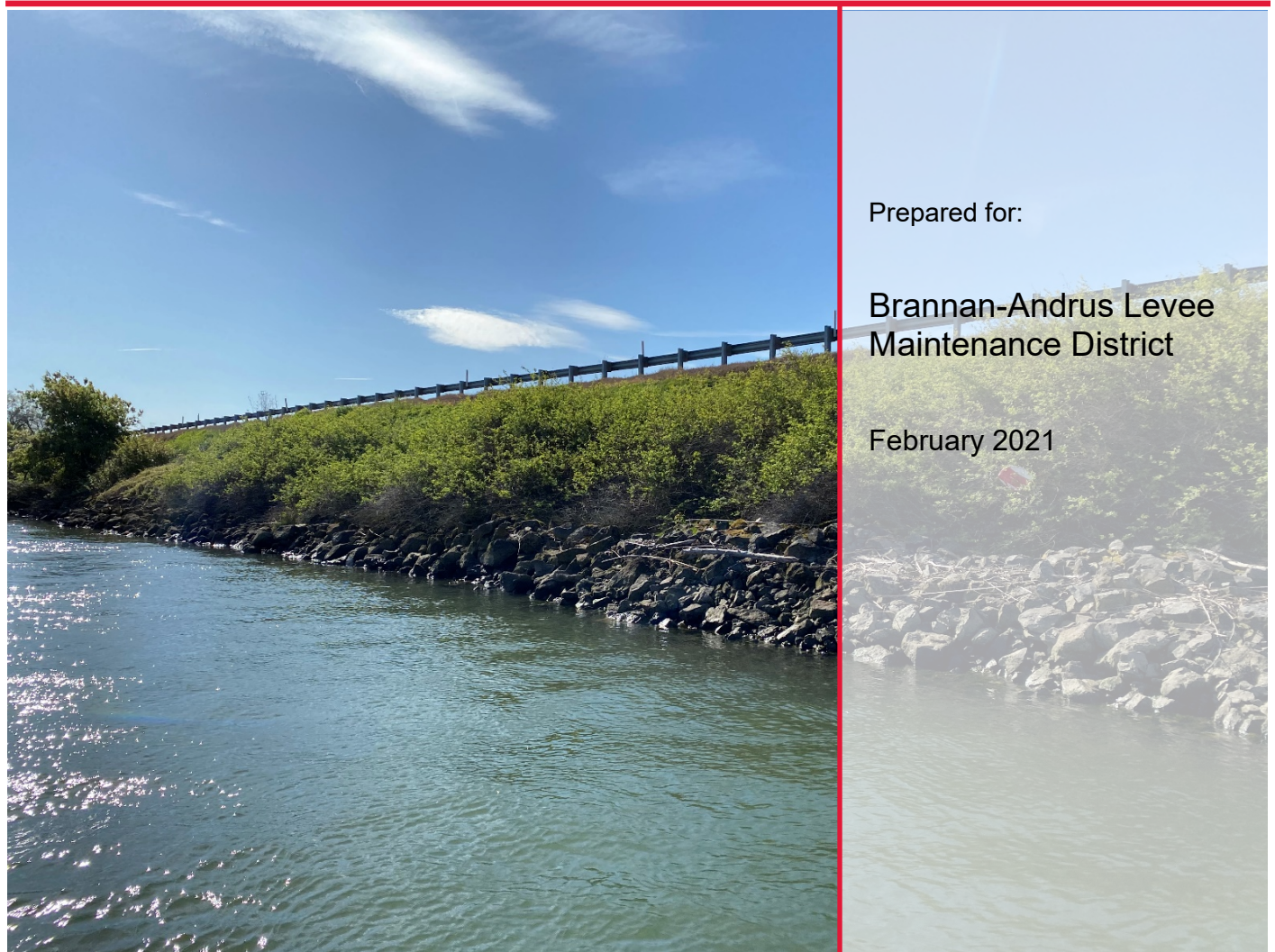


Mitigation and Habitat Enhancement Planting, Monitoring and Adaptive Management Plan - Sacramento River Erosion Control and Habitat Enhancement Project



Prepared for:

Brannan-Andrus Levee
Maintenance District

February 2021

Prepared by:

Buck and Associates Consultants, Planners, Ecologists and Scientists

Collaborating to Plan and Successfully Deliver Legacy Multi Benefit Projects that Protect and Enhance the Public Good and Environment that Sustains Us.

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This Technical Memorandum is submitted on behalf of the Brannan-Andrus Levee Maintenance District (BALMD) for the Sacramento River Erosion Control and Habitat Enhancement Project (SRECHEP) and authorized by DWR Project Funding Agreement (PFA) BA-15-1.0 SP, provides plans for habitat mitigation, enhancement, implementation and monitoring of the waterside levee habitat features that will be constructed for the Project, located on the waterside (north) levee slope of the Sacramento River along State Highway 160 south of the City of Isleton, CA (Figures 2 and 3). The SRECHEP has been designed to fully mitigate for all AB 360 habitat types (no net long-term loss of riparian, fisheries, or wildlife habitat) on-site, along with creating additional acreage of enhancement habitat.

Background

The Brannan-Andrus Levee Maintenance District (BALMD) is proposing the Sacramento River Erosion Control and Habitat Enhancement Project to resolve erosion issues on the left bank of the Sacramento River, on Brannan Island, at approximate River Miles (RM) 14.60 to 15.18, 16.36 to 17.00 and 17.13 to 17.34. Once completed, the project would: provide suitable levee erosion control on approximately 1.2 nautical miles (NM) of levee; provide fish-friendly habitat through the creation of wetland and riparian benches on the Sacramento River channel margin; and minimize long-term maintenance and repair costs by repairing existing areas of erosion using stable and effective erosion control methodologies.

The project is needed to increase levee stability and improve the level of flood protection for Brannan and Andrus islands by repairing areas of levee erosion. Erosion control would be implemented using methods that would also provide enhanced habitat in this reach of the Sacramento River that currently provides limited fish habitat. The project consists of revetment protection as well as the establishment of wetland and riparian benches at three separate erosion control sites:

- Site 1 – Station 321+00 to 292+00, RM 14.60L to 15.18L, approximately 2,900 lineal feet (LF)
- Site 2 – Station 230+00 to 197+30, RM 16.36L to 17.00L, approximately 3,300 LF.
- Site 3 – Station 189+00 to 179+00, RM 17.13L to 17.34L, approximately 1,000 LF.

The current levee system provides little habitat value for Delta fisheries and other special-status species known to occupy the region. The proposed project will create a variety of habitat types at three erosion repair sites (Sites 1-3) as both ‘enhancement’ and mitigation, intended to compensate for losses to both the terrestrial and aquatic environment associated with Project construction. These habitat types include riparian forest, scrub shrub, shaded riverine aquatic (SRA), freshwater marsh and native perennial grassland. The habitat will be created on newly constructed soil filled, linear, waterside benches parallel to the levee that vary in width from approximately 8-20-feet bench. The growth medium mixes (soil/rock) designed/planned for the benches and on the finished levee slope will favor a greater or equal proportion of soil (vs rock) to improve overall growth outcomes/success of planted vegetation. The slopes above the benches will be revegetated with native perennial grass, and with both scrub shrub and riparian forest habitats. Together these activities will mitigate for the project habitat impacts and create an overall increase in habitat enhancement acreage for freshwater tidal marsh, riparian forest, scrub-shrub and shaded riverine aquatic habitat.

The habitat areas are expected to provide multiple benefits to Delta fish and wildlife, including acting as a source of organic matter inputs through leaf litter, which would provide nutrient inputs for invertebrates and other small organisms that in turn serve as food sources for higher order organisms in the food web. In addition, fallen waterside vegetation can provide large woody material that act as habitat and cover for

fish and other aquatic organisms. The habitat areas are also expected to create additional rearing habitat as well as provide hydraulic and predation refuge for migrating salmonids^[1]. Little is known about Delta smelt spawning habitat; however, the eggs are thought to attach to substrates such as cattails, tules, tree roots, and submerged branches^[2]. Therefore, the habitat areas may also provide additional spawning habitat for Delta smelt; as well as spawning, cover, and forage habitat for other delta fish species including out-migrating juvenile salmonids, the longfin smelt, green sturgeon, white sturgeon, pacific lamprey, and river lamprey.

This waterside erosion protection and habitat enhancement project is being undertaken by the BALMD in accordance with the requirements of clause number 7 of the Project Funding Agreement BA-15-1.0-SP executed between the Department of Water Resources (DWR) and BALMD. BALMD worked with the California Department of Fish and Wildlife (CDFW) and DWR to develop preliminary concepts for the types of habitat enhancements suitable for this project, including waterside levee bench designs and suitable plant palettes as part of developing the initial conceptual scope of work for this project.

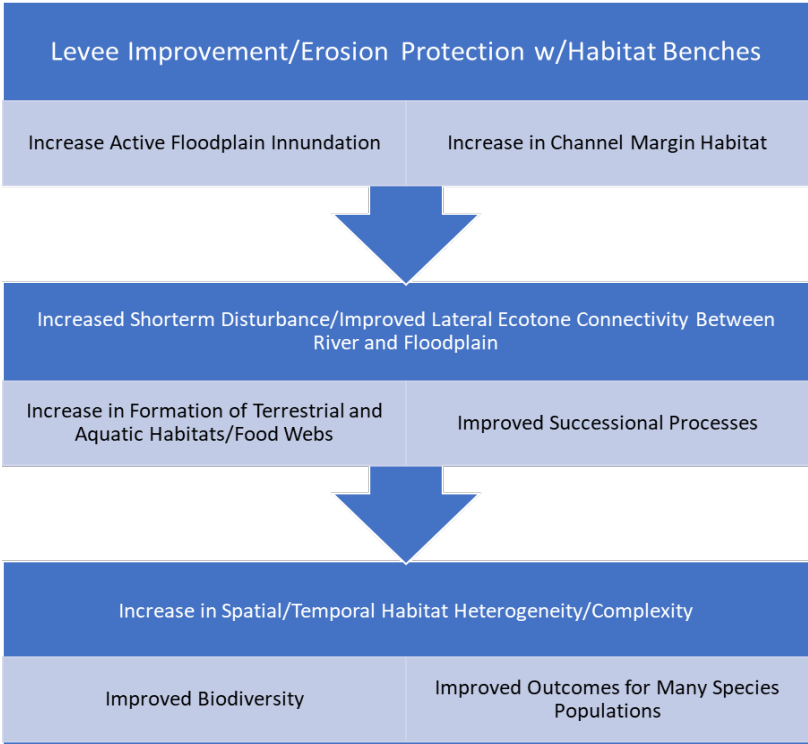
¹ Bozkurt, S., P. Dekens, R. Gartland, J. Gragg, J. Lawyer, M. McGoogan. Evaluation of Setback Levees on the Sacramento River.
² US Fish and Wildlife Service Bay Delta Fish & Wildlife Office Species Account for the Delta Smelt.

Levee Improvement, Habitat Mitigation and Enhancement Plans

As previously noted, the SRECHEP has been designed to provide both improvements to the levee through erosion protection and to fully mitigate for all AB 360 habitat types (no net long-term loss of riparian, fisheries, or wildlife habitat) on-site, along with creating additional acreage of enhancement habitat.

Figure 1 below illustrates the conceptual model developed for the SRECHEP.

Figure 1 Conceptual Model



All elevations indicated on plan sheets and referenced in this monitoring plan are referenced to the North American Vertical Datum of 1988 (NAVD88). The SRECHEP project includes creation of several thousand feet of linear, waterside habitat benches across the three identified erosion sites (Sites 1-3) including approximately 3,528-feet (0.90 acres) of freshwater tidal marsh and 4,430 feet of riparian forest (2.72 acres) bench (Figure 3). In addition, the riparian bench face, and slopes above the benches will be re-vegetated to both shoreline woody scrub shrub (2.59 acres) and seeded with native perennial grass (1.61 acres). A combined total of 7.82 acres of waterside habitat will be created by the project as shown in Table 1 below.

Table 1. Total Habitat¹ Created by Habitat Type

Location	Riparian Forest	Scrub Shrub	Freshwater Tidal Marsh	Native Grassland	Shaded Riverine Aquatic
Site 1	1.08 Ac	1.09 Ac	0.19 Ac	0.62 Ac	1,952 LF
Site 2	1.25 Ac	1.21 Ac	0.63 Ac	0.85 Ac	2,128 LF
Site 3	0.39 Ac	0.29 Ac	0.08 Ac	0.14 Ac	350 LF
Total	2.72 Ac	2.59 Ac	0.90 Ac	1.61 Ac	4,430 LF

Two typical levee cross sections are shown in Figure 4. The design includes a soil filled riparian bench constructed with the Gripper/Terrabag System. The top of this bench will be placed at elevation 8.0 ft and backfilled with a 4-foot-deep soil rock mix composed of 70% soil and 30% rock (6-inch minus) medium, which will be subsequently planted with a mix of riparian woody plants. The face of the riparian bench will also have pole cuttings placed into it at higher elevations, while the lower elevations will be planted with tules/rush species. The freshwater tidal marsh bench will be constructed up to elevation 4.0 ft (top of bench) and will also be back filled with a 70% soil and 30% rock (6-inch minus) mix to a 2-foot depth to improve establishment of tidal marsh vegetation (tules and rushes). Both benches will be covered with a 700-weight coir fabric matt to stabilize/reduce potential loss of soil and minimize erosion during the plant establishment period. Of further note, the slopes above both benches will also be re-vegetated with a

combination of both woody and herbaceous species found in the waterside Delta ecosystem.

It is anticipated that the rock slope protection/riprap (RSP) placement, placement of the 6-inch minus backfill and construction of the Gripper/Terrabag system will occur in sequence together. After the RSP material has been placed, geogrid and the Gripper/Terrabag System materials would be transported to the site via truck and placed from Highway 160. Gripper System Terrabags dimensions are approximately 6 inches (tall) x 24 inches (long) x 12 inches (wide). The bags are filled with a mixture of 75 percent sand and 25 percent topsoil. A 50:50 soil/6-inch minus rock mix would be placed on the new levee slope above both bench types (wetland and riparian) from approximately +4.0 and +8.0 feet respectively, to +17.5 feet NAVD88, near the crown of the levee. This fill material would be used as the planting medium. The soil that will be used to fill the Terrabags

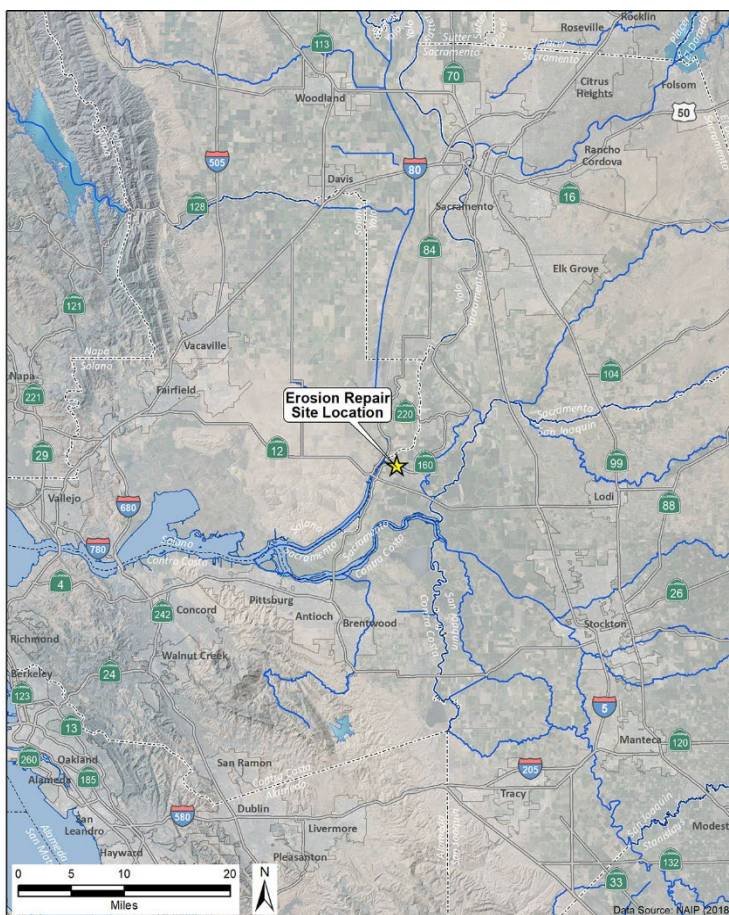


Figure 2. Project Vicinity

¹ Includes required project mitigation habitat and additional enhancement habitat.

and backfill the bench is native soil excavated from a nearby borrow site on Decker Island and classified as Tujunga fine sand (Class III) and Valdez silt loam (Class II). No soil amendments are proposed, and no pre-planting weed control will be required because soil will be placed within the planting area immediately prior to planting. Erosion control coir fabric will be placed on top and anchored along the full length of the benches following soil placement. The fabric will also work to prevent weed growth in the initial phases of establishment.

A supplemental irrigation system will be installed and used at all three sites through the initial 3-year plant establishment period for the riparian bench and vegetated slope portions of the project. Water will be drawn from the Sacramento River with a screened volume pump. Because some of the waterside plantings are occurring either within areas that are regularly tidally inundated, or within one foot of MHW at the higher edge, where soil moisture is maintained by capillary action from the saturated phreatic zone of the soil profile, intensive irrigation over the entire 3-year establishment period may not be required.

Planting Plans

The planting palettes for the habitat areas to be planted within each zone, are provided in Table 2. Planting zones described are depicted on the typical levee cross section plan sheet (Figure 4) and the typical planting plan sheet (Figure 5). Planting zones and palettes were informed by recommendations received from CDFW, best professional judgement, and current availability of appropriate native plant material from local nurseries. All plants will be installed by hand after cutting slits into the erosion control fabric at each plant location, sized as small as possible for soil protection while allowing for plant installation.

Wetland/Freshwater Tidal Marsh

Wetland/freshwater tidal marsh species will be planted (densely planted with rushes and sedges) on an approximately 10-foot wide bench surface area (elev. 4.0 ft), partially up the ‘vegetated’ slope to and within the lower elevation of the Terrabag wall (elev. 5.0 ft.). The wetland/freshwater tidal marsh zone will be planted in staggered offset pattern approximately 3-5 feet on center (O.C.).



Figure 3. Project Site Location

Figure 4. Vegetated Slope, Riparian and Wetland/Freshwater Tidal Marsh Benches - Typical Cross Sections

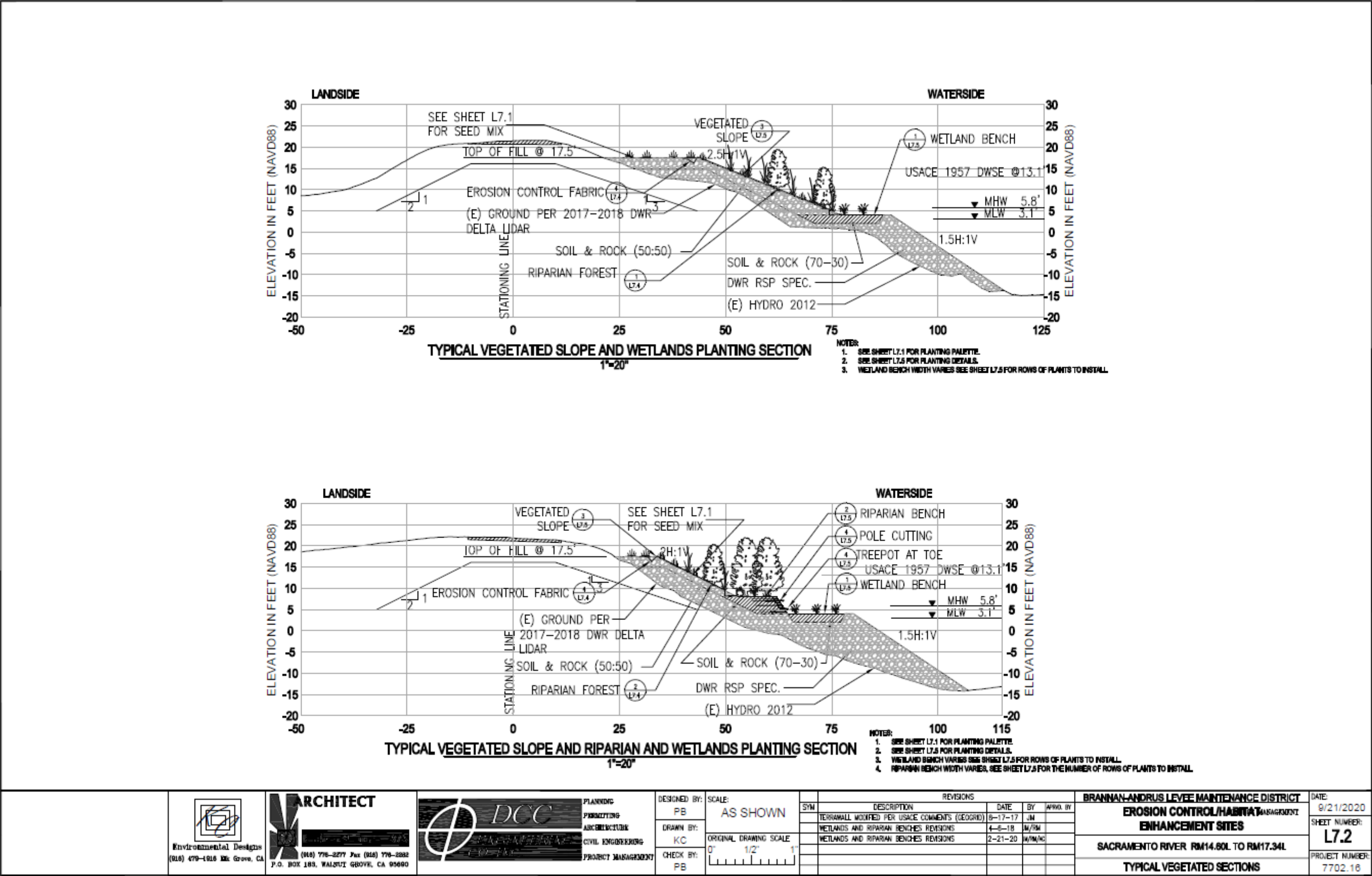


Figure 5. Vegetated Slope, Riparian and Freshwater Tidal Marsh Bench - Typical Planting Plan

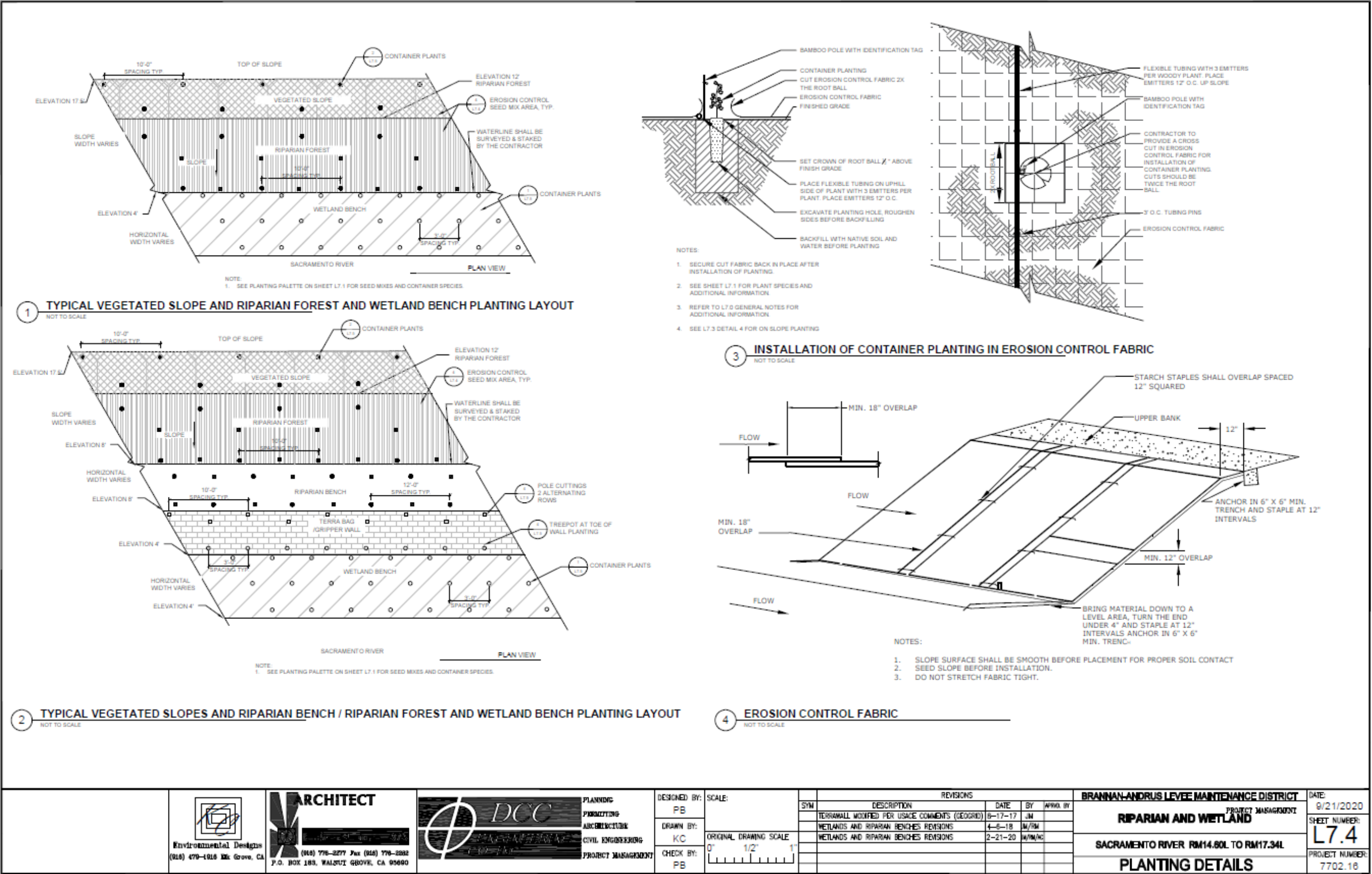


Table 2. Planting Palettes by Habitat Type

Sacramento River Erosion Control/Habitat Enhancement Project - Waterside Plant Palette						
PLANTING ZONE	BOTANICAL NAME	COMMON NAME	CONTAINER SIZE	PROPORTION OF PLANT PALETTE (PERCENT)	STAGGERED SPACING (FEET O.C.)	CONTAINER QUANTITIES
WETLAND BENCH	SCHOENOPLECTUS ACUTUS	HARDSTEM BULRUSH	TB2	50	3 ft OC staggered spacing between each row	2178
	SCHOENOPLECTUS CALIFORNICUS	CALIFORNIA BULRUSH	TB2	50	3 ft OC staggered spacing between each row	2178
	SUBTOTAL			100		4,356
TERRA BAG/GRIPPER WALL	SALIX SPP.	WILLOWS	POLE CUTTINGS	100	10 ft OC in top two rows of gripper wall; Minimum 4' long	886
	SUBTOTAL			100		886
	SCHOENOPLECTUS ACUTUS	HARDSTEM BULRUSH	TREEPOT OR APPROVED EQUAL	50	1 row at toe of gripper wall 3 ft OC	738
	SCHOENOPLECTUS CALIFORNICUS	CALIFORNIA BULRUSH	TREEPOT OR APPROVED EQUAL	50	1 row at toe of gripper wall 3 ft OC	738
	SUBTOTAL			100		1,476
RIPARIAN BENCH/RIPARIAN FOREST	JUNCUS BALTICUS	BALTIC RUSH	TB2	30	5 ft OC in staggered rows (alternating understory and placed as companion plants)	702
	JUNCUS EFFUSUS	COMMON RUSH	TB2	30		702
	JUNCUS XIPHIODES	IRIS-LEAVED RUSH	TB2	20		468
	CAREX BARBARAE	SANTA BARBARA SEDGE	TB2	20		468
	UNDERSTORY SUBTOTAL			100		2,340
	SALIX LAEVIGATA	RED WILLOW	TREEPOT OR APPROVED EQUAL	20	12 ft OC in staggered rows (alternating overstory)	76
	SALIX LASIOLEPIS	ARROYO WILLOW	TREEPOT OR APPROVED EQUAL	20		76
	SALIX LASIANDRA VAR. LASIANDRA	PACIFIC WILLOW	TREEPOT OR APPROVED EQUAL	10		38
	ALNUS RHOMBIFOLIA	WHITE ALDER	TREEPOT OR APPROVED EQUAL	10		38
	SALIX EXIGUA	SANDBAR WILLOW	TREEPOT OR APPROVED EQUAL	20		76
	ACER NEGUNDO VAR. CALIFORNICUM	CALIFORNIA BOXELDER	TREEPOT OR APPROVED EQUAL	10		38
	SALIX GOODINGII	BLACK WILLOW	TREEPOT OR APPROVED EQUAL	10		38
	OVERSTORY SUBTOTAL			100		380
VEGETATED SLOPE ABOVE RIPARIAN BENCH/RIPARIAN FOREST	BACCHARIS PILULARIS	COYOTE BRUSH	TB4	30	10 ft OC in staggered rows	118
	BACCHARIS SALICIFOLIA	MULE FAT	TB4	40		156
	CORNUS SERICEA	RED OSIER DOGWOOD	TREEPOT OR APPROVED EQUAL	30		118
	SUBTOTAL			100		392
VEGETATED SLOPE ABOVE RIPARIAN FOREST AND WETLAND BENCH	CEPHALANTHUS OCCIDENTALIS VAR. CALIFORNICUS	CALIFORNIA BUTTONWILLOW	TREEPOT OR APPROVED EQUAL	20	12 ft OC in staggered rows	127
	SALIX EXIGUA	SANDBAR WILLOW	TREEPOT OR APPROVED EQUAL	20		127
	BACCHARIS PILULARIS	COYOTE BRUSH	TB4	20		127
	BACCHARIS SALICIFOLIA	MULE FAT	TB4	25		157
	CORNUS SERICEA	RED OSIER DOGWOOD	TREEPOT OR APPROVED EQUAL	15		95
	SUBTOTAL			100		633
GRAND TOTAL						10,463

Riparian Forest, Scrub-Shrub, SRA Habitat

Scrub-shrub/SRA riparian habitat will be planted on a 6- to 8-foot wide bench located at or slightly above MHHW (Figures 4 and 5, Table 2). The woody overstory in this habitat zone will consist of various California willow species, Oregon ash, California boxelder, and white alder. The woody plant palette in this zone is comprised of species that tend to be avoided by beavers, except for white alder. White alder is subject to beaver damage, but this species was included due to its growth stature and canopy size to enhance the potential instream shading benefit that the shoreline habitat will provide, and habitat for avian and terrestrial species. Scrub shrub species on the vegetated slope will include mule fat, button willow, and coyote bush and red osier dogwood at the higher elevations.

Overstory species within the scrub-shrub riparian habitat will be planted at 10-12 ft O.C. (staggered plantings), to provide adequate growing space during the initial establishment period. Herbaceous understory species will be planted 3-5 feet O.C. on the riparian bench and on the vegetated slope up to elevation 8.0 ft. (soil placed over rock slope) as depicted in Figures 4 and 5; and Table 1.

Beaver exclusion fencing, or caging, will not be included at this time as to avoid conflicts with fish and wildlife movement, and potential maintenance issues. Cages around riparian trees will be installed as an adaptive management measure if beavers are observed to be causing greater than anticipated tree mortality.

As-built Documentation

Once the habitat areas and benches are planted, GPS points will be collected at intervals along the edges of the benches and the vegetated slope to develop as-built plans of planted habitat extents. Permanent photo-points will also be established at the time the site is planted, and as-built baseline photographs will be taken of the waterside benches following initial planting, for comparison with annual monitoring photographs during the establishment period.

Maintenance during Establishment Period

BALMD is committed to monitoring and maintaining the waterside habitat areas in cooperation, consultation and partnership with DWR and CDFW during the 3-year establishment period and beyond if needed. The waterside habitat areas will be regularly monitored, maintained, and reported on for a period of 3 years following construction and planting. BALMD will be responsible for maintenance of the habitat areas to meet performance objectives. Maintenance actions will be informed by quarterly monitoring to be undertaken by BALMD's consulting ecologist, as described below.

Maintenance actions to be undertaken by BALMD are likely to include manual removal or herbicide spot-treatments of noxious weed infestations, minor erosion repairs or additional erosion protective measures if needed, addition of beaver exclusion measures (e.g. plant caging) if needed, and/or supplemental plantings as deemed appropriate in areas with poor vegetation establishment.

Performance Monitoring, Reporting and Adaptive Management

Quarterly Site Inspections

An ecologist retained by BALMD would conduct an inspection of the waterside habitat areas quarterly

during the 3-year establishment period. During these inspections, the ecologist would record observations on plant establishment success, including trends and patterns in plant survival and health, new native vegetation recruitment, observable beaver damage, any site erosion problems, and noxious weed infestations that may threaten success of native vegetation establishment. Quarterly field visit observations will be shared with BALMD and CDFW along with the ecologist's maintenance recommendations.

Annual Quantitative Monitoring

In the spring or summer of each monitoring year, the monitoring ecologist will collect quantitative monitoring data, as described below, and take photographs from permanently established photo-points for visual documentation of project progress.

Plant survival

Riparian Forest, Scrub-Shrub, SRA Habitat. Surviving riparian forest and scrub-shrub plants will be counted each monitoring year to assess woody plant density within the riparian bench and on the vegetated slope.

Wetland/freshwater tidal marsh bench vegetative cover. Freshwater marsh vegetation cover will be assessed by BALMD's consulting ecologist by collecting plant cover data within 1-m² quadrats placed every 100-200 feet along the wetland/freshwater tidal marsh bench each monitoring year. If wetland/tidal marsh vegetation (e.g. tules and cattails) becomes too tall or dense to access and assess via quadrats, ocular estimates of tidal marsh cover will be made every 100-200 feet as viewed from the riparian bench or vegetated slope above.

At the end of the three-year establishment, riparian forest and scrub-shrub plant habitat will be considered successful if a 60 percent survival rate is achieved. Similarly, the freshwater tidal marsh habitat zone will be considered successful if native vegetative cover exceeds 60 percent absolute cover.

Reporting and Adaptive Management

At the end of the first- and second-year following planting, BALMD would provide an email summary of monitoring observations, quantitative monitoring results, representative site photographs, and maintenance and/or remedial/adaptive management actions (including replanting or additional weed management) taken and proposed, to DWR and CDFW.

At the end of the 3-year establishment period, a letter report would be submitted to CDFW and DWR, which would include a description of site conditions, qualitative assessment of vegetation composition and health, quantitative monitoring data by monitoring year, annual site progress photographs. The report would also summarize any applicable "lessons learned" from the Sacramento River Erosion Control and Habitat Enhancement Project.