

Lower American River Project Year 5

Mitigation Monitoring Report

Bank Protection Sites 1-5, and Offsite Mitigation Areas

at RM 0.9R, RM 3.3R, 11.6R

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ABSTRACT

This report summarizes Year 5 mitigation monitoring for the Lower American River Project. Habitat restoration sites include those located on five bank protection sites, Sites 1-5, as well as three offsite areas at River Miles (RM) 0.9R, 3.3R, and 11.6R. Specific habitat mitigation requirements are

- Riparian habitat: average tree height, shrub height, tree cover, and shrub cover;
- Shaded Riverine Aquatic (SRA) habitat: average cottonwood canopy width on the low berm, and percent vegetative cover and average shrub width on the berm face; and,
- Valley elderberry longhorn beetle (VELB) habitat: elderberry survival.

In general, all sites are performing well. Irrigation and weeding frequency was reduced on all sites as native vegetation is becoming well established. All sites exceed all Year 5 goals for riparian habitat, including tree and shrub height and cover. Some specific SRA goals, however, are not being met.

While Sites 1-4 meet SRA requirements for vegetative cover along the shoreline, Site 1 is not meeting the average shrub canopy width requirement, and no site meets the requirement for average cottonwood canopy width on the low berm. Prolonged inundation during the growing season and beaver pruning during breaks in the fence or high water events have combined to limit growth of some shrubs and cottonwood. Cottonwoods, however, are growing well and are naturally regenerating at most sites. In addition, the large number of cottonwood seedlings effectively reduces the average size calculated. In November, 2003, 357 individual tree cages were installed on low berm trees at Sites 1-5, RM 0.9R and 11.6R to provide additional tree protection to meet growth goals. Linear fencing and individual tree cages continue to greatly reduce beaver pruning on all sites. Beaver continue to cause sporadic damage, especially to cottonwoods, during high water stages or when gaps in the protective fence occur.

In 2004, elderberry met the 85% survival goal for Sites 1-4 through remedial planting of 100 shrubs on the high berm at RM 0.9R. An additional 100 shrubs were installed on the high berm at RM 11.6R in order to ensure the survival requirement is met. RM 0.9R and RM 11.6R were chosen for the remedial planting due to the maturity of other riparian vegetation at sites 1-4. The 3 transplanted elderberry at RM 3.3R are all alive, exceeding the 60% survival goal for Year 5.

1.0 INTRODUCTION

1.1 Background

Bank protection project sites 1-5 are located on the Lower American River (LAR), a tributary of the Sacramento River (Figure 1). The sites were selected for bank revetment based on selection criteria developed by both the United States Army Corps of Engineers (Corps) and the Sacramento Area Flood Control Agency (SAFCA) for determining critically eroding bank sites along the LAR. Bank protection was installed at five sites to provide underlying continuous hard protection to ensure a high level of flood control.

This report summarizes the 5th year status of SAFCA's compliance with specific riparian habitat mitigation requirements of the LAR Project pursuant to applicable federal and state laws and regulations. Onsite projects are the mitigation measures to restore riparian vegetation and aquatic habitat within bank protection Sites 1-5 (Table 1). Additional offsite riparian habitat enhancement measures were required to mitigate project impacts, including sites at River Miles (RM) 0.9R, 3.3R, and 11.6R (Table 2). All mitigation projects are located on the LAR active channel bank and/or floodplain.

Bank protection construction resulted in the loss of riparian, shaded riverine aquatic (SRA), and special-status species habitat. Several mitigation measures were incorporated into project designs. Site designs include a variety of surfaces capable of supporting vegetation; low riverside berms (small constructed floodplains) with varying berm-surface elevations and shoreline configuration; and woody materials submerged in constructed embayments or smaller bank scallops. Native woody and herbaceous riparian vegetation was planted on revetment at Sites 1-5 (including a low-berm face, low berm, lower slope, upper slope, and middle berm) with the goal of creating a self-sustaining, mixed canopy riparian forest and riparian scrub habitat, SRA habitat, and valley elderberry longhorn beetle (VELB) habitat. An illustration depicting a generalized cross section of mitigation sites and the terms used to describe planting surfaces is located in Figure 2.

1.2 Habitat Mitigation Requirements

Habitat mitigation requirements were derived from United States Fish and Wildlife Service (USFWS) Habitat Evaluation Procedure (HEP) analysis of Sites 1-4. No HEP analysis was performed for Site 5 because it was constructed under emergency conditions. The HEP analysis is a tool to identify the type and quantity of affected fish and wildlife habitat. Project construction affected three habitat categories in the HEP analysis:

- 1) Riparian vegetation;
- 2) SRA cover, and
- 3) VELB habitat.

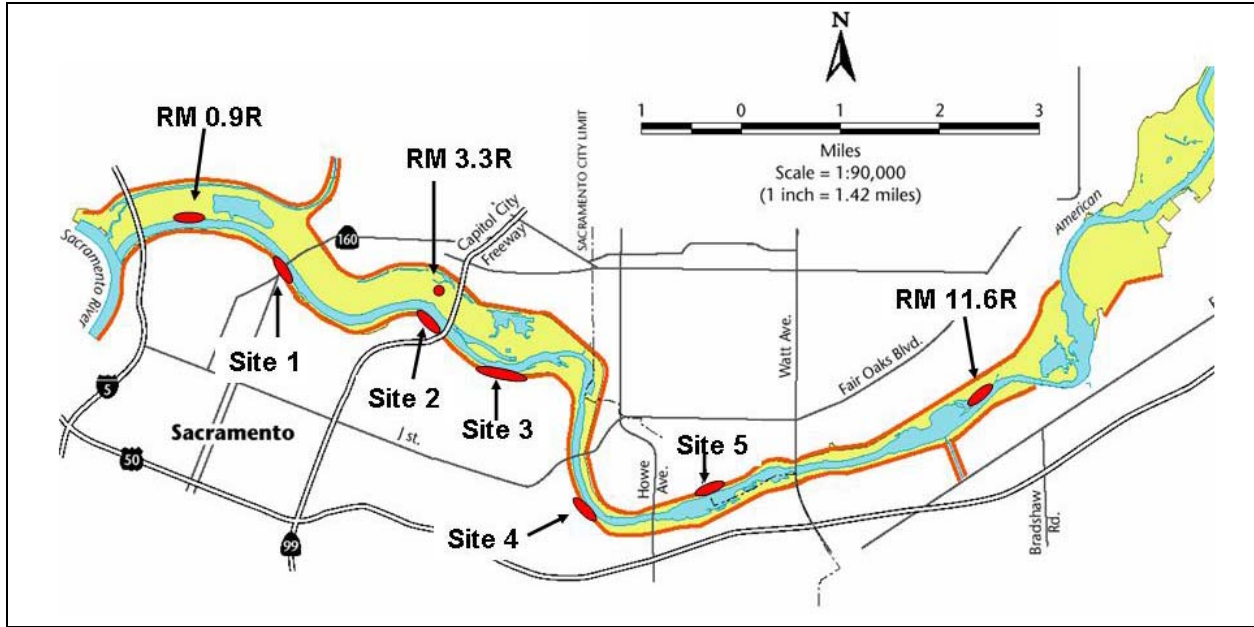


Figure 1. LAR onsite bank protection/mitigation sites and offsite mitigation areas.

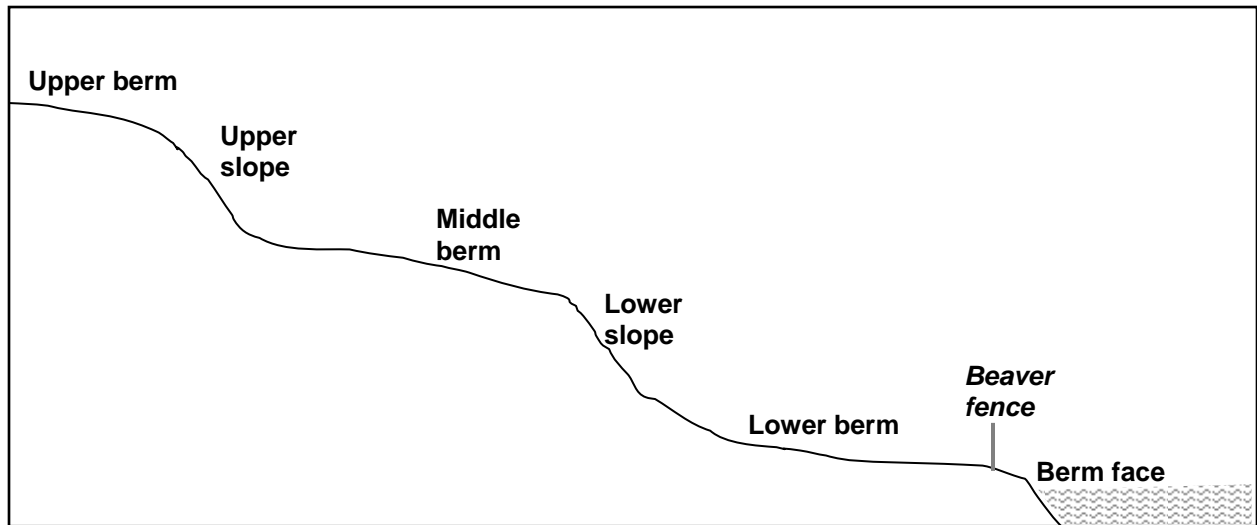


Figure 2. Generalized cross section of mitigation sites and planting surfaces

Table 1. Onsite bank protection habitat restoration sites on LAR.

Site	Size	Year planted	Transects	Features
Site 1 (RM 2.1L)	2,600 l-ft.	1999	16 (76-91)	Hardpoints and embayments; instream woody material; undulating, cobble-lined, low berm surface; and vegetation planting on low berm face, low berm, lower slope and upper slope
Site 2 (RM 3.7L)	650 l-ft.	1999	3 (70-73)	Hardpoints and embayments; undulating low berm covered by an erosion control blanket and mat; and vegetation planting on low berm face, low berm, middle berm, and upper slope
Site 3 (RM 4.4L)	3,500 l-ft.	1997, 1999	23 (40-62)	Hardpoints and embayments; undulating low berm surface covered by an erosion control blanket and mat; instream woody material; and vegetation plantings on low berm, upper slope and middle berm.
Site 4 (RM 6.8L)	3,100 l-ft.	1999	22 (15-36)	Pre-existing slope revetment and new, cobble-lined low berm surface
Site 5 (RM 8.7R)	1,500 l-ft. (0.7ac.)	1998- 1999	8 (1-7)	Irregular shore line; submerged low berm with fine textured in-stream woody material (whole willow trees); an undulating, cobble lined, low berm surface; planting on low berm and rock slope; biotechnical plantings on rock tie backs (partitions) in the low berm surface; plantings in coir logs at toe of slope above the low berm; and large portions of slope with existing vegetation were not rocked or planted.

Table 2. Offsite habitat restoration sites on LAR.

RM	Size	Year planted	Purpose	Features
0.9L (Discovery Park)	800 linear ft. 3.26 acres	2001- 2002	SRA and riparian mitigation for Site 5	Terracing, regrading low floodplain and planting
3.3R (Cal Expo)	3 elderberry shrubs	1999	VELB mitigation for Sites 1-2	Three transplanted elderberry shrubs
11.6R (Jacob Lane)	1,600 linear ft., 1.5 acres	2002	SRA and riparian mitigation for Site 5	Enhancing riparian habitat on riverbank

Performance Standards (standards) for riparian habitat, SRA habitat, and VELB at Sites 1-5 are established for Year 3 (2002) and Year 8 (2007). Non-binding Recommended Performance Goals (goals) were interpolated for intermediate years to determine site trends. Standards and goals were derived from predicted project alternative conditions for future years. These represent the weighted average of predicted future conditions for upstream, middle, and downstream sections of each site. Year 5 goals for specific riparian and SRA habitat parameters

are summarized in Table 3 and are presented with monitoring data in the results Section 3.0 below. Complete standards and goals are summarized in Appendix A.

Elderberry shrubs at Sites 1-5 must meet a standard of 85% survival. Elderberry planting mitigated for impacts to VELB habitat during project construction at Sites 1-3. The USFWS required the planting of 328 elderberry and associated native riparian species. Initially, 361 elderberry, were planted at Sites 1-5, with more planted in the fall of 2000 to replace those that had died, and an additional 200 planted in 2004.

Elderberry are planted on the upper slope and middle berm at Sites 2 and 3, and the upper slope at Sites 1, 4, and 5. Site 5 elderberries are intended to enhance riparian habitat and not required as elderberry mitigation. The additional elderberry planted in 2004 were installed at Sites 0.9 and 11.6.

Table 3. Summary of 2004 mitigation performance goals and standards.

Site	Report year	Survival (%)		Cover (%)			Height (ft.)		Width (ft.)	
		all veg.	elder-berry**	trees	shrubs	Shore-line	trees	shrubs	berm cotton-wood	berm face shrubs
1	5	-	85%	8.8%	14.3%	43%	7.9	3.3	9.9	6
2	5	-	85%	8.8%	14.3%	53%	7.9	3.3	9.9	6
3	5	-	85%	10%**	19%**	90%	8.4**	1.9**	9.9	6
4	5	-	85%	8.8%	14.3%	64%	7.9	3.3	9.9	6
5	5	-	85%	15%		-	-	-	-	-
0.9R	3	50%	85%	-	-	-	-	-	-	-
3.3R	5	-	60%	-	-	-	-	-	-	-
11.6R	4	-	85%	-	-	-	-	-	-	-

Source: (United States Army Corps of Engineers 2002, 2000a, 2000b, United States Fish and wildlife Service 1996).

*With the exception of transplanted elderberry shrubs at RM 3.3R, survival is calculated as the gross average across all sites.

**Site 3 has no Year 5 goals for tree and shrub cover and height, average of year 4 and year 6 goals is stated here.

1.3 Reporting Requirements

Monitoring report content requirements (United States Army Corps of Engineers 2000a, 2000b, 2002) are summarized in Table 4. This annual monitoring report is prepared for the Corps District Engineer and delivered by December 31st of each required reporting year (2000-2007).

Copies are also submitted to the following parties:

- Corps' Environmental Resources Branch (CESPK-PD-R),
- Corps' Project Manager (CESPK-PM),
- US Bureau of Reclamation (USBR),
- SAFCA
- CA State Department of Water Resources/ Reclamation Board
- USFWS,
- California Department of Fish and Game (CDFG),
- Sacramento County Department of Regional Parks, Recreation, and Open Space (County Parks).

Annual monitoring information for elderberry must also be submitted by December 31 of each monitoring year (from 2001 to 2010) to:

- 1) Assistant Field Supervisor for Endangered Species at the Sacramento Field Office of the USFWS,
- 2) Supervisor of Environmental Services at the Sacramento Office of CDFG,
- 3) Staff Zoologist at the California Natural Diversity Database of CDFG, and
- 4) Librarian at the California Academy of Sciences (CAS) in Golden Gate Park, San Francisco. A copy of the receipt from the CAS Library or the library catalog number assigned to it is also to be provided to the USFWS Sacramento Field Office.

Table 4. List and location of required monitoring report contents.

Required Content	Location in Report
Percent tree canopy cover over each site	Table 5 (Sect. 3.1)
Maps showing the survey transect locations	Section 2.1*
Summary of monitoring data for the project site by transect	Appendix C
Summary of extrapolated monitoring data for the project site	Table 5 (Sect. 3.1)
Photographic documentation from permanent sampling points	Appendices D and E
Qualitative description of the growth and vigor of vegetation	Sects. 1.3, 1.4, 4.1
Qualitative description of the low-berm substrate and depositional features	Sect. 4.1
Qualitative description of the establishment of volunteer vegetation	Sects. 1.3, 1.4, 4.1
Description of plant performance relative to performance standards and goals	Table 5 (Sect. 3.1)
Description of how each species planted is performing	Appendix C
Description of environmental factors adversely affecting plant success	Sects. 1.3, 1.4, 4.1
Description of proposed and implemented remedial measures	Sects. 1.3, 1.4, 4.2

* Described in report text

1.4 Onsite Mitigation Areas- 2004 Observations

1.4.1 Site 1

During 2004, vegetation at Site 1 continued to grow well and showed positive responses to the protective beaver fencing. Due to prolonged inundation of vegetation on the low berm during the spring growing season, some woody vegetation died back. Most of the affected plants resprouted and appeared healthy by the end of the growing season,. Few weeds occur on Site 1, and cottonwood, alder, box elder, rose and sandbar willow are naturally regenerating on the low berm. Vandalism of tree cages and fencing is common, resulting in sporadic beaver damage to vegetation. As the plants are becoming more mature, irrigation was reduced to a biweekly basis and delayed approximately two months into the growing season and discontinued in August. In late fall of 2003, the beaver fence was extended to protect the entire site, and 52 individual tree cages were installed primarily on cottonwood on the low berm. During 2004, most trees provided with this extra protection exhibited healthy growth and vigor. While no new cages

were added in 2004, individual tree cages were removed from dead trees and placed on adjacent unprotected cottonwood and sycamore trees.

1.4.2 Site 2

During 2004, vegetation at Site 2 continued to grow well and showed positive responses to the protective beaver fencing. Few weeds occurred on the site, and natural regeneration of cottonwood, alder, sycamore, box elder, rose, carex, and sandbar willow occurred on the low berm. Inundation over the fence in the winter resulted in sporadic beaver damage to vegetation. As the plants are becoming more mature, irrigation was reduced to a biweekly basis and delayed approximately two months into the growing season as well as being discontinued in August. Approximately 5 individual tree cages were installed primarily on cottonwood on the low berm in late fall of 2003. During 2004, most trees provided with this extra protection exhibited healthy growth and vigor. While no new cages were added in 2004, individual tree cages were removed from dead trees and placed on adjacent unprotected cottonwood and sycamore trees.

1.4.3 Site 3

During 2004, vegetation at Site 3 continued to grow well and showed positive responses to the protective beaver fencing. Due to prolonged inundation of vegetation on the low berm during the spring growing season, some woody vegetation died back. Most of the affected plants resprouted and appeared healthy by the end of the growing season,. The low berm at Site 3 has a few invasive weeds, such as white sweet clover and Pampas grass, which are removed as needed by contractors. Below an urban stormwater drain, woody exotic species such as Siberian elm, Chinese elm, catalpa, silver maple, and privet occur on the low berm and slope. Natural regeneration of cottonwood, alder, box elder, rose, arroyo willow and sandbar willow occurred on the low berm. Some vandalism of tree cages and fencing occurs in addition to water overtopping of the fence in the winter months, resulting in sporadic beaver damage to vegetation. As the plants are becoming more mature, irrigation was reduced to a biweekly basis and delayed approximately one month into the growing season on the slope, and two months on the low berm. The irrigation was also discontinued in early September due to the vigor of the plants. The beaver fence was extended to protect the entire site, and in late 2003, 150 individual tree cages were installed primarily on cottonwood on the low berm. During 2004, most trees provided with this extra protection exhibited healthy growth and vigor. While no new cages were added in 2004, individual tree cages were removed from dead trees and placed on adjacent unprotected cottonwood and sycamore trees. In Spring of 2004, 350 shrubs were installed along the berm face, including sandbar willow cuttings, blackberry, rose, buttonwillow, and mulefat. Growth and survival was limited, however, due to dry conditions during the summer months, and lack of adequate soil and rooting medium within the engineered rock and geotextile fabric of the berm face,.

1.4.4 Site 4

During 2004, vegetation at Site 4 continued to grow well and showed exceptional responses to the protective beaver fencing. Few weeds but also very little natural regeneration of cottonwood

and sandbar willow occurred on the low berm due to lack of surface soil on the cobble. Vandalism of fencing is occasional, resulting in sporadic beaver damage to vegetation. As the plants are becoming more mature, irrigation was reduced to a biweekly basis, delayed approximately one month into the growing season and discontinued in August. Invasive weeds are uncommon, but include catalpa, black locust, Pampas grass, and casuarina. The beaver fence was extended to protect the entire site, and 100 individual tree cages were installed primarily on cottonwood on the low berm in late 2003. During 2004, most trees provided with this extra protection exhibited healthy growth and vigor. While no new cages were added in 2004, individual tree cages were removed from dead trees and placed on adjacent unprotected cottonwood and sycamore trees.

1.4.5 Site 5

During 2004, vegetation at Site 5 continued to grow well and showed positive responses to the protective beaver fencing. The low berm at Site 5 has a few invasive weeds, such as verbena, palm, privet, photinia, and Pampas grass, which are removed as needed by contractors. Natural regeneration of cottonwoods, alder, rose, and sandbar willow occurred on the low berm. Some vandalism of tree cages and fencing occurred, resulting in sporadic beaver damage to vegetation. No irrigation occurred at Site 5 in 2004, and regular monitoring indicated that the existing native woody vegetation appeared healthy and grew well throughout the summer months. The beaver fence was extended to protect the entire site, and 50 individual tree cages were installed primarily on cottonwood on the low berm in 2003. During 2004, most trees provided with this extra protection exhibited healthy growth and vigor. While no new cages were added in 2004, individual tree cages were removed from dead trees and placed on adjacent unprotected cottonwood and sycamore trees.

1.5 Offsite Mitigation Areas

1.5.1 RM 0.9R

RM 0.9R has progressed exceptionally well and has experienced few problems in its third year. Perennial pepperweed and verbena continue to be problem weeds, although mowing and herbicides provide some control. Drill-seeded native grass was growing very well in the spring and early summer, but appeared to have been competing with vigorous weeds by late summer. Irrigation likely increased weed competition for the native grasses.

Berm face erosion continues to occur on the two upstream beaches largely due to wave wash energy on the sandy, poorly consolidated soil of the bank. To prevent ongoing undermining of the beaver fence, the fencing was moved back about 20 feet. Brush boxes, choir logs, and a dense planting of sandbar willow, button bush, mule fat, blackberry, and rose was installed along the berm face to curtail additional erosion and provide a living barrier to beaver predation. Tree cages were installed on 51 cottonwoods for additional protection against beaver damage. On the top of the berm, 100 elderberry were planted in order to maintain the survival standard for elderberry shrubs across all LAR sites.

1.5.2 RM 3.3R

RM 3.3R is an offsite area for VELB habitat mitigation for Sites 1 and 2. In 1999, three elderberry shrubs were transplanted from Sites 1 and 2 to RM 3.3R, near the Jedediah Smith National Recreation Trail, ¼ mile west of Business 80. This is the fourth year of monitoring, and performance requirements are described by the USFWS (United States Fish and Wildlife Service 1996). Fencing installed in 2002 continues to effectively prevent deer browsing. Each transplant area was irrigated approximately six times (monthly) during 2004.

1.5.3 RM 11.6R

RM 11.6R is a SRA and riparian habitat improvement project and off-site mitigation for Site 5. Success criteria are provided by the Corps (United States Army Corps of Engineers 2000b). Seeded native grasses have survived very poorly, and have been mostly replaced by annual weeds. The slope remains difficult to irrigate. The contractor installed a new soaker hose system to provide deeper irrigation in the more drought-prone areas. In 2005, we will install a second irrigation line along the shoreline in order to more effectively irrigate the slope. Individual tree cages perform well in limiting deer browse and beaver chewing. Prototype wooden fencing and dense planting of sandbar willow, button bush, mule fat, blackberry, and rose was installed along the shoreline to create a living barrier to beaver predation. On the top of the berm, 100 elderberry were planted in order to maintain the survival standard for elderberry shrubs across all LAR sites.

2.0 MONITORING METHODS

2.1 Riparian and SRA Mitigation

Mitigation monitoring for riparian, SRA, and VELB habitat at all sites was conducted by Trevor Burwell (County Parks) and Sarah Ross, Lizette Crosbie and Simon Helminski (SAFCA) in June 2003. Permanent monitoring transects occur at 150 foot intervals perpendicular to the shoreline. Two curled rebar pieces were installed to mark and number each transect location. Vegetation along each transect line was also marked with flagging tape and green marking paint on rock revetment.

A measuring tape was laid on the transect, and for each tree or shrub with a portion of its crown intersecting the tape, species, length of intersection on transect, and maximum width and height were recorded. Total transect length was recorded, and plant data was separated into tree, shrub, and vine categories. Percent cover was estimated by dividing the total length of plant intersection on the tape by transect length. Non-native species were not included in the transect data because they are removed as part of on going site maintenance. Appendix B contains a list of species with growth form category.

Transect data from Sites 1-5 were analyzed to determine:

- Average tree and shrub height,
- Average tree and shrub width,
- Average shrub width on berm face,
- Average cottonwood width on the low berm, and
- Percent tree and shrub cover (length of overlap on transect divided by total transect length).

For this analysis, all woody plants growing on the berm face were categorized as shrubs. All data were collected and analyzed by site and by landscape position (e.g., slope, berm, berm face) for the purposes of reporting requirements and adaptive management of site maintenance.

2.2 VELB Mitigation

Elderberry plant counts were collected for Sites 1-5 in March/April and again in June 2004. In the first survey, all live elderberry plants were counted, height, width, and vigor of all elderberry were measured, and those with a stem diameter ≥ 1 inch was searched for VELB exit holes. In June all live elderberry plants were counted, and those with a stem diameter ≥ 1 inch were searched for VELB exit holes. The location, number, and estimated age of all exit holes were recorded.

Shrub vigor is reported as good, fair, or poor. Shrubs with a good rating have $>50\%$ live foliage and an average leaflet size of ≥ 1 inch. Shrubs with a poor rating do not meet both criteria. Shrubs that meet only one criterion or meet both, but have mostly yellow leaves were considered

fair. Overall shrub size was not considered during the condition assessment. Elderberry survival rates are calculated by dividing the total elderberry count for Sites 1-5 in the June survey by the required number of elderberry planted (328).

2.3 SRA Shoreline Cover Requirements

Shoreline cover for Sites 1-4 was measured from digital photographs taken from mid-river in a canoe paddled and steered by Bill Griffith on August 3, 2004. Images were taken of the berm face in 150-foot segments between each transect line. Two people paddled individual kayaks to mark the shoreline terminus of each transect. Each digital image was cropped to transect markers and the top and bottom of the berm face and slope, enlarged to a 10-inch width image and printed (Appendix E). Cover was visually estimated to the nearest 5% by using past images of known, measured cover of similar sites using a dot matrix overlay.

2.4 General Photographic Documentation

Several permanent photographic points were established at permanent landmark features. Year 4 digital were taken in June 2004 (Appendix E). The views were selected to document vegetation change over landscape views of each site.

2.5 Periodic Site Assessments

Spring and fall periodic site assessments occurred in 2004 to inspect bank protection Sites 1-5 and offsite mitigation areas at RM 0.9R, RM 3.3R, and RM 11.6R. Representatives from the Corps, USFWS, National Oceanic and Atmospheric Administration Fisheries Department (NOAA Fisheries), California Department of Water Resources (CDWR), CDFG, County Parks and SAFCA were invited. Site conditions observed during inspections were recorded on checklist forms presented in Appendix F. The spring site tour was conducted on June 17, 2004, and the fall tour occurred on October 28, 2004.

3.0 RESULTS AND DISCUSSION

3.1 Riparian Habitat

3.1.1 Onsite

Sites 1-5 exceed all Year 5 goals for riparian habitat, including average tree height, average shrub height, shrub cover and tree cover (Table 5). In fact, Sites 1-5 exceed Year 8 standards for tree cover, shrub cover, and average shrub height. While still meeting the performance goal, average tree height is comparatively low due to natural tree recruitment on the low berm of most sites, which adds a large number of small seedlings to the average. Site 5 has no Year 5 goals for riparian habitat, but vegetation growth is meeting most goals set for Sites 1-4.

3.1.2 Offsite

This is the third and fourth reporting years, respectively, for off-site mitigation areas at RM 0.9R and RM 11.6R. These sites have survival goals but no cover or size standards for vegetation in 2004. Because survival at each site greatly exceeded goals in 2003, and there was no apparent appreciable loss of individual plants or cover in 2004, survival was not measured in 2004. Instead, cover, height, and width were measured along transects. Both sites exceed all riparian habitat goals for year 5. (Table 5).

At RM 0.9R, brush layered willow cuttings, are rooted and growing well. Natural regeneration is common throughout, and observed seedling species include arroyo willow, sandbar willow, Gooding's willow, yellow willow, wild grape, mule fat, Oregon ash, , interior live oak, coyote brush, box elder, cottonwood and sycamore. At RM 11.6R, natural regeneration was observed for Oregon ash, box elder, sandbar willow, sycamore, and California blackberry.

Table 5. Riparian habitat mitigation performance Year 5 (June 2004).

Site	n	Average height (ft)			Cover (%)		
		Goal	Actual	Met goal?	Goal	Actual	Met goal?
Trees							
1	97	7.9	10.85	Yes	8.8%	55.2%	Yes
2	21	7.9	13.00	Yes	8.8%	63.1%	Yes
3	229	8.4*	11.91	Yes	10.0%*	63.2%	Yes
4	93	7.9	9.83	Yes	8.8%	36.5%	Yes
5	31	-	11.18	-	15%	74%	Yes
0.9R**	38	-	8.67	-	15%**	30.7%	Yes**
11.6R**	-	-	9.57	-	-	20.9%	Yes**
Shrubs							
1	116	3.3	8.43	Yes	14.3%	38%	Yes
2	20	3.3	14.2	Yes	14.3%	63.4%	Yes
3	139	1.9*	7.98	Yes	19.0%*	29.3%	Yes
4	149	3.3	8.9	Yes	14.3%	42.8%	Yes
5	37	-	4.88	-	15%	25%	Yes
0.9R**	60	-	5.14	-	15%**	22.3%	Yes**
11.6R**	-	-	7.73	-	15%**	17.6%	Yes**

- = There are no Recommended Performance Goals or Performance Standards for this reporting year.

*Site 3 has no Year 5 goals for tree and shrub cover and height, average of year 4 and year 6 goals is stated here.

**RM 0.9R and RM 11.6R exceed Year 3 survival goals, Year 3 canopy cover is reported here against Year 5 cover goals.

3.2 SRA Habitat

Recommended Performance Goals for SRA mitigation in 2004 are divided among three separate components: percent vegetative shoreline (berm face) cover, average shrub width on the berm face, and average cottonwood canopy width on the berm at Sites 1-4.

3.2.1 Shoreline cover

Shoreline cover is generally performing well at all sites, averaging 86% cover across all planted shorelines. Vegetative cover on the shoreline is now well-established and overhanging the water in many areas. The white alder growth on Site 4 is particularly robust. Site 3 has several gaps due to repeated beaver access because the shoreline fence is lower in elevation at several locations. Sites 1 and 2 have especially vigorous sandbar willow growth along the shoreline.

3.2.2 Shrub width on the berm face

With the fourth season of barrier fencing and reduced beaver pressure, all sites with berm face plants except Site 1 are meeting or exceeding Year 4 berm face shrub width performance goals. Site 1 shrubs are just below the canopy width goal, which may be a function of crowding and small plant sizes due to natural recruitment of sandbar willow. Site 4 in particular exhibited tremendous growth of berm face shrubs and is currently meeting the final standard for Year 8.

3.2.3 Cottonwood width on the berm

No site is meeting Year 5 average cottonwood width goals on the low berm (Table 6). While cottonwood trees are numerous and growing well on the low berm, failure to meet the performance goal is largely because of the relatively young age of most cottonwoods counted. Substantial natural cottonwood regeneration has occurred on the low berm across all the sites, and while this is an encouraging indicator of a functioning riparian forest, it nonetheless has the effect of reducing the average size of all the trees measured. The average growth increase from last year is however is .84 feet.

Other factors include repeated beaver pruning prior to fence installation in 2001, which severely reduced the height of most berm cottonwoods; and continued preferential beaver pruning of berm cottonwoods whenever access is available due to high water or fence damage. The installation of individual trees cages on unprotected volunteer and planted cottonwoods on the low berm has greatly increased growth and survival of young cottonwoods. This has had the dual effect of increasing the number while decreasing the average size of most cottonwoods counted in the sampling. While no site is currently attaining the canopy width goal for cottonwood, we believe that continued growth following the installation of tree cages will result in the achievement of the Year 8 performance standard.

Table 6. SRA Performance for Year 5 (June 2004).

Site	Shoreline (berm face) cover (%)			Berm face average shrub width (ft.)				Berm average cottonwood width (ft.)			
	Goal	Actual	Met goal?	Goal	Actual	<i>n</i>	Met goal?	Goal	Actual	<i>n</i>	Met goal?
1	43%	82%	Yes	5	4.95	32	No	8	2.2	5	No
2	53%	85%	Yes	5	5.75	14	Yes	8	4.0	1	No
3	90%	95%	Yes	5	6.1	24	Yes	8	4.36	14	No
4	64%	81%	Yes	5	10.65	69	Yes	8	3.88	17	No

3.3 VELB Habitat

Elderberry planted for VELB habitat are meeting the recommended 85% survival goal (279/328 plants) for Year 5. There were 309 elderberry shrubs counted in June across Sites 1-5 and the

remedial planting on the high berm at RM 0.9R. An additional 100 elderberry shrubs were planted on the high berm at RM 11.6R in November, 2004. Most (78%) elderberry are rated as having good health and vigor, with 17% in fair condition and 5% in poor condition (Table 7).

Elderberry growth varies widely within and among sites. In general, elderberries planted on Site 4 are larger and healthier, followed by those at Sites 1 and 2. Site 4 is generally the most exposed, full sun environment of the five bank protection sites, and therefore may result in the greatest growth. We expect similar, rapid growth of the remedial plantings at RM 0.9R and 11.6R. Site 3 elderberry are generally the smallest and in the poorest health, perhaps because many occur in the understory of mature riparian tree canopy, or because of irrigation blocked by other maturing riparian vegetation. Less than half (41%) of the elderberry have a stem ≥ 1 " diameter, and no VELB exit holes occur on any elderberry within Sites 1-5. The largest stem diameters were 5-7" (Sites 2 and 4).

In the fifth year of monitoring, the three transplanted elderberry shrubs at RM 3.3R continued to grow from root sprouts as most of the larger, main branches had died back (Table 8). In June 2004, the shrubs were 3-10 feet tall. New growth was vigorous from the roots and the plant base. While all three shrubs are surviving, one is considered to be in poor health. All planting basins are in good condition. Associated plants include yellow star thistle, poison hemlock, fennel, mugwort, Himalayan blackberry, vetch, black (yellow?) mustard, Saint John's wort and grasses including annual bromes, orchard grass, and Bermuda grass. Existing mature valley oak and elderberry plants are in the vicinity. No adult VELB or exit holes were observed in 2004.

Table 7. Elderberry mitigation performance, Year 5 Sites 1-5 (June 2004)

Plant count		Survival		Average plant size (ft.)		Shrubs w/ stem >1 inch	Condition (%)		
Required	Counted	Goal	Actual	Height	Width		Good	Fair	Poor
328	309	85%	94%	3.7	4.5	129	78%	17%	5%

Table 8. Year 5 monitoring results for transplanted elderberry at RM 3.3R.

Shrub	Height (ft.)	Stems ≥ 1 "
1	10	4
2	8	6
3	3	0

4.0 QUALITATIVE SITE HEALTH ASSESSMENTS AND NOTES

4.1 General Notes

In addition to specific quantitative measurements, qualitative site assessments and notes are recorded on an ongoing basis. Observations by field biologists at SAFCA, County Parks, and by consultants inform maintenance and management actions in an adaptive management framework. General observations about all sites are listed below, followed by site specific observations.

- A substantial amount of natural regeneration is occurring on portions of most sites. Most notable are as follows:
 - Alder on the lower slope at RM 0.9R
 - Cottonwood on the low berm at Sites 1-5
 - Arroyo willow on the lower slope at RM 0.9R and Sites 1-5
 - Mugwort on slopes at RM 0.9R, and RM 11.6R, and
 - Coyote brush on slopes and upper berms at RM 0.9R, and RM 11.6R
- Most trees and shrubs are growing well, are healthy and vigorous, and have recovered well since the installation of the beaver exclusion fence in spring of 2001. However, localized beaver pruning still occurs where there are gaps or breaks in the fence or during periods of high water that inundate the fence. Fence gaps can occur as rocks slough off on the berm face or from vandalism. Consequently, regular fence maintenance is essential to maintaining vegetative growth on all sites.
- Beaver damage to cottonwood on the low berm continues because beaver preferentially prune cottonwoods during periods of site access. Most cottonwoods regrow with vigor, but many lag behind the recovery of less palatable species. Individual tree cages have proven successful at preventing further damage except during periods of very high water
- The low berm at all sites supports new cottonwood and mugwort seedlings and spreading sandbar willow, creeping wild rye, and white sedge. Verbena, white sweet clover, and Bermuda grass are common weeds on the low berm.
- Many trees that have resprouted from beaver pruning have a bushy structure with no clear leader. Pruning the trees to a single trunk and removing any stubs would improve their structure and decrease the likelihood of trunk failure in later life from windthrow or flooding. While there are no plans to proactively shape or prune trees to improve structure, side branches from trees with a bushy growth form may be harvested in the future for cutting material for propagation or for biotechnical slope stabilization.
- Many alders were inundated on the low berm after leafing out at Sites 1-3. Some suffered mortality but most resprouted.

- Invasive weeds occur sporadically at all sites and include Pampas grass, Chinese elm, Siberian elm, silver maple, Chinese tallow, privet, black locust, red sesbania, white sweet clover, Himalayan blackberry, and catalpa.
- New sediment deposition is negligible at all sites.

4.2 Adaptive Management Measures Implemented to Correct Year 4 Problems

Reducing beaver pruning of planted trees and shrubs on the berm face and low berm continues to be the greatest challenge for meeting SRA habitat goals, especially since beaver preferentially prune cottonwood trees. Beaver barrier fencing (installed spring 2001 on the low berm/berm face transition) effectively reduces beaver access and resulted in remarkable tree growth. This fence will continue to be maintained, and individual tree cages installed or relocated where necessary to meet goals. As the plants increase in size and density-, especially less palatable “barrier plants” such as California rose, California blackberry, and sandbar willow- the need for a wire fence to meet mitigation goals is expected to decrease.

Replanting elderberry shrubs. 200 elderberry seedlings were planted to replace dead shrubs and meet the survival requirement. New planting locations were selected because of poor performance at existing locations at Sites 1-5. Seedlings were installed at RM 0.9R and RM 11.6R because of the longer scheduled maintenance required at these sites, as well as more favorable growth conditions (native soil, full sun exposure, high elevation floodplain setting on high berm, existing elderberry). All shrubs have individual tree cages to protect against deer browse, and were installed within 100 m of existing, mature elderberry shrubs.

Living and biodegradable beaver fence. In order to provide long-term, sustainable protection from beaver predation that will require no removal or maintenance, we installed a living and biodegradable alternative to wire fencing about 3-6 feet from the low flow shoreline at RM 11.6R. This 3-foot high prototype fence is made by installing tree stakes into the ground and weaving 1-4” diameter branches through the stakes. The front and back of the fence was then densely planted with sandbar willow pole cuttings, California blackberry, California rose, button bush, box elder, and mulefat. As these plants mature, they will use the wooden fence for support and form a somewhat impenetrable barrier of nonpalatable woody plants along the shoreline. Within 3-5 years, we expect to be able to remove the wire fence and allow the “living” fence protect native trees and shrubs on the site.

Living brush box. To control berm face erosion and establish woody vegetation along the shoreline at RM 0.9R, brush boxes and choir logs were installed on the two upstream beaches in December 2004 and densely planted with nonpalatable species including sandbar willow pole cuttings, California blackberry, California rose, button bush, and mulefat.

Beaver gnawing deterrent experiment. In 2004, an experiment was conducted to determine the effectiveness of applying gnawing deterrents to stems as an alternative to metal cages. Two

commercially available sticky substances, Tanglefoot and 4-the-Birds, were mixed with sand and applied to stems, and monitored for one year in a controlled setting. Experimental sites are located on the LAR and other streams in the region. Longevity, cost effectiveness, and deterrent values will be measured, and results will be incorporated into next year's report. Data suggests that these treatments provide no deterrent to beaver chewing on newly installed cottonwood pole cuttings. A second experiment on existing cottonwood trees is still being conducted, and results will be included in next year's report.

4.3 PROPOSED REMEDIAL MEASURES

Sites 1-5 and RM 3.3R. Supplemental irrigation is no longer needed at these sites and will not be installed unless replanting will be required. 2005 maintenance is expected to focus on fence and tree cage maintenance and weeding.

RM 0.9R

- Install drip irrigation system to 100 elderberry planted in 2004, watering 2x/month.
- Monitor plant survival, replant if necessary elderberry and berm face plants.
- Monitor and repair if necessary berm face brush boxes.
- Supplemental irrigation will be limited to 2x/month but at a prolonged duration. We expect that 2005, with the exception of newly planted areas planted in 2004, will be the final year of supplemental irrigation. Increase riser height and add new emitters in 2004 to increase irrigation effectiveness.

RM 11.6R

- Install drip irrigation system to 100 elderberry planted in 2004, watering 2x/month.
- Monitor plant survival, replant if necessary elderberry and living fence plants.
- Monitor and repair if necessary living fence.
- Install second irrigation line along base of existing slope to improve water delivering to slope and living fence plants.
- Supplemental irrigation will be limited to 2x/month but at a prolonged duration.

5.0 REFERENCES

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APPENDIX A. PERFORMANCE STANDARDS AND RECOMMENDED PERFORMANCE GOALS

Table A-1. Riparian Habitat Performance Standards and Recommended Performance Goals for Sites 1, 2, and 4.

Performance Criterion	Performance Standards		Recommended Performance Goals					
	Year 3	Year 8	Year 1	Year 2	Year 4	Year 5	Year 6	Year 7
Mean tree height (ft.)	4.6	12.5	1.6	3.3	6.2	7.9	9.5	10.8
Tree canopy cover (%)	5.3	14.1	1.8	3.5	7.1	8.8	10.6	12.4
Mean shrub height (ft.)	2.0	4.9	0.7	1.3	2.5	3.3	3.6	4.3
Shrub cover (%)	8.6	N/A	2.8	5.7	11.4	14.3	17.1	20.0

Source: United States Army Corps of Engineers 2000a.

Table A-2. Riparian Habitat Performance Standards and Recommended Performance Goals for Site 3.

Performance Criterion	Performance Standards		Recommended Performance Goals					
	Year 3	Year 8	Year 1	Year 2	Year 4	Year 5	Year 6	Year 7
Mean tree height (ft.)	5.0	16.7	1.7	3.3	6.7	10.0	13.3	5.0
Tree canopy cover (%)	6.0	20.0	2.0	4.0	8.0	12.0	16.0	6.0
Mean shrub height (ft.)	1.2	4.0	0.4	0.8	1.4	2.4	3.2	1.2
Shrub cover (%)	11.0	38.0	3.0	8.0	15.0	23.0	30.0	11.0

Source: United States Army Corps of Engineers 2000a.

Table A-3. SRA Performance Standards and Recommended Performance Goals for Canopy Width, Sites 1-4.

Performance Criterion	Performance Standards		Recommended Performance Goals					
	Year 3	Year 8	Year 1	Year 2	Year 4	Year 5	Year 6	Year 7
Mean canopy width (ft.) of berm face shrubs	4.0	6.0	1.0	3.0	5.0	6.0	6.0	6.0
Mean canopy width (ft.) of berm face cottonwoods	6.0	16.0	2.0	4.0	8.0	10.0	12.0	14.0

Table A-4. SRA Performance Standards and Recommended Performance Goals for Shoreline Cover, Sites 1-4.

Location	Performance Standards		Recommended Performance Goals					
	Year 3	Year 8	Year 1	Year 2	Year 4	Year 5	Year 6	Year 7
Site 1	26%	57%	9%	17%	35%	43%	52%	54%
Site 2	32%	66%	10%	21%	42%	53%	63%	64%
Site 3	65%	90%	25%	50%	80%	90%	90%	90%
Site 4	38%	78%	13%	24%	51%	64%	77%	77%

Source: United States Army Corps of Engineers 2000a.

Table A-5. Elderberry Performance Standards and Goals, Sites 1-4.

Monitoring year	Performance Standard (% survival)	Performance Goal (% survival)
Year 1	n/a	90%
Year 2	n/a	87%
Years 3-7	n/a	85%
Year 8	84%	n/a

Source: United States Army Corps of Engineers 2000a.

Table A-6. Sites 5 and RM 0.9R Performance Standards and Recommended Performance Goals.

Plant establishment period survival rate (%)			Post-establishment period canopy cover (%)		
Year 1	Year 2	Year 3	Year 5	Year 8	Year 15
70%	60%	50%	15%	30%	60%

Source: United States Army Corps of Engineers 2002, 2000b.

APPENDIX B. PLANT SPECIES MENTIONED IN TEXT

Code ¹	Scientific name ²	Common name ²	Growth form	
BE	<i>Acer negundo</i> ssp. <i>californicum</i>	Box elder	Tree	
	<i>Acer saccharinum</i>	Silver maple	Nonnative weed	
AL	<i>Alnus rhombifolia</i>	White alder	Tree	
	<i>Arundo donax</i>	Giant reed	Nonnative weed	
CB	<i>Baccharis pilularis</i>	Coyote brush	Shrub	
MF	<i>Baccharis viminea</i>	Mule fat	Shrub	
	<i>Carex barbarae</i>	White sedge	Herb	
	<i>Catalpa</i> sp.	Catalpa	Nonnative weed	
BB	<i>Centaurea solstitialis</i>	Yellow star thistle	Nonnative weed	
	<i>Cephalanthus occidentalis</i>		Shrub	
	<i>Conium maculatum</i>	Poison hemlock	Nonnative weed	
	<i>Cortaderia selloana</i>	Pampas grass	Nonnative weed	
	<i>Cynodon dactylon</i>	Bermuda grass	Nonnative weed	
	<i>Dactylis glomerata</i>	Orchard grass	Nonnative weed	
	<i>Elymus triticoides</i>	Creeping wild rye	Herb	
	<i>Foeniculum vulgare</i>	Fennel	Nonnative weed	
	Ash	<i>Fraxinus latifolia</i>	Oregon ash	Tree
		<i>Hypericum perforatum</i>	St. John's wort	Nonnative weed
<i>Juncus balticus</i>		Baltic rush	Herb	
<i>Juncus effusus</i>		Pacific rush	Herb	
<i>Ligustrum</i> sp.		Privet	Nonnative weed	
<i>Melilotus alba</i>		White sweet clover	Nonnative weed	
Syc	<i>Platanus racemosa</i>	Sycamore	Tree	
CW	<i>Populus fremontii</i>	Cottonwood	Tree	
VO	<i>Quercus lobata</i>	Valley oak	Tree	
	<i>Robinia pseudoacacia</i>	Black locust	Nonnative weed	
Rose	<i>Rosa californica</i>	California rose	Shrub	
	<i>Rubus discolor</i>	Himalayan blackberry	Nonnative weed	
Rubus	<i>Rubus ursinus</i>	California blackberry	Vine	
GW	<i>Salix gooddingii</i>	Gooding's black willow	Tree	
SW	<i>Salix hindsiana</i>	Sandbar willow	Shrub	
RW	<i>Salix laevigata</i>	Red willow	Tree	
YW	<i>Salix lasiandra</i>	Yellow tree willow	Tree	
AW	<i>Salix lasiolepis</i>	Arroyo willow	Tree	
EB	<i>Sambucus mexicana</i>	Elderberry	Shrub	
	<i>Sapium sebiferum</i>	Chinese tallow	Nonnative weed	
	<i>Sesbania punicea</i>	Red sesbania	Nonnative weed	
	<i>Ulmus pumila</i>	Siberian elm	Nonnative weed	
	<i>Ulmus sinensis</i>	Chinese elm	Nonnative weed	
WG	<i>Verbena bonariensis</i>	Verbena	Nonnative weed	
	<i>Vitis californica</i>	California grape	Vine	

¹See Table C2, Appendix C.

²Botanical nomenclature follows Hickman 1993

APPENDIX C. 2004 MONITORING DATA BY TRANSECT

Table C-1. Plant Size by Transect

Site	Transect			Average Plant Size			
	#	Length ft.)	Cover (%)	Shrubs		Trees	
				Ht. (ft.)	Width (ft.)	Ht. (ft.)	Width (ft.)
5	1	37	49%			9.3	6.7
5	2	47	70%	5.4	2.6	9.8	6.6
5	3	53	100%	6.6	3.2	15.1	9.3
5	4	21	71%	3.0	4.0	9.5	4.3
5	5	26	69%	5.2	1.7	10.0	6.3
5	6	47	92%	4.5	5.0	7.3	4.4
5	7	18	133%	4.1	3.3	8.0	5.0
5	8	14	63%			9.6	2.8
Summary		263	94%	2.5	2.9	9.8	6.0
4	16	65	66%	4.3	6.8	10.0	7.4
4	17	64	109%	7.4	7.2	11.7	10.3
4	18	66	45%	9.0	8.0	7.8	4.8
4	19	78	52%	9.0	6.7	6.3	5.4
4	20	66	85%	8.1	8.3	6.7	4.2
4	21	82	51%	6.1	6.5	8.2	6.5
4	22	84	38%	6.1	6.2	9.0	8.5
4	23	82	49%	9.8	8.8	7.5	6.3
4	24	73	65%	4.5	4.8	10.5	7.5
4	25	33	28%	10.0	9.0	7.3	4.8
4	26	36	72%	11.1	10.8	4.5	3.3
4	27	73	66%	8.7	7.2	5.3	5.9
4	28	42	123%	10.3	8.7	7.1	4.5
4	29	40	83%	7.3	5.3	5.0	5.2
4	30	53	43%	6.7	6.4	7.3	5.8
4	31	48	57%	8.7	6.9	5.2	4.7
4	32	70	54%	6.4	6.0	9.3	8.0
4	33	73	53%	4.8	3.5	4.5	3.2
4	34	74	57%	8.1	5.3	7.3	8.2
4	35	72	22%	7.3	5.0	6.2	4.8
4	36	54	82%	8.7	5.7		
Summary		1328	58%	2.5	5.6	7.1	7.4
3	41	53	71%	7.3	4.2	7.3	4.9
3	42	52	86%	8.8	7.3	9.7	7.5
3	43	65	94%	8.0	9.5	10.6	7.9
3	44	53	123%	5.2	4.2	11.3	7.6
3	45	57	111%	4.2	3.7	7.4	5.3
3	46	69	123%	5.3	3.7	10.2	7.8
3	47	53	119%	6.6	4.7	7.3	6.3

Site	Average Plant Size						
	Transect			Shrubs		Trees	
	#	Length ft.)	Cover (%)	Ht. (ft.)	Width (ft.)	Ht. (ft.)	Width (ft.)
3	48	69	79%	5.2	4.7	5.8	6.0
3	50	70	104%	5.2	4.5	13.3	8.2
3	51	67	77%	5.0	4.5	9.8	6.5
3	52	69	118%	5.4	4.0	9.9	5.8
3	53	64	80%			8.5	6.0
3	54	76	112%	4.5	2.9	8.2	5.6
3	55	85	68%	4.8	5.7	8.8	4.7
3	56	96	98%	5.3	6.3	6.9	6.1
3	57	72	97%	7.0	7.8	11.0	7.3
3	58	72	105%	4.0	5.1	9.2	7.3
3	59	77	91%	6.0	6.0	10.3	6.5
3	60	71	130%	6.9	4.4	10.1	5.8
3	61	61	135%	5.4	3.8	14.1	9.2
3	62	80	127%	4.4	4.5	10.1	8.0
Summary		1431	112%	1.4	4.3	8.0	6.4
2	70	26	106%	5.5	2.5	11.0	22.0
2	71	60	125%	7.4	4.2	10.7	9.7
2	72	77	93%	10.3	5.3	7.7	6.0
2	73	28	166%	6.3	10.8	10.4	8.4
Summary		191	74%	2.5	5.3	7.1	9.3
1	76	60	93%	3.8	4.5	11.3	10.4
1	77	57	98%	6.3	6.0	12.2	12.7
1	78	58	72%	3.0	5.8	10.8	11.9
1	79	56	58%			7.9	9.1
1	80	58	61%	8.5	5.5	9.4	8.3
1	81	42	49%			7.2	13.6
1	82	68	86%	6.0	4.8	13.5	12.1
1	83	55	70%	6.0	4.8	9.2	7.2
1	84	63	75%	4.6	4.5	9.0	7.8
1	85	45	87%	6.3	6.1	8.8	8.2
1	86	56	80%	4.9	5.0	3.9	2.9
1	87	50	114%	6.4	8.3		
1	89	62	121%	8.9	7.5		
1	90	69	102%	7.3	7.8	10.2	7.0
1	91	66	128%	11.5	10.3	7.8	7.7
Summary		865	91%	7.7	6.0	9.6	7.8
RM 0.9R	120	140	15%	2.1	1.2	1.5	0.8
RM 0.9R	121	180	30%	5.2	5.0	6.1	7.3
RM 0.9R	122	154	49%	4.6	5.4	9.2	8.7
RM 0.9R	123	148	38%	3.7	2.4	6.1	5.2
RM 0.9R	124	125	71%	6.1	6.4	9.4	11.1
RM 0.9R	125	118	48%	5.3	3.3	4.4	5.4
Summary		865	33%	4.0	2.5	6.5	2.7
RM 4.2L	0	35	124%	6	10	13	8.25

Site	Average Plant Size						
	Transect			Shrubs		Trees	
	#	Length ft.)	Cover (%)	Ht. (ft.)	Width (ft.)	Ht. (ft.)	Width (ft.)
RM 4.2L	150	35	26%			5.5	2.5
RM 4.2L	300	35	103%			9.9	7.9
RM 4.2L	450	35	49%	4.5	2	5.5	5
RM 4.2L	600	35	123%	6.5	5.1	1.5	1.5
RM 4.2L	750	35	44%	7	3	7.5	7.25
RM 4.2L	900	35	43%	7.4	5.8		
RM 4.2L	1050	35	30%	7.4	5.8	6	3.8
RM 4.2L	1200	35	71%			7.5	5.5
RM 4.2L	1350	35	44%	4	1.5	4.8	3.8
Summary		350	50%	6.9	5.1	7.7	5.2
RM 7.6R	150	35	73%	5.1	3.2	5.0	5.8
RM 7.6R	300	35	57%			9.5	7.8
RM 7.6R	450	35	91%	4.5	3.3	14.5	14.8
RM 7.6R	600	35	120%			26.5	23.5
RM 7.6R	750	35	120%			21.9	19.8
RM 7.6R	900	35	127%			21.8	19.5
RM 7.6R	1050	35	114%			14.5	12.0
Summary		245	70%	4.9	3.2	15.1	13.7
RM 11.6R	100	92	32%	2	1	7.6	6.9
RM 11.6R	101	40	26%	2.5	3.5	7.3	3.8
RM 11.6R	102	40	26%	9	8	5.7	3.3
RM 11.6R	103	58	84%	9.4	6.2	8	5.1
RM 11.6R	104	39	27%			9.5	7.7
RM 11.6R	105	44	14%			4	2.3
RM 11.6R	106	66	4%	3	3	2.75	1.25
RM 11.6R	107	71	13%			6.5	3.7
RM 11.6R	108	67	9%	8	10	11	7
RM 11.6R	109	43	8%			5.5	3.5
RM 11.6R	110	44	89%	6.3	6		
Summary		604	31%	7.0	4.0	7.0	4.5

Table C-2. Shoreline Cover by Transect

Site	Transect	% Shoreline cover	Site	Transect	% Shoreline cover
1	76-77	80%	3	53-54	85%
1	77-78	75%	3	54-55	100%
1	78-79	65%	3	55-56	100%
1	79-80	55%	3	56-57	95%
1	80-81	75%	3	57-58	90%
1	81-82	60%	3	58-59	100%
1	82-83	50%	3	59-60	100%
1	83-84	95%	3	60-61	100%
1	84-85	95%	3	61-62	95%
1	85-86	95%	Avg.	Site 3	95%
1	86-87	95%	4	15-16	75%
1	88-89	95%	4	16-17	75%
1	89-90	100%	4	17-18	95%
1	90-91	100%	4	18-19	75%
1	91-end	95%	4	19-20	60%
Avg.	Site 1	82%	4	20-21	60%
2	70-71	65%	4	21-22	50%
2	71-72	100%	4	22-23	90%
2	72-73	90%	4	23-24	70%
Avg.	Site 2	85%	4	24-25	50%
3	40-41	95%	4	25-26	100%
3	41-42	95%	4	26-27	100%
3	42-43	95%	4	27-28	100%
3	43-44	80%	4	28-29	95%
3	44-45	95%	4	29-30	100%
3	45-46	90%	4	30-31	85%
3	46-47	95%	4	31-32	75%
3	47-48	100%	4	32-33	100%
3	48-49	100%	4	33-34	100%
3	49-50	100%	4	34-35	100%
3	50-51	100%	4	35-36	70%
3	51-52	100%	4	36-end	50%
3	52-53	85%	Avg.	Site 4	81%

APPENDIX D. 2004 PHOTOGRAPHIC DOCUMENTATION OF MITIGATION SITES

APPENDIX E. 2004 SHORELINE PHOTOGRAPHS

APPENDIX F. 2004 PERIODIC SITE ASSESSMENT FORMS

APPENDIX G. 2004 MAINTENANCE FORMS