Draft Policy No. X: Salinity Management to Provide Reasonable Protection of AGR Beneficial Uses in Groundwater

1.0 Problem Statement

The Water Quality Control Plan for the Sacramento River and San Joaquin River Basins (SRSJR Basin Plan) and the Water Quality Control Plan for the Tulare Lake Basin (TLB Basin Plan) ("Basin Plans") establish regulations for the management of salinity to protect the Agricultural Supply (AGR) beneficial use in groundwater. The AGR beneficial use was designed to protect both crop irrigation and livestock watering and has been designated in the majority of surface and groundwater throughout the Central Valley. Although the objectives to protect the beneficial use are narrative, there is currently no guidance on how to interpret the narrative objective in a manner that accounts for local and regional differences. As a default, a conservative approach is typically applied that ensures protection of the most sensitive crop in all locations at all times, even though individual crop and livestock sensitivity to salinity varies widely and potential impacts can be mitigated through management activities. The purpose of this policy is to recommend modifications to the Basin Plans to clarify how salinity will be managed within each groundwater basin and sub-basin to provide the appropriate level of protection of the AGR beneficial use and establish procedures to minimize degradation and where needed and where feasible reduce salt loading to achieve balance and ensure long-term protection of the AGR use.

1.1 Existing Regulatory Requirements

AGR Beneficial Use

The Central Valley Water Quality Control Board (Central Valley Water Board) defines the AGR beneficial use in its Basin Plans as follows:

- SRSJR Basin Plan:[1] "*Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation (including leaching of salts), stock watering, or support of vegetation for range grazing."*
- TLB Basin Plan:[2] "*Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing."*

One difference exists between the definitions – the inclusion of the phrase "(including leaching of salts)" in the SRSJR Basin Plan.

The SRSJR and TLB Basin Plans consider AGR to be a presumptive beneficial use applicable to all waters. Specifically, *"Unless otherwise designated by the Regional Water Board, all ground waters of the Region are considered suitable or potentially suitable, at a minimum, for agricultural supply (AGR)…"*[3]

The Basin Plans establish criteria for making exceptions to the presumptive application of the AGR beneficial use. Of relevance to salt management is the potential application of the following exception: "*there is pollution, either by natural processes or by human activity (unrelated to a specific pollution*

[1] Water Quality Control Plan for the Sacramento River and San Joaquin River Basins (SRSJR Basin Plan). Fourth Edition. Central Valley Water Quality Control Board. Revised October 2011. Pg. II-1.00.
[2] Water Quality Control Plan for the Tulare Lake Bain (TLB Basin Plan). Second Edition. Central Valley Water Quality Control Board. Revised October 2011. Pg. II-1.
[3] SRSJR Basin Plan, Pg. II-3.00; TLB Basin Plan, Pg. II-2.

incident), that cannot reasonably be treated for agricultural use using either BMPs [Best Management Practices] *or best economically achievable treatment practices."*[4]

Water Quality Objectives

The SRSJR Basin Plan does not establish explicit numeric water quality objectives for salinity in groundwater for the protection of the AGR beneficial use. Instead, this Basin Plan relies on the following narrative water quality objective to protect AGR:[5] *"Ground waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses."*

The TLB Basin Plan includes the same narrative water quality objective as the SRSJR Basin Plan, as described in the previous paragraph.[6] In addition, the TLB Basin Plan establishes a policy that allows for controlling the rate of increase of salinity ("managed degradation") by regulating both the maximum increase in salinity concentrations attributable to consumptive use ("*maximum EC shall not exceed the quality of the source water plus 500 µmhos/cm*")[7] and the maximum average annual increase in groundwater salinity on a basin-specific basis:[8]

> *"All ground waters shall be maintained as close to natural concentrations of dissolved matter as is reasonable considering careful use and management of water resources.*
>
> *No proven means exist at present that will allow ongoing human activity in the Basin and maintain ground water salinity at current levels throughout the Basin. Accordingly, the water quality objectives for ground water salinity control the rate of increase.*
>
> *The maximum average annual increase in salinity measured as electrical conductivity shall not exceed the values specified in Table III-4 for each hydrographic unit shown on Figure III-1.*
>
> *The average annual increase in electrical conductivity will be determined from monitoring data by calculation of a cumulative average annual increase over a 5-year period."*

The maximum average increase in electrical conductivity (EC) allowed varies by hydrographic unit, ranging from 1 µS/cm to 6 µS/cm in the Westside (North and South) and Tule River and Poso hydrographic units, respectively.[9]

As noted above, the TLB Basin Plan allowed for managed degradation by regulating the maximum average annual increase in groundwater salinity on a basin-specific basis. The Basin Plan assumed that average annual increase would be determined from monitoring data using the prescribed method. However, data monitoring network was never developed as planned and the allowable rate of increase of salt incorporated into the regulation has not been implemented as intended.

Commented [VL(1]: How is the quality of the source water calculated, and what is the basis of the 500 trigger/limit. What happens if say for a given year, the EC goes up to say 600 above source water quality?

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[4] SRSJR Basin Plan, Pg. II-3.00; TLB Basin Plan, Pg. II-3.
[5] SRSJR Basin Plan, Pg. III-10.00
[6] TLB Basin Plan, Pg. III-7.
[7] TLB Basin Plan, Pg. IV-11
[8] TLB Basin Plan, Pg. III-8 (see TLB Basin Plan for referenced table and figure)
[9] TLB Basin Plan, Pg. III-8, Table III-4

Basin Plan Implementation

In accordance with Basin Plan policies, Central Valley Water Board staffs typically follow the *Policy for Application of Water Quality Objectives* to evaluate compliance with narrative water quality objectives, which means interpreting the narrative objective with relevant numerical criteria and guidelines. Thus, given the lack of explicit groundwater numeric water quality objectives for salinity to protect the AGR beneficial use in either the SRSJR or TLB Basin Plans, Central Valley Water Board staffs generally rely on the assumption that Total Dissolved Solids (TDS) concentrations < 450 mg/L and EC concentrations < 700 µS/cm would protect both salt sensitive crops and livestock and not adversely affect the AGR beneficial use. These values, which are based on guidelines originally published by Ayers and Westcot (1985),[10] have been used to translate the narrative objective into numeric criteria for use in establishing numeric effluent limits in Waste Discharge Requirements (WDRs), and/or for determining compliance with receiving water limitations, and/or Conditional Waiver (Waiver) conditions issued by the Central Valley Water Board.[11] The Board has also allowed the development of site-specific water quality objectives, where appropriate.

Central Valley Water Board staffs have historically evaluated compliance with water quality objectives at First Encountered Groundwater, defined as the top of the saturated zone or the shallowest groundwater as a conservative means of protecting the remaining saturated zone. More specifically, when developing WDRs/Waivers (and determining compliance therewith), current Central Valley Water Board practice is to base an evaluation of the potential near and long-term impacts from a discharge on the First Encountered Groundwater, regardless of whether that shallow groundwater layer is or has the potential to be utilized for the specific beneficial use (i.e. for irrigation or stock watering)..

For selected areas, the TLB Basin Plan has established specific salinity management requirements for protection of groundwater used as an agricultural supply from land application of wastewater effluent. For example, three classes of irrigation water have been defined for the underlying groundwater in the White Wolf Subarea.[12,13] Class I irrigation water (or groundwater) has EC < 1,000 µS/cm; Class II irrigation water has EC of 1,000 µS/cm up to 3,000 µS/cm, and Class III irrigation water has EC > 3,000 µS/cm.

In addition, the TLB Basin Plan includes the following policy statement regarding regional management of salt:[14]

> *Degradation of ground water in the Tulare Lake Basin by salts is unavoidable without a plan for removing salts from the Basin. A valleywide drain to carry salts out of the valley*

[10] Ayers, R.S. and D.W. Westcot. 1985. *Water Quality for Agriculture*. Food and Agricultural Organization (FAO), Irrigation and Drainage Paper 29 Rev. 1, FAO, United Nations, Rome, 174 p.

[11] The original purpose for Ayers and Westcot (1985), which was published for the United Nations FAO, was to provide support to agricultural areas with limited irrigation technology and salt management capabilities. The guidelines state (Section 1.4): "The guidelines are practical and have been used successfully in general irrigated agriculture for evaluation of the common constituents in surface water, groundwater, drainage water, sewage effluent and wastewater. They are based on certain assumptions which are given immediately following the table: "*These assumptions must be clearly understood but should not become rigid prerequisites. A modified set of alternative guidelines can be prepared if actual conditions of use differ greatly from those assumed.*" (Emphasis added).

[12] TLB Basin Plan, Pg. IV-11.

[13] White Wolf Subarea consists of 64,000 acres within the Central Valley floor at the southern tip of the Tulare Lake Basin, about 20 miles south of Bakersfield, CA.

[14] TLB Basin Plan, Pg. IV-5-6

> *remains the best technical solution to the water quality problems of the Tulare Lake Basin. The drain would carry wastewater generated by municipal, industrial, and agricultural activities, high in salt and unfit for reuse. The only other solution is to manage the rate of degradation by minimizing the salt loads to the ground water body…The Regional Water Board supports construction of a valleywide drain to remove salt-laden wastewater from the Basin under the following conditions:*
>
> - *All toxicants would be reduced to a level which would not harm beneficial uses of receiving water.*
> - *The discharge would be governed by specific discharge and receiving water limits in an NPDES permit.*
> - *Long-term continuous biological monitoring would be required.*

The SRSJR Basin Plan includes similar language regarding the management of salts within the region,[15] and while both Basin Plans advocate for the construction of a valleywide drain to move salt out of the Central Valley, a drain that fully serves that purpose has not been constructed.

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1.2 Challenges with Application of Existing Basin Plan Language

The regional economy depends on efficient use and reuse of water (including, e.g., treated domestic wastewater effluent, agricultural tailwater, harvested stormwater) to maximize agricultural production and minimize waste of water. Reliance on conservative salinity thresholds as is current practice to protect the AGR beneficial use actually undermines this principle and jeopardizes the agricultural industry's ability to grow a variety of different crops with widely varying salt tolerances by reusing water many times. In addition, focusing only on salinity concentration as the primary metric for evaluating beneficial use protection and potential for water quality degradation may impede statewide efforts designed to promote increased use of recycled water and to encourage greater water conservation thru more efficient irrigation.[16] Accordingly, sound resource management should consider both concentration and mass when evaluating and regulating salinity effects on groundwater.

To achieve the goals of the Recycled Water Policy and establish a sound approach to water resource management, including during periods of water shortage in California, and to develop a regulatory program that maintains the Central Valley's agricultural economy, while appropriately protecting beneficial uses, the following concerns regarding the current regulatory approach require consideration:

- The fact that all ground waters in the Central Valley are considered "suitable or potentially suitable" for AGR, as is current practice, does not mean that subsurface water quality is, or should be, capable of sustaining maximum yield for every conceivable agricultural crop or for providing a stock watering source. It is well-established that the sensitivity of crops to salt varies widely.[17, 18] Moreover, the source of water for crop irrigation may or may not be local. In fact imported surface water is often

[15] SRSJR Basin Plan, Pg. IV-15.00

[16] State Water Board Recycled Water Policy, Resolution 2009-0011, adopted February 3, 2009, as amended by Resolution 2013-003, adopted January 22, 2013.

[17] Final Draft *Salinity Effects on Agricultural Irrigation-Related Uses of Water*. CV-SALTS White Paper; http://www.cvsalinity.org/index.php/docs/agendas-notes-and-materials/meeting-materials/1043-cv-salts-agr-white-paper-v2081012/file.html.

[18] See for example Figure 4c in: *Task 5.1 and 5.2 – Develop Map Layers and Identify Crop Sensitivity Zone, Final Report*, prepared for CV-SALTS by Larry Walker Associates, Inc., April 2014.

used to produce crops that would not be commercially viable if forced to rely on native or local groundwater as the sole source of irrigation supply.

- As noted above, Ayers and Westcot (1985) is currently the primary source used as the basis for translating the narrative objective into numeric values to be used for compliance. However, its recommended salinity guideline for "Unrestricted Use" (< 700 µS/cm EC) has been misinterpreted and applied in a manner inconsistent with the author's conclusions.[19] Some salinity impacts can be mitigated by modern irrigation strategies without unreasonably affecting the AGR beneficial use.
- Evaluating compliance with salinity standards at First Encountered Groundwater does not adequately consider the availability of assimilative capacity in the groundwater to mitigate the potential for adverse effects on AGR groundwater uses downgradient of the discharge. Similarly, the characteristics of First Encountered Groundwater do not reflect the actual water that is being used for agricultural purposes.
- It is often impossible to comply with the 700 µS/cm EC threshold even after implementing BMPs. For example, if an agricultural operator irrigates with high quality imported water (EC = 150 µS/cm) and the leaching fraction is assumed to be 15%, then salinity in the leachate will concentrate more than six-fold (EC = 1,000 µS/cm). Given the average salinity of available water supplies, there is no feasible or practicable means of meeting the 700 µS/cm EC threshold at First Encountered Groundwater.
- Irrigation practices designed to move salts past the root zone are considered an integral part of the protection of the AGR beneficial use (e.g., as noted in the SRSJR Basin Plan definition for AGR). Efficient irrigation naturally increases the concentration of salts in the leachate. Therefore, some water quality degradation will be the inevitable and unavoidable result of crop irrigation even when using BMPs. Regardless, irrigation water is the largest single source of new salt loads to ground waters in the Central Valley. Therefore, it is appropriate to require irrigators to implement BMPs to minimize salt loading (e.g., mass) to the vadose zone when and where reasonably possible.
- The "Controllable Water Quality Factors" policy limits the Central Valley Water Board's ability to allow further degradation where uncontrollable factors have already resulted in water quality objectives being exceeded.[20]
- The necessity to comply with state water use goals established during times of water shortage caused by drought may limit the feasibility to implement BMPs that reduce the concentration of salt in discharges to a waterbody.[21]
- Recycled water used for agricultural irrigation purposes has a range of salinity of XXX and TDS XXXX.

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Commented [VL(7]: Recycled water should have a separate and distinct recognition with respect to regulatory challenges.

[19] Dennis Westcot, CV-SALTS Executive Policy Committee meeting discussions.
[20] SJSRB Basin Plan, p. III-2.00.
[21] For example, January 17, 2014 State of Emergency issued by Governor Brown, and subsequent actions to address water shortages caused by extended drought conditions (April 25, 2014 [proclamation of continued state of emergency]; December 22, 2014 [Executive Order B-28-14]; April 1, 2015 [Executive Order B-29-15]; and November 13, 2015 [Executive Order B-36-15]).

Given the existing regulatory requirements and the challenges identified above with regard to protection of the AGR beneficial use in groundwater, CV-SALTS seeks to establish a salinity control strategy through the SNMP that:

- Provides "reasonable protection" for all existing and probable future AGR uses in the Central Valley in a manner consistent with the criteria described in §13000 and §13241 of the California Water Code.
- Preserves the economic viability of the broader agricultural industry in the Central Valley while minimizing and/or mitigating the potential for significant adverse effects on salt-sensitive crops when and where such crops are grown, and such salt-sensitive crops are commercially viable.
- Recognizes the unique characteristics of the AGR beneficial use. It is distinguished from other beneficial uses in that it is an “off-stream use” of water and users of the water have the ability to adapt to changing environmental conditions through crop selection and/or irrigation practices.
- Is consistent with statewide policies designed to encourage increased water conservation, reuse of water from agricultural return flows, use of reclaimed/treated municipal wastewater, and stormwater harvesting.
- Is implemented through an objective, transparent and consistent process to evaluate the real-world probability for the occurrence of adverse effects resulting from increasing salinity loads in groundwater.
- Is consistent with the Central Valley SNMP management goals to assure safe drinking water supply, achieve balanced salt loading within managed areas and implement a managed aquifer restoration program where needed to reduce salinity concentrations in groundwater.

2.0 Proposed Regulatory Approach to Manage Salinity to Protect the AGR Beneficial Use

CV-SALTS has developed a proposed regulatory approach that is consistent with the salinity control strategy described above and addresses the existing regulatory challenges, also described above. The approach, which is described in Section 2.2, is based on the findings and governing principles described below.

2.1 Findings and Governing Principles

The proposed regulatory approach to manage salinity to protect the AGR beneficial use is based on the following findings and governing principles:

- This approach applies exclusively to managing salinity in groundwater. In this regard, the policy determinations made in the course of protecting groundwater for the AGR use may influence similar decisions related to protecting surface water quality for AGR uses but do not override numeric

water quality objectives or other plans or policies intended to address salt and water supply, such as the Bay-Delta Plan,[22] nor does this proposed policy prohibit changes to be made in the future.

- The proposed approach for managing salinity in groundwater must be implemented in a manner consistent with the State Antidegradation Policy (i.e., Resolution No. 68-16), as applicable,[23] and/or any other applicable state groundwater policy.
- Establishing more flexible salinity standards for the AGR use in groundwater does not waive the legal obligation to comply with more stringent salinity standards, where such standards apply to protect other beneficial uses as designated in the Basin Plans (e.g., municipal and domestic supply [MUN], industrial service supply [IND], industrial process supply [PRO]).
- The applicability of AGR as an existing use in a groundwater basin or sub-basin is a site-specific or water body specific determination based on water quality or physical characteristics. Where existing characteristics severely limit a use, e.g., the salinity exceeds safe thresholds for use of the water for crop irrigation or stock watering, the rare, exceptional, or very temporary use of that water as an agricultural water supply, e.g., during a water shortage when the normal water supply is temporarily interrupted, does not require a finding that AGR is an existing use in the groundwater. This conclusion is based on the very limited actual "use" of the water body as agricultural water supply.
- The Central Valley Water Board retains the authority and the discretion to establish appropriate WDRs/Waivers, effluent limits, or receiving water limitations.
- No proven means exist at present that will allow ongoing human activity in the Central Valley Region and maintain salinity levels throughout every groundwater basin.[24] Therefore, in lieu of using a numeric water quality objective for salinity in ground waters designated AGR, the primary focus shall be on minimizing water quality degradation in a manner consistent with the statewide Antidegradation Policy. Specifically,
    - Lowering water quality cannot unreasonably affect present and anticipated beneficial uses;[25]
    - Lowering water quality must be consistent with "maximum benefit" to the people of California. Consideration of "maximum benefit" as part of the antidegradation review process incorporates a more holistic assessment of both the costs and benefits of increasing salinity in groundwater.
    - The Antidegradation Policy requires those who discharge or propose to discharge a waste to a high quality water to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.

[22] Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary, State Water Board, December 13, 2006.
[23] State Water Board Resolution 68-16. *Statement of Policy with Respect to Maintaining High Quality of Waters in California* (Antidegradation Policy)
[24] TLB Basin Plan, Pg. III-8.
[25] See: *Questions and Answers for State Water Resources Control Board Resolution No. 68-16*; February 16, 1995.

- A long-standing regulatory presumption associated with water quality standards exists in that adopting or applying water quality objectives to protect the most sensitive species or sub-population will also protect other less sensitive species and the general population. This presumptive approach is fundamental to the adoption of numeric objectives to protect aquatic life, wildlife or human health. However, the applicability of this approach to the protection of the AGR use is impractical. While aquatic life or wildlife, may not be able to adapt to changing water quality in the short term, agriculture can adapt to stressors that impact the use, including climate change and economic condition. Moreover, agriculture can quickly make use of new technologies and practices designed to benefit agriculture.

- Salinity varies from one location to another in the Central Valley; as such, there should not be an expectation that any crop may be grown in any place at any time. Furthermore, while it is true that conservative salinity water quality objectives will protect the theoretical yields of both salt-sensitive and salt-tolerant crops, the cost of managing salinity to protect the most salt-sensitive crops, irrespective of where such crops are actually or are likely to be grown, may alter the production costs and economic viability of many other crops currently being cultivated. If the result is a net loss of commercial production in the area of concern, then the AGR use has been adversely affected despite the original regulatory intent to provide increased use protection.

- It is difficult to establish a single (or basin specific) numeric water quality objective for salinity in ground waters designated AGR to protect crop irrigation, given the enormous number of relevant factors that may affect crop production and the complex interrelationships among these factors. Therefore, it is appropriate to continue relying on a narrative water quality objective to protect the AGR use from excessive salinity. This approach provides greater flexibility and allows for consideration of a wide range of site-specific conditions when translating the narrative objective into reasonable limitations (e.g., effluent limits, receiving water limits) for salinity. This approach also allows for consideration of crop management techniques that maximize the reuse of water by using the water on a range of crops with varying salt tolerances. Accordingly, translating the narrative objective into reasonable limitations for salinity for inclusion in a WDR/Waiver should consider the following:[26]

    - The salinity guidelines recommended by Ayers & Westcot (1985) are best employed as thresholds to trigger more detailed water quality analysis rather than as direct translators of the current narrative objective for chemical constituents. While salinity concentrations < 700 µS/cm EC (450 mg/L TDS) are presumed to protect nearly all crops and livestock, salinity concentrations > 700 µS/cm EC do not render water quality "unsuitable" for the AGR use.

    - Groundwater salinity in the range between 700 - 1,500 µS/cm EC (450 - 1,000 mg/L TDS) remains suitable for all but the most salt-sensitive crops but may result in agricultural operators needing to increase the leaching fraction to maintain maximum yields, depending on the crop and the level of salinity in the irrigation water. This is not an unusual management practice amongst agricultural operators, in order to assure the most efficient use and reuse of available

[26] Ayers, R.S. and D.W. Westcot. 1985. *Water Quality for Agriculture*. Food and Agricultural Organization (FAO), Irrigation and Drainage Paper 29 Rev. 1, FAO, United Nations, Rome, 174 p.; and Final Draft *Salinity Effects on Agricultural Irrigation-Related Uses of Water*. CV-SALTS White Paper; http://www.cvsalinity.org/index.php/docs/agendas-notes-and-materials/meeting-materials/1043-cv-salts-agr-white-paper-v2081012/file.html.

water supplies. However, the ability to increase leaching rates depends on an adequate supply of acceptable-quality water at a reasonable cost.

- Groundwater salinity in the range between 1,500 - 3,000 µS/cm EC (1,000 - 2,000 mg/L TDS), while generally not suitable for irrigating some salt-sensitive crops, remains suitable for irrigating many salt tolerant crops.[27] Where existing groundwater quality is in this range, it may be appropriate to consider sub-categorizing the AGR use to reflect this existing limitation.
- At groundwater salinities > 3,000 µS/cm EC (2,000 mg/L TDS), existing groundwater quality is generally not suitable for irrigating all but the most salt-tolerant crops.

- The AGR beneficial use also provides for the protection of ground waters used as a stock watering source. While sensitivity to salt varies considerably among types of stock animals (e.g., poultry, cattle, or swine), animal life stage (young vs. adult), or whether an animal is pregnant or lactating, at groundwater salinities < 7,500 µS/cm EC (5,000 mg/L TDS), existing groundwater quality is generally suitable to support some level of stock watering.[28]
- The volume and quality of water available for irrigation varies greatly from year to year and even from month to month. Consequently, it is appropriate for the Central Valley Water Board to take these factors into account when developing limitations and/or permit provisions related to salinity to protect the AGR use in ground waters. In particular, additional flexibility may be allowed during drought conditions when reduced availability of high quality surface waters may necessitate temporary reliance on alternate water supplies with higher salinity to meet irrigation requirements.
- It is reasonable to employ long-term averaging periods, e.g., use of annual averages rather than monthly or quarterly averages, when developing limitations and/or provisions related to salinity in groundwater. For example, the salt load currently existing in the vadose zone is typically unknown, but this load can impact the quality of the underlying groundwater over many years. In addition, the time required for recharge water to transit the vadose zone and return to use as groundwater at a nearby agriculture water supply well can be significant. Therefore, the need for shorter averaging periods is considered generally unnecessary for managing salinity in groundwater. Consider adding the need for long term modeling to predict impacts of vadose zone loads and recharge water.
- Preserving and protecting the AGR use for commercial agriculture will necessitate a large-scale coordinated effort to implement a sustainable salt management program. For example, findings from the CV-SALTS Strategic Salinity Alternatives Land and Transportation Study (SSALTS) confirm existing statements in the Basin Plans that a "*valleywide drain to carry salts out of the valley remains the best technical solution to the water quality problems"* in the Central Valley. Specifically, SSALTS recommends the construction of a regulated brine line to transport salts out of the Central Valley (in particular the lower Central Valley) to an ocean discharge, or other viable salt disposal options.[29] In

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[27] See for example Figure 4c in: *Task 5.1 and 5.2 – Develop Map Layers and Identify Crop Sensitivity Zone, Final Report*, prepared for CV-SALTS by Larry Walker Associates, Inc., April 2014.

[28] Requirements for protection of stock watering based on findings contained in: (a) *Salt and Nutrients: Literature Review for Stock Drinking Water Final Report*. Prepared for CV-SALTS by Kennedy-Jenks, May 20, 2013; (b) *External Peer Review of a Proposed Basin Plan Amendment to Address Beneficial Uses for Groundwater at the Royal Mountain Mine Site, Calaveras County*. Memorandum from Kerry Rood (Utah State University) to Gerald Bowes (Manager Cal/EPA Scientific Peer Review Program). November 23, 2012.

[29] CV-SALTS, *Strategic Salinity Alternatives Land and Transportation Study, Final Phase 2 Report: Development of*

addition, future WDRs will need to be consistent with the short-term (≤ 20 years) and long-term (> 20 years) salt management requirements established by the Central Valley SNMP, including compliance with scheduled milestones to evaluate progress towards achieving the SNMP's goals for the management of salt.

- Where significant salinity water quality concerns exist, future WDRs/Waivers will require a genuine long-term (> 20 years) commitment to execute a regional salt management program either as an individual discharger or collectively through a Management Zone as a prerequisite condition for allowing greater regulatory flexibility. An approved long-term salinity management program will include salinity treatment/control type projects and a schedule of milestones that support efforts to achieve salt balance within the managed area and, where appropriate, actual reductions in salt concentrations to protect the beneficial use.

2.2 Proposed Framework for Protection of AGR

Given the findings and governing principles described above, CV-SALTS proposes to interpret the narrative salinity water quality objective for the protection of the AGR beneficial use as described in the sections below.

2.2.1 Assign Groundwater Basins to AGR Classes Based on Existing Ambient Water Quality Conditions

It is recommended that the Central Valley Water Board assign AGR classes to groundwater basins and sub-basins or management zones?? based on existing ambient water quality in the production zone of the basin or sub-basin or management zone??. Assignment of groundwater basins and sub-basins into an AGR Class does not establish numeric water quality objectives. Instead, the establishment of AGR classes is intended to provide a basis for translating the existing narrative water quality objective at the local level to support management of salt through WDRs/Waivers.

To recognize the significant variability in salinity concentrations in groundwater across the Central Valley, groundwater basins or sub-basins will be classified into one of four AGR Classes based on the existing volume-weighted average salinity concentration in the production zone of that basin or sub-basin using TDS as the measure of salinity.[30] SNMP Section 4 provides the most recent calculation of existing ambient TDS water quality in the Central Valley.[31] The attached figure shows the class designations by groundwater basin/sub-basin.

When establishing an AGR Class for each groundwater basin/sub-basin, if there are any situations where the ambient TDS water quality in the basin/sub-basin is ~~close to~~ within 10% of the upper threshold of the range for the AGR Class or is significantly trending upward, the Central Valley Water Board has the discretion to assign the basin/sub-basin to the next higher AGR Class. Once a groundwater basin or sub-basin is given an AGR classification, salinity shall be managed within the range established for that class. The four AGR Classes, the range of TDS values (with comparable EC values) applicable to each class for

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Potential Salt Management Strategies, prepared by CDM Smith, October 1, 2014.

[30] The volume-weighted average existing ambient quality of the production zone is determined using the procedures described in Section XXX of the SNMP.

[31] The basis for these findings is the CV-SALTS study: *Updated Groundwater Quality Analysis for the Central Valley* (2016).

interpreting the narrative salinity objective, and information regarding the use of the water as an agricultural supply within each AGR Class is described as follows:[32, 33]

- ***AGR Class 1***: TDS < 600 mg/L (EC < 1,000 µS/cm). Groundwater quality in the production zone that may be used as an agricultural water supply is generally suitable for irrigating all crops and all stock watering. This presumption is rebuttable on a case-by-case basis with the burden of proof falling on those claiming that TDS levels at or below 1,000 µS/cm do not provide reasonable protection of existing AGR uses and that a site-specific TDS value should be established.
- ***AGR Class 2***: 600 mg/L < TDS < 2,000 mg/L (1,000 µS/cm < EC < 3,000 µS/cm). Groundwater quality in the production zone that may be used as an agricultural water supply is generally acceptable for stock watering and for irrigating most salt-tolerant crops; it is not generally suitable for irrigating many salt-sensitive crops, *except* as a temporary, short-term alternative when higher quality water supplies are not readily available.
- ***AGR Class 3***: 2,000 mg/L < TDS < 5,000 mg/L (3,000 µS/cm < EC < 7,500 µS/cm). Groundwater quality in the production zone that may be used as an agricultural water supply is generally acceptable for stock watering but is not generally suitable for irrigating all but the most salt-tolerant crops, *except* as a temporary, short-term alternative when higher water quality water supplies are not readily available.
- ***AGR Class 4***: TDS > 5,000 mg/L (EC > 7,500 µS/cm). Groundwater quality in the production zone that is not suitable for either stock watering or crop irrigation AGR uses unless blended with lower salinity water. Areas within this classification should be considered for AGR de-designation.

As noted above, the assignment of a groundwater basin or sub-basin to an AGR Class is based on a volume-weighted average of salinity concentrations in the agricultural production zone. Accordingly, there likely will be exceptions where localized water quality data from within a classified basin or sub-basin may indicate higher or lower TDS concentrations than the thresholds of the class assigned to the waterbody. When issuing WDRs/Waivers this potential for localized variability in existing quality will be managed through application of the State Antidegradation Policy and the requirements of the Central Valley SNMP.

2.2.2 Salinity Management Requirements

Within a groundwater basin or sub-basin, salinity may be managed by ~~an~~ individual discharger~~s~~ through ~~an~~ individual WDR~~s, or~~ collectively by a group of dischargers that has formed a Management Zone, or a combination.[34] Where salinity implementation measures are incorporated into the Salt and Nitrate Compliance Plan established for the Management Zone, the Central Valley Water Board will incorporate

Commented [VL(14]: This phrase is a little confusing. Consider a new term called the "agricultural water supply production zone" if it differs from the general production zone. Same comment for next 3 class descriptions.

[32] Ranges for protection of crop irrigation based on findings contained in Final Draft *Salinity Effects on Agricultural Irrigation-Related Uses of Water*. CV-SALTS White Paper; http://www.cvsalinity.org/index.php/docs/agendas-notes-and-materials/meeting-materials/1043-cv-salts-agr-white-paper-v2081012/file.html.

[33] Requirements for protection of stock watering based on findings contained in: (a) *Salt and Nutrients: Literature Review for Stock Drinking Water Final Report*. Prepared for CV-SALTS by Kennedy-Jenks, May 20, 2013; (b) *External Peer Review of a Proposed Basin Plan Amendment to Address Beneficial Uses for Groundwater at the Royal Mountain Mine Site, Calaveras County*. Memorandum from Kerry Rood (Utah State University) to Gerald Bowes (Manager Cal/EPA Scientific Peer Review Program). November 23, 2012.

[34] See CV-SALTS Management Zone Policy

the implementation measures into individual WDRs/Waivers issued within the Management Zone, as appropriate.

Existing ambient water quality within the area potentially impacted by a discharged shall be managed in a manner that is consistent with the Central Valley SNMP and the State Antidegradation Policy to ~~limit~~ manage? further degradation. Where the discharge may cause established salinity-based criteria to be exceeded, the discharger may be required to develop a Salt Compliance Plan that includes salinity treatment/control measures consistent with the Central Valley SNMP and SSALTS[35] to achieve balanced salt loadings (SNMP Management Goal 2), and, if deemed appropriate, a managed aquifer restoration program (SNMP Management Goal 3) for the area affected by the discharge. The specific criteria that triggers the requirement to develop a Salt Compliance Plan are currently under discussion.

Commented [VL(15]: Trying to keep terms consistent – is the intent to place a numeric limit on degradation or to manage it as the document(s) say in other places.

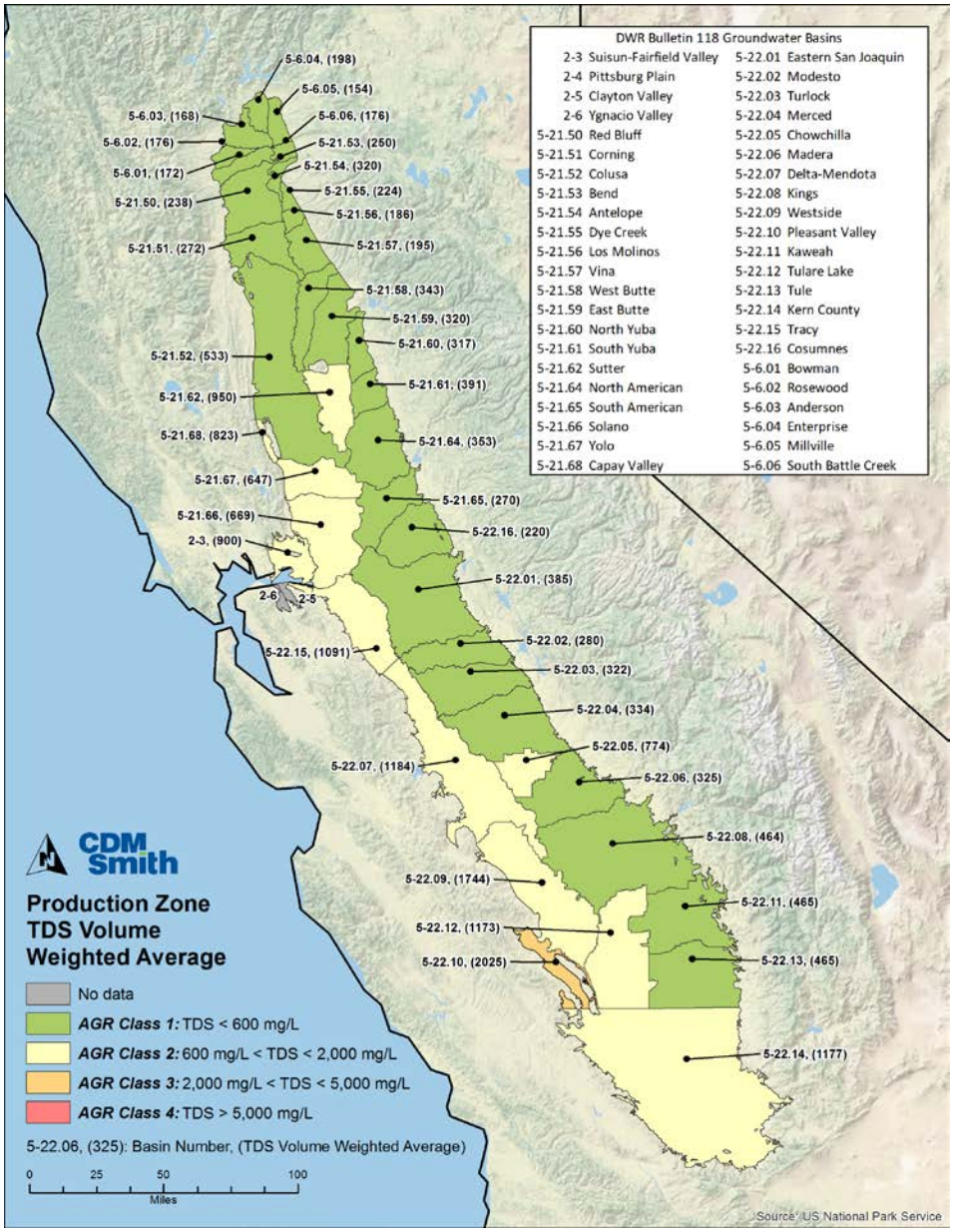
Where the trigger criteria are exceeded, the discharger shall submit a Salt Compliance Plan for the area under the influence of the discharge that includes short-term (≤ 20 years) and long-term (>20 years) implementation measures consistent with SSALTS. A long-term implementation program may include, but not be limited to:

Commented [VL(16]: Other documents have significant items done in 10 year increments.

- Commitments to direct participation in the development of a Central Valley regulated brine line or other approved salt-disposal or salt-management project;
- Participation in a mitigation bank to support development of a Central Valley regulated brine line;
- Participation in the development of a Central Valley Water Board approved salt management site that serves as a local or regional salt sink; or
- Other options that will support efforts to achieve balanced salt loading in the affected area and aquifer restoration, where required.

If the existing ambient TDS/EC water quality in the area affected by the discharge does not exceed the trigger criteria, salinity implementation measures shall be incorporated into the WDR/Waiver to the extent deemed necessary by the Central Valley Water Board to comply with the State Antidegradation Policy and limit further degradation consistent with the Central Valley SNMP.

[35] *Strategic Salt Accumulation Land and Transportation Study (SSALTS), Final Phase 2 Report: Development of Potential Salt Management Strategies.* Report prepared by CDM Smith on behalf of CV-SALTS. October 1, 2014; *SSALTS, Final Phase 1 Report: Identification and Characterization of Existing Salt Accumulation Areas*. Report prepared by CDM Smith on behalf of CV-SALTS. December 13, 2013. Phase 3 Report in development.


DWR Bulletin 118 Groundwater Basins
2-3 Suisun-Fairfield Valley
2-4 Pittsburg Plain
2-5 Clayton Valley
2-6 Ygnacio Valley
5-21.50 Red Bluff
5-21.51 Corning
5-21.52 Colusa
5-21.53 Bend
5-21.54 Antelope
5-21.55 Dye Creek
5-21.56 Los Molinos
5-21.57 Vina
5-21.58 West Butte
5-21.59 East Butte
5-21.60 North Yuba
5-21.61 South Yuba
5-21.62 Sutter
5-21.64 North American
5-21.65 South American
5-21.66 Solano
5-21.67 Yolo
5-21.68 Capay Valley
5-22.01 Eastern San Joaquin
5-22.02 Modesto
5-22.03 Turlock
5-22.04 Merced
5-22.05 Chowchilla
5-22.06 Madera
5-22.07 Delta-Mendota
5-22.08 Kings
5-22.09 Westside
5-22.10 Pleasant Valley
5-22.11 Kaweah
5-22.12 Tulare Lake
5-22.13 Tule
5-22.14 Kern County
5-22.15 Tracy
5-22.16 Cosumnes
5-6.01 Bowman
5-6.02 Rosewood
5-6.03 Anderson
5-6.04 Enterprise
5-6.05 Millville
5-6.06 South Battle Creek
5-6.04, (198)
5-6.05, (154)
5-6.03, (168)
5-6.06, (176)
5-6.02, (176)
5-21.53, (250)
5-21.54, (320)
5-6.01, (172)
5-21.55, (224)
5-21.50, (238)
5-21.56, (186)
5-21.51, (272)
5-21.57, (195)
5-21.58, (343)
5-21.59, (320)
5-21.60, (317)
5-21.52, (533)
5-21.61, (391)
5-21.62, (950)
5-21.68, (823)
5-21.64, (353)
5-21.67, (647)
5-21.65, (270)
5-21.66, (669)
5-22.16, (220)
2-3, (900)
5-22.01, (385)
2-6
2-5
5-22.15, (1091)
5-22.02, (280)
5-22.03, (322)
5-22.04, (334)
5-22.05, (774)
5-22.07, (1184)
5-22.06, (325)
5-22.08, (464)
5-22.09, (1744)
5-22.11, (465)
5-22.12, (1173)
5-22.10, (2025)
5-22.13, (465)
5-22.14, (1177)
CDM Smith
Production Zone
TDS Volume
Weighted Average
No data
AGR Class 1: TDS < 600 mg/L
AGR Class 2: 600 mg/L < TDS < 2,000 mg/L
AGR Class 3: 2,000 mg/L < TDS < 5,000 mg/L
AGR Class 4: TDS > 5,000 mg/L
5-22.06, (325): Basin Number, (TDS Volume Weighted Average)
0
25
50
100
Miles
Source: US National Park Service