Regulating Salinity to Provide Reasonable Protection of the Agricultural (AGR) Beneficial Uses in Groundwater

Summary of the Current Regulatory Approach

1) DEFINITION OF AGR: The Basin Plans define AGR as *"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."*

2) PRESUMPTION OF AGR: *"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)… In making any exception to the AGR beneficial use designation, the Regional Water Board will consider whether pollution, from either natural processes or human activity (unrelated to a specific pollution incident), that cannot reasonably be treated for agricultural use using either BMPs or best economically achievable treatment practices."*[1]

3) NARRATIVE OBJECTIVE: The Basin Plans do not establish explicit numeric water quality objectives for salinity in groundwater for the AGR beneficial use. However, the TLBP does regulate the maximum average annual increase in groundwater salinity (aka "managed degradation" policy). And, both Basin Plans include the following narrative water quality objective: *"Ground waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses."*

4) SALINITY TRANSLATOR: Historically, the Regional Board has assumed that TDS concentrations <450 mg/L and EC levels <700 *u*S/cm would not adversely affect the AGR beneficial use (including salt sensitive crops). These values, based on guidelines originally published by Ayers and Westcott (1976, 1985), are used to translate the narrative objective into appropriate Waste Discharge Requirements (WDRs), effluent limits, receiving water limitations, and/or waiver conditions by the Regional Board.

5) POINT OF COMPLIANCE: Historically, the Regional Board has evaluated compliance with narrative or numeric salinity objectives at "First Encountered Groundwater" (e.g. at the top of the saturated zone).

[1] Water Quality Control Plan (Basin Plan) for the California Regional Water Quality Control Board Central Valley Region - 4th Ed. The Sacramento River Basin and the San Joaquin River Basin. Revised Sept., 2009. Pg. II-3.00.

Concerns with the Current Regulatory Approach

1) Irrigation practices designed to move salts past the root zone are considered an integral part of the AGR beneficial use. 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 Best Management Practices.

2) It is often impossible to comply with the 700 *u*S/cm threshold even after implementing Best Management Practices. For example, if an agricultural operator irrigates with high quality imported water (EC=150) and the leaching fraction is assumed to be 15%, then salinity in the leachate will concentrate more than six-fold (EC=1,000). Given the average salinity of available water supplies, there is no feasible or practicable means of meeting the 700 *u*S/cm threshold at First Encountered Groundwater.

3) Ayers and Westcott's recommended salinity guideline for "Unrestricted Use" (<700 *u*S/cm) has been misinterpreted and applied in a manner inconsistent with the author's conclusions. Some salinity impacts can be mitigated by modern irrigation strategies without unreasonably affecting the AGR beneficial use.

4) Evaluating compliance with salinity standards at First Encountered Groundwater does not adequately consider the availability of assimilative capacity in the receiving water to mitigate the potential for adverse effects on AGR uses downgradient of the discharge.

5) Focusing on salinity concentration as the primary metric for evaluating use protection and water quality degradation may impede ~~conflicts with~~ statewide efforts designed to promote increased use of recycled water and to encourage greater water conservation thru more efficient irrigation. Sound resource management should consider both concentration and mass when regulating salinity effects on groundwater.

6) Irrigation water is the largest single source of new salt loads to ground waters in the Central Valley. Therefore, it is appropriate to require BMPs to minimize salt loading (e.g. mass) to the vadose zone when and where reasonably possible; however, irrigation and leaching should not be deemed "waste transport" per se.

7) The regional economy depends on efficient use and re-use of water to maximize agricultural production and minimize waste. Reliance on a single salinity threshold undermines this principle and jeopardizes the industry's ability to grow a variety of different crops with widely varying salt tolerances by reusing water many times.

8) The fact that all ground waters are considered "suitable or potentially suitable" for AGR does not mean that subsurface water quality is, or should be, capable of sustaining maximum yield for every conceivable crop. This is particularly true where imported surface water is used to produce crops that would not otherwise be commercially viable if forced to rely on native ground water as the sole source of irrigation supply.

Goals for a Salinity Control Strategy to Protect AGR Uses ~~Outcomes Sought~~

1) A salinity control strategy that provides "reasonable protection" for all existing and probable future AGR uses in the Central Valley in a manner consistent with the decision criteria described in §13000 and §13241 of the California Water Code.

2) A salinity control strategy that preserves the economic viability of the broader ~~larger~~ agricultural industry in the Central Valley while minimizing or mitigating the potential for significant adverse effects on ~~when and where~~ salt-sensitive crops when and where such crops are grown.

3) A salinity control strategy that recognizes the unique characteristics of the AGR beneficial use, particularly the ability to adapt to changing environmental conditions thru crop selection or irrigation practices, that distinguish it from other beneficial uses.

4) A salinity control strategy that is consistent with statewide policies designed to encourage greater water conservation, increased re-use of ~~recycled~~ water from both agricultural return flows and high quality municipal wastewater, and additional stormwater harvesting.

5) A salinity control strategy that 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 ground water.

Key Assumptions

1) The current discussion focuses exclusively on managing salinity in groundwater; no changes are proposed (at this time) to any of the numeric salinity objectives that have been previously established for surface water bodies in the Central Valley region (including those adopted for the Bay-Delta as part of the SWRCB's 1995 Salinity Plan). However, these pre-existing numeric salinity objectives may be re-evaluated at some later date. The policy determinations made in the course of protecting groundwater for AGR use may influence similar decisions related to protecting surface water quality for AGR uses but do not establish a binding precedent.

2) The proposed approach for managing salinity in ground water must be implemented in a manner consistent with the statewide Antidegradation Policy (Res. No. 68-16).

3) Establishing more flexible salinity standards for the AGR use in ground water does not waive the legal obligation to comply with more stringent salinity standards where such standards have been established ~~necessary~~ to protect other designated uses (e.g. MUN, IND, PRO).

4) As always, the Regional Board retains the authority and the discretion to establish appropriate Waste Discharge Requirements, Effluent Limits, Receiving Water Limitations, or Waiver Conditions based on site-specific conditions.

Governing Principles

1) Given the enormous number of relevant factors and complex interrelationships between these factors, it is difficult to establish a single numeric water quality objective for salinity in ground waters designated AGR. Therefore, it is appropriate to continue relying on narrative water quality objectives to protect AGR uses from excessive salinity. This approach provides greater flexibility to consider a wide range of site-specific conditions when translating the narrative objective into reasonable receiving water limitations for salinity. ~~regulating salinity discharges to ground water using a narrative implementation procedure to protect the AGR use.~~

2) 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. Therefore, in lieu of using a numeric water quality objective for salinity in ground waters designated AGR, the primary focus should be on minimizing water quality degradation ~~preserving existing quality~~ in a manner consistent with ~~the~~ statewide ~~Antidegradation~~ policy (Res. No. 68-16). This policy allows the Regional Board to authorize higher salinity subject to certain conditions.[2] The first of these conditions is that lowering water quality cannot unreasonably affect beneficial uses. Thus, the AD policy incorporates the requirement to protect existing uses and encourages consideration of ~~a more~~ site-specific factors.[3] ~~analysis.~~ Second, lowering water quality must provide "maximum benefit" to the people of California. This allows a more holistic assessment of both the costs and benefits of increasing salinity in groundwater. Finally, the AD policy requires dischargers to implement Best Practicable Treatment or Controls (BPTC) to minimize water quality degradation consistent with the "maximum benefit" analysis.

3) There is a long-standing regulatory presumption ~~working assumption~~ that adopting ~~designing~~ water quality objectives to protect the most sensitive species or sub-populations will also protect other less sensitive species and the general population. This assumption does not work well when applied to the AGR use for commercial agriculture ~~where crop yield is the primary measure of use attainment or impairment~~. It is true that conservative salinity objectives will protect the theoretical yields of both salt-sensitive and salt-tolerant crops. However, the cost of managing ~~reducing~~ salinity to protect the most salt-sensitive crops, irrespective of where such crops 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 across the region, then the general AGR use has been adversely affected despite the original regulatory intent~~ion~~ to provide increased use protection.

[2] See also: State Water Resources Control Board; Administrative Procedures Update 90-004

[3] See also: Questions and Answers for State Water Resources Control Board Resolution No. 68-16 (Feb. 16, 1995).

4) The salinity guidelines recommended by Ayers & Westcott 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 uS/cm are presumed to fully protect nearly all crops, salinity concentrations greater than 700 uS/cm do not necessarily render water quality "unsuitable" for the AGR use. Ground water salinity in the range between 700-1,500 *u*S/cm (500-1,000 mg/L as TDS) remains suitable for all but the most salt-sensitive crops but may require agricultural operators to increase the leaching fraction to maintain maximum yields. This is not an unreasonable requirement because, in order to assure the most efficient use and reuse of available water supplies, the obligation to implement cost-effective and reasonable BMPs applies equally to all stakeholders (dischargers and water users) in the Region. However, the ability to increase leaching rates depends on an adequate supply of acceptable-quality water at a reasonable cost.

5) Groundwater salinity in the range between 1,500 - 3,000 *u*S/cm (1,000 - 2,000 mg/L) is generally not suitable for irrigating some salt-sensitive crops. However, it remains suitable for irrigating many salt-tolerant crops. Where current groundwater quality is in this range, it may be appropriate to consider sub-categorizing the AGR use to reflect this existing limitation. (See discussion of AGR Classes below).

6) 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 Regional Board to take these factors into account when developing receiving water limitations related to salinity. In particular, additional flexibility may be allowed during drought conditions when reduced availability of high quality surface waters may necessitate temporary reliance on alternate supplies with higher salinity to meet irrigation requirements.

7) It is reasonable to employ long-term averaging periods when developing receiving water limitations related to salinity in groundwater. The time required to transit the vadose zone and return to use at a nearby production well generally makes shorter averaging periods unnecessary for managing salinity in groundwater.

8) Preserving and protecting the AGR use for commercial agriculture will necessitate a large-scale coordinated effort (such as SSALTS) to implement sustainable salt management strategies. Future Waste Discharge Requirements (WDRs) will require a genuine long-term commitment to execute such regional programs as a prerequisite condition for allowing greater regulatory flexibility. A schedule of milestones will be used to evaluate progress toward implementing these salt management programs and a regional monitoring program for evaluating long-term water quality trends, changes in assimilative capacity, and tracking salt loads/offsets is also appropriate.

Sub-Classification for AGR Use based on Existing Groundwater Quality

AGR - Class 1: (EC<1,000 *u*S/cm)

Volume-weighted average salinity concentrations in the groundwater production zone is generally suitable for irrigating all crops and livestock. This presumption is rebuttable on a case by case basis with the burden of proof falling on those claiming that EC levels at or below 1,000 *u*S/cm do not provide reasonable protection of existing AGR uses and that a site-specific objective should be established.

AGR - Class 2: (1,000 uS/cm <EC< 3,000 *u*S/cm)

Volume-weighted average salinity concentration in the groundwater production zone is generally acceptable for watering livestock and for irrigating most salt-tolerant crops but 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: (3,000 *u*S/cm <EC< 7,500 *u*S/cm)

Volume-weighted average salinity concentration in the groundwater production zone is generally acceptable for watering most livestock 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: (EC> 7,500 *u*S/cm)

Volume-weighted average salinity concentration in the groundwater production zone is not generally suitable for AGR uses, including watering livestock or irrigating most crops, except as a temporary, short-term alternative when higher water quality water supplies are not readily available.

The EC thresholds identified above are provided for the sole purpose of establishing broad sub-categories for managing salinity levels in groundwater. Groundwater basins or sub-basins will be assigned to the appropriate subcategory based on existing water quality and the Regional Board will establish reasonable receiving water limitations to preserve that categorical status.[4] In addition, the Regional Board will implement Performance-based Waste Discharge Requirements (WDRs) intended to control the rate of increase in salinity in a manner consistent with the statewide Antidegradation Policy. These Performance-based WDRs can and will vary between the four subcategories. A wide range of relevant factors must be considered in order to develop reasonable and appropriate Performance-based WDRs; the EC values shown above are just one of many such factors and should not be used as default numeric translators of the narrative objective.

[4] For groundwater basins where the average quality is on the cusp between two categories, the Regional Board may elect to assign that basin or sub-basin to either category based on careful consideration of site-specific conditions. The Board may also re-assign any basin or sub-basin to a different category by amending the Basin Plan accordingly.

Procedures to Develop Performance-based WDRs to Implement Narrative Objectives for Salinity

1) The primary tool for managing salinity in Central Valley groundwaters will be through the Antidegradation Review process. In this process the Regional Board will seek to maintain EC levels with broad categorical ranges based on the suitability of existing water quality to support certain AGR uses. The Regional Board will establish appropriate receiving water limitations to implement this objective and rely on Performance-based WDRs to assure compliance with such limitations.

2) To establish appropriate receiving water limitations for salinity control, the Regional Board will consider a number of factors including, but not limited to:

   a) Existing and probable beneficial uses consistent with the applicable AGR subclassification for each groundwater basin or sub-basin. This includes the crops that are grown or are likely to be grown in the area overlying each basin or sub-basin.

   b) Existing EC levels in each groundwater basin or sub-basin, the amount of assimilative capacity available, and any spatial or temporal variability in salinity concentrations.

   c) The degree to which crop irrigation or livestock watering is dependent on underlying groundwater to maintain economically viable production levels.

   d) The degree to which incremental increases in salinity, within the defined range for each AGR subclassification, may adversely affect existing crop yields and livestock production.

   e) The availability and cost of alternate water supplies of higher quality.

   f) The availability of practicable and cost-effective Best Management Practices to minimize or mitigate additional salt loads to the groundwater basin.

   g) The need for additional recharge to improve or maintain current groundwater levels.

   h) The need to encourage greater water conservation or increased use of recycled water in the region.

   i)

   j)

   k)

3) Existing and probable ~~The~~ AGR uses will be considered "reasonably protected" and "not unreasonably affected" under any of the following conditions…

a) The average EC in the zone-of-influence below a discharge is expected to remain in the specified range for the applicable AGR subcategory. ~~less than 700 uS/cm.~~ This is a rebuttable presumption; however, the burden-of-proof is on those advocating for a different site-specific EC value, ~~lower EC threshold,~~ or…

b) ~~The average EC in the zone of influence below a discharge is expected to remain below 1,500 uS/cm and a~~Any net increase in groundwater salinity resulting from authorized discharges is not expected to have more than a 5% probability (1 in 20 years) of reducing existing average crop yields by more than 5% based on current common irrigation practices. The burden-of-proof is on the discharger(s) to make this demonstration using models acceptable to ~~approved by~~ the Regional Board, or…

c) Local groundwater is being used to irrigate crops, at agronomically-efficient rates, ~~in a reasonable and responsible manner,~~ and the return flows are percolating back to the same aquifer (no net change in mass), or…

d) The average EC concentration in the agricultural return flow ~~discharge~~ is less than ~~or equal to than~~ the average EC level in the groundwater to which it percolates (measured at first-encountered groundwater), or…

e) High quality water supplies (<700 *u*S/cm) are used to irrigate crops and the leaching fraction is greater ~~less~~ than or equal to ~~15%~~ 10%, or…

f) High quality recycled water (<1,500 *u*S/cm) is used to irrigate crops presently being grown with imported surface water or local groundwater, or…

g) The discharger has mitigated any significant adverse localized effects on downgradient crop yields by an arrangement satisfactory to the affected agricultural operators and the Regional Board. This may include, but is not limited to: a) providing additional water supplies for irrigation in order to increase the leaching fraction; b) providing an alternate water supply of equal or better quality; c) providing economic assistance to change crop selections or offset yield reductions, or…

h) The permittee ~~discharger~~ has implemented Best Practicable Treatment or Controls and there is no reasonable or practicable means of further reducing EC concentrations in the agricultural return flows ~~discharge and imposing more stringent waste discharge requirements would result in a de facto moratorium~~ and the discharger participates in Alternate Compliance Program designed to provide more significant ~~long-term~~ water quality improvement in the same groundwater basin ~~programs~~ (such as the ~~including~~ salt export or salt sequestration projects suggested in SSALTS or a mitigation bank) that are acceptable to the Regional Board. The program may propose to rely on salt "offsets" or propose to ~~focus on~~ implement~~ing~~ more cost-effective controls for other pollutants (i.e.. nitrates, arsenic, selenium) that pose a greater and more urgent risk to public health or the environment, or…

i) In emergency drought conditions, or other exceptional circumstances, as authorized by the Regional Board, State Water Resources Control Board, Governor or other proper authority.

CALIFORNIA WATER CODE
Section 13000

"...activities and factors which may affect the quality of the waters of the state shall be regulated to attain the highest water quality which is reasonable, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible."

CALIFORNIA WATER CODE
Section 13241

"It is recognized that it may be possible for the quality of water to be changed to some degree without unreasonably affecting beneficial uses. Factors to be considered by a regional board in establishing water quality objectives shall include, but not necessarily be limited to, all of the following:

a) Past, present, and probable future beneficial uses of water.

b) Environmental characteristics of the hydrographic unit under consideration, including quality of water available thereto.

c) Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area.

d) Economic considerations.

e) The need for developing housing within the region

f) The need to develop and use recycled water."

STATE WATER RESOURCES CONTROL BOARD

RESOLUTION NO. 68-16

STATEMENT OF POLICY WITH RESPECT TO
MAINTAINING HIGH QUALITY OF WATERS IN CALIFORNIA

WHEREAS the California Legislature has declared that it is the policy of the State that the granting of permits and licenses for unappropriated water and the disposal of wastes into the waters of the State shall be so regulated as to achieve highest water quality consistent with maximum benefit to the people of the State and shall be controlled so as to promote the peace, health, safety and welfare of the people of the State; and

WHEREAS water quality control policies have been and are being adopted for waters of the State; and

WHEREAS the quality of some waters of the State is higher than that established by the adopted policies and it is the intent and purpose of this Board that such higher quality shall be maintained to the maximum extent possible consistent with the declaration of the Legislature;

NOW, THEREFORE, BE IT RESOLVED:

1. Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.

2. Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required 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.

3. In implementing this policy, the Secretary of the Interior will be kept advised and will be provided with such information as he will need to discharge his responsibilities under the Federal Water Pollution Control Act.

Table 4. Guidelines for interpretations of water quality for irrigation[1] (adapted from Ayers and Westcot 1985)

Water Quality Concern	Constituent	Degree of Restriction on Use		
		None	Slight to Moderate	Severe
Salinity[2]	Electrical Conductivity (irrigation water) (EC_w) (dS/m)	< 0.7	0.7 – 3.0	> 3.0
	Total Dissolved Solids (mg/L)	< 450	450 – 2,000	> 2,000
Infiltration as related to SAR and EC_w (infiltration rate increases with increased salinity)	SAR = 0 - 3	EC_w > 0.7	EC_w = 0.7 – 0.2	EC_w < 0.2
	SAR = 3-6	EC_w > 1.2	EC_w = 1.2 – 0.3	EC_w < 0.3
	SAR = 6 – 12	EC_w > 1.9	EC_w = 1.9 – 0.5	EC_w < 0.5
	SAR = 12 – 20	EC_w > 2.9	EC_w = 2.9 – 1.3	EC_w < 1.3
	SAR = 20 - 40	EC_w > 5.0	EC_w = 5.0 – 2.9	EC_w < 2.9
Specific Ion Toxicity	Sodium –surface irrigation	SAR <3	SAR = 3 - 9	SAR > 9
	Sodium – sprinkler irrigation	SAR <3	SAR > 3	
	Chloride –surface irrigation	SAR <4	SAR = 4 - 10	SAR > 10
	Chloride – sprinkler irrigation	SAR <3	SAR > 3	
	Boron (mg/L)	< 7	0.7 – 3.0	> 3.0
Miscellaneous Effects	Nitrogen (NO_3 – N) (mg/L)	< 5	5 - 30	> 30
	Bicarbonate (HCO_3) – overhead sprinkling only (me/L)	< 1.5	1.5 – 8.5	> 8.5
	pH	Normal Range = 6.5 – 8.4		

[1] Adapted from University of California Committee of Consultants 1974.

[2] EC_w means electrical conductivity in water used for irrigation, a measure of the water salinity.

[3] SAR means sodium adsorption ratio. See Figure1 in Ayers and Westcot (1985) for the SAR calculation procedure – not provided here. At a given SAR, infiltration rate increases as water salinity increases. The values provide a means to evaluate the potential infiltration problem by SAR as modified by EC_w.

[4] For surface irrigation, most tree crops and woody plants are sensitive to sodium and chloride; use the values shown. Most annual crops are not sensitive; use the salinity tolerance tables (Tables 4 and 5 in Ayers and Westcot 1985 – not provided here). For chloride tolerance of selected fruit crops, see Table 14 in Ayers and Westcot (1985) – not provided here. With overhead sprinkler irrigation and low humidity (< 30 percent), sodium and chloride may be absorbed through the leaves of sensitive crops. For crop sensitivity to absorption, see Tables 18, 19 and 20 in Ayers and Westcot (1985) – not provided here.

[5] For boron tolerances, see Tables 16 and 17 in Ayers and Westcot (1985) – not provided here.

[6] NO_3 -N means nitrate nitrogen reported in terms of elemental nitrogen (NH_4 -N and Organic-N should be included when wastewater is being tested).

- *Restriction on Use Information: "…*The divisions are somewhat arbitrary since change occurs gradually and there is no clearcut breaking point. A change of 10 to 20 percent above or below a guideline value has little significance if considered in proper perspective with other factors affecting yield. Field studies, research trials and observations have led to these divisions, but management skill of the water user can alter them. Values shown are applicable under normal field conditions prevailing in most irrigated areas in the arid and semi-arid regions of the world."

have little value for irrigation. Within these limits, the *value* of water appears to decrease as the salinity increases. Where water is to be used regularly for irrigation of relatively impervious soil, its value is limited if the TDS is in the range of 2,000 mg/L" (emphasis in the original)

Table 1. Salinity hazard associated with various types of agricultural water use (adapted from FWPCA 1968)

Water Use	TDS (mg/L)	EC (dS/m)
Water for which no detrimental effects will usually be noticed	< 500	< 0.75
Water which can have detrimental effects on sensitive crops	500 – 1,000	0.75 – 1.50
Water that may have adverse effects on many crops and requiring careful management practices	1,000 – 2,000	1.50 – 3.00
Water that can be used for tolerant plants on permeable soils with careful management practices	2,000 – 5,000	3.00 – 7.50

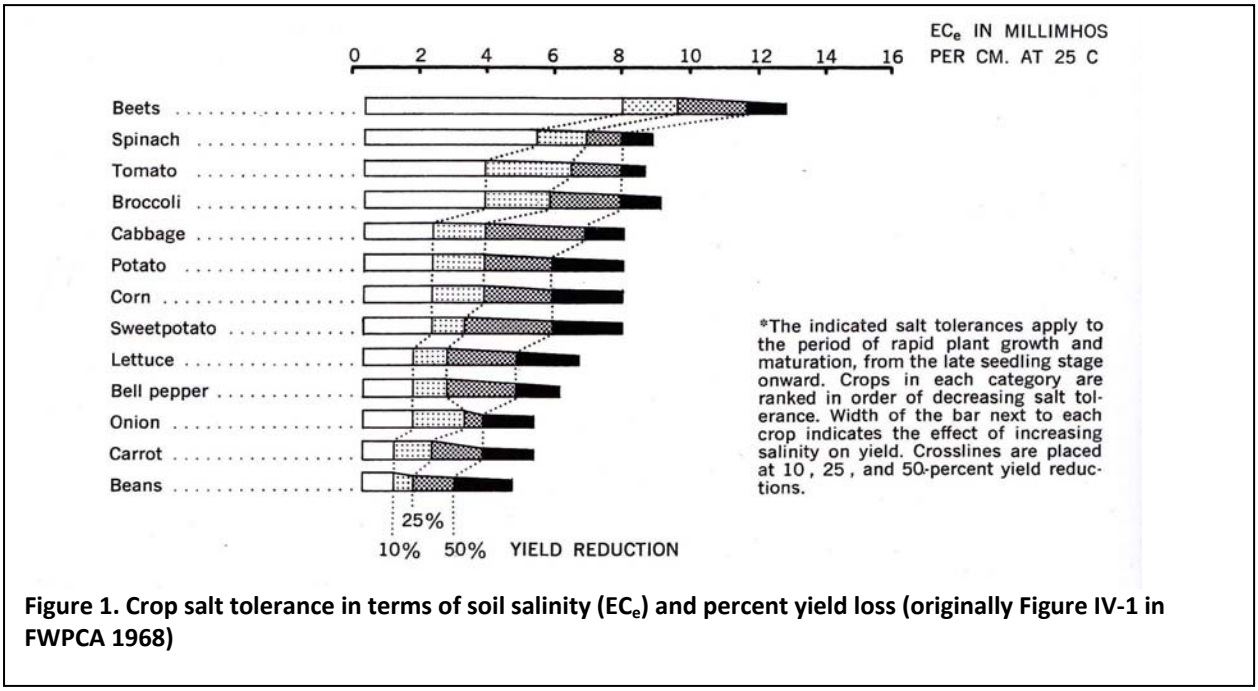


Figure 1. Crop salt tolerance in terms of soil salinity (EC_e) and percent yield loss (originally Figure IV-1 in FWPCA 1968)

Additional effluent limits follow:

- The incremental increase in salts from use and treatment must be controlled to the extent possible. The maximum EC shall not exceed the EC of the source water plus 500 micromhos/cm. When the source water is from more than one source, the EC shall be a weighted average of all sources.

- Concentration of total coliform organisms in reclaimed wastewater must be in accordance with limits established in the following provisions of Title 22, California Code of Regulations: Sections 60303 (Spray Irrigation of Food Crops), 60305 (Surface Irrigation of Food Crops), 60311 (Pasture for Milking Animals), 60313 (Landscape Irrigation), 60315 (Nonrestricted Recreational Impoundment), 60317 (Restricted Recreational Impoundment), and 60319 (Landscape Impoundment).

- In the Poso Creek Subarea, discharges shall not exceed 1,000 micromhos/cm EC, 200 mg/l chlorides, and 1.0 mg/l boron. The Poso Creek subarea consists of about 35,000 acres of land between State Highways 99 and 65 about six miles north of Bakersfield, and is defined more specifically in Regional Water Board Resolution No. 71-122, which is incorporated by reference into this plan.

- In the White Wolf Subarea, for areas overlying Class I irrigation water, discharges shall not exceed 1,000 μmhos/cm EC, 175 mg/l chlorides; 60 percent sodium, and 1.0 mg/l boron. For areas overlying Class II or poorer irrigation water, discharges shall not exceed 2,000 μmhos/cm EC, 350 mg/l chlorides, 75 percent sodium, and 2 mg/l boron. In areas where ground water would be Class I except for the concentration of a specific constituent, only that constituent will be allowed to exceed the specified limits for Class I water. In no case shall any constituent be greater than those limits specified for areas overlying Class II irrigation water. The White Wolf subarea consists of 64,000 acres within the valley floor, at the southern tip of the Tulare Lake Basin, about 20 miles south of Bakersfield. The subarea is bounded on the west by the San Emigdio Mountains, on the south and east by the Tehachapi Mountains, and on the north by the White Wolf Fault.

  Criteria for mineral quality of irrigation water is described below:

Constituent	Class I	Class II	Class III
TDS (mg/l)	<700	700 - 2,000	>2,000
EC (μmhos/cm)	<1,000	1,000 - 3,000	>3,000
Chlorides (mg/l)	<175	175 - 350	>350
Sodium (percent base constituents)	<60	60 - 75	>75
Boron (mg/l)	<0.5	0.5 - 2	>2

- Discharges to areas that may recharge to good quality ground waters shall not exceed an EC of 1,000 micromhos per centimeter, a chloride content of 175 mg/l, or a boron content of 1.0 mg/l.

Wastewater Reclamation

Reclaimed water provides a substitute source of water and provides nutrients that nourish crops. When properly managed, reclamation consumes nitrates and effluent that would normally percolate to local ground waters underlying a community and can free up potable water for growth or other uses. Extensive reclamation is a practical necessity simply to maintain present levels of development and activity in the Basin.

Wastewater reclamation shall be maximized by controlling or limiting salt pickup and evaporation during use, treatment, or disposal. Integration of final disposal into existing surface distribution systems appears to be advantageous. Wherever feasible, eventual wastewater reclamation will be requested.

Title 22, California Code of Regulations, establishes reclamation criteria for direct use of reclaimed water but has no criteria for wastewater distributed with irrigation supplies. Therefore, municipal treatment facilities producing effluent for introduction to irrigation canals for unrestricted irrigation will be required, as a minimum, to disinfect to 23 MPN coliform per 100 ml. The Department of Health Services will be consulted for all cases.

To facilitate the use of treated wastewater with short notice, wastewater reclamation requirements may be waived for up to one year provided that the following conditions are met:

1. The reclaimed water will comply with any applicable criteria provided by Title 22, Division 4, California Code of Regulations;

2. The proposed uses receive prior approval from the state and local health departments and the Executive Officer; and

animal, or aquatic life, or that result in the accumulation of radionuclides in the food web to an extent that presents a hazard to human, plant, animal or aquatic life.

At a minimum, ground waters designated MUN shall not contain concentrations of radionuclides in excess of the maximum contaminant levels (MCLs) specified in Table 4 (MCL Radioactivity) of Section 64443 of Title 22, California Code of Regulations, which are incorporated by reference into this plan. This incorporation-by-reference is prospective, including future changes to the incorporated provisions as the changes take effect.

Salinity

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.

Tastes and Odors

Ground waters shall not contain taste- or odor-producing substances in concentrations that cause nuisance or adversely affect beneficial uses.

Toxicity

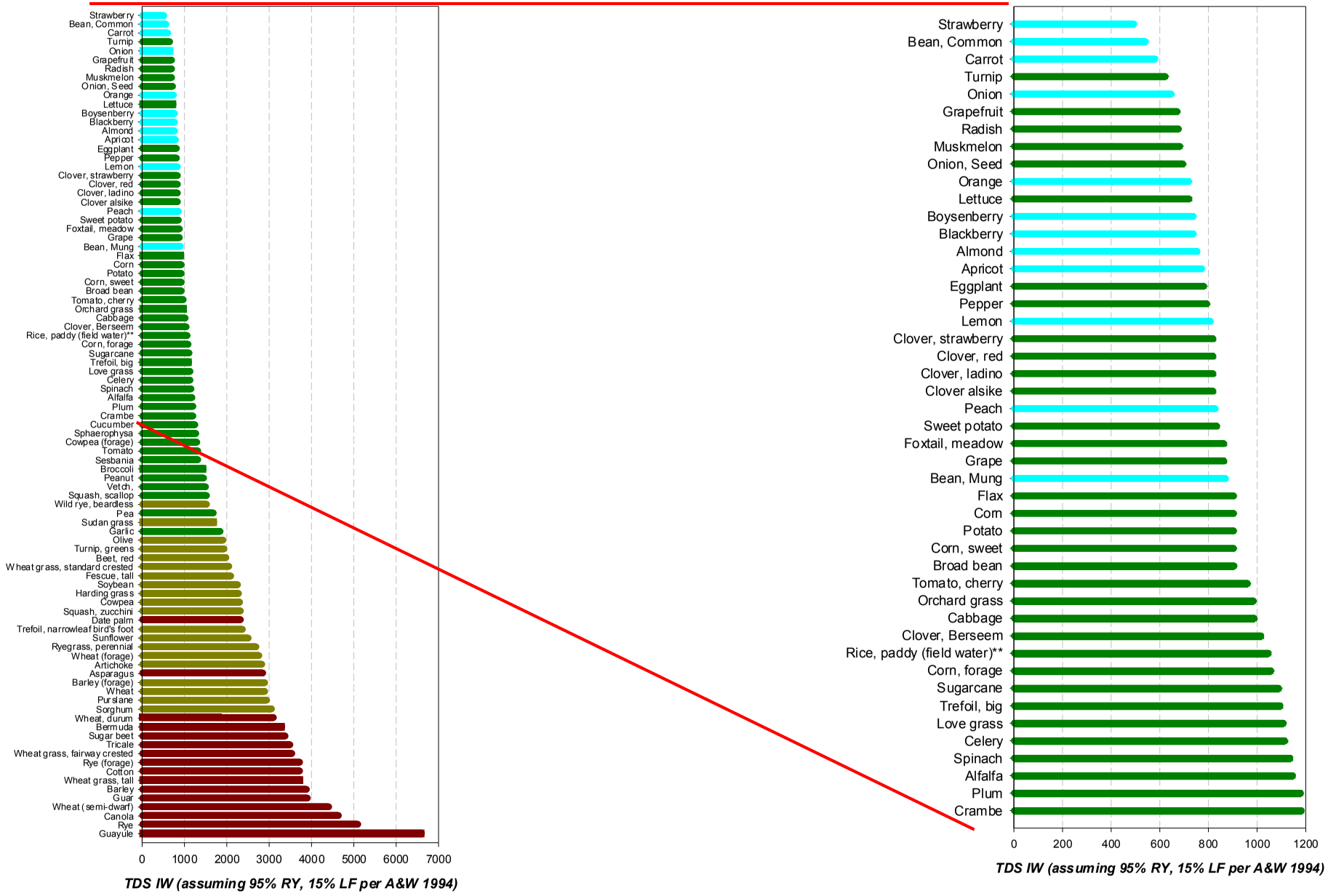
Ground waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life associated with designated beneficial use(s). The Regional Water Board will also consider all material and relevant information submitted by the discharger and other interested parties and numerical criteria and guidelines for toxic substances developed by the State Water Board, the California Office of Environmental Health Hazard Assessment, the California Department of Health Services, the U. S. Food and Drug Administration, the National Academy of Sciences, the U. S. Environmental Protection Agency, and other appropriate organizations to evaluate compliance with this objective. This objective applies regardless of whether the toxicity is caused by a single substance or the interactive effect of multiple substances.

TABLE III-4
TULARE LAKE BASIN
GROUND WATER QUALITY OBJECTIVES FOR SALINITY

Hydrographic Unit	Maximum Average Annual Increase in Electrical Conductivity (µmhos/cm)
Westside (North and South)	1
Kings River	4
Tulare Lake and Kaweah River	3
Tule River and Poso	6
Kern River	5

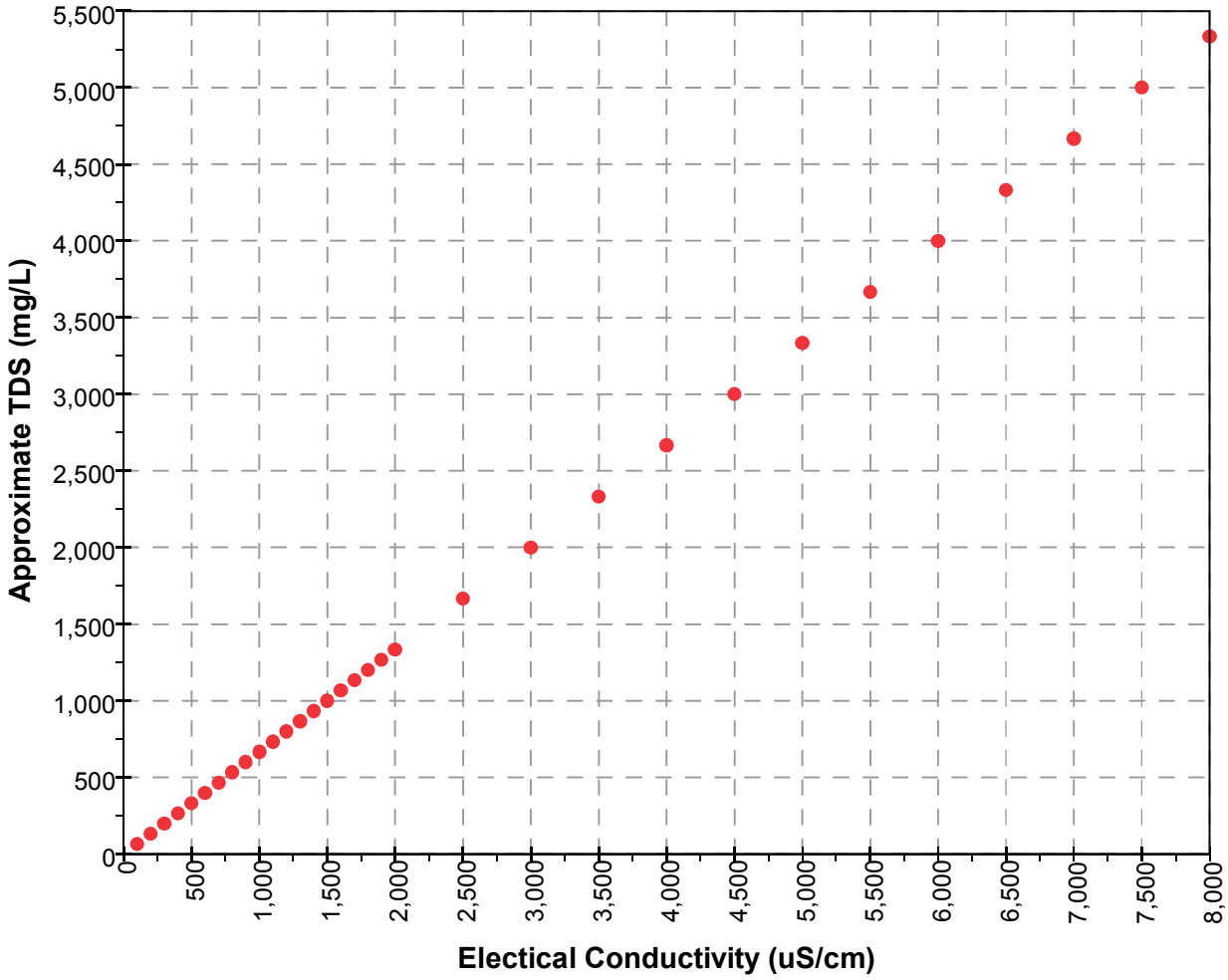
Preliminary Crop Sensitivity Thresholds[a]

[a]New data compilation or analysis for CV-SALTS



Crops for which coefficients have not been measured[a]

Sensitive	*Moderately Sensitive*	*Moderately Tolerant*	*Tolerant*
Okra	Brussels sprouts	Fig	Jojoba
Parsnip	Cauliflower	Jujube	Kenaf
Apple	Kale	Papaya	Millet, channel
Avocado	Kohlrabi	Pineapple	Oat
Cherimoya	Pumpkin	Pistacio	Alkali grass, nuttall
Cherry, sweet	Watermelon	Pomegranate	Alkali sacaton
Cherry, sand	Castorbean	Safflower	Kallar grass
Currant	Bentgrass	Brome, mountain	Kikuyagrass**
Gooseberry	Bluestem, Angleton	Canary grass, reed	Oat (forage)
Lime	Brome, smooth	Clover, Hubam	Paspalum, Polo**
Loquat	Buffelgrass	Clover, sweet	Salt grass, desert
Mango	Burnet	Dhaincha	Wild rye, Altai
Passion fruit	Clover, white Dutch	Fescue, meadow	Wild rye, Russian
Pear	Dallis grass	Guinea grass	Timothy
Persimmon	Glycine	Panicgrass, blue	
Pummelo	Grama, blue	Paspalum, PJ299042**	
Raspberry	Milkvetch, cicer	Rape	
Rose apple	Millet, Foxtail	Rescue grass	
Sapote, white	Oatgrass, tall	Rhodes grass	
Tangerine	Sirato	Ryegrass, Italian	
Sesame	Eucalyptus	Trefoil, broadleaf bird's foot	
Walnut		Wheat grass, intermediate	
Nursery		Wheat grass, slender	
Mixed		Wheat grass, western	
		Wild rye, Canadian	
		Kiwi	


Approximate TDS (mg/L)
5,500
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
5,500
6,000
6,500
7,000
7,500
8,000
Electical Conductivity (uS/cm)