

CV-SALTS Summary Accomplishments and Next Steps Central Valley Water Board Information Item--April 2015

In February 2012, the stakeholder lead Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) initiative updated its strategy and workplan for developing a Central Valley-wide Salt and Nitrate Management Plan (SNMP). The workplan identified several needed policy decisions as well as the technical work necessary to inform both the policies and potential implementation alternatives for the final SNMP. CV-SALTS has completed several of the workplan items, is in-progress on many more and has updated its timeline to insure thorough economic and environmental review of the proposed alternatives.

The following section identifies completed, ongoing, and upcoming activities. Figure 1, Figure 2, and Table 1, provide the activities and timeline of key technical components, the overall project timeline, and the budget for the effort, respectively.

Policy Discussions

- ✓ Establishing authorities to support pollutant trading and offset programs and long-term compliance schedules for nitrate discharges to groundwater in order to prioritize safe drinking water supply projects during long-term restoration efforts
- ✓ Determining consistent methodology to interpret narrative objective to protect agricultural irrigation and stock watering (AGR)
- ✓ Consider development of a "Limited-MUN" Use and appropriate application of secondary Maximum Contaminant Levels (MCLs)

Technical Efforts

Completed

- ✓ Initial salinity/nitrate conceptual model (ICM) compiled data; source/fate; initial background and trend analysis for 22 analysis zones (December 2013);
- ✓ Phase 1 of the Strategic Salt Accumulation Land and Transport Study (SSALTS) implementation alternatives study completed (December 2013);
- ✓ Central Valley Salinity brochure available at:
- ✓ http://cvsalinity.org/index.php/document-listing/doc_download/984-salt-story-brochure;
- ✓ Improved functionality of the CV-SALTS website;
- ✓ Four California Environmental Quality Act (CEQA) Scoping meetings were held during October 2013;
- ✓ Phase 1 of the Management zone based evaluation of appropriate salinity water quality objectives to protect irrigated agriculture (April 2014), Phase II is not currently scheduled; and,
- ✓ SSALTS Phase 2: Development of a range of salt disposal/treatment alternatives for in-valley, out-of-valley, and combination salt management strategies (September 2014)

Ongoing

- ✓ Phase II Conceptual Model: Updated CV-SALTS project database, develop calculation methods for background water quality and determination of available assimilative capacity in groundwater; focused management zone study;

development of preliminary draft SNMP that incorporates outcomes of completed technical studies;

- ✓ SSALTS Phase 3: Develop salt management implementation measures and a phased implementation strategy for inclusion in the SNMP; and
- ✓ Case studies to ground-truth policy and implementation recommendations:
 - Appropriate application and protection of municipal and domestic supply in agriculturally dominated surface water bodies (Publicly Owned Treatment Works receiving waters in the Sacramento River Basin);
 - Appropriate application and protection of municipal and domestic supply and agricultural beneficial uses in a portion of the unconfined aquifer within the Tulare Lake Bed;
 - Lower San Joaquin River salinity and boron water quality objectives and implementation program;
 - Planning and coordination for early implementation project to provide safe drinking water for disadvantaged community; and,
 - Identification of acceptable methods to characterize trends in assimilative capacity and assess effect of discharge on available assimilative capacity.

Upcoming

- ✓ Continue economic review of alternatives
- ✓ Continue CEQA Equivalent Documentation
- ✓ Prepare SNMP

Figures a through d describe SSALTS initial estimates on the percent of salinity management possible with known implementation alternatives and cost in relation to a no-action alternative identified in a University of California Davis Economic Study (Howitt et al 2009).

Attachment A summarizes the major technical projects.

Figure 1 - Technical Activities Timeline

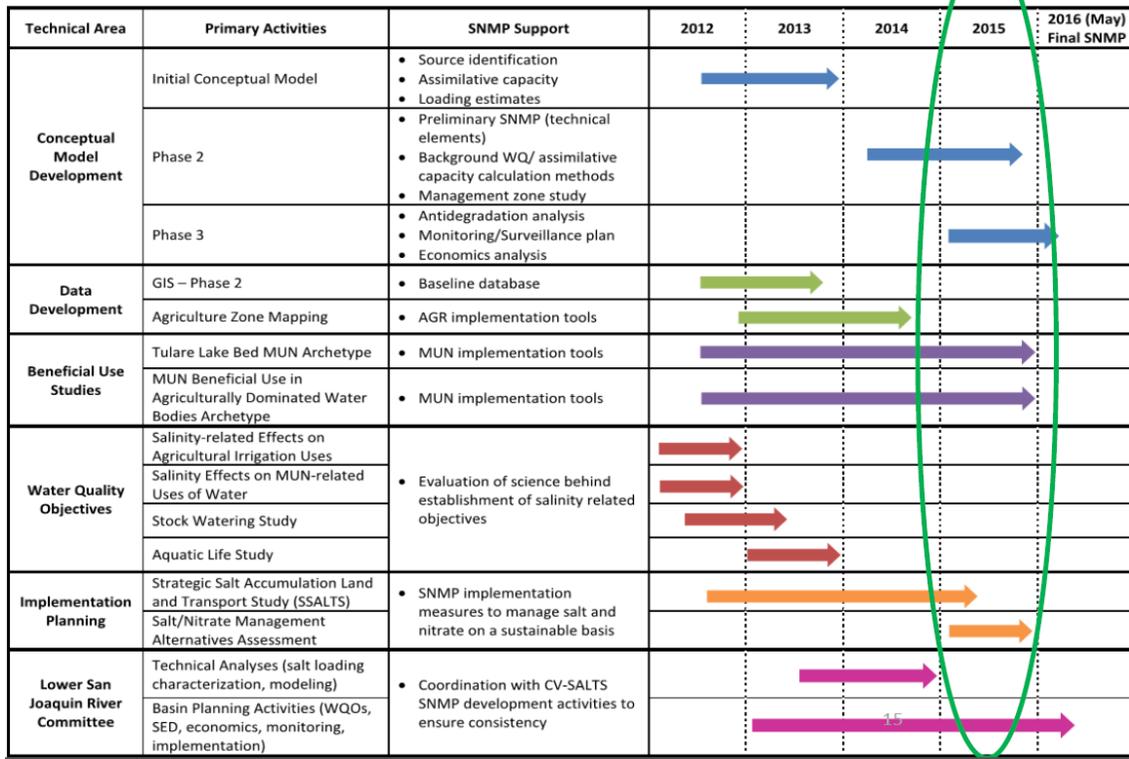


Figure 2 - Summarized CV-SALTS Workplan Schedule

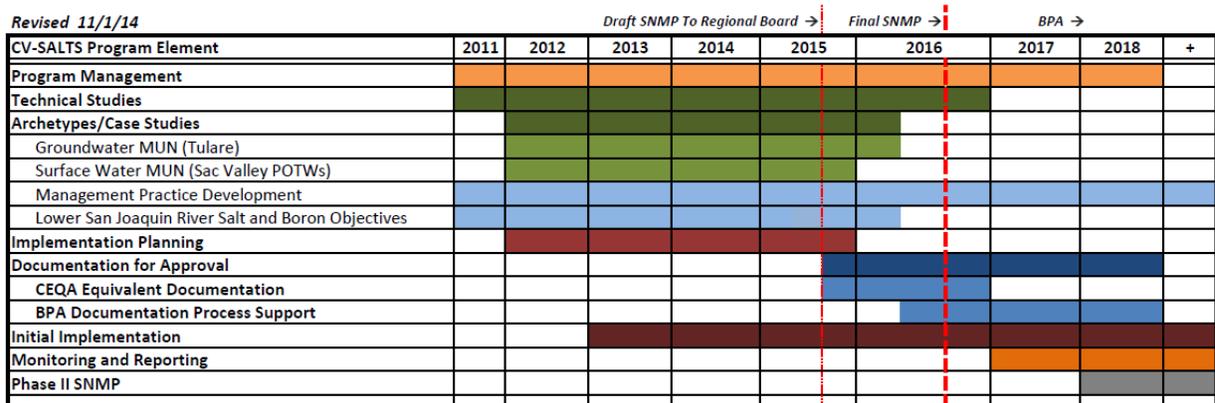


Table 1. Cleanup and Abatement Account Funding Allocated to CV-SALTS

Expenditures as of September 30, 2014 update 11/1/14

| CAA Funding | Resolution 2009-0023 (\$1.2-mil) | | | | | Total |
|--|----------------------------------|--------------------|-----------------|-------------------|--------------------|--------------------|
| | Obligated | Expended | Remaining | Projected FY14/15 | Projected FY 15/16 | |
| SJVDA Contract #09-076-150 (\$1.2-million) | | | | | | |
| a. SJVDA Mgt. Services | \$82,262 | \$80,061 | \$2,201 | \$2,201 | | \$82,262 |
| b. BUOS Phase I | \$49,982 | \$49,982 | | | | \$49,982 |
| c. Program Mgt/Facilitation | \$742,758 | \$742,747 | \$9 | \$9 | | \$742,758 |
| □Strategy/Framework/Workplan Feb 2012 | | | | | | |
| □Facilitation of Policy Discussions | | | | | | |
| □Outreach (website, brochure, workshops) | | | | | | |
| d. Technical Support | | | | | | |
| •Technical Project Management | \$111,915 | \$111,915 | \$0 | | | \$111,915 |
| □Framing Conceptual Model; finalize Salt Source guidance; Initial budget reviews | | | | | | |
| •Long Term LSJR Committee Manager | \$213,085 | \$128,319 | \$84,766 | \$84,766 | | |
| Total: | \$1,200,000 | \$1,113,024 | \$86,976 | \$86,976 | \$0 | \$1,200,000 |
| Percent of \$1.2-million: | 100% | 93% | 7% | 100% | 0% | 100% |

*Work Products

Percent of Remaining

| CAA Funding | Resolution 2010-0042 (\$3.8-mil) | | | | | Total |
|--|----------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| | Obligated | Expended | Allocated | Projected FY14/15 | Projected FY 15/16 | |
| SJVDA Contract #11-123-555 (\$3.8-million) | | | | | | |
| a-1. SJVDA Mgt. Services | \$176,500 | \$78,979 | \$97,521 | \$73,141 | \$24,380 | \$176,500 |
| b. Technical Support | | | | | | |
| •Technical Project Manager | \$296,098 | \$296,098 | \$12 | \$12 | | \$296,098 |
| *Scopes of work: Concept Model; BUOS II; AGR Zone; Groundwater MUN; LSJR wkpln | | | | | | |
| •Basin Planning Support | \$104,789 | \$104,778 | \$13 | \$13 | | \$104,778 |
| □White Paper-Salinity Effects on MUN-Related Uses of Water | | | | | | |
| □White Paper-Salinity Effects on AGR-Related Uses of Water | | | | | | |
| •Interim LSJR Committee Manager | \$50,000 | \$31,413 | \$18,587 | \$18,587 | | \$31,413 |
| •LSJR Committee Manager contract (unallocated) | \$65,615 | | \$65,615 | \$65,615 | | \$65,615 |
| *Final wkpln; problem statement; background; beneficial use review; RFQ for technical work | | | | | | |
| c. Refine BUOS Phase II | | | | | | |
| •Additional GIS Work | \$100,004 | \$98,830 | \$1,374 | \$1,374 | | \$98,830 |
| d. Conceptual Model (Three Phases) | | | | | | |
| •Initial Conceptual Model Phase 1 | \$473,884 | \$472,007 | \$1,857 | \$1,857 | | \$472,007 |
| Additional Data Support | \$22,000 | \$22,000 | \$0 | | | \$22,000 |
| e. Technical Studies | | | | | | |
| □Aquatic Life Criteria Review | \$31,500 | \$31,150 | \$350 | \$350 | | \$31,150 |
| □Tulare Lake Bed GW MUN Archetype | \$100,000 | \$0 | \$100,000 | \$100,000 | | \$100,000 |
| □MUN POTW Archetype | \$199,868 | \$19,087 | \$180,781 | \$180,781 | | \$199,868 |
| □MUN POTW Water Analysis | \$80,000 | \$43,535 | \$16,465 | \$16,465 | | \$43,535 |
| □AGR Water Quality Zones | \$120,000 | \$119,897 | \$103 | \$103 | | \$119,897 |
| □Strategic Salt Accumulation Land and Transportation Study (SSALTS) | \$345,000 | \$327,288 | \$17,712 | \$17,712 | | \$345,000 |
| a-2. SJVDA Mgt. Services allocation 2 | \$142,500 | \$0 | \$142,500 | \$71,250 | \$71,250 | \$142,500 |
| f. Technical Studies | | | | | | |
| •Conceptual Model Phase 2:SNMP | \$550,000 | \$119,007 | \$430,993 | \$344,794 | \$86,199 | \$550,000 |
| * Work Plan | \$25,000 | \$24,995 | \$5 | \$5 | | \$25,000 |
| *Assess sustainable salt/nitrate balanced | | | | | | |
| *ID large scale MP's for evaluation | | | | | | |
| *Incorporate Changes to BUs and WQOs from Archetypes | | | | | | |
| *Prepare CV SNMP Assessment | | | | | | |
| *Review and Prepare SNMP Document | | | | | | |
| •Conceptual Model Phase 3:refine SNMP | | | \$471,028 | \$376,821 | \$94,205 | \$471,028 |
| *Incorporate regional SNMP Info in Conceptual Model | | | | | | |
| *Conduct Economic Analyses | | | | | | |
| *Perform Antidegradation Analysis | | | | | | |
| •Completion SSALTS Implementation Study | | | \$100,000 | \$100,000 | | \$100,000 |
| g. CEQA Documentation | | | \$300,000 | \$60,000 | \$240,000 | \$300,000 |
| h. CV SNMP | | | \$104,997 | \$52,499 | \$52,499 | \$104,997 |
| Total: | \$2,862,738 | \$1,788,850 | \$2,049,911 | \$1,481,378 | \$568,533 | \$3,800,000 |
| Percent of 3.8 million: | 75% | 47% | 54% | 72% | 28% | 100% |

Percent of Remaining

Obligated = subcontract approved and/or in progress

Figure a - Key Salinity Management Alternatives

Key Salt Management Alternatives

| Treatment & Salt Recovery Technology | Brine Disposal and Storage |
|--|---|
| <ul style="list-style-type: none"> • Mature Technologies <ul style="list-style-type: none"> • Reverse Osmosis • Ion Exchange • Lime Softening • Evaporation Ponds • Emerging Technologies <ul style="list-style-type: none"> • Smart Integrated Membrane System (SIMS) • WaterFX Aqua4 System – Multi-effect Distillation • Zero Discharge Distillation by Veolia – Electrodialysis Metathesis • New Sky Energy – Temperature Control and Electrodialysis • Element Renewal – addition of polymers to remove trace elements | <ul style="list-style-type: none"> • Brine Supply for Hydraulic Fracturing • Deep Well Injection • Salt Management Disposal Areas <ul style="list-style-type: none"> • Landfills • Dedicated Disposal Sites • San Joaquin River Improvement Project • San Joaquin River Real Time Management • Transport Brine Out of Valley <ul style="list-style-type: none"> • Truck/Rail Brine • Regulated Brine Line • Bay Area WWTP • New, permitted Bay Area Outfall |

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Figure b – Salt Sustainability

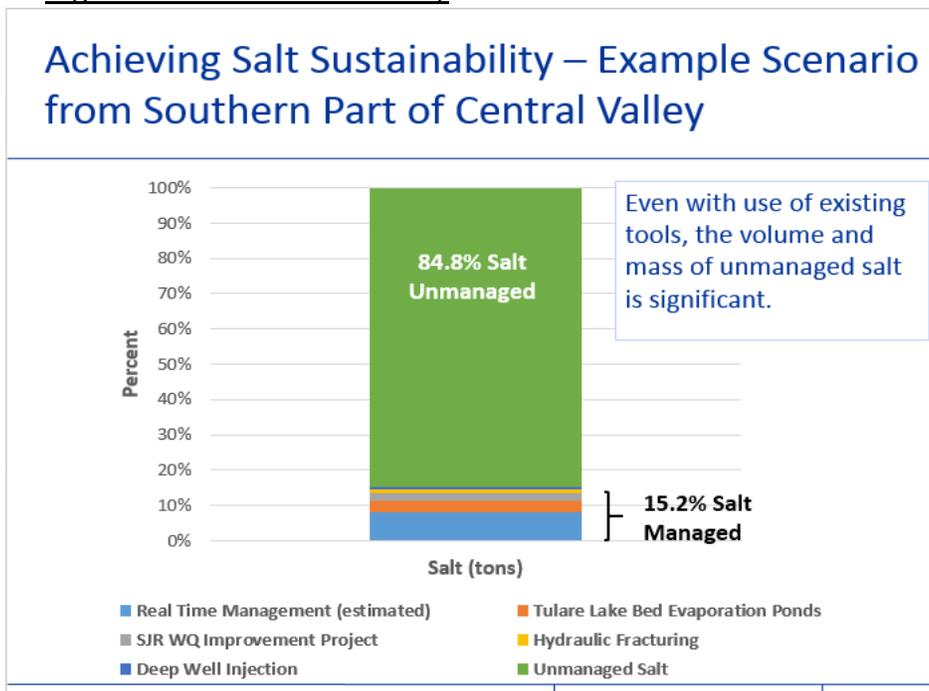


Figure c – Conceptual Cost Brine Line Alternative

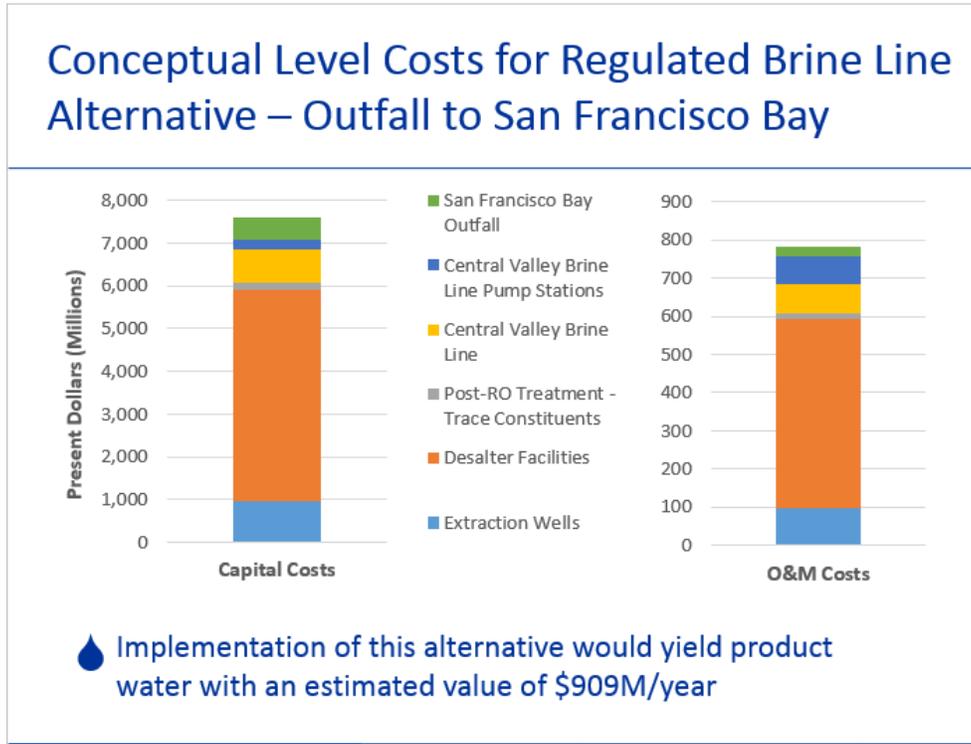
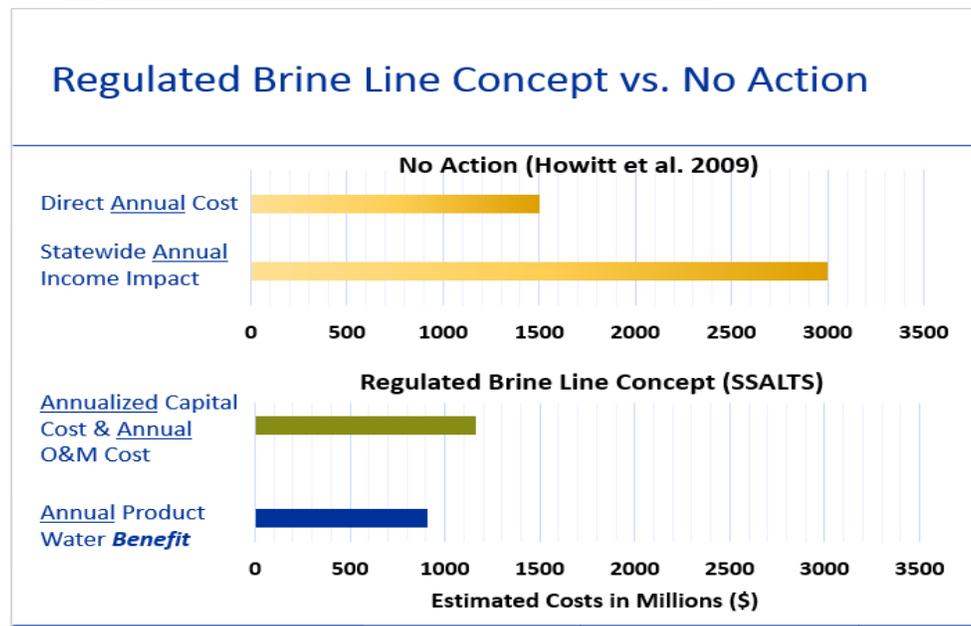


Figure d – Brine Line vs No Action Alternative



Attachment A.

Technical Projects Supporting Central Valley-wide Salt and Nitrate Management Plan

Conceptual Model Development

Salt and Nitrate Sources Pilot Implementation Study - The *Salt and Nitrate Sources Pilot Implementation Study* ("Pilot Study") was the precursor to what is now described as the development of a Conceptual Model for the Central Valley. The primary objective of the Pilot Study was to develop a methodology and provide guidance for development of the Salt/Nutrient Management Plan for the Central Valley. Specifically, the project developed and documented methods to fairly and equitably quantify salt and nitrate sources. These methods were then pilot tested in selected Central Valley areas to evaluate their appropriateness for region-wide application. Following completion of the Pilot Study, CV-SALTS developed *A Framework for Salt/Nitrate Source Identification Studies* based on the findings from the Pilot Study. Status: Project was completed in February 2010.

Initial Conceptual Model (ICM) - Development of the ICM is the first phase of a planned three-phased effort to develop the technical and regulatory basis for adoption of a Salt/Nutrient Management Plan (SNMP) for the Central Valley. The purpose of this phase is to develop a conceptual level (or 30,000 foot level) analysis of water balance and associated salt and nutrient (nitrate) conditions in the Central Valley. This effort will rely on the establishment of Initial Analysis Zones (IAZs) to complete water quantity and quality analyses within smaller areas within the valley and detailed analyses in two selected subareas of the Central Valley. The IAZs provide the foundation for the eventual establishment of salt/nutrient management zones in the Basin Plan. The outcome of the ICM project will be an assessment of salt/nitrate conditions in the Central Valley, including identification of hotspots and long term trends for salt and nitrate concentrations. Subsequent phases will refine the findings from the ICM and develop the SNMP which includes preparation of a salt/nitrate program of implementation and completion of regulatory analyses to support adoption of the SNMP into the Basin Plan. Status: Project was initiated in September 2012 and completed in December 2013.

Phase 2 Conceptual Model - Development of the Conceptual Model to support preparation of the Salt/Nitrate Management Plan (SNMP) was initiated under CV-SALTS' Initial Conceptual Model (ICM) Project (completed in December 2013). This project builds off the findings of the ICM to begin development of a draft SNMP for the Central Valley. Scope of work elements include targeted refinements to the project database, development of salt and nitrate data analysis methods to support regulatory decisions, implementation of an archetype or pilot analysis to evaluate salt and/or nitrate management options at a management zone scale, and preparation of the first drafts of the technical elements of the SNMP. Status: Project was initiated in April 2014; completion expected in early summer 2015.

Phase 3 Conceptual Model - Development of the Conceptual Model to support preparation of the Salt/Nitrate Management Plan (SNMP) was initiated under CV-SALTS' Initial Conceptual Model (ICM) Project (to be completed in October 2013) and refined under the CV-SALTS' Phase 2 Conceptual Model project. This project will build off the work completed under Phase 2 and focus on completion of regulatory-related analyses and preparation of documentation to support adoption of the SNMP into the Basin Plan. Status: Project is planned for initiation in 2015.

Data Development Projects

GIS Services - Phase 1 Beneficial Use & Objectives Study (BUOS) - CV-SALTS began data gathering and Geographic Information System (GIS) development efforts through the implementation of the Phase 1 BUOS. This project included three tasks: (a) Identification of existing and potential beneficial uses in the Central Valley which included development of GIS mapping layers showing beneficial use categories assigned to surface water and groundwaters; (b) compilation of data for use in the development of the beneficial use map layers; and (c) completion of a literature review of criteria related to salt and nutrients and protection of various beneficial uses. Status: Project was completed in September 2010.

GIS Services – Phase 2 - CV-SALTS continues to develop a Geographic Information System (GIS) to organize information pertaining to the beneficial uses, water quality objectives, water use infrastructure, and water quality of surface water and groundwater in the Central Valley. Development of this GIS supports ongoing efforts to develop a Salt/Nutrient Management Plan (SNMP) for the Central Valley by providing a centralized geodatabase for all matters pertaining to the development and implementation of the SNMP. This project builds off the CV-SALTS Phase 1 Beneficial Use Objectives Study (BUOS), which established baseline GIS-related data to support CV-SALTS. Phase 2 will update the existing geodatabase to incorporate the 2012 National Hydrography Dataset and incorporate new water infrastructure-related data, e.g., municipal surface water intakes, locations of wastewater facility discharges to surface water, agricultural water intakes, and groundwater wells. Status: Project initiated in September 2012 and completed October 2013.

GIS Services – Agricultural Zone Mapping - CV-SALTS implemented a GIS project to develop map layers of agricultural-related data to support development and implementation of water quality objectives to protect waters used for agricultural irrigation. Data layers incorporated into the CV-SALTS geodatabase included agricultural-related jurisdictional boundaries, soil characteristics, irrigation supply sources, water quality, historic and current cropping patterns, as well as other relevant data. These data layers were used to identify potential Crop Sensitivity Zones (CSZs) based on similar hydrologic and hydrogeologic conditions, cropping patterns, management practices, and other factors related to crop sensitivity to salinity. This project was originally planned to occur in two phases. Phase 1 was authorized in 2013, but Phase 2 authorization was deferred, pending the findings of the Phase 1 work. Phase 1 deliverables included (a) developing agricultural-related data and preparing appropriate GIS map layers; (b) identifying up to 25 CSZs for the Central Valley; and (c) conducting a workshop with the agricultural community to discuss project findings. The need for a second phase for this project has not yet been determined by CV-SALTS. Status: Phase 1 project was implemented February 2013 and was completed in April 2014.

Beneficial Use Designation Studies

Tulare Lake Bed MUN Archetype - As part of its effort to develop a Salt/Nutrient Management Plan (SNMP) for the Central Valley, CV-SALTS is evaluating appropriate designations and level of protection for waterbodies currently designated with the MUN beneficial use, taking into account the requirements of the California Sources of Drinking Water Policy (SDWP) (Resolution 88-63) and other environmental characteristics. Through this activity, a portion of the Tulare Lake Bed groundwater basin has been identified as an area that appears to meet the exemption criteria set forth in the SDWP. In portions of this same area the AGR use also may not be applicable. Accordingly, CV-SALTS initiated technical studies and basin planning activities in collaboration with the Tulare Lake Drainage District to develop the required documentation to support de-designation of MUN (and possibly AGR) from a portion of groundwater body

underlying the Tulare Lake Bed. The expected final outcome is a Basin Plan Amendment. In addition, the project deliverables will support development of the Central Valley SNMP by providing an archetype or template for other studies designed to evaluate the applicability of beneficial uses on a groundwater body. Status: Project initiated in September 2012; completion expected in 2015.

MUN Beneficial Use in Agriculturally Dominated Water Bodies Archetype - By way of the Sources of Drinking Water Policy (Resolution 88-63), the Central Valley Regional Water Quality Control Board Basin Plans (Basin Plans) designate MUN beneficial use to all surface and groundwater bodies unless they are specifically listed in a Basin Plan as water bodies that are not designated with MUN. Recent court findings have confirmed that to utilize exceptions identified in Resolution 88-63, for constructed and modified natural channels used to transport agricultural drainage, a basin plan amendment is required. The CV-SALTS initiative has identified the need to evaluate the appropriate designation and level of protection of MUN beneficial uses in constructed agricultural drains as well as other agriculturally dominated water bodies. The receiving waters of four POTWs in the cities of Willows, Colusa, Biggs and Live Oak are serving as archetypes or case studies for the development of a framework to evaluate the appropriate level of MUN beneficial use protection in agriculturally-dominated water bodies throughout the Central Valley. Status: Project initiated in the latter part of 2011; completion expected in 2015.

Water Quality Objectives Review

Aquatic Life Study - CV-SALTS implemented a study to identify potential water quality criteria that could be used to establish salinity-related water quality objectives to protect aquatic life in Central Valley surface waters. This study researched the following information sources to fulfill the project purpose: (a) recent literature reviews conducted by selected states to establish water quality criteria for salinity-related constituents; (b) peer-reviewed published literature; (c) data and methodologies developed by federal agencies, including U.S. Environmental Protection and Department of Interior; (d) recommendations developed by selected international agencies; and (e) any information developed by other California agencies. The final report provided technical recommendations for adoption of salinity-related water quality objectives to protect aquatic life. Status: Project initiated in December 2012; completed in January 2014.

Stock Watering Study - CV-SALTS implemented this study to identify water quality criteria that may be used to establish salinity and nitrate-related water quality objectives to protect stock watering supplies in the Central Valley. This study was completed through the completion of research on the following information sources: (a) water quality objectives established in other regions of California or in other selected states; (b) review of U.S. Environmental Protection Agency recommendations; (c) university extension publications and specialists; (d) published peer-reviewed literature; and (e) selected international agencies. The final report provides recommendations for protection of stock watering sources which will be used to support development of a Salt/Nutrient Management Plan for the Central Valley. Status: Project was initiated in January 2012; completed May 2013.

Salinity-related Effects on Agricultural Irrigation Uses - CV-SALTS completed research to define what constitutes reasonable protection of existing and probable future use of water for agricultural irrigation. This research focused on the preparation of a summary of the current state of knowledge regarding the effects of elevated salinity concentrations on crop yields, wetland plants and vegetation commonly used for landscaping. In addition, the research effort reviewed water quality objectives established in other California regions, federal recommendations developed by the U.S. Environmental Protection Agency, water quality standards adopted by other states to protect water used for irrigation, and guidelines

established by selected international entities. The resulting White Paper provides a summary of the key findings along with supporting data and references to support development of a Salt/Nutrient Management Plan for the Central Valley and ensure that waters used for agricultural irrigation are appropriately protected. Status: Project was initiated in June 2012. A draft White Paper was submitted in July; a Final Draft White Paper was submitted in August 2012. A final document is in preparation.

Salinity Effects on MUN-related Uses of Water - CV-SALTS completed research to define what constitutes reasonable protection of existing and probable future MUN (Municipal and Domestic Supply) uses. This research focused on the preparation of a summary of the current state of knowledge regarding the effects of elevated salinity concentrations on drinking water supply, including human health concerns, and other domestic uses of water, including impacts of salinity on residential, commercial and industrial water-using devices. In addition, the research effort reviewed water quality objectives established in other California regions, federal recommendations developed by the U.S. Environmental Protection Agency, MUN-related water quality standards adopted by other states, and guidelines established by selected international entities. The resulting White Paper provides a summary of the key findings along with supporting data and references. CV-SALTS is using the findings of the White Paper to support development of a Salt/Nutrient Management Plan for the Central Valley and ensure that MUN-related uses of water are appropriately protected. Status: Project was initiated June 2012; draft White Paper was submitted in July 2012; Final Draft White Paper was submitted in August 2012; Document currently undergoing technical review; final White Paper will be prepared following completion of technical reviews.

Water Quality Objectives Review and Implementation Planning

Lower San Joaquin River Committee – The Lower San Joaquin River (LSJR) Committee and its subcontractors reviewed salinity criteria, guidelines, and water quality goals in previous Beneficial Use Source studies commissioned by CV-SALTS. Beneficial Uses included water quality criteria for the protection of municipal drinking water, irrigation supply water, stock watering, and aquatic life. In addition, the Committee and subcontractors identified almonds as the most sensitive crop grown in the LSJR basin. Through the use of the Hoffman model (Hoffman, G. J. 2010. Salt Tolerance of Crops in the Southern Sacramento-San Joaquin Delta), an EC range of 1.01 to 1.55 micro Siemens per centimeter ($\mu\text{S}/\text{cm}$) was identified for consideration of salinity WQO for the LSJR. The LSJR Committee is in the process of comparing potential objectives with historical water quality data and modeled salt loading anticipated in the future under various implementation alternatives. Status: Based on the Committee timeline, a Basin Plan Amendment proposing salt and boron water quality objectives and an implementation program for the LSJR is planned for Board consideration in April 2016.

Implementation Planning

The Economic Impacts of Central Valley Salinity - The purpose of this study was to measure the economic impacts of increasing salinity in the Central Valley out to the year 2030. To conduct the analysis, the project team assumed that there would be no change in current salt management policies; as such, the findings from the analysis represented the economic impacts associated with taking no action. The study was conducted on an aggregate valley-wide basis that averaged salinity effects and costs. Based on estimates of increasing levels of salinity under existing conditions, the study estimated the direct economic effects on industry, residential, food processing, confined animal operations, and irrigated agricultural production in the Central Valley using different physical and economic models. Status: Project was completed in 2009.

Strategic Salt Accumulation Land and Transport Study (SSALTS) - CV-SALTS is implementing a study to identify the range of viable Central Valley alternatives for salt disposal (taking into account regulatory, institutional, economic, and technological issues) to provide input for consideration during development of the Salt/Nutrient Management Plan (SNMP) for the Central Valley. Potential alternatives for salt disposal range from expanded use of existing salt disposal areas, establishment of new salt disposal areas within the Central Valley, export or transport of salt out of the Central Valley, or some combination of the above. The findings from this study will provide input to policymakers regarding where opportunities exist to dispose of salt over the long term in a sustainable manner. In addition, the findings will provide important input to the development of the SNMP under Phases 2 and 3 of Conceptual Model, and provide information to support development of the Basin Plan Amendment to adopt a Central Valley SNMP. Status: Project was initiated in December 2012. Phase 1, which focused on an evaluation of current salt disposal practices at selected study areas, was completed in December 2013. Phase 2, which concentrated on the development of potential future salt disposal/treatment alternatives for the Central Valley, was completed in September 2014. Phase 3 is evaluating the potential salt disposal/treatment alternatives identified in Phase 2 to develop implementation measures and a phased implementation strategy for inclusion in the SNMP. This final phase is planned for completion in the first quarter of 2015.

More Information on Projects and Current Activities at:

www.cvsalinity.org