



# Agricultural Drainage Control Project

Final Report  
Agricultural Water Quality Grant Program



Submitted to the State Water Resources Control Board  
June 2010

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# Stevinson Water District Agricultural Drainage Control Project Final Report

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## 1. Project Description

### 1.1 Purpose

The purpose of this project is the construction of artificial wetlands and ancillary facilities to control discharges of agricultural drainage and storm water to the San Joaquin River from the Stevenson Water District (SWD) and the neighboring Merquin County Water District (MCWD) (collectively, the Districts).

This project evolved as part of the Integrated Water Resources Plan (IWRP) that the Districts developed with the support of the Department of Water Resources. A major element of the plan involved improving the Districts' capacity to manage agricultural drainage and storm water.

### 1.2 Scope

The work performed by Stevenson Water District in designing and constructing the Agricultural Drainage Control project conformed with the scope of work presented in the Grant Agreement.

### 1.3 Goals

This program has the following objectives:

- Reduce salt loading to the San Joaquin River.
- Control the timing of agricultural drainage discharges so that loadings coincide with periods of high flow.
- Create groundwater mounds by infiltration from the wetlands to obstruct intrusion of saline groundwater from the west side of the San Joaquin Valley.
- Manage storm water flows to reduce peak discharges and diminish loadings of sediment and other contaminants.

### 1.4 Activities completed

Activities performed during the project are described below.

### **1.4.1 Pre-Project Field Work**

- 1.4.1.1 Existing wetland areas were delineated and the locations where project features would be constructed were identified.
- 1.4.1.2 GPS coordinates for project features (wetland boundaries, slide gates, monitoring sites) were determined.
- 1.4.1.3 A pre-project site condition inspection was performed.
- 1.4.1.4 A topographic survey was conducted as a basis for design.
- 1.4.1.5 A packet of pre-project site information was prepared.
- 1.4.1.6 Due to the project's location, no landowner agreements were required for construction.

### **1.4.2 Design**

The Design Plan (included as Appendix A) describes design elements for three features: the Existing Wetland, the Infiltration and Recirculation Wetland, and the Turner Slough Outlet Gate. The Design Plan also describes control, measurement and monitoring facilities appurtenant to each of these features.

- 1.4.2.1 Design of Existing Wetland, Infiltration and Recirculation Wetland, and Turner Slough Outlet Gate. Criteria for these designs included:
  - a. Anticipated average flows entering and leaving each wetland site.
  - b. Maximum flow rates and storage capacities.
  - c. Description of instrumentation and hydraulic controls used to maintain water levels and prevent overtopping of the wetland facilities.
  - d. Operating parameters to attain the flow management and water quality improvement objectives of the Project.
  - e. Contingency plan to allow for immediate modification of Project operations or termination of discharge in response to extraordinary circumstances.

Vegetation within the Existing Wetland and the Infiltration and Recirculation Wetland has been preserved throughout construction.

### **1.4.3 Implementation**

- 1.4.3.1 Operate project and compile initial data.
- 1.4.3.2 Evaluate initial data.

### **1.4.4 Monitoring**

- 1.4.4.1 Monitoring data has been provided to the Grant Manager throughout the term of the Agreement. A Monitoring Plan (MP) was completed and approved. This plan is included as Appendix B.

- 1.4.4.2 Visual monitoring of the project was conducted throughout project implementation. Visual monitoring included inspection of project facilities, observation of inflow and outflow locations and confirmation that dairy wastes were not entering the Existing Wetland.
- 1.4.4.3 Surface water quality monitoring was conducted in accordance with the MP at specified monitoring locations for the following water quality parameters: total dissolved solids (TDS), electrical conductivity (EC), boron, nitrate and nitrite nitrogen, total phosphorous, turbidity and selenium. In addition, water quality samples were analyzed for a range of pesticides, metals and other contaminants. All reporting on water quality sampling was conveyed to the Grant Manager.
- 1.4.4.4 Sampling and analysis of sediment was performed as directed by the Grant Manager to determine levels of sediment-bound chemicals.
- 1.4.4.5 Water quality monitoring data has been provided to the Westside Watershed Coalition (WWC) for inclusion in their database. Water quality data on key constituents has also been incorporated together with flow data into a project database.
- 1.4.4.6 Groundwater data from monitoring wells installed in Stevinson Water District under the Department of Water Resources-funded groundwater monitoring program has been compiled.

### **1.4.5 Project Construction**

- 1.4.5.1 Measurement and control devices have been installed at the Existing Wetland
- a. A Doppler acoustic flow metering device has been installed to measure and record inflows to the Existing Wetland.
  - b. The broad-crested weir discharging water from the Existing Wetland to Turner Slough has been replaced with an automated Rubicon flume gate that maintains water levels in the wetland and measures outflows to Turner Slough. Gate levels are set by remote control from SWD headquarters to change the pool elevation to be maintained in the wetland. The automated water level control features of the Rubicon gate and the 24-inch gate valve outlet from the Existing Wetland provide discharge capacity adequate to protect the wetland berm from being overtopped during storms.
  - c. A new pump, flow meter and connector pipeline have been installed to convey water from the Existing Wetland to the Infiltration and Recharge Wetland.
  - d. The berm enclosing the Existing Wetland was rehabilitated and raised an average of 1.1 feet to increase the berm crest to elevation 74.5 feet.
  - e. A watertight slide-gate and a propeller-type flow meter were installed at the 24-inch outlet pipe at the southern tip of the Existing Wetland. This pipe allows water to be released, if necessary, to the San Joaquin River during winter storms.
  - f. Record drawings have been prepared and are included in Appendix C.

1.4.5.2 The site of the Infiltration and Recirculation Wetland was prepared, and a perimeter embankment was constructed around the feature.

- a. Soil was excavated from the site of the Infiltration and Recirculation Wetland and from adjacent project-owned lands to construct the perimeter embankment.
- b. A new pump platform was constructed and a pump and flowmeter were installed and connected to deliver water from the Infiltration and Recirculation Wetland to the SWD distribution system.
- c. Existing vegetation was preserved within the wetland area and established on the perimeter embankment.
- d. Record drawings were prepared and are included in Appendix C.

1.4.5.3 A new gate was installed at the inlet to the forty-eight (48)-inch pipe that conveys water from Turner Slough through the flood control levee.

- a. A new gate housing was constructed at the inlet to the forty-eight-inch culvert conveying water from Turner Slough through the flood control levee.
- b. Record drawings have been prepared and are included in Appendix C.

**1.4.6 Project Support, Community Involvement, and Acceptance**

1.4.6.1 SWD has provided updates on progress and background information on the project to District directors, the Westside Watershed Coalition, Merquin County Water District and the San Joaquin Valley Drainage Authority (SJVDA) through regular reporting.

1.4.6.2 A User Guide has been developed and is included as Appendix D.

Table 1, below, is a summary of items that have been submitted to the SWRCB Grant Manager for review.

**Table 1. Items Submitted for Review**

Item	Description	% of Work Completed	Date Submitted
Exhibit A – Scope of Work			
1.0	Project Assessment and Evaluation Plan, Monitoring Plans, Quality Assurance Project Plan	—	—
1.1	GPS Locations for monitoring	100%	September 30, 2006
1.2	Project Assessment and Evaluation Plan	100%	October 30, 2006
1.3	Monitoring Plan (MP)	100%	September 26, 2006
1.3	Monitoring Reports	100%	Quarterly
1.4	Quality Assurance Project Plan (QAPP)	100%	March 30, 2007
2.0	WORK TO BE PERFORMED BY GRANTEE		—
2.1	Pre-Project Field Work		—
2.1.4	Obtain landowner agreements	Not applicable	Not applicable

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Item	Description	% of Work Completed	Date Submitted
2.1.6	Map of Project area with locations of Project features, GPS coordinates (latitude & longitude) of key points and a brief summary of results of preliminary field work	100%	September 30, 2006
2.2	Design Plan	100%	December 2006 February 2007
2.2.1	Draft Contingency Plan	100%	December 2006
2.3	Implementation		—
2.3.2	Adaptive Management Plan(s)	Not applicable	Not applicable
2.3.3	Complete photo record (on cd)	100%	With Final Report
2.4	Monitoring		—
2.4.2	Summary of Visual Monitoring	100%	Quarterly
2.4.3	Water and sediment quality and flow monitoring data summary- parameters of immediate concern	100%	Quarterly and Final Reports
2.4.4	Water and sediment quality and flow monitoring data summary- parameters being screened	100%	Quarterly and Final Reports
2.4.6	Collected data	100%	With Final Report
2.5	Project Construction	100%	Quarterly updates
2.5.1	As-built drawings: Inlet flume and outlet devices from Existing Wetland	100%	January 2009
2.5.2	As-built drawings: Infiltration and Recirculation Wetland	100%	January 2009
2.5.3	As-built drawings and Certificate of Completion: Gate	100%	January 2009
2.6	Project Support, Community Involvement, and Acceptance		—
2.6.1	Notice of events, distribution list and outreach materials distributed to participating and supporting entities	100%	Quarterly
2.6.2	Response to outreach	NA	Quarterly or as needed
2.6.3	Draft User guide	100%	March 2010
2.6.3	User guide	100%	May 2010
2.7	Draft and Final Project Reports		—
2.7.1	Draft Project Report	100%	March 2010
2.7.2	Final Project Report	100%	May 2010
Exhibit B – Invoicing, Budget Detail and Reporting Provisions			
1.0	Invoices	100%	Quarterly
5.0	REPORTS		—
5.1	Progress Reports by the twentieth (20 <sup>th</sup> ) of the month following the end of the calendar quarter	100%	Quarterly

Item	Description	% of Work Completed	Date Submitted
5.2	Expenditure/Invoice Projections	100%	Quarterly
5.3	Grant Summary Form	100%	July 2007
5.4	Natural Resource Projects Inventory (NRPI) Project Survey Form	100%	May 2010
Exhibit C – State Water Board General Conditions			
6	Copy of final CEQA/NEPA documentation Adopted Programmatic Mitigated Negative Declaration	100%	March 27, 2006
22	Signed cover sheets for all permits	100%	

**1.5 Techniques used**

Standard techniques were used for constructing this project. Monitoring and operating equipment used for data collection and water level control are modern, automated equipment that enable reliable monitoring of flow and rapid adjustment of water level controls.

**1.6 Partners**

Partners for this project included the Westside Watershed Coalition and the Merquin County Water District.

**2. Monitoring and Management Practices**

Monitoring and management practices for the Stevinson Water District Agricultural Drainage Control Project were developed through a series of documents. These documents include the project Monitoring Plan, Quality Assurance Project Plan (QAPP), Project Assessment and Evaluation Plan (PAEP), and the Design Plan. The Monitoring Plan was developed to define the water quality and flow monitoring program that would be followed during pre-project and post-project conditions to determine the effects of the project on movement of water and key water quality constituents through the project features and on discharges to the San Joaquin River.

**2.1 Monitoring Plan**

The project’s Monitoring Plan details the techniques employed to monitor the volume and quality of water flowing through the wetland system and discharged to the San Joaquin River. The Monitoring Plan outlines the locations and types of testing used to collect water quality and flow measurement data and discusses the following two phases of monitoring activity: Phase 1) pre-project monitoring to develop a baseline for constituent loading and storage capacity in the Existing Wetland, and Phase 2) post-project monitoring of constituent concentrations flowing into the project area and of discharges to the San Joaquin River. All sites referred to in this section are shown on Figure 1.

Pre-Project water quality monitoring was performed at the three locations listed below to investigate existing contaminant loading and flow of SWD's agricultural discharges:

- Site-A – Upstream of the wetland system on Turner Slough
- Site-B – South end of the wetland system
- Site-C – Outflow of wetland system to Turner Slough

In addition to the monitoring sites established for pre-project monitoring, an additional location was determined for monitoring post-project conditions:

- Site-F – West end of the Infiltration and Recirculation Wetland

Analyses of the samples taken pre- and post-project provide data on the following constituents:

- Total dissolved solids (TDS)
- Electrical conductivity (EC)
- Boron
- Nitrate and nitrite nitrogen
- Phosphorus
- Turbidity
- Total suspended solids (TSS)
- Selenium

The Monitoring Plan called for flow monitoring to be implemented in two phases as well. Pre-project flow monitoring was established at two locations:

- Site-A – Upstream of Existing Wetland on Turner Slough
- Site-C – Outflow of the Existing Wetland to Turner Slough

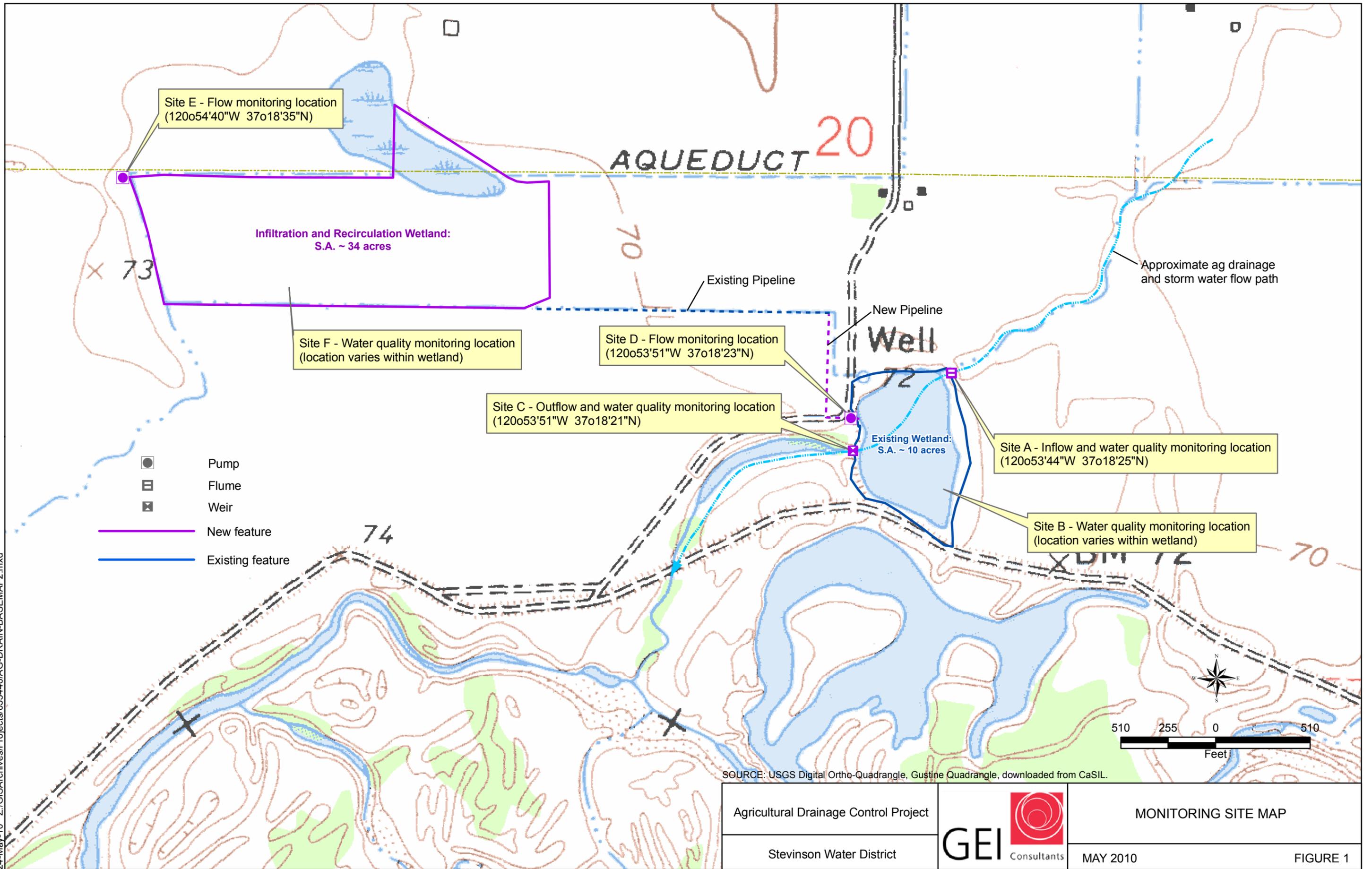
Two additional flow monitoring locations were required to accurately track post-project water movement through the system:

- Site-D – Pumping station in the Existing Wetland
- Site-E – Pumping station at west end of the Infiltration and Recirculation Wetland

Equipment purchased and installed for project monitoring included:

- 1 Hach flow meter (920 AV flow meter with sensors)
- 4 Teleog data recorders
- 3 McCrometer flow meters (16-in, 24-in and 20-in)

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Agricultural Drainage Control Project

Stevinson Water District



MONITORING SITE MAP

MAY 2010

FIGURE 1

- 1 24-in open flow propeller meter
- 1 48-in Rubicon sharp-crested weir master flume gate and meter
- 1 Sierra Controls data logger for Rubicon master flume gate

The complete Monitoring Plan is included as Appendix B of this document.

## **2.2 Quality Assurance Project Plan**

The Quality Assurance Project Plan (QAPP) provides guidelines for quality assurance in the following areas:

- Group A – Project Management
- Group B – Data Generation and Acquisition
- Group C – Assessment and Oversight
- Group D – Data Validation and Usability

Group A – *Project Management* discusses the project management team, regulatory criteria, quality objectives, field sample accuracy, and certifications required.

Group B – *Data Generation and Acquisition* describes the sampling process. Topics covered under this section are:

- Sampling methods
- Handling and custody
- Field and laboratory analytical methods
- Quality control
- Instrumentation and equipment
- Data management

Group C – *Assessment and Oversight* details assessment and response actions and reporting to project management.

Group D – *Data Validation and Usability* describes data validation requirements and methods to be used.

The complete QAPP is included as Appendix E.

## **2.3 Project Assessment and Evaluation Plan**

The Project Assessment and Evaluation Plan (PAEP) details the goals of the Agricultural Drainage Control Project, the activities required to complete the project, and the performance measures and desired outcomes of the project.

The activities described for this project were:

- Project management and administration
- Preparation and implementation of the Monitoring Plan, PAEP and QAPP

- Environmental documentation and permit applications
- Topographic surveying and engineering design
- Construction and installation of necessary facilities
- Preparation of a Users' Guide
- Monitoring and evaluation
- Project support, community involvement and acceptance

The goals of the project are:

1. Manage wetlands and install flow control and measurement facilities to allow for improved management of agricultural drainage and storm water.
2. Reduce loadings of TDS, boron, nitrogen, phosphorus, and sediment associated with agricultural drainage to the San Joaquin River.
3. Control the timing of agricultural drainage discharges so that loadings coincide with periods of high river flow.
4. Create a groundwater mound to obstruct intrusion of saline groundwater from the west side of the San Joaquin Valley.
5. Gain local support and acceptance of the wetland enhancement project as a mechanism for managing agricultural drainage.

The performance of the project with respect to attaining these goals is discussed below.

1. All wetland improvements and flow control and measurement facilities planned for the project were installed and operate as designed.
2. Irrigation drainage water and storm water were captured by the wetland system. Available water quality monitoring data shows that the project was successful in reducing loadings of nitrogen and phosphorus leaving the wetland system due to uptake by wetland vegetation. Sediment loadings were reduced due to deposition of sediment during retention in the wetland. TDS concentrations increased due to evaporation of water from the wetland system during the irrigation season. However, although TDS concentrations increased, no additional salinity was added during residence in the wetland system so loadings of TDS were similar for the pre-project and post-project conditions.
3. All releases from the wetland system have occurred outside of the irrigation season during periods when the flows in the San Joaquin River were adequate to augment the assimilative capacity of the river. Because the winter of 2008 was dry, there were no releases to the river until October of 2009.
4. Groundwater elevation data did not conclusively show a correlation between implementation of the Agricultural Drainage Control Project and groundwater

elevations. Up to this point, any influence the project may have on groundwater elevations is masked by normal seasonal fluctuations of groundwater levels.

5. The project has been implemented at by a small water district that is remote from any population centers. In addition, the project site is accessible only by crossing private property. Although these conditions limited public exposure to and awareness of the enhanced wetland system, the project has been accepted by the community. The project illustrates a highly successful cooperative effort between the State Water Resources Control Board and a small local agency.

Project Performance Measures are outlined below in Table 2.

The complete PAEP is included as Appendix F.

## **2.4 Design Plan**

The Design Plan details the three major design elements: the Existing Wetland, the Turner Slough Western Outlet, and the Infiltration and Recirculation Wetland.

The design criteria outlined in the Design Plan are:

- Anticipated average flow entering and leaving each wetland site
- Maximum flow rates and storage capacity
- Description of instrumentation and hydraulic controls used to maintain water levels and prevent overtopping of the wetland facilities
- Timing of key elements of operation (optimal and acceptable range of water levels within the system) to attain flow management and water quality improvement objectives

**Table 2. Agricultural Drainage Control Project – Project Performance Measures**

<b>Project Goals</b>	<b>Desired Outcomes</b>	<b>Output Indicators</b>	<b>Outcome Indicators</b>	<b>Measurement Tools and Methods</b>	<b>Targets</b>
1. Manage wetlands and install associated flow control and measurement facilities to allow for improved management of agricultural drainage and storm water	Reduce salt loading to the San Joaquin River, contribute to implementing the TMDL for Salinity and Boron in the Lower San Joaquin River	Progress reports, photographs, record drawings and other documentation of progress in construction	Completion of enhanced wetland system	Not applicable	Completion of project facilities
2. Reduce loadings of salt, boron, nitrogen and other contaminants associated with agricultural drainage to the San Joaquin River	Quantifiable reduction in annual loadings of key water quality constituents Reductions in loadings are expected to vary with hydrologic year type.	Laboratory analyses of water quality samples. Recorded volumes of inflows to and releases from the wetland system	Comparison of loadings of key constituents to the wetland system and of loadings released from the wetlands to the San Joaquin River	Standard water quality analysis techniques	Reduction in annual loadings of TDS, boron, nitrate nitrogen, phosphorus and sediment to the San Joaquin River. Target normal year reduction in TDS is 900 tons, a reduction of 84 percent from the existing load. Similar percentage reductions in loadings of other constituents are anticipated during normal years
3. Control the timing of agricultural drainage releases so that releases coincide with periods of high river flow	Contribute to implementing the TMDL for Salinity and Boron in the Lower San Joaquin River and to compliance with water quality standards	Data showing the timing and volume of water released from the wetland system to the San Joaquin River	Use of recorded measurements to compare timing of inflows of agricultural drainage to the wetland system with releases from the system	Spreadsheet analysis of flow data	Elimination of releases of agricultural drainage during the period from May through October
4. Create a groundwater mound to obstruct intrusion of saline groundwater from the west side of the San Joaquin Valley	Impede intrusion of saline groundwater to maintain groundwater quality in the vicinity of the project	Data from monitoring wells showing groundwater levels in the vicinity of the project	1) Use of groundwater monitoring data to compare groundwater levels before and after project implementation 2) Use of water balance to estimate volume of groundwater recharged from the wetland system	Spreadsheet analysis of groundwater elevation data	Development of a groundwater mound under the wetland system
5. Gain local support and acceptance of wetland treatment as a mechanism for managing agricultural drainage	Demonstrate project efficacy to neighboring districts and develop local support for applying this type of management in other suitable locations.	Comments from stakeholders and others familiar with the project	Comparison of comments received early in implementation with those received after the project has become operational	NA	Acceptance of the Agricultural Drainage Control Project for management of agricultural drainage by stakeholders and local water authorities (Merquin County Water District is a partner and the Westside Coalition is a cooperator on this project. Acceptance is a given)

- A Contingency Plan that allows for immediate modification of Project operations or termination of discharge in response to extraordinary circumstances. Such circumstances would include release of storm water to the San Joaquin River in the event that excessive inflows threaten Project facilities and termination of discharge to the river in the event that inflows to the Project are contaminated due to spillage of a prohibited substance.

The complete Design Plan is included as Appendix A.

## **2.5 Operating Guidelines**

During the irrigation season, the wetland system will be monitored and water from the system will be used for supplemental irrigation of 350 acres of district lands using Pumps 1 and 2 and the pump at the Infiltration and Recirculation Basin to convey water between the Wetland System and the district's distribution system. All drainage and canal spillage entering the wetland system will be collected and stored in the system, and none will be released to the river during the irrigation season. In instances where the Existing Wetland is full, surplus water will be pumped to the Infiltration and Recirculation Basin to avoid the need to release water to the river.

Outside of the irrigation season, the wetland system will be monitored daily during periods when flows are known to be entering the wetland. Water levels will be monitored in the Existing Wetland so that when the water level encroaches on the two-foot freeboard of the Existing Wetland, Pump No. 1 and Pump No. 2 will be activated to convey water between the Existing Wetland and the Infiltration and Recirculation Basin. The 48-inch weir at Site C will be used to release water from the Existing Wetland to the river in the event that the Infiltration and Recirculation Basin is full and the system is still receiving water. The Site C weir is set to automatically spill water to the river during occasions when operation of Pump No. 1 and Pump No. 2 does not remove water from the Existing Wetland at a rate adequate to prevent encroachment on the two-foot-high freeboard on the downstream bank of the Existing Wetland levee. The 24-inch spill gate at Site B will be used to release more water to the river whenever the combined capacities of Pump No. 1, Pump No. 2 and the Site C weir are inadequate to prevent water levels from encroaching on the two-foot freeboard of the Existing Wetland.

SWD staff will remotely monitor water levels and movement of water within the wetland system by monitoring inflows to the system, pumping to the Infiltration and Recirculation Basin and to the district's irrigation canals, and releases to the San Joaquin River from the weirs and gates at Site B and Site C. Water levels and flows are to be monitored using remote telemetry units installed at monitoring locations throughout the wetland system which transmit data on water levels and flow rates to the SWD office SCADA system.

Up to this point, SWD experience has been that pumping to control water levels at the Infiltration and Recirculation Basin has not been necessary because evaporation and infiltration from this feature has kept water levels within an acceptable range. Similarly, water storage capacity in the wetland system has been such that no water was discharged from the weir at Site C until October of 2009.

The last element of the project to have been completed has been installation of telemetry to allow flow meter data to be transmitted to the district office and to alert district staff to any problems in data acquisition. The newly installed telemetry should eliminate instances when malfunctioning flow meters or data loggers have gone undetected resulting in failure to capture flow data. Failure to capture or record data has only affected project monitoring; no flows were released to the San Joaquin River without knowledge of the District.

## **2.6 Operating Instructions**

### **2.6.1 Irrigation Season**

During irrigation season, the 48-inch gate controlling flow through the San Joaquin River levee from Turner Slough will be closed, and the Rubicon flume gate controlling releases from the Existing Wetland into Turner Slough will be set at the closed position. A two-foot freeboard will be maintained and will be monitored through the SCADA system from the district office. Water levels will be maintained in the Existing Wetland by pumping water from that location to the Percolation and Infiltration Basin. All water pumped from the Existing Wetland to the Percolation and Infiltration Basin and all water pumped from the Percolation and Infiltration Basin into the District's irrigation system will be measured by the flow meters installed on the project pumps.

No drainage or canal spillage collected in the wetland system is to be spilled to river during the irrigation season. Water collected during this period is to be stored in the Existing Wetland and in the Percolation and Irrigation Basin or put to beneficial use by being pumped into the District's irrigation system. District staff will remotely monitor and record water levels, inflows into the wetland system, pumping of water within the wetland system and discharges from the system through the project SCADA system. The SCADA system is equipped with an external hard drive for backing up project data to prevent loss. The SCADA system is also equipped with an alarm to alert staff should water elevations in the Existing Wetland encroach upon the two-foot freeboard.

### **2.6.2 Non-irrigation Season**

After the irrigation season, the wetland will be monitored daily during periods when flows are known to be entering the system. In monitoring the water entering the wetland, once the two-foot freeboard on the downstream bank of the wetland is being exceeded, the 48-inch gate controlling flow under the San Joaquin River levee will be opened, and the Rubicon flume gate at the Existing Wetland will be used to control

the release of water from the wetland system to the river. The volume and timing of all flows released from the Existing Wetland will be monitored and recorded by the District’s SCADA system. The 24-inch gate at Monitoring Site B on the Existing Wetland will normally be maintained in a closed position but will be opened in the event that inflows of storm water exceed the capacity of the Rubicon flume gate, and additional outlet capacity is required to maintain adequate freeboard within the Existing Wetland.

### 3. Lessons Learned

The Agricultural Drainage Control Project was a highly successful model for cooperation between the Central Valley Regional Water Quality Control Board and a local water management agency. In spite of the uncertainties that resulted from the impact of the state’s budget crisis on project funding and schedule, the Stevinson Water District successfully completed construction under budget and on schedule.

The project has been successful in capturing agricultural drainage flowing from district lands and containing this water so that no outflow has occurred until after the irrigation season. Overall, the project has produced a positive, long-term approach to management of agricultural drainage that will reduce contaminant loadings to the San Joaquin River and restrict discharges from this area to the winter when the assimilative capacity of the river is high. In addition, the project has water level and flow monitoring features and control capabilities adequate to support real-time operation of the wetland system.

Water quality monitoring data collected at all monitoring sites has been provided to the Grant Manager. The following summary analysis focuses on two locations, Site A – at the inlet to the Existing Wetland and Site B – at the south end of the Existing Wetland. Table 3 shows average concentrations of three constituents measured at these two locations.

**Table 3. Average Concentrations of Constituents (mg/l)**

<b>Location/Constituent</b>	<b>Nitrate</b>	<b>TDS</b>	<b>TSS</b>
<b>Site A</b>	1.068	371	32.0
<b>Site B</b>	0.870	717	22.6

The averages presented in Table 2 include a range of observed values with individual readings being shown on Figures 2 through 7. Viewed together, the water quality data from these two locations demonstrate that during the sampling period, which extended from September 2007 through October 2008, the project performed largely as envisioned. It should be noted that the sampling period encompassed 14-months when inflows to the project were sufficiently high to justify monthly sampling during the irrigation season. During the 2009 irrigation season, due to low water deliveries, little agricultural drainage flowed to the wetlands, and water quality sampling was suspended.

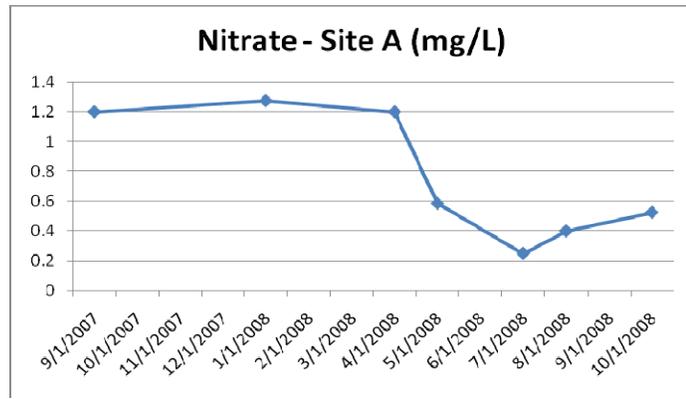


Figure 2 – Nitrate nitrogen concentrations (inflow to project area)

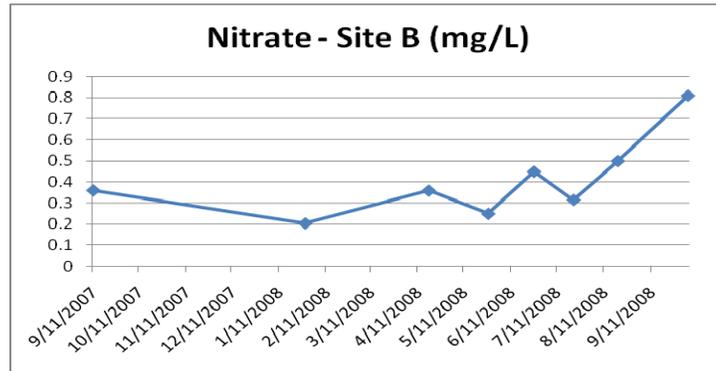


Figure 3 – Nitrate nitrogen concentrations (south end of Existing Wetland)

The average nitrate nitrogen values shown in Table 2 indicate average concentrations at Site B lower than those at Site A, probably because of uptake of nitrogen by plants during the time water is resident in the wetland. Figure 2 indicates inflow nitrate concentrations were highest before the irrigation season, dropped during the April through July readings and began to climb during the August and October readings.

Nitrate levels at Site B are generally lower than at Site A and remain relatively constant throughout the sampling period. The one exception is the last sample (September 2008) which is the highest reading at this location and is higher than inflow values measured at Site A during the fall. The cause of this high reading has not been determined.

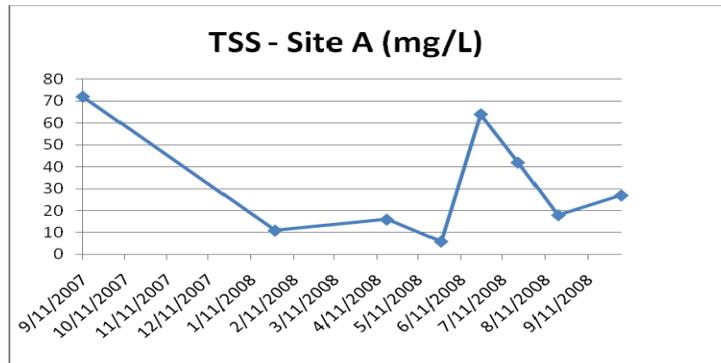


Figure 4 – TSS concentrations (inflow to Project area)

TSS concentrations in inflow to the Project area are heavily influenced by the timing of the sampling. Monthly samples were taken during the irrigation season when there is little rainfall runoff. The one winter sample was taken during a dry period when inflow to the basin due to rainfall runoff was low and transported little suspended sediment. Although the TSS concentrations in inflow samples are highly dependent on the timing of the sampling relative to a runoff event, the average TSS concentrations in inflow, as expected, are higher than the average concentrations at Site B due to deposition of suspended sediment during residence in the wetland.

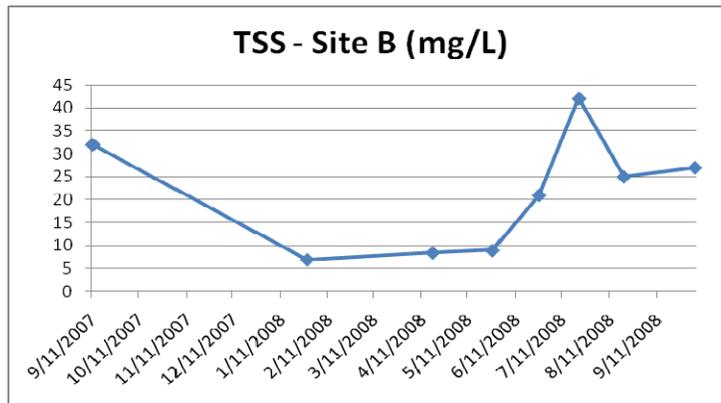


Figure 5 – TSS concentrations (south end of Existing Wetland)

The TSS samples plotted in Figure 5 were taken concurrently with those plotted in Figure 4 and result in a pattern similar to that of Figure 4 but with somewhat lower values. This is the expected outcome due to settling of sediment in the wetland and mixing of the inflow with water that has resided in the wetland for some time.

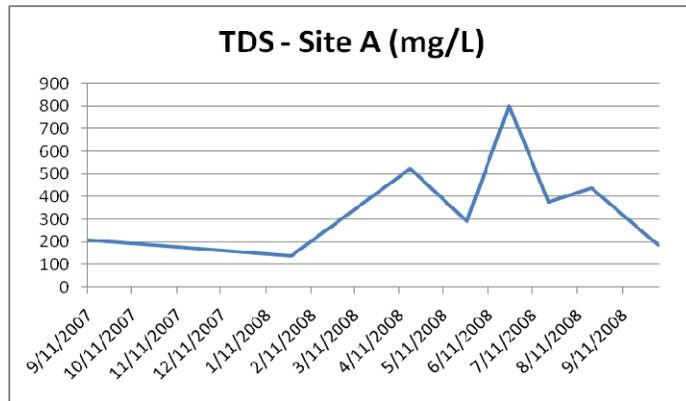


Figure 6 – TDS concentrations (inflow to Project Area)

With respect to TDS, Figure 6 shows low TDS levels associated with inflow measurements outside of the irrigation season as would be expected from inflow resulting largely from rainfall. By contrast, measurements taken during the irrigation season show higher concentrations of TDS as would be expected from inflow whose source is primarily irrigation return flow. The average values presented in Table 2 suggest that evaporation from the wetland surface and transpiration by vegetation tended to reduce water volumes and increase concentrations of TDS recorded in the wetland system. TDS concentrations at Site B appear to be more stable than the inflow values. Concentrations at Site B climb at the end of the 2008 irrigation season as evaporation from the water surface concentrates TDS and as inflow volumes decline.

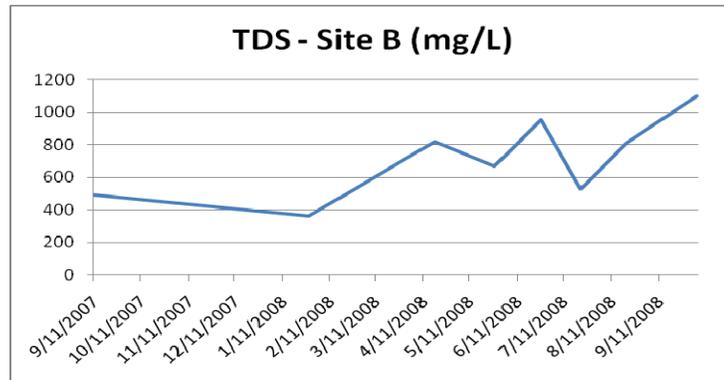


Figure 7 – TSS concentrations (outflow from Existing Wetland)

#### 4. Project Support, Community Involvement and Acceptance

The Agricultural Drainage Control Project was carried out by the Stevinson Water District without direct involvement from other parties. Because of the Stevinson Water District’s small size, distance from major communities and agricultural nature, little emphasis was placed on promoting the project and community involvement was focused on interactions with neighboring agricultural entities. The West Side Watershed Coalition provided advice early in the project and receives data on flow

and water quality including the results of laboratory analysis. The Merquin County Water District has received periodic reports on project status.

Because the project is now fully implemented, there is no necessity to promote or publicize the results of the project to achieve additional implementation. However, the District would be happy to support the SWRCB or other interested agencies who wish to identify this project as an example of a successful collaborative effort to control agricultural drainage discharges.

## 5. Project Funding

### 5.1 Projected Budget vs. Actual Budget

The project was funded by a grant from the Central Valley Regional Water Quality Control Board's Agricultural Water Quality Grant Program. Funding for the project was provided by the State Water Resources Control Board and came from Proposition 50, the Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002. The level of funding required for project construction was less than the funding available under the grant enabling the project to be completed and all project features installed for a total cost below the grant amount of \$603,000. As of April 30, 2010, total expenditures on the project have been \$497,553.41.

### 5.2 Outside Funding

The project was supported entirely by the Agricultural Water Quality Grant Program and received no funding from other sources.

## 6. Planned/Potential Follow-up Projects

Currently there are no planned follow up projects to the Agricultural Drainage Control Project for Stevinson Water District as the project was scaled to meet the water management objectives of the District and because the availability of land suitable for expansion of the project is limited. However, the successful completion of this project within the planned schedule and budget suggests that this project could be used as a model for similar projects to control agricultural drainage to the San Joaquin River.

## 7. Environmental Compliance and Permitting Requirements

### **Environmental compliance for this project included:**

- A Programmatic Mitigated Negative Declaration for the Integrated Water Resources Plan was filed on December 12, 2005 and a Notice of Determination was filed on March 27, 2006. These documents are filed under State Clearinghouse Number

2005121175. The Environmental Checklist Form for this filing is presented in Appendix G.

- A Storm Water Pollution Prevention Plan (SWPPP) was prepared for the project and filed under WDID 5F24C350710. The Notice of Termination for this SWPPP was issued on April 4, 2009.



## Agricultural Drainage Control Project

Final Report  
Agricultural Water Quality Grant Program

Submitted to the  
State Water Resources Control Board  
June 2010