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SALT RIVER ECOSYSTEM RESTORATION PROJECT
ADAPTIVE MANAGEMENT PLAN

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1.0 EXECUTIVE SUMMARY

The Salt River Ecosystem Restoration Project (SRERP) is located in Humboldt County, near the City of Ferndale, California. The purpose of the Salt River Ecosystem Restoration Project is to restore historic processes and functions to the Salt River watershed. These processes and functions are necessary for re-establishing a functioning riverine, riparian, wetland and estuarine ecosystem as part of a land use, flood alleviation, and watershed management program. The goals of the Salt River Ecosystem Restoration Project include:

- Restore the Salt River channel and adjacent riparian floodplain by increasing hydraulic conveyance and constructing habitat features that re-establish ecological processes beneficial to fish and other native species.
- Restore historic estuarine habitat and tidal connectivity within the lower Salt River.
- Improve water quality and drainage efficiency across the floodplain.
- Manage excess sediment loads by maximizing fluvial and tidal channel sediment transport capacity and designing sediment management areas.

In an effort to achieve the project goals, 4 project components have been identified, including 1) restoration of the Salt River channel and riparian floodplain, 2) tidal marsh restoration at Riverside Ranch, 3) sediment maintenance in the channel and riparian floodplain, and 4) upslope sediment reduction.

Given the watershed-level scale of the SRERP, the variety of habitats and hydrologic conditions, the high initial disturbance to the ecosystem, interactions with agricultural land uses, and typical level of uncertainty associated with the evolution of ecosystem restoration projects, this project will benefit from an adaptive management program. Adaptive management employs a structured approach, yet it is also a flexible tool that can adjust to a dynamic environment and an evolving project. Adaptive management can thereby keep a project 'on track' toward meeting its goals and objectives, despite the variability inherent in dynamic, natural systems over spatial and temporal scales.

This AMP describes the organizational structure for the adaptive management process and identifies the initial monitoring activities proposed to evaluate project progress towards meeting the goals and objectives, establishes the triggers or thresholds that would initiate a management response, and describes a range of potential adaptive management actions. If project monitoring determines that a management trigger has been "activated" then there are 3 possible response pathways:

- determine that more data is required and continue (or modify) monitoring,
- identify and implement a remedial action, or
- modify project goals and objectives (this option would *only* be considered as a last resort and upon careful consideration by and consensus of the Project Management Team).

There may be multiple management action options when a particular trigger or threshold is activated, depending on a variety of factors such as how far the project is from achieving a specific goal, whether the situation is an imminent threat to local infrastructure, ecosystem services/functions or site stability, etc. The process is flexible as it allows for a wide range of management actions but just as importantly it imposes a structured approach as management actions must derive from monitoring results.

This Adaptive Management Plan (AMP) has been designed to provide a strong long-term adaptive management program while still providing flexibility within both the organizational structure and the monitoring program to ensure that the project can work toward meeting the long-term SRERP goals and objectives.

2.0 INTRODUCTION

2.1 PROJECT BACKGROUND

The Salt River Ecosystem Restoration Project is located in Humboldt County, near the City of Ferndale, California (Figure 1). The purpose of the Salt River Ecosystem Restoration Project (SRERP) is to restore historic processes and functions to the Salt River watershed. These processes and functions are necessary for re-establishing a functioning riverine, riparian, wetland and estuarine ecosystem as part of a land use, flood alleviation, and watershed management program. Levees constructed to protect the productive agricultural lands of the Salt River floodplain from the adjacent Eel River's tidal and flood influences have changed regional drainage patterns. As a result, naturally high influent sediment loads are no longer effectively transported across the Salt River floodplain. The ongoing aggradation of the Salt River channel, and aggradation and flooding of local infrastructure and residential properties, have lead to loss of habitat, diminished property value, and declining agricultural productivity.

The SRERP will re-connect the Eel River estuary - via the historic Salt River channel- to a series of 5 streams draining the Wildcat Mountains. In order to do this, 7 river/riparian corridor miles and 400 acres (ac) of tidal wetland will be restored to support a broad list of special status and native species. The SRERP focuses on re-establishing hydraulic connections across the floodplain and will also serve community needs including water quality improvement, flood alleviation, and carbon sequestration. Specific goals of the Salt River Ecosystem Restoration Project include the following:

- Restore the Salt River channel and adjacent riparian floodplain by increasing hydraulic conveyance and constructing habitat features that re-establish ecological processes beneficial to fish and other native species;
- Restore historic estuarine habitat and tidal connectivity within the lower Salt River;
- Improve water quality and drainage efficiency across the floodplain;
- Manage excess sediment loads by maximizing fluvial and tidal channel sediment transport capacity and designing sediment management areas;
- Initiate a long-term corridor adaptive management process that maximizes ecological restoration success in a working landscape by:
    - reducing headwater erosion and sediment delivery to the Salt River floodplain;
    - increasing the volume and efficiency of clear water drainage from the upstream watershed and adjacent agricultural land, and;
    - providing and maintaining sediment management areas that minimize impacts to land use and ecological function.

In an effort to achieve these goals, 4 components have been identified to serve as the framework of the SRERP. They include:

1. Salt River Channel and Riparian Floodplain Corridor Restoration
2. Riverside Ranch Tidal Marsh Restoration
3. Channel and Riparian Floodplain Sediment Maintenance
4. Upslope Sediment Reduction

Each component has a pivotal role in the overall success and long-term benefit of the project. Restoration objectives have been established for each project component in an effort to achieve the overall project goals.

2.1.1 Salt River Channel and Riparian Floodplain Corridor Restoration

One element of the Salt River Ecosystem Restoration Project is the Salt River channel and riparian floodplain corridor restoration. This component will re-establish a defined channel and riparian corridor from the Salt River confluence with Williams Creek downstream to the confluence of the Salt River with Cutoff Slough, a total corridor length of approximately 7.4 miles. The corridor design is intended to re-establish a functioning channel and floodplain corridor that integrates long-term sediment management and regional drainage needs while restoring significant aquatic and riparian habitat value and ecologic function to the project area.

The following Salt River Channel and Floodplain Corridor Restoration objectives are designed to attain the overall project goals of the Salt River Ecosystem Restoration Project.

- Establish and sustain a dynamic river corridor by optimizing flow and sediment conveyance, integrated with natural floodplain interaction and discrete sediment management areas.
- Integrate sediment capture and removal (sediment management) actions into the Adaptive Management Plan in order to help sustain hydraulic conveyance and ecologic function.
- Minimize the cost, frequency and extent of required sediment management related maintenance activities which disturb the riparian corridor and disrupt ecosystem function.
- Maximize riparian habitat functions and values, extent and complexity by increasing plant species diversity, corridor shading, large wood recruitment, and minimizing invasive species.
- Optimize floodplain habitat complexity.
- Introduce instream salmonid rearing and refugia habitat where acceptable and sustainable within corridor design.
- Incorporate opportunities to re-connect the corridor to watershed tributaries to improve fish access to spawning and rearing habitats.
- Improve and maintain adjacent land drainage.
- Integrate a Regional Landowner Drainage Management planning process into the Adaptive Management Plan that establishes the framework for the development, coordination and funding to enhance the integration of overland drainage with agricultural land practices adjoining the corridor.

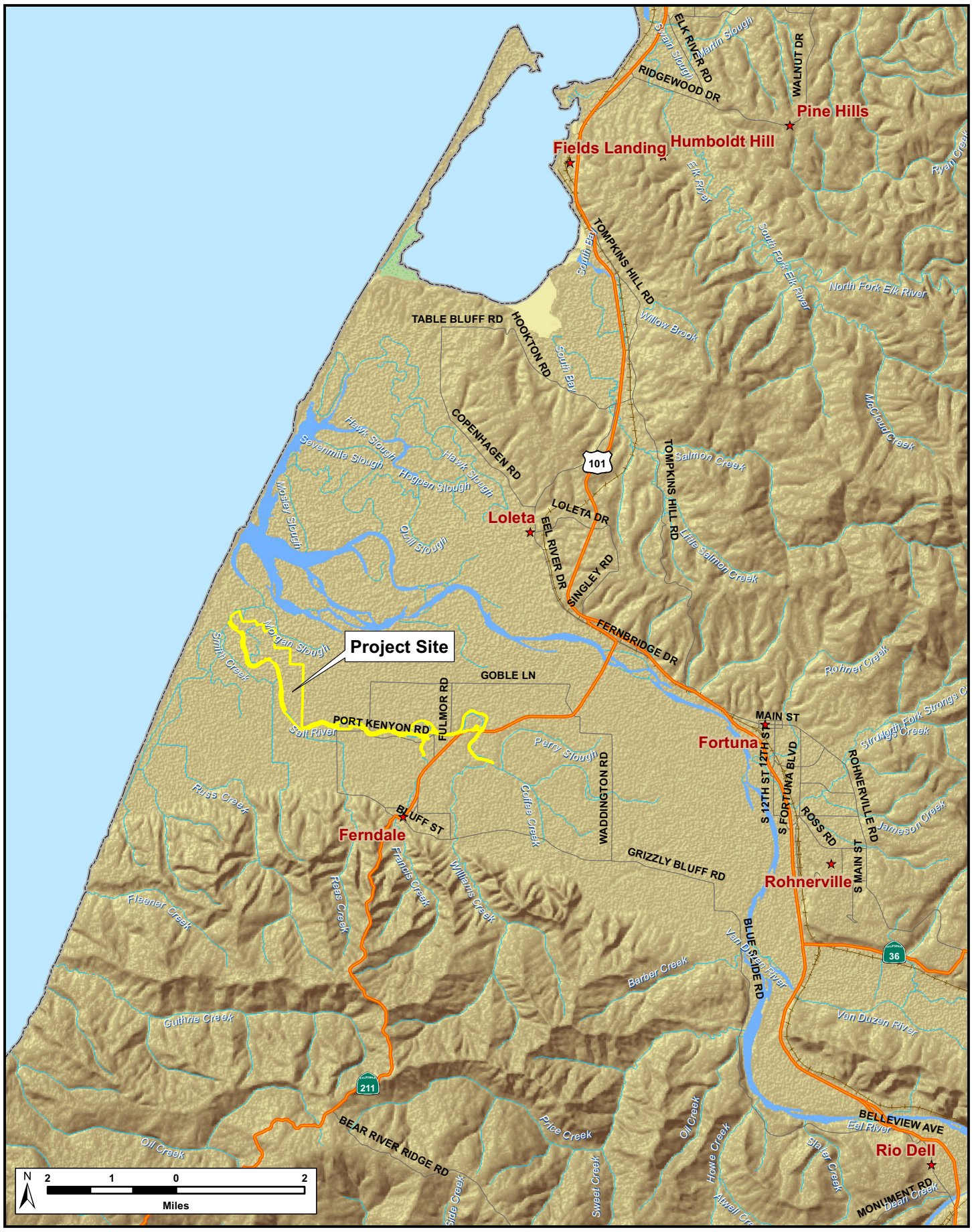

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Figure 1: Vicinity Map
Salt River Ecosystem Restoration Project
Adaptive Management Plan (3117-04)
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2.1.2 Riverside Ranch Tidal Marsh Restoration

The Riverside Ranch restoration will re-establish intertidal wetland habitat to the Eel/Salt River Estuary. The increase in tidal exchange associated with a restored marsh will also help sustain a restored Salt River channel. Restoring tidal prism to the lower Salt River, (i.e., increasing the volume of water exchanged on each tidal cycle) increases channel scour and helps maintain and equilibrate the width and depth of the channel.

The objectives of the Riverside Ranch Tidal Marsh Restoration include the following specific items to help attain the overall project goals of the Salt River Ecosystem Restoration Project.

- Use the increase in tidal prism to help maintain the constructed Salt River channel geomorphology and conveyance.
- Improve drainage and water quality in the lower Salt River and Eel/Salt River estuary.
- Restore tidal connectivity to historic tidal wetlands to allow for the natural evolution of diverse and self-sustaining salt- and brackish water tidal marshes, intertidal mudflat and shallow water habitats.
- Restore the marsh to include and expand the transition zone between tidal wetland and upland.
- Create a template for the natural evolution of a complex tidal drainage network. The network will maximize subtidal and intertidal habitats beneficial to target fish and wildlife species. This includes the enhancement of rearing and migration conditions for estuarine-dependent species including: coho salmon, Chinook salmon, steelhead trout, coastal cutthroat trout, tidewater goby, and commercially and recreationally valuable species such as redtail perch.
- Retain approximately 70 acres where agricultural management techniques can be used for short-grass Aleutian cackling goose habitat.
- Provide wintering habitat for migratory waterfowl and shorebirds.
- Provide public access to the extent feasible without compromising the physical and biological project objectives.
- Avoid adverse impacts to the existing drainage of adjacent parcels.
- Design site components that can support natural geomorphic response to sea-level rise.

Restoration of Riverside Ranch is intended to strike a balance between creating significant amounts of new tidal marsh habitat, retaining and enhancing some of the important existing upland features, preserving sufficient acreage for creation of short grass habitat, minimizing long-term site maintenance, and incorporating design features that accommodate sea-level rise.

2.1.3 Riparian Floodplain and Channel Corridor Maintenance

Ongoing maintenance activities will be vital to ensuring lasting hydraulic and ecological function of the restored system. Maintaining the proposed project components, such as the channel, sediment management areas, drainage ditches, and the berms, will require optimizing overland drainage inflows to the system, and integrating land use with sediment and vegetation maintenance areas. Although minimized, and circumscribed as much as possible, these designated maintenance areas may require vegetation removal, ongoing riparian planting and/or repeated excavation or reworking of deposited sediments.

The channel maintenance activities will be conducted during seasons that avoid impacts to most salmonid and wildlife species. These include conducting in-water activities between July and October to avoid water quality impacts that could affect salmonids, and conducting upland activities, including vegetation removal, after mid-August when the breeding season is over to avoid impacts to actively nesting birds, unless the area has been cleared by pre-construction surveys.

2.1.4 Upslope Sediment Reduction

Activities that will be employed under this project component include: on- and off-channel sediment retention basins; debris basins; stream bank stabilization; and road improvements such as culvert replacement, revegetation of riparian habitat, rock armoring, stabilizing stream banks or small streamside landslides, road rehabilitation, watercourse-crossing improvements, ditch relief culverts and drainage ditches. These road drainage improvements will reduce sediment loading into the headwater streams. Using the information from an upslope erosion inventory in the Wildcat Mountain tributaries, sediment sources have been identified and prioritized. As opportunities arise and funding allows, Best Management Practices (BMPs) and other site-specific erosion control measures will be implemented to reduce fine sediments from upslope areas. Upslope activities are excluded from the AMP.

2.2 RATIONALE FOR ADAPTIVE MANAGEMENT

This project will benefit from an adaptive management program for a number of reasons. The watershed is situated in a region with a combination of a relatively active tectonic regime, highly erodible soils, and high rates of annual precipitation. This creates an extremely dynamic natural system in which to work. Given the large scale of the Salt River project, the variety of habitats and hydrologic conditions, the high initial disturbance to the ecosystem, interactions with agricultural land uses, and typical level of uncertainty associated with the evolution of ecosystem restoration projects, this project will benefit from an adaptive management program. Additionally, in light of the technical challenges involved in maintaining the restored channel, and resultant complexity of the associated monitoring program, this Adaptive Management Plan (AMP) has been developed as the most effective and flexible management tool.

Adaptive management is a systematic and iterative process that provides for feedback between monitoring and management actions. The feedback mechanism is engaged when monitoring data are analyzed, and the results are utilized to adjust project operations in a manner that optimizes the achievement of project goals.

Adaptive management employs a structured approach, yet it is also a flexible tool that can adjust to a dynamic environment and an evolving project. Adaptive management can thereby keep a project 'on track' toward meeting its goals and objectives, despite the variability inherent in dynamic, natural systems over spatial and temporal scales. Adaptive management assists managers in responding to unanticipated changes in the various components of a project such as hydrology, sedimentation, target habitat development, or changes in the species' response along a restoration trajectory (NRC 2004).

2.3 GOALS AND OBJECTIVES OF THE ADAPTIVE MANAGEMENT PLAN

This AMP describes the organizational structure for the adaptive management process to ensure that project goals and objectives are attained while providing for on-going, long-term input from local property owners. We have included the following critical elements which we consider integral to a successful Adaptive Management Plan:

- Specify the structure and responsibilities of the Project Management Team;
- Assign responsibility to identify/obtain funding for monitoring and adaptive management activities;
- Identify monitoring program components for use in evaluating the results of project implementation;
- Identify triggering mechanisms or early stress indicators that will be used to alert the project management team of the need to take action;
- Identify potential adaptive project management options once trigger thresholds have been reached;
- Develop an appropriate conceptual model of adaptive management process, which will:
    - outline a feedback loop between management actions and monitoring,
    - inform managers,
    - select adaptive management actions, and
    - refine the on-going monitoring program.

3.0 ADAPTIVE MANAGEMENT APPROACH

Two key elements of this AMP are 1) a description of the organizational structure for the Adaptive Management Participants that will implement the adaptive management process (Figure 2), and 2) the conceptual model of the adaptive management process itself (Figure 3). This AMP also provides descriptions of the roles and responsibilities of the Adaptive Management Participants, monitoring activities, management triggers and actions, and other elements that together constitute a functional AMP. This AMP is a companion document to the project's CEQA document, the Habitat Mitigation and Monitoring Plan (HMMP), and the other various technical documents that are incorporated into the project's regulatory permits, such as the Biological Opinions (BO).

The adaptive management process is outlined in Figure 3. The entire process is driven by the project goals and objectives together with the regulatory permit requirements. The Adaptive Management Participant group provides the structure to ensure that the project goals and objectives are met through the monitoring and adaptive management activities described in this document. This AMP group is composed of the Project Management Team, the Program Coordinator, the Stakeholder Work Group, the Regulatory Work Group, the Technical Advisory Work Group, and the Monitoring Group. As shown on Figure 2, the various parties have different responsibilities ranging from decision making, to project management and coordination, to advisory.

This AMP also identifies the initial monitoring activities proposed to evaluate project progress towards meeting the goals and objectives, establishes the triggers or thresholds that would initiate a management response, and describes a range of potential adaptive management actions. If project monitoring determines that a trigger has been "activated" then there are 3 possible response pathways:

1. determine that more data is required and continue (or modify) monitoring,
2. identify and implement a remedial action, or
3. modify project goals and objectives (this option would *only* be considered as a last resort and upon careful consideration by and consensus of the Project Management Team).

There may be multiple management action options when a particular trigger or threshold is activated, depending on a variety of factors such as how far the project is from achieving a specific goal, whether the situation is an imminent threat to local infrastructure, ecosystem services/functions or site stability, etc. The adaptive management process applies to the project as a whole, but management actions can be identified and implemented on individual reaches or sub-reaches, as needed. The process is flexible as it allows for a wide range of management actions but just as importantly it imposes a structured approach as management actions must derive from monitoring results. The adaptive management process also accommodates different physical and temporal scales for management actions.

Adaptive Management Participants

Roles

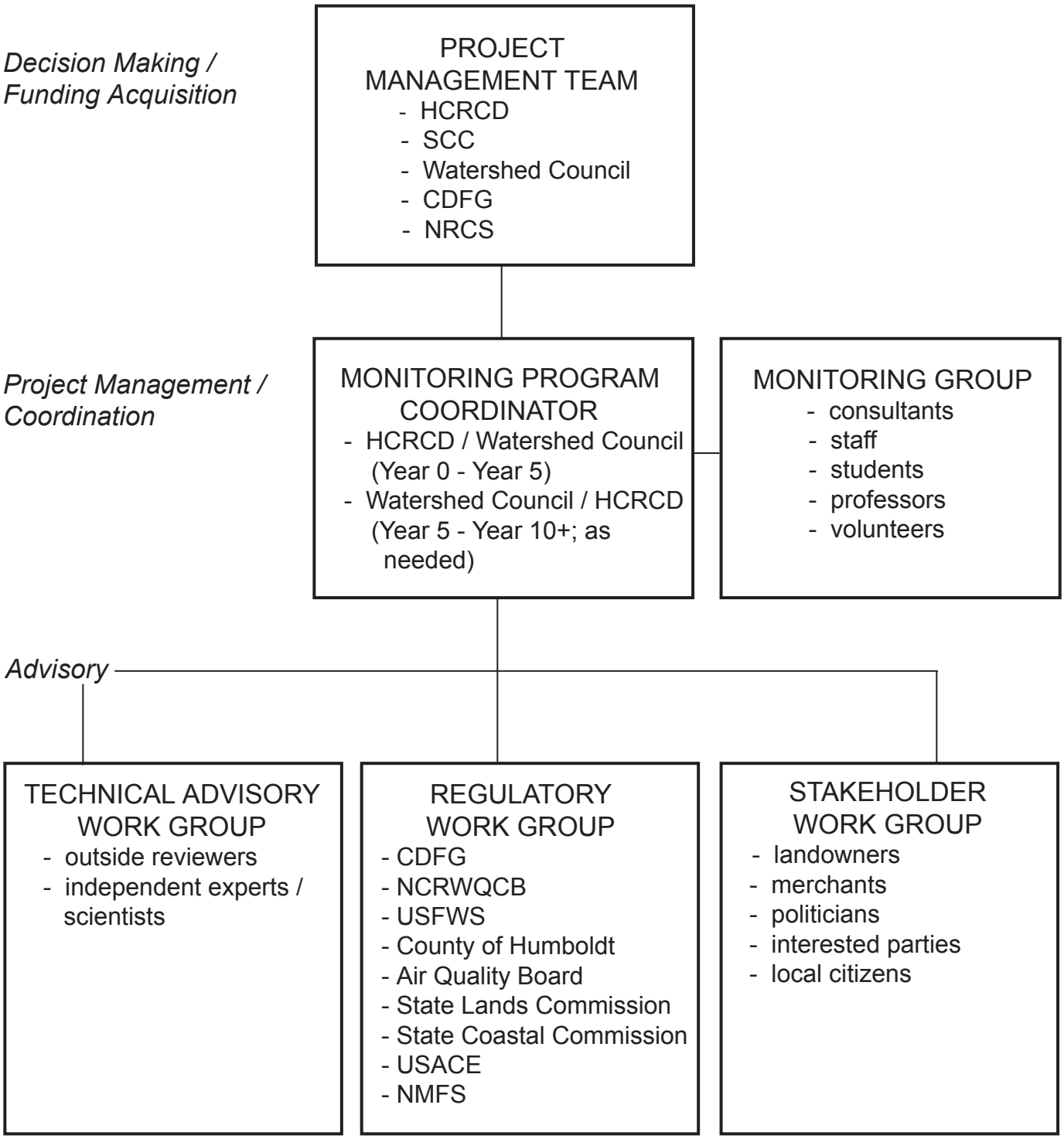

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Figure 2: Organizational Structure for the Adaptive Management Participants
Salt River Ecosystem Management Project (3117-04)
January 2011

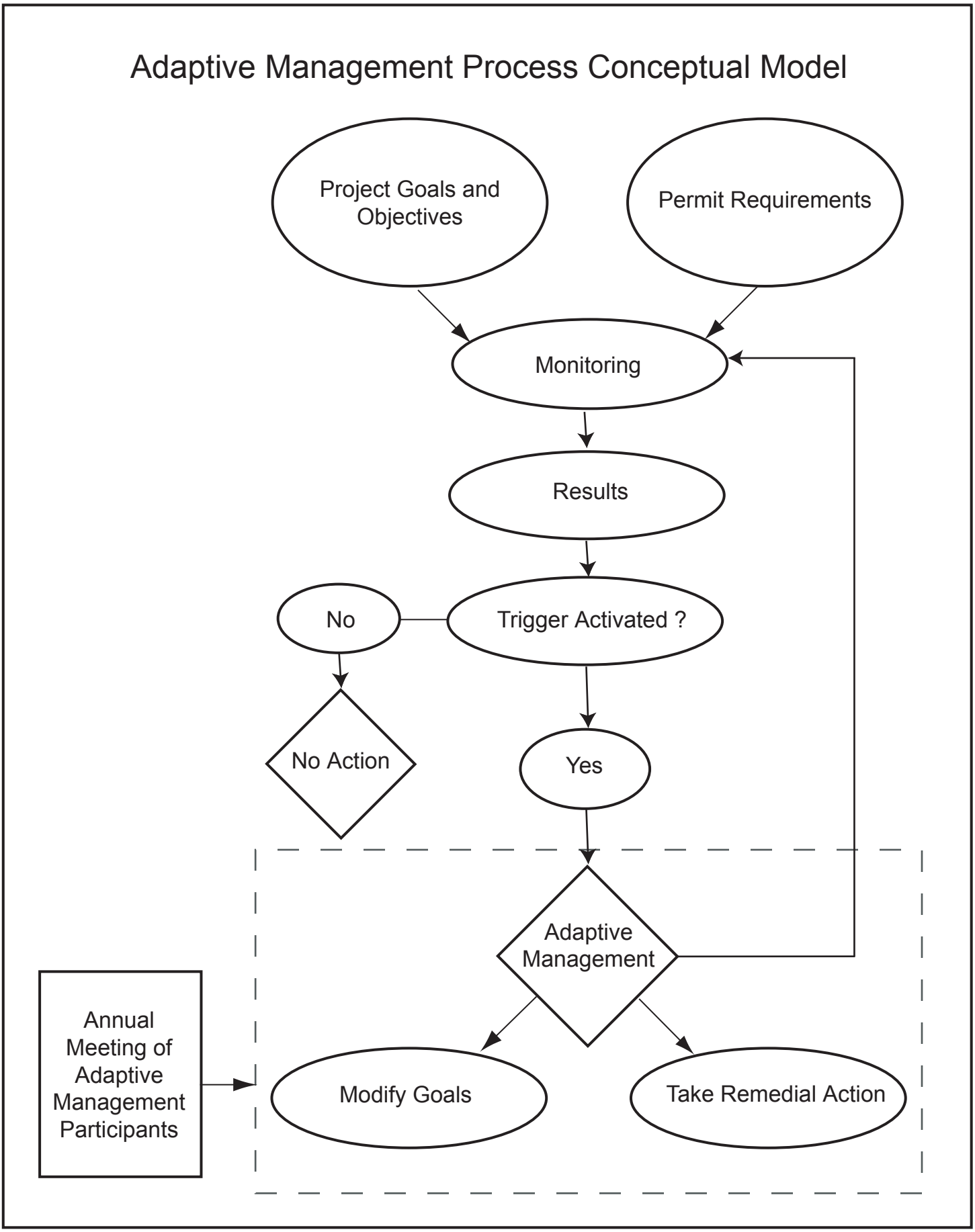

Figure 3: Organizational Structure for the Adaptive Management Participants
Salt River Ecosystem Management Project (3117-04)
January 2011

4.0 ADAPTIVE MANAGMENT PARTICIPANTS

4.1 PROJECT MANAGEMENT TEAM

The Project Management Team (PMT) will comprise the Humboldt County Resource Conservation District (HCRCD), the Natural Resources Conservation Service (NRCS), the Salt River Watershed Council (Watershed Council), the California State Coastal Conservancy (SCC), the California Department of Fish and Game (CDFG), and possibly 1 or 2 other active project participants (to be determined prior to the completion of construction). The PMT is responsible for ensuring that the project goals and objectives are met. This includes day-to-day and long-term decision-making and ensuring that adaptive management decisions are implemented. The PMT is also responsible for ensuring that adequate funding is available to ensure that project goals and objectives are met, which includes funding for implementation, restoration, monitoring and adaptive management, maintenance, and daily operations. They will also be responsible for any ongoing communication that needs to be distributed to the rest of the Adaptive Management Participants (see Figure 2) such as reports, e-mails, newsletter, and website materials.

Below is a description of the roles of each of the PMT member agencies.

4.1.1 Humboldt County Resource Conservation District (HCRCD)/Salt River Watershed Council.

The duties described here will be the responsibility of the HCRCD, with assistance from the Watershed Council in Years 0-5. After Year-5, the Watershed Council will assume primary responsibility with guidance and assistance from the HCRCD.

4.1.1.1 General Project Management

The HCRCD will be responsible for the general day-to-day management of the project for the first 5 years after implementation. The HCRCD will work with the Program Coordinator to report to the Adaptive Management Participants on project conditions and will be responsible for implementing any maintenance and management actions. They will review and revise the restoration targets and triggers and ensure that management actions and recommendations received from the Project Management Team and the Technical Advisory, Stakeholder, and Regulatory Work Groups are considered in ongoing management. The Watershed Council will assist the HCRCD in these duties during the first 5 years.

4.1.1.2 Funding

The HCRCD will oversee budgeting and funding and will ultimately be responsible as part of the PMT for ensuring that the necessary funding is in place to perform project management. The HCRCD will be responsible for assuring necessary staff (including the Program Coordinator), consultants as needed, and any additional staff to perform maintenance and monitoring.

4.1.1.3 Meetings, Outreach, and Communication

The HCRCD will convene the various members of the Project Management Team for a mandatory annual meeting to discuss management items and to ensure that the project is progressing as designed and is in compliance with all regulatory requirements. The HCRCD will ensure that regular reports are provided to the Technical Advisory, Stakeholder, and Regulatory Work Groups for comment and review before the annual meeting. Additional meetings will be scheduled as necessary to address any ongoing maintenance or management concerns. They will communicate regularly with stakeholder groups (including local landowners) to inform those groups on the progress of the project, coordinate access for maintenance and monitoring to address any concerns. The HCRCD, in coordination with the Watershed Council, will take the lead in encouraging and developing volunteer community restoration, maintenance, and monitoring activities.

4.1.2 Salt River Watershed Council

The Salt River Watershed Council (Watershed Council) was incorporated as a 501(c)(3) in 2008 to manage and maintain the project once it is completed. The Watershed Council comprises an all-volunteer Board of Directors with the mission to foster education and encourage public cooperation to restore, improve, protect and maintain ecosystem functions and agricultural, economic, and community sustainability in the Salt River Watershed. The Watershed Council will assist the HCRCD by providing input on the project design. Once the project is implemented, the Watershed Council will work cooperatively with the HCRCD during the first 5 years of the project to provide assistance and guidance for ongoing activities such as project management, funding, monitoring, reporting, outreach, meetings and establishing volunteer programs.

After Year-5, the Watershed Council will assume the primary management responsibilities for the project. These responsibilities will include those spelled out above for the HCRCD for Years 0-5. The HCRCD will take a lesser role in Years 5-10 and beyond, and will function to assist and guide the Watershed Council in management activities.

4.1.3 California State Coastal Conservancy

The California State Coastal Conservancy (SCC) will provide advisory input, project management and review, as well as assistance with the identification of funding avenues.

4.1.4 California Department of Fish and Game (Riverside Ranch)

The California Department of Fish and Game (CDFG) as owners of Riverside Ranch will have primary responsibility for developing overall resource management goals and objectives for their property. Additional management activities may occur per CDFG objectives.

4.1.5 Natural Resources Conservation Service

The Natural Resources Conservation Service (NRCS) will be responsible for some monitoring and maintenance activities in connection with a Wetlands Reserve Program (WRP) contract on Riverside Ranch and also on other Conservation Easements throughout the channel corridor.

4.1.6 Program Coordinator

The Project Management Team will hire or designate a Program Coordinator who will be responsible for developing and overseeing the implementation of the monitoring program as outlined in this AMP and in the project's Mitigation and Monitoring Plan (HMMP) (HTH 2010, in process). The Program Coordinator will report to the Project Management Team and will oversee the funding process to hire consultants or research teams, manage monitoring programs, and/or coordinate with interns or volunteers through HSU Graduate programs or other educational or volunteer organizations to collect monitoring data. As part of this coordination, the Program Coordinator will develop an annual training program to provide instruction on monitoring methods to any volunteer staff performing field work.

The Program Coordinator will oversee the Monitoring Group activities and will ensure that all monitoring data are collected, analyzed and stored in a credible and timely fashion. He/she will perform an initial review of the data to ensure that data collection is complete, analyzed properly and that reports are prepared in a timely manner. The Program Coordinator will evaluate the data per the AMP, and the HMMP schedules to determine progress toward meeting project goals and identifying the need for management triggers as they arise. He/she will ensure the Project Management Team prepares results, monitoring reports, and management recommendations for review before they are disseminated to the Technical Advisory, Stakeholder, and Regulatory Work Groups. The Program Coordinator will attend funder, stakeholder, agency, and other meetings as needed.

4.1.7 Monitoring Group

The PMT, with assistance from the Program Coordinator, will assume responsibility for selection or hiring of the Monitoring Group members and will ensure that the Monitoring Group provides sound scientific monitoring. The HCRCD and the Watershed Council will provide oversight, management, direction, leadership, and coordination for the Monitoring Group activities. The Monitoring Group members may include private consultants, volunteer organizations, and academic institutions such as Humboldt State University. Monitoring may be performed by any of these entities, either individually or in coordination with others.

4.1.8 Technical Advisory Work Group

The Technical Advisory Work Group shall be made up of a committee of outside reviewers and independent technical experts and scientists. The Technical Advisory Work Group will perform a peer review of the annual monitoring report. They will review the annual monitoring report and provide feedback and recommendations for the upcoming year at the annual meeting with the Project Management Team, the Stakeholder and Regulatory Work Groups. This feedback

could consist of potential management actions, revisions to the monitoring program, and general recommendations to management actions.

4.1.9 Stakeholder Work Group

An additional component of a successful adaptive management strategy includes providing an avenue to inform and educate the public about the project, as well as soliciting their regular input and providing an opportunity for them to voice observations, concerns and opinions. A Stakeholder Work Group will provide this avenue and will serve in an advisory capacity to the Project Management Team. The Stakeholder Work Group will serve as the 'eyes and ears' on the ground and will be able to immediately report any problems to the Project Management Team. The Stakeholder Work Group may comprise local landowners and businesses, local government staff, elected officials, local citizens, environmental organizations, public works managers, or other interested parties. They will review the annual monitoring report and participate in an annual meeting with the Project Management Team, the Technical Advisory and Regulatory Work Groups to provide input and recommendations on the ongoing implementation of the project. The Watershed Council may also be an appropriate entity to serve in this capacity, augmented by additional public meetings to solicit input from the larger community.

4.1.10 Regulatory Work Group

A Regulatory Work Group has been established as part of the permit application process, and will be maintained to evaluate the progress of the project toward meeting the various regulatory requirements. The Regulatory Work Group will include agency members from the CDFG, the California State Coastal Commission (CCC), United States Fish and Wildlife Service (USFWS,) NOAA Fisheries/NMFS, the United States Army Corps of Engineers (USACE,) the RWQCB, North Coast Regional Water Quality Control Board (NCRWQCB), the County of Humboldt, the State Lands Commission, (SLC) and others as identified during the permitting process. The Regulatory Work Group members will be invited to participate in the annual meeting with the Project Management Team, and the Stakeholder and Technical Advisory Work Groups to provide review, input and recommendations to the project for the upcoming year.

4.2 ADAPTIVE MANAGEMENT PROCESS

The Adaptive Management Plan process shown in Figure 3 outlines the decision making process. Each element of this process is briefly described below.

4.2.1 Project Goals and Objectives

The Project goals and objectives have been described in the Project Background section above. The goals and objectives have been developed from various supplemental materials during the project planning phases. These supplemental documents include, but are not necessarily limited to:

- Riverside Ranch Conceptual Restoration Plan (H. T. Harvey & Associates 2008)
- Salt River Channel Excavation Design Report (Tauzer and Chow 2009)

- Excavation Materials Management Plan- Salt River Ecosystem Restoration Project (Winzler & Kelly 2010)
- Salt River/Riverside Ranch Revegetation and Land Use Plan (H. T. Harvey & Associates 2010)
- Salt River Ecosystem Restoration Project 30% Restoration Design Plans (Humboldt County Resource Conservation District 2010)
- Salt River Habitat Mitigation and Monitoring Plan (H. T. Harvey & Associates 2010)
- Draft Environmental Impact Report: Salt River Ecosystem Restoration Project (Grassetti 2010).

4.2.2 Permit Requirements

Agencies with permitting or regulatory responsibility for the project are detailed in the Draft Environmental Impact Report (Grassetti 2010) and the HMMP (H. T. Harvey & Associates 2010, in prep). Results of annual monitoring per the HMMP and the AMP will be compared with the project's permitting and monitoring requirements. Management actions will be determined based on the requirements in those documents and in other project regulatory documents.

4.2.3 Monitoring

The purpose of monitoring per the HMMP and the AMP is to assess progress of the project toward meeting Project goals and objectives, to track regulatory compliance during the required monitoring period, evaluate management actions, and to detect areas displaying potential problems or changes that may require remedial actions.

4.2.3.1 Monitoring Per the Habitat Mitigation and Monitoring Plan

The HMMP serves as a companion document to CEQA and permit support documents and describes the mitigation associated with project impacts under regulatory jurisdiction. The DEIR does not specifically call for development of a HMMP. Various project alternatives cover the restoration that is the project's mitigation. The HMMP includes a detailed description of the project impacts and a conceptual plan to mitigate for those impacts, including a description of implementation and planting plans for revegetated areas of the project. The HMMP also includes a description of the project's long-term mitigation site monitoring and maintenance requirements, and provides management recommendations for ongoing maintenance during the mitigation monitoring period.

4.2.3.2 Monitoring per the Adaptive Management Plan

The HMMP only addresses the 3 years of mitigation site maintenance during the plant establishment period and the 10 years of mitigation site monitoring required for regulatory compliance. This Adaptive Management Plan is a supplement to the HMMP and describes the process of monitoring and management to ensure the long term viability of the project relative to the overall goals and objectives.

4.2.4 Responsible Parties

The HCRCD and the Watershed Council will be the parties responsible for ensuring that all monitoring and adaptive management actions are implemented.

4.2.5 Data Collection, Analysis, and Storage

Data analysis will be conducted as soon as possible following collection of field data. Minimizing delays between data collection and analysis will provide an opportunity to return to the project area to verify any discrepancies encountered during analysis and to conduct further field sampling if necessary. Data analysis will be conducted using standard spreadsheet, database, and statistical software as applicable. Any field notes, photos, datasheets and numerical or statistical data should be stored in raw data format for 10 years after current monitoring year or until the completion of the project or for such terms as may be required by permits or funders. All electronically stored data should be kept for at least 10 years after the completion of the project.

4.2.6 Quality Control (QC) / Quality Assurance (QA)

Quality control (QC) is a system of routine checks to ensure the integrity, correctness, and completeness of the project data. This system may include spot-checks on methods, data acquisition, calculations, and appropriate use of any statistical analyses. Quality control is expected to be performed by the entity conducting the monitoring, and will include a careful review by the Program Coordinator of the data input and analysis, project documentation, and data storage.

Quality assurance (QA) provides for a system of review procedures conducted by individuals/entities not directly involved in the collection/compilation of monitoring data. Quality assurance will be performed after the data is finalized and the quality control is performed. The Project Management Team and Technical Advisory Work Group will provide additional QC and QA of data during review of the annual monitoring report.

4.2.7 Review and Assess Monitoring Results

Monitoring results will be assessed in context of the project objectives and will be compared to the success criteria outlined in this AMP, the HMMP, the project's permit requirements, Biological Opinions (BO's), and other documents. This assessment will evaluate the original criteria and objectives given current knowledge to determine if the project is progressing along a trajectory toward meeting the project's success criteria and objectives. This assessment will evaluate whether the system is functioning as designed and whether or not the original criteria and objectives are reasonable and attainable at this point in time.

4.2.8 Reporting and Report Distribution

Monitoring results will be compiled into an annual report and reviewed by the Program Coordinator and the Project Management Team for initial review. Results will then be distributed to the Technical Advisory, Stakeholder, and Regulatory Work Groups for review and comment.

4.2.9 Evaluate Triggers

Monitoring results will be reviewed by the Project Management Team and compared with management triggers to determine whether project objectives are being met. If the management triggers are activated, the Project Management Team will suggest potential management actions that will be discussed during the annual meeting or any necessary follow-up meetings of Adaptive Management Participants.

4.2.10 Annual Meeting/Adaptive Management Decision-Making

Each year, the Adaptive Management Participants group, consisting of the Project Management Team, Program Coordinator, the Technical Advisory Work Group, the Stakeholder Work Group, and the Regulatory Work Group will meet to review the status of the project. The Project Management Team will give a project update and present the results of the annual monitoring. The Adaptive Management Participants Group will compare the monitoring results with the project goals and objectives, the HMMP and the AMP to discuss and recommend any potential required management actions.

5.0 ADAPTIVE MANAGEMENT PLAN

5.1 ADAPTIVE MANAGEMENT SUMMARY TABLES

A series of Adaptive Management Summary tables have been developed to provide descriptions of how the AMP process will be used to evaluate progress toward individual goals and objectives and permitting requirements. Each table is organized in a similar manner, with separate tables provided for the following categories:

- Erosion, Sediment Deposition, and Geomorphic Condition Monitoring and Adaptive Management for the Salt River Corridor
- Erosion, Sediment Deposition, and Geomorphic Condition Monitoring and Adaptive Management for Riverside Ranch
- Water Quality Monitoring and Adaptive Management for Salt River Corridor and Riverside Ranch
- Habitat Development, Vegetation and Invasive Species Monitoring and Adaptive Management for Salt River Corridor and Riverside Ranch

These 4 categories were derived from the Project's goals and objectives, and consolidated to relate to the geographic or technical focus of specific long-term management actions.

A general description of each of the columns in the Adaptive Management Summary tables is provided here. However, it should be noted that the proposed approach under each of these columns in the 4 tables is also subject to the adaptive management process, and can be modified (or even eliminated) as the implemented project evolves and additional data are gathered.

5.1.1 Management Element

This category describes basic management elements that have been identified per the project goals and objectives and spelled out in the various project permits or supporting documents.

5.1.2 Objective

Individual objectives within each table, linked to specific Management Elements, represent concrete outcomes that can be measured, and help define progress towards the overall project goals.

5.1.3 Monitoring Method

For each management element, a proposed monitoring method has been chosen that is the most effective way to assess change with respect to the monitoring targets. Details of specific monitoring methods may be more fully described in other documents, such as the project's Biological Opinion (BO), the HMMP, and permit documents. This section of the table summarizes the variables to be measured and the general monitoring approach (i.e., cross-sections, qualitative evaluations, etc). The variables and approach were selected to adequately

detect change in a timely fashion (see also discussion below of "temporal scale" under Monitoring Frequency).

5.1.4 Monitoring Frequency

The monitoring frequency is based on the temporal scales of the success criteria for each individual management objective. The frequency is determined as the period in which adverse change could realistically be detected and in which management actions could be implemented if the project is not meeting specific goals or to avoid adverse environmental impacts. The monitoring frequency is subject to change, depending upon achievement of project goals and objectives and may vary between project objectives. For example, annual monitoring may be sufficient to determine whether plant survival is within acceptable limits, but more frequent monitoring may be required to ensure that the channel hydrology is functioning as designed while the channel is reaching an equilibrium condition. Some monitoring may be relevant over longer temporal scales (i.e., determining that restoration of the riparian forested community is on a successful trajectory after Year 5 may only require monitoring every 2-3 years).

5.1.5 Management Trigger

Management triggers define the specific point or a range of values where monitoring data indicate that the project may be developing along an unexpected or unfavorable trajectory and where management actions may be necessary to ensure that the project meets habitat and regulatory performance goals. Management triggers may also include emergency maintenance items such as log jams and tree falls that may threaten channel and floodplain conditions or hydraulic functions. Triggers will be analyzed based on effects of the event on overall habitat and channel function and management actions will be determined based on monitoring data, such as the annual channel cross sections and longitudinal profiles. Examples of emergencies requiring immediate action include erosion or deposition that threatens the integrity of public infrastructure such as bridges, culverts, and roads, or a massive treefall that blocks the entire channel, thereby restricting channel function.

Management triggers are activated at a point before a significant adverse environmental impact occurs. The triggers are purposely set at a low threshold to ensure that adaptive management will be triggered before adverse impacts occur. If assessment of monitoring results determines that no management trigger has been activated, then no management action is required.

The first step in evaluating a management trigger is to determine whether it is a result of the project or of outside factors (i.e., climate change, large-scale regional flooding, or adjacent landowner practices). If it is determined that the trigger has been activated as a result of the project, specific management actions will be applied based on the prescriptions spelled out in this AMP, the HMMP, project permits and documents.

5.1.6 Potential Management Actions

Once a management trigger is activated, there are a range of possible management options (Figure 3). For example, 1) it may be determined that no management action is indicated or that additional (or modified) monitoring may be required to make a decision on whether or not

remedial action is required, 2) monitoring results indicate that remedial action is required, or 3) careful consideration of monitoring results (likely over several years) indicate that the original goal was unrealistic or unattainable and that the goal may need to be modified. In the case of the latter this is considered a last resort and would require careful consideration and consensus by the Project Management Team with input from the Technical Advisory and Regulatory Work Groups.

Potential management actions listed in the adaptive management tables (Tables 1-4) are not intended to be an exhaustive list. Rather, they represent a likely range of options given the current knowledge of the system and anticipated management actions. Actual actions may deviate from this list given unforeseen monitoring results and/or site performance. Additionally, the details on the timing and degree of each of these actions are equally dependent upon the monitoring results. Final decisions of a course of action will be made annually with the members of the Adaptive Management Participants group. The Project Management Team will make the final decision on the appropriate actions to be taken in a given year, and the proposed activities will be reviewed by the Regulatory Work Group to ensure compliance with existing permits.

5.2 ADAPTIVE MANAGEMENT ELEMENTS

Natural ecosystems are dynamic and subject to change over time. This is especially true in the SRERP area where physical processes such as flow and sediment transport from tributary watersheds will likely influence magnitude and frequency of sediment management area and channel maintenance activities. Adaptive management may be necessary to minimize erosion and/or sedimentation that could adversely affect success of the created and enhanced channel habitats. Goals and objectives for the *Salt River Channel and Riparian Floodplain Corridor Restoration* and *Riverside Ranch Tidal Marsh Restoration* were evaluated on the basis of potential requirements for long term monitoring and adaptive management. Those goals and objectives that could require adaptive management were then consolidated to fit into the following 4 categories so that similar objectives can be described within the same context.

- **Erosion, Sediment Deposition, and Geomorphic Condition for the Salt River Corridor** - The Adaptive management activities for the channel and riparian corridor portion (including the portion of the channel adjacent to Riverside Ranch) are described under Section 5.2.1 *Erosion, Sediment Deposition, and Geomorphic Condition Monitoring and Adaptive Management for the Salt River Corridor* and also summarized in Table 1.
- **Erosion, Sediment Deposition, and Geomorphic Condition for Riverside Ranch** Adaptive management activities for erosion and sediment control within non-channel areas are described below under 5.2.2 *Erosion, Sediment Deposition, and Geomorphic Condition Monitoring and Adaptive Management for Riverside Ranch* and summarized in Table 2.
- **Water Quality Monitoring for Salt River and Riverside Ranch** - Water Quality Monitoring for both the Salt River Corridor and Riverside Ranch are described in 5.2.3 *Water Quality Monitoring and Adaptive Management for the Salt River Corridor and Riverside Ranch* and summarized in Table 3.

- **Habitat Development/Vegetation Maintenance/Invasive Species Control** - Habitat Development and Vegetation Maintenance/Invasive Species Control for both the Salt River Channel and Riverside Ranch are covered under Section 5.2.4 *Habitat Development, Vegetation and Invasive Species Monitoring and Adaptive Management for the Salt River Channel and Riverside Ranch* and summarized in Table 4.

5.2.1 Erosion, Sediment Deposition, and Geomorphic Condition Monitoring and Adaptive Management for the Salt River Corridor

Channel design objectives for the SRERP that relate to erosion and sediment deposition monitoring and adaptive management are to establish and sustain a dynamic river corridor by optimizing flow and sediment conveyance, providing connection with the floodplain, and integrating sediment capture and removal (sediment management). This will help sustain hydraulic conveyance and ecologic function while minimizing cost, frequency and extent of required sediment management maintenance activities. This section of the AMP also includes measures to monitor and adaptively manage erosion and water quality per Mitigation Measures 3.1.1-1 and 3.1.1-3 in the DEIR (Grasetti 2010).

The adaptive management triggers for erosion and sediment deposition control in the Salt River channel that will dictate the necessity and/or scale of adaptive management actions include: threats to public infrastructure, excessive sediment deposition in the channel/floodplain corridor, excessive sediment deposition in an adjacent Sediment Management Area, excessive bank or bed erosion in the channel, large wood/debris dams (e.g., fallen trees), failure to extend the tidal prism upstream in the channel, severely muted tides within the Riverside Ranch portion of the channel, road and stream crossings and culverts that are not functioning due to excessive sedimentation, impeded fish passage at high and/or low flows, and failure or excessive maintenance of sediment management areas.

A degree of erosion and deposition is expected along the channel as it naturally reshapes to reach a state of equilibrium after construction, and some limited erosion is expected at the outfalls of existing tributaries and contributing storm drain pipes. Significant erosion requiring adaptive management would include: erosion that undermines the integrity of the restored channel banks and causes a significant loss of existing and planted stream-side vegetation; excessive erosion at the confluences of the main tributary creek channels; and erosion that threatens infrastructure such as bridge foundations and road beds. In most cases, significant erosion, deposition, or treefalls would be anticipated to take place during the winter rainy season. Unless an emergency situation arose as a result, no action would be taken until the dry season. Management actions will be determined based on an analysis of the effects of the event on overall channel function. This analysis will be based on monitoring data, such as the annual channel cross sections and longitudinal profiles. Examples of an emergency situation requiring immediate action include erosion or deposition that threatens the integrity of public infrastructure such as bridges, culverts, and roads, or a massive treefall that blocks the entire channel, thereby threatening the hydraulic and sediment transport performance of the newly constructed channel.

Periodic maintenance/sediment removal within the channel and specified project Sediment Management Areas will be required to maintain the channel design width and depth and to maintain the channel water flow and sediment transport capacity and a functional tidal prism.

The accumulation of excess sediment in the Sediment Management Areas is due to high sediment loading from tributaries, particularly at the confluence regions of Francis and Williams Creek with the Salt River. Major geomorphic modifications would be deemed necessary only if it is determined that no other procedure could be used to ensure achievement of the target restoration goals. Specific adaptive management actions are included in Table 1.

Sediment capture and removal (sediment management) will be integral to the success of the project to help sustain hydraulic conveyance and ecologic function. A major goal of the channel design effort is to minimize the frequency and need for excavation of the majority of the main channel through strategic design of Sediment Management Areas (SMAs); some SMAs will be located within and immediately adjacent to the main channel corridor. In addition, the project will develop a Regional Landowner Drainage Management planning process focused on establishing a framework for coordination and funding to enhance 'clean water' drainage (flows that are relatively sediment free) from adjoining parcels to the river corridor – a process that will increase the Salt River sediment transport capacity. Because it is not part of the SRERP, a Regional Landowner Drainage Management Plan will need to identify a lead agency for this effort, Drainage Management goals and objectives, an outreach program to coordinate with willing landowner participants, and a compilation of existing technical studies that will inform the drainage planning process. It is likely that the Watershed Council will lead this planning effort.

Upslope sediment reduction activities will also reduce sediment entering the Salt River. These activities will be defined on a project-by-project basis and may include on- and off-channel sediment retention basins, debris dams, stream bank stabilization and road drainage improvements. Adaptive management for these individual activities is not included in this document as these individual activities have not been fully defined at this time. Even with upslope sediment reduction activities, periodic removal of deposited sediments from lower, near-river Sediment Management Areas and possibly the Salt River channel will be required to maintain the restored channel geomorphology.

Table 1. Erosion, Sediment Deposition, and Geomorphic Condition Monitoring and Adaptive Management for Salt River Corridor

MANAGEMENT ELEMENT	PROJECT OBJECTIVE	MONITORING METHODS	MONITORING FREQUENCY	MANAGEMENT TRIGGER	POTENTIAL MANAGEMENT ACTIONS[1]
Erosion and/or Sediment Deposition Monitoring	Minimize areas of excessive sediment deposition in the Salt River channel Minimize bank erosion and/or threats to public infrastructure	Cross-section and longitudinal profile surveys of channel. Physical surveys should include a minimum of 6 freshwater reach cross-sections, and 4 tidal (fresh, brackish, and saltwater) reach cross-sections. The longitudinal thalweg profile survey along the project reaches shall be completed annually, with thalweg elevations shot at least every 200 ft, at a minimum. Photo-point monitoring (Hall 2001)	Reach-level surveys during summer, Years 1-10. Physical surveys of the river channel will be completed annually for the first 5 years, and then bi-annually through Year 10. Surveys will be performed after Year 10 only if annual qualitative assessments determine that excessive erosion or sedimentation is occurring. Solicit input regarding channel and floodplain conditions from landowners and other stakeholders on a regular basis. Photo-point monitoring during preliminary visual reconnaissance and during winter and summer baseflows concurrent with channel surveys.	Erosion or aggradation that results in a threat or damage to the stability of public infrastructure Any given channel survey indicates that the channel geometry has been reduced or enlarged by 10% or greater as compared to project plans, as-built surveys or previous monitoring surveys. Summer surveys and annual monitoring data indicate that excessive channel or floodplain erosion and/or sediment deposition is affecting the overall channel function or threatens infrastructure such as bridges, culverts and roads. Development of conditions (e.g., log jams, tree falls, bar formation) that block the entire channel and threatens channel and floodplain structure or hydraulic function. Excessive erosion or sediment deposition at the confluence of tributary channels or drainage outfalls, including head-cuts or knick-point formation.	No action More detailed assessment of rate/causes of erosion or sedimentation and evaluation of effects relating to structure and function of channel. Implement site specific erosion control BMPs such as soil bioengineering and vegetative revetments as need to reduce streambank mass wasting while maintaining channel function and riparian habitat value. Increase monitoring to locate sediment source(s) Selective sediment removal from channel Remove obstructions if deemed necessary (based on results of annual monitoring and channel surveys) to maintain habitat and hydrologic function. Install or modify instream structures such as Engineered Log Jam (ELJ) structures or Large Woody Debris (LWD) to re-direct flow and sediment conveyance to floodplains and SMAs Plan and implement sediment management areas in upslope tributary watersheds. Implement Engineered Sediment Detention Basin/s in existing Active or Passive SMAs.

MANAGEMENT ELEMENT	PROJECT OBJECTIVE	MONITORING METHODS	MONITORING FREQUENCY	MANAGEMENT TRIGGER	POTENTIAL MANAGEMENT ACTIONS[1]
Tidal Exchange Monitoring	Saline, brackish and freshwater marsh habitat created Increased tidal prism helps maintain the channel geomorphology and conveyance	Multi-parameter water level and salinity recorders will be used to determine whether the project has established the desired tidal exchange, functional tidal prism, and healthy salinity structure. To quantify and evaluate tidal and salinity exchange up the Salt River channel, a network of 5 multi-parameter recorders (measuring water level, temperature, dissolved oxygen, and salinity) are proposed in the mainstem Salt River and Eel River Estuary at the following locations: 1) within the Eel River Estuary; 2) immediately downstream of the confluence with the new northern Riverside Ranch connector channel; 3) immediately downstream of the confluence with the new southern (upstream) Riverside Ranch connector channel; 4) at Dillon Road Bridge; and 5) immediately downstream of the confluence of Francis Creek. In order to evaluate the tidal and salinity exchange within Riverside Ranch, 2 additional multi-parameter recorders shall be located inside Riverside Ranch; 1 strategically located in the northern half of the wetland and a second in the southern half of the wetland. As part of data analysis and reporting, all water levels should be compared to Pacific Ocean tide ranges as reported by NOAA at their Humboldt Bay, North Spit tide gauge. In conjunction with tidal exchange monitoring, dissolved oxygen monitoring should be performed at least once a year during a 2-week summer (July/August) tidal cycle when DO is expected to be the lowest, and measured near the bottom if possible.. Photo-point monitoring (Hall 2001)	Water surface elevation monitoring should be completed for 4 to 6 months during the dry season (May through October). The duration of monitoring will be weather dependent and instruments should not be installed until after the threat of high flows but initiated early enough to capture the transition from freshwater to marine conditions in the estuary and project wetlands associated with the seasonal flow recession. If no adverse tidal exchange conditions are identified during the first 3 years of Tidal Exchange Monitoring, tidal monitoring can be reduced to every other year as long as there are not large flood flow events on the Salt or Eel River. Photo-point monitoring during preliminary visual reconnaissance and during winter and summer baseflow periods.	Tidal influence does not extend into upper reaches as per model projections or based on comparison to water levels recorded at other tidal monitoring locations. Severely muted tides within the Riverside Ranch section of the channel. Observed stagnant water areas within Riverside Ranch wetlands. Average dissolved oxygen concentrations below 7.0 mg/L. Excessive channel/floodplain erosion or sediment deposition that reduces channel and SMA function and effectiveness as determined by the Project Management Team professionals. Development of channel obstructions (e.g., log jams, tree falls, bar formation) that reduce flow conveyance. Any given channel survey indicates that the channel geometry has been reduced or enlarged by 10% or greater as compared to project plans, as-built surveys or previous monitoring surveys. Management actions will be based on an analysis of the effects of the event on overall channel function and will include a review of monitoring data, annual channel cross sections and longitudinal profiles. Examples of an emergency situation requiring immediate action include erosion or deposition that threatens the integrity of public infrastructure such as bridges, culverts, and roads, or a massive treefall that blocks the entire channel.	No action Continue monitoring to see if conditions improve as channel evolves. Channel excavation to remove sediment to improve channel function Additional monitoring to establish temporal and spatial extent of low DO zone(s); compare to available pre-project DO data Determine source of problem (e.g., poor circulation, sedimentation, excess decaying organic matter), and repair/modify (i.e., dredge channel, clean out sediment basin management area) Discontinue monitoring after 5 consecutive years in which DO objectives are met; Monitoring duration will be dependent on flows and DO levels and could take longer than 5 years (see Appendix A; Figure A-1). Additional Riverside Ranch breaches and/or levee lowering Implement site specific erosion control BMPs such as soil bioengineering and vegetative revetments as need to reduce streambank mass wasting while maintaining channel function and riparian habitat value. Remove obstructions. Install or modify instream structures such as Engineered Log Jam (ELJ) structures or Large Woody Debris (LWD) to re-direct flow and sediment deposition.

MANAGEMENT ELEMENT	PROJECT OBJECTIVE	MONITORING METHODS	MONITORING FREQUENCY	MANAGEMENT TRIGGER	POTENTIAL MANAGEMENT ACTIONS[1]
Bridges and Culverts	Maintain channel flow and control flow to minimize erosion	At the completion of construction, survey inverts of bridges and culverts and any other drainage structures. Periodic surveys to ensure that inverts and drainage structure elevations are not substantially changing. Visually inspect bridges and culverts in project area to ensure that flow is not impeded by blockages or sedimentation and that no erosion is occurring around these structures Photo-point monitoring (Hall 2001)	At completion of project construction. Annually for years 1-5, biennially for years 6-10 and after major storm events Photo-point monitoring during preliminary visual reconnaissance and during winter and summer baseflow periods.	Road and drainage structure elevations reflect excess sedimentation or erosion Bridges or culverts are damaged by erosion or are not conveying flows as designed Culverts are plugged or not adequately carrying the channel flow	No action Conduct pre- or post-storm maintenance to remove excess sediment Repair failed or damaged road-stream crossings and subject to the jurisdiction's discretion. Excavate plugged culverts, or replace or enlarge culverts as needed Remove obstructions Implement site specific erosion control BMPs as deemed necessary to protect bridge and culvert function while minimizing channel and riparian habitat impacts.
Sediment Management Areas	Integrate sediment management actions to help sustain hydraulic conveyance and ecological function Minimize cost, frequency, and extent of sediment management maintenance activities Avoid and minimize stranding of fish species in sediment management areas	**Active SMAs** Measure sediment deposition in sediment management areas and compare with projected design depth or previous monitoring survey results. Inspect channel and floodplain design components used to maintain the function and efficiency of sediment capture and retention in sediment management areas Monitor vegetation growth in and around sediment management areas. Riparian vegetation will be used to control desired channel morphology and hydraulics to establish and maintain SMA function Monitor sediment management areas for presence of fish using beach seines or dip nets prior to sediment removal Inspect upstream and channels for sediment accumulation or erosion. Inspect upstream diversion structure for damages, sediment accumulation, erosion or other maintenance needs. Inspect condition of sediment removal access points and haul routes. Photo-point monitoring (Hall 2001)	**Active SMAs** Inspect sediment management areas and associated facilities monthly or after storm events during the first year, then annually and after major storm events that exceed a 1-year recurrence interval. Thereafter, inspect SMA annually and after large storm events for life of structure. Monitor for vegetation growth in and around sediment management areas, annually at the end of summer for life of structure. Photo-point monitoring during preliminary visual reconnaissance and during winter and summer baseflow periods. **Passive SMAs** Complete visual reconnaissance annually after wet season. Complete physical surveys annually for first 3 years and biannually through year 10. Photo-point monitoring during preliminary visual reconnaissance and	Sediment storage capacity is reduced by 25%. Sediment management areas are not collecting sediment Vegetation establishment that hinders function of the sediment management areas and/or adjacent river channels. Observation of excessive sediment deposition, erosion or vegetation in associated conveyance channels, grade controls, diversion structures or other facilities. Obstructions observed hindering SMA performance. Fish species found during beach seine and dip net surveys. Vegetation management in SMA's will be completed pursuant to project design and vegetation management plan.	No action Excavate sediment management area and deposit excavated sediment at designated reuse areas Re-visit sediment management area design and re-design individual feature as needed to adequately collect sediment Trim or remove undesirable vegetation Collect and relocate fish to appropriate habitat; analyze whether modifications to sediment management areas are necessary to limit potential for fish strandings. Implement site specific erosion control BMPs such as soil bioengineering and vegetative revetments as need to reduce streambank mass wasting while maintaining channel function and riparian habitat value. Install or modify instream structures such as Engineered Log Jam (ELJ) structures or Large Woody Debris (LWD) to re-direct flow and sediment deposition.

MANAGEMENT ELEMENT	PROJECT OBJECTIVE	MONITORING METHODS	MONITORING FREQUENCY	MANAGEMENT TRIGGER	POTENTIAL MANAGEMENT ACTIONS[1]
		Passive SMAs Physical surveys to monitor sediment accumulation thickness and volumes in SMA area. Visual inspection of connection points to mainstem Salt River to evaluate condition and sufficiency for future function. Photo-point monitoring (Hall 2001)	during winter and summer baseflow periods.		Remove obstructions. Install or modify instream structures to redirect or concentrate flows.

5.2.1.1 Short-Term Erosion and Sediment Control

Erosion and sediment control during construction will be conducted in accordance with the construction documents and project permits, including a Stormwater Pollution Prevention Plan (SWPPP) administered by the State General Permit for Storm Water Discharges associated with Construction and Land Disturbance Activities (Order No. 2009-0009 DWQ, NPDES No. CAS000002). The SWPPP shall be developed by a Qualified SWPPP Developer (QSD) and implemented by a Qualified SWPPP Practitioner (QSP) to ensure the receiving waterbodies are not impacted as a result of erosion and sedimentation during construction activities and until the disturbed areas are stabilized and sheet and rill erosion potential are minimized and a Notice of Termination of the general permit has been filed with the Regional Board.

The SWPPP will detail the location and type of erosion and sediment control Best Management Practices (BMPs) for the project area. These BMPs may shift and require short-term adaptive management to find the best solutions to control effects from sediment sources during and immediately following construction. Sediment source control BMPs that may be applicable for this project include, but are not limited to: silt fencing, fiber rolls, rock slope protection, turbidity curtain, controlled dewatering and handling of turbid water, sediment management areas, and check dams. These measures will be implemented prior to and during grading activities and removed once the site has stabilized. Applicable erosion control BMPs including seeding, mulching, erosion control blankets, plastic coverings and geotextiles. Erosion control BMPs describing seed mixes and possible seeding techniques and mulching requirements are covered in the HMMP.

5.2.1.2 Erosion and Sediment Deposition Monitoring of the Salt River Channel

Quantification of the geomorphic and hydrologic functions will allow the PMT to determine whether the objective of sustaining a dynamic river corridor with optimal flow and sediment conveyance is being met. Monitoring to quantify the geomorphic and hydrologic function of the Salt River corridor will include a preliminary visual reconnaissance of the corridor channel to identify potential areas of concern, followed by physical surveys (topographic measurements to include channel cross-sections and a longitudinal thalweg profile) throughout the Salt River corridor. The preliminary visual reconnaissance will be conducted in the early to mid-spring, at the termination of the wet season high flows. The physical surveys will help to quantify the height/depth of erosion or sedimentation within the channel and floodplain as well as quantify any changes in channel flow conveyance area. Prior to the Year 1 monitoring, locations for the cross-sections will be determined once construction is complete and will be focused on areas where erosion or sedimentation events have the greatest potential to occur. Pending findings from the annual visual channel reconnaissance, cross-section locations may be relocated or added to best address altered areas. Physical surveys should include a minimum of 6 freshwater reach cross-sections, and 4 tidal (fresh, brackish, and saltwater) reach cross-sections. Physical surveys of the river channel will be completed annually for the first 5 years, and then biannually through Year 10. End points of all cross-sections shall be monumented pursuant to standard methods in order to replicate surveys during future surveys. All survey elevations should be reported in the NAVD88 vertical datum. The longitudinal thalweg profile survey along the

entire project reach shall be completed annually, with thalweg elevations shot at least every 200 feet (ft), at a minimum. If there are significant changes in elevations at survey locations or locations identified during the visual reconnaissance as a result of storm damage, fallen trees, or excessive accumulation of vegetation and sedimentation, corrective actions will be evaluated and, if determined appropriate, a solution will be proposed to the regulatory agencies. Frequency of surveys beyond Year 10 will be determined by the Project Management Team in consultation with the Technical Advisory Work Group and Regulatory Work Group. For reporting purposes, all Erosion and Sediment Deposition Monitoring sections shall be referred to with a "ESXS" abbreviation, followed by the river stationing indicated on project plans (e.g., a cross section at the confluence with Reas Creek would be reported as "ESXS-140+00").

Photos will be taken to document channel conditions during the annual visual reconnaissance visits and during winter and summer baseflow conditions at permanently marked photo-documentation points. The number and location of these photo-documentation points will be determined after the construction is complete and will be selected with the long-term monitoring in mind. The locations and orientations of the photo-documentation points will be included in the Record Drawings for the project. These photos will document any changes occurring along the channel. Additional photos shall be taken during/after 2-year storm events to record any damage from flooding or erosion. Photos will be included in annual reports and also used in conjunction with other long-term monitoring methods to determine whether adaptive management actions are warranted.

5.2.1.3 Tidal Exchange Monitoring

Salinity in the project reaches is primarily controlled by estuary salinity, thus, salinity in the project reach will show more temporal change than lateral change. It is anticipated that the majority of the project area (Riverside Ranch in particular) will have marine salinity in the summer and freshwater salinity in the winter. Multi-parameter water level and salinity recorders will be used to determine seasonal changes in the tidal salinity gradient. In order to quantify and evaluate tidal and salinity exchange up the Salt River channel, a network of 5 multi-parameter recorders (measuring water level, temperature, salinity) are proposed in the mainstem Salt River and Eel River Estuary. Four of the recorders shall be installed at the following locations: 1) immediately downstream of the confluence with the new northern Riverside Ranch connector channel; 2) immediately downstream of the confluence with the new southern (upstream) Riverside Ranch connector channel; 3) at Dillon Road Bridge; and 4) immediately downstream of the confluence of Francis Creek. In order to evaluate the tidal and salinity exchange within Riverside Ranch, the fifth multi-parameter recorder shall be located inside Riverside Ranch at habitat constructed for tidewater goby. Water surface elevation monitoring should be completed for 6 to 7 months to capture the transition from freshwater to marine conditions and through the dry season (e.g., April/May through October). In addition to these measurements, dissolved oxygen monitoring is proposed during July/August when seasonal freshwater flows are low, temperatures are high, and DO levels are anticipated to be at their lowest concentration. Dissolved oxygen monitoring will consist of hourly measurements using a DO probe at each of the recorder sites over a 2-week tidal cycle. Dissolved oxygen measurements should be collected within and near the bottom of the water column. The initiation of monitoring will be weather dependant and instruments should not be installed until after the threat of high flows but initiated early enough to capture the transition from freshwater to marine conditions in the estuary and

project wetlands associated with the seasonal flow recession. As part of data analysis and reporting, all water levels should be reported in elevations tied to the NAVD88 datum and compared to Pacific Ocean tide ranges as reported by NOAA at their Humboldt Bay, North Spit tide gauge. If it is determined that adequate tidal exchange has not been established in the wetlands and/or channel (compared to model projections or design capacity), water surface elevation monitoring should continue in conjunction with any adaptive management required to correct problems with tidal exchange. If no adverse tidal exchange conditions are identified during the first 3 years, then Tidal Exchange Monitoring should be eliminated unless channel capacity monitoring indicates changes that would likely affect tidal exchange.

5.2.1.4 Bridge and Culvert Monitoring/Inspections

Bridge and culvert crossings will be monitored to ensure that flow pathways are maintained free of blockages or sedimentation and that erosion around these structures is minimal. Cross-section surveys at these crossings will be conducted annually for the first 5 years, and then biannually through Year 10 to determine if any significant changes are occurring and whether any adaptive management actions may be required. The elevations will be compared to the elevations on the Record Drawings. Qualitative surveys will consist of visual inspections following flood flow events exceeding a 1-year recurrence. Adaptive management may consist of pre- and post- storm maintenance such as clearing or excavating sediment from these locations or may require repair of any failed or damaged road or stream crossings. Frequency of surveys beyond Year 10 will be determined by the Project Management Team in consultation with the Technical Advisory Work Group and Regulatory Work Group.

5.2.1.5 Sediment Management Areas (SMA)

The SRERP is striving to promote as extensive and continuous band of riparian vegetation as possible, but many land-owners will continue to use areas within and adjacent to River corridor for grazing or other agricultural uses. In order to maintain optimal flows, sediment conveyance, riparian forest and associated aquatic and wetland ecosystems along the Salt River corridor, active and passive sediment management practices will be required. The proposed footprint of the Salt River corridor will contain an active channel and associated floodplain. The floodplain will host 2 types of sediment management areas (SMAs) currently under design as part of the 75% channel design configuration (Kamman 2010). SMAs are intended to be integrated along the mainstem Salt River in coordination with floodplain and riparian vegetation enhancements. SMA size will be kept to a minimum in order to maximize habitat enhancement and restoration. SMA's are referred to as Active and Passive, with Active SMAs including areas of annual or periodic sediment removal and Passive SMAs including areas that promote sediment deposition without sediment removal. Specific locations for each of the SMAs will be designated during the final design phase of the project. The long-term management and maintenance practices required varies based on SMA type. The following sections describe the different SMA types and likely long-term management requirements.

Active SMAs will be designed and constructed with the primary purpose to efficiently trap and manage sediment over the full spectrum of winter flows that transport sediment and have led to channel filling in the past. Active SMAs would be constructed in designated areas in a fashion to reduce flow velocity and create conditions that promote fine-sand to silt-sized grains to settle

out. They would be constructed to emulate natural floodplains along the mainstem Salt River by separating existing or created floodplain and low-lying areas from the River channel with a low-relief levee and or barrier consisting of native riparian vegetation. Large portions of the SMA would be subject to periodic (every 1 to 5 years) sediment removal to maintain topography and selected riparian vegetation zones that promote sediment deposition. Active SMAs will need to have sediment removed on a regular basis in order to maintain function and a high sediment trapping efficiency. Although they will be disturbed on a regular basis, Active SMAs will focus sediment deposition and management activities in order to protect larger reaches of adjacent and downstream River corridor.

Active SMAs will also provide landowners with areas that can continue to be used for grazing and other agricultural practices. As such, Active SMAs will be designed in close coordination with property owners and land managers in order to promote desired land use practices. Accumulated sediment in these areas could be reworked (leveled or tilled) in order to accommodate desired dry season land management practices. Once dry, sediment could be excavated and removed and the area could be seeded and used for agricultural production, cattle grazing, etc. Planting riparian or permanent vegetation in Active SMAs would not be sustainable given the annual disturbance associated with sediment removal. There are 3 discrete Active SMAs currently being designed into the corridor and in total will comprise approximately 20 acres.

Passive SMAs are intended to ultimately function as floodplain and riparian habitat areas of net sediment deposition and aggradation through natural fluvial processes. Some limited initial earthwork may be required to restore hydraulic connection between these floodplain and low-lying back-water areas to the mainstem Salt River. No long-term sediment removal or maintenance activities are anticipated in these SMAs. Thus the establishment or enhancement of riparian, wetland, and backwater aquatic habitats will be promoted in these SMAs. However, if excessive sediment deposition occurs in Passive SMAs, sediment removal per this AMP may occur. Alternatively, these areas can also continue to be maintained and managed pursuant to existing landowner land management practices.

In the event that channel transport and SMA performance are not capable of eliminating undesirable sediment accumulation in the mainstem Salt River channel or sediment accumulation poses an undesirable threat, excavation may be performed on a smaller scale within the River corridor (excavating specific areas of the channel). Larger-scale excavation across the entire width of the channel corridor may be necessary at sediment deposition-prone areas such at the confluence with Francis Creek, if designed SMAs and adjacent Salt River corridor are overwhelmed with sediment, which overflows into the adjacent River corridor. Routine vegetation maintenance activities within SMAs will occur during late summer or early fall months when the channel flows are lowest to minimize the potential for erosion and sediment transport and to minimize impacts to salmonid and wildlife species. Vegetation removal methods are described in the project's HMMP and include grazing, manual removal and mechanical removal.

5.2.1.6 Upslope Sediment Reduction

Per the DEIR (Grassetti 2010) upslope sediment management activities will be performed separately from the management actions described for this project. These activities will occur as part of restoration actions within the watershed and will benefit the SRERP by reducing the potential for sediment inputs. Upslope sediment and erosion hazard assessments have been completed for 2 of the Salt River sub-watersheds (Francis Creek and Williams Creek). These assessments mapped and prioritized potential road and stream related sediment sources and have recommended activities to reduce the amount of fine sediments entering the stream. Potential upslope sediment reduction activities may include: additional SMAs; construction of on- and off-stream detention/debris dams; stream/road crossing improvements such as culverts or bridges; livestock exclusion activities and off-site watering facilities; riparian planting; and stream bank stabilization measures. BMPs will be used to minimize erosion and fine sediment delivery to the mainstem of the Salt River from tributary streams during construction and any sediment reduction activities. The planning for the type and nature of activities on individual landowner's parcels is ongoing and has not been identified at this time. Adaptive management for these activities is not covered by this document.

5.2.2 Erosion, Sediment Deposition, and Geomorphic Condition Monitoring and Adaptive Management for Riverside Ranch

The Riverside Ranch portion of the project is designed primarily to restore a healthy tidal and brackish marsh to the 400-ac ranch site. In doing so, this restoration effort provides the opportunity to increase the tidal prism to maintain the Salt River geomorphology downstream of the marsh connector channels and to improve drainage and water quality in the lower Salt River. The increase in tidal prism will also increase channel scour of the Salt River and help to maintain the width and depth of the restored channel and maintain optimal tidal exchange between estuary and restored wetlands. This restored tidal connectivity will also allow for the natural evolution of intertidal mudflat, salt and brackish tidal marshes, and shallow water habitats.

The adaptive management triggers for erosion and sediment deposition within Riverside Ranch include lack of tidal prism establishment, severely muted tides within Riverside Ranch, evidence of erosion on the constructed setback berm, sediment deposition in marsh channels, indications that existing and constructed berms are not functioning as designed or are at risk for failure, and erosion and/or stagnant waters that are contributing to low vegetation establishment. This section of the AMP includes measures to monitor and adaptively manage erosion per Mitigation Measure 3.1.1-1 in the DEIR. In addition, monitoring and adaptive management for wind-generated waves that may contribute to erosion is included here per Mitigation Measure 3.1.1-9.2 of the DEIR (Grasetti 2010). Specific adaptive management actions are included in Table 2.

Table 2. Erosion, Sediment Deposition, and Geomorphic Condition Monitoring and Adaptive Management for Riverside Ranch.

MANAGEMENT ELEMENT	OBJECTIVE	MONITORING METHOD	MONITORING FREQUENCY	MANAGEMENT TRIGGER	POTENTIAL MANAGEMENT ACTIONS[1]
Erosion and Sediment Deposition Monitoring of Riverside Ranch Wetlands	Create a template of a naturally evolving tidal drainage network to benefit target fish and wildlife species. Establish complex tidal channel network Establish diverse marsh habitat Minimal maintenance of new channels or filled areas or ditches	Annual visual inspection of marsh channel development for first 10 years Physical surveys should include a total of 12 cross-sectional surveys; 6 in each of the southern and northern halves of the marsh along with a longitudinal profile of the main northern and southern slough channels. Cross-sections to extend 200 ft beyond top of channel banks to capture marshplain conditions. The end points of all cross-sections to be tied to monuments pursuant to standard methods in order to replicate surveys during future surveys. The longitudinal profiles shall be completed with thalweg elevations shot at least every 100 ft, at a minimum. Photo-point monitoring (Hall 2001)	Four times yearly for 1-month periods during 2 spring and 2 neap tide events to coincide with channel capacity monitoring for the Salt River (Table 1). A visual reconnaissance will be conducted during low tide in the early to mid-spring, at the termination of the wet season high flows. Physical surveys within Riverside Ranch will be completed annually for the first 5 years, and then biannually through Year 10. Quarterly review of data during the first 3 years. Photo-point monitoring during preliminary visual reconnaissance and during winter and summer baseflow periods.	Any given channel survey indicates that channel capacity has been reduced or enlarged by 10% or greater as compared to project plans, as-built surveys or previous monitoring surveys. Evidence that former straight line ditches are robbing tidal flows Surveys indicate excessive channel or floodplain erosion or sediment deposition. Development of conditions (e.g., log jams, tree falls, bar formation) that may threaten channel and floodplain conditions or hydraulic function. Erosion or sediment deposition at the confluence of tributary channels or drainage outfalls, including head-cuts or knick-point formation.	No action Excavation of tidal channels and/or re-fill or plug drainage ditches to improve hydrologic connectivity. Additional management actions as defined by CDFG Resource Management Plan
Culverts/Tide Gates and Perimeter Drainage	Maintain drainage of selected properties around project area.	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 as needed to make any maintenance recommendations.	Structure elevations reflect excess sedimentation or erosion Culverts are damaged by erosion or are not conveying flows as designed Culverts are plugged or not adequately carrying the channel flow Erosion or sediment deposition around culvert inflow or outflow areas. Outboard drainage ditch is not conveying flows as designed	No action Conduct pre- or post-storm maintenance to remove excess sediment Remove obstructions Repair failed or damaged culverts Excavate plugged culverts, or replace or enlarge culverts as needed Erosion control measures upstream and along channel (protecting bare soil, stabilizing banks, armoring, geotechnical bank protection, dissipating concentrated flows) Additional management actions as defined by CDFG Resource Management Plan.

MANAGEMENT ELEMENT	OBJECTIVE	MONITORING METHOD	MONITORING FREQUENCY	MANAGEMENT TRIGGER	POTENTIAL MANAGEMENT ACTIONS[1]
Setback Berm	Protect adjacent grazing lands, roads, and structures from flooding Achieve stable berm with minimal erosion and maintenance Wind generated waves do not contribute to shoreline or private property erosion	Visual inspection of berm by biologist/hydrologist or individual qualified to perform such observations for evidence of obvious flooding or erosion Visual inspections to determine level of settling or cracking Periodic visual inspections of adjacent lands, roads, and structures during storm events to ensure that erosion from any flooding or wind generated waves are not compromising berm stability Photo-point monitoring (Hall 2001)	Annually and after storm and extreme high tide events during the first year, then annually and after major (5-year) storm events. Annual survey during the summer, in Year-10 to determine ensure the structural integrity of the constructed berm	Evidence of berm erosion or potential failure such as cracking, slumping. If it is determined that cracking or slumping may be causing a problem, then topographic surveys will be performed. Visual observation of active erosion or conditions that would promote erosion (e.g., bare soil).	No action Repair eroded sections and employ erosion control measures (protecting bare soil, stabilizing banks, dissipating concentrated flows) Raise height of berms Maintain or repair access ramps and road atop berm Additional management actions as defined by CDFG Resource Management Plan and by NRCS Management Plan or other specifications for long-term maintenance.

[1]Details related to the specifics of management actions are dependent upon the monitoring results and the annual adaptive management review process.

5.2.2.1 Channel and Marshplain Evolution of Riverside Ranch Wetlands.

Numerous existing drainage ditches will be filled on site and new, more sinuous, tidal channels will be excavated to enhance the habitat function and quality of the restored marshplain. Monitoring of the geomorphic and hydrologic function of the Riverside Ranch wetlands will include an annual preliminary visual reconnaissance of the wetland to identify potential areas of concern, followed by physical surveys (topographic measurements to include combined marshplain/channel cross-sections and longitudinal channel profiles). Surveys will be based on the conditions described in the Record Drawings completed for the project after construction is complete. The preliminary visual reconnaissance will be conducted during low tide in the early to mid-spring, at the termination of the wet season high flows. The physical surveys will help to quantify the height/depth of erosion or sedimentation within the slough channels and marshplain as well as quantify any changes in channel tidal exchange capacity. Pending findings from the annual visual channel reconnaissance, cross-section locations will be sited to best address the project conditions and potential problem areas. Physical surveys should include a total of 12 cross-sectional surveys; 6 in both the southern and northern halves of the marsh along with a longitudinal profile of the main northern and southern slough channels. Cross-sections will extend 200-ft beyond top of channel banks to capture marshplain conditions.

Physical surveys within Riverside Ranch will be completed annually for the first 5 years, and then biannually through Year 10. The end points of all cross-sections shall be monumented pursuant to standard methods in order to replicate surveys during future surveys. All survey elevations should be reported in the NAVD88 vertical datum. The longitudinal slough channel profiles shall be completed with thalweg elevations shot at least every 100 ft, at a minimum. If there are significant changes in elevations at survey locations or locations identified during the visual reconnaissance as a result of tidal scour, fallen trees, or excessive accumulation of vegetation and sediment, corrective actions will be evaluated and, if determined appropriate, a solution will be proposed to the regulatory agencies. Frequency of surveys beyond Year 10 will be determined by the Project Management Team in consultation with the Technical Advisory Work Group and Regulatory Work Group.

Photos will be taken to document channel conditions during the annual visual reconnaissance and during spring and summer at permanently marked photo-documentation points. These photos will document any changes occurring within the tidal marsh, the berms, the filled drainage ditches, the salt marsh/upland ecotone, and along the channel. Additional photos shall be taken during/after large storm events to record any damage from flooding or erosion. Photos will be included in annual monitoring reports and will also be used in conjunction with other long-term monitoring methods to determine whether adaptive management actions are warranted.

5.2.2.2 Culverts/Tide Gates and Perimeter Drainage

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. Regular maintenance and monitoring will follow procedures outlined in the project's BO to protect fish species such as salmonids and tidewater goby. In addition, CDFG will be taking ownership of Riverside Ranch and may implement standard management procedures congruent with CDFG management in other wildlife areas.

5.2.2.3 Setback Berm Maintenance

A new setback berm approximately 9,060 ft long will be constructed from sediments excavated from the Salt River channel. The setback berm is designed with a varying interior slope (10H:1V and 4H:1V) to minimize impacts to existing wetlands, minimize wave erosion and create salt marsh/upland ecotone transition habitat. The berm is designed with a crest elevation of 14.75 ft NAVD88 and top width of at least 12 ft; with an outboard slope of approximately 4H:1V. The design includes culverts with radial or tide gates to provide drainage for the outboard ditch, access ramps; and a wide surface for maintenance access, and protection of adjacent grazing lands, roads and structures from tidal flooding. The base of the outboard slope will host cattle exclusion fencing to prohibit erosion from livestock access. All berm slopes will be well vegetated to provide erosion protection.

The setback berm is designed to operate without extensive maintenance. Monitoring will consist of qualitative monitoring including visual inspections performed annually and after major storm and high tide events by an individual qualified to perform these inspections. . 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 surveys will be performed to determine whether any structural repairs are needed.

5.2.3 Water Quality Monitoring and Adaptive Management for the Salt River Corridor and Riverside Ranch.

Short-term water quality monitoring and adaptive management measures are covered in the Stormwater Pollution Prevention Plan (SWPPP) (to be prepared). The SWPPP identifies potential sources of pollution that may affect the quality of water discharged from the project area during and immediately after construction. The SWPPP proposes best management practices to minimize the effects of pollution on water quality and outlines short-term adaptive management measures should water quality be adversely affected. It is anticipated that the SWPPP adaptive management measures will apply to the project until such time as the soils at the site stabilize and the grasses begin to establish (approximately 6 months after construction).

This section of the AMP includes measures to monitor and adaptively manage erosion and water quality per Mitigation Measures 3.1.1-1 and 3.1.1-3 in the DEIR (Grasetti 2010). Long-term water quality elements that will be adaptively managed include dissolved oxygen, temperature, and salinity (Table 3). The decision-making process for individual water quality parameters is outlined in Table 3 and will follow the example of a conceptual model constructed for dissolved oxygen (Figure A-1) in Appendix A. Additional conceptual models for other monitoring parameters may be developed as appropriate as the project progresses. The objective of the dissolved oxygen monitoring will be to meet the water quality standards as set out in the North Coast Regional Water Quality Control Plan (NCRWQCB 2007) and to achieve dissolved oxygen

levels suitable to support salmonids and the tidewater goby. The temperature objective is designed to maintain a temperature range that supports salmonids. The salinity objective is designed to inform whether the saline, brackish, and freshwater tidal areas of the project are located near to where they were predicted.

Dissolved Oxygen. Adequate dissolved oxygen (DO) is a necessary component of good water quality and a healthy biotic system and dissolved oxygen concentrations can determine the suitability for aquatic plant and animal life. For example, relatively high DO is associated with fish reproduction and rearing and low DO levels can cause stress or death for many aquatic organisms. Dissolved oxygen concentration can vary with water depth and with the flow rate of the water. The NCRWQCB standards recommend minimum DO concentrations of 7.0 mg/L. DO is unlikely to be low where there is good tidal circulation; however, in created backwater habitats for tidewater goby, DO could become low. DO is usually lowest in the early morning before aquatic plant photosynthesis begins and in the summer when the temperatures are highest. Continuous monitoring of DO is proposed over a 2-week tidal cycle during the summer (July/ August) at habitats created for tidewater goby. Monitoring should be performed within and near the bottom of the water column. This monitoring should provide information on whether conditions in these created habitats are approaching levels of concern for tidewater goby or salmonids.

Temperature. Water temperature may be a concern during the summer, when it is possible that temperatures could become warm enough to affect aquatic species. Water temperature in the Salt River channel will be monitored continuously just below each tributary junction from June 1 to October 1 to ensure that it does not limit or control the aquatic species that will inhabit the channel. Water temperature monitoring can also be used to assess the significance of other water quality parameters, such as the amount of oxygen that can dissolve in water, salinity, and conductivity. Water temperature monitoring locations and approach are described above under the Section heading, “Tidal Exchange Monitoring”.

Salinity. Slight changes in salinity can have substantial effects on aquatic plant and animal life. The project will create saline, brackish, and freshwater tidal areas along the channel accommodating salt and brackish marsh plant species as well as freshwater riparian plant species. These habitats will support wildlife species that depend on specific salinity ranges including tidewater goby and salmonid species. Continuous water surface elevation and salinity monitoring will be conducted as described above under the Section heading, “Tidal Exchange Monitoring” and as described in Table 3 to determine whether or not the salinity objectives are met.

Table 3. Water Quality Monitoring and Adaptive Management for the Salt River Corridor and Riverside Ranch.

MANAGEMENT ELEMENT	WATER QUALITY OBJECTIVE	MONITORING METHOD AND LOCATION(S)	MONITORING FREQUENCY	MANAGEMENT TRIGGER	POTENTIAL MANAGEMENT ACTIONS[1]
Dissolved Oxygen	Meets water quality standards for Dissolved Oxygen (DO) as found in the North Coast Regional Water Quality control plan (NCRWQCB 2007) Supports dissolved oxygen levels in an acceptable range for salmonids and tidewater goby.	Continuous water surface elevation monitoring and water quality monitoring at locations indicated under Management Element "Tidal Exchange Monitoring" in Table 1. In lower Salt River and Riverside Ranch: Continuous oxygen monitoring should be performed during a 2-week tidal cycle during the summer at the same time and at locations where tidal stage is monitored. Sampling locations should represent a range of DO conditions, e.g., in the Salt River channel as well as up sloughs/in tidewater goby habitats.	Frequency as stipulated under Management Element "Tidal Exchange Monitoring" in Table 1.	For salmonids – average dissolved oxygen is less than 7.0 mg/l (NCRWQCB 2007) Visual observation of stagnant water areas and/or salt pannes. Visual observation of dying vegetation or aquatic organisms in response to poor water quality.	No action Additional monitoring to establish temporal and spatial extent of low DO zone(s); compare to available pre-project DO data Determine source of problem (e.g., poor circulation, sedimentation, excess decaying organic matter), and repair/modify (i.e., dredge channel, clean out sediment basin management area) Discontinue monitoring after 5 consecutive years in which DO objectives are met; Monitoring duration will be dependent on flows and DO levels and could take longer than 5 years (see Appendix A; Figure A-1).
Temperature	Temperature range supports salmonids and tidewater goby.	Continuous water surface elevation monitoring and water quality monitoring at locations indicated under Management Element "Tidal Exchange Monitoring" in Table 1. In Salt River channel and Riverside Ranch: Continuous temperature monitoring should be performed at the same time and at locations where tidal stage and DO is monitored. Sampling locations should represent a range of conditions, e.g., in the Salt River channel as well as up sloughs/in tidewater goby habitats.	Frequency as stipulated under Management Element "Tidal Exchange Monitoring" in Table 1. In Salt River channel and Riverside Ranch: ensure that at least 1 monitoring event occurs in the summer, to coincide with DO and salinity monitoring. Annually in summer for a period of at least 60 days when water temperature is likely to be warmest (July/August).	Water temperatures exceed 22-23ºC (Madej et al. 2006). Visual observation of stagnant water areas and/or salt pannes. Visual observation of dying vegetation or aquatic organisms in response to poor water quality.	No action Additional monitoring to establish temporal and spatial extent of high temperature zone(s) Determine source of problem (e.g., poor circulation, sedimentation, lack of bank vegetation for shade), and repair or modify conditions. Monitor riparian vegetation until it provides shade over water in Salt River (10+ years) if temperature standards are exceeded. Provide additional and sufficient streamside revegetation to meet habitat objectives Discontinue monitoring after 5 years if thresholds not exceeded

MANAGEMENT ELEMENT	WATER QUALITY OBJECTIVE	MONITORING METHOD AND LOCATION(S)	MONITORING FREQUENCY	MANAGEMENT TRIGGER	POTENTIAL MANAGEMENT ACTIONS[1]
Salinity	Saline, brackish, and freshwater tidal areas are located where projected. Salinity levels to support tidewater goby and salmonid species, including freshwater tidal habitat during the summer in areas of the Salt River channel.	Continuous water surface elevation monitoring and water quality monitoring at locations indicated under Management Element "Tidal Exchange Monitoring" in Table 1. Conduct salinity/conductivity monitoring in Salt River and within Riverside Ranch at locations described above where tidal stage is monitored.	Frequency as stipulated under Management Element "Tidal Exchange Monitoring" in Table 1. In Salt River channel and Riverside Ranch: ensure that at least 1 monitoring event occurs in the summer, to coincide with temperature and DO monitoring.	Increase in salinity levels leading to mortality Visual observation of stagnant water areas and/or salt pannes. Visual observation of dying vegetation or aquatic organisms in response to poor water quality.	No action Inspect system to determine source of problem (i.e., tidal channels are filling, or sediment management areas have reduced freshwater flows), and repair/modify Discontinue monitoring after 5 years if salinity objectives are attained Continue monitoring beyond 5 years until management triggers are no longer exceeded for at least 5 years.

[1]Details related to the specifics of management actions are dependent upon the monitoring results and the annual adaptive management review process.

5.2.4 Habitat Development, Vegetation Management, and Invasive Species Monitoring and Adaptive Management for the Salt River Corridor and Riverside Ranch

The project is designed to maximize floodplain habitat complexity by increasing plant species diversity, channel shading, and large woody debris recruitment while minimizing invasive species. Post-construction vegetation monitoring and management for habitat areas along the Salt River channel and in Riverside Ranch (including the mitigation plantings) will be covered under the project's HMMP and Revegetation Plan (H. T. Harvey & Associates 2010a, 2010b) for 10 years to ensure that the desired habitats are establishing. After the mitigation habitats have met the HMMP's success criteria the AMP will govern their long-term management. . AMP elements pertaining to habitat development address the broader issues of long-term adequacy and sustainability in attaining project goals and objectives.

The project has also incorporated elements to provide beneficial wildlife habitat where possible and restoration of the channel will facilitate reconnection of the corridor to watershed tributaries which will improve habitat for a number of wildlife species (i.e., fish access to spawning and rearing habitats and wintering habitat for migratory waterfowl and shorebirds, and tidewater goby habitat). The project's permitting documents, particularly the BO, will address monitoring and adaptive management for special-status wildlife species. Adaptive management elements presented here and in Table 4 address long-term adequacy in obtaining goals and objectives to improve habitat for specific plant and wildlife species.

Salmonid and Tidewater Goby *(Eucyclogobius newberryi*) Habitat. The restored Salt River will create Essential Fish Habitat (EFH) and has in part been designed to provide a migration corridor for adult salmonids, and high flow refugia and rearing habitat for juvenile salmonids, especially coho salmon and steelhead. Habitat types will include off-channel habitat, large woody material, and freshwater tidal habitat. Studies in nearby Humboldt Bay indicate the relevance of tidal freshwater habitat for salmonid rearing (Wallace and Allen 2009). Restoration of Riverside Ranch should provide overwintering rearing habitat for juvenile salmonids as well as habitat important for fish transitioning between the ocean and freshwater stream habitats; e.g., adults moving upstream from the ocean to upstream freshwater spawning habitat and juveniles moving downstream from freshwater rearing habitat to coastal marine habitats (e.g., during smoltification). Tidewater goby habitat creation and enhancement is targeted through the creation of tidal marsh, off-channel and tidal channel habitat in Riverside Ranch. Tidewater goby require habitat that allows them to complete their annual life cycle (e.g., adult spawning to pelagic larval phase to benthic juveniles/adults). This habitat tends to be at upper ends of bays and estuaries, and generally includes waters that are occasionally connected with, but periodically discontinuous, from the tidal environment (Chamberlain 2006). Tidewater goby have been found to tolerate water quality conditions varying from nearly fresh to hypersaline, and with very low dissolved oxygen; however, conditions that are likely to be more favorable for tidewater goby include well-oxygenated water with salinities <15 ppt (Stillwater Sciences 2006).

Table 4. Habitat Development, Vegetation and Invasive Species Monitoring, and Adaptive Management for Salt River Corridor and Riverside Ranch.

MANAGEMENT ELEMENT	OBJECTIVE	MONITORING METHOD AND LOCATION(S)	MONITORING FREQUENCY	MANAGEMENT TRIGGER	POTENTIAL MANAGEMENT ACTIONS[1]
Salmonid and Tidewater Goby Habitat	Restore and enhance aquatic habitat Create habitat and water quality conditions that support salmonids and tidewater goby	Conduct beach seine or dip net surveys in all habitats created for tidewater gobies and where possible at 3 or more locations within Riverside Ranch and 1-2 locations on the Salt River tidal freshwater ecotone for salmonids Continuous water surface elevation monitoring and water quality monitoring at locations indicated under Management Element "Tidal Exchange Monitoring" in Table 1. In addition to the monitoring described herein, monitoring may also prescribed per the HMMP (H. T. Harvey & Associates 2010) and the project BO (in progress) may include: • Channel geomorphology monitoring (see Table 1) • Vegetation monitoring per the HMMP • Invasive species monitoring (see below) • Fish monitoring • Water quality monitoring (see Table 3)	Frequency as described in the project BA/BO. If not described, use the following frequency: 1 monitoring effort in spring and 1 monitoring effort in summer (after July 1) For gobies, monitor every year for 5 years using USFWS protocol for gobies in habitats specifically created to support gobies; if gobies occur each year for 5 years, then discontinue monitoring. For juvenile salmonids, use baited traps or beach seining as per Wallace and Allen (2009). If juvenile salmonids occur each year for 5 years, then stop monitoring. In Salt River channel and Riverside Ranch: ensure that at least 1 monitoring event occurs in the summer, to coincide with temperature and DO monitoring. Frequency as stipulated under Management Element "Tidal Exchange Monitoring" in Table 1.	Habitat created specifically to support tidewater goby is not used by them sustainably and/or year-round. Habitat that should support rearing of juvenile salmonids (freshwater tidal ecotone in spring and summer) is not used annually. Temperature thresholds for both species as described in the project's BO are not met.	No action Continue monitoring If gobies are not present, attempt to determine what is preventing them from using habitat and modify design if feasible. If no salmonids are present at likely habitats within Riverside Ranch and Salt River tidal freshwater ecotone, then Project Management Team confers with the Technical Advisory and Regulatory Work Groups to determine what is preventing them from using habitat and modify design as feasible. Sediment management as described above in Table 1 for Salt River channel if lack of connectivity is restricting species use. Add habitat modifications (e.g., revegetation, channel shading, in-stream habitat features) Discontinue monitoring after 10 years if habitat objectives are met

MANAGEMENT ELEMENT	OBJECTIVE	MONITORING METHOD AND LOCATION(S)	MONITORING FREQUENCY	MANAGEMENT TRIGGER	POTENTIAL MANAGEMENT ACTIONS[1]
Aleutian Cackling Goose Habitat	Work with landowner, California Department of Fish and Game, to implement CDFG/RCD "Protocol for Prescribing Agricultural Activities on lands within North Coast Wildlife Area Complex" (Protocol) on areas of Riverside Ranch retained for ACG habitat enhancement.	Monitoring methods will follow procedures outlined in the established DFG/RCD Protocol and will include; annual pasture management planning, the development of an annual management plan, and annual evaluation of vegetative composition.	Monitoring of agricultural practices and vegetative composition will occur from April through January, depending on conditions and approved management plan.	Annual pasture management planning process indicates need for renovation or improvement of forage to improve habitat conditions for ACG.	No action Increase or decrease herd size, adjust grazing rotation and/or grazing intervals Use other accepted agricultural practices such as haying or mowing to improve conditions Renovate areas to improve forage conditions for ACG
Salt Marsh to /Riparian Upland Ecotone	Restore and expand transition zone between tidal wetland and riparian/upland habitat by creating a salt marsh/riparian upland ecotone along the constructed setback berm	Riverside Ranch monitoring for percent cover of naturally recruiting native salt marsh vegetation using satellite imagery or aerial photography A passive restoration strategy is planned for the Riverside Ranch marsh plan with no initial planting prescribed for this area. However, if natural recruitment does not occur as expected, active planting may be necessary. The inboard side of the setback berm will be actively planted with high marsh species and with willows on the upper portion to create a riparian/upland transition zone. Monitoring of planted salt marsh species using transect monitoring. Measure percent cover of 0.05% of the planted surface area. Annual vegetation monitoring per HMMP (H. T. Harvey & Associates 2010) which includes: • Salt marsh percent cover vegetation monitoring based on success criteria in Years 3, 5, 7, and 10 using aerial photography or satellite imagery • Percent cover of naturally recruiting native salt marsh species using aerial photography or satellite imagery • Photo-documentation • Percent cover of invasive species based on imagery used for salt marsh vegetation monitoring	Monitoring for naturally recruiting salt marsh species in Years 3,5,7, and 10 Annual monitoring in Years 1-5, 7, and 10.	Percent cover of naturally recruiting salt marsh species in Year-10 is <55% or is not progressing along a trajectory of meeting the final success criterion. Percent cover of the planted setback berm is <30% and is not progressing along a trajectory of meeting the final success criterion.	No action Continue monitoring Active replanting Test soil to determine if soil characteristics are limiting target plant establishment; amend soils if required. Monitor recolonization, replant if necessary Weed management/and or invasive species control to assist in native salt marsh plant establishment

MANAGEMENT ELEMENT	OBJECTIVE	MONITORING METHOD AND LOCATION(S)	MONITORING FREQUENCY	MANAGEMENT TRIGGER	POTENTIAL MANAGEMENT ACTIONS[1]
Woody Vegetation Management	Riparian vegetation establishment goals are covered in the HMMP. Woody vegetation will be managed consistent with the goal to maintain structure and function of the Salt River corridor as designed, and/or to manage situations that impede channel function Vegetation maintenance does not contribute to erosion	Cross-section and longitudinal profile surveys of the channel. These should include a minimum of 4 freshwater reach sections, and 3 tidal (fresh, brackish and saltwater) reach cross-sections). Vegetation monitoring methods per HMMP (H. T. Harvey & Associates 2010).	Cross-section surveys during summer, Years 1-10. Surveys after Year 10 only if qualitative assessments determine that vegetation establishment in the channel is contributing to excessive sedimentation. Vegetation monitoring per HMMP schedule through Year 10, if project meets vegetation success criteria, then AMP will assume responsibility for vegetation monitoring at a minimum of every 2 years	Any given channel survey indicates that the channel geometry has been reduced or enlarged by 10% or greater as compared to project plans, as-built surveys or previous monitoring surveys. Bank erosion visible in vegetation removal areas Significant woody vegetation establishment in channel that limits structure and function of the Salt River channel and riparian corridor habitat development. Maintain vegetation in channel corridor and Sediment Management Areas in a manner consistent with project design that maintains intended hydraulic and geomorphic function and efficiency.	No action Continue monitoring to determine if conditions improve as channel evolves More detailed assessment/modeling to determine if excessive vegetation is contributing to excessive channel sedimentation Remove or control unwanted vegetation, and potentially replace with desired vegetation per HMMP (H. T. Harvey & Associates 2010) Selected sediment removal from channel BMPs during maintenance activities and during invasive plant removal or replanting to minimize erosion
Weed Abatement	Maximize riparian habitat extent and complexity by increasing plant species diversity and minimizing invasive species	Annual vegetative monitoring per the HMMP for the first 10 years (H. T. Harvey & Associates 2010). Additional monitoring beyond Year 10 should weedy vegetation dominate the restoration area or threaten to spread to adjacent landowner properties Qualitative surveys and photo-doc during site visits	Annually through Year 10 per HMMP Annually after the HMMP monitoring period until such time as weedy species do not dominate the project area	Weedy vegetation dominates the restoration area and threatens to spread to adjacent landowner properties.	No Action Continue monitoring to determine if conditions improve Remove unwanted vegetation and/or replant with desirable species BMPs during weed abatement activities to protect against spreading undesirable seeds as well as erosion and diminished water quality.

MANAGEMENT ELEMENT	OBJECTIVE	MONITORING METHOD AND LOCATION(S)	MONITORING FREQUENCY	MANAGEMENT TRIGGER	POTENTIAL MANAGEMENT ACTIONS[1]
Invasive Species Management - Plants	Maximize riparian habitat extent and complexity by increasing plant species diversity and minimizing invasive species. Create riparian, salt marsh and salt marsh/upland ecotone habitat <5% colonization by invasive species, with particularly emphasis on invasive *Spartina*, dwarf eelgrass and reed canary grass.	The HMMP requires annual eradication of *Spartina* (H. T. Harvey & Associates 2010). Monitor for invasive species, particularly for *Spartina*, and reed canary grass during annual vegetation monitoring per HMMP. Visual surveys during years 1-10 in addition to regularly scheduled monitoring, particularly in Riverside Ranch for invasive *Spartina* and dwarf eelgrass.	As described in the HMMP for years 1-10 (H. T. Harvey & Associates 2010).	Significant areas of invasive plant species establishing in project area and limiting density of desired species. Invasive species comprise 10% vegetation cover or greater as a target in Year 10	No action Continue monitoring Weed management and/or invasive species control to assist in native plant establishment (*Spartina* control to be consistent with *Spartina* Management Plan currently under development by the California Coastal Conservancy). Dwarf eelgrass control to be consistent with best available methods as researched by California Sea Grant. Active replanting of desired vegetation per HMMP (H. T. Harvey & Associates 2010).
Invasive Species Management – Pikeminnow	Occupation of the newly created habitat by native fish species	Monitoring as described in HMMP (H. T. Harvey & Associates 2010) and the project BO (in progress): Determine pikeminnow presence/abundance by surveys using beach seine or dip net surveys at 3 or more locations within Riverside Ranch at 1-2 locations on the Salt River tidal freshwater ecotone. Pithing and monitoring stomach contents of euthanized pikeminnows	Annually for 5 years	Pikeminnows greater than 10 inches with evidence of piscivory become dominant in the project area to the exclusion of native species	No action Continue monitoring Implement a 3-year pilot pikeminnow control program using annual seining or netting of the main channel with a suitable mesh size to trap, document and euthanize all captured pikeminnow Install or modify instream habitat features to provide additional refugia for salmonids

[1]Details related to the specifics of management actions are dependent upon the monitoring results and the annual adaptive management review process.

Aleutian Cackling Goose (*Branta hutchinsii leucopareia*) Habitat. Portions of the project area may be managed to optimize Aleutian cackling goose (ACG) habitat. For example, the agricultural area retained within Riverside Ranch is designed for agricultural and grazing uses that will provide goose habitat with this objective in mind. Under a Memorandum of Understanding (MOU) between the California Department of Fish and Game (CDFG) and Humboldt County Resource Conservation District (HCRCD), agricultural activities are used on several CDFG-owned wildlife areas to achieve a variety of habitat goals. The document developed by CDFG and HCRCD, *Protocol for Prescribing Agricultural Activities on Lands Within the North Coast Wildlife Area Complex* outlines the process to determine and monitor agricultural activities, such as livestock grazing, haying, mowing, irrigation, fertilizing and seeding. 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 geese, Aleutian cackling geese, waterfowl, shorebirds, or wading birds and other wildlife. Success of these efforts is monitored on an ongoing basis and agricultural practices are adjusted as needed to achieve goals.

Project elements can be incorporated over time as needed to retain and/or enhance the short grass habitat within the project area to benefit regional ACG management strategies and minimize crop depredation damages on private property. Working with private landowners, management techniques such as grazing, haying, or mowing could be used to enhance the quality of the short grass habitat for ACG, in order to attract and/or retain geese on the project site. In addition, the grassland areas retained as part of the project could provide a refuge for geese hazed from adjacent private lands. Observations of Aleutian cackling geese use of habitat in the project area and vicinity can be qualitatively monitored by project biologists and from information collected from private landowners.

Salt Marsh/Riparian Upland Ecotone. Ecotones are important habitats that serve as transition zones or buffers between terrestrial and aquatic landscapes and provide an important function by trapping nutrients from surrounding upland areas and generating increased species richness and diversity while providing optimal habitat for ecotone species (James 2001; Traut 2005). In addition to the objective of restoring tidal salt marsh habitat, the Riverside Ranch restoration includes expanding and creating a salt marsh/riparian upland ecotone along the intersection of the high marsh with the inboard slope of the constructed setback berm. Naturally recruiting vegetation in the marsh plain will be monitored using satellite imagery or aerial photography. Salt marsh plants will be installed on the lower portion of the inboard side of the constructed setback berm and riparian tree and shrub species will be planted at the upper portion of the berm to create salt marsh/riparian upland ecotone habitat. This area will be monitored per the HMMP for percent cover of establishing salt marsh species and to ensure that invasive species do not colonize this area.

Woody Vegetation Management (years 5+). Establishment of riparian vegetation is important to project goals and objectives. Success criteria outlined in the HMMP will determine if vegetation establishment is occurring at the anticipated rate. For purposes of the AMP, vegetation management will refer to weed abatement to achieve habitat goals, undesirable woody vegetation control (including willow establishment in the channel) to achieve channel conveyance goals, and invasive species management. All other vegetation management aspects

are considered short-term and are addressed in the HMMP and ultimately the agency approval of habitat establishment per the project's mitigation success criteria. Controlled grazing of ditches to remove encroaching woody vegetation will likely be a long-term endeavor to maintain the complexity of habitats.

Weed Abatement (years 3+). Weed abatement should be performed per the HMMP (H. T. Harvey & Associates 2010) during the 3-year plant establishment period for the project. If the weed abatement procedures have not been successful (see HMMP for assessment standards) at limiting the colonization of weedy species within the restoration area, the Project Management Team will continue to perform weed abatement on a regular basis to ensure that weedy species do not dominate the restoration area or expand from the site onto adjacent private property. This maintenance should continue until such time as weedy species do not present a detriment toward maintaining a self-sustaining riparian forest or tidal salt marsh (see HMMP for assessment standards). Weed abatement may include mechanical or manual control by paid staff, contractors, or volunteers, or continuance of flash grazing methods as described in the HMMP.

Invasive Species Management. Minimizing invasive species throughout the riparian and salt marsh habitat will contribute to increased plant species diversity and complexity throughout the project area. Several species have been identified as posing potential threats to the ability to meet this objective. Species for which adaptive management may be necessary include dense-flowered cordgrass, reed canarygrass, and Sacramento pikeminnow. Potential adaptive management activities for these species are described below.

Dense-flowered Cordgrass (Spartina densiflora). Dense-flowered cordgrass (*Spartina densiflora*) is a non-native invasive perennial that competes with native salt marsh species and typically invades bare mudflat and pickleweed habitats to replace native salt marsh habitat with dense monospecific stands. Colonization by dense-flowered cordgrass in channel areas can also result in increased sedimentation. Dense-flowered cordgrass is difficult to eradicate and current eradication techniques being used with some success in Humboldt County include mowing and hand-digging. Herbicide use for large-scale eradication has not been approved. A control plan for dense-flowered cordgrass is currently being prepared by the California Coastal Conservancy and its partners for invasive *Spartina* in Humboldt Bay, the Eel River Delta, and the Mad River Estuary. Methods developed in that plan should be used to eradicate dense-flowered cordgrass before and during construction if the regional plan is developed before restoration occurs. If the regional plan is not developed before implementation of this plan, project proponents should contact botanists at the Humboldt Bay National Wildlife Refuge and the Invasive *Spartina* Project in San Francisco Bay regarding recent research on cordgrass eradication and methods currently in use to eradicate dense-flowered cordgrass in Humboldt County.

It is anticipated that ongoing long-term maintenance will be required to continue to eradicate *Spartina* unless it is controlled throughout all of Humboldt Bay. During the first 10 years of the project, the project site will be monitored annually per the vegetation monitoring described under the HMMP. If new areas of *Spartina* colonization are mapped within the project footprint they will be flagged for eradication. Eradication of any newly establishing *Spartina* shall be performed at least once a year using the methods currently under development for the Humboldt Bay *Spartina* Management Plan (in process). These methods may include manual, mechanical,

and/or any approved chemical methods. After the initial 10-year monitoring period, a funding mechanism should be set in place by the PMT to provide long-term maintenance and monitoring to ensure that invasive *Spartina* does not re-invade within the project area.

Dwarf Eelgrass (Zostera japonica). Dwarf eelgrass (*Zostera japonica*) is a non-native invasive submerged hydrophyte that has invaded west coast estuaries. It can rapidly colonize intertidal marine and estuarine habitats, particularly unvegetated mudflats. Colonization by dwarf eelgrass can alter physical habitat structure and alter the densities and richness of resident fauna. Early detection of dwarf eelgrass is difficult as it is typically found at tides of 2.0 ft MLLW or lower, the narrow blades of the eelgrass make it difficult to detect, and surveys are difficult to conduct in intertidal mudflat areas. Similar to other invasive species, the best was to ensure that dwarf eelgrass does not successfully colonize requires monitoring to ensure early detection, followed by a rapid response consisting of eradication and follow-up monitoring (CDFG 2010).

Monitoring for colonization by dwarf eelgrass should be performed during annual vegetation monitoring being performed as part of the requirements of the HMMP. Qualitative monitoring to look for the presence of dwarf eelgrass should be performed during routine monitoring that occurs in the intertidal areas (i.e., topographic surveys and fish surveys).

If dwarf eelgrass is detected, eradication efforts should be coordinated with Susan Schlosser at California Sea Grant in Eureka, CA to ensure that the most current eradication methods are being used. Current experimental methods in use by staff from California Sea Grant and CDFG include manual excavation and heat treatments. Manual excavation is performed by digging up individual plants or patches. California Sea Grant is also conducting experiments to control dwarf eelgrass using heat treatments which consist of experimental burn plots and heated water (pers. comm. Schlosser 2010).

Reed Canarygrass (Phalaris arundinacea). Reed canarygrass (*Phalaris arundinacea*) is an aggressive waist high perennial grass which tolerates wet soil conditions and invades and dominates wetland habitats. Reed canarygrass is often one of the first wetland plants to emerge early in the growing season and readily invades bare or disturbed areas. Once established, it reduces plant diversity because it can outcompete seedlings of other establishing plants. It can also modify the hydrology of streams because of its ability to trap sediment, leading to constriction of waterways. Control of reed canarygrass needs to address suppressing above-ground vegetative growth and underground rhizomes as well as the seed bank. In Washington and Oregon, physical methods have included mowing, grazing when stems and leaves are young, use of ground coverings, burning, inundation, herbicide application and using shading to discourage plant establishment (Miller et al. 2008; Antieau 1998). Competitive exclusion is also a potential option to discourage reed canarygrass seedling establishment. Competitive grass species include tufted hairgrass, spike rush, and bentgrass (*Agrostis* sp.).

In the long-term, the planting of riparian vegetation, particularly coniferous forested wetland plant communities, will likely provide adequate shading to limit reed canarygrass growth (Antieau 1998). In the event that coniferous forested wetland plant communities do not provide adequate shading to control reed canary grass in the long-term, a management plan will need to be developed by the Watershed Council to control any remaining populations found within the channel.

Sacramento Pikeminnow (Ptychocheilus grandis). Sacramento pikeminnow (*Ptychocheilus grandis*) are considered ubiquitous within the Eel River watershed and can compete with native species, such as coho salmon, Chinook salmon, steelhead, sculpin, stickleback, etc. Therefore, any attempt to control the pikeminnow population within the project must be considered an interim measure designed to minimize competition during the time that native species colonize the newly created habitat.

Monitoring will be performed to determine whether larger juvenile or adult pikeminnow capable of piscivory are present and/or dominant in the project area, if their presence is harmful to native species, and, if so, whether practicable measures can be taken to control their numbers while native species are recolonizing newly created habitat. The RCD/Watershed Council will conduct annual monitoring for at least 5 years to assess relative abundance of pikeminnow, habitat preferences, dietary preferences, movement patterns, and other factors.

Presence and relative abundance of both pikeminnow and native species will be documented and reported in order to help assess trends in relative abundance and responses to the project. Documentation of both pikeminnow and native species relative abundance will help characterize species use of habitats within the project area. Pikeminnow shall be euthanized with non-toxic methods such as pithing, and stomach contents shall be examined to assess piscivory. Standard monitoring methods shall be used for both assessment and control to ensure the avoidance of take of listed species, and the protection of water quality during sampling. Monitoring shall follow standard protocols to avoid take of state or federally listed species.

In the event that adult, piscivorous pikeminnow (adults greater than 10" with evidence of piscivory, such as stomach contents) become dominant in the project area, to the exclusion of native species, the RCD shall conduct a 3-year, pilot, pikeminnow-control-program subsequent to the 5 year monitoring program. The anticipated approach will include annual seining or netting of the main channel with a suitable mesh size in order to trap, document and euthanize pikeminnow. Native species shall be documented and returned unharmed to the channel.

The program shall be conducted in coordination with the CDFG and the Redwood Sciences Lab over a 3-year period, culminating in a survey report of the Salt River fish assemblage no later than 12 years after project implementation. The reports shall be posted online at Calfish.org, and made available to the DFG and the Redwood Sciences Lab for interpretation. Eradication of the introduced Sacramento pikeminnow is considered infeasible, so no extension of the pilot program is proposed. However, the pilot program would serve as an intermediate measure to promote the occupation of newly created habitat by native species. Moreover, the information generated in the pilot program would help resource managers determine the effectiveness of the proposed pikeminnow control approach for future projects.

5.3 ATTAINMENT OF VARIOUS PERMIT REQUIREMENTS

Short-term monitoring under the HMMP and long-term monitoring under the AMP has been designed to ensure that the project complies with the various permits and biological documents required for this project. A list of these permits is included here. This is not an exhaustive list and additional permits/biological documentation may be required as the permitting process progresses.

- USACE Section 404
- RWQCB Section 401 Water Quality Certification
- CDFG 1600 Lake and Streambed Alteration Agreement
- CDFG Take Avoidance Measures
- State Lands Commission Lease
- California Coastal Commission Coastal Development Permit
- NMFS, USFWS Section 7 Formal Consultation
- Humboldt County Conditional Use Permit
- Humboldt County Grading and Encroachment Permits
- Caltrans Encroachment Permit

Additional permit requirements beyond the scope of this AMP may be requested by a specific agency and will need to be folded into the adaptive management process as appropriate.

5.4 BEST MANAGEMENT PRACTICES FOR LONG-TERM MANAGEMENT

Short term Best Management Practices (BMPs) during and immediately after construction will be employed per the Excavation Materials Management Plan (Winzler & Kelly 2010), the final project Plans and Specifications, and the SWPPP (to be prepared with 100% design). Long-term BMPs include:

- Time maintenance/monitoring activities such that these activities minimize disturbance to wildlife as outlined in project documents and permits (see *Attainment of Various Permit Requirements* above).
- Minimize potential for invasive species colonization during and after construction. Measures to prevent spread of existing populations of *Spartina* during construction will be addressed in the HMMP.
- Evaluate monitoring results to determine the biological response from short-term BMPs and to use these results to identify whether any short-term BMP measures need to be incorporated into long-term management.
- Continue to identify upstream sediment sources and develop additional measures to reduce sediment supply to the Salt River as opportunities become available.

- Continue to identify any upstream sources that may contribute to decreased water quality and develop measures to reduce the input of any pollutants. These methods may include sediment or infiltration basins, vegetated riparian buffers, mulching of exposed soil surfaces, streambank fencing, road drainage upgrades, low impact development structures, erosion controls, streambank armoring in highly erosive areas, or other methods that could improve water quality.
- Increase public awareness regarding project goals with community education programs to communicate methods to reduce sediment/pollutant inputs to landowners in the Salt River watershed.

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PERSONAL COMMUNICATIONS

Schlosser, S. 2010. Personal communications via phone and e-mail between Donna Ball (H. T. Harvey & Associates) and Susan Schlosser (California Sea Grant) regarding eradication methods for dwarf eelgrass on 11/29/2010.

APPENDIX A.
DISSOLVED OXYGEN CONCEPTUAL MODEL

Dissolved Oxygen (DO) Monitoring