Salt River Ecosystem Restoration Project

Photo: Dave Kenworthy

Monitoring Report 2015

Finalized September 2016

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Humboldt County RESOURCE CONSERVATION DISTRICT

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EXECUTIVE SUMMARY

The Salt River Ecosystem Restoration Project has been developed in collaboration with landowners and resource and regulatory agencies over 30 years. The Humboldt County Resource Conservation District (HCRCD) is spearheading the Project on behalf of multiple private landowners throughout the Salt River watershed. The Salt River watershed is located in Humboldt County, California; approximately 15 miles south of the City of Eureka. The watershed surrounds the city of Ferndale and is bounded to the south by the Wildcat Hills, to the east and north by the Eel River and to the west by the Pacific Ocean. The watershed derives its name from the Salt River that historically flowed across the Eel River delta discharging into the Eel River estuary about 0.2 miles from the mouth of the Eel River.

The overarching goal of the project is to restore and improve hydrologic function and fish and wildlife habitat in the Salt River watershed. The Project area includes the main stem of the Salt River, four Salt River tributaries in the Wildcat Hills above the town of Ferndale (Williams Creek, Francis Creek, Reas Creek, and Smith Creek), and the approximately 400-acre Riverside Ranch, which is contiguous to the Salt River estuary. The California Department of Fish and Wildlife acquired Riverside Ranch from a willing seller and is an active partner in the project. The remainder of the Project Area is in private ownership.

The project intends to restore natural hydrologic processes to a significant portion of the watershed, promoting restoration of ecological processes and functions. The project is presented in two primary phases to distinguish between the tidal wetland restoration (known as Phase 1) and the riverine restoration work (known as Phase 2). The project includes work that will be accomplished over several years. Within the two phases, the project is further broken down in to four primary components, discussed below:

- **Upslope Erosion control:** Work with willing landowners to implement upslope erosion control activities in the upper portions of the Francis and Williams Creeks watersheds to reduce the level of sediment input and delivery to the Salt River, thereby improving water quality while reducing sediment deposits in the channel.
- **Salt River channel excavation:** Excavate and rehabilitate approximately 7.4 miles of the historic Salt River channel to restore hydrologic connectivity within the watershed thereby improving aquatic and riparian habitat, providing fish passage to tributaries, and improve drainage in the delta.
- **Riverside Ranch tidal marsh restoration:** Restore tidal marsh in the lower Salt River. This will also increase the tidal prism exchanged through the lower river,

increasing sediment transport potential, increasing scour and promoting hydraulic connectivity with the upper watershed.

- **Adaptive Management:** Work with the community and regulatory agencies to implement an environmentally and geomorphically acceptable adaptive maintenance and management program to maintain hydraulic and ecological function in the Project Area into the future.

In 2013, restoration of Riverside Ranch (Phase 1 of the project) re-converted 330 acres of pasture back to intertidal wetland habitat, while also preserving approximately 70 acres that will be agriculturally managed to provide short-grass habitat for Aleutian cackling geese and other wetland-associated birds. Three miles of internal slough networks were excavated to create additional habitat for salmonids, tidewater goby, and other fish and provide areas for the natural recruitment of eelgrass. Two miles of setback berm were constructed to create a boundary between the tidal area and the agricultural area and a gravel road was installed on top of the berm to provide access for monitoring and maintenance. This component of the project also widened and deepened approximately 2.5 miles of the tidally-influenced portion of the Salt River channel; increasing tidal exchange and greatly improving fish passage and fish habitat in the lower Salt river channel.

The design of Phase 1 is intended to strike a balance between creating significant amounts of new tidal marsh habitat, retaining and enhancing some of the important existing upland and riparian features, preserving sufficient acreage to manage for short grass habitat for Aleutian cackling geese, minimizing long-term site maintenance, and incorporating design features that accommodate sea-level rise. Earthwork on Phase 1 was balanced on site, with excavated materials all being utilized to construct a range of habitat features at varying elevations and to construct the 2-mile setback berm.

Phase 2 represents the Salt River “corridor restoration” portion of the larger project. Within Phase 2, seven miles of the Salt River channel and its adjacent floodplain will be excavated. Wetlands and riparian corridors will be re-vegetated with a diversity of native plants. Fish passage will be restored to three watershed tributaries – Reas, Francis and Williams Creeks. In 2014, 1.2 miles of channel and floodplain were constructed and riparian and wetland species were planted in late 2014 and early 2015. Reas Creek was reconnected to the Salt River. In 2015, an additional 1,200 ft of channel was excavated to nearly the confluence of Francis Creek, but not completing the reconnection of Francis Creek to the Salt River. It is anticipated that furture Phase 2 construction will occur in 2017 and 2018, completing the Salt River corridor restoration.

Project monitoring was performed under direction of the Humboldt County Resource Conservation District and complies with requirements generated during the development of the project. This report provides information on data collected during the **second** year (Year 2), post construction, on Phase 1 and the **first** year (Year 1), post construction, on the constructed Phase 2 of the larger Salt River Ecosystem Restoration Project. As discussed in the General Conclusions section of this report, monitoring results demonstrate the project is performing successfully and largely meeting project goals.

SUMMARY OF CONCLUSIONS

As detailed in this report, Phase 1 -Year 2 and Phase 2 – Year 1 monitoring results provide a point of reference on how the restoration has responded to the area's environmental conditions during its formative years after construction. The following is a brief summary of what the various monitoring efforts generally found.

Water Quality

Continuous water sampling on the Phase 1 and Phase 2 project area proved challenging. The tidal and fresh water conditions almost immediately foul the sensors after the deployment of monitoring equipment, which consequently provided some unusable data. Additionally, lost equipment in main channels of the Salt River due to either vandalism or heavy currents continues to happen each year. However, the usable data and spot sampling for salinity, temperature, and DO during fish sampling surveys provided data parameters that suggests that the aquatic habitat is conducive to the requirements of aquatic species.

Vegetation

On Phase 1, the sampled high marsh ecotone habitat had more than 50% total vegetation cover, and was dominated by native plant species. This value exceeded the 15% vegetation cover success criteria given in the Project's environmental documents.

Salt Marsh habitat mapping determined that Phase 1 is developing in to varied habitat types within the estuary, such as mudflats, salt marsh, wet grass, etc. In this second year, the monitoring methods determined that 146 acres is considered vegetated salt marsh.

Riparian habitat was mapped across Phase 1 and the 2014 completed reach of Phase 2. Phase 1 and 2 exceeds the projected number of acres of riparian required.

Phase 1 rare plant surveys for eelgrass determined that the Project has met all the success criteria (e.g. extent of 6.3 acres, 11.3% cover, and shoot density of 138 shoots/m^2) of during this second year of monitoring.

Wildlife

Monitoring fish utilization of the Phase 1 project area was the primary focus of the Year 2 monitoring. In collaboration with CDFW, NOAA/NMFS, Humboldt State University, and Ducks Unlimited, a fish sampling program was created. The sampling effort that took place from April to July proved that habitat restoration efforts in the Eel River Delta benefitted fish species. Salmonids were not captured during this time period, however separate winter sampling captured salmonids from December to March. Tidewater gobies were present during the entire sampling season. Year 2, once again, proved that the project is a success for fish species.

Geomorphic

The monitoring tasks under the Geomorphic heading show that the site is further stabilizing. The photo documentation not only visually records the dramatic differences between pre-construction to post-construction conditions, but records the vegetation recruitment and tidal effects. The cross-section surveys indicate that the Salt River channel and slough channels are adjusting to the environmental conditions where channel capacity had both increased and decreased at individual sites. Weekly general visual inspection of the Phase 1 area determined that the setback berm, outboard ditches, and tide gates are functioning as expected.

INTRODUCTION

The Salt River Ecosystem Restoration Project (SRERP) took some 30 years to develop and drew upon several studies and assessments completed during that time examining cultural, biological, geological, aquatic, and vegetative resources as well as tidal influences in the watershed. Project proponents also developed documents to guide implementation, maintenance, and long-term monitoring. Monitoring documents include the Salt River Monitoring Plan, Habitat Mitigation and Monitoring Plan, the Adaptive Management Plan, and other specialized plans to assure the protection of sensitive wildlife habitats, landowner properties, and the hydrologic system itself.

As outlined in the Project's CEQA, Habitat Mitigation and Monitoring Plan, and the Adaptive Managements Plan documents, a variety of monitoring tasks are required to be conducted to demonstrate achievement of project goals and objectives. Most of the monitoring tasks are to be completed over a period of ten years, post-implementation. Monitoring was conducted prior to beginning project implementation to establish baseline data and/or assist in identifying and protecting resources in the project area. Monitoring during construction was also conducted to assure that construction activities conformed to approved design plans and specifications and to protect identified plants and wildlife. Post-implementation monitoring is being conducted as required by the projects various funders, permit requirements, and environmental compliance documents. Many of the individual reports are available from the Humboldt County Resource Conservation District upon request.

The report is presented in four, broad sections:

1. Water Quality,
2. Vegetation,
3. Wildlife, and
4. Geomorphic.

Within each section is a discussion that identifies 1) the discrete task called for, 2) the agency requiring the task, 3) the reference document, and 4) results and discussion.

WATER QUALITY

Monitoring Task: Tidal Exchange and Water Level Monitoring

Agencies: NCIRWM Plan and Consolidated Grants Program; Coastal Commission

Documents: Salt River Monitoring Plan 2008; Coastal Development Permit- Special Conditions 2.6, 2.7; SRERP Adaptive Management Plan

Description: Monitor for water level, salinity, temperature, and dissolved oxygen at specific sites on Phase 1 (estuary) and 2 (channel corridor).

Goals:

- To determine areas of saline, brackish, and freshwater marsh habitat in the Salt River Corridor and in the restored estuary of Riverside Ranch;
- To determine areas of increased tidal prism, which helps maintain the Salt River channel geomorphology and conveyance;

Report: Tidal Exchange and Water Quality Report – Phase 1 and 2 – Year 2, 2015. Prepared by the Humboldt County Resource Conservation District.

Methods: The Humboldt County Resource Conservation District (HCRCD) deployed a network of 6 multi-parameter recorders across the Phase 1 and 2 project area as follows and shown on Figure 1:

1) in the Salt River immediately downstream of the confluence of the southern slough channel;
2) in the interior of the southern slough channel network.
3) in the Salt River immediately downstream of the confluence of the northern slough channel;
4) in the interior of the northern slough channel network;
5) at the confluence of the Salt River and Eel River

Tidal exchange monitoring occurs for 4 to 6 months during the dry season. This Year 2 effort recorded Dissolved Oxygen levels for two weeks in July, and other water quality parameter data from July to the end of October. Recorders were set to sample every hour to capture tidal fluctuations.

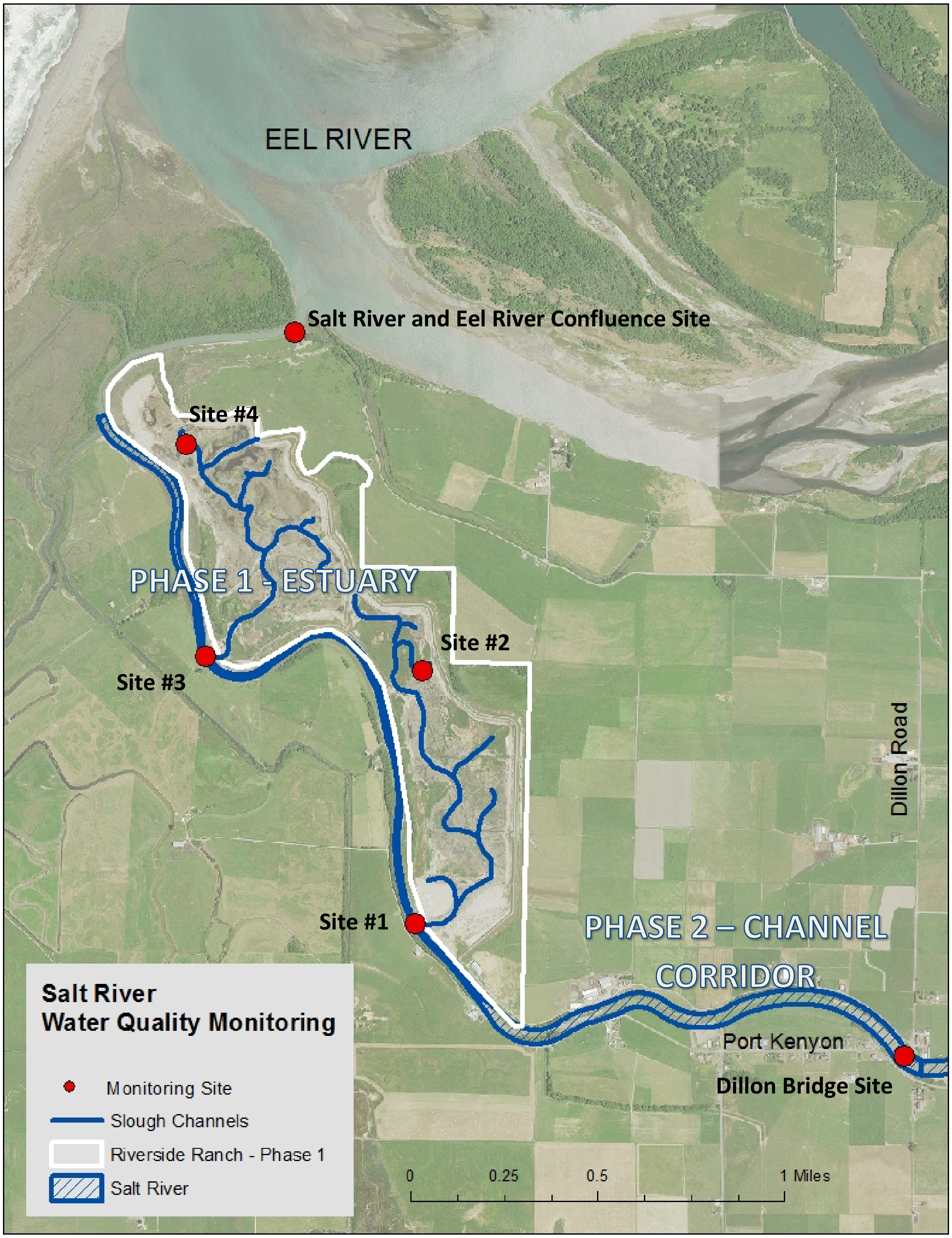


Figure 1: 2016 Water Quality Sampling Sites across the Salt River Ecosystem Restoration Project.

Results and Discussion:

The Tidal Exchange and Water Quality Report, provided by the HCRCD in January 2016, is available upon request. The water level and water quality data is summarized in the following narrative and in Table 1.

During the day of retrieval of the data recorders, the housing and meters at the confluence of the Salt River and Eel River were missing, therefore the data for this site are not provided in this summary. The lost recorders were likely due to vandalism or scouring of the site by the channel current.

Table 1. Salt River Phase 1 Water Level and Quality Parameters for 2015 Sites

	Water Parameters							
	Site #1				Site #2			
	Water Level	Temp	Salinity	Dissolved Oxygen	Water Level	Temp	Salinity	Dissolved Oxygen
	(ft)	(°F)	(ppt)	(mg/L)	(ft)	(°F)	(ppt)	(mg/L)
Maximum	6.0	83.2	39.9	N/A	3.2	90.3	33	31.4
Minimum	-0.3	51.0	0.3	N/A	0.1	56.1	13.3	-0.02
Average	2.5	64.5	31.7	N/A	1.1	68.2	25.3	5.9

	Water Parameters							
	Site #3				Site #4			
	Water Level	Temp	Salinity	Dissolved Oxygen	Water Level	Temp	Salinity	Dissolved Oxygen
	(ft)	(°F)	(ppt)	(mg/L)	(ft)	(°F)	(ppt)	(mg/L)
Maximum	7.1	73.8	31.6	N/A	2.8	86.1	55.7	24.7
Minimum	-0.3	53.3	19.8	N/A	0.2	53.2	28.9	-0.02
Average	3.2	62.3	24.4	N/A	0.7	66.2	39.9	8.1

	Water Parameters							
	Salt River and Eel River Confluence				Dillon Road Bridge			
	Water Level	Temp	Salinity	Dissolved Oxygen	Water Level	Temp	Salinity	Dissolved Oxygen
	(ft)	(°F)	(ppt)	(mg/L)	(ft)	(°F)	(ppt)	(mg/L)
Maximum	Recording Devices Lost				2.9	87.7	46.0	N/A
Minimum					-0.3	50.8	2.8	N/A
Average					0.8	63.1	34.1	N/A

Water-Level
Water-level is the depth of water located at a specific site. Due to the diurnal tidal inundation of Phase 1 (Riverside Ranch), it is expected to see large fluctuations in the water level given that the site receives nearly 100 percent of tidal water (a small tributary contributes very little fresh water volume). The tides are muted at all the sites compared to actual ocean conditions. Sites #1 and #3, in the main Salt River channel has a low-tide lag time of between one and two hours. The sites located within the constructed estuary (Phase 1) and at Dillon Bridge have the longest low-tide lag time, 3 to 4 hours. All sites tend to have the same high-tide lag time from one to two hours.

It is observed that the maximum water level depth during the sampling period (July through October) was in the main channel of the Salt River. Site #3 had a maximum depth of 7.1 feet. The interior estuary sites are higher in elevation and had maximum depths at approximately 3 feet. Low-tide water depth all fell near to 0 feet; thus low tide nearly drained all sites. Unfortunately, the extreme low water levels would have impacted the other recorded water quality parameter as the loggers were more than likely out of the water column.

Temperature
Temperature readings were collected from the water level recorder. Reviewing the results in the above tables, maximum, minimum, and average temperatures tended to be similar across all the sites. Maximum temperature ranged from 90.3 °F to 73.8 °F. Minimum temperatures ranged from 51.0 °F to 56.3 °F. Average temperatures range 62.3 °F to 66.2 °F. Site #2, which is in a shallow terminal slough arm with in the estuary, experienced the higher temperatures within the maximum, minimum, and average temperatures. Site #3 is in the lower main Salt River channel that experiences high volume tidal exchange, and the water monitoring probe was likely deployed at the greatest depth as compared to the others, thus average temperature readings appear to be lower than at the other sites.

Salinity
Ocean salinity is approximately 35 ppt and it is expected that salinity at the various sites should reflect ocean salinity as all sites are tidally influenced. Recorded probe results show that the overall site had a maximum salinity of 55.7 ppt and a minimum of 0.3 ppt. Salinity of 55.7 ppt is an improbable reading. Site #4 had the highest salinity level. This has slow water movement and it appears the sensor on the probe became fouled. The minimum 0.3 ppt (at Site #1) likely occurred because the low tide exposed the probe to air and recorded during the absence of water. The average readings for each site appear probable.

Dissolved Oxygen

Dissolved oxygen (DO) probes were deployed at Sites #2 and #4 (in two slough channels on Riverside Ranch). The DO levels recorded at these sites indicate that DO is appears to be positively correlated with temperature. That is, as temperature peaks, DO peaks; as temperatures decrease, DO decreases. This is contrary to rule that cold water contains higher DO levels than warm water. Analyzing the data, DO is not correlated with high tides or changing tides; unless it is coincides with temperature. For example, the highest DO recorded at the end of the sampling period is correlated with high temperatures and a high water level from a high tide. After further analysis, it was determined that DO is directly and positively correlated with daylight, where DO concentrations are highest during midday (thus during the warmest part of the day). This is likely due to the increased photosynthesis of aquatic microbes in the water (e.g. phytoplankton).

Typically, the amount of dissolved oxygen at 100% saturation is around 10 mg/L. However, water can become supersaturated (>100%) due to the photosynthesis of aquatic microbes. This could explain the maximum DO level of 55.7mg/L at Site #4. The recorded minimum DO level of -0.02 mg/L is also at Site #4. It is unknown if these values are indicative of true levels as DO meters may read inaccurately. However spot DO measurements during fish surveys at the same sites indicate supersaturated DO concentrations (approximately 17 mg/L and 23.5 mg/L in June and July respectively). These sites support a variety of fish species such as tidewater goby and juvenile smelt.

VEGETATION

Monitoring Task: High Marsh Ecotone Percent Cover Monitoring

Agencies: Coastal Commission

Documents: Coastal Development Permit- Special Conditions 2.8; SRERP Habitat Mitigation and Monitoring Plan and the Adaptive Management Plan

Description: Map and monitor quantitative vegetative growth in the high marsh ecotone habitat type in Year 2 on Phase 1 of the Salt River Ecosystem Restoration Project.

Goals:

- Reach a goal of creating 12 acres of high marsh ecotone habitat
- To reach success criteria of 15% cover of high marsh species in Year 2 as stated in SRERP's Habitat Mitigation Monitoring Plan.

- To meet a non-invasive, non-native species cover criteria of 15% or less in Year 10
- To meet an invasive-non-native species cover criteria of 5% or less in Year 10

Report: 2015 Quantitative Habitat Monitoring for the Salt River Ecosystem Restoration Project Final Report, 2015, prepared by H.T. Harvey & Associates

Methods:

H.T. Harvey & Associates performed the vegetation monitoring surveys across Phase 1 and on the 2014 Phase 2 restoration areas.

Percent cover data were collected using plot-based field sampling methods. Plot locations were selected using GIS software to generate randomly distributed sample points. A total of 30 plots were sampled in the high marsh ecotone habitat bordering the setback levee in the project's Phase 1 reach, as defined by Year 1 habitat mapping (HTH 2014). Sample plots were 10.8-square-foot (1-square-meter) square quadrats. In each plot, all plant species present were recorded, and the percent cover by species was visually estimated in cover classes using a modified Braun-Blanquet (1928) cover-abundance scale. Taxonomic nomenclature used in this report follows Baldwin et al. (2012), and common names follow Calflora (2015). All plant species encountered in sample plots were categorized as native, invasive, or non-native non-invasive.

For each habitat type, H.T. Harvey & Associates examined the data using a power analysis to determine whether the sample size (i.e., number of plots/quadrats) provided sufficient statistical power, defined as 80% power, to detect a significant difference in cover between the observed state and the relevant success criterion, at an 80% confidence level. To assess plant species composition, the consultant used the median percent cover by cover class to calculate mean percent cover for each plant species observed. For each plot in each habitat type, total cover by native plant species was calculated as the sum of the percent plant cover for each native species observed in the plot. Mean percent cover by native plants for the survey area was then calculated as the mean of total native plant cover for all plots in each habitat type. Nonparametric bootstrap methods were used to construct approximate 95% confidence intervals for the mean percent cover by native plants in the survey area.

Figure 2. High Marsh Ecotone Habitat and Sample Plot

Results and Discussion:

The 2015 Quantitative Habitat Monitoring for the Salt River Ecosystem Restoration Project Final Report, 2015, prepared by H.T. Harvey is available upon request. Results are summarized from the report in the following narrative and in Table 2.

The sampled high marsh ecotone habitat had more than 50% total vegetation cover, and was dominated by native plant species. Plant species composition by plant species category is summarized in the following table (Table 2).

Table 2. Percent Cover Assessment for the High Marsh Ecotone, Year 2

Plant Species Category	Mean Percent Cover	95% Confidence Intervals	
		Lower Limit	Upper Limit
Native species	40.9	31.2	51.7
Non-native non-invasive species	3.3	1.4	5.7
Invasive species	15.7	10.0	21.7
Sterile hybrid wheatgrass	0	N/A	N/A
Total	60.0	50.3	69.1

Total vegetation cover in the high marsh ecotone was estimated to be 60.0%, an approximate 14% increase from the total cover of 46.5% estimated in 2014 (HTH 2014). This exceeds the needed 15% success criteria for Year 2. As in 2014, the most common species were two native grasses: tufted hairgrass and meadow barley (*Hordeum brachyantherum*), both found in nearly 80% of the plots. Tufted hairgrass showed a dramatic increase in mean cover, from 9.4% to 27.0%, whereas meadow barley declined from 9.7% to 4.0%. The native salt marsh species perennial pickleweed was found in 50.0% of the plots with a mean cover of 5.6%, a slight increase compared with last year. Salt marsh sand spurry (*Spergularia marina*) also was found in nearly half the plots, with a mean cover of 3.0%. Other native salt marsh species that were present with low cover (<1.0%) included saltgrass and gumplant (*Grindelia stricta*). Fat-hen (*Atriplex prostrata*), a non-native species that colonizes open areas in salt marshes, remained frequent (60.0% frequency), but mean cover dropped from 16.2% in 2014 to 3.9% in 2015, whereas the mean cover of another non-native colonizer, brass buttons (*Cotula coronopifolia*), increased from 0.9% to 11.7%, with 63.3% frequency. The sterile hybrid wheatgrass planted in the high marsh ecotone in fall 2013 to help provide erosion control through the 2014 growing season did not reproduce and thus was not present this year.

VEGETATION

Monitoring Task: Salt Marsh Habitat Mapping

Agencies: Coastal Commission

Documents: Coastal Development Permit- Special Conditions; SRERP Habitat Mitigation and Monitoring Plan and the Adaptive Management Plan

Description: Map the salt marsh habitat acreage on Phase 1 of the Salt River Ecosystem Restoration Project

Goals:

- Achieve 322 acres of salt marsh habitat by Year 10

Report: 2015 Quantitative Habitat Monitoring for the Salt River Ecosystem Restoration Project Final Report, 2015, prepared by H.T. Harvey & Associates

Methods:

H.T. Harvey & Associates performed the vegetation monitoring surveys across Phase 1 and on the 2014 Phase 2 restoration areas.

Mapping was based on a combination of aerial photointerpretation and ground-truthing. H.T. Harvey & Associates performed preliminary mapping in the office using GIS software (ESRI ArcGIS) and the most recent available true color satellite imagery (NAIP June 2014) as a map base. The consultant consulted 1-foot contours of the as-built condition, provided by HCRCD in GIS format (converted from AutoCAD). Ground-truthing was performed in the field to verify habitat extents and revise the map as needed, using an IPad with Garafa GIS Pro software and true color satellite imagery (Google Earth 2014). After mapping was completed, habitat acreage was calculated using GIS software.

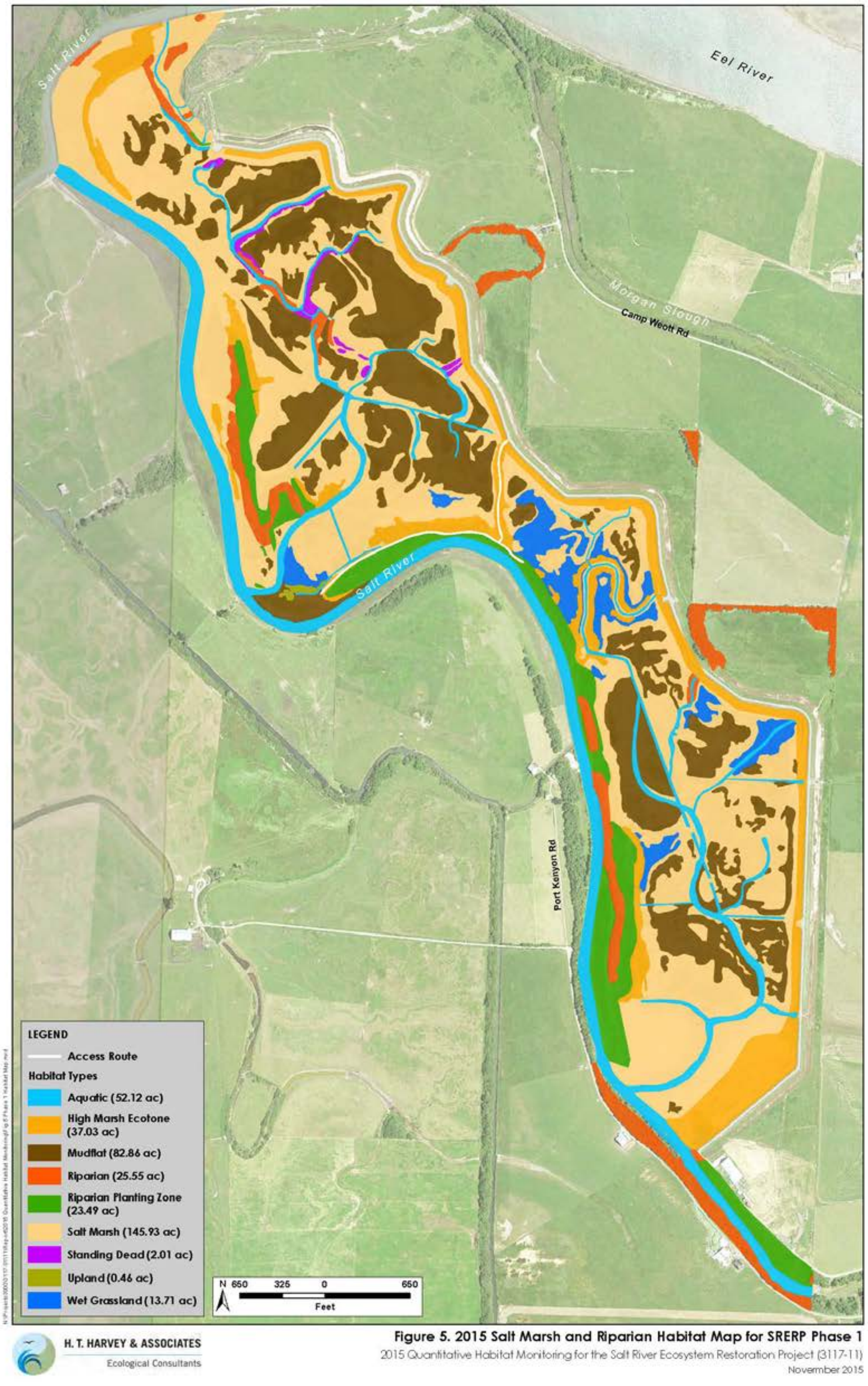


Figure 3: Salt Marsh and Riparian Map for Phase 1

Results & Discussion:

The 2015 Quantitative Habitat Monitoring for the Salt River Ecosystem Restoration Project Final Report, 2015, prepared by H.T. Harvey is available upon request. Results are summarized from the report in the following narrative and in Table 3.

As outlined in the Project's HMMP 36 acres of tidal salt marsh existed prior to restoration construction. The HMMP projected that 322 acres of tidal salt marsh would be developed on Phase 1. The post construction Year 2 estimation of tidal salt marsh acreage is calculated to be 146 acres. Previously, a standard mapping exercise used elevation (< 7.5 feet in elevation) as criteria for salt marsh in Year 1, and determined that Phase 1 site contained 280 acres of salt marsh. Differences in the definition of "salt marsh" are driving the disparate estimated acreages. The Project team is meeting with the Coastal Commission, who set the salt marsh habitat acreage success criteria, to come to consensus about the definition of, and methods to assess, salt marsh.

A field component complemented the elevational mapping exercise which more accurately described the diverse habitats on the Phase 1 site (see Figure 3).

Table 3: Comparison of 2015 Tidal Marsh Acreage with HMMP Success Criteria

Land Use and Habitat Projections (all units in acres)

	Phase 1 - Riverside Ranch				
Habitat Type	**Pre - Construction**	**Removed**	**Project Created**	**Total Created (Project Goal)**	**Year-2**
Tidal Salt Marsh	36	14	300	322	**146**

By Year 2, H.T. Harvey and Associates found that salt marsh plants have colonized much of the restored tidal area. No quantitative data for plant species composition were collected during this monitoring year; however, it is apparent that the salt marsh is dominated by native plant species. Some areas of the salt marsh are dominated by perennial pickleweed (*Salicornia pacifica*), whereas other areas are dominated by saltgrass (*Distichlis spicata*).

Other habitats found in the area projected to be salt marsh also were mapped. Mudflats were found at lower elevations. For mapping purposes, mudflats were defined as areas with less than 5% cover by vascular plant species. Deeper areas of mudflat ponded water, and shallow areas supported *Vaucheria longicaulis* var. *macounii*, a species of macroalgae commonly found regionally in tidal sloughs and on high tidal flats associated with salt marshes. At elevations higher than salt marsh were areas of high marsh ecotone, mostly dominated by tufted hairgrass (*Deschampsia cespitosa*) and some areas of wet grassland dominated by creeping bentgrass *(Agrostis stolonifera*). A small elevated area appeared to support a predominance of upland plants (mapped as "upland"); however, no quantitative sampling was conducted, and no jurisdictional determination was performed.

VEGETATION

Monitoring Task: Riparian Habitat Acreage Monitoring

Agencies: Coastal Commission

Documents: Coastal Development Permit- Special Conditions; SRERP Habitat Mitigation and Monitoring Plan

Description: Map the habitat acreage on Phase 1 (Riverside Ranch) and on the Lower 2A (2014) project footprint.

Goals:

- Reach the projected 43 acres of riparian on Phase 1 (Riverside Ranch)
- Reach the projected 20 acres of riparian (approximate) on Lower 2A (2014) footprint

Report: 2015 Quantitative Habitat Monitoring for the Salt River Ecosystem Restoration Project Final Report, 2015, prepared by H.T. Harvey & Associates

Methods:
Habitat mapping was performed by H.T. Harvey & Associates to determine habitat acreage for salt marsh and riparian habitats. Mapping was based on a combination of aerial photointerpretation and ground-truthing. The consultant performed preliminary mapping in the office using GIS software (ESRI ArcGIS) and the most recent available true color satellite imagery (NAIP June 2014) as a map base. They consulted 1-foot contours of the as-built condition, provided by HCRCD in GIS format (converted from AutoCAD). Ground-truthing was performed in the field to verify habitat extents and revise the map as needed, using an IPad with Garafa GIS Pro software and true color satellite imagery (Google Earth 2014). For Phase 1, the consultant used the "Riparian Planting Zone" GIS layer provided by HCRCD and did not attempt to verify these boundaries in the field. After mapping was completed, habitat acreage was calculated using GIS software. Assessment of riparian habitat acreage in the first growing season following planting involved consideration of the riparian forest and scrub habitat retained, as well as riparian and active berm planting zones.

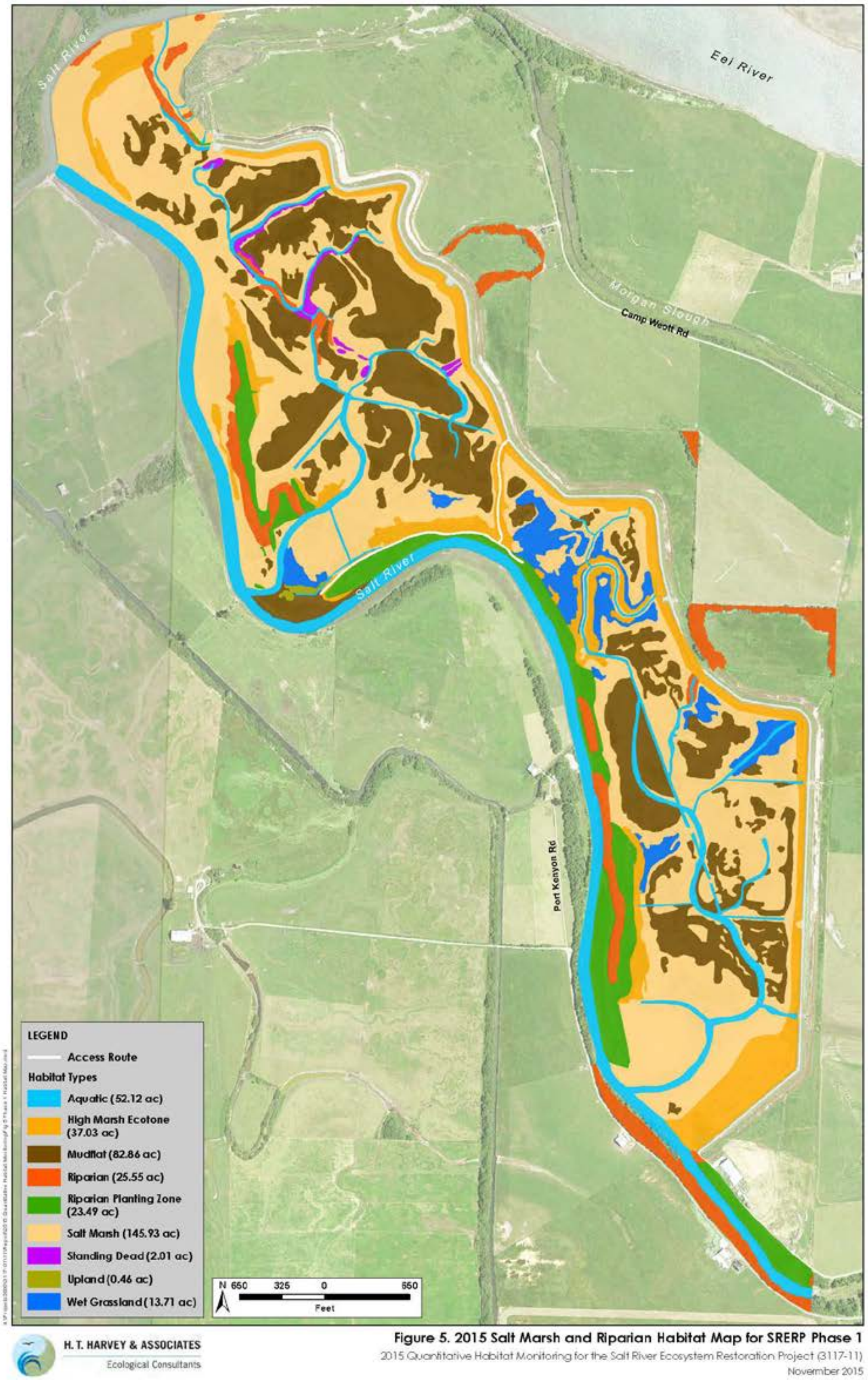


Figure 4: Salt Marsh and Riparian Map for Phase 1

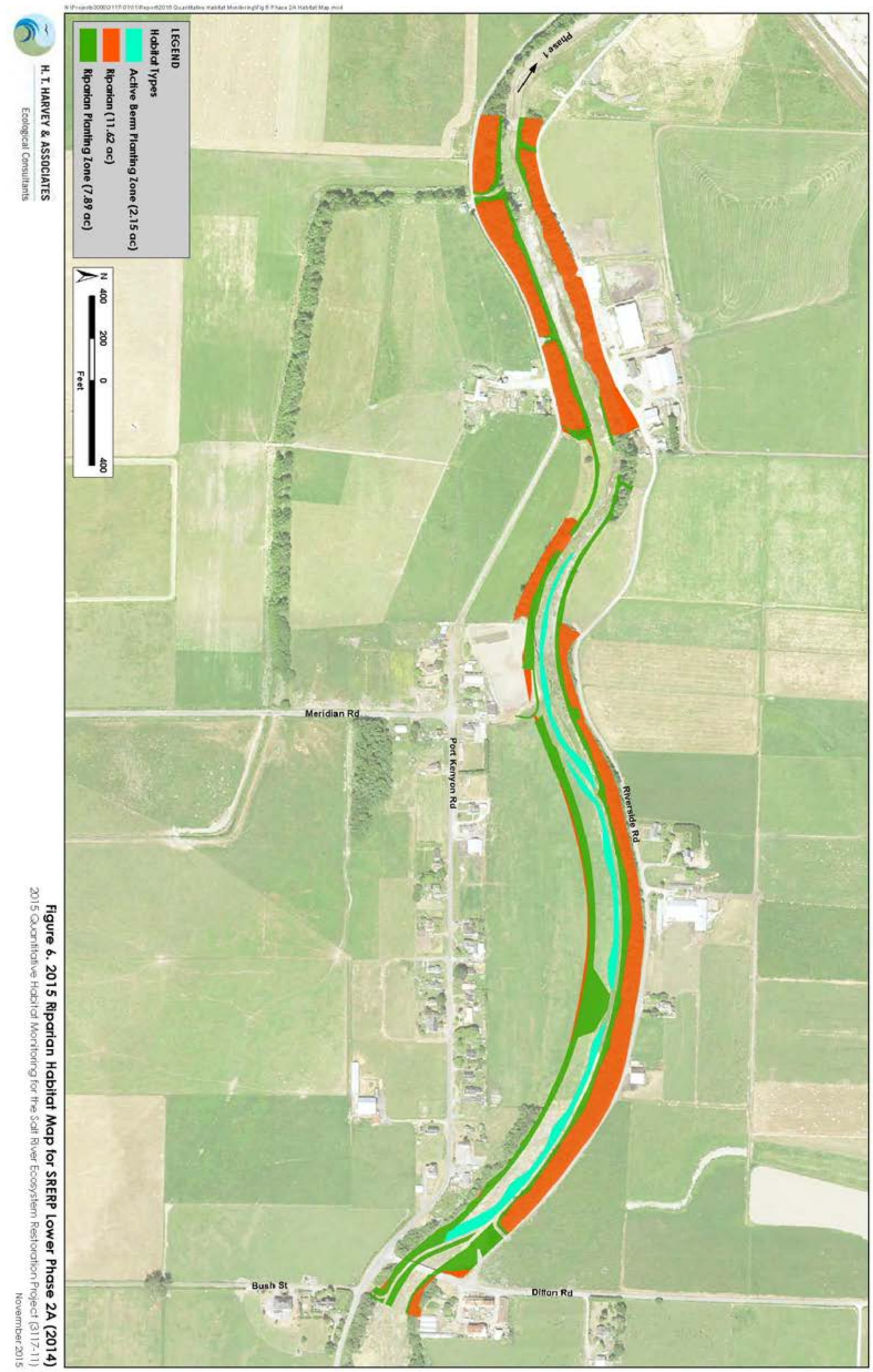


Figure 5: Riparian Habitat Map for 2014 Phase 2 Restoration Area

Results & Discussion:

The 2015 Quantitative Habitat Monitoring for the Salt River Ecosystem Restoration Project Final Report, 2015, prepared by H.T. Harvey is available upon request. Results are summarized from the report in the following narrative and in Table 4.

Much of the riparian habitat present before restoration was retained. New areas were planted with riparian species in winter 2014–2015 and spring 2015 in designated planting zones as part of the project's Phase 1 restoration (Salt River estuary) and the first year of Lower Phase 2A restoration (extending upstream from Phase 1 to approximately 200 feet upstream of the Dillon Road Bridge). In 2015, 26 acres of retained riparian habitat and 23 acres of newly planted riparian areas in the Phase 1 project reach were mapped (Figure 4). The retained riparian habitat on Phase 1 alone represents 60% of the restoration goal of 43 acres, and the combined habitat acreage for retained riparian habitat and riparian planting zones are estimated at 114% of the restoration goal. In the Lower Phase 2A (2014) project reach, we estimated 12 acres of retained riparian habitat and 10 acres of newly planted riparian areas exist (Figure 5). The retained riparian habitat alone represents 60% of the restoration goal of 20 acres, and the combined habitat acreage for retained riparian habitat and riparian and active berm planting zones is 110% of the restoration goal.

Table 4: Comparison of 2015 Riparian Habitat Acreages with HMMP Success Criteria

Phase	Habitat Type	HMMP Projected Acreage	HMMP Success Criterion*	2015 Acreage Mapped
1	riparian	43	39	26 retained; 23 planted
2	riparian	20	18	12 retained; 10 planted

*HMMP success criterion is +/- 10% of projected acreage by habitat type.

Most of the riparian habitat at SRERP is forest bordering the Salt River channel. The riparian forest is dominated by tree species, mostly willows (*Salix* spp.), and also has red alder (*Alnus rubra*) and black cottonwood (*Populus trichocarpa*). In Phase 1, several channels are bordered by riparian scrub, dominated by the shrub species coyote brush (*Baccharis pilularis* var. *consanguinea*) and willow shrubs some of which has died off in response to inundation by tidewater. Where the stands contained mostly live trees or shrubs, they were mapped as riparian habitat. In the project's Lower Phase 2A (2014) reach, some riparian habitat was retained on the banks of the newly excavated channel. In addition, riparian species were planted in the riparian and active berm planting zones (see Figure 5).

VEGETATION

Monitoring Task: Rare Plant Survey - Eelgrass

Agencies: Coastal Commission, California Environmental Quality Act (CEQA)

Documents: Coastal Development Permit- Special Condition 11; Salt River Ecosystem Restoration Project Final Environmental Impact Report (FEIR) (Mitigation Measure 3.3.1-6) and Salt River Ecosystem Restoration Project Rare Plant Mitigation and Monitoring Plan.

Description: Monitoring the natural recruitment of eelgrass and locate invasive eelgrass species. Map extent, percent coverage, density of eelgrass beds in the main stem Salt River channel.

Goals:

- The Salt River Ecosystem Restoration Project will provide suitable habitat for replacing impacted populations of native eelgrass; a plant species considered rare or threatened by the California Native Plant Society (CNPS 2010).
- Eelgrass recruitment shall have an extent of vegetative cover equal to at least 1.2 times the impacted area and have an average density equal to the pre-construction average density three years after construction.

Report: The Post-Construction Eelgrass Survey Report – Year 2 – 2015. Prepared by Susannah Manning and Daniel O'Shea.

Methods:

The 2015 eelgrass surveys were performed by consultants Susannah Manning and Daniel O'Shea.

Surveys were performed between May and July during minus tides and included a reference site.

Extent – Identified discreet patches of eelgrass in the main stem Salt River. Discreet eelgrass patch location and number of shoots/patch were recorded. Discreet patches are areas of eelgrass separated by at least a meter from surrounding eelgrass. Length and location of continuous beds of eelgrass are to be recorded and mapped.

Percent Cover - Bottom percent cover was visually estimated by measuring how much of the substrate was covered by eelgrass. Percent bottom cover is defined as total plant cover/total bed area.

Density - Shoot density is defined as number of shoots/m^2. Eelgrass percent cover and shoot density can vary according to channel depth; therefore, percent cover and density measurements were spaced evenly across the channel. The channel were divided evenly into four cross-sectional zones: 1) north right bank to north mid slope, 2) north mid slope to north low slope, 3) south low slope to south mid slope, 4) south mid slope to south bank.

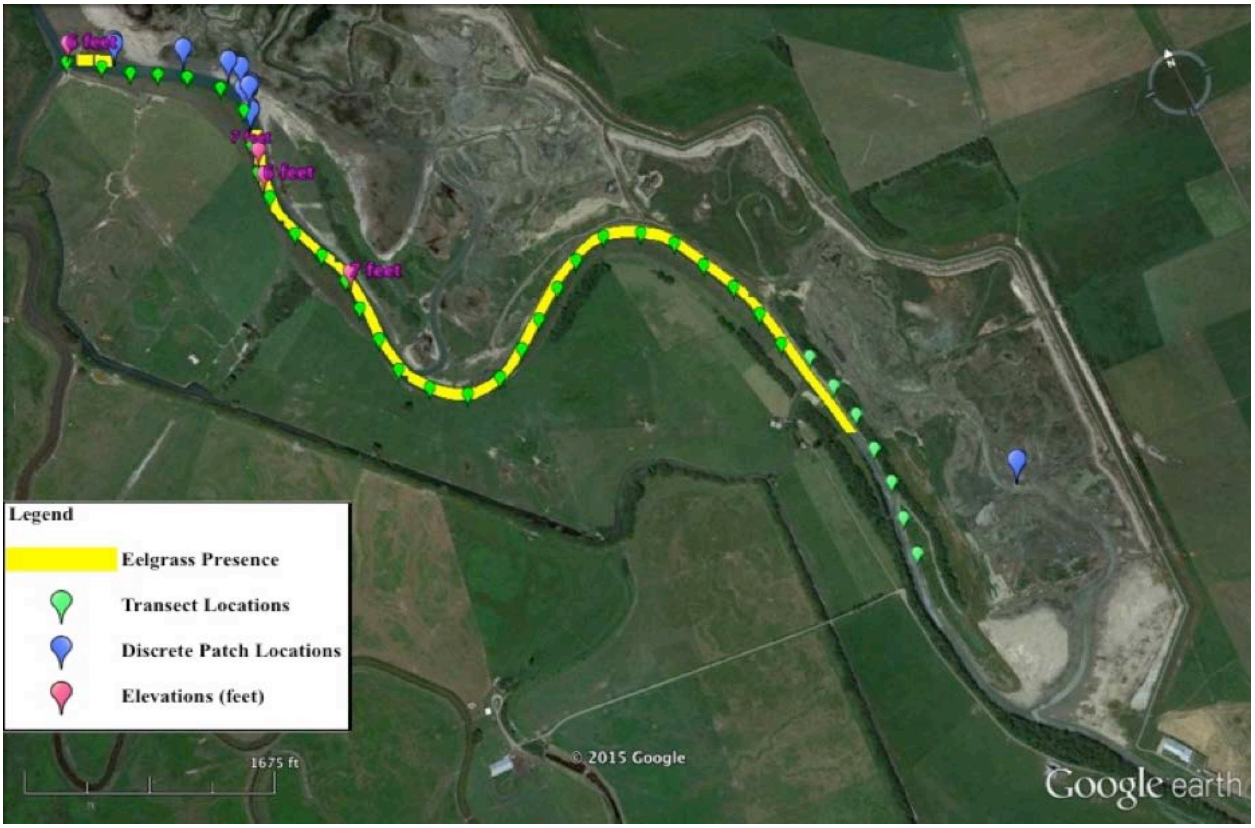


Figure 6: Eelgrass presence, transect, and patch locations on Phase 1

Results and Discussion:

The Post-Construction Eelgrass Survey Report – Year 2 – 2015. Prepared by Susannah Manning and Daniel O'Shea. is available upon request. Results are summarized from the report in the following narrative.

In 2015, surveys were performed between June and July during minus tides. These dates included a reference site at Morgan Slough. Survey results are provided in the 2015 Salt River Ecosystem Restoration Project Eelgrass Survey (Manning 2015).

Extent – Prior to construction in 2013, there were 35 discrete patches of *Z. marina* in the Salt River. Within these patches, there were an approximate total of 388 individual Z. marina shoots. In 2015, there were 13 discrete patches of Z. marina in the Salt River and the newly formed slough channels. Within these patches, there were an approximate total of 59 individual Z. marina shoots. In 2013, the total length of continuous Z. marina beds in the Salt River was 2,053 meters. In 2015, the total length of continuous Z. marina beds in the Salt River was 2,075 meters.

The total combined area of *Z. marina* in both continuous beds, and discrete eelgrass patches in 2013 was 1.06535 acres. Of that total area, 0.53 acres of *Z. marina* were excavated in 2013. The success criterion states that "within three years of completion of the project (both phases), the entire pre-construction eelgrass area plus the restored areas suitable for eelgrass recruitment shall have an extent of vegetative cover equal to at least 1.2 times the impacted area and have an average density equal to the pre-construction average density" (California Coastal Commission special conditions for CDP 1-10-32-Eelgrass). The impacted area was 0.53 acres; 0.64 acres of eelgrass is needed to meet the special condition. The total combined *Z. marina* extent for 2014 was 1.06899 acres; the total acreage increased by 102% or a 2.02 times increase from the impacted area. Therefore, the success criterion of 1.2 times increase in *Z. marina* coverage was achieved in 2014. The total combined *Z. marina* extent for 2015 increased further to 1.08 acres, yielding a total acreage increase of 104% or a 2.04 times increase from the impacted area. Acreage calculations are based on detailed surveys of previous and existing *Z. marina* continuous beds and discrete patches as described in detail in the methods section.

Percent Cover - *Z. marina* percent cover in the Salt River was significantly higher in zones 1, 2 and 4 in 2015 than it was in 2013 ($p = 0.04$, 0.05, 0; $t = 2.16$, 2, 5.26, $df = 56$, 53, 33). Salt River *Z. marina* percent cover in zone 3 did not differ significantly between 2015 and 2013 ($p = 0.52$; $t = 0.64$; $df = 58$).

Comparing the Salt River *Z. marina* average percent cover between 2013 and 2014 indicates a decrease in percent cover of 81% following excavation activities. Between 2014 and 2015, *Z. marina* percent cover increased by 483%, indicating a substantial recovery in one year. Between 2013 and 2015, *Z. marina* percent cover in the Salt River increased by 11.7%. The eelgrass success criteria required percent cover increase by 11.3% in 2016. Therefore, the project has achieved the percent cover criteria goal in 2015.

Shoot Density - *Z. marina* shoot density in Salt River was significantly higher in zones 2 and 4 in 2015 than it was in 2013 ($p = 0.05$, 0.0; $t = 2.05$, 3.71; $df = 50$, 43). Salt River *Z. marina* shoot density in zones 1 and 3 did not differ significantly between 2015 and 2013 ($p = 0.7$, 0.16; $t = 0.39$, 1.44; $df = 50$, 51).

Comparing the Salt River *Z. marina* average density between 2013 and 2014 indicates a 69% decrease in shoots/m^2 following excavation activities. Between 2014 and 2015, *Z. marina* density increased by 226%, indicating a substantial recovery in one year. Between 2013 and 2015, *Z. marina* average density in the Salt River increased by 1.45% or 140 shoots/m^2. The eelgrass density success criteria is 138 shoot/m^2 in 2016. Therefore, the project has reached the shoot density criteria goal in 2015.

Non-Native Eelgrass - In 2013, eight shoots of *Z. japonica*, the non-native eelgrass, were found in one patch in the Salt River. The GPS location of the patch was 40°37'7.20"N, 124°18'56.34"W. *Z. japonica* was not observed in the Morgan Slough control area. *Z. japonica* was not found in the Salt River or Morgan Slough in 2014 or 2015.

VEGETATION

Monitoring Task: Aleutian Goose Short-Grass Habitat Monitoring

Agencies: California Department of Fish and Wildlife (CDFW)

Documents: Salt River Ecosystem Restoration Project Adaptive Management Plan

Description: Approximately 72 acres of agriculturally managed land is retained on Phase 1 of the Salt River Ecosystem Restoration Project. Agricultural activities will follow CDFW protocols on the 72 acres where short-grass habitat will be achieved suitable for migrating flocks of Aleutian cackling Geese and other wetland-associated birds.

Goals:

- Develop a pasture management plan on Phase 1.
- Annual evaluation of vegetation on Phase 1
- Provide short-grass habitat for Aleutian Cackling Goose

Report: N/A

Methods:

From 2001 through 2012 a Memorandum of Understanding (MOU) between the HCRCD and the California Department of Fish and Wildlife (CDFW) allowed for the HCRCD to manage leases and oversee agricultural activities on several CDFW-owned wildlife management areas (WMAs). The purpose of these types of activities was to achieve a variety of wildlife habitat goals through well-managed agricultural activities. Livestock grazing and/or other agricultural management techniques are used to create, maintain and/or enhance habitat for plants, wetland associated birds such as Canada Goose, Aleutian Cackling Goose, waterfowl, shorebirds, or wading birds and other wildlife. To this end, CDFW and HCRCD jointly developed the *Protocol for Prescribing Agricultural Activities on Lands Within the North Coast Wildlife Area Complex,* to outline the process to determine and monitor specific agricultural activities, such as livestock grazing, haying, mowing, irrigation, fertilizing and seeding on all CDFW-owned wildlife areas in Humboldt County, including Riverside Ranch; the site of the Phase 1 tidal marsh restoration.

Under the MOU, HCRCD provided ongoing monitoring and oversight and made recommendations for agricultural practices to be adjusted as needed to achieve CDFW goals. This successful model was utilized by CDWF up and down the State until it was ended in late 2012 when an internal CDFW audit revealed that the practice of allowing RCDs to manage lands and lease payments for CDWF conflicted with State regulations. Due to these findings, all agricultural activities on WMAs were suspended in 2013/2014. Therefore, the 72 acres of pasture on Phase 1 reserved for shortgrass habitat has not been managed to promote optimal forage for Aleutian Goose since the winter of 2013.

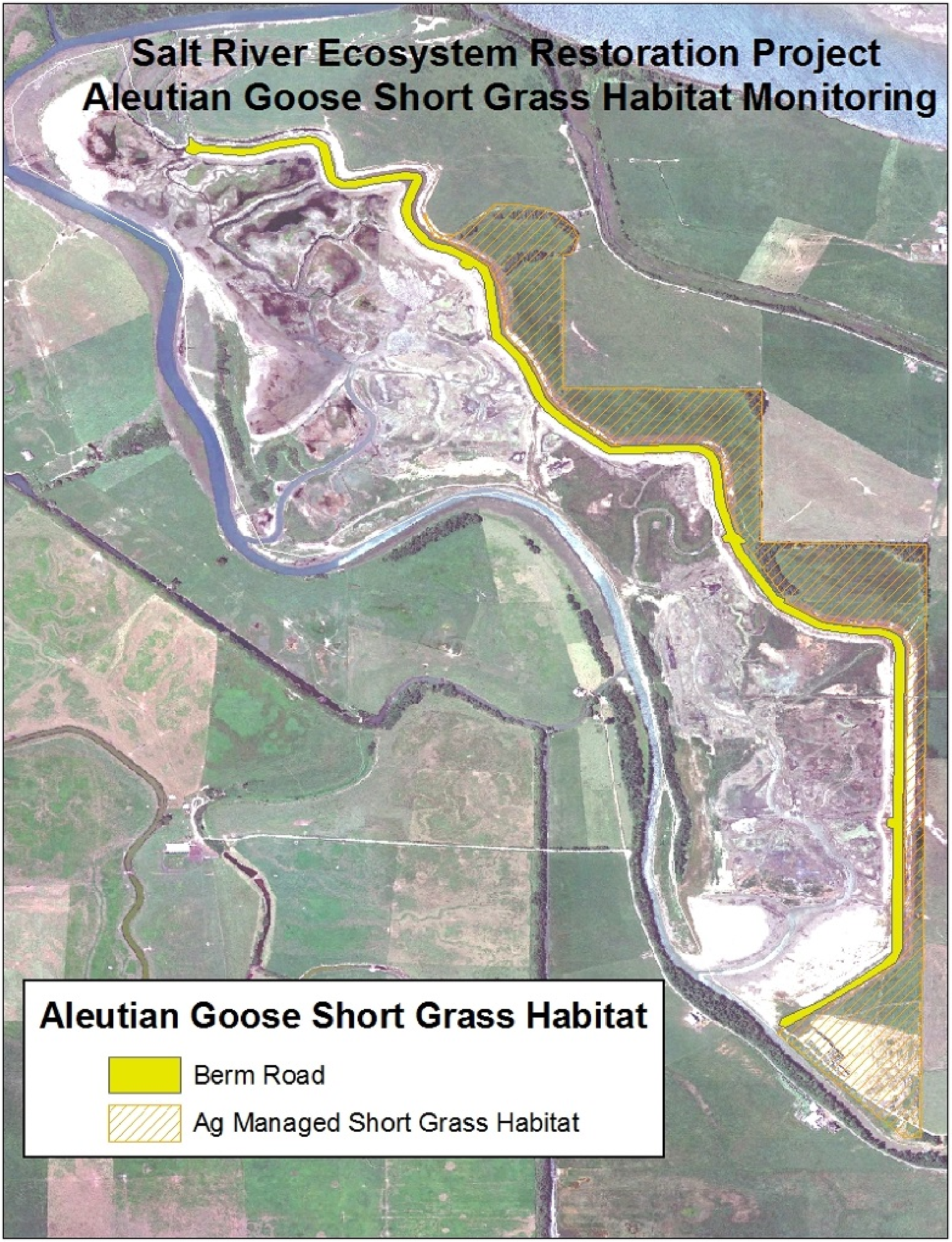


Figure 7: Proposed Managed Short Grass Habitat on Phase 1

Results and Discussion:

CDFW have allowed haying on the agricultural fields of Phase 1. In 2014, the HCRCD used its own funding to twice mow the pastures during the summer growing season to control weeds and manage the grass. The HCRCD also worked closely with the regional CDFW office to develop a haying contract in late fall to have the overgrown forage removed. However, haying occurs in the late summer or early fall season and does not promote the short grass habitat that the Aleutian Goose prefer. Therefore, the agricultural managed short grass habitat and the "prime agricultural" status on Phase 1 has been compromised for the winters of 2014/2015 and 2015/2016.

As of 2016, HCRCD is still continuing to work collaboratively with CDFW to develop a state-approved process to utilize agricultural activities to provide short-grass habitat on the retained agricultural lands in Phase 1. Once this process has been established, monitoring methods will be confirmed.

WILDLIFE

Monitoring Task: Salmonid and Tidewater Goby Monitoring

Agencies: Coastal Commission

Documents: Coastal Development Permit- Special Conditions 12, 13; SRERP Habitat Mitigation and Monitoring Plan and the Adaptive Management Plan

Description: Survey for presence of salmonids and tidewater gobies on Phase 1 in the spring through summer months.

Goals:

- Surveys will show that salmonids and tidewater gobies will utilize the restored Salt River main channel and the tidal slough networks.

Report: California Department of Fish and Wildlife. Region One CDFW Salt River Restoration Project Fisheries Monitoring Report Number 2015_12_31. Prepared By Doreen Hansen of the Humboldt County Resource Conservation District.

Methods:

The California Department of Fish and Wildlife, Humboldt State University, and the Humboldt County Resource Conservation District lead and/or participated in the fish monitoring program.

Once a month, during low tide periods, sites across the Phase 1 portion of the Salt River Ecosystem project were surveyed for salmonids and tidewater gobies from March to July. Eleven sites on the Salt River Phase 1 restoration project and one site on the Salt River in the Phase lower 2A (2014 construction footprint) area were selected for fish presence and distribution monitoring to represent the diversity of channel size and habitats in the main Salt River channel in the slough network. Each site is sampled using a 1/8th inch mesh pole seine net. Typically a single 1/8th inch mesh pole seine pass is made through each site. Captured fish are held in aerated buckets, identified to species, counted, and released back into the waterway. Additionally, juvenile salmonids are measured, held in a recovery bucket, and then released back into the waterway. Captured pike minnow are enumerated into 100 millimeter size classes by ocular estimation, and the non-native pike minnow are humanely euthanized and buried via permit requirement. A start time, end time, and air and water temperature, measured by thermometer, are recorded for each minnow trap and seine deployment. In previous years minnow traps were deployed at each site but results did not significantly add further information to the seining effort, thus minnow trapping was abandoned.

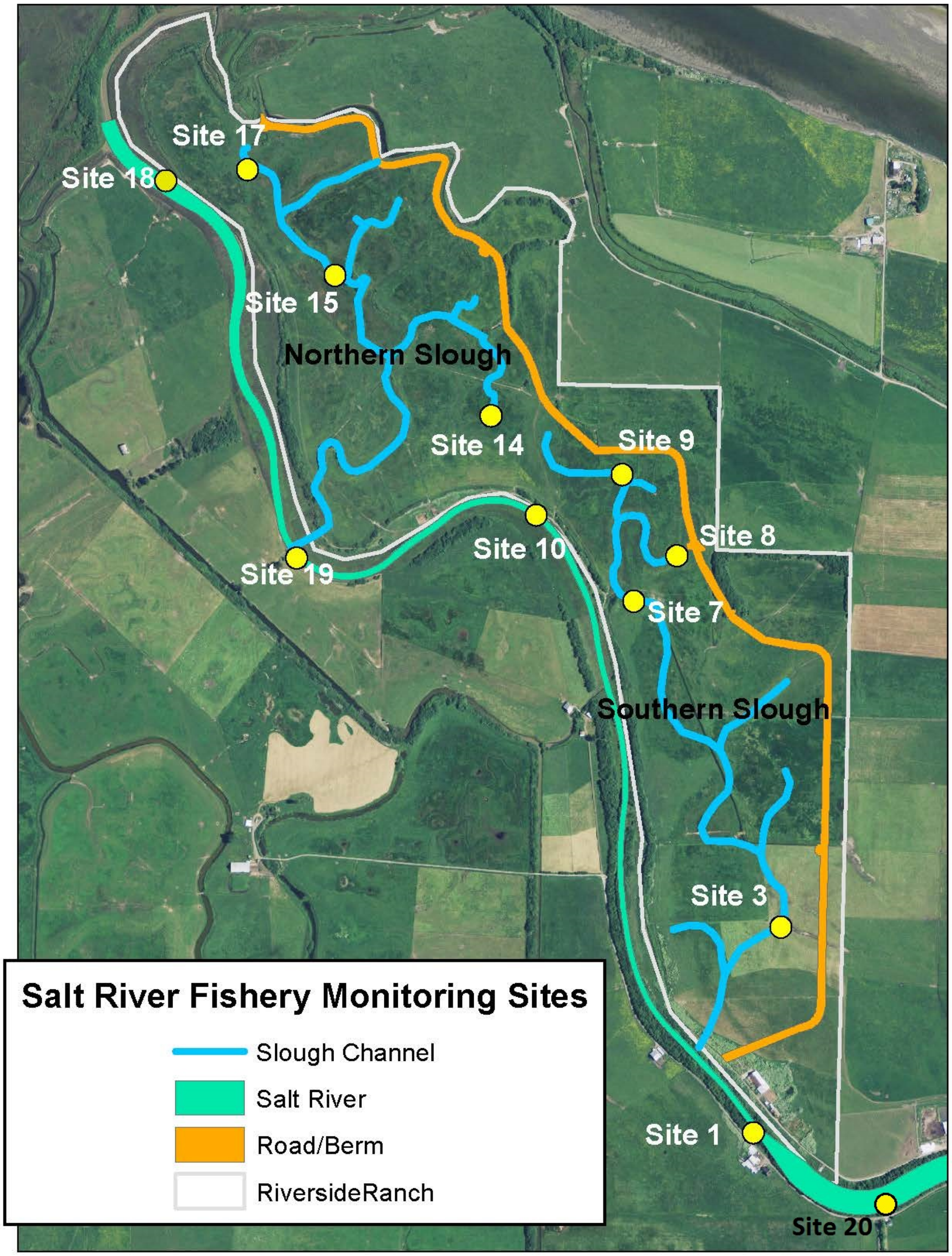


Figure 8: Fish Monitoring Sites Across Phase 1 of the Salt River Ecosystem Restoration Project

Results and Discussion:

The summary results of the Region One, CDFW Salt River Restoration Project Fisheries Monitoring Report Number 2015_12_31, prepared By Doreen Hansen of the Humboldt County Resource Conservation District, are provide in the following narrative and table (Table 5).

The following total number of fish sampled over four months (April to July) at 12 survey sites in 2015, are provided below:

Table 5: Species Captured During the 2015 Fish Monitoring Surveys

Common Name	Scientific Name	Number Sampled
Tidewater Goby	*Eucyclogobius newberryi*	160
Three Spined Stickleback	*Gasterosteus aculeatus*	4633
Smelt species (juvenile)		3414
Top Smelt	*Atherinops affinis*	4
Top Smelt (juvenile)	*Atherinops affinis*	255
Surf Smelt	*Hypomesus pretiosus*	144
Whitebait smelt	*Allosmerus elongatus*	1
Shiner Surfperch	*Cymatogaster aggregate*	3
Bay Pipefish	*Syngnathus leptorhyncus*	12
Saddleback Gunnel	*Pholis ornata*	6
Pacific Herring	*Clupea pallasii*	1
Starry Flounder	*Platichthys stellatus*	1
Flatfish species		18
Speckled Sanddab	*Citharichthys stigmaeus*	33
Sculpin species	*Cottoidea*	1131
California Roach	*Hesperoleucus symmetricus*	5
Sacramento Pike Minnow	*Ptychocheilus grandis*	17
Dungeness Crab	*Metacarcinus magister*	131
Crab species		133

In 2014, salmonid juveniles (Coho and Chinook) were sampled during the months of March and April. However, in 2015, no salmonids were captured during the low-tide sampling period (March to July). But, juvenile salmonids were sampled across Phase 1 during high-tide sampling (not part of this monitoring task) from December 2014 and March 2015. Severe drought conditions existed during the winter of 2014/2015 and likely impacted the presence of specific species.

The tidewater gobies were present during the entire sampling season and more abundant during the summer months. The tidewater gobies were sampled across most locations on Phase 1, though at higher numbers occur at the terminal ends of the southern slough channel network (sites 8 and 9) (Figure 8) and associated with specially designed backwater features. They were also sampled in the main Salt River Channel and at the stepped weirs at the confluence of Reas Creek (site 20).

The estuary portions support a majority of the fish species sampled (Table 5). Three spined stickle back are salt tolerant and were found in the thousands, as were juvenile smelt species. Areas of the estuary are ideal breeding and rearing habitat for these species. The primarily brackish water site at the confluence of Reas Creek and Salt River (site 20) saw three spined sticklebacks, sculpin, Sacramento pike minnow, California roach, and a small handful of tidewater goby.

GEOMORPHIC

Monitoring Task: Restoration Documentation Photos

Agencies: NCIRWM Plan and Consolidated Grants Program

Documents: Salt River Monitoring Plan 2008

Description: Perform qualitative documentation of the restoration with feature and landscape photos such as stream profile, floodplain, and riparian conditions.

Goals:

- Photo point monitoring will be used to qualitatively document pre- and post-project visual changes at restoration sites.

Report(s):

Salt River Ecosystem Restoration Project – Phase 1, Photo Monitoring Year 2, 2015. Prepared by HCRCD.

Salt River Ecosystem Restoration Project – Phase 2A Lower (Reas Creek to Dillon Bridge), Photo Monitoring Year 1, 2015. Prepared by HCRCD.

Salt River Ecosystem Restoration Project – Phase 2 (2A Middle 2015) Dillon Bridge to Sousa, Year 0. Prepared by HCRCD.

Methods:

Photo monitoring across the Phase 1 and the completed Phase 2 footprint by a staff member of the HCRCD.

Seven photo monitoring sites were established across Phase 1and six across the completed Phase 2 channel corridor (2015) during the pre-construction period. These same sites are used post-construction. Handheld GPS units are used to navigate to photo point sites. The compass direction of the photo is recorded and aligned with previous photo elements. Post-project photos will be taken during the same season or month as pre-project photos (Fall/November).

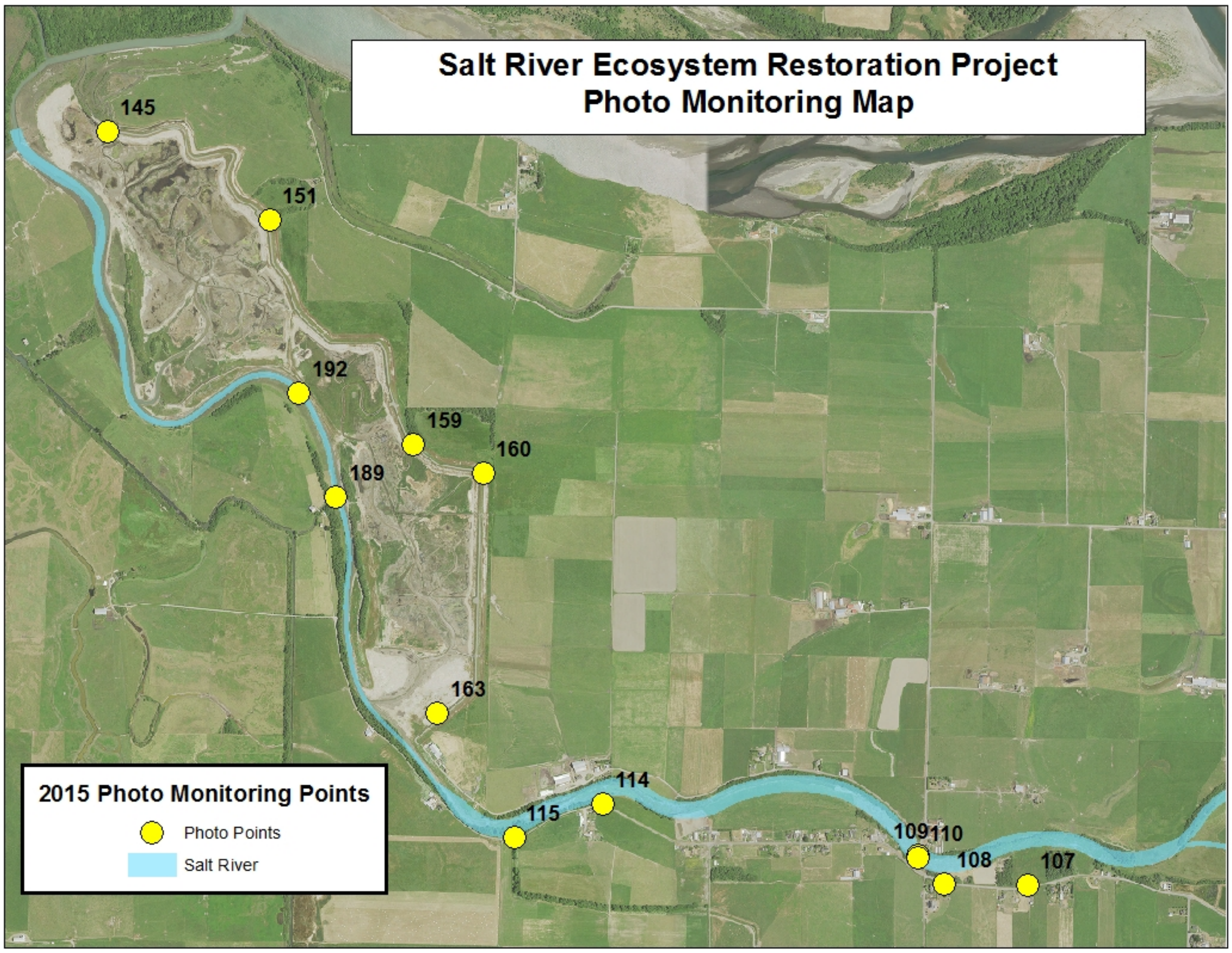


Figure 9: Photo Monitoring Points for the Constructed Footprint - 2015

Results and Discussion:

A total of 13 photo point sites are established across the Phase 1 and the completed portion of the Phase 2 project area. Pre-construction and post-construction photos have been recorded. The following five photo points are a sample of the 13 sites described the three photo monitoring reports sited above.

Photo Point 145

PP145 – SW – July 2011

PP145 – SW – November 2013

PP145 – SW – November 2015

Photo Point 160

PP160 – West – July 2011

PP160 – West – November 2013

PP160 – West – November 2015

Photo Point 163

PP163 – NW – July 2011

PP163 – NW – November 2013

PP163 – NW – November 2015

Photo Point 115


PP115 – Reas Cr – Jul 2011


PP115 – Reas Cr – Nov 2014


PP115 – Reas Cr – Nov 2015

Photo Point 109


PP109 – Dillon Br W – Jul 2011


PP109 – Dillon Br W – Nov 2014


PP109 – Dillon Br W – Nov 2015

Multiple mild winters have helped the project's channel and vegetation stabilize over the initial years. Though several large rain events have tested the project design and observations during storm events have shown that the channel corridor and estuary are functioning as expected.

GEOMORPHIC

Monitoring Task: Cross Sectional and Longitudinal Surveys/Riverside Ranch Erosion and Sediment Deposition Surveys

Agencies: Coastal Commission, and California Environmental Quality Act (CEQA)

Documents: Coastal Development Permit- Special Conditions; Salt River Ecosystem Restoration Project Final Environmental Impact Report (FEIR); and Salt River Ecosystem Restoration Project Adaptive Management Plan

Description: Cross-sectional and longitudinal profile surveys are performed across and along the main channel Salt River and slough channels.

Goals:

- Cross-sectional and longitudinal surveys will describe how the channel is remaining consistent with restoration designs, or if areas are aggrading or eroding to the point of intervention.

Report: Post-Construction Channel Monitoring of Salt River, Phase One, 2015, prepared by Susannah Manning and Daniel O'Shea.

Methods:

The cross-sectional surveys were conducted on the main channel of the lower Salt River (SR), and of the newly excavated slough channels, in both the northern (NC) and southern (SC) regions, that were excavated during the summer and fall of 2015. A longitudinal survey was conducted of the lower main Salt River channel from Cutoff Slough to the Riverside Ranch barn. This effort concentrates on Phase One of the restoration Project in the Estuarine and Salt Marsh portions. All elevations are geo-referenced in feet to the 1988 North American Vertical Datum (NAVD88).

Three cross-sectional profiles of the main Salt River channel, and three cross-sections in each of the northern and southern slough channels, were collected using a CTS/berger automatic level, tripod and stadia rod along the lower, middle and upper sections of the main Salt River channel. (Documents entail that surveys perform six cross-sectional surveys in each of the slough channel networks, however, with low tide coinciding with late evening darkness over two months, the project opted for three cross-sectional surveys in each of the slough channel networks.) Permanent, rebar monuments were set on both sides of the main channel and referenced to the Salt River Ecosystem Restoration Project's survey control points SR12, SR14 and SR11. The cross-sectional monuments were established using 4-foot lengths of ½"-rebar pounded into the substrate, leaving 3-inches exposed, and topped with labeled end caps. GPS (Garmin GPSMAP 62s) locations were recorded for each monument, along with photo documentation.

Elevations and distances were collected at each major break in slope, vegetation edge (dotted line), water's edge, mid-channel, and at least 2 locations on either side of mid-channel. These are indicated by the tick marks (+) on the cross-section graphs. Flood plain measurements were collected approximately 200-feet on either side of the main channel. The only exception was cross-section three, the upper most section, where dense vegetation obscured visibility on the south side of the channel.

The longitudinal profile survey of the main Salt River channel from Cutoff Slough to the Riverside Ranch barn was collected using a Nikon DTM-352 Total Station laser theodolite, tripod, stadia rod, prism pole and single prism. Due to the aforementioned adverse surveying conditions, wetsuits and a standup paddleboard were used to locate the thalwag during the 2-day survey. The prism pole was secured to the stadia rod at a height of 10.28 feet to account for the deep-water conditions at the time of the survey. The prism pole was placed in the thalwag approximately every 200-feet with the total station located at one of four locations along the north bank of the main Salt River channel and geo-referenced to the project's survey control points SR11, SR 14 and SR 12. A total of 48 measurements were taken along the Salt River. All elevations are reported in feet using the NAVD88 vertical datum.

Map:

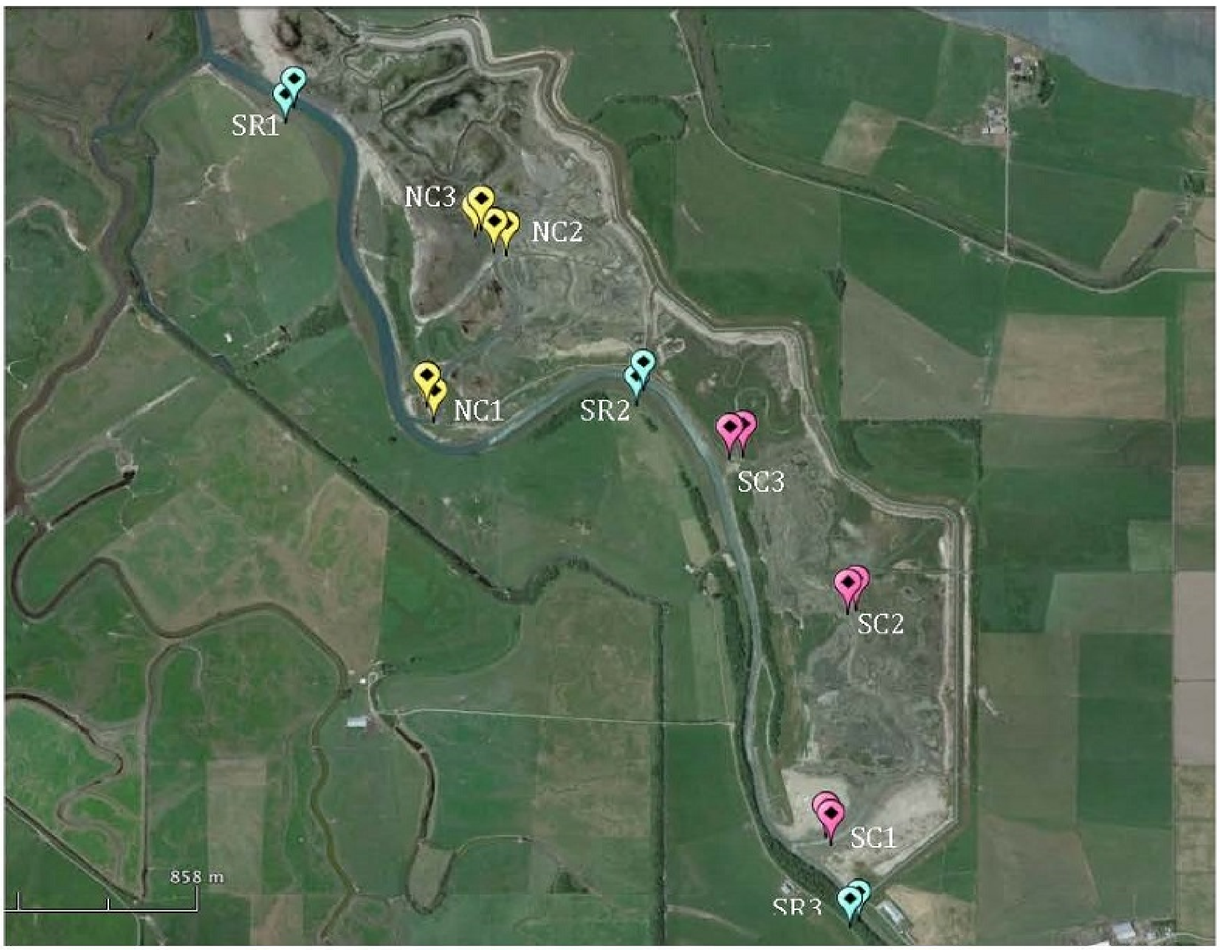


Figure 1: Location of the cross-section profiles for Salt River Ecosystem Restoration Survey Project, Fall 2014. SR = Salt River cross-sections; NC= new North Channels cross-sections; SC= new South Channel cross-sections.

Results and Discussion:

The Post-Construction Channel Monitoring of Salt River, Phase One, 2015, prepared by Susannah Manning and Daniel O'Shea is available upon request. Results are summarized from the report in the following narrative and in Figures 6 - 17

Results of the cross-sections determine the width and depth of the channels. The following are the cross-sectional and longitudinal profiles for the Salt River main channel and the southern and northern slough channel network.

Figure 6: Salt River Cross-Section #1 (SR1)

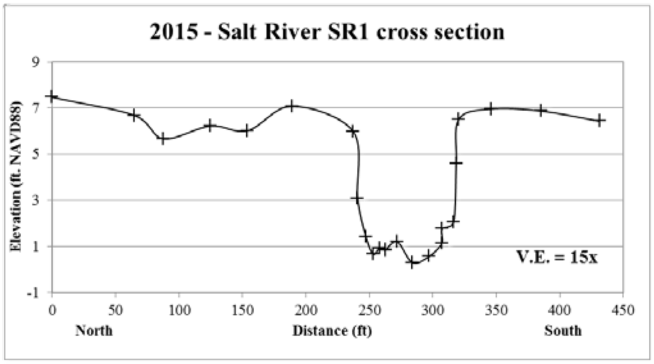


Figure 7: Salt River Cross-Section #2 (SR2)

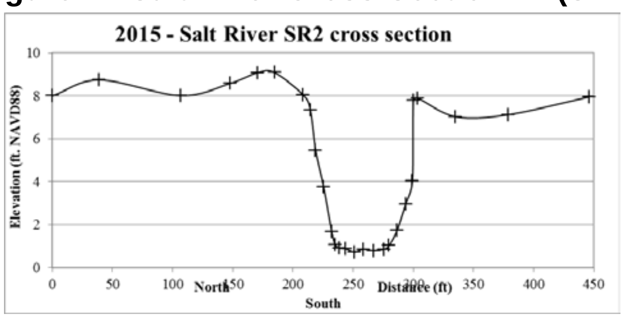


Figure 8: Salt River Cross-Section #3 (SR3)

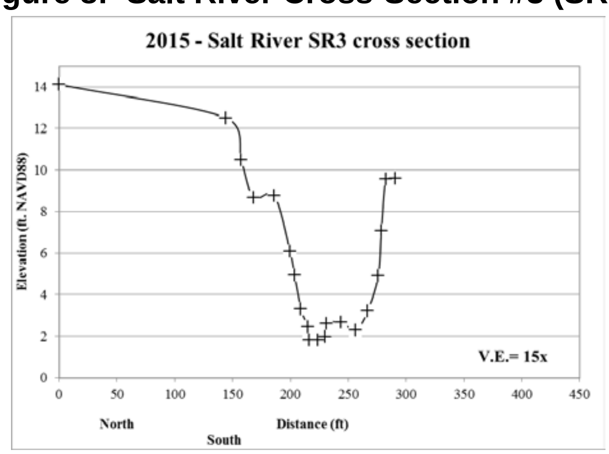


Figure 9: Slough North Channel Cross-Section #1 (NC1)

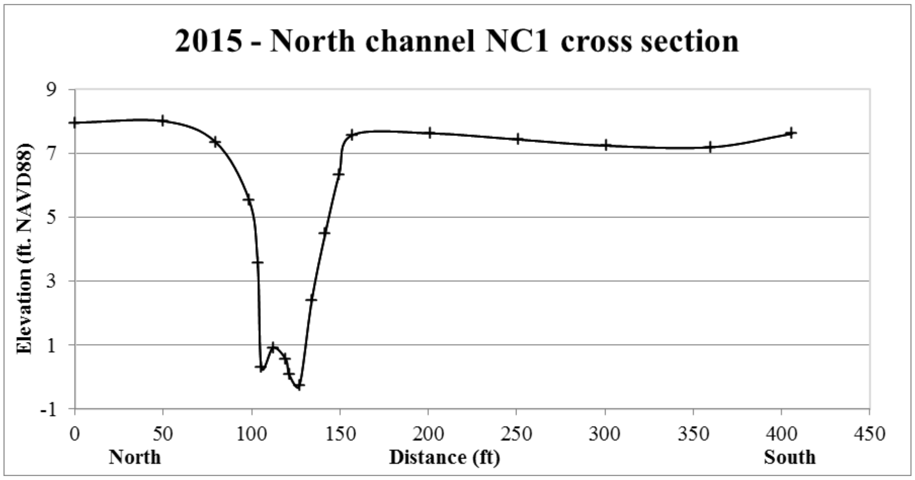


Figure 10: North Slough Channel Cross-Section #2 (NC2)

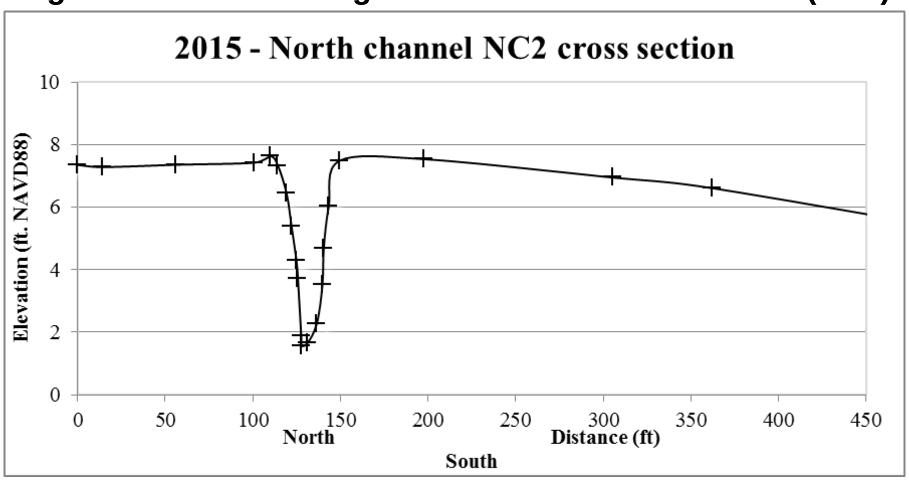


Figure 11: North Slough Channel Cross-Section #3 (NC3)

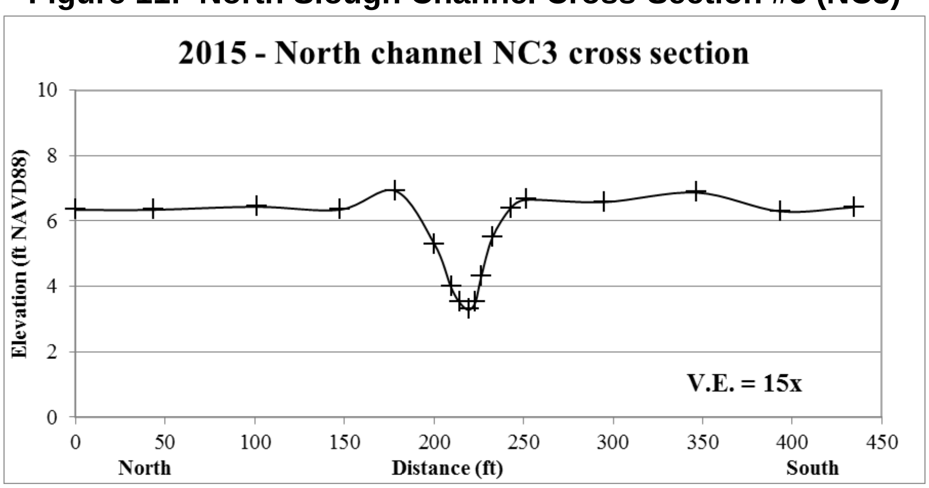


Figure 12: South Slough Channel Cross-Section #1 (SC1)

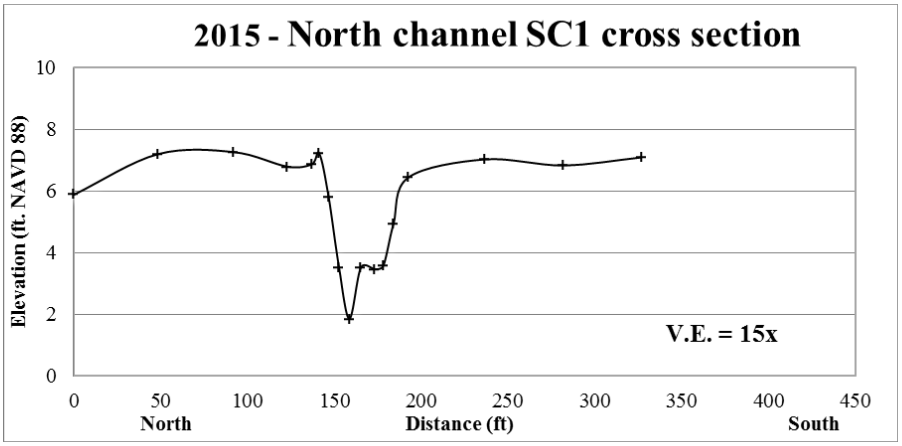


Figure 13: South Slough Channel Cross-Section #2 (SC2)

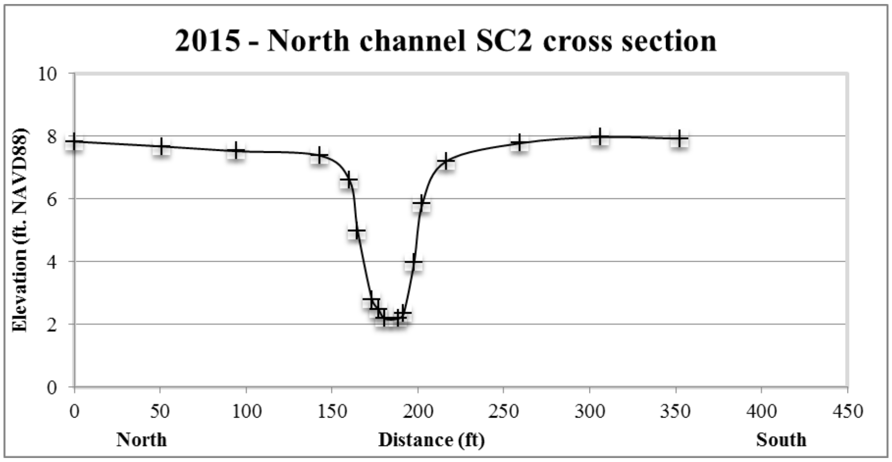


Figure 14: South Slough Channel Cross-Section #3 (SC3)

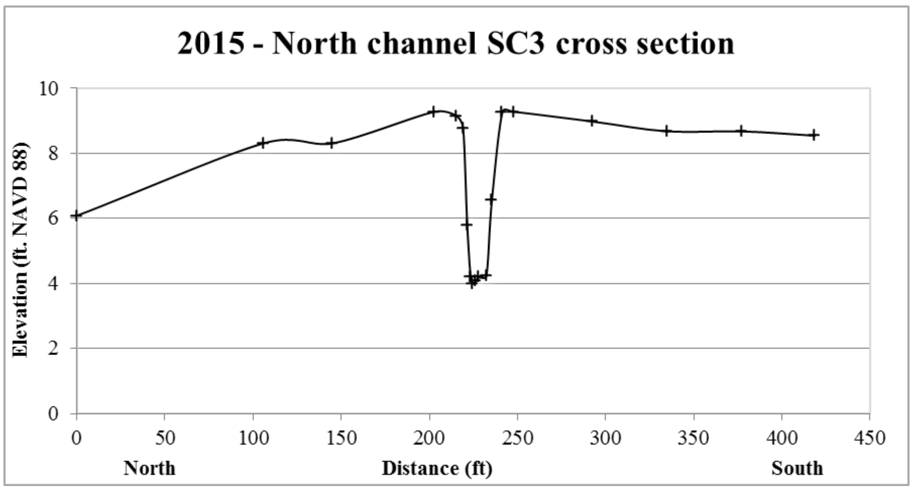
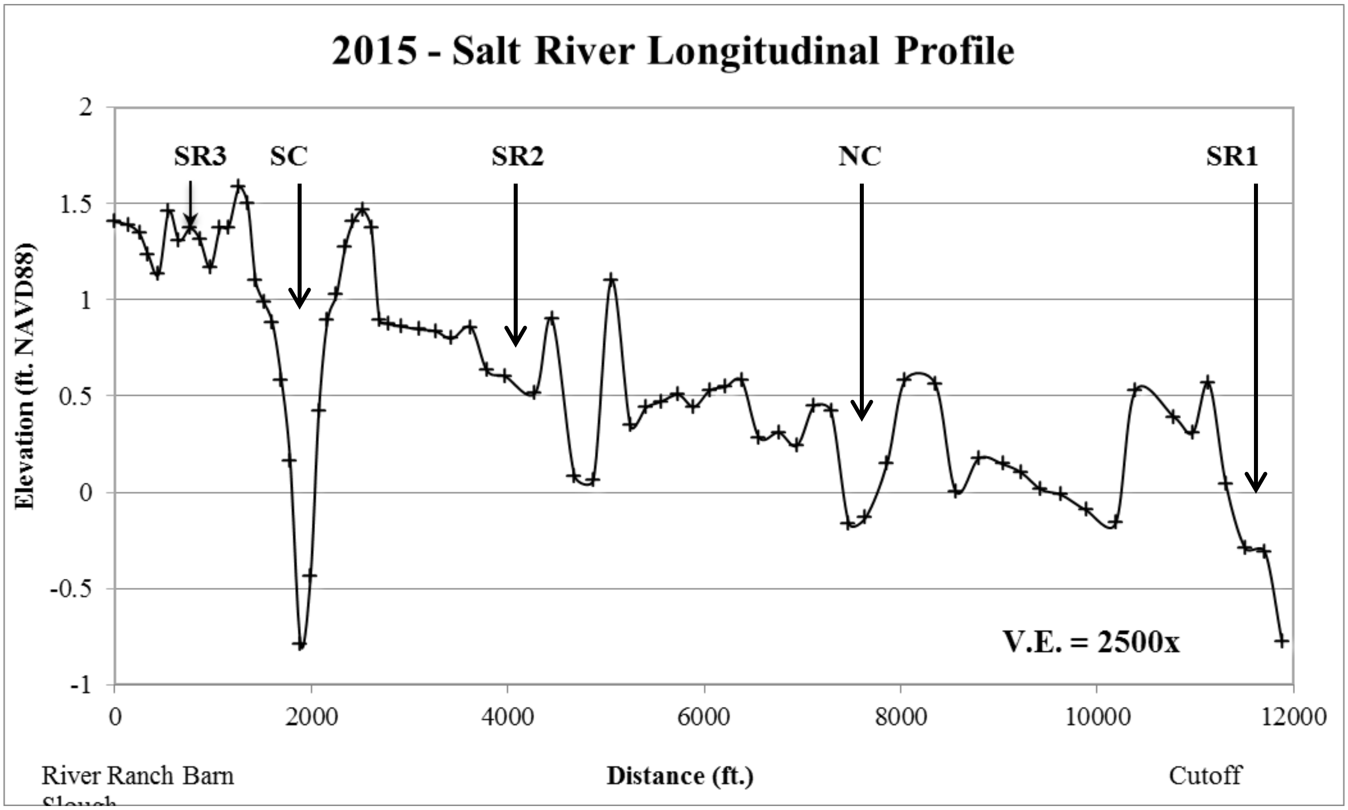


Figure 15: 2015 Salt River Longitudinal Profile



June 2015 longitudinal profile of the main channel of the Salt River. SR1, SR2 and SR3 are locations of cross sections; NC and SC are the locations of the confluence with the North and South Channels, respectively.

Figure 16: 2015 North Slough Channel Longitudinal Profile

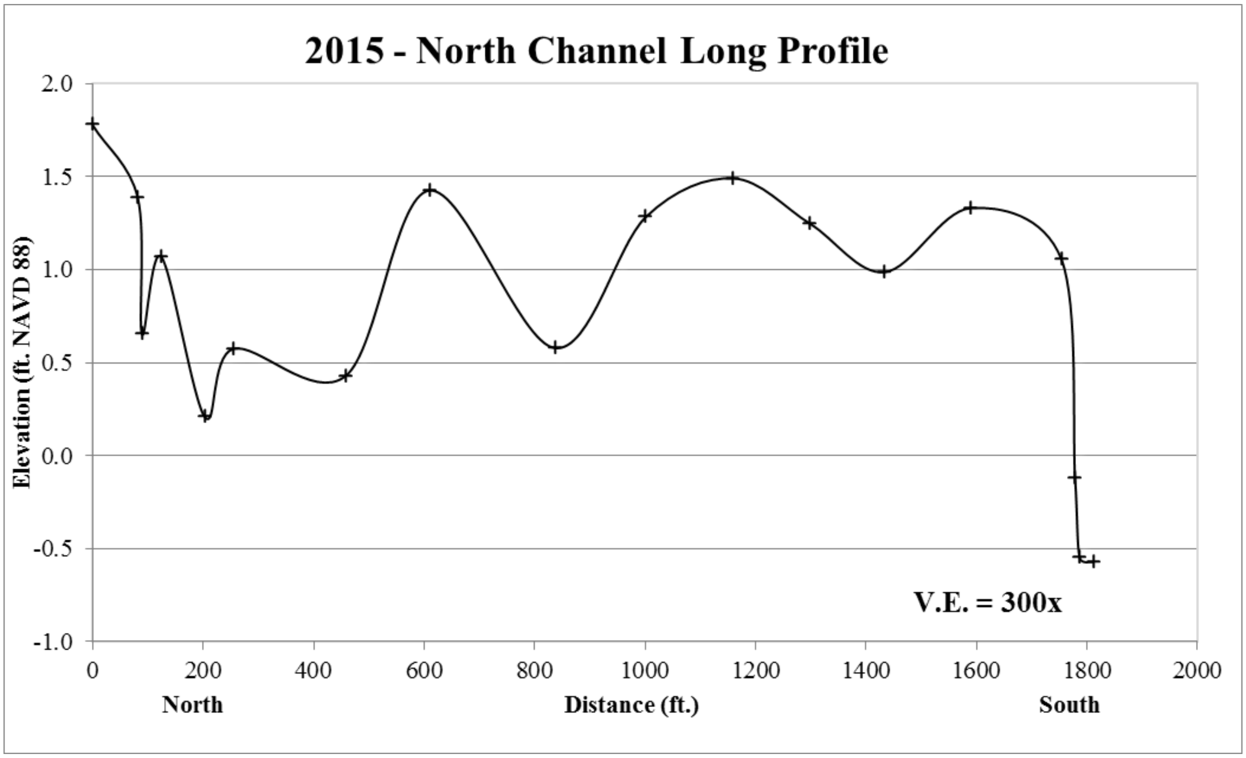
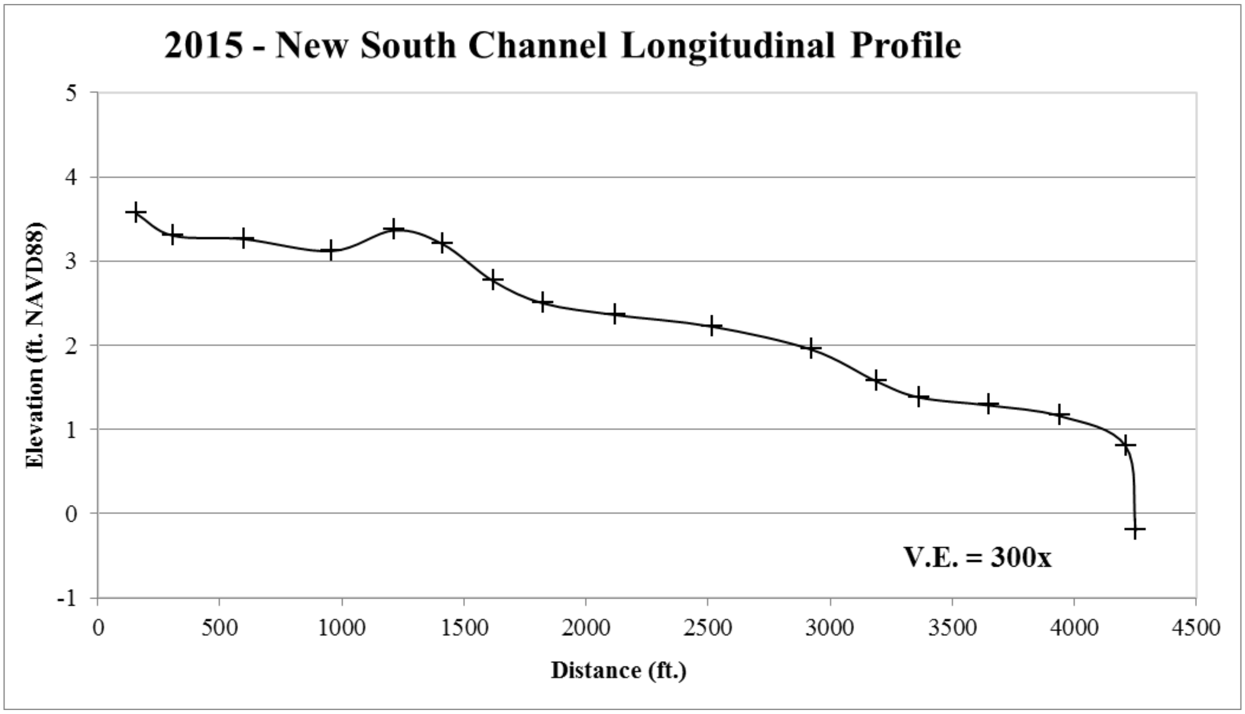


Figure 17: 2015 South Slough Channel Longitudinal Profile



In 2015, scouring and slumping on several channel banks was observed throughout the project area and most evidently downstream of the confluence of the Salt River and the south slough channel. Sedimentation was observed along the main Salt River channel that was deposited on the 2013 excavated surface. Suspended sediments were observed moving upstream during flood tide, and it is suspected that these fine grained sediments are deposited upstream during slack high tide, and would explain the deposition that was observed at the main channel cross sections SR1 and SR3, as well as the 4-5” aggradation of Salt River and south channel confluence. Overall, it appears that sediments are moving downstream, although there is some degree of upstream transport.

Referring to the longitudinal profile, total relief on the 9775-foot section of the lower, main Salt River channel surveyed, from Riverside Ranch barn to the confluence with Cutoff Slough, was 1.1 feet in 2014 and 2.4 feet in 2015. Longitudinal profiles of the new north and south slough channels were not collected in 2014. Longitudinal surveys in 2015 show the total relief on the north channel was 2.5 feet, and the relief of the south channel was 2.8 feet.

Comparing the channel dimensions at the cross sections is valuable to determine whether scour aggradation is occurring and to what degree it is occurring. The following are graphs (Figures 18 to26) for each cross-section comparing the 2015 channel to the 2014 channel, and in some cases comparing those to the 2013 As-Built channel.

Figure 18: Salt River Main Channel Cross- Section #1 Comparison 2013 to 2015

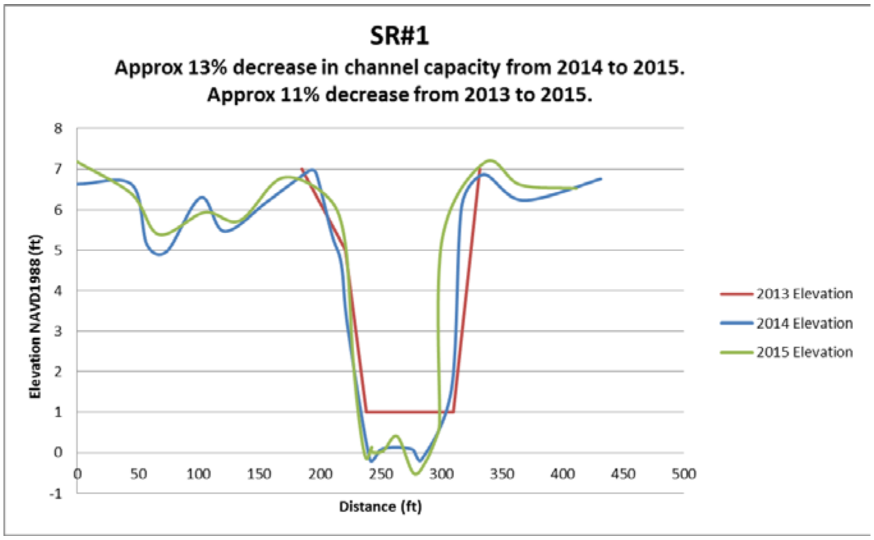


Figure 19: Salt River Main Channel Cross- Section #2 Comparison 2013 to 2015

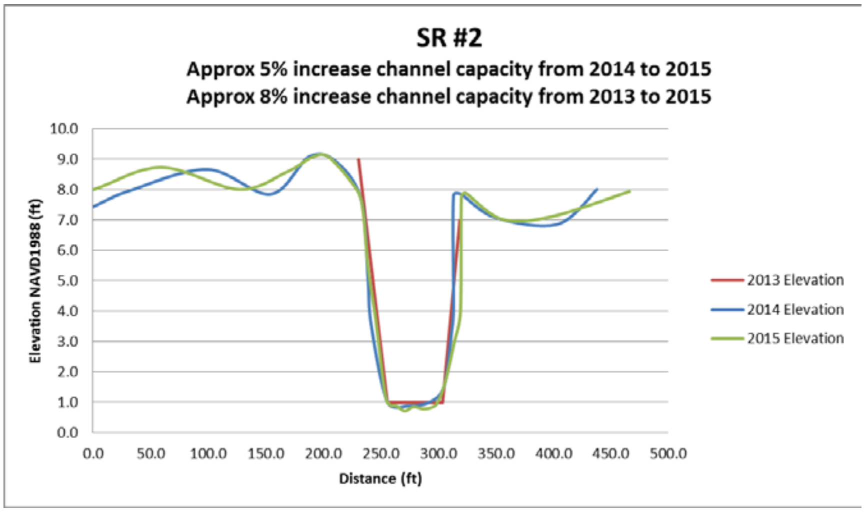


Figure 20: Salt River Main Channel Cross- Section #3 Comparison 2013 to 2015

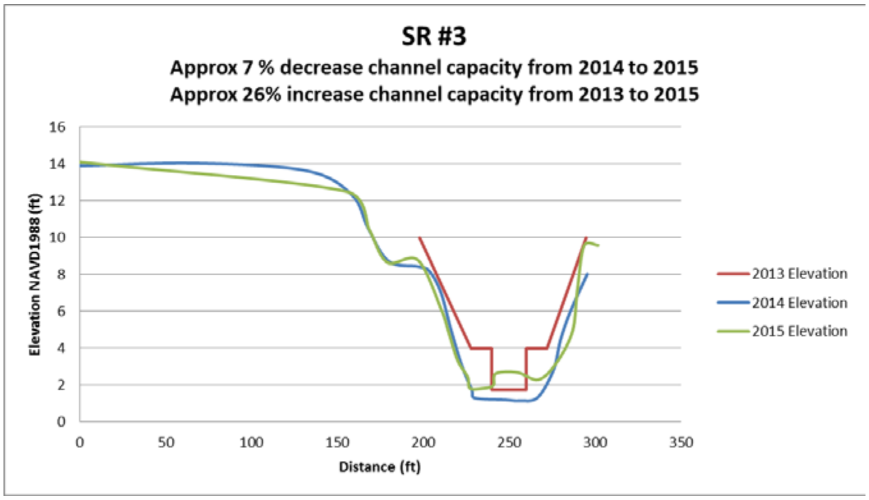


Figure 21: North Slough Channel Cross- Section #1 Comparison 2013 to 2015

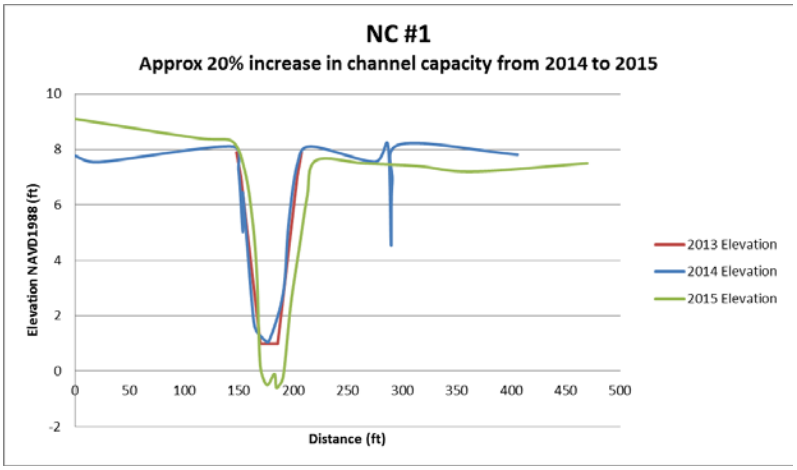


Figure 22: North Slough Channel Cross- Section #2 Comparison 2014 to 2015

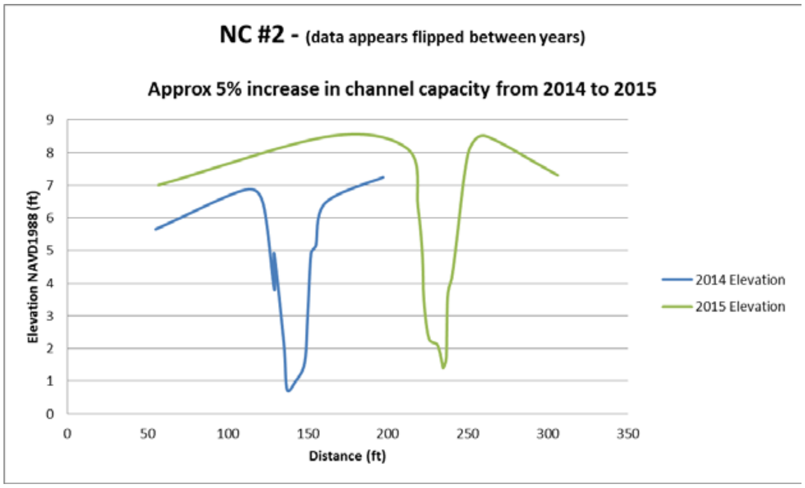


Figure 23: North Slough Channel Cross- Section #3 Comparison 2014 to 2015

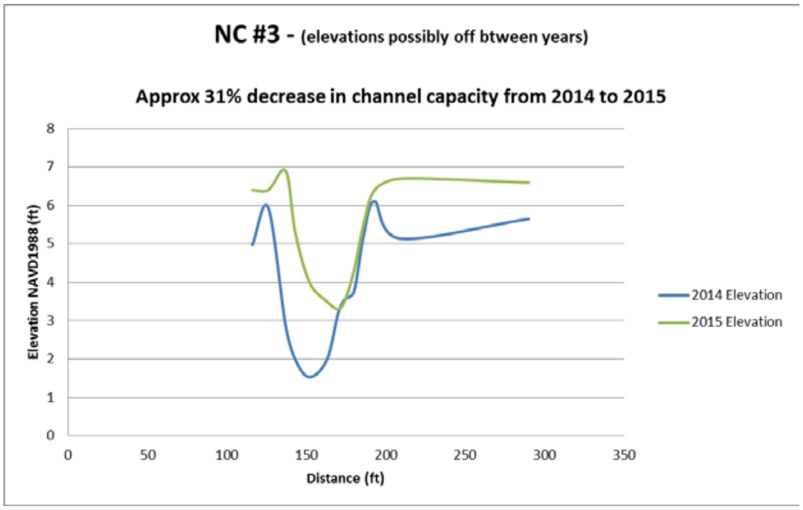


Figure 24: South Slough Channel Cross- Section #1 Comparison 2013 to 2015

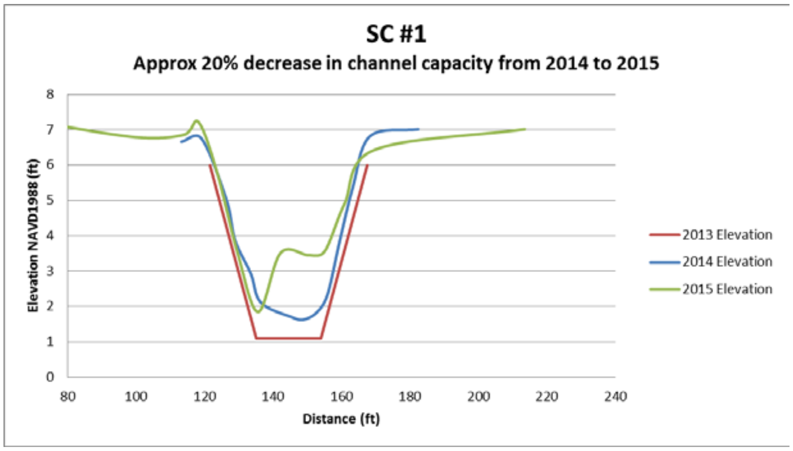


Figure 25: South Slough Channel Cross- Section #2 Comparison 2014 to 2015

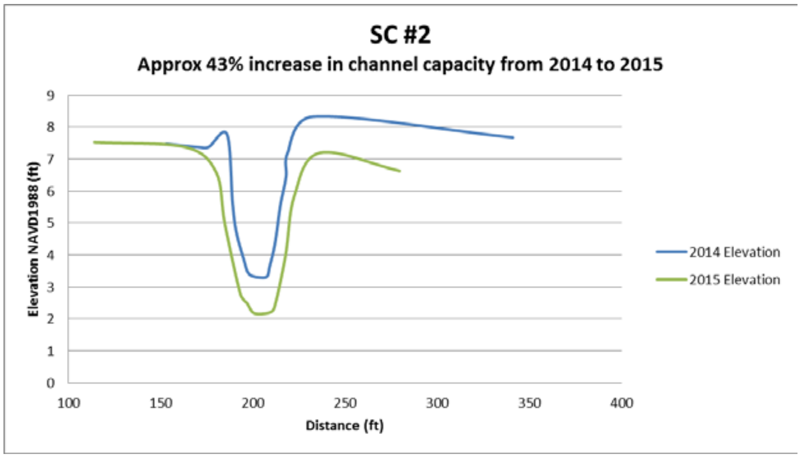
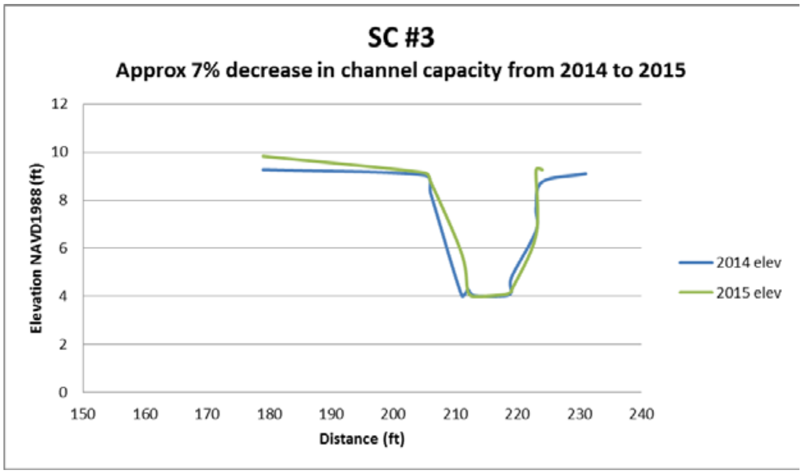


Figure 26: South Slough Channel Cross- Section #3 Comparison 2014 to 2015



Sedimentation and scour has occurred in the main channel over the past two years of monitoring. In 2015, cross-section #1 (SR1) (Cutoff Slough) (Fig. 18) channel capacity has decreased by approximately 13% since 2014 and by 11% since 2013; it appears that though the channel is experiencing bottom scour, aggradation along the south bank is causing the decrease in area capacity at this site. Cross-section #2 (SR2) (Fig. 19) increased by approximately by 5% since 2014 and 8% since 2013; some minor north and south bank scour is occurring. Cross-section #3 (SR3) (near the barn) (Fig. 20) decreased by approximately 8% since 2014 but has increased by 26% since 2013; some scour of the channel bottom occurred in 2014, however sedimentation along the bottom at this site has decreased capacity.

Two of the northern slough channel cross-section sites increased in capacity from 2014 to 2015 (NC1 by approximately 20% and NC2 by approximately 5%) (Figs. 21 and 22) primarily due to scour at the bottom of the channel.   These sites are further down in the main stem of the northern slough channel network. NC3 is located just above the NC2 site, but just above a break in elevation where a short water fall is developing. Water backs up and slows in this area as the flow waits to travel to the waterfall, which likely causes sediment to drop out of the water. NC3 is calculated to have a 31% decrease in channel capacity at this site (Fig. 23).

The southern slough channel network has seen both scour and aggradation. SC1, near the confluence had significant sedimentation on one side of the channel which decreased its capacity by approximately 20% (Fig. 24). SC2 is located near the midpoint of the main southern slough channel network and has increased in channel capacity by approximately 43% (Fig. 25). Further up the main southern slough channel, SC3 indicates further sedimentation in the system, but comparatively insignificant, where the channel capacity has reduced by approximately 7% at this site (Fig. 26).

Sedimentation is apparent at the terminal ends of the northern and southern slough channel networks and will likely slowly fill in. Portions of the Salt River main channel also appear to have significant aggradation that is captured in both the cross-section sites an in the longitudinal profile. Initial discussions with Project participants accept that this is a dynamic system and some areas will likely fill and others will expand.

GEOMORPHIC

Monitoring Task: Cross Sectional and Longitudinal Surveys/Salt River Channel Corridor Upstream of Reas Creek - Erosion and Sediment Deposition Surveys

Agencies: Coastal Commission, and California Environmental Quality Act (CEQA)

Documents: Coastal Development Permit- Special Conditions; Salt River Ecosystem Restoration Project Final Environmental Impact Report (FEIR); and Salt River Ecosystem Restoration Project Adaptive Management Plan

Description: Cross-sectional and longitudinal profile surveys are performed across and along the main channel Salt River.

Goals:

- Cross-sectional and longitudinal surveys will describe how the channel is remaining consistent with restoration designs, or if areas are aggrading or eroding to the point of intervention.

Report: N/A. Raw collected data is available.

Methods:

The cross-sectional surveys were done by a Humboldt State University graduate student under the direction of a Salt River team engineer from the USFWS.

The cross-sectional surveys and longitudinal profile were conducted on the Salt River (SR) channel above Reas Creek to just downstream of the Francis Creek confluence using a CTS/Berger automatic level, tripod and stadia rod. This portion of the channel was constructed in 2014 and 2015. All elevations are geo-referenced in meters to the 1988 North American Vertical Datum (NAVD88) using Trimble Real Time Kinematic technology based on project survey control point SR11.

Nine cross-sectional profiles of the Salt River channel, between Reas Creek to the upstream end of the 2015 construction area, were collected in December 2015 and June 2016. Permanent, rebar monuments were set on both sides of the main channel at a minimum of three feet above bank full elevation and referenced to the Salt River Ecosystem Restoration Project's survey control points. The cross-sectional monuments were established using 4-foot lengths of ½"-rebar pounded into the substrate, leaving 12 – 16 inches exposed. Sub-meter GPS locations were recorded for each monument using a Trimble Geo-XH, along with photo documentation.

Elevations and distances were collected at a maximum resolution of every two meters and at each major break in slope, vegetation edge, water's edge, and mid-channel.

Flood plain measurements were collected approximately 200-feet on either side of the main channel.

The longitudinal profile survey of the main Salt River channel from Reas Creek to the upper extent of the 2015 construction site was collected over four days in June 2016. Surveys were timed to co-inside with dry weather and low tide (within intertidal reaches) conditions to allow for maximum visibility of the channel thalweg. Elevation data were collected within the thalweg at a maximum resolution of approximately every 50 meters. A total of 44 measurements were collected along the Salt River, from the upstream extent (below the Francis Creek confluence) to the downstream extent (just upstream of Reas Creek).

Figure 27: Salt River Phase 2 Cross-Section Sites.

Results and Discussion:

Nine cross-sections sites were developed and surveyed in the 2014 and 2015 restored reach of the Salt River. Project monitoring criteria indicates that four cross-section sites be situated in the tidal/brackish reach and six cross-sections be situated in the freshwater boundaries of the project footprint. The 2014 and 2015 construction reach consists of tidal/ brackish water between cross-sections #1 to #6. Three cross-sections are already established within the 2013 tidal reach (Phase 1, Riverside Ranch), therefore only one additional tidal/brackish site is needed to meet the project monitoring criteria. One to two freshwater cross-sections could be selected between cross-sections #7 to #9 to comply with the project's monitoring criteria. However, for this report, all nine sites will be discussed.

The following graphs (Figures 28 to 36) show each cross-section associated with each site on the above map. Each cross-section survey was performed in December 2015 and a follow up survey was performed in June 2016. Keep in mind cross-sections #1 to #6 are located in a reach constructed in 2014, therefore it would have performed through two winters with higher flows (2014 was a drought winter and 2015 was an El Niño winter). Cross-sections #7 to #9 performed through one El Niño winter.

Figure 28: Cross-Section 1 – 2014 Construction

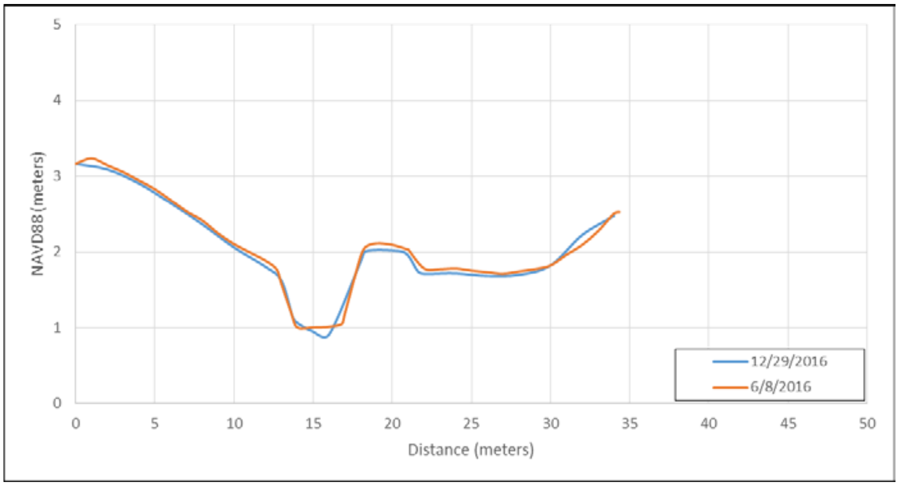


Figure 29: Cross-Section 2 – 2014 Construction

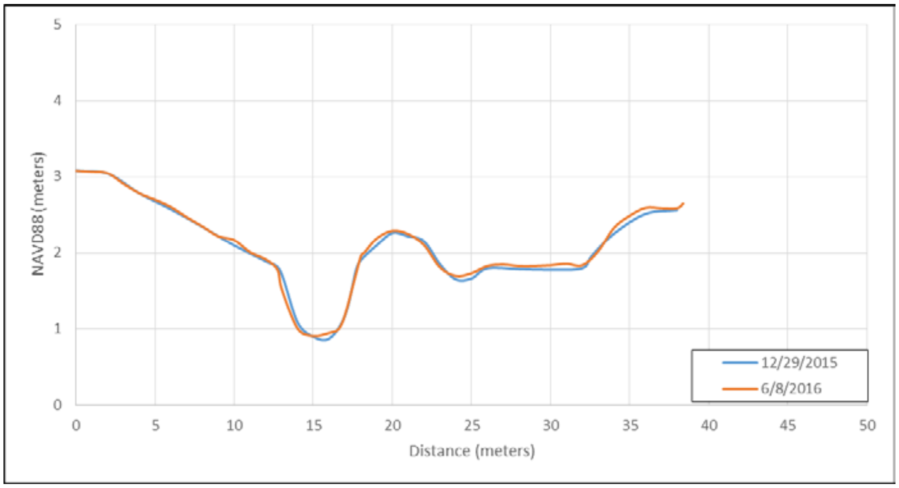


Figure 30: Cross-Section 3 – 2014 Construction

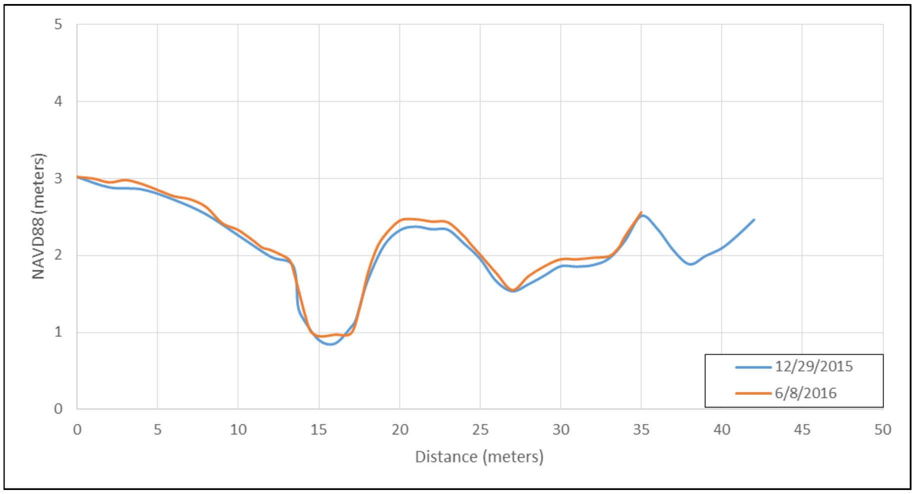


Figure 31: Cross-Section 4 – 2014 Construction (26% increase channel capacity)

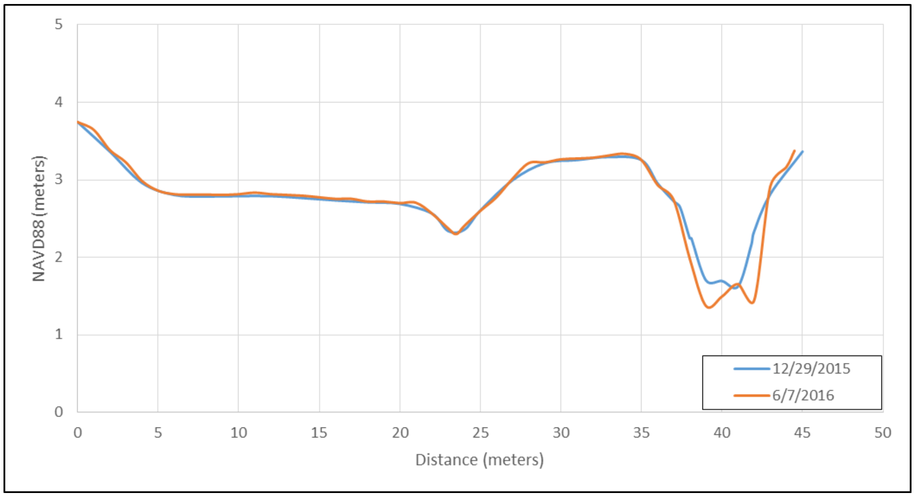


Figure 32: Cross-Section 5 – 2014 Construction

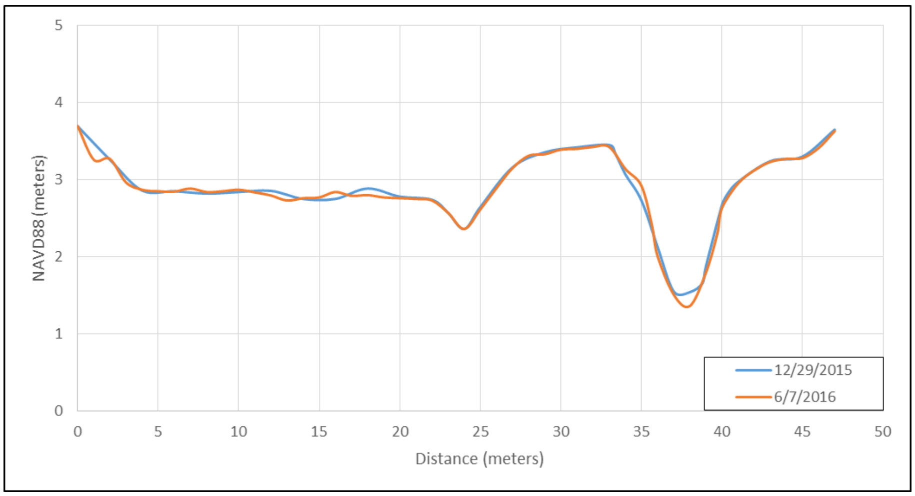


Figure 33: Cross-Section 6 – 2014 Construction (13% increase in channel capacity)

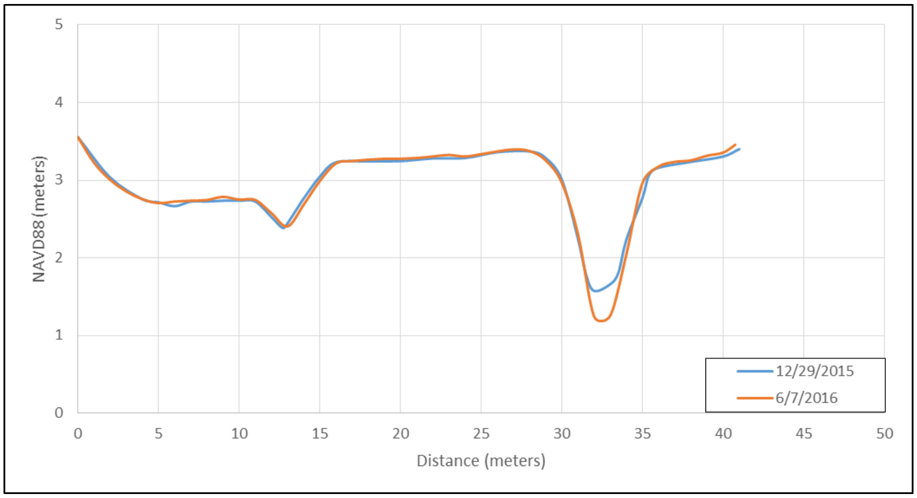


Figure 34: Cross-Section 7 – 2015 Construction

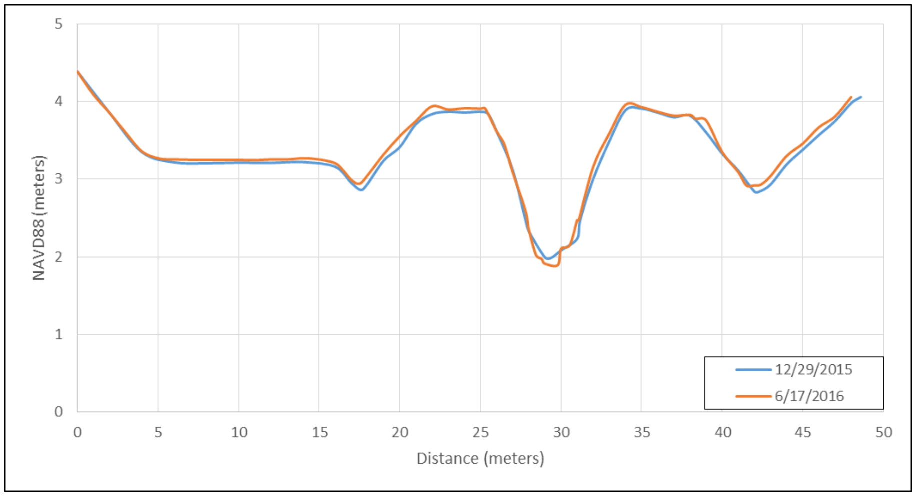


Figure 35: Cross-Section 8 – 2015 Construction

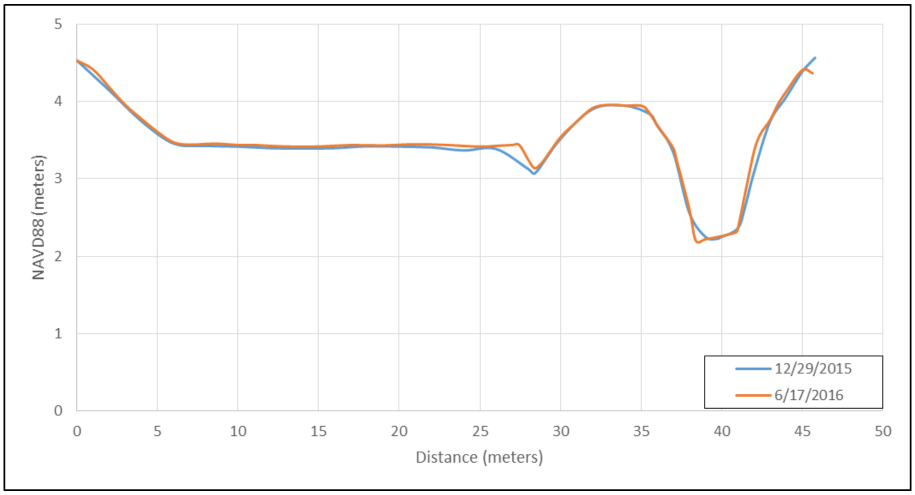


Figure 36: Cross-Section 9 – 2015 Construction (7% decrease in channel capacity)

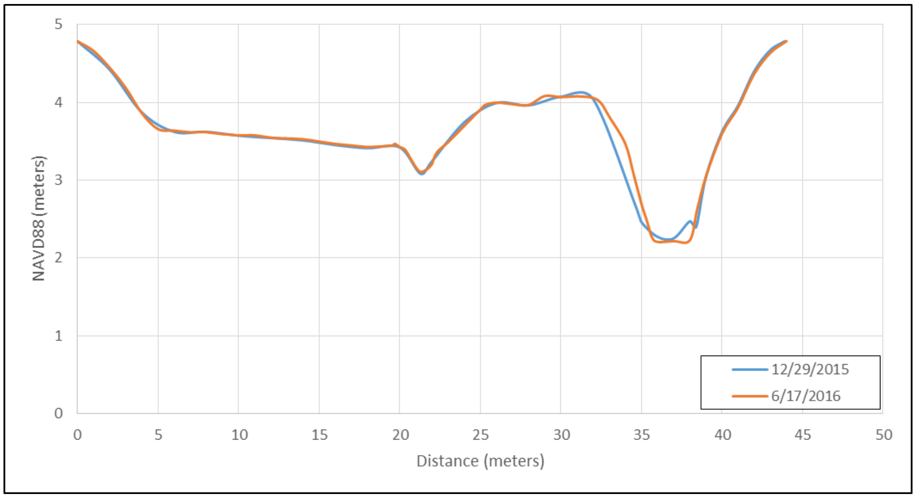
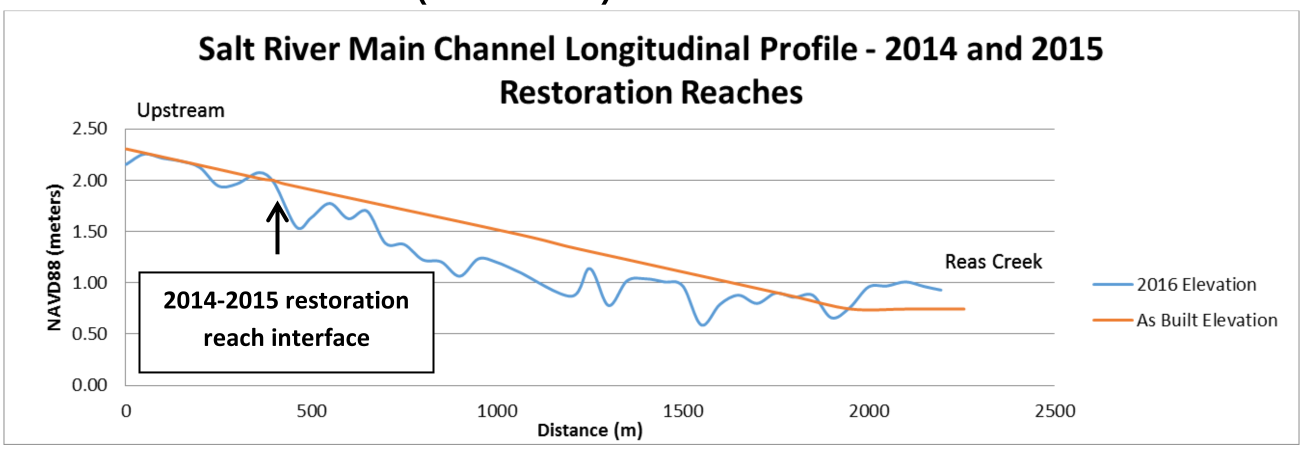


Figure 37: Longitudinal Profile from upstream extent of 2015 restoration to the bottom of 2014 restoration (Reas Creek)



Comparing the cross-sectional graphs on top of one another provides a quick visual indication on how the channel changed over one winter period. Of the nine cross-sections, six showed minimal change. However, three cross-sections indicate that the channel either scoured or accreted. Channel capacity (area) at cross-section 4 increased by 26% (Fig. 34). This area was examined to determine if wood structures or other channel features would have contributed with scouring in the area, but nothing obvious appears to be causing the increase in capacity, other than it is within proximity (160 feet upstream) of an outlet and inlet transition zone which has high shearing flow dynamics. Cross-section 6 (Fig. 33) also experienced an increase of channel capacity; 13%. This site is downstream of Dillon Bridge and immediately downstream of a floodplain/active bench outlet. The increase of stream flow at this site during high flow events is likely the cause of the scour. A 7% decrease of channel capacity occurred at cross-section 9 (Fig. 36). This aggradation appears to be happening on the left bank (looking downstream) which is on an inside bend. This location is immediate downstream on an inlet where the water is slightly slowed down during high flows to direct a portion of the flow onto the floodplain. This slowing may cause sediment to drop out at this location. Additionally, this location is furthest upstream and is the first to receive sediment laden water exiting the area known as Lake Vevoda.

Cross-section sites 4 and 6 exceeds the SRERP's Adaptive Management Plan's 10% trigger. The results for these sites will be addressed by the SRERP's management team. All nine sites will be re-surveyed this winter (2016) and next summer (2017).

The longitudinal profile graph (Fig. 37) shows that after one winter, the 2015 channel bottom elevation has changed very little from the constructed dimensions. Two years of winter flows has dropped the 2014 constructed active bottom elevations from the As-Built elevations. Through a majority of the 2014 reach, the channel bottom dropped on average between 0.3 and 0.2 meters (.9 to .7 feet). During channel inspections, observations noted that narrow strips (thalwags) were scoured throughout the active channel bottom and maybe attributing to the decrease in elevation. However, at the lowest portion of the reach, aggradation is occurring approximate 250 meters (820 feet) upstream of the confluence of the Salt River and Reas Creek. This aggradation is on order of 0.3 meters (0.98 feet).

GEOMORPHIC

Monitoring Task: Culvert and Tide Gate Inspections on Riverside Ranch

Agencies: Coastal Commission

Documents: Coastal Development Permit- Special Conditions; Salt River Ecosystem Restoration Project Adaptive Management Plan

Description: Annual inspection of tide gates, culverts, and drainage outboard drainage ditch

Goals:

- All tide gates and remaining culverts on Riverside Ranch remain unobstructed and operational.
- The Riverside Ranch outboard ditch will be monitored for flow and erosion impacts and maintained

Report: N/A. Observational data sheets are available upon request.

Methods:

Any culverts or tide gates remaining or installed in Riverside Ranch as part of the restoration design will be inspected annually and regularly maintained to ensure that they are functioning as designed. Annual reconnaissance of the outboard drainage ditch adjacent to the new Riverside Ranch berm will also be conducted to identify areas of impacted flow conveyance and/or erosion and any maintenance recommendations.

Although the SRERP's Adaptive Management Plan outlines that monitoring take place annually, during 2014 HCRCD staff monitored the above items at least weekly to ensure tide gates and the outboard ditch are working properly to not allow high salinity water to encroach onto neighboring lands. A site-check form has been developed to help monitor various elements on Riverside Ranch. The form includes observations pertaining to the tide gates, outboard ditch, pasture condition, fencing, wildlife, roads, structures, etc. The forms are reviewed by the Project Manager to determine any issues that need to be addressed. Monthly reports are forwarded to CDFW Lands Division staff.

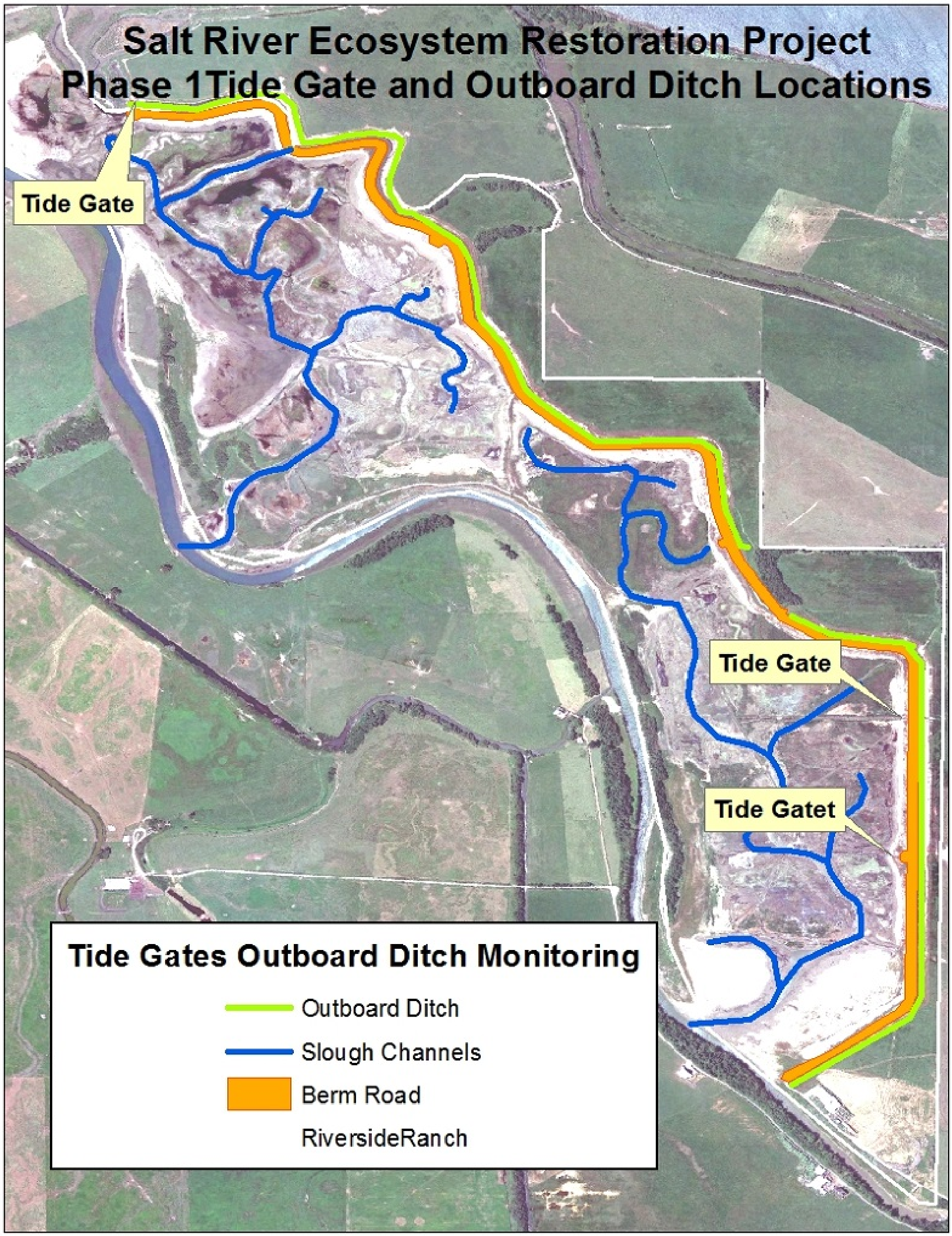


Figure 38: Tide Gates and Outboard Ditch Locations

Results and Discussion:

The Phase 1 (Riverside Ranch) project area is monitored for various items. These items include the three tide gates and an outboard ditch on a nearly weekly basis. No culverts remain on Riverside Ranch; all culverts were removed during construction. The installed tide gates are functioning as expected. No debris has been observed to obstruct the closing or opening of the tide gates thus far. However, the southernmost tide gate has been observed to leak more than the other two during higher tide events. The outboard ditch has more than accommodated the excess water during the summer and fall months.

The 2014/2015 winter season experienced another year of drought conditions. The largest storm event was less than 2 inches during the hydrologic year. In addition, the outboard ditch was mowed/hayed in the summer and winter to reduce any vegetation impacts.

GEOMORPHIC

Monitoring Task: Setback Berm Inspection

Agencies: Coastal Commission, and California Environmental Quality Act (CEQA)

Documents: Coastal Development Permit- Special Conditions; Salt River Ecosystem Restoration Project Adaptive Management Plan; and Salt River Ecosystem Restoration Project Final Environmental Impact Report (FEIR)

Description: Visual inspections for evidence of erosion and/or cracks after major storm events and high tides.

Goals:

- Determine if any annual maintenance is needed on the setback berm (berm road).

Report: N/A. Observational data sheets are available upon request.

Methods:

Monitoring will consist of qualitative monitoring including visual inspections performed annually and after major storm and high tide events. Monitoring will look for evidence of obvious flooding and erosion or erosion resulting from wind generated waves. If significant erosion or signs of potential failure are observed, engineering evaluations will be performed to determine whether any structural repairs are needed.

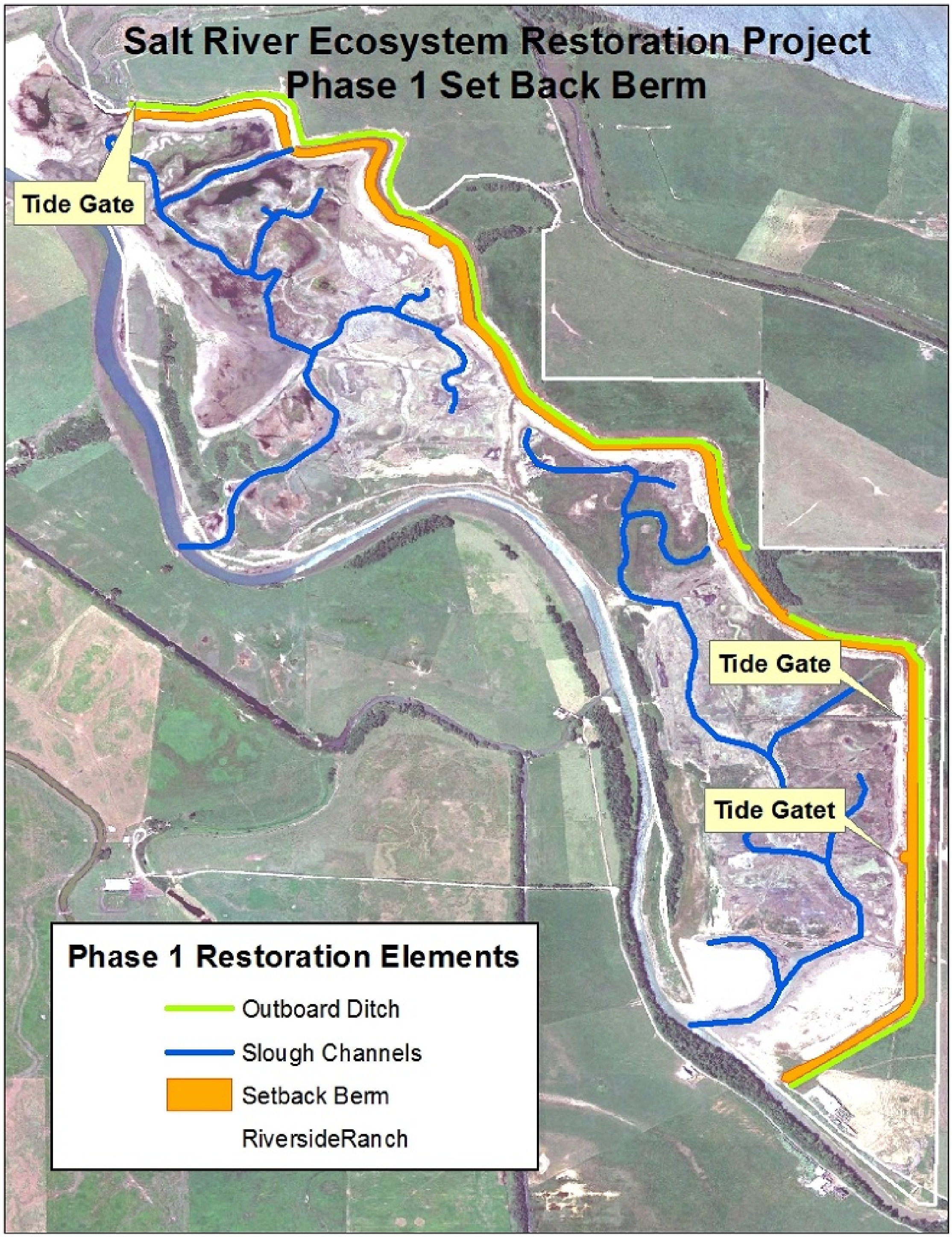


Figure 39: Setback Berm Location

Results and Discussion:

The HCRCD makes weekly observations on the various elements on Riverside Ranch. Taking observations on the setback berm and the berm road are included in the visual inspections. No erosion or cracking has been observed on the setback berm since conclusion of construction activities in 2013. The 2014/2015 hydrologic year was considered a drought year, thus the project site was not impacted with normal rainfalls or storm events.

LIST OF AVAILABLE REPORTS

2015 Quantitative Habitat Monitoring for the Salt River Ecosystem Restoration Project. 2015. Prepared by H.T. Harvey and Associates for the Humboldt County Resource Conservation District.

Post-Construction Eelgrass Survey Report, Year 2 – 2015. Prepared by Susannah Manning and Daniel O'Shea for the Humboldt County Resource Conservation District..

Post-Construction Channel Monitoirng of Salt River, Phase One. 2015. Revised in July 2016. Daniel O'Shea and Susannah Manning for the Humboldt County Resource Conservation District..

Salt River Ecosystem Restoration Project – Phase 1 - Photo Monitoring – Year 2, 2015. Prepared by the Humboldt County Resource Conservation District.

Salt River Ecosystem Restoration Project - Phase 2A Lower - Photo Monitoring – Year 1. 2015. Prepared by the Humboldt County Resource Conservation District.

Salt River Restoration Project Fisheries Monitoring Report. 2015. Prepared by California Department of Fish and Wildlife for the Humboldt County Resource Conservation District.. Monthly reports from March to July of 2015 available.

Tidal Exchange and Water Quality Report – Phase 1 and 2 – Year 2. 2015. Prepared by the Humboldt County Resource Conservation District.