CORRELL RODGERS POND ENHANCEMENT PLAN

Prepared For:

Yolo County Parks and Recreation

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FOOTHILL ASSOCIATES

ENVIRONMENTAL CONSULTING • PLANNING • LANDSCAPE ARCHITECTURE

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this Feasibility Report is to recommend strategies to improve the ecological health of the Correll-Rodgers Ponds, a pair of interconnected mining pits that have undergone several different restorations focused on habitat and infiltration. The overriding goals driving the recommendations in this report are to enhance native vegetation and habitats, improve site hydraulics and water quality and protect private property rights of adjoining land owners.

1.2 BACKGROUND

The Correll and Rodgers Pond site (the Project) is located at the north terminus of County Road 96, adjacent to Cache Creek (Figure 1). The Rodgers Pit is located immediately east of the County Road 96 easement and is adjacent to the Schwarzgruber mining site across the road to the west and the Rodgers property to the south. The Correll Pit abuts the Rodgers pit on the east side and is west of the Harrison property and north of the Correll farm. Both pits are separated from Cache Creek by a berm.

The project team visited the site on September 26th, 2007 to assess site conditions and conduct an initial public meeting to identify stakeholder concerns and previous history with the site. The assessment team consisted of a wetland scientist/botanist; two landscape architects, one also trained as a biologist; a hydrologist; and a hydraulic engineer. Qualitative data was collected on existing biological/botanical resources, hydraulic and water quality conditions, and recreational opportunities.

Both of the former mining pits have undergone varying degrees of restoration in the past. The Rodgers pit was part of a thirty acre parcel sold to Teichert by the Rodgers family in 1979. Teichert actively mined the site in 1987 extracting approximately 1,000,000 tons of aggregate[1]. Following resource extraction activities, the pit was restored as an infiltration area to test infiltration rates. It was graded into three areas, a settling basin in the center, abutted by a habitat basin on the east and an infiltration basin on the west. Water from the Yolo County Flood Control and Water Conservation District (YCFCWCD) Magnolia Canal was discharged into the settling basin, from which it flowed into the two adjacent basins east and west. Infiltration performance of the basin was measured from 2001 to 2003, and results were disappointing, averaging 153 acre-feet in 2001, 137 acre-feet in 2002, and 113 acre-feet in 2003[2]. Following this test, YCFCWCD determined that the effectiveness of this site for groundwater recharge was minimal due to the low infiltration rates, and that the Rodgers Pond was not needed as a groundwater recharge area.

Habitat restoration on the Rodgers site was undertaken at the time of creation of the infiltration basin in 1999. Restoration activities included planting of 235 seedlings, irrigation of the revegetation area, and weed control. Maintenance occurred from 1999 to 2003, and success of the restoration effort was monitored during those years. Average revegetation survival rate after four years was 90 percent with average plant health rated at between stable/fairly healthy and healthy/good growth. Species planted during this restoration included Valley oak, Interior live oak, California box elder, Oregon ash, California sycamore, Coyote brush, and California wild rose. Natural recruitment during this timespan included Black willow, Sandbar willow, Fremont cottonwood, Mule fat, and Coyote brush[3].

Mining permits were secured by Lone Star Industries on the Correll property in 1979 and mining was to occur over the following four years. A separate area not covered by the permits was previously mined prior to 1976[4]. In 1996, Mr. Richard Correll donated approximately 40 acres of land along the creek, including the majority of the Correll pit, to Yolo County. Subsequently, the County enacted an agreement with the Cache Creek Conservancy to restore and manage the site. [5]

Two plans were prepared at different times to restore the Correll mining pit. The first plan, developed in 1988, detailed existing site conditions and proposed eight management zones: valley oak woodland, willow corridor, freshwater marsh, annual grassland, perennial grassland, meadow, meadow with brush groupings, and pond[6]. The second plan divided the pit into the following areas: separation wall, pit floor and test plots, side slopes, and marsh area. Additionally, areas were designated for preservation of existing riparian vegetation[7] The Jones and Stokes plan included grading to create an area of marsh adjacent to the existing pond. Both plans included management of invasive exotic nonnative plants.

Implementation of the Jones and Stokes plan was delayed for several years due to prolonged inundation of the Correll pit. 77 groups of acorns were planted by volunteers in the spring of 1997[8].

In 2002, a plan was developed and largely implemented with the goals of 1) enhancing existing wildlife habitat, 2) creating additional riparian, oak woodland, and wetland habitat types, and 3) improving environmental education opportunities. The plan included creation of approximately 8 acres of oak woodland, 14 acres of riparian forest and scrub, and 0.85 acres of marsh; preservation of 4 acres of riparian and seasonal marsh habitat; and excavation of approximately 20,000 cubic yards of earth from an approximately 1,250 foot section of the berm along the downstream end of the Correll pit. The objective of the earthwork was to enhance flows into the pond/marsh. Additionally, a demonstration garden was created on the uplands between the Rodgers and Correll pits, overlooking the restoration areas.

A hydraulic analysis was performed on Cache Creek as part of the 2002 planning effort and identified that prior to the berm modifications the Correll pit was only connected to the creek at the 10-year flood event or approximately 34,000 cfs[9]. That report identified the 2 year flow event at 13,500 cfs, the 5 year at 25,000 cfs, the 20 year at 43,000 cfs, the 50 year at 56,700 cfs, the 100 year at 63,500 cfs, and the 500 year event at 80,900 cfs.

In 2007, Yolo County acquired funds to further study the habitat and water systems on the project site, develop additional recommendations for restoration, and establish a plan for implementation. The project covered by this report was funded through a $25,000 grant from the Yolo County Water Resources Association and approximately $31,000 from the Cache Creek Resource Management Plan fund. The project was managed by the Yolo County Department of Parks and Recreation.

[1] Elliot, 1994.
[2] Luhdorff & Scalmanini, 2001-2003.
[3] Teichert Aggregates, 2003.
[4] Newton, 1988.
[5] Yolo County, undated.
[6] Newton, 1988.
[7] Jones and Stokes, 1997.
[8] Yolo County, undated.
[9] Murray, Burns and Kienlen, 1997.

1.3 SCOPE OF WORK

Table 1 summarizes the tasks conducted while completing this restoration planning project. The total span of this project was approximately 2.5 months.

Table 1 Summary of Tasks Conducted in Preparation of This Feasibility Report

Task	Description
Background Research	Conduct kickoff/public meeting and initial site visit, compile and review existing information and complete field investigations
Hydrology and Vegetation Design	Prepare design alternatives, model hydraulic conditions and present results to Technical Advisory Committee (TAC). Prepare recommended design alternative.
Enhancement Plan	Prepare draft Enhancement Plan and present to the TAC. Incorporate changes and produce the final Enhancement Plan.

2.0 PROJECT GOALS AND OBJECTIVES

The following goals and objectives were developed by the consultant team, Yolo County, and the TAC. In discussions between the project team and the County, it was decided that these goals should apply to this project only and not to larger visions for the project and region. Future recreational use was discussed during the course of this project but was not included as a goal, since recreational use is beyond the scope of the project grant, requiring detailed discussions between the County, adjacent landowners, the Cache Creek Conservancy, the TAC and other stakeholders. Following this study, a more comprehensive Master Plan should be developed for the site that addresses recreation as well as habitat and hydrology.

2.1 GOALS:

- Enhance terrestrial and aquatic habitats,
- Improve hydrologic connections and water quality, and
- Protect private property values and rights and preserve public safety.

2.2 OBJECTIVES

Goal: Enhance terrestrial and aquatic habitats

Objectives:

- Increase diversity of riparian plants in and around the ponds,
- Manage invasive species so that native species are not significantly displaced,
- Remove berms between the three Rodgers ponds and revegetate, and
- Reduce side-slopes on ponds to create better upland habitats and improve transitions of upland to wetland habitat.

Goal: Improve hydrologic connections and water quality

Objectives:

- Improve connectivity of the pond site to the creek,
- Repair areas of erosion and recontour banks to reduce erosion potential, and
- Improve connectivity between the ponds.

Goal: Protect private property values and rights and preserve public safety

Objectives:

- Encourage native species that contribute to better IPM (such as bat-houses to attract bats that eat codling moths, parasitic wasps, etc.),
- Maintain current level of flood protection to neighboring property,
- Reduce impact of off-highway vehicles (OHV) on project site and neighboring parcels,
- Improve ability to control mosquitoes, and
- Reduce incidence of trespass.

3.0 EXISTING CONDITIONS SUMMARY

3.1 HABITAT

The Correll-Rodgers project site exhibits four biotic communities: valley foothill riparian, annual grassland, valley oak woodland, seasonal wetland/ pond. The site is bounded on the south and east by walnut orchards and agricultural fields and on the west by an aggregate mining facility. Across Cache Creek to the north are agricultural fields.

3.1.1 Habitat types

Valley Foothill Riparian

The valley foothill riparian community is described as such by the California Department of Fish and Game (Mayer and Laudenslayer 1998). Valley foothill riparian habitats occur in the Central Valley and the lower foothills of the Cascade, Sierra Nevada, and Coast Ranges from sea level to 3,000 feet elevation.

Within the project site, the most intact valley foothill riparian habitat, with multiple vegetation strata, occurs along Cache Creek north of the earthen berm. Riparian habitat in the two pits is still in a relatively early successional stage and has a simple structure consisting of a primary canopy and herbaceous layer. There is little to no shrub or lower canopy layer.

The Correll pit is dominated by a 10-acre riparian forest of cottonwoods (*Populus fremontii*) and willows (*Salix* spp.). The trees in this area are mature, but few, if any, have not reached senescence, resulting in a lack of snags or large woody debris. A small population of tree tobacco (*Nicotiana glauca*) is present along the north-central boundary of the pit. A narrow band of shrubby willows and cottonwoods has grown up around the two ponds. This band of vegetation is too narrow to provide habitat benefits for many animals, particularly nesting birds.

The main riparian habitat in the Rodgers pit was planted in 2000 in the easternmost basin of the pit. It is composed of Oregon ash (*Fraxinus latifolia*), box elder (*Acer negundo*), California sycamore (*Platanus racemosa*), Valley Oak (*Quercus lobata*), California wild rose (*Rosa californica*), coyote brush and Interior Live Oak (*Quercus wislizenii*). Willows and cottonwoods naturally colonized the basin. There is a narrow ring of willow shrubs around the central basin. A copse of 20 to 30 large willows occupies approximately 1/3 of an acre in the southeast corner of the western basin.

Many bird species utilize riparian habitat, especially riparian areas that are connected and occur in association with one another. Migratory birds use riparian areas for breeding, foraging, and as migratory stop-over sites between winter and summer breeding grounds. Due to a higher potential for predation and less protection from the elements, the small, scattered patches of riparian vegetation that characterize much of the site are of questionable habitat value for many wildlife species.

Annual Grassland

Annual grassland, which is characterized primarily by an assemblage of non-native grasses and forbs, is found on approximately 15 acres on the side slopes of the pits and in some areas of the pit floors. Much of the vegetation in these communities is common to the Central Valley. Dominant grass species consist of wild oat (*Avena fatua*), Mediterranean barley (*Hordeum marinum*) and soft chess (*Bromus hordeaceous*). Common dominant herbaceous non-natives include yellow star thistle (*Centaurea solstitialis*), wolly mullein (*Verbascum thapsus*), and Italian thistle (*Carduus pycnocephalus*). Yellow star thistle (*Centaurea solstitialis*) has become established in scattered patches throughout the annual grassland habitat. The eastern tip of the Correll pit is grassland dominated by whitetop (*Cardaria pubescens*), a highly invasive non-native perennial plant.

Valley Oak Woodland

Valley Oak Woodland, as described by the California Department of Fish and Game is typically found below 600 feet in elevation in well-drained soils. The canopy is dominated by valley oak (*Quercus lobata*) with an understory primarily composed of grasses with occasional shrubs.

The valley oak woodland on the site is located on approximately one acre at the southeast corner of the Rodgers pit, and is probably the result of an acorn planting project. The trees are all approximately 10 feet tall. The understory is primarily annual grasses. Given the immaturity of the trees and the narrow width (~50 feet) of the corridor, this habitat has limited value for wildlife.

Seasonal Wetlands and Ponds

Seasonal wetland habitat occurs primarily in the Rodgers pit. The three basins retain rain water, runoff, and high flows seasonally and receive tailwater from the Magnolia canal during the dry season. However, this tailwater is insufficient to keep the wetlands inundated or saturated over the summer. Due to the construction of the basins the seasonal wetlands habitat is of marginal value. The side slopes of the basins are a consistent 4:1 horizontal:vertical slope, which abruptly changes to a flat-bottomed pool. There is no transitional zone between the side slopes and basin bottom where emergent plants could establish. The westernmost basin is dominated by cocklebur (*Xanthium strumarium*). A small stand of salt cedar (*Tamarix chinensis*) has established in the northeast corner of the Rodgers pit near the concrete spillway.

The two ponds in the Correll pit have almost no emergent wetland vegetation. Once the ponds dry during the hot season, upland plants invade the pond floor. As with the basins in the Rodgers pit, the pond bottoms are almost level, and have no refuges for aquatic or amphibious species. Currently, the ponds may offer habitat benefits for migratory waterfowl, but their apparent lack of vegetation makes their habitat value questionable.

3.1.2 Special-Status Species

Federal and state laws regulate impacts to a number of species that may occur on the project site. There are recorded sightings of tri-colored blackbird (*Agelaius tricolor*), Swainson's hawk (*Buteo swainsoni*), valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), bank swallow (*Riparia riparia*), pallid bat (*Antrozous pallidus*), mountain plover (*Charadrius montanus*), and American badger (*Taxidea taxus*) within five miles of the project site. Additionally, the site may be used by species protected under the Migratory Bird Treaty Act (MBTA).

Tri-Colored Blackbird

The tricolored blackbird is a colonial nester of marshy areas throughout the Central Valley and coastal California. It can be observed in the Central Valley year-round and is typically a resident throughout its range, however tricolored blackbirds that occur in northeastern California have been known to migrate south during fall and winter months. Tricolored blackbirds breed near freshwater, preferably in emergent marsh areas with tall, dense cattails (*Typha* spp.) but will also nest in willow thickets. Nests are usually located a few feet over water or may be hidden on the ground in vegetation. Blackbirds build nests of mud and plant material. Blackbirds are highly colonial; nesting areas must be large enough to support a minimum colony of at least 50 pairs. Tricolored blackbirds are omnivorous and often shift their diet from insects and spiders during the spring season, to seeds, cultivated grains, rice and oats during fall and winter months. Blackbirds forage on the ground in croplands, grassy fields, and flooded rice fields. There is one record in the CNDDB for this species within five miles of the site. This species was not observed on the site during the field assessment. This species currently has a low potential for occurrence within the site because there is no suitable habitat large enough to support a nesting colony.

Swainson's Hawk

Swainson's hawk is a long-distance migrant with nesting grounds in western North America. The Swainson's hawk population that nests in the Central Valley winters primarily in Mexico, while the population that nests in the interior portions of North America winters in South America (Bradbury *et al*. in prep.). Swainson's hawks arrive in the Central Valley between March and early April to establish breeding territories. Breeding occurs from late March to late August, peaking in late May through July (Zeiner *et al.* 1990). In the Central Valley, Swainson's hawks nest in isolated trees, small groves, or large woodlands next to open grasslands or agricultural fields. This species typically nests near riparian areas; however, it has been known to nest in urban areas as well. Nest locations are usually in close proximity to suitable foraging habitats, which include fallow fields, annual grasslands, irrigated pastures, alfalfa and other hay crops, and low-growing row crops. Swainson's hawks leave their breeding grounds to return to their wintering grounds in late August or early September (Bloom and De Water 1994). There are two records in the CNDDB of this species within five miles of the site (CNDDB 2007). This species was not observed on the site or in the vicinity during the field survey. However, due to the suitable nesting habitat found on the site, the surrounding agricultural fields, and the known occurrences of this species in the vicinity, the potential for Swainson's hawk to occur on the site is high.

Valley Elderberry Longhorn Beetle

Valley elderberry longhorn beetle (VELB) requires mature blue elderberry (*Sambucus mexicana*) stems to complete its life cycle. VELB spends up to two years in the larval stage burrowing in elderberry stems. There are large elderberry shrubs located on the north side of the earthen berm. Some of these shrubs do show signs of past VELB use, but the exit holes do not appear recent. However, some studies suggest that it is possible for VELB to be actively using an elderberry shrub with no evidence of exit holes. Therefore there is a moderate potential for VELB occurrence on the site.

Bank Swallow

The bank swallow is a neotropical migrant found primarily in riparian and other lowland habitats in California west of the Mohave deserts. Bank swallows can be seen in the Central Valley during spring and fall migration and as an uncommon and local summer breeder. During summer months, bank swallows are restricted to riparian and lacustrine breeding areas with vertical banks and bluffs with fine-textured or sandy soils where it is a colonial nester in cavities along steep banks. Bank swallows arrive in California from South America in early March and numbers peak by early May; colonies are usually vacant by late July or early August when migration begins; they breed from early May through July, with peak breeding activity in June. Bank swallows, the smallest swallow species, forages for insects over nearby open meadows and water. There is one record in the CNDDB for this species within five miles of the site. This species was not observed on the site during the field assessment. This species has a low potential for occurrence within the site because suitable nesting banks are not present on the site.

Pallid Bat

The pallid bat occurs from the desert southwest and semiarid lands from Mexico and north throughout the west coast. This is one of the most common species at low elevations throughout the southwest. It favors habitat with rocky outcrops with desert scrub and is also commonly found in forested oak and pine regions (Barbour and Davis 1969). Pallid bats may roost in caves, crevices, and hollow trees (Harris, 2005). This species has one of the most unique feeding habits of any other North American bat; their prey is taken primarily from the ground. They prefer food items such as Jerusalem crickets, grasshoppers, scorpions, June beetles and ground beetles (Barbour and Davis 1969). The pallid bat is considered a California Species of Special Concern. Although pallid bats may utilize the site for foraging there are few suitable roosting areas, so the potential for occurrence is low.

Mountain Plover

Mountain plovers do not breed in California, however they do winter in California and can be found within short grasslands and plowed fields of the Central Valley from September through March. This species breeds in shrub-steppe and short-grass prairie in Montana, New Mexico, Colorado, Arizona, Kansas, Oklahoma and other mid-western states. Winter bird counts performed in California show that over 90 percent of the North American population winters in California with the most important wintering sites occurring within western San Joaquin County, outer coastal valleys and southern Sacramento Valley. There is one record in the CNDDB for this species within five miles of the site. This species was not observed on the site during the field assessment. This species currently has a low potential for occurrence within the project site as the on-site ponds have a low habitat value.

American Badger

The distribution of American badger occurs from Alberta southward to central Mexico and eastward from the Pacific coast to Ohio. They range throughout the state of California but are absent from humid coastal forests of Del Norte county and Humboldt county. Suitable habitat for badgers is characterized by grasslands, shrub, mountain meadow, and open stages of most habitats with dry soil. Badgers habitat in mountainous areas requires large, treeless meadows and expanses near timberline. They dig burrows in soil for cover, or reuse old burrows. They prey mostly on fossorial rodents such as gophers, ground squirrels, marmots, and kangaroo rats. They will also eat a variety of other animals including mice, woodrats, birds and insects (Ahlborn, 2005).

Badgers have declined drastically from California in the last century over almost all of their range and are now listed as a California Species of Special Concern. Habitat loss and deliberate killing are considered major factors in reduction of their population. No current data exists on the population of badgers in the state, but they have obviously declined or disappeared in large sections of the state, particularly areas west of the Cascade-Sierra Nevada mountain axis and in coastal basins of southern California (CDFG 1986).

One badger observation was recorded within five miles of the site in downtown Woodland. There is moderate potential for occurrence on the site due to its current open nature.

Raptors and Other Bird Species Protected by the MBTA

Several species of raptors may forage and nest on or immediately adjacent to the site. Active raptor nests are protected by the California Fish and Game code Section 3503.5 and the MBTA. Raptor species that may utilize the site include Red-tailed hawk (*Buteo jamaicensis*), Cooper's hawk (*Accipiter cooperii*), American kestrel (*Falco sparverius*), white-tailed kite (*Elanus leucurus*), western burrowing owl (*Athene cunicularia*), red-shouldered hawk (*Buteo lineatus*), and sharp-shinned hawk (*Accipiter striatus*).

The trees, shrubs, and grasslands on the site provide suitable nesting habitat for a number of common and special-status birds protected solely by the MBTA, which prohibits the killing of migratory birds.

3.2 HYDROLOGY AND HYDRAULICS

3.2.1 HYDROLOGY

Cache Creek and its principal tributaries drain approximately 1,140 square miles of watershed area. Predominant features include (1) Clear Lake, (2) the main stem of Cache Creek from Clear Lake to the Yolo Bypass, (3) the principal tributaries to Cache Creek, including North Fork Cache Creek and Bear Creek, and (4) Capay Valley and the alluvial floodplain areas west of Capay through Woodland to the Yolo Bypass. The topography of the basin varies from steep, rugged, densely vegetated hillslopes of the California Coastal Range to the gentle slopes of the valley floor near Capay. Elevations range from 6,120 feet at Goat Mountain on the edge of the northern basin to approximately 25 feet at the Corps of Engineers' sediment retention basin east of Woodland (EIP Associates *et al.*, 1995).

For the analysis of the Correll-Rodgers project site, flood frequency flows were obtained from previously completed studies for the Cache Creek Watershed. Multiple resources were referenced to determine flood frequency flows for the site, including reports by MBK Engineering (1997 and 2002), EIP Associates et al (1995) and the Army Corps of Engineers (2003). Data from the USGS Gauge station along Cache Creek in Woodland near Interstate-5 was also referenced. Table 2 displays the flood frequency values from the referenced resources and the values used in this analysis. The 10-year and greater flood frequency flows used in the analysis of the Correll-Rodgers Site were obtained from the 2002 and 2003 reports. Flows for the 2 and 5-year events were obtained from the MBK 1997 report. Although multiple flow events are listed below, only the 2, 5 & 10-year events were evaluated for this project.

Table 2 Flood Frequency Flow for Cache Creek

Resource	Flood Frequency Interval (Years)						
	2	**5**	**10**	**20**	**50**	**100**	**500**
Lower Cache Crk Potential Flood Damage Reduction Project Report, Corps of Engineers, 2003	--	--	31,500	42,000	53,300	63,700	78,600
Technical Report for Hydraulic Analysis Results, MBK, 2002	--	--	31,500	--	53,290	63,683	78,595
Cache Creek Correll Wildlife Enhancement Hydraulic Analysis of Grade Modifications, MBK, 1997	13,500	25,000	34,000	43,000	56,700	63,500	80,900
Technical Studies and Recommendations for the Lower Cache Creek Resource Management Plan, EIP Assoc., Northwest Hydraulics and David Todd, 1995 (@ Capay)	15,000	27,000	34,000	--	50,000	58,000	--
USGS Gauge Station 11452500, Cache Crk, Yolo Co.	11,090	24,060	33,340	--	52,620	59,850	74,240
Modeled flows for the Correll-Rodgers Pond Enhancement Project	**13500**	**25,000**	**31,500**	--	--	**63,700**	--

3.2.2 HYDRAULICS

Existing water surface elevations and inundation frequencies were estimated using the Army Corps of Engineers Hydraulic Engineering Centers, River Analysis System (HEC-RAS) Model (Version 4.0 Beta) for steady state flow simulation. Development of the existing conditions model is described in the following paragraphs.

Site Geometry

The existing conditions hydraulic model extends approximately 2,000 feet upstream and downstream of the project boundaries. LiDAR information provided by the County was used to create a 3-dimensional existing condition digital terrain model of the project reach in AutoCAD Land Development Desktop (LDD). The coordinate system for the LiDAR topography is Cal State Plane Zone II feet NAD 1983 (i.e. State Plane NAD 83). Cross-sections were cut at intervals along the project reach and input into the HEC-RAS model. See Figure 3 for existing topographic mapping and cross-section locations.

Boundary Conditions

Downstream boundary conditions were set based on the latest flood inundation HEC-RAS model for Cache Creek (MBK, 2006). The flood model was created to evaluate flooding along the northern boundary of Woodland and, therefore, extends significantly further downstream than the model created for this analysis. As Cache Creek travels east beyond the Correll-Rodgers sites the channel becomes confined creating a backwater effect that extends to the project reach. To properly model this backwater effect, water surface elevations (WSE) at a cross-section from the Cache Creek flood model nearly matching the downstream limit of the Correll-Rodgers reach were used as the downstream boundary condition. Table 3 lists the starting WSE's for the different flow events.

Table 3 Downstream Boundary Conditions

Flow Event (Year)	Starting WSE (Feet)
2	74.97
5	82.86
10	88.27

Manning's "n" Roughness Values

Manning "n" roughness coefficients for the project reach were estimated during onsite reconnaissance surveys and from aerial photos of the project reach. Roughness values varied from 0.035 in the main channel to 0.055 in the more heavily vegetated overbank areas. A manning's roughness value of 0.045 was used in areas outside of the main channel, such as gravel pits and higher floodplains.

Mining Pits

Multiple mining pits are located along the project reach. Water within the pits is not actively being conveyed due to the downstream berm preventing water from reentering the channel. These areas were considered to be permanently ineffective until the WSE in the main channel exceeds the high berm elevation. Once the berm is overtopped, the flow above the elevation of the berm is considered effective and is included in the total flow conveyed downstream.

Modeled Flow Events

The 2, 5 and 10-year flow events were modeled for the analysis of the Correll-Rodgers site. For the purposes of this study, the 2-year event is used to approximate the bankfull or channel forming flow. Therefore, it is important to understand the effects of the proposed project on this flow event. The 5 and 10-year flows were modeled to determine what effects the project may have regarding flooding on neighboring properties. The 100-year event completely inundates the proposed project reach and adjacent farmland. Modifications to the project features should have no effect on 100-year flooding.

3.2.3 *Hydraulic Model Results*

The results from the hydraulic model were used to determine how frequently the project sites would become inundated. Under current conditions and during a 2-year flow event, the berm at the east end of the Correll site separating the channel from the pit overtops allowing water to pond within the Correll site. During this event it is estimated that the pond would fill to approximately Elevation (El.) 78.4' (See Figure 4 for limits of inundation). Once inundated the water surface will rise and fall closely with the WSE in the main channel at the east end of the site. The berm upstream of the overtopping area becomes higher therefore containing the 2-year flow in the main channel.

During the 5-year flow event the majority of the berm along the Correll site is overtopped as well as the weir structure located between the Correll and Rodgers Sites. The existing weir located between the two project sites has an overtopping elevation of approximately 82'. During a 5-year event it is estimated that the WSE in the Correll site will be approximately 84.5', therefore overtopping the weir by more than 2'. During the 10-year event it is assumed that the entire site is inundated as well as a small portion of the neighboring farm land to the south.

The purpose of this model is to determine how the proposed project will react during more frequent flow events (2, 5, 10-year). Based on conversations with the Yolo County Flood Control and Water Conservation District (YCFCWCD) and local land owners, the Correll and Rodgers sites were not designed for flood flow storage or protection and typically inundate every 5 to 7-years. The City of Woodland is currently updating their flood protection for up to the 10-year event. According to the 1D steady-state model used for this project the ponds will be completely inundated prior to the 10-year event, not adding any benefit of flood storage. Therefore, the proposed project should not adversely affect downstream flood flow elevations and inundation limits.

As the WSE in the main channel recedes, so will the water contained in the Correll site. It is estimated that once WSE's recede the water in the Correll site will be at elevation 68'+/-. This is the approximate elevation of the existing culvert connecting the Correll site to the main channel. The ponded water in the Rodgers Site will recede to the elevation of the weir (El 82'). The water will be retained at the site until such time that it infiltrates into the groundwater and/or evaporates.

The existing conditions HEC-RAS results are presented in Table 4 for the area along the Correll-Rodgers sites.

Table 4 Existing Conditions HEC-RAS Results

Cache Creek - Correll-Rodgers Reach
Existing Conditions Hec-Ras Modeling Results

River Sta	Profile	Q Total	Min Ch El	W.S. Elev	E.G. Slope	Vel Chnl	Top Width	Froude # Chl
7500	2-yr	13500	62.14	80	0.00050	4.25	312.07	0.2
7500	5-yr	25000	62.14	85.33	0.00043	4.87	1279.66	0.19
7500	10-yr	31500	62.14	89.72	0.00018	3.65	1295.23	0.13
7075	2-yr	13500	61.13	79.92	0.00027	3.39	1241.41	0.16
7075	5-yr	25000	61.13	85.4	0.00011	2.71	1322.23	0.11
7075	10-yr	31500	61.13	89.74	0.00006	2.29	1352.58	0.08
6350	2-yr	13500	60.03	79.79	0.00019	2.58	384.44	0.12
6350	5-yr	25000	60.03	85.29	0.00013	2.62	943.02	0.1
6350	10-yr	31500	60.03	89.72	0.00005	1.85	2368.13	0.06
5900	2-yr	13500	60	79.64	0.00030	3.83	453.77	0.16
5900	5-yr	25000	60	85.08	0.00029	4.55	556.46	0.17
5900	10-yr	31500	60	89.35	0.00037	5.74	1628.23	0.2
5375	2-yr	13500	59.22	78.97	0.00089	5.96	400.38	0.27
5375	5-yr	25000	59.22	84.77	0.00051	5.3	855.38	0.21
5375	10-yr	31500	59.22	89.37	0.00018	3.59	1947.08	0.13
4875	2-yr	13500	58.52	78.66	0.00065	5.42	160.66	0.24
4875	5-yr	25000	58.52	84.76	0.00020	3.67	1641.9	0.14
4875	10-yr	31500	58.52	89.35	0.00008	2.68	1791.59	0.09
4400	2-yr	13500	58.24	78.35	0.00088	5.29	555.89	0.25
4400	5-yr	25000	58.24	84.68	0.00021	3.19	1249.05	0.13
4400	10-yr	31500	58.24	89.3	0.00010	2.49	1387.66	0.09

3.3 WATER QUALITY

The main potential impact to water quality that the Correll-Rogers Pond site poses is related to erosion and sediment. The many steep interior slopes are the primary location for the site erosion, many of which are scarred with rills and small gullies.

The 1998 Jones and Stokes plan was intended to allow creek water to back up into the site and deposit sediment, but the creek-pond hydraulics of this design are such that only finer suspended material enter the ponds. An unintended consequence of this design was that it created several areas where rising creek waters spill over the existing berm into the relatively empty, lower elevation ponds. In particular, this occurs at approximately the 2-year flood level along the existing inlet weir structure in the Correll Pond. As flood waters crest the top of the wier, they must flow down the back side of the earthen weir structure and follow the topography to the pond low point, resulting in substantial erosion along this flow path. Similarly, at approximately the 7-year flood level, the creek starts to spill over the berm into the Rodgers Pond. At this flood level, the Correll Pond is full of water that has entered over the earthen weir structure. However, the Rodger's Pond is still relatively empty, and as such the flood waters flow into and fill up this pond, and in so doing have been eroding large gullies in the berm and undercutting the existing connecting concrete weir. Both of these sources of erosion can be addressed by opening the pond up to the creek through excavating portions of the berm down to the existing active floodplain elevations on the north side of the berm.

A second cause and source of erosion is the sheet and rill erosion that forms on illegal Off Highway Vehicle (OHV) trails located on site. OHV use tears up the vegetation and compacts the soil, destroying the two most effective means of preventing erosion. In addition, the illegal trails tend to follow more "exciting" routes which typically entail steep paths, adding to the erosion potential. While enforcement of illegal OHV access and use is a county wide issue, certain design elements of the project site enhancements can assist in reducing OHV usage by removing much of the steep terrain that makes riding in the area so enjoyable.

Currently, a failure with the Magnolia Drain pipeline along the southwestern edge of the Correll Pond has resulted in massive erosion of the slope down into the mining pit. This pipeline failure, where an entire section of pipe has been undercut and eroded away, has created a safety hazard with near vertical 25 foot drop offs and a sizable scour hole at the base of the failure. This will continue to erode as long as the Yolo County Flood Control and Water Conservation District (YCFCWCD) delivers water via the drain. Repair of the pipeline, either by reconnecting the failed section or installing a new outfall location, should be a priority for both water quality and safety purposes.

Another important existing condition to take into consideration in the development of the enhancement plan is the existence of the berm that was constructed to separate the prior mining pits, and now the ponds, from Cache Creek. This berm is not a natural structure and is located such that natural creek processes will eventually erode it away, creating an extended active floodplain that will span into the existing ponds. The berm contains approximately 45,000 -50,000 cubic yards of soil, likely mining overburden, which tends to be easily erodible and highly suspendable. These properties of the soil will lead to increased turbidity and total suspended solids downstream of the site during high flow events as the berm undergoes erosion. The volume in the berm constitutes approximately half of the equivalent the total annual sediment yield at Capay (EIP Associates et al, 1995), which will contribute to filling up the settling basin downstream of I-5.

Currently, the Correll-Rodgers Pond site provides little, if any, water quality benefits directly to Cache Creek. As mentioned earlier, the ponds do capture some suspended sediment with the water that they impound, but this is relatively minimal.

4.0 DESIGN ALTERNATIVES

4.1 UNIVERSAL DESIGN CONCEPTS

The alternative design concepts for the Correll-Rodgers Pond were chosen to provide a wide array of options for the County, while achieving a self sustaining enhanced habitat that requires little or no long-term maintenance. To meet this and the Project Goals and Objectives existing trees and riparian vegetation will be preserved wherever possible. To facilitate mosquito control, the bottom of all ponds will be re-contoured to provide a series of interconnected pools and swales, rather than the current flat bottoms. This will help ensure that mosquito fish and other mosquito predators can access all pools as the water level lowers and thus improve management of the mosquito population. As part of re-contouring the ponds, the edges will be varied to create habitats for different plant communities as supported by varying inundation levels.

Currently, the annual grasslands on the slopes and upper benches of the pits are dominated by non-native annual grasses and invaded in areas by star thistle. This habitat can be improved with the planting of upland species such as valley oak and native bunchgrasses. Non-native invasive species such as yellow star thistle and whitetop will be targeted for control and removal in all of the alternatives. The current extensive erosion throughout the site will be repaired and re-graded to minimize future problems.

4.2 OPTION A: MINIMAL CHANGE

Option A focuses on improving habitat values while minimizing impacts to the site, thereby providing a lower implementation cost (Figure 6). The hydrologic connection between Cache Creek and the mining pits is improved by further lowering the weir section of the earthen berm to the surrounding existing grade on the north side so that the ponds flood on a near annual basis.

Smaller more naturalistic ponds/pools are added to the pit floor to provide a more diverse topography to improve mosquito control and establish additional hydrologic regimes for plant establishment. The hydrologic connection between the pits is also be improved by the removal of the concrete spillway between the two pits and re-grading the area to the pit floor grade, removal of the interior berms in the Rodgers Pit, and construction of a swale connecting the ponds. The existing overlook and native plant garden are protected from future erosion with a retaining structure or armored bank.

4.3 OPTION B: REINTRODUCE FLOODING

Option B focuses on establishing proper creek channel geomorphology by reconnecting Cache Creek to the pits throughout the length of the project site (Figure 7). The earthen berm is lowered to establish a bankfull channel geometry[10] with three slightly lower weirs, armored to protect against erosion, which allow controlled flow of water paste the berm into the pits. Soil excavated from the berm is used to fill areas of the Rodgers pit to reduce side slopes and create more natural upland topography.

The hydrologic connection between the pits is improved by the removal of the concrete spillway and lowering of the berm separating the Correll and Rodgers pits, removal of the interior berms in the Rodgers Pit, and construction of a swale connecting the ponds. Smaller more naturalistic ponds/pools are added to the pit floor to provide a more diverse topography to improve mosquito control and establish additional hydrologic regimes for plant establishment. The existing overlook is kept in place and protected with a retaining structure or armored bank.

4.4 OPTION C: RESTORE FLOODPLAIN

Option C removes the earthen berm along the entire project site to match the existing elevations on the Cache Creek side, which will allow geomorphic floodplain processes to re-establish within the project site (Figure 8). This connects the entire pit with the creek and allows the creek to re-establish its own bankfull channel geometry. This option provides a neutral condition on which both creek and floodplain geomorphic processes may start to act, and from which a sustainable riparian ecosystem can establish. Existing mature trees on the earthen berm along Cache Creek are preserved as elevated islands. Soil excavated from the earthen berm is used to ease the slopes throughout the Rodgers pit.

The hydrologic connection between the pits is improved by the removal of the concrete spillway between the two pits, removal of the interior berms in the Rodgers Pit, and construction of a swale connecting the ponds. Smaller more naturalistic ponds/pools are added to the pit floor to provide a more diverse topography to improve mosquito control and establish additional hydrologic regimes for plant establishment. In order to minimize the pinch point between the pits, the existing overlook is relocated to the southwest corner of the Rodgers pit on County Road 96 and the existing orchard is protected by a bio-engineered reinforced slope. A seasonal wetland is constructed below the relocated overlook and can continue to be utilized for a variety of interpretive activities. The pipe for the Magnolia Drain is repaired, and a new outfall location is installed at the existing failure site.

[10] Assumed to be approximately the 2 year event for this study.

5.0 PREFERRED ALTERNATIVE

5.1 DESIGN INTENT

An overriding consideration of the design for this project was to create a naturally robust system that would allow the site to evolve based upon changing conditions while remaining ecologically healthy. It is not the intent of this plan to establish a ‘final design” for the project site. Rather, the designs presented in this report should be considered a starting point from which hydrologic forces, plants and animals will further modify the site geomorphology and habitats. Adaptive management will be one method for ensuring that this evolution is towards a more stable state, rather than the other way around.

5.2 DESIGN CONCEPT

Upon review of the three design alternatives, presented in Section 4.0, by the Cache Creek Technical Advisory Committee (TAC), public comments, and feedback from County staff, a preferred alternative was developed as a hybrid between Options B and C (Figure 11 and Figure 12).

Guidance provided for the development of the preferred alternative focused on

- Cost savings from the reduced earth moving with Option B, and
- Lack of hard armoring needed for inlet weir structures providing cost savings, reduced long-term maintenance, and a visually more pleasing and natural/native project in Option C.

Utilizing this guidance, the preferred alternative design was developed in which the berm separating the ponds from Cache Creek is lowered to the bankfull elevation as was proposed in Option B[11]. However, instead of having armored inlet weirs, three wide inlets into the ponds will be provided at the elevation of the existing grade on the Cache Creek side of the berm, as was seen in Option C (Figure 11). Providing wide openings that are at grade will reduce the problem of scour and erosion, thereby reducing the need for protective armoring. This configuration allows water to enter the pond area on a near annual basis providing suitable hydrology for a riparian ecosystem. It will also help to maintain the existing creek channel geomorphology, while reducing construction costs.

The existing concrete weir structure that separates the Correll and Rodgers pits will be removed and lowered to connect the two pit floors, forming one single cohesive unit. A simple complex of swales connecting small pools or ponds will extend throughout the project area. The swales, pools and ponds will provide a place for receding waters to concentrate, creating areas where aquatic species that get trapped within the pit floor area can survive between inundation events.

In some aspects, much of the swale complex appears similar to an oxbow or abandoned remnant channel. Unfortunately, due to the topography of the pit floors, which causes water to drain from east to west instead of following the flow of Cache Creek, creating a properly functioning oxbow is difficult to achieve. The swale complex is only intended to receive water from Cache Creek during storm events and provides topographic diversity within the existing pit areas to help establish native habitat and improve mosquito population control.

The existing overlook located next to the concrete weir structure will be moved to the southwest corner of the Rodgers pond. This will provide both an area for future parking and public access should it be desired in the future and further widen the connection between the Correll and Rodgers sides reducing scour potential during flood events and improving both hydrologic and habitat connectivity between the two former mining pit areas. By removing the concrete structure and lowering the berm, the erosional features currently associated with this location will be eliminated, and the cause of the erosion greatly minimized.

The majority of the excavated material from lowering the berm and weir connecting the pits will be used to extend the cut slopes and lessen their steepness on the Rodgers pit side-slopes. The two small existing interior berms that form the three separate Rodgers ponds will also be removed. Certain stands of mature healthy trees will be preserved in place and the fill locations design to work around them.

The current failure in the Magnolia Drain will be utilized in this design to relocate the outfall. While the preferred alternative does not require the scheduled delivery of water for the success of this project, it does take into account that irrigation delivery tail-water will likely be present throughout the summer in varying quantities. By moving the outlet to one corner of the project site, it allows the swale system to move the water from one end to the other, as if it were a small tributary entering the swale system. However, if this source of water is discontinued in the future, the proposed design will still function, and the existing vegetation will adjust accordingly.

In the Correll pit, the existing earthen weir where the berm was previously lowered will further be dropped to existing grade on the creek side. This will remove the potential for much of the rilling and gullies that have formed in prior years when flood waters spilled over the berm and into the pond. Removed material will be used to lessen the slope into the pond and fill larger existing gullies. Minimal fill will be done on the Correll side of the project site, so additional contouring is included to create the swale and adjacent areas. In the flatter bottom areas where riparian vegetation establishment has been minimal, the swale will connect a series of small pools, reducing the surface area of standing water during dry-down periods which will encourage the establishment of vegetation in these areas and improve mosquito control, as in the Rodgers wetlands.

5.2.1 Test 3 Compliance

Both the Cache Creek Resource Management Plan (CCRMP) and the Cache Creek Implementation Program (CCIMP) incorporate the “Test 3” concept that was developed by North West Hydraulics in Technical Studies and Recommendations for the Lower Cache Creek Resource Management Plan (1994). It was the third creek configuration modeled in the study that looked at various scenarios for the CCRMP that would lead to improved channel stability and encourage aggregation. Test 3 was picked because it had the potential to be implemented at some time in the future.

Test 3 provides “a conceptual model for reshaping the Cache Creek channel in order to improve streamflow characteristics and reduce erosion and scour” (CCRMP). It will “assist in returning the creek to a form that is more similar to its historical condition…, result in reduced erosion, increased channel recharge, and additional riparian habitat opportunities” (CCRMP). Both a channel alignment and typical cross sections are provided in the CCRMP for a 100-year channel.

Two requirements of the CCRMP that came of the Test 3 scenario are:

1) Future in-channel modifications will be limited to the 100-year floodplain and must take not only the elevation of the streambed into account, but the slope of the streambed and the ratio of the width to depth.

[11] For the purposes of this plan it was assumed that the 2-year flow generally approximated bankfull or channel forming conditions. The assumptions typically provides an over approximation that is useful for planning purposes only. A detailed geomorphic study of Cache Creek adjacent to the project site should be conducted in order to more closely identify bankfull conditions for use in the final design and construction drawings.

2) Since one of the primary goals of the CCRMP is to allow aggregation of the streambed, channel reshaping activities will remain six feet above the existing thalweg, unless maintenance of the existing 100-year flood capacity requires otherwise.

In addition to meeting both of these requirements, based on available information, the entire project site is within the Test 3 boundary line. As such, the proposed alternative meets all of the requirements of the Test 3 scenario, CCRMP and CCMP.

It should be noted that the CCIP states "(t)he TAC, with assistance of consultants as needed, will develop specific project designs in accordance with the goals of the Test 3 concept and the CCRMP." This allows the TAC to adjust the guidance provided in the CCRMP as needed to meet project specific requirements that may not have been properly addressed or foreseen.

5.2.2 Removal of Existing Structures and Infrastructure

In addition to the removal of the concrete weir structure and relocation of the Magnolia Drain outfall, there are several other existing infrastructure components that will need to be removed (Figure 13). These consist primarily of engineered drainage control structures previously installed, including removal of pipes and gates between the three Rodgers ponds and the Correll and Rodger pits, the existing Magnolia Drain outfall and gauging station structure, and the single culvert and headwalls that connect the Correll pond to Cache Creek.

5.2.3 Off-Highway Vehicle Use

The control of Off-Highway Vehicle (OHV) use will also be implemented. At a minimum, a three pronged approach should be used to reduce or eliminate unauthorized usage including fencing, signage and patrols. Fencing along the east and west property boundaries should be installed to prohibit easy site access. To prevent access from the creek, fencing should also be installed parallel to the existing berm in the direction of flow to minimize its impacts on creek hydraulics. Should it be deemed necessary, additional fencing can be added along the southern project boundary to prevent access to the site from the neighboring agricultural fields.

Signs should be placed every 500 feet along the perimeter that clearly state no unauthorized access or motorized vehicle use. The signs can also provide a brief description of the project such as "Habitat Restoration In Progress." Patrols of the site, by both official local law enforcement or County staff and by volunteer citizens or public interest groups such as the Cache Creek Conservancy would help to maintain a presence and deter trespassers. Methods to reduce recreational OHV access and trespassing should be updated as the County and Department policies change. For more details see Section 6.0 Maintenance and Management.

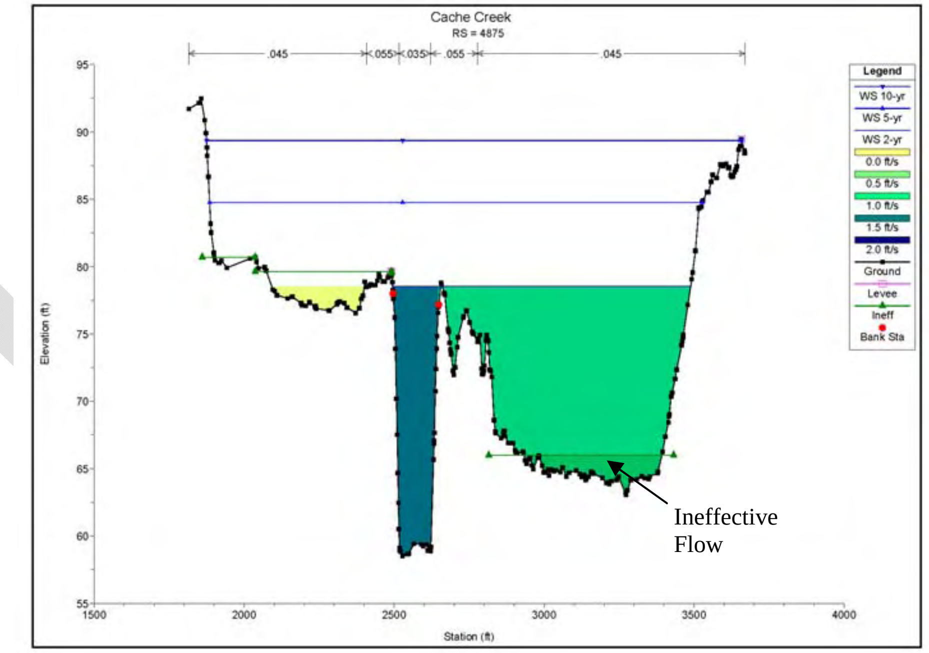
5.3 HYDRAULICS

Proposed conditions water surface elevations and inundation frequencies were estimated using the HEC-RAS model for steady state flow simulation. Development of the proposed conditions model is described in the following paragraphs.

5.3.1 Proposed Geometry Modifications

The existing conditions HEC-RAS model was modified to simulate the preferred alternative topography. Cross-sections were modified at locations where the berm is to be removed, allowing effective flow to pass through the project sites. In areas where the berm is to remain, it is lowered and flow is conveyed on both sides, therefore increasing the overall conveyance of the system. Since the Correll and Rodgers sites have bottom elevation ranging from 59.5' to 66' and since the downstream bank elevation tying back into the channel is at elevation 66+/-, flow below the downstream bank elevation is considered ineffective (See Figure 9). All flow above the bank elevation is effective and is included in the total flow conveyed downstream. An average manning's roughness coefficient of 0.045 was used for the modified floodplain through the proposed project site.

Figure 9 Typical Section with Floodplain Inundation



5.3.2 Results

As would be expected, allowing the flow to spread out across a larger floodplain reduces the water surface elevations (WSE) through and upstream of the project site (Figure 14). The 2-year flow has the greatest decrease in WSE which occurs toward the upstream limit of the project. Figure 10 provides a graphical example of how the proposed alternative will decrease the WSE at section 7075. Table 5 displays a comparison of the existing and proposed conditions WSE's at the upstream, center and downstream limits of the project for the 2, 5, & 10-year event.

Figure 10 Cross Section Showing Existing (EX) and Proposed (PRO) WSE's

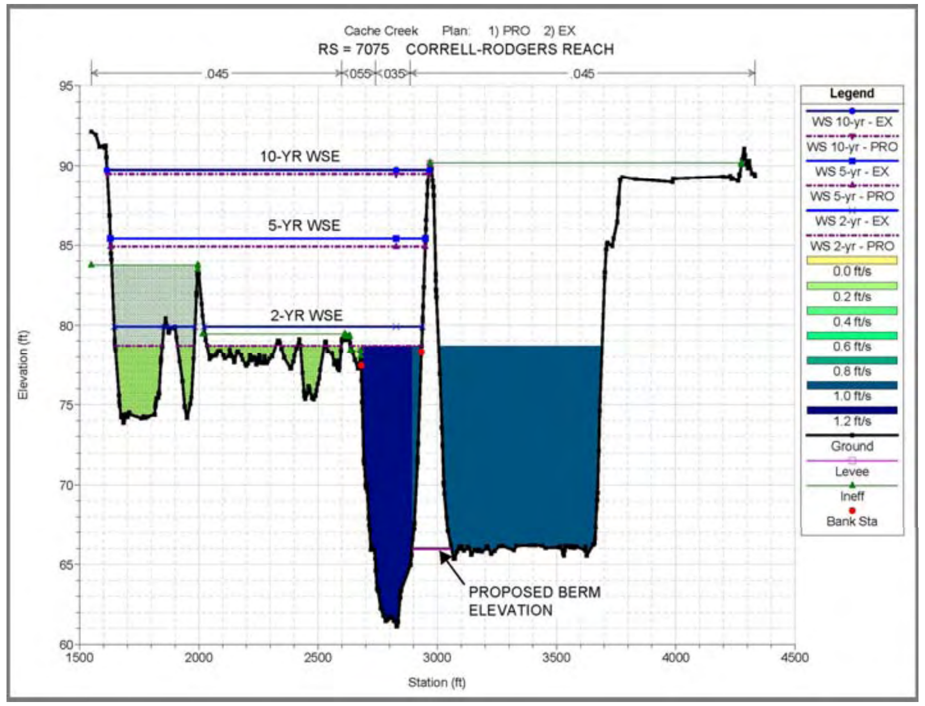


Table 5 Existing vs. Proposed WSE Comparison

Hec-Ras Section	Existing Condition	Proposed Condition	Deviations(ft)
Upstream Project Limit (Station 70+75)			
2-year	79.9'	78.7'	-1.2
5-year	85.4'	84.9'	-0.5
10-year	89.7	89.5'	-0.2
Mid-Reach (Station 59+00)			
2-year	79.6'	78.6'	-1.0
5-year	85.1'	84.8'	-0.3
10-year	89.4'	89.3'	0.1
Downstream Project Limit (Station 44+00)			
2-year	78.4'	78.4'	0.0
5-year	84.7'	84.7'	0.0
10-year	89.3'	89.3'	0.0

Average velocities in the main channel are reduced due to the proposed improvements. Average velocities in the main channel range from 1.2 to 3.3 feet per second (fps) during the 2-year event and 1.2 to 3.5 during the 10-year event. Table 6 displays the differences in channel velocity between in the existing and proposed conditions model.

Table 6 Existing & Proposed Average Channel Velocity

HEC-RAS Section	Existing Condition, (fps)	Proposed Condition, (fps)	Deviations (fps)
Upstream Project Limit (Station 70+75)			
2-year	3.4	1.2	-2.2
5-year	2.7	1.2	-1.5
10-year	2.3	1.3	-1.0
Mid-Reach (Station 59+00)			
2-year	3.8	2.7	-1.1
5-year	4.6	2.8	-1.8
10-year	5.7	3.5	-2.2
Downstream Project Limit (Station 44+00)			
2-year	5.3	3.3	-2.0
5-year	3.2	2.6	-0.6
10-year	2.5	2.2	-0.3

Average velocities across the newly inundated floodplain range from approximately 1.0 to 2.2 fps during a 2-year event and 0.8 to 1.6 fps during a 10-year event. Although the velocities through the project site are relatively slow, special consideration should be given to erosion protection at the entrance and exist locations of the project reach. Since HEC-RAS is a 1-dimensional steady state model, it does not accurately reflect potential eddy currents or local velocity increases that may occur in these areas. A 2-dimensional model through the project site would assist to determining actual flow patterns in and out of the site and along the floodplain. A 2D model would also assist in evaluating potential sedimentation accumulation across the site. It is recommended that a 2-dimensional model of the project site be created during the design phase of the project.

5.3.3 Summary of Conclusion

From the modeling results the following conclusion can be made:

1. The proposed project will lower the water surface elevation through and upstream of the project site during the 2, 5 & 10-year event.
2. In-channel velocities along the project site will decrease as much as 3.2 fps during a 2-yr event and as much as 2.3 fps during a 10-yr event. Velocities upstream of the project will slightly increase by as less than 1 fps.
3. The entire project site will be inundated during a 2-year event.
4. Localized erosion potential needs to be evaluated during the design phase of the project to determine where erosion protection may be required.

5.4 HABITAT ENHANCEMENT

The proposed plan will seek to create and enhance three habitat types: emergent wetland, riparian woodland, and grassland/oak savannah (Figure 15). The location of these habitats within the basin is based upon the proposed grading and anticipated hydrology. The bankfull elevation (~77 feet), which is expected to flood every two years on average, was used as the boundary between riparian woodland and oak woodland planting. This boundary may change over time as plants establish themselves in the most suitable locations.

Planting for all habitat types will be done based on a repeated cell pattern. Shrubs and trees will be planted in groups of three to six. Since water is not readily available onsite, planting should be done in the early winter after the first major rains, between December and January, to allow establishment of plants with minimal irrigation. Weed control and removal may be necessary prior to planting. This may be accomplished by mechanical or chemical means.

5.4.1 Exotic species

Removal of exotic species such as salt cedar, tree tobacco, yellow star thistle, and whitetop should be initiated before habitat restoration is begun. Eradication of these species may be an on-going project, particularly in the case of yellow star thistle and whitetop. The existing grasslands are dominated by non-native annual grasses. Due to the surrounding land uses and vegetation it is unreasonably to expect to eliminate these species from the site. However, with preparation of the seedbed, establishment of a grassland dominated by native perennial grasses is possible. Since the area has not been in cultivation it can be assumed that there is an extensive seedbank of annual grasses in the soil. Weed reduction measures such as controlled burning, tilling or other cultivation, and herbicide application may be begun up to a year in advance of grassland planting to help minimize competition for desired species.

5.4.2 Emergent Wetland

Approximately 6 acres of emergent wetland habitat will be established along the newly created swales, ponds, and wetlands in the Rodgers pit and around the edges of the re-contoured ponds in the Correll pit. Emergent wetland plants will be planted with plugs. Generally, the plugs will be planted 24" on center and the wetland will be allowed to fill in naturally. In areas of anticipated high flow or with erosion potential, plugs will be planted more densely. Additionally, biodegradable erosion control matting may be used to protect critical areas. Currently, there is little emergent wetland habitat due to the grading and inundation patterns of the pits. Creation of this habitat will provide foraging and breeding habitat for a variety of wildlife species.

5.4.3 Riparian Woodland

The preferred alternative will include creation of approximately 24 acres of riparian woodland and enhancement of 26 acres of existing woodlands. As previously discussed, much of the existing riparian habitat in the pits is either arranged in narrow bands or lacking in structural elements. This habitat will be enhanced by the installation of additional understory trees, shrubs, and vines. This will help create a more complex habitat that may be valuable to more wildlife species. Created riparian habitat will include a variety of shrubs, forbs, and trees, which will mature into a multi-canopy woodland. Flowering shrubs such as monkeyflower (*Mimulus aurantiacus*), red-flowering currant (Ribes sanguineum), and California fuschia (*Zauschneria califonica*) have been included in the planting palette to provide forage for hummingbirds in place of the tree tobacco. Created riparian habitat will join the existing isolated stands of trees into a large contiguous habitat area. This will increase habitat value by minimizing detrimental edge effects, such as nest parasitism by brown-headed cowbirds (*Molothrus ater*), which are frequently found in orchards.

5.4.4 Grassland/ Valley Oak Savannah

Approximately 8 acres of native grassland/ valley oak savannah will be created under the preferred alternative. This habitat is located above the two-year flood elevation around the east, west, and southern boundaries of the site. The area will be planted primarily with perennial grasses, with scattered groups of valley oaks and upland shrubs. As in the riparian area, plants that are a food source for hummingbirds such as California fuschia, vinegarweed (*Trichostema lanceolatum*), and hummingbird sage (*Salvia spatheca*) may be planted in some areas.

5.5 PROTECTION OF NATIVE FISH

The Revised SEIR (Yolo County 2002) updated Mitigation Measures 4.2-5 and 4.2-6 to protect against fish mortality. They state:

MM 4.2-5: Low weirs may be installed, outside of the lowflow channel, to provide shallow pools for encouraging the establishment of riparian vegetation. When establishing shallow pools outside of the low flow channel, but within the floodplain of Cache Creek, the County shall coordinate with the California Department of Fish and Game to minimize the potential for native fish species mortality.

MM4.2-6: Where riparian reforestation is proposed in streambed areas located outside of the low-flow channel, cottonwood and willow cuttings should be placed within existing swales and other naturally occurring low elevation areas in order to provide them with sufficient water to survive the summer months

The preferred alternative will meet both of these mitigation measures. Prior to being finalized and adopted, the plan will be provided to California Department of Fish and Game (CDFG) for review and comment. The proposed design maintains just slightly lower surface water elevations in the pits but with additional inlet and outlet areas to facilitate fish egress from the project area. The design also utilizes existing depressions per the SEIR mitigation measure and will actually partially fill some of these existing depressions to reduce the overall volume of water that could potential capture and strand native fish.

6.0 MAINTENANCE AND MANAGEMENT

6.1 SHORT TERM MAINTENANCE

Regular maintenance of the restoration area including intensive weeding and remedial plantings should be performed during the construction year and subsequent five-year monitoring period. Site maintenance activities should be summarized in an annual report issued in January for work performed the previous year. Maintenance activities should include but are not limited to the following:

- Removal of aggressive non-native weeds should be implemented during the five-year monitoring period for the restoration areas. All weeding should be done by hand in the wetlands and within the creek banks. If hand weeding proves ineffective against invasive exotic weeds, the Site Manager[12] may choose to use biological controls, and if these are ineffective, herbicides may be employed. The Site Manager should consult with the local Weed Management Area (WMA) or the California Exotic Pest Control Council (CalEPPC) to determine which substances or techniques should be applied. The Cache Creek Conservancy could also be consulted to determine which control methods have been the most effective for them. In riparian, upland and grassland communities, weeds should be controlled through use of approved herbicide, hand tools, or a line trimmer. The frequency and amount of weeding will depend on the rainfall patterns and other contributing factors. Until non-native invasive plants are under control, the site should be weeded at a minimum of twice annually: once following initial germination of nonnative seedlings and again prior to non-native weeds setting seed as directed by a qualified biologist. Additional weeding should be conducted if success criteria are not met.

- The Site Manager in consultation with a qualified biologist should direct weeding crews to remove weeds that require control during the five-year monitoring period. The need for weeding is expected to decrease substantially by the end of the monitoring period provided successful habitat restoration has been achieved.

- The benefits of large woody debris (LWD) to aquatic health and habitat are well documented. With a properly functioning floodplain, down woody vegetation promotes a healthier riparian environment and has minor effects on flood carrying capacity.

  For many small streams in the proper setting, LWD and standing trees roots enhance the channel bed and bank stability. Often when these elements are removed, channels have major negative responses that are cumulative. It is important that minimum "debris" clearing is undertaken, if such action is needed to maintain flood capacity or protect public health and safety.

- If it becomes necessary to remove live standing trees that are growing within the channel or within the riparian area to preserve public health and safety, the Site Manager or other qualified individual shall be consulted to determine which trees can be removed without adversely affecting the Project Goals and Objectives (Section 2).

- Trash in the restoration areas should be removed.

- The Site Manager should conduct monthly site inspections for damage to fencing and signage due to illegal site access. Damages should be repaired as soon as feasible.

- Any persons found willfully damaging the habitat within the project site, including but not restricted to trash dumping, off-road-vehicle activity, plant removal, and vandalism should be prosecuted to the full extent of the law.

- Other site problems such as vehicle damage and erosion shall be reported to Yolo County with recommendations for remedial measures.

6.1.1 *Off Road Vehicle Use*

Trespass by off road or all terrain vehicles and/or dirt bikes is currently a significant factor leading to site degradation and neighborhood concern. One neighbor mentioned that his fences are cut by trespassers and require repair on a monthly basis. Another neighborhood resident said that a significant number of ORV operators utilize their property without authorization to gain access the creek corridor. ORVs can be detrimental to on-site habitat through direct damage to plants and animals, disruption of animal behaviors due to proximity and noise of human activities, and increased erosion. In the past, fencing has been effective on neighboring properties in discouraging ORV access.

A multi-pronged approach is likely to be needed to control ORV use of the site and neighboring properties. Some measures that should be considered include:

- Fencing to prevent access. Fencing material should be durable, highly visible to prevent accidents, and effective at limiting access. Fencing should be located at both the upstream and downstream of the project site, oriented perpendicular to the existing berm, and within the project site parallel to the berm on the creek-side in areas where ORV's utilizing the creek corridor are likely to attempt climbing the berm. See the section on the Preferred Alternative for additional details on fence locations.

- Signage. The Preserve should be well marked at both upstream and downstream ends and every 500 feet along perimeter and interior fencing with signs stating that motorized vehicles are prohibited.

- Patrols. Citizen patrols are sometimes effective at limiting access. Neighborhood residents should be provided with a telephone number that they can call to report unauthorized access. More formal patrols can be organized if informal policing by residents proves ineffective. Local law enforcement personnel should be consulted for their advice on enforcing ORV prohibitions.

Once control methods are in place, unauthorized access to the site will likely diminish with time. Monthly site visits should be conducted to inspect and repair signs and fencing until ORV use has declined to the point that visit intervals can be increased.

6.1.2 *Pest Species Control*

The Monitoring Biologist and the Site Manager should refer to the species found on the CalEPPC List A, List B, and Red Alert List to assist them in determining if a plant is an exotic plant species of concern, and which species should be given priority for management.

In addition to looking for non-native species during inspections, the Site Manager should assess the presence of any newly introduced

[12] As used in this report, the Site Manager is the Yolo County staff person, or their representative, responsible for management of the project site.

exotic pest plant species and recommend removal as needed. Three methods of removing or controlling these species are outlined below:

1) Hand/Mechanical Removal

Hand removal or use of small hand powered or handheld equipment (such as a Weed Wrench or a chainsaw) should be the preferred method of removing exotic pest plant species from the project site. If hand removal methods are tried and found to be ineffective, or the problem is too widespread for hand removal to be practical, then mechanical methods (use of larger equipment with motors such as mowers) or biological controls as described below can be implemented.

2) Biological Controls

The Yolo County Agricultural Department should be the point of contact for use of any biological controls within the Preserve. There are several natural enemies of yellow star thistle such as the hairy weevil. The local WMA should also be consulted as to the effectiveness and acquisition of biological controls.

Attracting insects and bats that prey on pests can be an effective mechanism in managing population levels of pest species. Recent research at Michigan State University has shown a correlation between the amount of floral area on a plant and the population of beneficial species on those plants[13]. Planting flowering plants may have an impact on the agricultural landscape beyond aesthetics by providing food and shelter to beneficial insect species. Installation of bat boxes can be an effective method for attracting bats, which can be an important control for certain moths and other flying insects. One neighboring property owner mentioned the presence of bats in his roof tiles.

If biological control methods are tried and found to be ineffective or if biological control methods are not available for the target species, then herbicides may be used as outlined below.

3) Use of Herbicides for Non-Native/Exotic Pest Plant Management

Herbicides must be applied according to the label. This approval does not obviate the need for the Site Manager to obtain any other applicable approvals for the use of these chemicals. Herbicides may be needed to control exotic weed species, such as water hyacinth, Himalayan blackberry, Arundo or Red sesbania. The Site Manager will follow all applicable guidelines and directives from state and federal resource agencies with regard to application of herbicides near wetland habitats.

The use of herbicides and their effectiveness should be described in an annual report.

6.1.3 *Nuisance Wildlife*

Beavers and Feral Animals

Although there is no evidence of beaver activity on the site at this time, it is possible that this area could support beaver without adversely impacting surrounding land uses or riparian vegetation. If this were the case, acceptable beaver populations would need to be defined, and populations would need to be maintained at this level. Controls would need to be installed to prevent beaver harvesting of desirable trees. Effective controls usually employ wire screens to limit beaver access to trunks, though research is ongoing in effective beaver management techniques. Additional controls may include beaver pond leveler devices, which maintain beaver ponds at pre-determined acceptable levels. The devices consist of a screened inlet inside the pond and piping to an outlet sufficiently below the pond so that the beaver cannot hear the running water, which triggers their dam-building instinct. The outlet is set at the acceptable height of the water behind the dam.

Feral cats and dogs can have a significant impact on wildlife in through predation of native species. Yolo County Animal Services should be contacted if feral cats or dogs are noted during site inspections. Future interpretive signage onsite might include warnings for site visitors to contact Animal Services if feral species are seen; if it is determined that public access to the site is desirable.

6.1.4 *Mosquito Control*

While many benefits occur from preservation and enhancement of seasonal wetlands, these natural features may also pose risks to human health and safety due to the proximity of these habitat types to residential land use or visitors. The presence of standing water in wetland drainages may provide breeding and rearing habitat for mosquitoes. This potential for mosquito development within the Project Site may be a concern for nearby residents and neighboring communities. Due to the potential for mosquito-borne diseases such as West Nile Virus, vector control of these insects is required by the Sacramento-Yolo Mosquito & Vector Control District (SYMVCD).

The SYMVCD is responsible for implementing the control methods discussed below.

The SYMVCD will be required to access the site from County Road 96. Vehicles are not permitted within the wetlands or pit bottoms. ATV's are allowed permitting the ground is not saturated. If the ground is wet, the site will require access by foot to avoid create erosion problems or impacting sensitive habitat. Driving inside the wetland or drainage features is strictly prohibited.

While the District is primarily responsible for mosquito management, it is important for the Site Manager and other County staff to have effective communication to coordinate mosquito management. Field conditions are always changing, and effective coordination can help implement control methods in the most practical and efficient way possible. The District should notify The Preserve manager in the event of detection of virus activity within or near the Project Site. Any resident or migratory birds found dead on site should be reported to the District supervisor immediately by The Site Manager. The Site Manager should provide the District with any information that may effect possible treatments and their scheduled implementation prior to the on-set of the mosquito season.

Mosquito populations may best be controlled by targeting the larvae, which are found in stagnant water. By preventing adult emergence, a control program can be conducted that has the least impact on the environment. Monitoring immature and adult mosquito populations is key to preventing mosquito populations from becoming too abundant. The following list includes some of the techniques that may be used by the Sacramento-Yolo Mosquito & Vector Control District to control mosquito populations:

- Routine mosquito surveillance activities:
  - American Light Traps
  - Mosquito magnet traps
  - Gravid traps
  - Encephalitis Virus Surveillance
  - Monitoring Sentinel Chickens
  - Monitoring public health pesticide efficacy

- Routine immature mosquito management:

[13] www.nativeplants.msu.edu.

- Evaluate site for immature mosquito threshold densities.
- Evaluate environmental and regulatory conditions and requirements
- If possible, conduct drainage or modification of site
- If appropriate, introduce biological control measures
- If appropriate, apply appropriate public health pesticide

- Routine Adult Mosquito Management measures
  - Adult management is initiated when threshold criteria in the IVM of adult mosquito application guidelines are met or exceeded.
  - Wide spread adult control measures conducted by ground and air applications in non-urban areas that exceed adult mosquito threshold levels
  - Control in urban areas will be on an as needed basis predicated by direct request from a homeowner.

When mosquito threshold densities are met or exceeded, management techniques are implemented to control the population. The Sacramento-Yolo Mosquito & Vector Control District defines thresholds for larval mosquito populations in the District Mosquito and Mosquito-Borne Disease Management Plan available at http://www.fightthebite.net. This threshold is a density of 0.1 mosquito larvae per 350 ml dipper of water. The District monitors thresholds periodically during summer and fall, and treatment is initiated once populations exceed the threshold. Management of adult population is based on seven components: (1) Initiation Criteria, (2) Treatment Area Delineation, (3) Agricultural and Land Use Practices, (4) Environment Conditions (5) Continuance Criteria, (6) Termination Criteria, and (7) Factors that Influence Implementation. With each component, a series of conditions must be met before implementing an action.

Mosquito Reduction Best Management Practices (BMP) Policies

The SYMVCD has created mosquito reduction policies designed to address Significant Mosquito Sources. The SYMVCD identifies Significant Mosquito Sources using the following criteria:

- Mosquito production is significantly more than comparable land uses, and exceeds treatment thresholds.
- Treatment costs incurred by the SYMVCD are increased due to problems caused by management practices.
- Close proximity to areas of significant population density.
- BMPs exist to address the land management practices and can be reasonably utilized to reduce mosquito production.

Once identified, these significant sources will be reduced or eliminated through the implementation of a BMP plan created by the SYMVCD. The plan will be reviewed by the responsible party and adjustments will be made to achieve a mutually agreeable plan. The SYMVCD may consider charging for treatment costs if costs are above and beyond the normal level of treatment required by a similar mosquito source with similar land use.

The primary methods that the Vector Control District utilizes for control of mosquitoes includes aerial spraying, draining or filling areas that contain still water with soil, wearing of mosquito repellents, adding mosquito-eating fish to water bodies, and treating water with Bacillus thuringiensis subsp. israelensis (Bti) or Methoprene. Aerial spraying and wearing repellents target adult mosquitoes, while the other methods work at the larvae stage. Filling or draining is not an option for wetlands on the Project Site, and wearing repellents cannot be reliably implemented over a wide range of people. Aerial spraying must be applied over a large area, and raises some concerns by the public about human impacts, so should be used sparingly. The two preferred methods of control within the Project Site are the use of mosquito-fish (Gambusia affinis) and application of Bti.

Mosquitofish are surface-feeding minnows that are not native to California. They are effective at mosquito control because the fish preys on adult and pupating mosquitoes. Mosquitofish should not be used in circumstances where the fish will be washed into natural waterways, since the species is nonnative.

Bti is a microbial insect pathogen used to control larval stages of mosquitoes. It also is toxic to a limited number of other flies, including blackflies and some midges. The bacterium infects the digestive tract and must be ingested by the mosquito larvae to be effective, thus it is does not kill pupae or larvae near pupation. Bti is available as a sprayable liquid, granules, or as floating briquettes.

Methoprene may be used if Bti proves ineffective. Methoprene acts as a growth regulator, mimicking the natural juvenile hormones found in insects. Juvenile hormones must be absent for a pupa to molt to an adult, so Methoprene treated larvae will be unable to successfully change from a pupa to an adult insect. This break in the biological life cycle of the insect prevents recurring infestation.

Wetlands/Basins Control Method

Treatment for the wetlands within the Project Site should include the use of mosquitofish and/or Bti. Mosquitofish should only be used in the wetlands once these features have become stagnate, in mid to late April, at the rate of up to 1.0lb. per acre of water body (rates vary from 0.1 lbs./acre to 1lb/acre based on larval dipping data). If changing channel conditions create additional areas of standing water, those areas can be treated with mosquitofish or Bti, whichever is most appropriate for the specific channel morphology and hydraulic conditions. Applications for mosquitofish and Bti should be performed when the chance of the treatment being washed downstream is minimal. Mosquitofish should not be used in the wetlands when there is a possibility that they may be washed downstream during flooding.

Adaptive Management

As new techniques are developed for the treatment of mosquitoes and prevention of mosquito-borne diseases, this plan should be revised to reflect new knowledge. Techniques that are demonstrated via scientific research to be safe for use in vernal pools and wetlands should be incorporated into the control methods allowed by this plan. Approval of the Corps and Service will be required before any new techniques are added to this plan or used in the Preserve.

6.1.5 Erosion Control

Within the scope of this study, every effort has been made to determine and recommend long-term stable designs; however not all hydrologic impacts can be predicted. The creek should be inspected yearly for erosion problems and issues should be corrected promptly. If the problems appear to be arising due to hydrogeomorphic changes, further study should be done to determine the new state of the watershed and adjoining Cache Creek channel, and this Restoration Plan should be revised to reflect the changes. Other erosion problems should be corrected promptly before they significantly impact downstream habitat or structures. Bioremediation techniques should be favored over traditional engineering in correcting problems. Acceptable techniques include use of willow cuttings, wattles and mats to stabilize slopes, V and W weirs to direct creek flows and root wads and LWD to protect banks. It is unlikely, given the configuration of the ponds in relation to the creek channel, that harder engineering techniques such as gabions would be needed to protect bed and bank; however, if such are necessary, they should be designed with planting areas to soften their appearance and improve habitat and creek shading.

6.2 LONG-TERM ADAPTIVE MANAGEMENT

The purpose of an adaptive management strategy is to be able to respond positively to changing conditions. At the Correll-Rodgers site, the importance is placed on improving the ecological integrity and value of the riparian corridor and wetlands and improving connectivity to Cache Creek. Many indicators of biological health can be monitored onsite. As the surrounding land use changes, the changes to the health of this system must be assessed. Therefore, once restoration is implemented, the management plan should be re-evaluated every three to five years. This re-evaluation may lead to necessary management changes that benefit the long-term sustainability of the site. Any revision to the plan should be consistent with the primary goals of enhancing habitat for wildlife and aquatic species and maintaining a stable hydrologic system within the creek.

6.3 PERFORMANCE CRITERIA

The following criteria will be used to measure project success. These criteria should be evaluated periodically to ensure long-term functionality of the restoration design. Performance criteria should be revised as necessary to respond to changing goals and objectives for the project site.

6.3.1 Biological, Physical and Chemical Integrity

- Are the creek channel and pit banks stable? Is there evidence of erosion, sedimentation, aggradation or degradation, excessive channel movement, etc.?
- Are non-native species being managed such that native plant communities are not compromised?
- Are the following habitat types represented on-site: aquatic/riverine, riparian, oak woodland/savannah, seasonal wetland?
- Are beaver being managed such that their activities do not compromise other project objectives or target habitats?
- Are other nuisance wildlife such as skunks, raccoons, feral cats and dogs being managed such that they do not cause conflicts with project objectives or users?
- Are trash and fine grained sediments being managed so as not to degrade water or habitat quality or stream function?
- Is there visual evidence of water quality issues such as oil or grease on the water surface, foul odor, abnormal color, or excessive foam?
- Is there evidence of off-road vehicles damage?

6.3.2 Long-Term Sustainability

- Has outreach been extended to involve appropriate stakeholders, particularly surrounding land-owners, in the design process as well as involve local community groups in the finished project?
- Are volunteers active in project management functions such as bird counts, trash pick-up, revegetation activities, or vegetation management?
- Are project capital and maintenance costs within County means and expectations?
- Are the restored ponds and habitats sustainable?
- Has the project helped to reduce incidence of trespass on adjacent private property?

6.4 MONITORING

Periodic monitoring will be required to ensure long-term success of the restoration site. Created habitats should be monitored to verify that they provide functions and values for which they were designed. The creek channel should be monitored to ensure that it is stable and not experiencing excessive erosion.

Monitoring should begin after the first growing season following construction. Monitoring should include aerial photographic documentation and site-specific observations. A Restoration Site Manager should be designated among County or consultant staff. Additionally, a qualified Biologist should be employed to assess vegetation and habitat. The Biologist and Site Manager may be the same individual. The Site Manager should submit a summary report of monitoring results to Yolo County Parks and Recreation by January 30th of the following year in which monitoring took place. The reports should compare the establishment of the created habitats to the prior years' performance to determine the level of success of the mitigation effort.

First-year monitoring data should be used as the baseline to judge yearly success of created habitats during the monitoring period. The hydrologic and floristic data for the project site should be compared to baseline data and previous year(s) data, if applicable. If the monitoring data does not demonstrate progress toward the desired state, the County may decide that remediation is warranted or other contingency measures are needed.

6.4.1 Monitoring Methodology

Hydrologic and vegetation monitoring should be conducted for five (5) years during the appropriate seasons and should be reviewed by Yolo County in the form of annual monitoring reports. The goal of this monitoring is to proactively evaluate site conditions in order to assess items before they become a problem. As such the project biologist should perform qualitative horticultural monitoring, which will focus on soil conditions (e.g., moisture and fertility), plant health and growth, shrub and tree regeneration and growth rates, presence of native and nonnative plant species, any significant disease or pest problems, and any significant erosion problems. An important feature of this monitoring is to coordinate with County maintenance personnel and the Cache Creek Conservancy to exchange information, provide feedback, and agree on priority maintenance items and potential remedial measures during different stages of the plant establishment.

Quantitative botanical monitoring should consist of plant survival counts. Cover development should be documented with visual assessments and photographs. Plant survival counts should be conducted annually in the late summer, so there is sufficient time to obtain replacements and install them in the ensuing fall/winter. As part of the survival counts, all plugs, tree cuttings and container plants should be inspected, and a list of dead or diseased plants provided to the County and/or general contractor (if plants are still under the warranty period) along with an inventory of failed seeded or bare earth areas. Results will be incorporated in the Annual Report.

Hydrologic monitoring should consist of installation of staff gauges in the lowest areas of the created wetlands and periodic reading of those gauges throughout the wet season. Peak stage levels should be recorded either by carefully timing site visits during runoff events or through the use of high water markers or automated instrumentation. Routine recording of the gauges should, at a minimum, be done monthly during the first three years or until confidence is relatively high that the average baseline condition has been recorded.

During each monitoring site visit a general inspection of the restoration area should be made to document the occurrence of potentially detrimental conditions such as:

- Erosion or sedimentation, especially in areas that threaten riparian habitat.

- Evidence of unauthorized trespass, damage to fencing, off-road vehicle impacts, etc.

- Excessive trash or litter.

In the event that such conditions are encountered, the monitor should note the location and extent of the detrimental condition and notify the County to initiate remediation measures.

6.4.2 Photo-Documentation

Photo-documentation should be an integral part of the monitoring efforts on this site. Four to five photo points should be established throughout the project area such that an appropriate overview of the restoration area can be obtained and tracked throughout the five year monitoring period. Photo points should be permanently marked using permanent stakes, stainless steel tags and Global Positioning System (GPS) locations, with the direction of the photographs noted using degrees from true north. Photo locations should be included in a table in the yearly monitoring report.

6.4.3 Monitoring Schedule

As a guideline, the Project Biologist should perform botanical monitoring monthly during the 90-day plant establishment period, once every 2 months during year 1, quarterly during year 2, and biannually during years 3, 4, and 5. The monitoring Biologist and the Site Manager should conduct General Inspections twice annually in May and November to review overall site status, observe creek and wetland hydrology, note the presence or absence of trash and signs of damage from trespass. Additional inspections may be conducted as needed to respond to specific issues or concerns.

7.0 IMPLEMENTATION

7.1 PROJECT COST

Phase/ Task	Amount	Unit	Unit Cost	Total Cost
Planning				
Construction Documents	1	LS	$100,000.00	$100,000.00
Regulatory Tasks				
CEQA Categorical Exemption	1	LS	$1,900.00	$1,900.00
OR CEQA Initial Study	1	LS	$4,775.00	$4,775.00
USACE Section 404 Notification	1	LS	$1,450.00	$1,450.00
RWQCB Section 401 Coordination	1	LS	$635.00	$635.00
DFG 1600 Agreement	1	LS	$3,130.00	$3,130.00
			Planning Total	*$109,990.00*
Implementation				
Demolition and Grading				
Mobilization, Bonds, Insurance	1	LS	$20,000.00	$ 20,000
SWPPP Preparation & Implementation	1	LS	$20,000.00	$ 20,000
Clear & Grub	25	AC	$1,500.00	$ 37,500
Berm Grading Cut/Fill	112,840	CY	$11.60	$ 1,308,944
Topsoil Grading Cut/Fill	5,969	CY	$11.60	$ 69,240
Magnolia Drain Outfall Structure (Concrete Headwall w/ Rock Lined channel)	1	LS	$20,000.00	$ 20,000
Demolition	1	LS	$35,000.00	$ 35,000
Rock Slope Protection	2380	CY	$50.00	$ 119,000
Salvage Overlook Signs	1	LS	$2,000.00	$ 2,000
			Demolition and Grading Sub-total	*$1,631,684.40*
Habitat Restoration				
Invasive Species Removal	1	LS	$7,000.00	$7,000.00
Emergent Wetland Planting - Plugs	5.7	AC	$11,980.00	$68,286.00
Riparian Woodland Planting				
Tree Planting - 5 Gallon	1,900	EA	$20.00	$38,000.00
Understory Planting - 1 gallon	42,267	EA	$10.00	$422,670.00
Grass Seeding	2.8	AC	$1,200.00	$3,360.00
Riparian Woodland Restoration Along Cache Creek	479,448	SF	$0.10	$47,944.80
			Total	*$511,974.80*
Grassland/ Valley Oak Savannah				
Weed/ Annual Grass Eradication	8.25	AC	$140.00	$1,155.00
Tree Planting - 5 gallon	150	EA	$20.00	$3,000.00
Shrub Planting - 1 gallon	5,550	EA	$10.00	$55,500.00
Native Grass Seeding	8.0	AC	$1,200.00	$9,600.00
			Total	*$69,255.00*
Temporary Irrigation (per plant)	49,867	EA	$2.50	$124,667.50
			Habitat Restoration Sub-total	*$781,183.30*
Site Improvements				
Access Control Fencing	6,760	LF	$5.00	$33,800.00
			Site Improvements Sub-total	*$33,800.00*
			Total	**$2,556,657.70**
Construction Administration (8%)				$204,532.62
Contingency (20%)				$511,331.54
			Grand Total	**$3,272,521.86**

7.2 PHASING

The Preferred Alternative can be phased in several ways, depending upon available funding. Ideally, the entire project would be constructed at one time to minimize disturbance and mobilization costs; however, that is not always possible due to funding limitations and grant sources. Below are several options for project phasing:

Option A – Phased by pit. This option separates construction into two main phases, one for each pit.

1. Phase One -- Rodgers Pit
    a. Conduct invasive species control on areas to be restored around Rodgers pit (up to 2 years),
    b. Excavate and stockpile topsoil in areas to be disturbed,
    c. Excavate berm adjacent to Rodgers Pit to rough grades,
    d. Create west and central inlets/outfalls in berm,
    e. Grade pit bottoms and side-slopes to create wetland basins and channels,
    f. Repair Magnolia drain to create outfall,
    g. Reapply topsoil from stockpile,
    h. Install vegetation and temporary irrigation systems,
    i. Install access control fencing and signage, and
    j. Hydroseed or drill-seed disturbed areas.
2. Phase Two -- Correll Pit
    a. Conduct invasive species control on areas to be restored around Correll pit,
    b. Excavate and stockpile topsoil in areas to be disturbed,
    c. Excavate berm adjacent to Correll pit to rough grades,
    d. Create east inlet/outfall in berm and remove culvert,
    e. Fine grade pit bottoms as needed to create low spots for better mosquito population management,
    f. Relocate overlook, (could become Phase 3 if needed to fit available funds),
    g. Grade connecting weir between Correll and Rodgers pits and Cache Creek, (could become phase 3 if needed to fit available funds),
    h. Reapply topsoil from stockpile,
    i. Install vegetation and temporary irrigation systems,
    j. Install access control fencing and signage, and
    k. Hydroseed or drill-seed disturbed areas.

Phase/ Task	Amount	Unit	Unit Cost	Total Cost
Planning				
Construction Documents	1	LS	$110,000.00	$110,000.00
Regulatory Tasks				
CEQA Categorical Exemption	1	LS	$1,900.00	$1,900.00
OR CEQA Initial Study	1	LS	$4,775.00	$4,775.00
USACE Section 404 Notification	1	LS	$1,450.00	$1,450.00
RWQCB Section 401 Coordination	1	LS	$635.00	$635.00
DFG 1600 Agreement	1	LS	$3,130.00	$3,130.00
			Total	**$119,990.00**
Phase 1: Rodgers Pit				
Demolition and Grading				
Mobilization, Bonds, Insurance	1	LS	$20,000.00	$20,000.00
SWPPP Preparation & Implementation	1	LS	$20,000.00	$20,000.00
Clear & Grub	15	AC	$1,500.00	$22,500.00
Berm Grading Cut/Fill	59,400	CY	$11.60	$689,040.00
Topsoil Grading Cut/Fill	5,485	CY	$11.60	$63,626.00
Magnolia Drain Outfall Structure (Concrete Headwall w/ Rock Lined channel)	1	LS	$20,000.00	$20,000.00
Demolition	1	LS	$25,000.00	$25,000.00
Rock Slope Protection	1190	CY	$50.00	$59,500.00
			Demolition and Grading Sub-total	*$919,666.00*
Habitat Restoration				
Invasive Species Removal	1	LS	$4,000.00	$4,000.00
Emergent Wetland Planting - Plugs	2.1	AC	$11,980.00	$24,798.60
Riparian Woodland Planting				
Tree Planting - 5 Gallon	975	EA	$20.00	$19,500.00
Understory Planting - 1 gallon	18,200	EA	$10.00	$182,000.00
Grass Seeding	1.6	AC	$1,200.00	$1,920.00
			Total	*$203,420.00*
Grassland/ Valley Oak Savannah				
Weed/ Annual Grass Eradication	4.05	AC	$140.00	$567.00
Tree Planting - 5 gallon	75	EA	$20.00	$1,500.00
Shrub Planting - 1 gallon	2,720	EA	$10.00	$27,200.00
Native Grass Seeding	3.8	AC	$1,200.00	$4,548.00
			Total	*$33,815.00*
Temporary Irrigation (per plant)	21,970	EA	$2.50	$54,925.00
			Habitat Restoration Sub-total	*$320,958.60*
Construction Administration (8%)				$99,249.97
Contingency (20%)				$248,124.92
			Phase 1 Total	**$1,587,999.49**
Phase 2: Correll Pit				
Demolition and Grading				
Mobilization, Bonds, Insurance	1	LS	$20,000.00	$ 20,000.00
SWPPP Preparation & Implementation	1	LS	$20,000.00	$ 20,000.00
Clear & Grub	10	AC	$1,500.00	$ 15,000.00
Berm Grading Cut/Fill	53,440	CY	$11.60	$ 619,904.00
Topsoil Grading Cut/Fill	538	CY	$11.60	$ 6,240.80
Demolition	1	LS	$15,000.00	$ 15,000.00
Rock Slope Protection	1190	CY	$50.00	$ 59,500.00
			Demolition and Grading Sub-total	*$755,644.80*
Habitat Restoration				
Invasive Species Removal	1	LS	$5,000.00	$5,000.00
Emergent Wetland Planting - Plugs	3.6	AC	$11,980.00	$43,128.00
Riparian Woodland Planting				
Tree Planting - 5 Gallon	950	EA	$20.00	$19,000.00
Understory Planting - 1 gallon	24,000	EA	$10.00	$240,000.00
Grass Seeding	1.4	AC	$1,200.00	$1,656.00
			Total	*$260,656.00*
Grassland/ Valley Oak Savannah				
Weed/ Annual Grass Eradication	4.19	AC	$140.00	$586.60
Tree Planting - 5 gallon	75	EA	$20.00	$1,500.00
Shrub Planting - 1 gallon	2,815	EA	$10.00	$28,150.00
Native Grass Seeding	3.9	AC	$1,200.00	$4,716.00
			Total	*$34,952.60*
Temporary Irrigation (per plant)	27,840	EA	$2.50	$69,600.00
			Habitat Restoration Sub-total	*$413,336.60*
Construction Administration (8%)				$93,518.51
Contingency (20%)				$233,796.28
			Phase 2 Total	**$1,496,296.19**

Option B – Phased by earthwork. This option is likely to be more costly for the initial phase, but results in a workable solution for both ponds following phase 1 implementation.

1. Grade pits and openings
   a. Perform invasive species control over entire project site (up to 2 years),
   b. Excavate and stockpile topsoil in areas to be disturbed,
   c. Excavate berm only at openings and create outfalls,
   d. Repair Magnolia Drain to create outfall,
   e. Relocate overlook,
   f. Grade weir between ponds,
   g. Spoil excavated earth on south side of Rodgers pit and in ponds to create basins and channels,
   h. Reapply topsoil from stockpile,
   i. Install vegetation and temporary irrigation system,
   j. Install access control fencing and signage, and
   k. Hydroseed or drill seed disturbed areas.
2. Finish berm grading
   a. Excavate and stockpile topsoil in areas to be disturbed,
   b. Excavate remainder of berm to finished grade,
   c. Spoil excavated soil on north side of Rodgers pit and in eroded areas to ease oversteepened slopes,
   d. Reapply topsoil from stockpile,
   e. Hydroseed or drill-seed disturbed areas, and
   f. Repair or replace any damaged fencing and signage.

Phase/ Task	Amount	Unit	Unit Cost	Total Cost
Planning				
Construction Documents	1	LS	$110,000.00	$110,000.00
Regulatory Tasks				
CEQA Categorical Exemption	1	LS	$1,900.00	$1,900.00
OR CEQA Initial Study	1	LS	$4,775.00	$4,775.00
USACE Section 404 Notification	1	LS	$1,450.00	$1,450.00
RWQCB Section 401 Coordination	1	LS	$635.00	$635.00
DFG 1600 Agreement	1	LS	$3,130.00	$3,130.00
			Total	**$119,990.00**
Phase 1: Weirs				
Demolition and Grading				
Mobilization, Bonds, Insurance	1	LS	$20,000.00	$ 20,000
SWPPP Preparation & Implementation	1	LS	$20,000.00	$ 20,000
Clear & Grub	15	AC	$1,500.00	$ 22,500
Berm Grading Cut/ Fill	86720	CY	$11.60	$ 1,005,952
Topsoil Grading Cut/Fill	3,925	CY	$11.60	$ 45,530
Magnolia Drain Outfall Structure (Concrete Headwall w/ Rock Lined channel)	1	LS	$20,000.00	$ 20,000
Demolition	1	LS	$35,000.00	$ 35,000
Rock Slope Protection	2380	CY	$50.00	$ 119,000
Salvage Overlook Signs	1	LS	$2,000.00	$ 2,000
			Demolition and Grading Sub-total	*$1,289,982.00*
Habitat Restoration				
Invasive Species Removal	1	LS	$7,000.00	$7,000.00
Emergent Wetland Planting - Plugs	5.7	AC	$11,980.00	$68,286.00
Riparian Woodland Planting				
Tree Planting - 5 Gallon	1,160	EA	$20.00	$23,200.00
Understory Planting - 1 gallon	24,825	EA	$10.00	$248,250.00
Grass Seeding	1.7	AC	$1,200.00	$2,028.00
			Total	*$273,478.00*
Grassland/ Valley Oak Savannah				
Weed/ Annual Grass Eradication	8.25	AC	$140.00	$1,155.00
Tree Planting - 5 gallon	150	EA	$20.00	$3,000.00
Shrub Planting - 1 gallon	5,550	EA	$10.00	$55,500.00
Native Grass Seeding	8.0	AC	$1,200.00	$9,600.00
			Total	*$69,255.00*
Temporary Irrigation (per plant)	31,685	EA	$2.50	$79,212.50
			Habitat Restoration Sub-total	*$497,231.50*
Site Improvements				
Access Control Fencing	6,760	LF	$5.00	$33,800.00
			Site Improvements Sub-total	*$33,800.00*
Construction Administration (8%)				$145,681.08
Contingency (20%)				$364,202.70
			Phase 1 Total	**$2,330,897.28**
Phase 2: Lower Berm				
Demolition and Grading				
Mobilization, Bonds, Insurance	1	LS	$20,000.00	$ 20,000
SWPPP Preparation & Implementation	1	LS	$20,000.00	$ 20,000
Clear & Grub	10	AC	$1,500.00	$ 15,000
Berm Grading Cut/Fill	26,120	CY	$11.60	$ 302,992
Top Soil Cut/Fill	2043	CY	$11.60	$ 23,699
			Demolition and Grading Sub-total	*$381,690.80*
Habitat Restoration				
Emergent Wetland Planting -Repair	0.6	AC	$11,980.00	$7,307.80
Riparian Woodland Planting				
Tree Planting - 5 Gallon	750	EA	$20.00	$15,000.00
Understory Planting - 1 gallon	17,445	EA	$10.00	$174,450.00
Grass Seeding	1.1	AC	$1,200.00	$1,320.00
			Total	*$190,770.00*
Riparian Woodland Restoration Along Cache Creek	479,448	SF	$0.10	$47,944.80
Temporary Irrigation (per plant)	18,195	EA	$2.50	$45,487.50
Access Control Fencing Repair	1	LS	$3,000.00	$3,000.00
			Habitat Restoration Sub-total	*$294,510.10*
Construction Administration (8%)				$54,096.07
Contingency (20%)				$135,240.18
			Phase 2 Total	**$865,537.15**
			Grand Total	**$3,316,424.43**

7.3 FUNDING AND GRANTS

While it is outside of the scope of this project to include a detailed list of grant sources with the potential to fund this project, a number of grants have been available through both Federal and State of California sources in the past. Proposition 50 has been a source of significant funding for restoration of habitat and improvement of water quality in the past several years. Chapter 5, Clean Water and Water Quality provided $370,000,000, Chapter 7 CalFed Bay-Delta Program allocated $825,000,000 and Chapter 8, Integrated Regional Water Management provided $640,000,000 for planning and implementation projects[14]. As of 1-10-2007, $107,179,000 remained in the bond fund[15]. Proposition 84, The Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006, has the potential for funding similar projects over the next few years. If recreation were added to this project through incorporation of trails and/or interpretive exhibits, Proposition 50 River Parkways Grants could also be a potential source for planning and construction funds; however, round three submissions of these grants were due in October 2007, and the California Resources Agency has not announced whether a fourth round will be funded.

This report recommends that a more detailed assessment of grant sources and other options for funding be included in the next phase of this project.

[14] http://www.resources.ca.gov/bond/Prop_50_Summary_of_Programs2.pdf

[15] http://www.4050bonds.resources.ca.gov/Downloads/Prop50AllocationBalanceReport.pdf

8.0 REFERENCES

1. Ahlborn, G. 2005. *California Wildlife Habitat Relationships System, American Badger.* California Department of Fish and Game.

2. Anderson John and Rick Rominger. 2001. *Levee Revegetation With Native Grasses (1998)* in *Bring Farm Edges Back to Life*. Yolo County Resource Conservation District, Woodland, CA.

3. Anderson John and Jeanette Wrysinski. 2001. *Tailwater Ponds for Water Quality, Habitat and Farmland Benefits* in *Bring Farm Edges Back to Life*. Yolo County Resource Conservation District, Woodland, CA.

4. Arnold, R. A. 2007. *Sacramento Fish and Wildlife Service Species Account, Valley Elderberry Longhorn Beetle*. United States Fish and Wildlife Service. Sacramento, CA.

5. Barbour, R.W. and W.H. Davis. 1969. *Bats of America*. The University Press of Kentucky, Lexington.

6. Bloom, P. and D. Van De Water. 1994. *Swainson's Hawk in Life on the Edge: A Guide to California's Endangered Natural Resources: Wildlife*. BioSystems Books, Santa Cruz, California.

7. Bradbury, M., Estep, J.A., and D. Anderson. *In Preparation. Migratory Patterns and Wintering Range of the Central Valley Swainson's Hawk.*

8. California Department of Fish and Game. 2007. *California Natural Diversity Data Base*. Sacramento, California.

9. California Native Plant Society. 2001. *Inventory of Rare and Endangered Plants of California* (sixth edition). Sacramento, California.

10. EIP Associates, Northwest Hydraulic Consultants, and David Keith Todd, Consulting Engineers. 1995. *Technical Studies and Recommendations for the Lower Cache Creek Resource Management Plan.*

11. Elliot, Christopher. 1994. *Rodgers Pit: Reclamation Alternatives*, University of California, Davis.

12. Harris J. 2005. *California Wildlife Habitat Relationships System, Pallid Bat*. California Department of Fish and Game.

13. Hedgerow Farms. Personal Communication. November 27, 2007.

14. Hunting, K. 2000. *Grassland Bird Conservation Program, Mountain Plover. California Partner's in Flight. California* Department of Fish and Game. Sacramento, CA.

15. Jones and Stokes Associates, Inc. 1997. *Correll Pit Revegetation Program*, Cache Creek Conservancy.

16. Luhdorff and Scalmanini. 2002. *Summary of the 2001 Demonstration Recharge Activities at the Rodgers Mining Excavation per Development Agreement #96-286.*

17. Luhdorff and Scalmanini. 2003. *Summary of the 2002 Demonstration Recharge Activities at the Rodgers Mining Excavation per Development Agreement #96-286.*

18. Luhdorff and Scalmanini. 2004. *Summary of the 2003 Demonstration Recharge Activities at the Rodgers Mining Excavation per Development Agreement #96-286.*

19. Mayer Kenneth E. and William F. Laudenslayer, Jr. 1988. *A Guide to Wildlife Habitats of California*. California Department of Fish and Game. Sacramento, CA.

20. Murray, Burns and Kienlen. 1997. *Cache Creek Correll Wildlife Enhancement Hydraulic Analysis of Grade Modifications*, Cache Creek Conservancy.

21. Newton, Gail and Hogan, Phil. 1988. *Correll Property Revegetation Project, A Plan for Creating and Enhancing Riparian and Marsh Habita*t, Yolo County Resource Conservation District.

22. Sawyer, John O. and Todd Keeler-Wolf. 1995. *A Manual of California Vegetation*. California Native Plant Society, Sacramento, California.

23. Sibley, D. A. 2003. *The Sibley Field Guide to Birds of Western North America*. Alfred A. Knopf, New York.

24. Teichert Aggregates. 2003. *Rodgers Demonstration Water Recharge and Habitat Project, Woodland, Yolo County, Habitat Restoration Area Final (Fifth) Annual Report*, Teichert Aggregates.

25. U.S. Army Corps of Engineers, Sacramento District, Reclamation Board of the State of California and City of Woodland, 2003. Lower Cache Creek, Yolo County, CA, City Of Woodland And Vicinity Draft Feasibility Report For Potential Flood Damage Reduction Project

26. Wrysinski, Jeanette. 2001. *Roadside Establishment of Native Perennial Grasses* in *Bring Farm Edges Back to Life*. Yolo County Resource Conservation District, Woodland, CA.

27. Yolo County. Undated. *Project Description, Correll Wildlife Enhancement Project*, Yolo County, California;

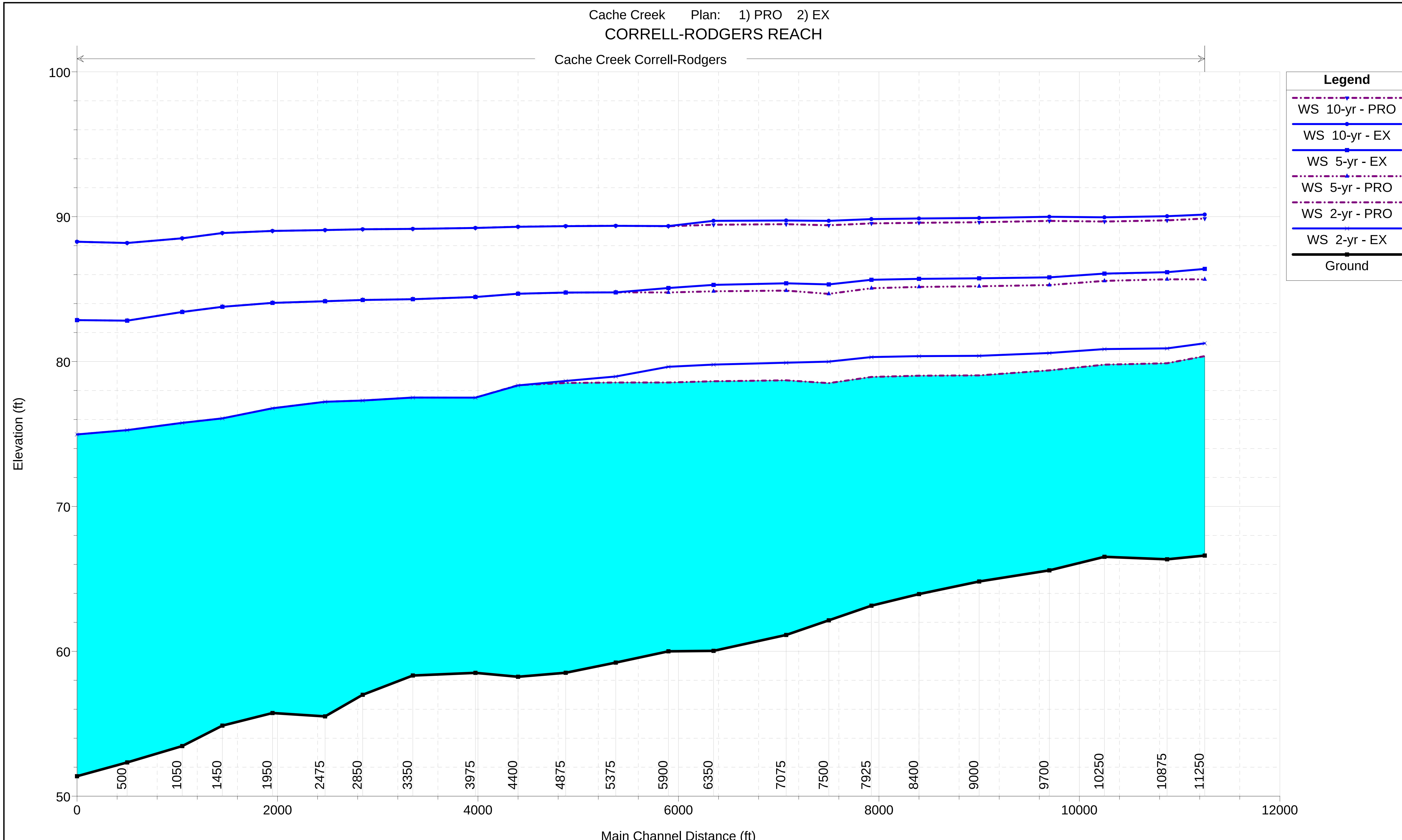
28. Yolo County, 1996. *Final Cache Creek Improvement Program For Lower Cache Creek (CCIP).*

29. Yolo County, 2002. *Revised Final Cache Creek Resources Management Plan For Lower Cache Creek (CCRMP).*

30. Yolo County, 2002. *Supplemental Program/Project-Level Environmental Impact Report (SEIR) for the Cache Creek Resources Management Plan and the Cache Creek Improvement Program for Lower Cache Creek.*

31. Zeiner, D.C., W.R. Laudenslayer Jr., K.E. Mayer, and M. White, eds. 1990. *California's Wildlife Volume II: Birds*. California Department of Fish and Game, Sacramento, CA

Appendix A – HEC-RAS Profile and Cross Sections of Proposed and Existing Conditions



Cache Creek Plan: 1) PRO 2) EX
CORRELL-RODGERS REACH
Cache Creek Correll-Rodgers
Legend
WS 10-yr - PRO
WS 10-yr - EX
WS 5-yr - EX
WS 5-yr - PRO
WS 2-yr - PRO
WS 2-yr - EX
Ground
Elevation (ft)
Main Channel Distance (ft)
100
90
80
70
60
50
0
2000
4000
6000
8000
10000
12000
500
1050
1450
1950
2475
2850
3350
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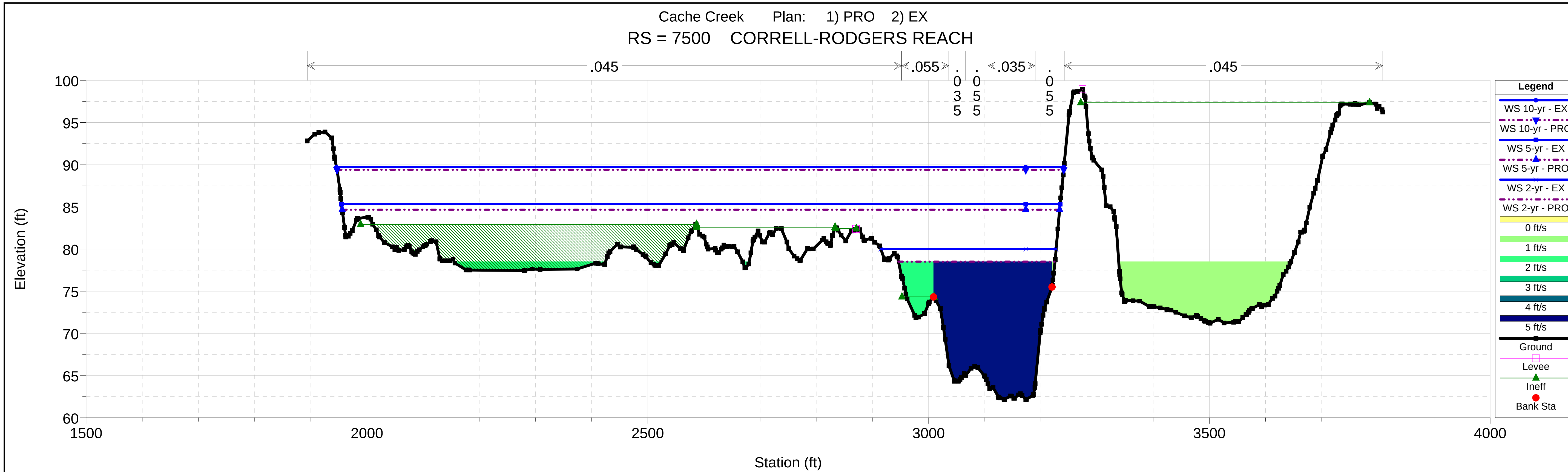
9700
10250
10875
11250



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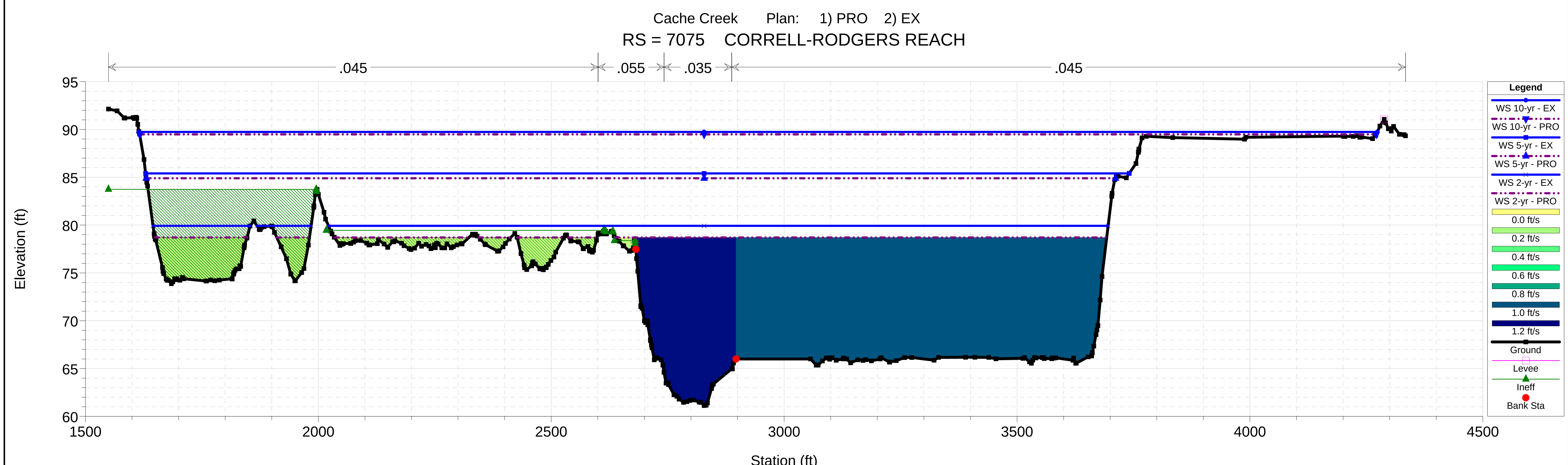
RS = 7500 CORRELL-RODGERS REACH
.045
.055
.035
.035
.055
.035
.055
.045
Elevation (ft)
Station (ft)
Legend
WS 10-yr - EX
WS 10-yr - PRO
WS 5-yr - EX
WS 5-yr - PRO
WS 2-yr - EX
WS 2-yr - PRO
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Levee
Ineff
Bank Sta



Cache Creek Plan: 1) PRO 2) EX
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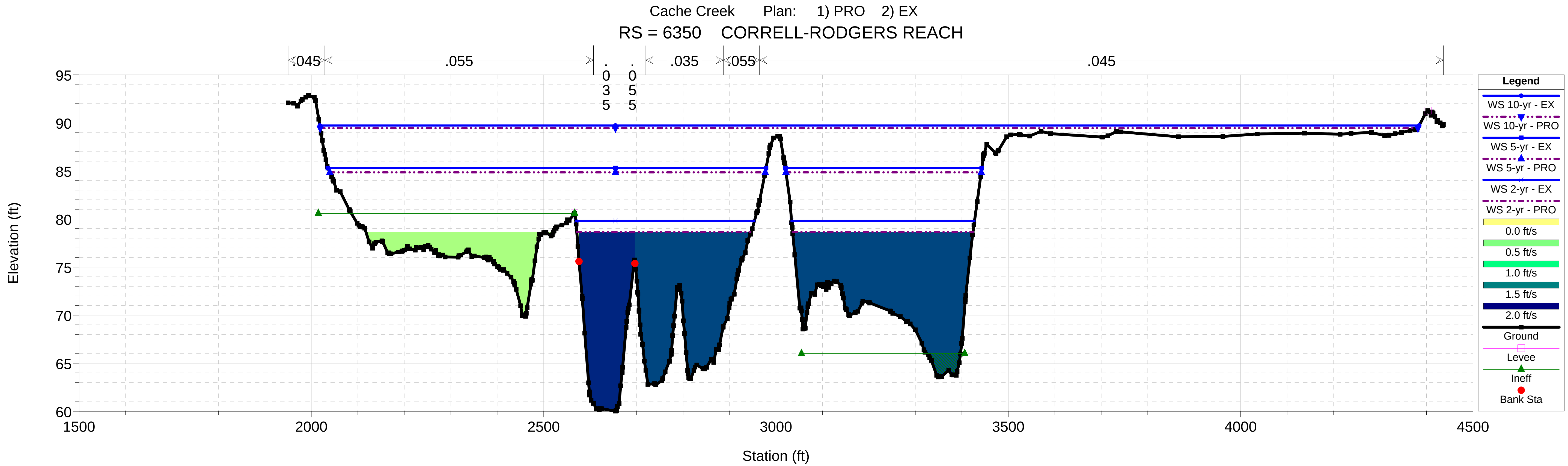
.045
.055
.035
.045
Elevation (ft)
Station (ft)
Legend
WS 10-yr - EX
WS 10-yr - PRO
WS 5-yr - EX
WS 5-yr - PRO
WS 2-yr - EX
WS 2-yr - PRO
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
1.2 ft/s
Ground
Levee
Ineff
Bank Sta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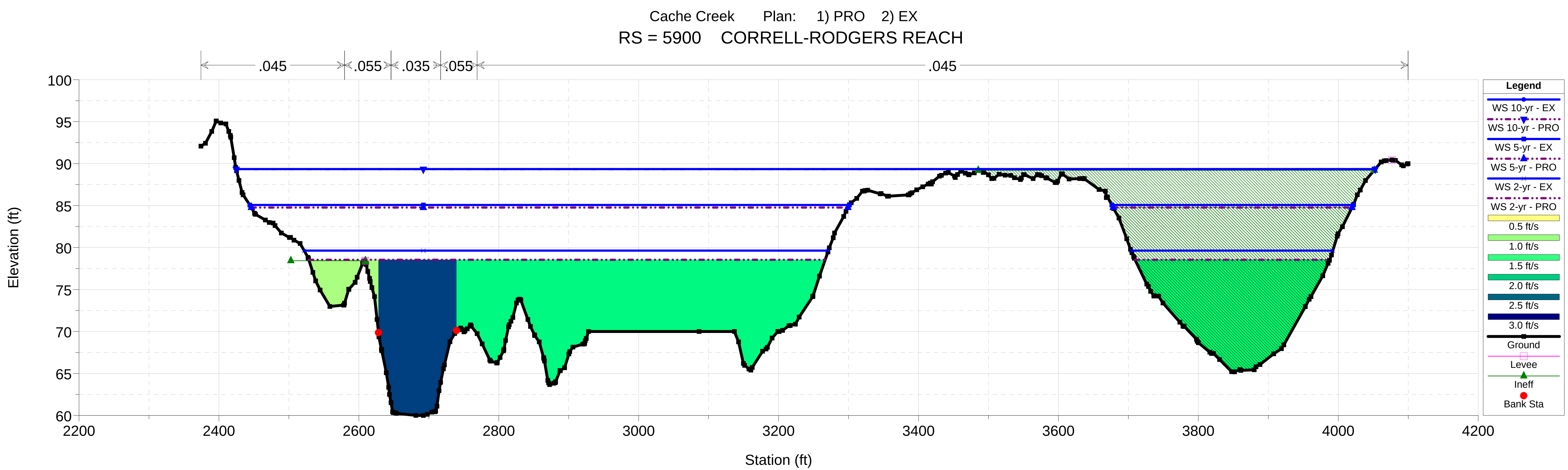
RS = 6350 CORRELL-RODGERS REACH
.045
.055
.035
.055
.035
.055
.045
Elevation (ft)
Station (ft)
Legend
WS 10-yr - EX
WS 10-yr - PRO
WS 5-yr - EX
WS 5-yr - PRO
WS 2-yr - EX
WS 2-yr - PRO
0.0 ft/s
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
Ground
Levee
Ineff
Bank Sta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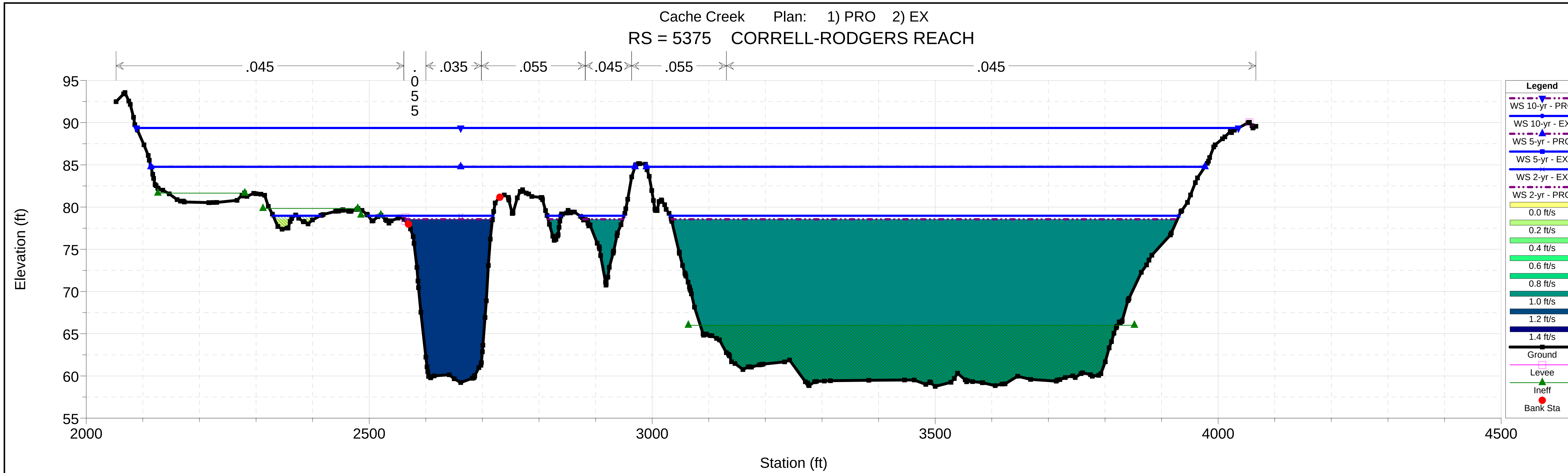
RS = 5900 CORRELL-RODGERS REACH
.045
.055
.035
.055
.045
Elevation (ft)
Station (ft)
Legend
WS 10-yr - EX
WS 10-yr - PRO
WS 5-yr - EX
WS 5-yr - PRO
WS 2-yr - EX
WS 2-yr - PRO
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
Ground
Levee
Ineff
Bank Sta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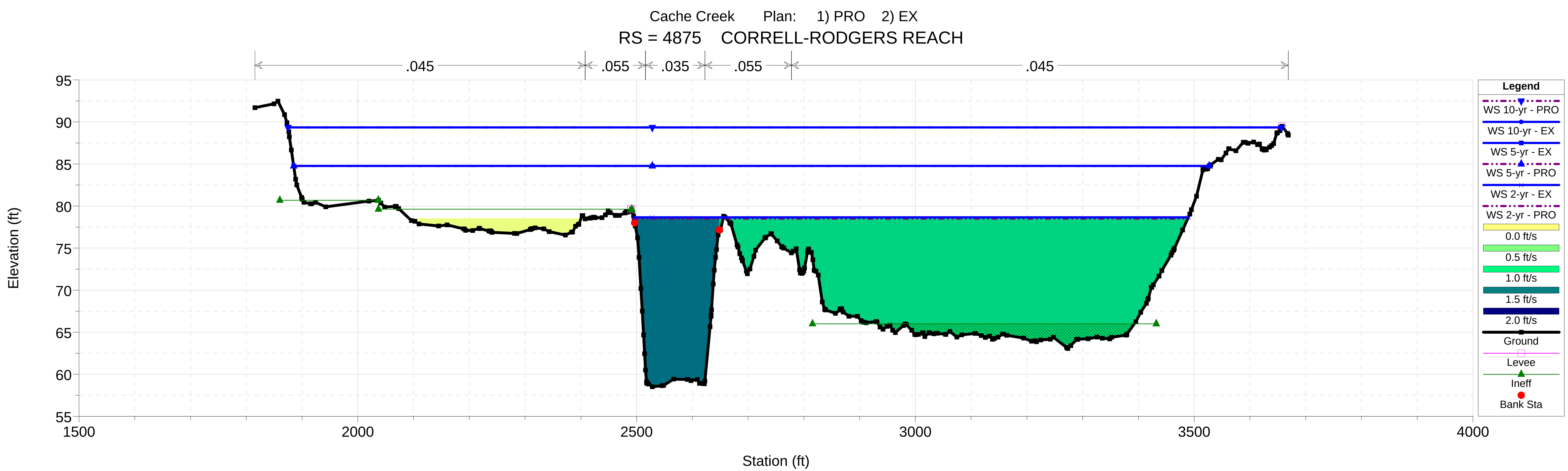
.045
.055
.035
.055
.045
.055
.045
Elevation (ft)
Station (ft)
Legend
WS 10-yr - PRO
WS 10-yr - EX
WS 5-yr - PRO
WS 5-yr - EX
WS 2-yr - EX
WS 2-yr - PRO
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
1.2 ft/s
1.4 ft/s
Ground
Levee
Ineff
Bank Sta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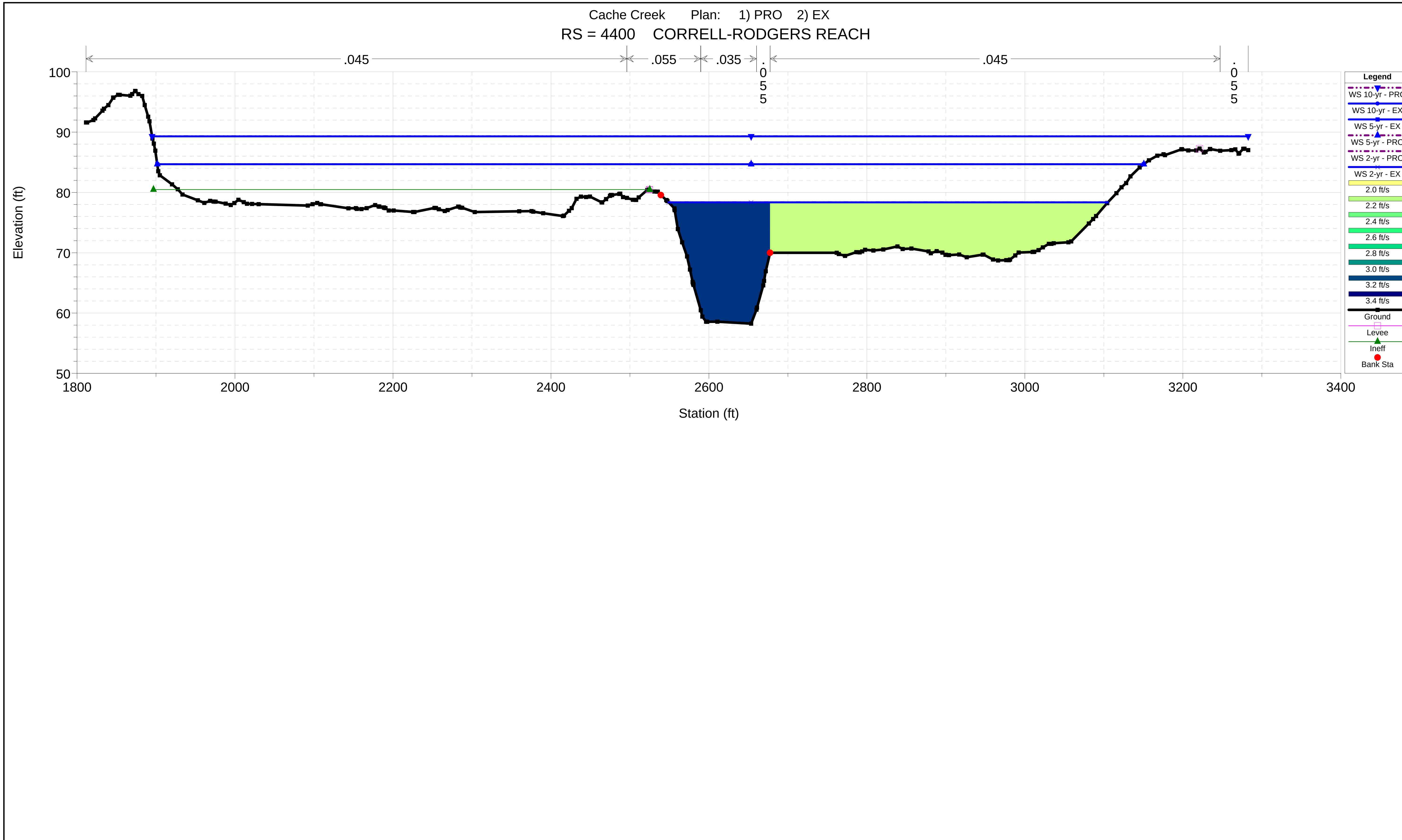
.045
.055
.035
.055
.045
Elevation (ft)
Station (ft)
Legend
WS 10-yr - PRO
WS 10-yr - EX
WS 5-yr - EX
WS 5-yr - PRO
WS 2-yr - EX
WS 2-yr - PRO
0.0 ft/s
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
Ground
Levee
Ineff
Bank Sta



Cache Creek Plan: 1) PRO 2) EX
RS = 4400 CORRELL-RODGERS REACH
.045
.055
.035
.055
.045
.055
Elevation (ft)
Station (ft)
100
90
80
70
60
50
1800
2000
2200
2400
2600
2800
3000
3200
3400
Legend
WS 10-yr - PRO
WS 10-yr - EX
WS 5-yr - EX
WS 5-yr - PRO
WS 2-yr - PRO
WS 2-yr - EX
2.0 ft/s
2.2 ft/s
2.4 ft/s
2.6 ft/s
2.8 ft/s
3.0 ft/s
3.2 ft/s
3.4 ft/s
Ground
Levee
Ineff
Bank Sta