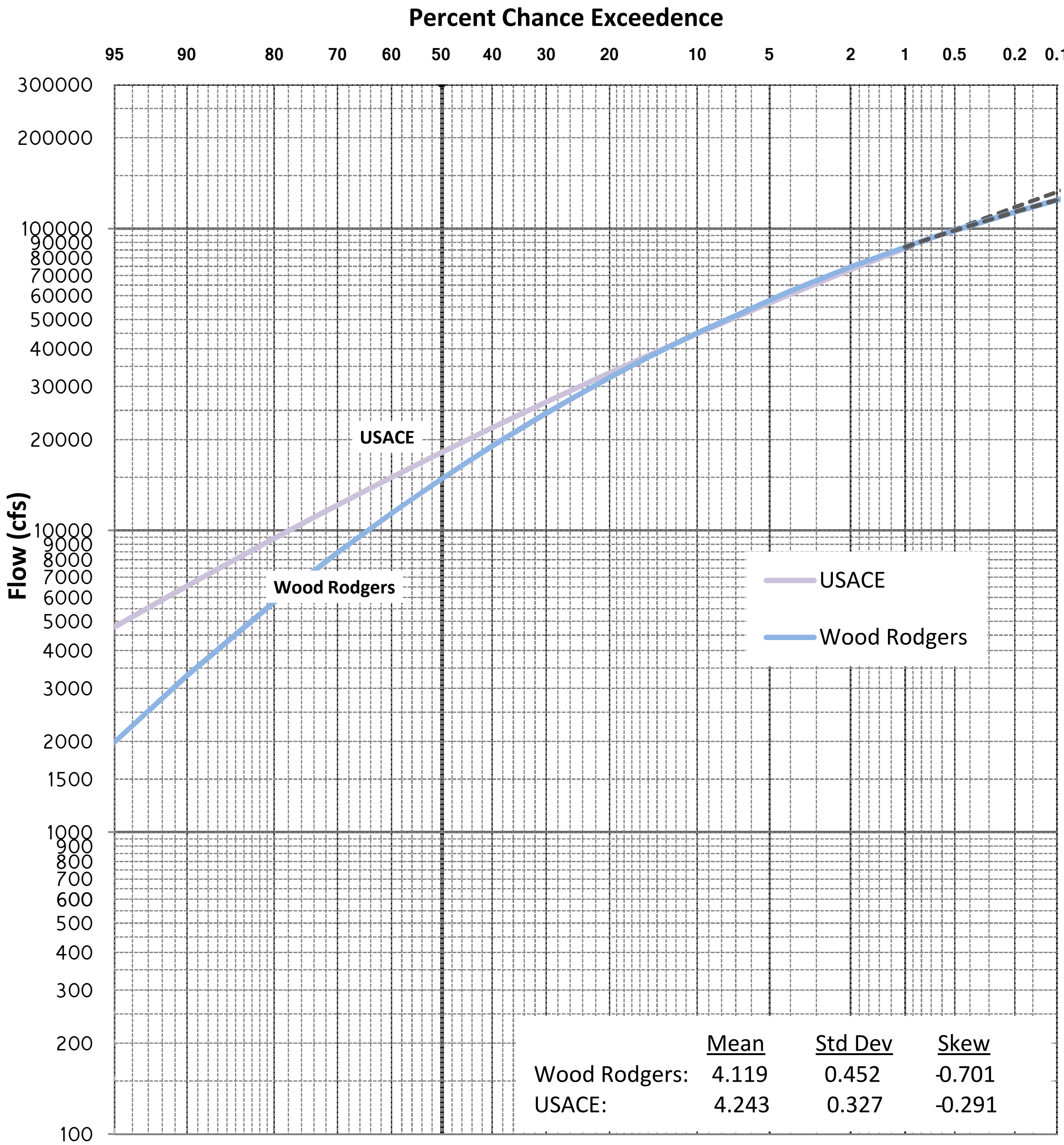
City of Woodland

Data Source:
1. U.S. Army Corp of Engineers. National Levee Database (NLD)
2. U.S. Geological Survey National Hydrograph Dataset (NHD)
3. Basemap: ESRI

CACHE CREEK, CA

CACHE CREEK WATERSHED PLATE 1

U.S. ARMY CORPS OF ENGINEERS SACRAMENTO DISTRICT



	Mean	Std Dev	Skew
Wood Rodgers:	4.119	0.452	-0.701
USACE:	4.243	0.327	-0.291

NOTES:

1. Computed Probability
2. Drainage area: 955 sq. mi.
3. Wood Rodger's curve: WY 1943-2008
4. USACE's curve: 1943-2011

CACHE CREEK STUDY
CACHE CREEK, CALIFORNIA

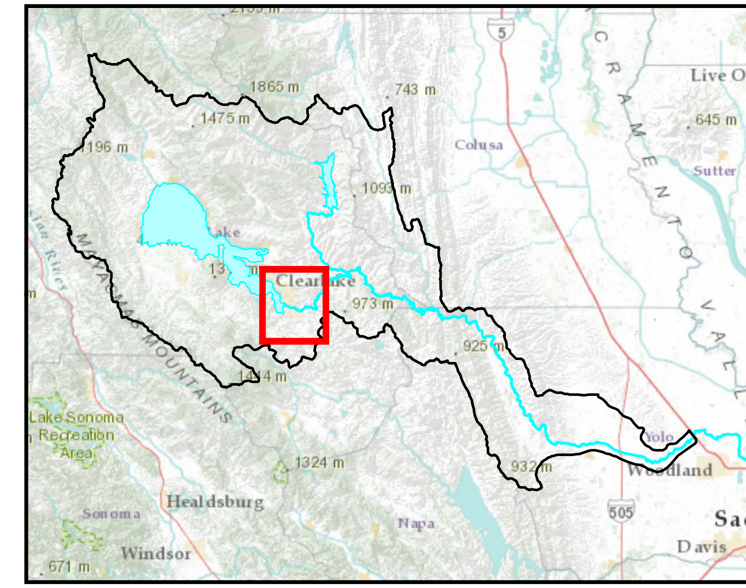
UNREGULATED PEAK FLOW FREQUENCY CURVES

COMPARISON AT RUMSEY

PLATE 2

U.S ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

22-Feb-13



Grigsby Riffle

Clear Lake Dam

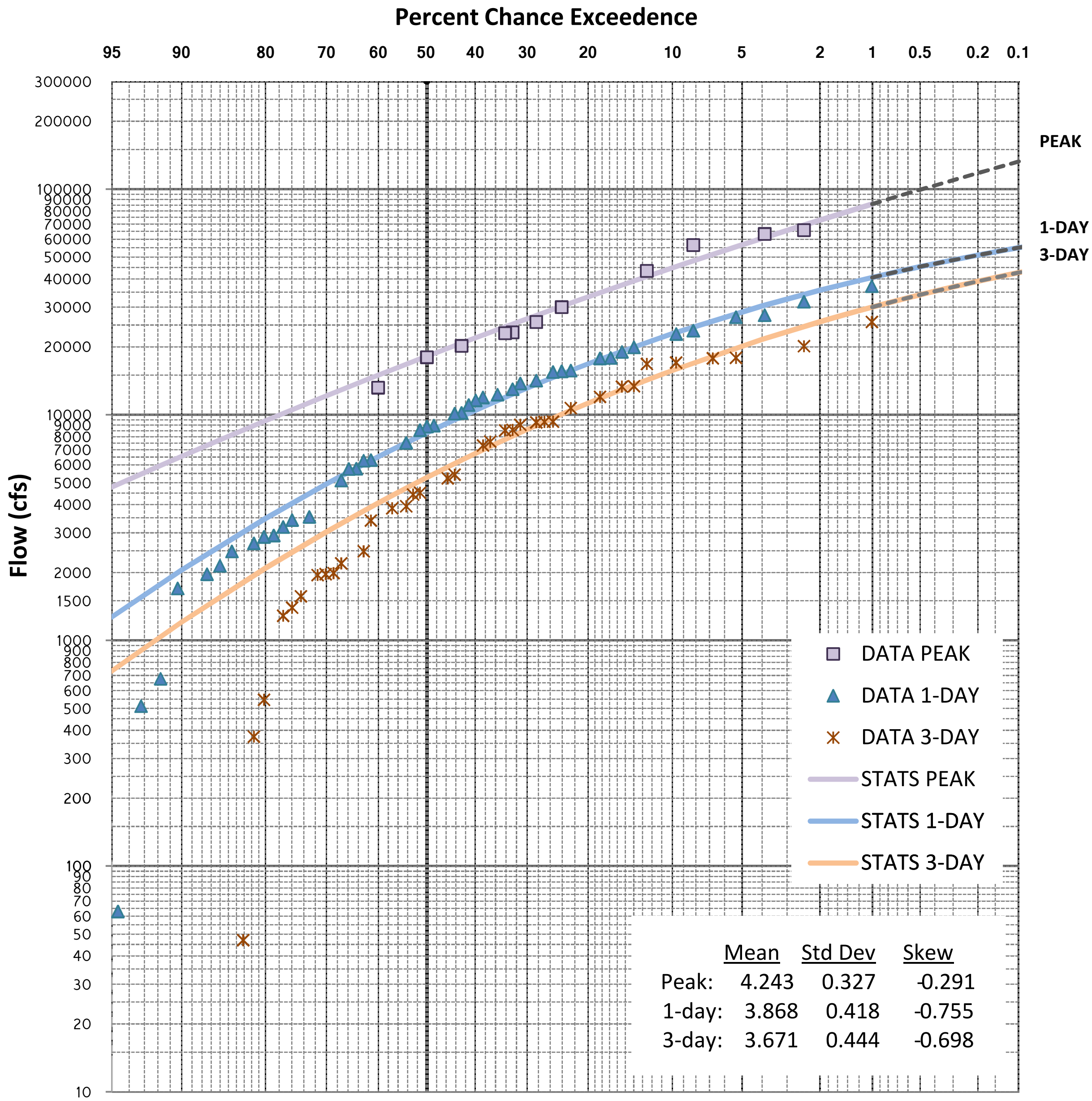
Cache Creek River

Data Source:
1. U.S. Army Corp of Engineers.
National Levee Database (NLD)
2. U.S. Geological Survey
National Hydrograph Dataset (NHD)
3. Basemap: ESRI

CACHE CREEK, CA

CLEAR LAKE - GRIGSBY RIFFLE
PLATE 3

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT



NOTES:

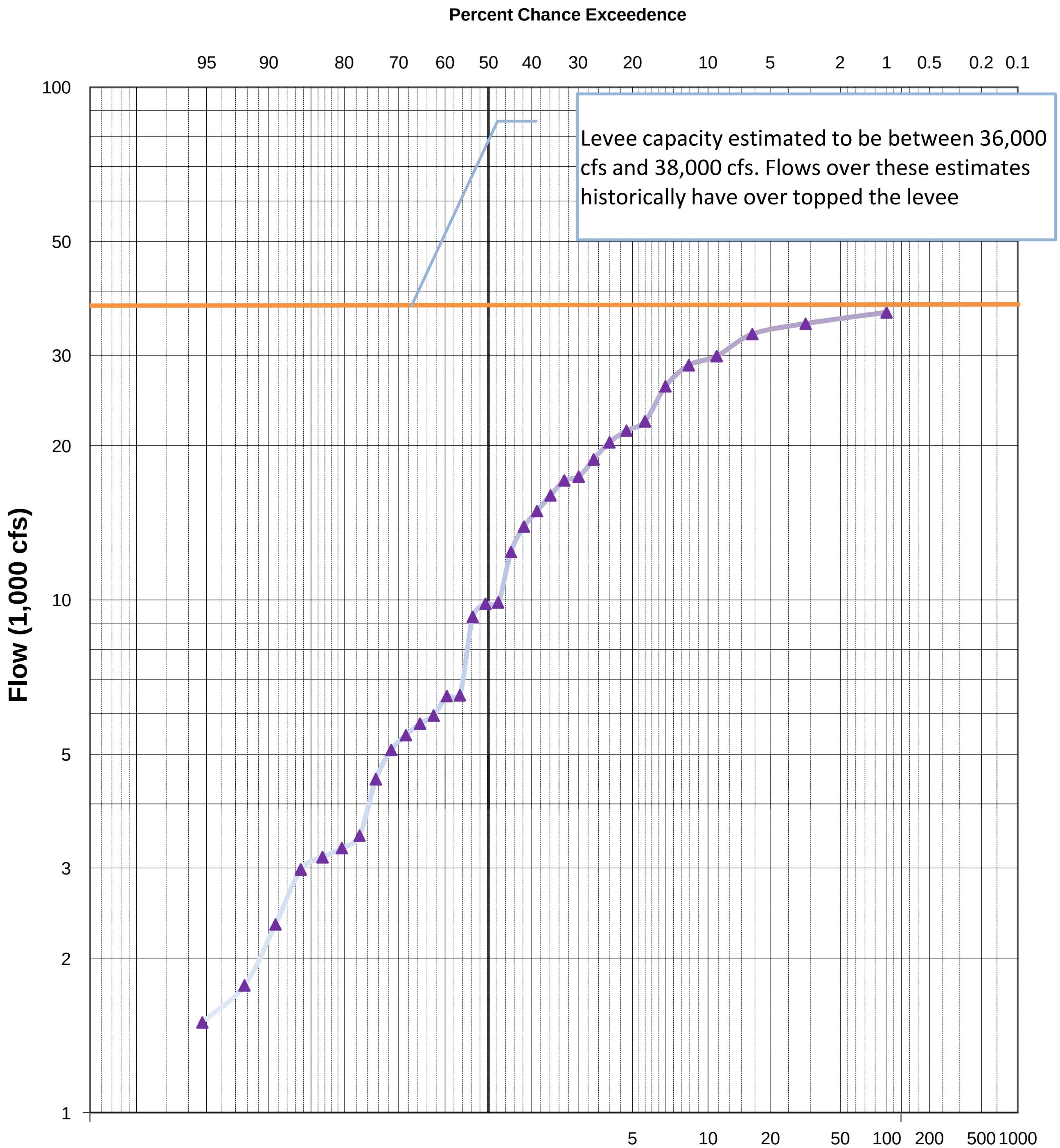
1. CDEC ID: RUM
2. Median plotting positions.
3. Computed Probability
4. Drainage area: 955 sq. mi.
5. Historical Maximum Discharge: WY 1943-2011.
6. WY 1977 low outlier

CACHE CREEK STUDY
CACHE CREEK, CALIFORNIA

UNREGULATED FREQUENCY CURVES
CACHE CREEK AT RUMSEY
PLATE 4

U.S ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

25-Feb-13



NOTES:

1. Drainage Area: 1,139 sq mi.
2. Period of Record: 1978-2010.
3. Historical Record: 1943-2012
4. 1995 Historical Peak: 34,600 cfs
5. USGS #: 11452500.
6. Median plotting position

CACHE CREEK STUDY
YOLO, CALIFORNIA

PLATE 5

CACHE CREEK AT YOLO

REGULATED FREQUENCY CURVES

1978-2010

U.S ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

3/4/2013

ESSENTIAL FISH HABITAT NO EFFECT DETERMINATION

APPENDIX L

LOWER CACHE CREEK FEASIBILITY STUDY

Yolo County, CA

December 2019

United States Army Corps of Engineers
Sacramento District

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

CESPK-PDR-A July 9, 2019

MEMORANDUM FOR RECORD

SUBJECT: No Effect Determination call on Essential Fish Habitat in Goodnow Slough-Lower Cache Creek for the Lower Cache Creek, Yolo County, Woodland Area, California General Investigation Feasibility Study.

USACE Employees:

Keleigh Duey – Environmental Manager
Robert Chase – Senior Fisheries Biologist

1. **Study Location:** The approximate 300-acre Lower Cache Creek Feasibility Study area is the lower portion of Goodnow Slough-Lower Cache Creek, a perennial tributary to the Sacramento River, located Northeast of Interstate 5, near the City of Woodland in Yolo County, California, Latitude 38.68138°, Longitude -121.71104°.

2. **Project Purpose and Need:** The overall project purpose consists of improving existing levee segments and constructing a new levee to alleviate flooding concerns in the City of Woodland. The U.S. Army Corps of Engineers, Central Valley Flood Protection Board, Department of Water Resources, and City of Woodland have identified the need for levee improvements in the vicinity.

3. **Environmental Baseline:** The study area consists of the lower portion of Goodnow Slough-Lower Cache Creek a perennial tributary to the Sacramento River. The study site is located within the Hydrologic Unit Code 1802011 and has been identified as Essential Fish Habitat (EFH) for Pacific Chinook Salmon (*Oncorhyncus tshawytscha*). Designated Critical Habitat is not found within the study area. The study site is part of an existing flood control project consisting of levees, maintenance roads and flood control weir structures along Lower Cache Creek and the Cache Creek Settling Basin (CCSB). Due to fluctuating flows, bypass drainage, fish passage impediments and upstream gravel mining operations, fluctuating flows, the proposed study site does not provide suitable passage, rearing, or spawning habitat for Pacific Salmonids.

4. **Project Description.** The Lower Cache Creek Feasibility Study would reduce flood risk to the Woodland area by constructing a new levee north along the city limit line. This feature would redirect floodwaters that have potential to overtop and erode the existing levees along Cache Creek during storm events. The new levee would feature a 175 foot wide trapezoidal drainage ditch on the waterside to carry flood flows southeast to the CCSB. The drainage canal would terminate in an engineered 15 acre detention basin, which performs to pass floodwaters over a new concrete weir into the CCSB. A

seepage berm would be constructed on the landside of the new levee. Existing CCSB levees would be rehabilitated by installing cutoff walls, preventing underseepage in a high flow event or during long-term inundation. The proposal also includes roadway improvements and raises along the new levee alignment, and the installation of culverts, closure structures, and other small flood risk management structures.

5. **Project Impacts:** There are no expected impacts to Cache Creek as the levee improvements are set back from the natural channel and riparian corridor. Modifications to the existing levee would consist of rehabilitating the CCSB southwest levee by constructing a 45-foot deep cutoff wall through the levee, and a portion of the southern levee of the CCSB would be rehabilitated with a 60-foot deep cutoff wall. A 3,000 foot long section of the west levee of the CCSB would be degraded to accommodate for a concrete weir that would be placed on top of the existing adjacent grade. The current impact footprint does not contain shaded aquatic riverine habitat, habitat areas of particular concerns or any EFH elements. Instead the impact area consists of concrete, debris, dirt and other miscellaneous fill material from previous constructed features.

The impacts are like-for-like meaning fill material will be taken out and replaced with the same type of fill material i.e. dirt, concrete. There will be no loss of, or impact to habitat under the EFH jurisdiction within the study area.

6. **EFH Determination:** A no effect determination has been made for EFH in the study area.

Robert Chase
Senior Fisheries Biologist
Sacramento District

PHASE 1 ENVIRONMENTAL SITE ASSESSMENT

APPENDIX M

LOWER CACHE CREEK FEASIBILITY STUDY

Yolo County, CA

December 2019

United States Army Corps of Engineers
Sacramento District

Phase I Environmental Site Assessment
(ASTM 1527-13/ER 1165-2-132)

Lower Cache Creek
Yolo County, Woodland Area, California
General Investigation Feasibility Study
October 2014

Prepared By:
Environmental Chemistry Section
U.S. Army Corps of Engineers, Sacramento

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Appendices

Appendix A - Map

Appendix B - EDR Records Search Report

ACRONYMS

AST	Aboveground Storage Tank
ASTM	American Society for Testing and Materials
CA FID	California Facility Inventory Database
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESPK	US Army Corps of Engineers, Sacramento District
CHMIRS	California Hazardous Material Incident Reporting System
CREC	Closed Recognized Environmental Condition
CS	Contaminated Sites
DB	Database
DTSC	Department of Toxic Substance Control
ED-ECS	Engineering Division - Environmental Chemistry Section
ED-EDS	Engineering Division – Environmental Design Section
EDR	Environmental Data Resources Inc
ER	Engineering Regulation (USACE)
ERNS	Emergency Response Notification System
ESA	Environmental Site Assessment
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
GRR	General Reevaluation Report
HIST	Historical UST Registered Database
HREC	Historical Recognized Environmental Condition
HTRW	Hazardous, Toxic or Radioactive Waste
IAW	In accordance with
LUST	Leaking Underground Storage Tank
MBTA	Migratory Bird Treaty Act
NEPA	National Environmental Policy Act
NFA	No Further Action
NPL	National Priority List (Superfund List)
PM10	Particulate Matter 10microns or less
RCRA	Resource Conservation and Recovery Act
RD1000	State of California Reclamation District 1000
SLIC	Spill, Leaks, Investigation and Cleanup Cost Recovery
SWF/LF	Solid Waste Facilities/Landfill Sites
SWIS	Solid Waste Information System
SWRCB	State Water Resources Control Board
TSCA	Toxic Substance Control Act
USEPA	US Environmental Protection Agency
USGS	US Geological Survey
UST	Underground Storage Tank
VCP	Voluntary Cleanup Program
WDS	Waste Discharge System
WMUDS	Waste Management Unit Database System

1.0 EXECUTIVE SUMMARY

This Environmental Site Assessment (ESA) was conducted to confirm any known contamination due to Hazardous substances or petroleum products in, on, or within the Lower Cache identified project boundary in conformance with ASTM 1527-13, Standard Practice for Environmental Site Assessment. Currently, the Lower Cache Creek project boundary includes an evaluation of eight proposed alternatives to reduce flood risk damages. The objective of this site assessment is to update the 2000 USACE Environmental Design Section ESA, Draft Feasibility Report for Potential Flood Damage Reduction Project, May 2000.

An earlier ESA was completed on the Lower Cache Creek site in May 2000 by USACE under ASTM 1527-05 guidance. The site boundary included approximately 12 miles on both sides of Cache Creek. The Site starts above the town of Yolo at County Road 94B and ends at the Cache Creek Settling Basin near Yolo Bypass. A May 2000 records search concluded that there was no apparent HTRW contamination that would impact project activities.

An ESA was completed for Mid Valley Area, Phase III Levee Reconstruction project in July 2012. This project was located in the upper northeastern section of the Site and consisted of six sites that were located southeast of Knights Landing. The sites were bounded by County Road 102 on the west, Karnak Road on the north, Becker Road on the east and County Road 17 on the south. The 2012 ESA identified five RECs – two dry gas well facilities and three pole-mounted power transformers.

The ESA contained herein has been completed under the updated guidance of ASTM 1527-13. The record search included 53 Federal databases (DBs), 41 State/Local DBs, 4 Tribal databases (DBs), and 3 EDR proprietary DBs. The ESA did not identify any closed recognized environmental conditions (CRECs) or historical recognized environmental conditions (HRECs) during this assessment within the proposed project boundary area.

One REC was identified on GeoTracker non regulatory cases closures. The GeoTracker listed as “Active” several no regulatory closures as small leaks or spills. The non closures will not impact the project alternatives.

2.0 INTRODUCTION

2.1 Scope of Report

The purpose of this ESA is to identify recognized environmental conditions, including the presence of any hazardous substances or petroleum products under conditions that indicate an existing release, a past release, or the material threat of a release into structures, the soil, groundwater and/or surface within the project site boundary of lower Cache Creek. This report addresses HTRW within the study area which may impact the proposed project. This report was prepared in accordance with ASTM E-1527-13, Standard Practice for Environmental Site Assessment: Phase I Environmental Site Assessment Process; ER 1165-2-132; Hazardous, Toxic, and Radioactive Waste (HTRW) Guidance for Civil Works Projects; and EC 1105-2-206, Project Modifications for Improvement of the Environment.

The USACE defines hazardous, toxic, and radioactive wastes (HTRW) as the following:

"Except for dredged material and sediments beneath navigable waters proposed for dredging, for purposes of this guidance, HTRW includes any material listed as a "hazardous substance" under the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. 9601 et seq. (CERCLA). (See 42 U.S.C. 9601(14)). Hazardous substances regulated under CERCLA include "hazardous wastes" under Sec. 3001 of the Resource Conservation and Recovery Act, 42 U.S.C. 6921 et seq.; "hazardous substances" identified under Section 311 of the Clean Air Act, 33 U.S.C. 1321, "toxic pollutants" designated under Section 307 of the clean Water Act, 33 U.S.C. 1317, "hazardous air pollutants" designated under of the Clean Air Act, 42 U.S.C. 7412; and "imminently hazardous chemical substances or mixtures" on which USEPA has taken under Section 7 of the Toxic Substance Control Act , 15 U.S.C. 2606; these do not include petroleum or natural gas unless already included in the above categories. (See 42 U.S.C. 9601(14).)"

The USACE requires an assessment to address the existence of, or potential for, HTRW contamination on lands, including structures and submerged lands in the study area, or external HTRW contamination, which could impact, or be impacted by, a project (USACE 1992).

A literature search, interviews, and on-site investigation were conducted in order to compile information for this ESA. This assessment did not include sampling or analysis of soil or groundwater.

2.2 Detailed Scope-of-Services

The ESA update consists of two parts: (1) a review of the relevant regulatory list of REC sites, historical literatures and websites; (2) interviews with people who are knowledgeable about project boundary area.

2.3 Significant Assumptions

The following significant assumptions were made when conducting this ESA in February 2014:

- All information that was obtained for this ESA, i.e., the regulatory list of REC sites, historical literatures, photographs, websites, interviews, and site reconnaissance, is considered to be the available information about the project sites and their surrounding areas at this time.
- No information search, no matter how extensive and exhaustive it may be, can absolutely identify all hazardous substances or petroleum products or all conditions above and below the ground.

- Pesticides (e.g. DDT) and herbicides (e.g. Dinoserb, Dalapon, MCPA or 2-methyl-4-chlorophenoxyacetic acid, etc.) were likely use on nearby farmlands and marshes for pest and weed control purpose. It may be assumed that some concentrations of the substances exist today. Pesticides and herbicides routinely and historically applied for control purpose are considered to be in a de minims condition as defined by ASTM 1527-05 and are not considered REC.

2.4 Limitations and Exceptions

The findings and conclusions of this ESA are based only on the best information that is available during the time of the assessment. The possibility exists where subsequent information might be discovered and could alter the findings and conclusion of this assessment report. According to AAI standards, this ESA is valid for one year from its date of completion.

2.5 Special Terms and Conditions

The current project does not involve the purchase of property for commercial purpose, and as such, the conditions for the ASTM specifications are not completely applicable. The ASTM standard is used as a guide and sections that are not applicable are deleted or modified to meet the requirements of this project. Where applicable, the format and guidance recommended by ASTM is followed as stated in the standard E 1527-05.

2.6 User Reliance

This Phase I ESA is intended for use only as the complete document, may be distributed and relied upon by USACE and its assignee. This report is subject to the Significant Assumptions, Limitation and Exception, and other restrictions as stated in Section 2.3 – 2.5.

3.0 PROJECT SITE AND DESCRIPTION

3.1 Location

For the purpose of this ESA, Cache Creek, the levees, and the settling basin plus a 100-foot construction zone on the land side of the project, will be referred to as “the site”. A 1.5 mile corridor on the land side of the site, in accordance to ASTM-E 1527-94, shall be referred to as "the study area". The project boundary encompasses approximately 202 square miles.

3.2 Project Boundary Characteristics

The project boundary, located in Yolo County, is primarily rural and sparsely populated, except for the town of Yolo and woodland. Generally the project boundary area consists of flat agriculture, pasture, and undeveloped land. The creek serves as a source of water for domestic use, farming, cattle grazing, gravel mining, other industrial uses, and recreation. Approximately 3 miles within the project study boundary, from County Road 94B to the town of Yolo, has been the site of gravel mining since the late 1800's. Approximately 90% of the top of the levees are accessible by vehicle but are limited to public access by locked gates.

Yolo County is known to naturally contain high levels of mercury in some areas, including the Cache Creek watershed. The naturally elevated levels of mercury under the right conditions may readily be transformed into methyl mercury. Mercury species have been demonstrated to move into aquatic food chain resulting in unacceptable high mercury levels in edible fish. Methyl mercury is a developmental toxin for both humans and wildlife.

3.3 Descriptions of Improvements within Project Boundary

In 2012, CESPK and Central Valley Flood Protection Board (CVFPB) reconstructed six levee sites in Area 3. The reconstruction on the selected levees included the following work: (1) installing a slurry wall in the center of levee; (2) relocate drainage ditch away from the landslide levee toe; (3) reconstruct and flatten the landside levee slopes; (4) install landside stability berm; and (5) restore the levee crown heights.

4.0 HISTORICAL INFORMATION

4.1 Prior Environmental Site Assessment

- An ESA of a property site within the present project boundary was completed in May 2000 as part of a feasibility report for potential flood damage reduction study for Lower Cache Creek, Yolo County, California City of Woodland and vicinity, by USACE (EDS, May 2000). The finding for this ESA was that there was no apparent HTRW contamination that would impact activities within the project area.

- HTRW Phase I Environmental Site Assessment was completed for Mid Valley Area, Phase III Levee Reconstruction project in July 2012. The project site consisted of six sites that were located southeast of Knights Landing. The sites were bounded by County Road 102 on the west, Karnak Road on the north, Becker Road on the east and County Road 17 on the south. ECS identified five RECs – two dry gas well facilities and three pole-mounted power transformers.

- In 2005, the Central Valley RWQCB adopted a TMDL for mercury in Cache Creek and its tributaries. Cache Creek is also listed on the Clean Water Act Section303 (d) list as impaired for unknown toxicity.

4.2 Historical Literatures and Website Queries

CESPK-ED-EC reviewed the following sources of the historical literatures and website queries for known REC sites:

1. http://geotracker.waterboards.ca.gov
2. http://www.envirostor.dtsc.ca.gov/public/
3. http://www.epa.gpv/superfund/sites/cursites/
4. http://www.dtsc.ca.gov/sitecleanup/
5. Lower Cache Creek, Yolo County, CA, City of Woodland and Vicinity, Draft Feasibility Report for Potential Flood Damage Reduction Project, USACE, May 2000.
6. Cache Creek North Levee Setback Project Critical Erosion Site LM 3.9L and LM 4.2L, Yolo County, California, Kip Young, CVFPB, April 2013.
7. Review of Yolo County Lower Cache Creek Water Quality, G. Fred Lee and Associates, September 2002.
8. Technical Memorandum No. 8, Special Design Study, Flood Mitigation Evaluation, West Yost Associates - Consulting Engineers, June 3, 2013.

5.0 RECORDS REVIEW

5.1 ASTM 1527-13 Requirements

ASTM E 1527-13 requires that an ESA consists of a "diligent" and reasonable search of all available information that pertains to the current and past uses of the project site and its surrounding areas, the waste disposal practices, and environmental compliance history.

5.2 Standard Environmental Records Sources

The search consisted of reviewing federal, state, and county records that included but were not limited to Confirmed and Suspected Contaminated Sites (CSCS), Leaking Underground Storage Tank (LUST), Registered Underground Storage Tank (RUST), Toxic Cleanup Program Register, EPA Resource Conservation and Recovery (RCRA) Generator's list, EPA Facility Index System (FINDS), RPA comprehensive Environmental Response Compensation and Liability Act (CERCLA) database, EPA National Priority List (NPL), and EPA Emergency Response Notification System (ERNS) list.

5.3 Environmental Data Resources Records Review

On January 23, 2014, Environmental Data Resources, Inc. (EDR, Milford, CT) conducted a search of 100 publicly available databases (54 Federal, 41 State/Local, 5 Tribal, and 3 Proprietary). In addition, the assessor reviewed the California EPA State Water Resource Control Board GeoTracker Records.

5.4 Historical use Information of Project Boundary

The lower Cache Creek geology consists mainly of alluvial deposits and Tehama gravels on a sequence of shale and sandstone. Braided streams produce large gravel deposits. The study area is primarily rural and sparsely populated except for the city of Woodland. The study area consist of agriculture, pastures, and undeveloped land. The creek serves as a source of water for domestic use, farming, cattle grazing, gravel mining, industry uses, and recreation.

6.0 SITE RECONNAISSANCE

6.1 USACE ESA Phases I - Lower Cache Creek March 2000

On 27 and 28 March 2000, Bruce VanEtten from the Environmental Design Section (EDS), USACE – Sacramento District visited the study area. The purpose of the site visit was to identify recognizable environmental concerns in connection with the project area. Common environmental concerns that were assessed included the following: asbestos, construction and demolition debris, drums, landfill/ solid waste disposal sites, pits, ponds/lagoons, wastewater, fill dirt, depressions, mounds, artificial structures, PCB containing transformers, and the presence or likely presence of any hazardous substance within the project area.

6.2 USACE ESA Phase I – Mid-Valley Area Phase III Reconstruction May 2012

Mid-Valley Area, Phase III, Levee Reconstruction reconnaissance **(**May 22, 2012). The Mid-valley area is located in the upper northeast corner of the proposed project boundary. ECS limited their assessment features and conditions to those that were visible from public access.

6.3 ECS will perform a site reconnaissance for this project upon the final alternative selection. The site assessment observations will be included as an addendum to this ESA.

7.0 INTERVIEWS

7.1 Interviews were conducted with individuals knowledgeable of the project boundary. Information obtained from the interviews are shown in the emails below and in the in the appropriate sections of this report.

7.2 The following people were interviewed via emails:

- Patrick Morris, Central Valley Regional Water Quality Board, 916-464-4621, ppmorris@waterboards.ca.gov.

EXTERNAL RE HTRW Sites andor Environmental Spills (UNCLASSIFIED).txt

- Jennifer Iida, Department of Water Resources, 916-653-3925, jiida@water.ca.gov.

EXTERNAL RE HTRW Sites andor Environmental Spills1 (UNCLASSIFIED).txt

- C. Gardner, Cache Creek Conservancy Organization, 530-661-1070, cgardner@cachecreekconservancy.org.

- Noel Romanhf, noelromanhfd@yahoo.com

EXTERNAL Map Details.txt

- Shoji, Kerry, Information @ EPA, shoji.kerry@epa.gov

EXTERNAL Re HTRW Sites andor Environmental Spills - Cache Creek.txt

8.0 FINDINGS

8.1 Known or Suspected RECs

8.11 The GeoTracker records list a number of environmental cases as “active” with no regulatory closures. Example, Cache Creek Chemicals, Inc (SLT5S3533665) located at 40261 CR 18C (off 113N @ I-5), Woodland, CA, has been identified as a REC due to a lack of regulatory closure. The chemical of potential concern has been identified as fertilizer.

8.12 During two previous Phase I Environmental Site Assessments, EDS and ECS personnel identified pole mounted electrical transformers as potential REC sites.

8.2 Controlled Recognized Environmental Conditions (CRECS)

ECS’s review of the EDR records search and a search of the state GeoTracker listing do not identify any CRECs within the proposed project boundary.

8.3 Historical Recognized Environmental Conditions (HRECS)

ECS’s review of EDR records search identified the following HREC sites:

- Historical California Sites - 2
- Historical Cortese - 63
- LUST - 91
- SLIC - 43
- CORRACTS - 1

8.4 De Minims Conditions

Since the lower Cache Creek boundary consists of agricultural farms and orchards, the soil is exposed to pesticide and herbicide spraying. The levees within the Site boundary are probably sprayed to control weeds during the year. The intended, controlled use of these chemicals can be classified as *de minimis* condition and not as a recognized environmental condition.

8.5 Vapor Migration

No study of vapor migration was performed within the proposed project boundary during this environmental site assessment**..**

8.6 Other

The Cache Creek watershed is an important source of total inorganic mercury (HgT) to downstream areas including the Delta of the Sacramento and San Joaquin rivers which drain into San Francisco Bay. Although the Cache Creek drainage basin covers only approximately 4% of the area drained by the Sacramento River, the amount of total mercury transported downstream can be as high as 50% of the total annual load of the Sacramento River (Domagalski *et al*, 2004). Sources of inorganic mercury in Cache Creek include:

- natural geothermal springs,
- abandoned and inactive mercury mines, and
- mercury prospects.

Currently, the Cache Creek Settling Basin is one of the only source removal activities in the Delta. The current Lower Cache Creek Project needs to align with the overall mercury management objectives for the Settling Basin and the Delta. With that in mind, the alternatives presented in the Lower Cache Creek Feasibility Study were evaluated to identify potential negative impacts from mercury and methyl mercury. The focused array of alternatives selected for evaluation in the Feasibility Study includes:

1. No Action - The No Action Plan would essentially be the same as the without project condition.

2. North Bypass - This alternative will allow flow over 30,000 cubic feet per second (cfs) to leave the creek and flow north either following the natural floodplain or by being somewhat contained by subtle floodplain contouring.

3. South Bypass - This alternative will allow flow over 30,000 cfs to leave the creek and flow through a new bypass along the northern edge of Woodland's urban area into the Yolo Bypass.

4. Levee Fix in Place - The purpose of this alternative is to contain flow within the levee system where possible by raising existing levees, repairing other levees, and adding new levees where needed.

5. Partial Setback Levees - The purpose of this alternative is to contain flow within the levee system where possible, primarily by strengthening existing levees and adding new setback levees in strategic locations.

Negative impacts from total inorganic mercury and/or methyl mercury production are not anticipated for Alternative 1, Alternative 4 and Alternative 5 because these alternatives do not change existing flow patterns. Further, there is no in-water work proposed for Alternatives 4 and 5 that would indicate a change in mercury loading or methyl mercury production within Cache Creek.

Alternatives 2 and 3 both include flooding of areas adjacent to Cache Creek that potentially deposit mercury-laden sediment onto floodplain soils. Negative impacts are considered negligible based on the following considerations:

1. Background sediment concentrations in sediment upstream from the proposed project area are roughly 0.2 mg/kg HgT (CVRWQCB, 2008).

2. Background concentrations for agricultural soils are roughly 0.34 (Kearney, 1996) mg/kg total mercury.
3. In a flood event above 30,000 cfs, the bulk of the background mercury-laden sediment will stay in the channel under any proposed alternative.
4. The dissolved mercury concentrations in Cache Creek flows that overtop the proposed flood control structures would stay in the dissolved state and pass to the receiving water body in very low, presently unknown, concentrations.
5. Some sedimentation will occur in the proposed flood diversion areas. However, the maximum background value in flood sediment (0.2 mg/kg HgT) is already below the estimated background concentration in the existing soil (0.34 mg/kg HgT) , indicating minimal impact to the flooded soil. Further, the deposited concentration would be significantly lower than the sediment source material during a flood event.
6. Finally, all expected mercury inputs to floodplain soils will be below the 2013 USEPA Residential Regional Screening Level of 23 mg/kg HgT. A conservative screening value for agricultural exposure is 2 mg/kg HgT (RAIS, 2014), again higher than the expected inputs or background values in the Cache Creek watershed.

9.0 CONCLUSION

9.1 RECs

A Phase I Environmental Site Assessment for the Lower Cache Creek Project boundary area has been completed in accordance with ASTM 1527-13 and ER 1165-2-132. This assessment has revealed no evidence of recognized environmental conditions, which could impact the selection of the National Economic Development or the proposed project alternatives.

The State Water Resources Control Board GeoTracker records identified a number of cases as active, without regulatory closure. These RECs are considered small leaks or spills requiring no actions and will not impact any of the project alternatives.

9.2 Mercury Contamination

The potential presence of contamination related to mercury has been recognized during the formulation of the various alternatives and will be further described and discussed in the environmental documents prepared for the tentatively selected plan (TSP). However, based on the above, issues associated with potential mercury contamination are not likely to impact selection of the National Economic Development (NED) or TSP alternative for the Lower Cache Creek flood control project. USACE will consult with the appropriate regulatory agencies when a project is authorized.

10.0 SIGNATURE AND CERTIFICATION STATEMENT

10.1 Certification Statement

We certify that to the best of our knowledge and belief:

1. The statements of fact contained in this report are true and correct.

2. The reported analyses, opinions, and conclusions are limited by the reported assumptions and limiting condition and are ESC's unbiased professional analysis, opinions, and conclusions.

3. Other consultant provided significant professional assistance to the consultants signing this report.

4. This report is forwarded as an accurate representation of the identified site condition at the reported point in time to the best of our knowledge.

We declare that, to the best of our professional knowledge and belief, we meet the definition of the Environmental Professional as defined in the guidance, ASTM 1527-13 and we have specific qualifications based on training, and experience to assess a property of the nature, history and setting of the subject property. We have developed and performed all appropriate inquires in conformance with the standards and practices set forth in ASTM 1527-13.

Environmental Chemistry Section

Tommy L. Waldrup
Environmental Chemist

Cory Koger, PhD
Environmental Toxicologist

John Esparza
Environmental Chemistry, Chief

11.0 REFERENCES

(1) ASTM, E 1527-05 Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process (Phase I ESA).

(2) U.S. Army Corps of Engineers ER 1165-2-132 Hazardous, Toxic, and Radioactive Waste (HTRW) Guidance for Civil Works Projects, 26 June 1992.

(3) U.S. Army Corps of Engineers, Sacramento District (EDS), Environmental Site Assessment OWER Cache Creek, Yolo County, Woodland Area, May 2000.

(4) U.S. Army Corps of Engineers, Sacramento District (ECS), HTRW Phase I Environmental Site Assessment, Mid-Valley Area (June 2012), Phase III Levee Reconstruction- Contract 3, Yolo County, California, July 2012.

(5) CVRWQCB, 2008 – Central Valley Regional Water Quality Control Board Staff Report, Mercury Inventory in the Cache Creek Canyon. February 2008.

(6) Domagalski et al, 2004. Mercury and Methyl Mercury Concentrations and Load in the Cache Creek Watershed, California. Science of the Total Environment v. 327, p. 215-237.

(7) Kearney, 1996. Kearny Foundation Special Report, Background Concentrations of Trace and Major Elements in California Soils. March 1996.

(8) Regulating Mercury in the Water Column and Sediments, G. Fred Lee & Associates, August, 8, 2003.

Appendices

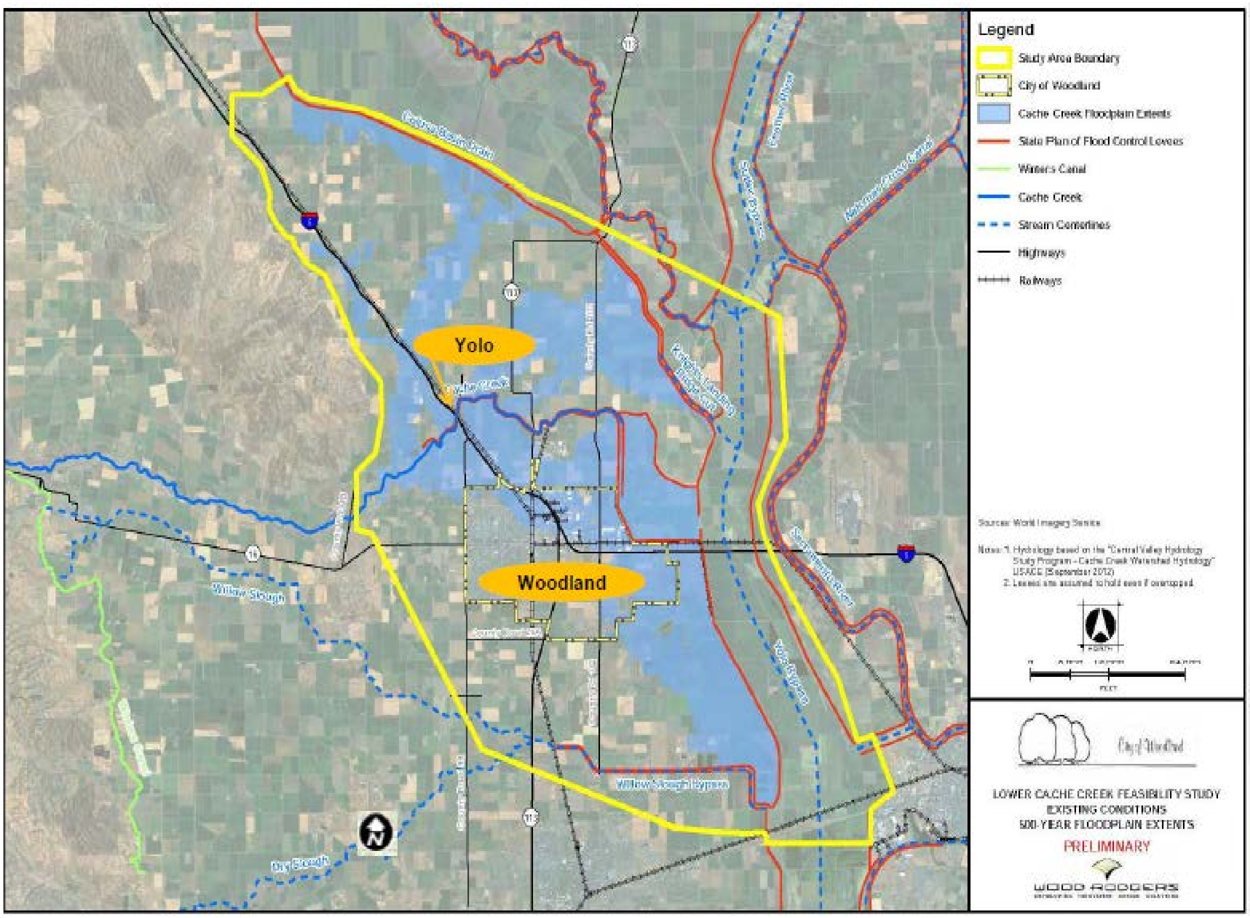
Appendix A - Map

Appendix B - EDR Records Search Report

Lower Cache Creek
Yolo County, Woodland Area, California
General Investigation Feasibility Study
October 2014

APPENDIX A

PROJECT AREA MAP



Lower Cache Creek
Yolo County, Woodland Area, California