

# **Improving California Central Valley Watersheds: Selenium Control Program - Reducing Selenium in the San Joaquin River and the Aquatic Environment Through Unique Federal/State/Local Cooperation**

REPORTING WATERSHED IMPROVEMENT (SP 12) – Reporting Watershed Improvement  
Based on Impairment Removal (Option 1)

***Executive Summary*** – **Thirteen sub-watersheds of the San Joaquin River have been significantly improved by reducing selenium impairments.** Farmland irrigation of seleniferous soils within the Grasslands Watershed on the west side of the San Joaquin River basin generates subsurface drainage with high levels of selenium. Historically, this drainage was routed through wetland areas before being discharged to the San Joaquin River. As a result, the Grasslands marshes and a portion of the San Joaquin River were placed on California’s Clean Water Act (CWA) section 303(d) (CWA 303[d]) list of impaired waters in 1988 for exceeding selenium water quality objectives, followed by the listing of two local tributaries, Mud Slough (northern reach) and Salt Slough, in 1990. The Grasslands Bypass Project (Project) rerouted the drainage through the San Luis Drain, bypassing sensitive wetland areas, immediately bringing Salt Slough into compliance with selenium water quality standards and significantly reducing the frequency of exceedances within the Grassland Marshes. The project also implemented field and district-level best management practices (BMPs) and area-wide measures to reduce total selenium loading. These efforts led to the CWA 303(d) selenium de-listing of Salt Slough (10 miles) in 2008 and three segments of the San Joaquin River in 2010: Merced River to Tuolumne River (29 miles), Tuolumne River to Stanislaus River (8.4 miles), and Stanislaus River to the Delta Boundary (3 miles), totaling 50.4 river miles improved.

## ***Watershed Information***

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C. Project Title: Improving California Central Valley Watersheds: Selenium Control Program - Reducing Selenium in the San Joaquin River and the Aquatic Environment Through Unique Federal/State/Local Cooperation

D. Number of Watersheds Improved

1. Jones Drain- Merced River (180400080803)
2. San Joaquin River (180400020202)
3. Pear Slough – San Joaquin River (180400020205)
4. Lake Ramona – San Joaquin River (180400020403)
5. Turlock Lake (180400020404)
6. Kern Canyon – San Joaquin River (180400020405)
7. Shiloh Bridge – Tuolumne River (180400091403)
8. Lower White Lake – San Joaquin River (180400020405)
9. Riley Slough (180400100705)
10. Miller Lake ( 180400100704)
11. Boscha Lake (Historical) – Stanislaus River (180400100706)
12. Red Bridge Slough – San Joaquin River (180400030202)
13. Walthall Slough – San Joaquin River (180400030203)

### ***Historic Conditions***

The 360,000 acre Grasslands watershed (Attachment 1) in California’s Central Valley contains the largest freshwater wetland ecosystem in California (the “Grasslands Ecological Complex”). Historically sustained by overflow from the San Joaquin River (River), these wetlands are now hydrologically separate from the River and receive water supplies via channels within a system that also serves over 97,000 acres of agriculture within the watershed.

The Grasslands watershed is located on the west side of California’s San Joaquin River Basin, where irrigation has mobilized selenium in the soil, along with other trace elements and salts. These salts build up in the shallow ground water in areas with poor natural drainage, resulting in crop damage. Agricultural tile drains capture this subsurface water and generate surface drainage water (drainage) containing salts and other contaminants; selenium concentrations are as high as 500 µg/L.<sup>1</sup>

To avoid build-up of ground water in the crop root zone, farms collect and pump drainage that, due to local soil conditions, has high concentrations of selenium. Prior to the Project, the drainage was routed to the River through channels used seasonally for water supplies to the wetlands. Effectively, the drainage commingled with fresher supplies. The presence of selenium was known, but its potential to cause defective development in wildlife and fish (teratogenic effects) was not recognized until the discovery in the 1980s of deformed waterfowl at Kesterson National Wildlife Refuge, a terminal reservoir for drainage.

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<sup>1</sup> Central Valley Regional Water Quality Control Board, Selenium TMDL for the San Joaquin River (2001). Annual mean values ranged between 40 and 60 µg/L.

In 1988, responding to new information on selenium risk, the State placed the Grasslands marshes on the Clean Water Act 303(d) List. This was followed in 1990 by selenium listings for a portion of the River downstream of the agricultural discharges and two local tributaries, Mud Slough (northern reach) and Salt Slough. The Central Valley Regional Water Quality Control Board (CVRWQCB) also amended its regulatory policies regarding drainage management by requiring future actions to emphasize irrigation management and to route selenium away from wetland supply canals during seasonal flood-up.

Incentive to carry out these policies crystallized in 1992, when the Central Valley Project Improvement Act<sup>2</sup> established that the supply-scarce wetlands were entitled to water from the federal Central Valley Project. By this time, the current freshwater quality standards for selenium were in place: 5 µg/L (four day average) in the San Joaquin River and Mud Slough, and, to protect sensitive threatened and endangered species, 2 µg/L (monthly mean) in the Grassland wetland channels and Salt Slough.

### ***Description of 2002 Baseline Condition***

The CVRWQCB included the Grassland Marshes and the Lower San Joaquin River in its 2002 CWA 303(d) List of Impaired Water Bodies (303[d] List) due to elevated levels of selenium causing impairments of the aquatic life freshwater habitat designated use (beneficial use)<sup>3</sup>.

The areal extent of the Grassland Marshes impairment was listed as 8,224 acres in 1988 as part of the water quality assessment and 303(d) listing process. The original basis for determining the extent of impairment is not available. As part of its 1996 amendments to the Water Quality Control Plan for the Regional Water Quality Control Board - Central Valley Region (Basin Plan), the CVRWQCB re-evaluated the miles of wetland channels and the extent of wetland acreage impaired or threatened by selenium contamination. The CVRWQCB determined that approximately 75 miles of wetland supply channels and 61,810 acres of wetland marshes were impaired or threatened by elevated selenium concentrations in agricultural subsurface drainage water. Attachment 1 provides maps of the Grassland Bypass Project.

The San Joaquin River was listed for exceeding selenium water quality objectives. Areal extent of the impairment was listed as 50 river miles from the Salt Slough confluence to the Airport Way Bridge near Vernalis. The water quality limited segment was first listed in 1990. The source of the selenium is from subsurface agricultural return flows from the Drainage Project Area of the Grassland Watershed. Since the original 1990 listing, the 50 river miles from the Salt Slough confluence to the Airport Way Bridge near Vernalis has been broken up into smaller river segments.

CVRWQCB identified various other pollutants in the selenium-impaired segments within the Grasslands Marshes and lower San Joaquin River in its 2002 303(d) List<sup>4</sup>. In addition to

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<sup>2</sup> Central Valley Project Improvement Act (PL 102-575).

<sup>3</sup> [http://www.waterboards.ca.gov/water\\_issues/programs/tmdl/docs/2002reg5303dlist.pdf](http://www.waterboards.ca.gov/water_issues/programs/tmdl/docs/2002reg5303dlist.pdf)

<sup>4</sup> [http://www.waterboards.ca.gov/water\\_issues/programs/tmdl/docs/2002reg5303dlist.pdf](http://www.waterboards.ca.gov/water_issues/programs/tmdl/docs/2002reg5303dlist.pdf)

selenium the waters were listed as impaired for electrical conductivity, boron, chlorpyrifos, diazinon, unknown toxicity, mercury, Group A pesticides (e.g.; aldrin, endrin, heptachlor, heptachlor epoxide, hexachloreyclohexane [including lindane], endosulfan, and toxaphene) and DDT.

The list below includes river segments within the Lower San Joaquin Basin on the 2002 303(d) List for selenium impairments and the watersheds that contribute runoff to the impaired river segments. The watersheds are United States Geological Survey 12-digit hydrologic units (USGS 12-digit HUCs), the smallest watersheds mapped by USGS, see Figure 1.

- A. San Joaquin River** from the confluence of the Mud Slough to the Sacramento – San Joaquin Delta boundary
1. San Joaquin River from the confluence of Mud Slough to the confluence of the Merced River
    - Shag Slough – San Joaquin River (180400012103)
    - Jones Drain – Merced River (180400080803)
  2. San Joaquin River from the confluence of the Merced River to the confluence of the Tuolumne River
    - Jones Drain – Merced River (180400080803)
    - San Joaquin River – (18400020202)
    - Pear Slough – San Joaquin River – (180400020205)
    - Lake Ramona – San Joaquin River – (18400020403)
    - Turlock Lake – (180400020404)
    - Kern Canyon – San Joaquin River – (180400020405)
    - Shiloh Bridge – Tuolumne River – (180400091403)
  3. San Joaquin River from the confluence of the Tuolumne River to the confluence of the Stanislaus River
    - Shiloh Bridge – Tuolumne River – (180400091403)
    - Lower White Lake – San Joaquin River – (180400030202)
    - Riley Slough – (180400100705)
    - Miller Lake – (180400100704)
    - Boscha Lake (Historical) – Stanislaus – (180400100706)
    - Red Bridge Slough – San Joaquin River – 180400030202)
  4. San Joaquin River from the confluence of the Stanislaus River to the Delta Boundary
    - Boscha Lake (Historical) – Stanislaus – (180400100706)
    - Red Bridge Slough – San Joaquin River – (180400030202)
    - Walthall Slough – San Joaquin River – (180400030203)

### ***Evidence of Watershed Approach***

#### **A. Area of Effort**

The Grassland Watershed is a valley floor sub-basin of the San Joaquin River Basin. The portion of the watershed for which agricultural subsurface drainage policies and regulations apply covers an area of approximately 370,000 acres and is bounded on the north by the alluvial fan of Orestimba Creek and by the Tulare Lake Basin to the south. The San Joaquin River forms the eastern boundary and Interstate Highway 5 forms the approximate western boundary. Cities within the area include Firebaugh, Los Banos, Dos Palos and Newman.

The San Joaquin River Basin is the largest single river basin in California, covering 31,800 square miles. The watershed is bounded by and drains the Sierra Nevada, Coast Range, and Tehachapi mountains, and ends at its confluence with the Sacramento River, forming the Sacramento-San Joaquin Delta and flowing to the San Francisco Bay, the largest estuary on the west coast of North America. Until the early 1900s, the San Joaquin River Valley sustained a rich mosaic of ecological types and landscapes: grasslands, riparian, and wetlands interspersed among complex and highly-varied river and tributary systems that in turn supported immense resident and migratory bird populations, large ungulate and top predator species, and multiple runs of Chinook salmon that spawned in foothills to the north. The now dry Tulare Lake to the south was an occasional tributary to the River: it was a 13,670 square mile lake, wetland, grassland, and stream system which supported its own vast terrestrial, avian and aquatic populations. It was the second largest freshwater lake in the nation, receiving water from the Kern, Tule, Kaweah, and Kings Rivers.

The natural hydrology of the River Basin has been drastically altered in the last century by large-scale water impoundments, diversions, and flood bypasses. The River conveys water coming from the Sacramento River, as well as tributary flows bypassing their normal flow patterns, that are not timed with natural flood or snow melt cycles. The River corridor is presently managed for land uses which are dominated by highly productive irrigated agriculture and managed wetlands providing important waterfowl habitat along the Pacific Flyway. The River channel itself is managed to convey supply water and to remove drainage. The reach of the River between Mud Slough and the Merced River carries largely agricultural and wetland drainage water, due to local surface and groundwater withdrawals.

These modifications to the natural hydrology have led to a loss of assimilative capacity in the River segment upstream of the confluence with the Merced River, making water quality standards difficult to achieve. Lack of flow and changes in stream flow composition have clear impacts on the River's ability to support its designated beneficial uses of aquatic and wetland habitat. Additionally, the alluvial fans of the southwestern portions of the watershed contain naturally-occurring salts and selenium, which can be mobilized through irrigation practices. The resulting drainage can lead to additional impacts on beneficial uses of surface waters and wetlands if not properly regulated. Further, the dependence of agricultural and wetland uses on water supplies via manmade delivery systems has led to the disconnection of current land uses from the watershed's ability to support these uses, along with the degradation of the River's value to local communities.

## B. Regulatory and Funding Agencies

The Project was initially conceived in the early 1990s, as one component of the multi-agency San Joaquin Valley Drainage Implementation Program.<sup>5</sup> EPA's promulgation of more stringent selenium criteria in 1992 (5 µg/L chronic exposure), followed by State adoption of this standard in 1996, have influenced compliance strategy and timing because of limited assimilative capacity in the River. Since 1998, the Grassland Area farmers have been focused on achieving the water quality objectives set forth by the Basin Plan, related to subsurface drainage discharges from the drainage area, while maintaining viable agricultural production in the area. The Project coordinates irrigation and drainage management at the district and regional level to control the discharge of selenium.

1. **Central Valley Regional Water Quality Control Board<sup>6</sup>** is responsible for protecting water quality under the state Porter-Cologne Water Quality Control Act and the federal CWA by implementing regulatory programs and supporting watershed activities. The CVRWQCB adopted, and incorporated into their Basin Plan, three selenium total maximum daily loads (TMDLs) – for the Grasslands marshes, Salt Slough, and the San Joaquin River; a plan to implement these TMDLs in a coordinated manner; and Waste Discharge Requirements (WDRs) that enforce load limits. The 1996 Basin Plan selenium control program had three parts: first, by re-routing drain water, water quality objectives would be attained in the wetland supply channels and Salt Slough; next, improved management practices would achieve selenium objectives in the main stem of the San Joaquin River below the Merced River; and finally, by October 2010, additional load reductions would bring Mud Slough and a lower flow portion of the San Joaquin River (above the Merced River confluence) into compliance. The goals of the first two parts have been achieved, but in 2010 the CVRWQCB adopted a Basin Plan amendment allowing more time to achieve compliance in Mud Slough and the San Joaquin River from Mud Slough to the Merced River confluence. Discharges not meeting water quality objectives after 2019 will be prohibited.
2. **US Environmental Protection Agency (EPA)<sup>7</sup>** EPA provides technical and financial support for implementing CWA requirements including monitoring, assessment and TMDL development. Financial assistance is also provided to the State under CWA Section 319 (CWA 319) to develop and implement the [California Nonpoint Source Pollution Control Program \(NPS Program\)](#), which includes sub-awards to support water quality improvement projects. CWA 319 funding was used to develop a

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<sup>5</sup> In response to the problems at Kesterson, a group of federal and state agencies, including the U.S. EPA, participated in development of a drainage report issued in 1990. See "Final Report of the San Joaquin Valley Drainage Program," September 1990 (US Department of the Interior and California Resources Agency). This was followed in 1992 by a multi-agency implementation program. Although not a signatory to this program, in 1992 EPA pursued a national rulemaking promulgating a 5 µg/L (4 day average) criterion for selenium. EPA subsequently disapproved the State's 10 µg/L objective for effluent-dominated water bodies upstream of the Merced River.

<sup>6</sup> <http://www.waterboards.ca.gov/centralvalley/>

<sup>7</sup> <http://www.epa.gov/>

trading system for selenium that is a successful example of managing nonpoint source pollution. This system, operated by local water agencies served by the Project, aims to comply with load limits for selenium discharge and sets fees for exceeding the limits. Stakeholders set selenium load allocations efficiently among the participants and have flexibility in approaches to meeting load targets. Compliance is measured at points where drainage leaves the participating districts.

3. **US Bureau of Reclamation (Reclamation)**<sup>8</sup> – established an agreement (Use Agreement<sup>9</sup>) with local water agencies for the use of the federal San Luis Drain that sets the terms and conditions that must be met in rerouting the selenium-laden agricultural drainage water around sensitive wetlands. The provisions in the Use Agreement were the result of negotiations between Reclamation, the Grassland Area Farmers and other interested parties, including the Environmental Defense Fund, CVRWQCB, EPA, wetland operators, and other downstream water users. Reclamation also provides funding assistance through their San Joaquin River Salinity Management Program. In 2010, the San Luis and Delta-Mendota Water Authority received \$10.3 million from Reclamation.
4. **Local water agencies working through the San Luis and Delta-Mendota Water Authority (Grassland Area Farmers)**<sup>10</sup> – coordinate irrigation and drainage management at the district and regional level to control the discharge of selenium. This group signed the Use Agreement with Reclamation and is regulated by Waste Discharge Requirements (WDRs) issued by the CVRWQCB. Activities include providing low interest loans to landowners for the improvement of irrigation systems, lining delivery canals to reduce seepage into the groundwater and using drainage water to irrigate salt-tolerant crops grown on district-owned and operated lands.
5. **California Department of Water Resources**<sup>11</sup> – provides technical assistance in drainage management and reduction, and in 2007 approved \$25 million in state proposition bond funds
6. **California State Water Resources Control Board (State Board)**<sup>12</sup> – has provided approximately \$20 million in low interest loans through the CWA State Revolving Funds for subsurface water recirculation projects and irrigation system improvements at both the field and district levels. The State Board also develops and administers the California NPS Program through a combination of regulatory and non-regulatory approaches, addressing improved management of pollution from agriculture, livestock and grazing, forestry, marinas and recreational boating, hydromodification, and on-site disposal systems, as well as protection of streams, wetlands, and riparian

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<sup>8</sup> <http://www.usbr.gov/mp/grassland/>

<sup>9</sup> [http://www.swrcb.ca.gov/centralvalley/water\\_issues/grassland\\_bypass/gbp\\_2010\\_2019\\_use\\_agree.pdf](http://www.swrcb.ca.gov/centralvalley/water_issues/grassland_bypass/gbp_2010_2019_use_agree.pdf)

<sup>10</sup> <http://www.sldmwa.org/>

<sup>11</sup> <http://www.water.ca.gov/>

<sup>12</sup> <http://www.swrcb.ca.gov/>

areas. The NPS Program seeks to improve the State's ability to effectively manage nonpoint source pollution and conform to the requirements of the CWA and the Federal Coastal Zone Act Reauthorization Amendments of 1990.

### C. Key Stakeholders

The Project is reviewed and managed by a Drainage Oversight Committee (DOC) made up of representatives from the US Bureau of Reclamation (Reclamation), US Fish and Wildlife Service (USFWS), EPA, California Department of Fish and Game (CDFG), and CVRWQCB. The DOC reviews progress and operation of the project including drainage reduction goals, progress in achieving water quality objectives, monitoring data, etc. It makes recommendations to the GAF, Reclamation, and/or the Regional Board, as appropriate, regarding all aspects of the Project, including modifications to operations, appropriate mitigative actions, and termination of the Use Agreement if necessary. The DOC also carries out other functions such as determining the occurrence and extent of load exceedances, setting fees and remedies for noncompliance with the Use Agreement, and selecting projects to be funded from a Drainage Incentive Fee Account.

The Project is supported by monitoring and assessment following a single, comprehensive plan to track project compliance, trends in water and sediment quality, toxicity and presence of selenium in biota. Implementation of the plan is shared across state and federal agencies, and overseen by a Technical and Policy Review Team and Data Collection and Reporting Team in which EPA and the agencies listed below participate. Information is available to the public on the web: <http://www.sfei.org/grassland/>.

1. **US Bureau of Reclamation**<sup>13</sup>: Reclamation convenes the Data Collection and Reporting Team on a quarterly basis, funds a portion of Project monitoring related to selenium sampling, and coordinates collection of sediment data with the GAF.
2. **US Fish and Wildlife Service**<sup>14</sup>: The USFWS works with States, local communities, and other Federal agencies to ensure that any water quality standards they set are protective of fish and wildlife. At the time of the 1988 303(d) listing, 2 µg/L was the USFWS recommended selenium criteria to protect waterfowl and other wildlife uses. The USFWS and Reclamation serve on the Project's Data Collection and Reporting Team and Technical and Policy Review Team.
3. **United States Geological Survey (USGS)**<sup>15</sup> USGS provides data throughout the project area through stationary stream gauges, and have published reports on the chemical and biological processes specific to irrigation-induced water quality problems in selenium-enriched areas.

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<sup>14</sup> <http://www.fws.gov/>

<sup>15</sup> <http://www.usgs.gov/>



4. **United States Environmental Protection Agency<sup>16</sup>** - EPA provides technical assistance, quality assurance/quality control, and program oversight for toxicity testing.
5. **California Department of Fish and Game<sup>17</sup>** - Since 1993, CDFG has been implementing the bio-monitoring portion of the Compliance Monitoring Program.
6. **San Francisco Estuary Institute (SFEI)<sup>18</sup>** – All entities collecting data for the Project are responsible for providing their data to the SFEI, which, through a cooperative agreement with Reclamation, serves as the overall data manager.

#### D. Watershed Plans

1. The *Basin Plan Amendment for the Control of Subsurface Agricultural Drainage* (1996)<sup>19</sup>. The Amendment put in place the current selenium objectives<sup>20</sup> and the implementation plan that considered, in addition to irrigation management, land retirement and treatment of drainage water might be considered. As part of this amendment, the Project was developed to divert agricultural subsurface drainage around wetlands to a discharge point on Mud Slough, six miles above the confluence with the San Joaquin River. By directing drainage into the San Luis Drain, a single, concrete-lined “bypass,” selenium load reductions were achieved in the wetland channels and Salt Slough.
2. The *Long-Term Drainage Management Plan: Annual Update (2010)*<sup>21</sup>. The original 1998 plan and subsequent yearly updates are developed by the dischargers pursuant to the Project waste discharge requirements. The plan describes irrigation and drainage management at the district and regional level within the Grassland Watershed to control the discharge of selenium to achieve water quality objectives.
3. The *Westside Regional Drainage Plan (2003)*<sup>22</sup> is a stakeholder-developed plan that identifies projects that can be implemented in conjunction with the San Luis Unit Drainage Program (Reclamation) to control drainage problems on the west side of the San Joaquin Basin. The area addressed in this plan would curtail discharge to the San Joaquin River.
4. The *California Regional Water Quality Control Board, Central Valley Region, Total Maximum Daily Load for Selenium in the Lower San Joaquin River (Aug*

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<sup>16</sup> <http://www.epa.gov/>

<sup>17</sup> <http://www.dfg.ca.gov/>

<sup>18</sup> <http://www.sfei.org/book/export/html/2427>

<sup>19</sup> [http://www.waterboards.ca.gov/centralvalley/water\\_issues/grassland\\_bypass/r5-1996-0147.pdf](http://www.waterboards.ca.gov/centralvalley/water_issues/grassland_bypass/r5-1996-0147.pdf)

<sup>20</sup> Selenium objectives: 2 ppb in Salt Slough and wetland water supply channels; 5 ppb River and Mud Slough

<sup>21</sup> [http://www.waterboards.ca.gov/centralvalley/water\\_issues/grassland\\_bypass/2010\\_longterm\\_drainage\\_plan.pdf](http://www.waterboards.ca.gov/centralvalley/water_issues/grassland_bypass/2010_longterm_drainage_plan.pdf)

<sup>22</sup> [http://www.swrcb.ca.gov/rwqcb5/water\\_issues/salinity/library\\_reports\\_programs/westsd\\_regnl\\_drng\\_plan\\_may2003.pdf](http://www.swrcb.ca.gov/rwqcb5/water_issues/salinity/library_reports_programs/westsd_regnl_drng_plan_may2003.pdf)

2001)<sup>23</sup> outlines load allocations that will be implemented for the Project to reduce the selenium impairment in the River. The CVRWQCB adopted the EPA aquatic life criterion for total selenium of 5 µg/L four-day average as the selenium water quality objective for the lower San Joaquin River.

5. The *California Regional Water Quality Control Board, Central Valley Region, Selenium TMDL for Grassland Marshes (April 2000)*<sup>24</sup> sets the loading capacity at 2 ppb selenium as the monthly mean and sets a load allocation (no NPDES sources) of 0 lbs selenium.
6. The *California Regional Water Quality Control Board, Central Valley Region, Selenium TMDL for Salt Slough (1999)*<sup>25</sup> sets the loading capacity at 2 ppb selenium as a monthly mean and sets a load allocation (no NPDES sources) of 0 lbs selenium. The allocations for the surface drainage, wetlands discharge and groundwater accretions are not necessary since they are not significant sources and are consistently found to be less than 2 ppb.

## E. Restoration Work

The State Board placed the Grasslands marshes on the 303(d) List in 1998, followed by selenium listings for a portion of the San Joaquin River downstream of Mud Slough and Salt Slough. The 1996 Basin Plan Amendment required future actions to consider irrigation management, routing selenium away from wetland supply canals during seasonal flood-up, land retirement, and drainage treatment systems.

### Organization and Accountability

Effective response to the drainage problem required organizing on a scale that could address the hydrologic connectivity of the surface and groundwater within the watershed. Thus, a significant initial step was agreement among the Grassland Area Farmers (GAF) to form a regional entity that would manage the subsurface drainage within the “Grassland Drainage Area.”<sup>26</sup> Five federal and state agencies provide technical and `project oversight.<sup>27</sup>

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<sup>23</sup>[http://www.waterboards.ca.gov/centralvalley/water\\_issues/tmdl/central\\_valley\\_projects/san\\_joaquin\\_se/se\\_tmdl\\_rpt.pdf](http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/san_joaquin_se/se_tmdl_rpt.pdf)

<sup>24</sup>[http://www.waterboards.ca.gov/centralvalley/water\\_issues/tmdl/central\\_valley\\_projects/grasslands\\_se/grasslands\\_se\\_tmdl.pdf](http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/grasslands_se/grasslands_se_tmdl.pdf)

<sup>25</sup>[http://www.waterboards.ca.gov/centralvalley/water\\_issues/tmdl/central\\_valley\\_projects/salt\\_slough\\_se/salt\\_slough\\_se\\_tmdl.pdf](http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/salt_slough_se/salt_slough_se_tmdl.pdf)

<sup>26</sup> The San Luis and Delta-Mendota Water Authority serves as the ‘umbrella agency’ for the districts participating in the Project. The districts are Broadview Water District, Charleston Drainage District, Firebaugh Canal Water Districts, Pacheco Water District, Panoche Drainage District, Widren Water District, and the Camp 13 Drainers (an association of landowners located in the Central California Irrigation District). These districts are collectively referred to as the ‘drainers.’

<sup>27</sup> The Oversight Committee comprises the U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, U.S. EPA, California Department of Fish and Game, and the CVRWQCB. Additionally, the San Luis and Delta-Mendota Water Authority assists in representing the participating districts; the USGS provides technical support; and Environmental Defense Fund staff have been active in the project.

### Regulatory Framework

CVRWQB's regulatory framework and Reclamation's management approach are the driving forces behind the Project. In 1996 an amendment to the Basin Plan included a prohibition of discharge of agricultural subsurface drainage unless water quality objectives for selenium are met, or the discharge is regulated by WDRs – a permit issued by the CVRWQCB under California's Porter-Cologne Act. The WDRs for the Grasslands Project was initially adopted in 1998. They were updated in 2001 and are in the process of being updated again to reflect Basin Plan amendments adopted in 2010. After 2019, discharges not meeting water quality objectives will be prohibited. The technical analysis and implementation plan to meet selenium objectives are set out in coordinated selenium TMDLs for the Grassland Marshes, Salt Slough, and the San Joaquin River.

The Project has also been supported by commitments set out in a Use Agreement between Reclamation and the Authority allowing use of a portion of the federal San Luis Drain to capture the selenium-rich subsurface drainage from the Project Area. This Agreement establishes load targets and provides for penalties if load limits are exceeded.

### Implementation

A portion of the San Luis Drain is used to convey the drain water from the agricultural areas, which are up-gradient of the Grasslands marshes, around the wetlands to a discharge point on Mud Slough six miles above its confluence with the San Joaquin River - hence the name, "Bypass Project." Over a 15 year period beginning in 1996, the GAFs implementing the Project have adopted various practices to meet targets for reduced selenium loads to surface waters, such as crop changes and improved irrigation efficiency, water reuse to reduce the volume of drainage water, and facilities to control timing of discharges so that, within allowable loads, the selenium concentration in water is not too high. Pilot projects to treat the drain water have been less successful.

To date, Project participants have invested approximately \$93 million in selenium control activities. A large part of this funding was through State bond measures and federal funds. Through the California NPS Program, CWA Section 319 funding was also used to develop a program within the Project area for trading selenium loads in a structured context. The San Luis Drain Use Agreement recognizes load limits for selenium discharge and sets fees for exceeding the limits. Stakeholders set selenium load allocations among the member districts and have flexibility in approaches to meeting load targets. Trading encourages selection of efficient control measures in a defined area where the hydrologic connection between the drainage districts using the discharge point, and cost and relative effectiveness of specific measures, are sufficiently understood.

Between 1998 and 2009, irrigation and drainage management BMPs implemented by GAF resulted in the removal of over 22,300 pounds of selenium and 80,735 acre-feet of drainage that would have otherwise been discharged into the Mud Slough and the River. A collateral benefit has been reduced salt loading, which helps the basin to comply with its 2004 Salt and Boron TMDL.

### Ongoing Issues

The Project was not able to meet the compliance target date of October 2010. In applying to the State for an extension of the compliance period until 2019, the GAF pointed to delays in funding assistance to test technologies that would remove selenium from drain water.<sup>28</sup> With the prospect of pending funding, the GAF stated that they expected to be able to develop treatment methods that would result in zero discharge before 2019. Alternatively, selective land retirement is a possibility. The Central Valley adopted, and the State Board subsequently approved, an extension of the WDR until 2019 to meet objectives. As the most recent science suggests that the current standards may not be protective of sensitive species, EPA is developing new regulatory selenium criteria to protect aquatic life and wildlife.

### ***Evidence of Impairment Removal***

- A. Watershed-wide improvement is documented in thirteen USGS 12-digit HUC watersheds surrounding the San Joaquin River within the Lower San Joaquin River Basin. Water quality improved as a result of activities using a watershed approach to reduce selenium levels in impaired water bodies.

According to EPA's watershed improvement performance measure, "Improved means that one or more of the impairment causes identified in 2002 are removed for at least 40 percent of the impaired water bodies or impaired miles/acres." Impairment removal refers to removing, or delisting, a waterbody from the state 303(d) List. Figure 2 shows the location of 2010 selenium-impaired and improved (delisted) waterbodies and the individual watersheds they flow through.

The broader Lower San Joaquin River Basin also shows an overall water quality improvement due to the reduction of selenium levels. Selenium levels are meeting water quality objectives in Salt Slough (10 miles), and while the Grassland Marshes (75 miles) now have significantly less exceedances than 2002, they have not improved enough to be delisted for selenium.

- B. Evidence demonstrating selenium water quality improvements can be found in the Tables 1 and 2 below. Other reports, including monitoring data, are synthesized into fact sheets produced by the CVRWQCB and can be found at the links provided below:
1. Lower San Joaquin River – Merced River to Tuolumne River – 29 miles  
[http://www.waterboards.ca.gov/water\\_issues/programs/tmdl/2010state\\_ir\\_reports/01304.shtml#8139](http://www.waterboards.ca.gov/water_issues/programs/tmdl/2010state_ir_reports/01304.shtml#8139)
  2. Lower San Joaquin River – Tuolumne River to Stanislaus River – 8.4 miles  
[http://www.waterboards.ca.gov/water\\_issues/programs/tmdl/2010state\\_ir\\_reports/01304.shtml#8139](http://www.waterboards.ca.gov/water_issues/programs/tmdl/2010state_ir_reports/01304.shtml#8139)
  3. Lower San Joaquin River – Stanislaus River to Delta Boundary – 3 miles

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<sup>28</sup> To date the Project participants have spent roughly \$73 million on selenium control activities, have recently invested another \$20 million, and estimate need for an additional \$75 million to reach zero discharge to the River.

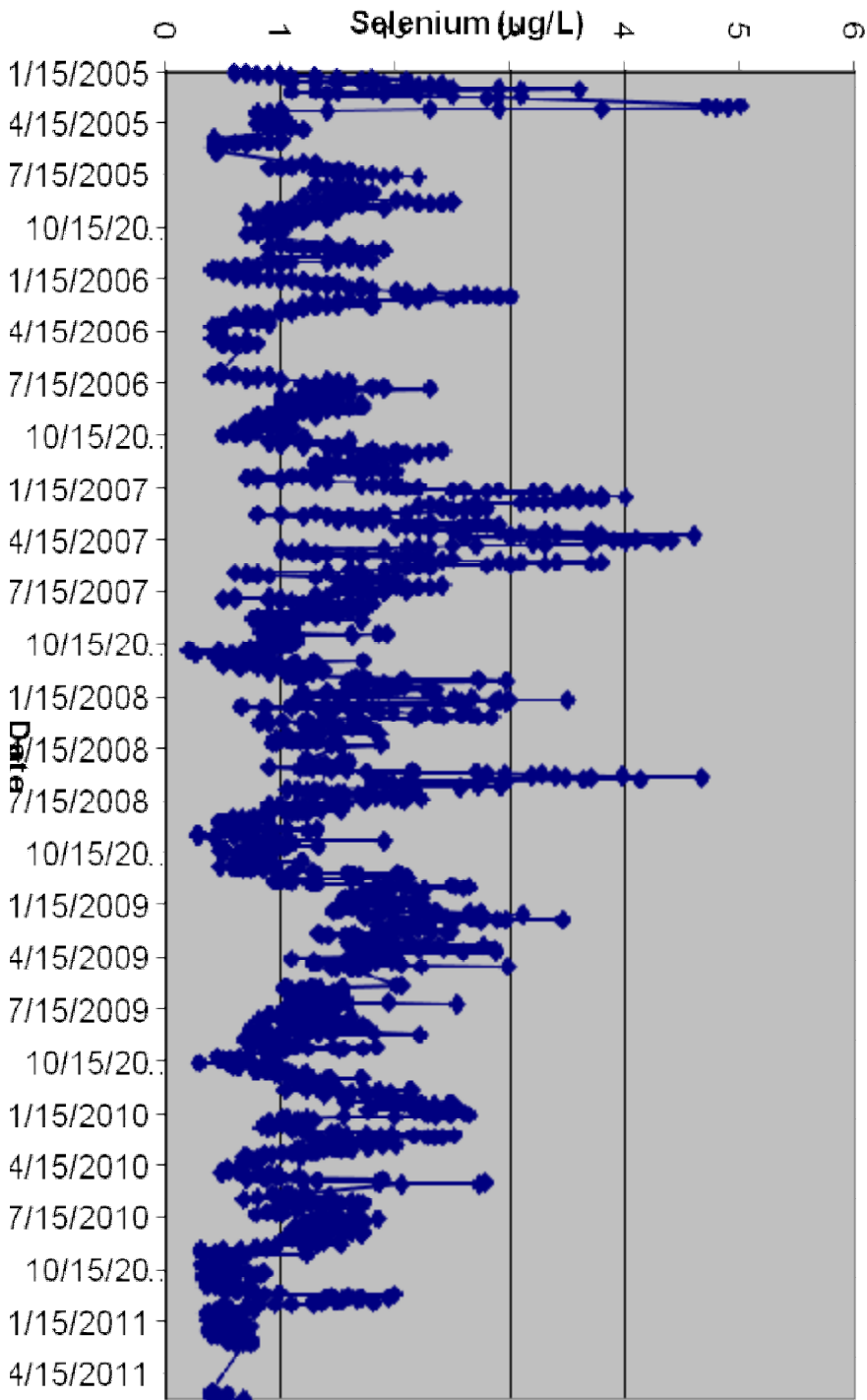
[http://www.waterboards.ca.gov/water\\_issues/programs/tmdl/2010state\\_ir\\_reports/01306.shtml#8143](http://www.waterboards.ca.gov/water_issues/programs/tmdl/2010state_ir_reports/01306.shtml#8143)

C. Photos and graphics

1. Figure 1: 2002 Baseline Condition – Lower San Joaquin River Segments with Selenium Water Quality Impairments
2. Figure 2: Selenium Improvements in the Lower San Joaquin River

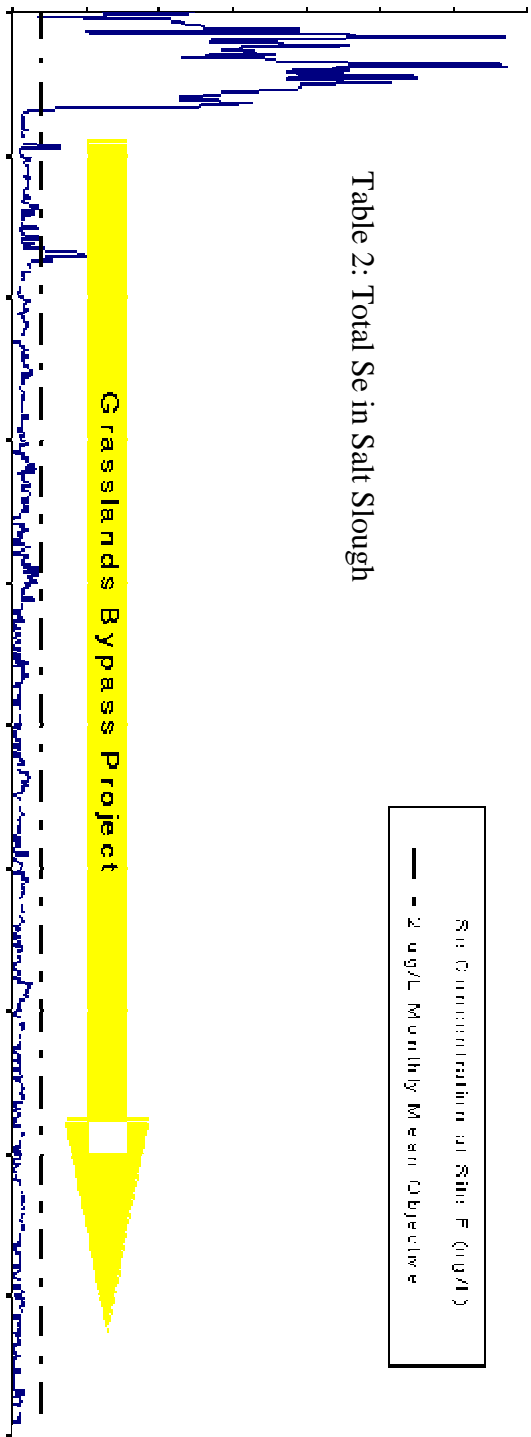
Table 1: Total Se in SJR below confluence with Merced River

**Selenium in SJR at Crows Landing**

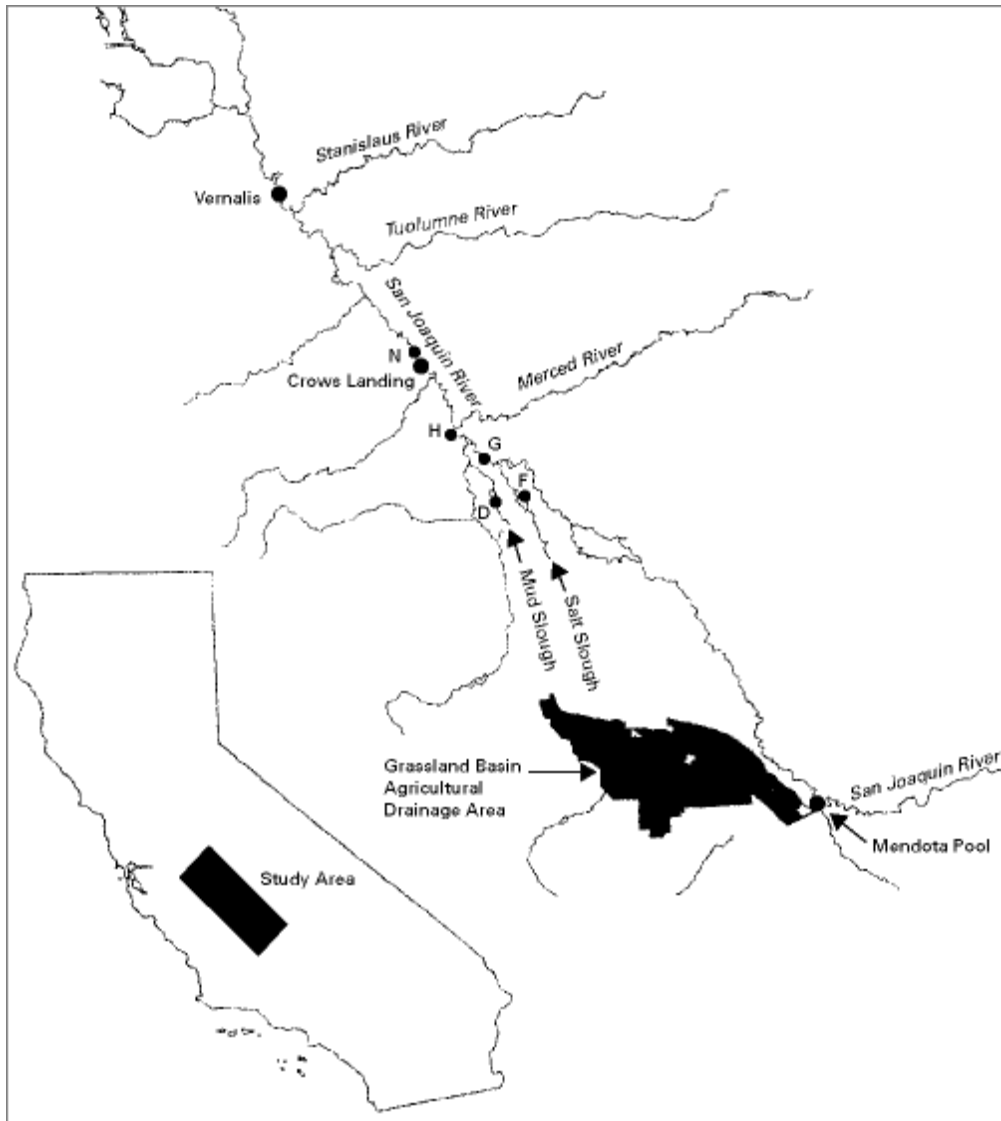


R

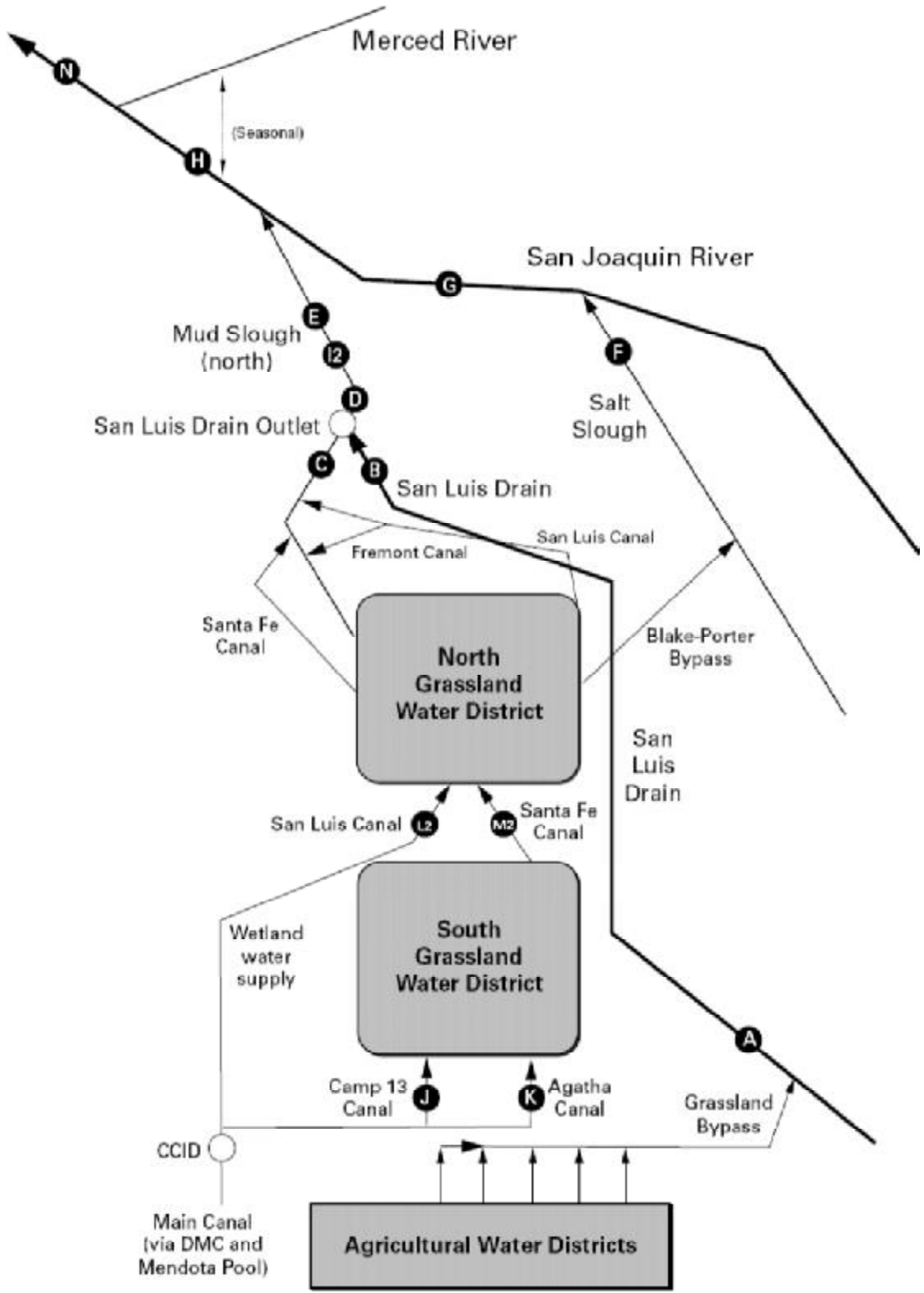
Table 2: Total Se in Salt Slough

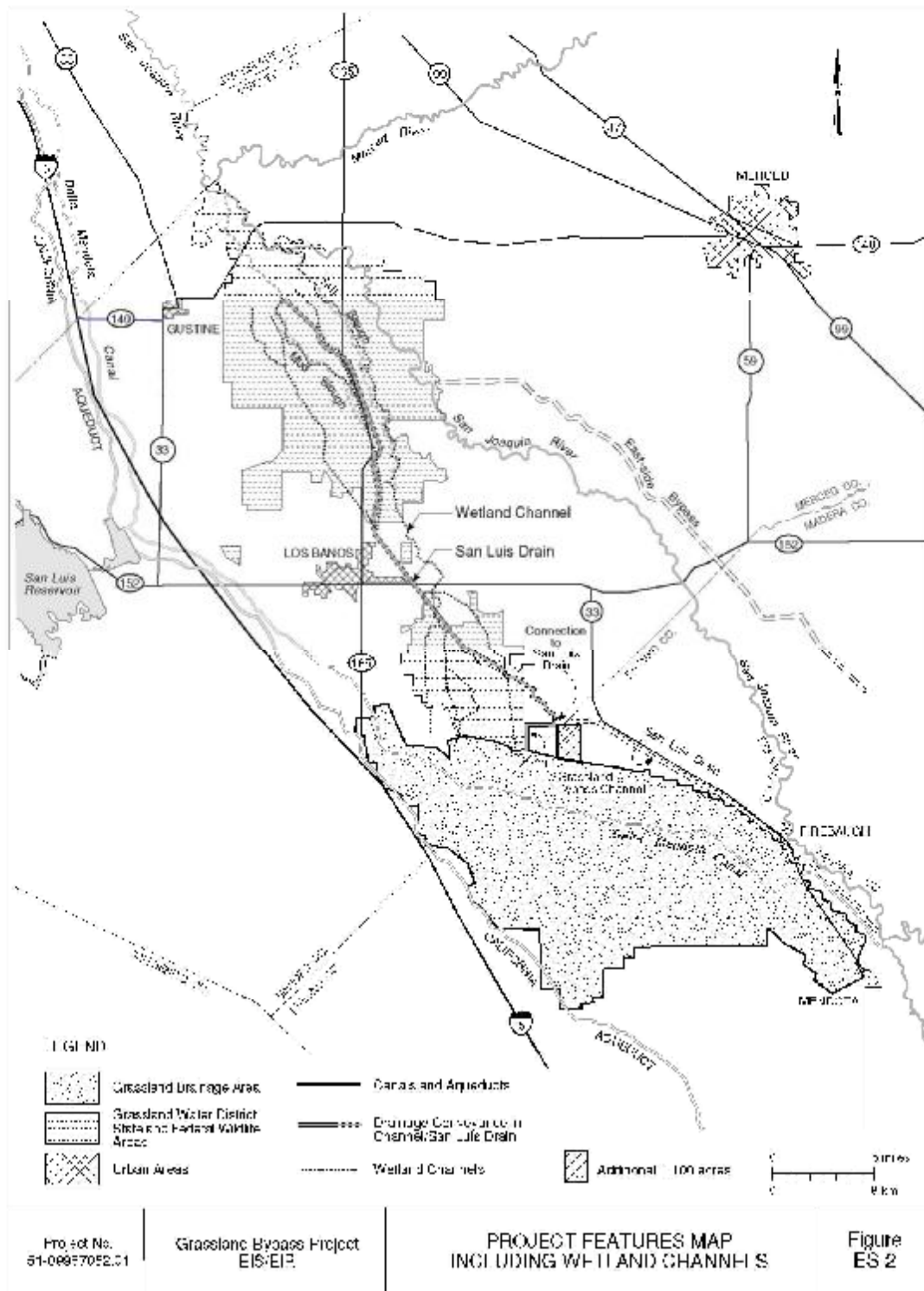


Attachment 1. Maps of the Grasslands Bypass Project (three maps)









DRAFT MAP 1 – NOTE – MAP will be updated, high res provided.

