Agricultural Zone Map Project – Phase II Scope of Work

Project Purpose and Benefits

There are two key issues around which AGR-related policy discussions focus:

Issue 1: AGR Use Protection - What is the required level of protection (applied water salinity threshold) for crops grown within the zone of influence of a discharge? This level of protection is required regardless of whether the source of irrigation water is surface or ground water.[I would tend to re-phrase this in the context of setting water quality objectives – what are the appropriate AGR water quality objectives (for surface waters or groundwater) based on the existing crops that are irrigated using those waters

Issue 2: Baseline Water Quality Protection (Antidegradation): What is the maximum salinity concentration that can be discharged to a groundwater or surface water without causing significant degradation?

The Phase I Agricultural Zone Mapping Project developed data that can be used to preliminarily define levels of protection required to respond to Issue 1. This work ended with a compiled data set that illustrates crop-specific protection requirements in the Central Valley and may be used for making site-specific AGR protection evaluations. Findings from this effort indicate that the potential still exists to delineate relatively large-scale crop protection zones (based on applied water salinity sensitivity thresholds).

A second phase to the Agricultural Zone Mapping Project could be implemented to refine Phase I findings with regard to proposed default salinity protection requirements, and to further explore how protection of the AGR beneficial use could be implemented in the future. Specific benefits to be achieved include development of methods:

- To establish base maps that define spatially default AGR protection requirements (e.g., in the form of an Electrical Conductivity (EC) or Total Dissolved Solids (TDS) water quality objective).
- To demonstrate that AGR protection is achieved within a delineated area.
- To demonstrate how to develop a site-specific WQO, if the default AGR protection WQO is deemed overly stringent.

Phase II Project Objectives

(1) Complete additional mapping to support policy development. Develop alternatives based on two definitions of major crops *discussed in the 5.2 report*[can we be more specific?].The basis areas for these determinations should be *spatially* dynamic [does this mean to let the delineation happen as a result of the information?], as opposed to being based on a set of a priori, static boundaries.

(2) Using data collected under Phase I, delineate crop protection zones in selected areas using statistical techniques.

(3)   Develop additional data to support implementation of a regulatory framework applicable to the protection of irrigated agriculture [does this framework include adoption of WQOs? Other elements?] .

(4)   Develop methodology for developing a site specific AGR water quality objective and pilot test application of the methodology.

General Project Approach

Task 1 shall be completed for the entire Central Valley floor and Task 5 will result in a deliverable that may be applied anywhere in the Central Valley region. While the other tasks described below (primarily Tasks 2-4) also could be applied to the entire Central Valley floor, these tasks involve activities that will only be completed within defined study areas. The outcomes from these tasks are intended to serve as an archetype for application of the methods to other areas of the Central Valley.

In addition to using an archetype approach, the overall project approach includes a number of check-in steps to provide opportunity for completed work to be fully evaluated before moving forward with additional tasks. At any of these check-in points, stakeholders can choose to modify the project to better meet the needs of CV-SALTS. Commensurate changes to scope, schedule, and budget would be made as needed to match available resources to the work that is deemed to be necessary.

Proposed Tasks

Task 1 – Complete Additional Central Valley Mapping

To assist stakeholders in discussions regarding the definition of major crops, the Consultant will prepare two maps of the Central Valley. For both, a dynamic unit of analysis (as opposed to the static Crop Sensitivity Zones required under Phase 1) will be used, so that statistical definition of "Major" will be context dependent, shifting depending on cropping patterns surrounding a field. The two maps will respectively define major crops defined as a) those occupying >5% of the irrigated agricultural area, and b) the smallest number of irrigated crops that together occupy >95% of the irrigated agricultural area. [Question – does this approach avoid the problem of having to define the boundary condition to be able to do the 5% calculation? Not clear how that would work]

To support CV-SALTS policy discussions regarding appropriate salinity protection levels for the Central Valley, the Consultant shall revise the existing applied water salinity threshold map (which categorizes land parcels based on the salinity tolerance of existing major crops, i.e., sensitive, moderately sensitive, moderately tolerant, tolerant) to show only two categories of salinity tolerance: (a) major crops sensitive to applied water with salinity of < 1,600 EC (1,000 mg/L TDS)[1]; and (b) major crops not sensitive

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[1] Note – this task was included per discussion with Tim Moore as a map that would support policy discussions; however, could be removed and developed separately as it should be a relatively minor task.

to this threshold. Two versions of this map will be developed, one based on each alternative definition of major crop.

Check-in points:

- Dynamic unit of analysis method.
- Major crop, crop sensitivity map review

Task 2 – Select Archetype Study Areas

The Consultant will select two areas to test delineation of AGR protection requirements, develop water quality data, and evaluate regulatory methods described in Tasks 3 through 5. It is recommended that one archetype area be in the Sacramento River planning region; the other area should be in the San Joaquin River planning region[2]. The appropriate size of each archetype area is unknown at this time but needs to be large enough to test and evaluate AGR protection requirements, as described below. When developing recommended archetype areas, consideration should be given to: (a) relationship of area to Initial Analysis Zones (IAZs), groundwater basins or surface water hydrographic boundaries; (b) preference for a similar geography, e.g., area within the eastside or westside of the San Joaquin River basin; and (c) other factors (e.g., areas with relatively saline field drainage) as appropriate. [based on the needs of the Lower San Joaquin River Committee in its BPA work, I would recommend that reach 83 of the Lower SJ River be considered as one surface water to be addressed]

Check in:

- The Consultant will prepare a recommendation for CV-SALTS approval. Approval is required before implementation of subsequent tasks.

Deliverable: Delineation of two recommended archetype areas for use in subsequent tasks.

Task 3 – Delineate Crop Protection Areas in Archetype Areas

Task 3 builds on the data development and mapping work completed under Phase I of the Agricultural Zone Mapping project. Subtasks include:

Task 3.1- Develop Statistical Analysis Method

The Consultant shall develop a statistical method (most likely a form of cluster analysis) for delineating crop protection zones based on existing crop parcel data and associated applied water salinity threshold estimates developed under Phase I. The goal is to identify contiguous areas in space where the applied water salinity sensitivity threshold to protect crops within the delineated area is relatively similar. It is assumed that within the archetype study area there will be two or more areas delineated where the variance (of applied salinity threshold values) within the delineated area is significantly less than the variance between delineated areas. Under this task the Consultant will develop the statistical methodology to perform this task. Explanation of the

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[2] This will provide support to ongoing LSJR Committee work.

methodology will be provided in a manner that can be understood in layman's terms with supporting illustrations as needed. Approval of the methodology will be obtained before the methodology is applied in Task 3.2.

Check-in:

Initial proposed and final methodology

Deliverable: Draft and Final Technical Memorandum that provides detailed description of proposed statistical methodology.

Task 3.2 – Implement Approved Statistical Analysis Method

The Consultant shall implement the approved statistical analysis methods developed under Task 3.1 and create applied water salinity threshold maps for the two archetype areas based on the outcome of the statistical analysis. The Consultant shall prepare a Technical Memorandum that provides the findings from the analysis including the statistical analysis results and a map-based presentation of the contiguous areas delineated by the analysis.

Deliverable: Draft and Final Technical Memoranda with detailed analysis results and resulting delineated areas provided in the form of map.

Task 4 – Data Development to Support CV-SALTS AGR Protection Framework

Task 4 builds on the data development work completed under Phase I of the Agricultural Zone Mapping project to provide additional data analysis to support ongoing AGR protection policy discussions. Subtasks include:

Task 4.1 - Groundwater Quality

The goal of this task is to organize available groundwater data from other tasks into a spatial data set containing applied groundwater source quality information. For each of the archetype areas the Consultant shall develop an estimate of salinity concentrations (in EC and/or TDS) in groundwater at depths most likely to be used as a reliable source of water for irrigated agriculture and be impacted by irrigation agricultural activity. The basis for this analysis will be existing groundwater data developed under previous CV-SALTS projects (e.g., GIS data development, Initial Conceptual Model and Phase I Agricultural Zone Mapping Projects), supplemented by data provided by stakeholders within the archetype area. Further resources include 1) DWR mapping of groundwater use for irrigation, and 2) WARMF estimates of groundwater use for irrigation. The level of effort and budget allocated to data development is to be carefully evaluated (considering balance between need for definitive data and acceptance of a reasonable level of uncertainty). Following completion of data development activities, estimates of groundwater quality shall be prepared using methods consistent with the Phase 2 Conceptual Model Task 4, which is focused on establishment of a method to calculate ambient groundwater quality in any given area in the Central Valley.[this is an

area where the level of effort could expand greatly – the more said to constrain the effort, the better]

Deliverable: Technical memorandum that summarizes water quality data development activities, final data sources, categorized water quality data based on depth. TDS Results shall be provided in two formats: (a) tabulated data both vertical and horizontal; and (b) contoured groundwater quality maps (with different layers to the extent needed). Method for developing map contours shall be provided.

Task 4.2 – Applied Source Water Quality

The Consultant will (a) determine the primary source(s) of water used to irrigate agriculture throughout each of the archetype areas; and (b) develop an estimate of the typical salinity concentration (in TDS) of these sources of irrigation water. [does this go back to the repeated request for information which, to date, has been unfulfilled?]To the extent possible, temporal variation in the quality of source waters will be documented (both seasonal and annual). The basis for this analysis will be existing data developed under previous CV-SALTS projects (e.g., Phase I Agricultural Zone Mapping Projects) supplemental data developed under this subtask through interaction with stakeholders within the archetype areas. As part of the development of the Workplan and budget for this subtask, the Consultant will prepare a clear plan for obtaining these data recognizing the challenges of obtaining these data through low level of effort approaches such as written data requests.[do we have a default for this task if unsuccessful – use of WARMF output, etc?]

Deliverable: Technical memorandum that summarizes data development activities, final data sources, and categorized water quality data for irrigated water sources (groundwater vs. surface water, groundwater depth, etc.). Results shall be provided in two formats: (a) tabulated data that includes spatial and temporal related information on applied water source data; and (b) applied water source and quality maps that illustrate spatial and temporal characteristics of applied water sources within the archetype areas.

Task 5 – Crop Protection Requirements within Archetypes

The Consultant shall use the findings from Tasks 3 and 4 to prepare reports for each archetype that include the following information:

- Crop protection requirements within each archetype that, at a minimum, are based on the following factors: existing crops grown, sources of applied irrigation water (spatial and temporal), quality of irrigation water sources (including temporal variability if it exists).[is this meant as a reality check? Or as information to be used in the adoption of objectives?]
- Extent to which crops in the study area are dependent on groundwater during critical growth periods, e.g., germination.
- Extent to which concerns regarding applied water salinity can be mitigated through standard or routine salt management practices.

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- Identification of priority areas for ensuring that existing crop patterns are protected in the future, e.g., taking into account existing groundwater quality in the area crops are grown, reliability of primary source of applied water, dependency of crop on groundwater, and salt management practices.

Deliverable: Draft and Final Crop Protection Reports for each archetype area.

Task 6 – Site-Specific AGR Water Quality Objective (WQO) Methodology

If CV-SALTS established a default WQO for mapped agricultural zones based on requirements to protect existing crops (e.g., as could be defined under Tasks 1 and 3), the opportunity to develop a site-specific WQO that is less stringent than the default WQO is still available. Under this Task, the Consultant shall develop a site-specific methodology that may serve as a template for use during SNMP implementation. This methodology will be developed through execution of the following subtasks:

Task 6.1 – Develop Site-Specific WQO Methodology Framework

The Consultant shall first prepare a stepwise framework for developing a site-specific AGR WQO. The framework will include proposed WQO development steps and data requirements and data sources associated with each step. The framework shall be approved before implementing Task 6.2.

Deliverable: Draft and Final Site-Specific AGR WQO Methodology Framework

Task 6.2 – Develop Site-Specific WQO Methodology Document

Using the approved framework developed in Task 6.1, the Consultant shall prepare a site-specific methodology document that provides detailed description of each step in the methodology with supporting data tables, maps, or figures as required to support the text. Where default parameters are used, e.g., leaching fraction, not only will the basis and use of the default parameters be provided, but the methodology shall also include how these default parameters may be modified in a technically defensible manner.[Does this include the use of the Grattan model or other transient models?Is the use of the Hoffman model the default assumption?]] Where the methodology incorporates steps that require data collection, the document will clearly describe how these data may be gathered as well as the quality assurance requirements associated with data collection. The final methodology prepared under this task requires approval before implementing Task 6.3.

Deliverable: Draft and Draft Final Site-Specific AGR WQO Methodology

Task 6.3 – Test Site-Specific AGR WQO Methodology

The Draft Final Site-Specific AGR WQO Methodology completed under Task 6.2 will be tested in two areas that are within the two archetype areas included under this project. This test will include the following subtasks:

Task 6.3.1 – Select Methodology Test Locations

Select two areas to test the methodology (test areas can either be in one archetype study area, or there may be one test area within each study area). The Consultant shall prepare a recommendation for the two test areas to be included in this task. In preparing the recommendation, the Consultant shall consider test locations that provide the best opportunity to test as many of the components of the methodology as possible, e.g., by selecting areas that have different factors/issues that may affect development of a site-specific WQO. The Consultant shall obtain approval of the test areas before implementing additional Task 6.3 subtasks.

Deliverable: Proposed locations for testing the methodology.

Task 6.3.2 – Implement Site-Specific AGR WQO Methodology Test

The Consultant shall implement the test of the site-specific AGR WQO Methodology in each of the approved test areas. The outcome of this effort will be (a) fully documented Site-Specific AGR WQO Proposals[3] for each test area based on the execution of the methodology; and (b) recommendations for modification (if any) to the Draft Final Site-Specific AGR WQO Methodology based on its use in this task.

Deliverable: Draft and Final Site-Specific AGR WQO Proposals

Task 6.3.3 – Prepare Final Site-Specific AGR WQO Methodology

The Consultant shall revise the Draft Final Site-Specific AGR WQO Methodology to the extent needed based on the findings from Task 6.3.2.

Deliverable: Final Site-Specific AGR WQO Methodology

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[3] These are not intended to be formal proposals in the sense that they would be submitted to the Central Valley Water Board for approval; instead, they are to be written in the form of a proposal that is consistent with the methodology and that could be submitted for approval.