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SANTA CLARA WATERSHED CHLORIDE ISSUE

- The taxpayers of the Santa Clarita Valley have paid $5 million for an EIR for a project that is proposed to be built, for possibly hundreds of millions of dollars, which is not based on science. The first line of the EIR says, "The State of California has determined that high levels of chloride (salt) harm salt-sensitive avocado and strawberry crops along Highway 126, downstream from the Santa Clarita Valley's (Valley's) two wastewater (sewage) treatment plants owned and operated by the Santa Clarita Valley Sanitation District (SCVSD). I have asked both the Sanitation District and a representative of the RWQCB-LA to tell me where these crops are and I have yet to receive an answer.

  When asked this question in the EIR process, the answer was,

  "This sentence does not say that there are currently salt-sensitive crops along Highway 26 that are being damaged by chloride levels in the SCR."

The Executive Summary for the Draft Facilities Plan and EIR was prepared in accordance with §15123 of the California Environmental Quality Act (CEQA) Guidelines, which states that a summary should "be as clear and simple as reasonably practical." In an effort to provide a clear and simple description of the highly technical Chloride TMDL, the Executive Summary used the following language: "The State of California has determined that high levels of chloride (salt) harm salt-sensitive avocado and strawberry crops along Highway 126, downstream from the Santa Clarita Valley's (Valley's) two wastewater (sewage) treatment plants owned and operated by the Santa Clarita Valley Sanitation District (SCVSD)." This sentence does not say that there are currently salt-sensitive crops along Highway 126 that are being damaged by chloride levels in the SCR.

21-224 October 2013 Santa Clarita Valley Chloride Compliance Facilities Plan and EIR (page 246) (SCVSD CCFP EIR Volume 2)

The fact is that there has never been any scientific evidence given that shows that Chloride discharges from the Santa Clarita treatment plants has harmed downstream crops. In fact there has never been any evidence that the level of chlorides currently in the surface or groundwater in the lower Santa Clara River have harmed any crops at all.

During the LARWQCB meeting October 9' 2014, when a representative of the downstream agricultural interests was asked (under oath) if there were damages to the crops and to crop yields from the discharge of Chlorides, the answers were that there were no visible damages, but rather that the damages were taking place akin to "air pollution" where eventually damages would become evident at some undetermined time. The claims of detriment to yield and fruit quality were stated verbally, but has also never been backed up by any scientific studies.

There is simply no evidence that the beneficial users downstream are being harmed by the discharge of chlorides by the upstream users.

In addition the TMDL for chloride of 100 mg/liter that is being imposed upon the Sanitation plants in the Santa Clarita Watershed is arbitrary and capricious. Historic levels in the SCR shown in measurements going back to 1951 show historic levels of over 500mg/Liter for some periods of time, with no crop damages ever reported. (historic levels chart attached)

Even the highly suspect (due to conflicts of interest on the part of half of the authors) Literature review evaluation of what levels would be safe for salt sensitive crops found that the safe level would be at least 117mg/Liter, so the 100 mg/liter level isn't even backed up by majority report of the authors of the study that has been sighted by the Water Boards as the scientific study upon which the chloride level is predicated. (Literature Review Evaluation 2005)

Another disturbing and unscientifically supported contention that was given under oath was that there was chloride being called "pollution" that was 1) negatively impacting drinking water of a low income community in the Piru Basin and 2) that there was a build-up of chloride levels which was moving across the basin.

The levels of chlorides in the wells in the basin are nowhere near the federal guidelines of 250mg/liter for drinking water. And the levels of chlorides in the basins according to sampling data that is attached show a general falling of chloride concentrations across the basin over the last four years. (see attached data charts for chloride levels for the last several years) This is particularly important to note because in the current drought situation these numbers should be shooting up. (Also included is the study refuting the claims that there was chloride moving across the basin.)

- The agribusiness on the Oxnard plain has been over pumping their aquifers since the 1930's which has led to approximately 25-square miles of saltwater intrusion. This is a problem because saltwater has approximately 34,000 mg/liter of chloride. (USGS-#2)

- The United Water District was formed to help combat this problem by reducing pumping and increasing supply. One of the major ways that they are looking at as a method to increase the supply is to use more wells inland to pump water to the plain. (LA Times Article- #3)

- The agribusiness of Ventura County created the Ventura County Agricultural Water Quality Coalition to convince the Los Angeles Regional Water Quality Control Board to create an unscientifically supported 100 mg/Liter threshold to "protect" salt sensitive crops, although the basis of this level according to the Sanitation District is "what was said to have been" a historical level since the 1970's, with no scientific studies to support that level. (PDF comments from address to Farm Bureau by representative of VCAWQ- #4)

- The agribusiness lobbied the regional water quality control board and the State regional water quality control board to create an unscientifically supported low level to force the citizens and businesses of the Santa Clarita Valley to attempt to have the ratepayers of the Santa Clarita Valley watershed pay for the supply and pumping of 11 billion gallons of water per year to be used by the agribusiness downstream. Option #4 of the recommendation by Sanitation District Board EIR, Castaic Lake Water Agency, and Agribusiness. (EIR for proposed projects for Sanitation District - #5). Although this attempt was unsuccessful, there exists in the TMDL, the ability for agricultural interests to demand an alternative source of water be supplied if the TMDL goes above 100mg/liter. The real issue continues to be not the chloride level, but the desire for upstream users to supply them more free low chloride water.

- The agribusiness also expects to have the people of the Santa Clarita Valley supply them low chloride water so that they can use it to leach the chloride from their soils and dilute the water in their seawater contaminated aquifers. (2008 AWRM- #6)

- There was no laboratory or site specific field studies done to establish what the chloride thresholds should be for avocados, even though the Literature Survey study called for them to establish a true threshold number based on scientific studies. (Literature Review Evaluation-Upper Santa Clara River Chloride TMDL Collaborative Process- #7)

- The literature survey which the agribusiness has touted as being the "proof" was evaluated by six "scientists", of which three had obvious conflicts of interest since they worked for the Ventura county agribusinesses. (Literature Review- #8)

- The six "scientists" who participated called for a chloride threshold to protect avocados in a range of between 100mg/Liter to 270 mg/liter (Literature Review- #9)

- Only one avocado farm is supposedly impacted by the 100mg/liter, but there was no evidence of crop damage, only damage to the tree's leaves which can also be caused by heat, excessive fertilizers, or high levels of total dissolved solids in the water. (Literature Review- #10)

- Of the nine Regional Water Boards in California, four have NO chloride threshold for Agricultural irrigation water, and the lowest chloride threshold for the other four Boards is 140mg/liter, even though salt sensitive crops are grown in many of these regions.(Chart generated by SCV Sanitation District- #11)

- Commercial Avocados are grown in the Calleguas watershed which is near to the Santa Clara watershed, but they have been given a chloride threshold of 150mg/liter by the same Board that has given us a 100mg/liter. (Study in progress by Newhall County Water District-#12)

- We need time to do actual studies to find out the real number at which Avocado crops are injured, or an adjustment to 140 mg/liter to be in line with the thresholds of the rest of the State of California.

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U.S. Department of the Interior
U.S. Geological Survey

Seawater Intrusion in a Coastal California Aquifer

This report is a summary of recent work on seawater intrusion in aquifers underlying the Oxnard Plain, Ventura County, California. It is part of a series of reports describing the results of the U.S. Geological Survey's Southern California Regional Aquifer-System Analysis (RASA) study of a southern California coastal ground-water basin. The geologic setting and hydrologic processes that affect seawater intrusion in aquifers underlying the Oxnard Plain are similar to those in other coastal basins in southern California.

Introduction

Seawater intrusion in aquifers underlying the Oxnard Plain, Ventura County, California, was first observed in the early 1930's and became a serious problem in the mid-1950's (California Department of Water Resources, 1965) (fig. 1). Historically, local agencies responsible for the management of ground water used a criterion of 100 milligrams per liter (mg/L) chloride to define the leading edge of the seawater front. It was assumed that all high-chloride water from wells behind the front originated from seawater that entered aquifers through outcrop areas in submarine canyons. Recent work (Izbicki, 1991; Stamos and others, 1992) showed that other sources of high-chloride water to wells are present and that the areal extent of seawater intrusion in the upper aquifer system is smaller than previously believed.

Hydrogeology

The Oxnard Plain, 60 miles northwest of Los Angeles, has an area of 120-square miles (mi^2) and is underlain by a complex system of aquifers more than 1,400 feet thick. These aquifers (like many similar coastal aquifers in southern California) can be divided into an upper and a lower aquifer system (fig. 2).

The upper aquifer system consists of relatively flat-lying alluvial deposits about 400 feet thick and contains two aquifers that have been developed for water supply—the Oxnard and Mugu aquifers. The Oxnard aquifer, about 180 feet below land surface, is the primary water-yielding zone. The Oxnard aquifer is underlain by the Mugu aquifer and overlain by a thick, areally extensive clay deposit. This clay deposit separates the Oxnard aquifer from a shallow unconfined aquifer that previous researchers have referred to as the 'perched aquifer.' (Use of this name in this report does not imply that perched conditions exist in the Oxnard Plain.) The Oxnard and Mugu aquifers crop out in Hueneme and Mugu submarine

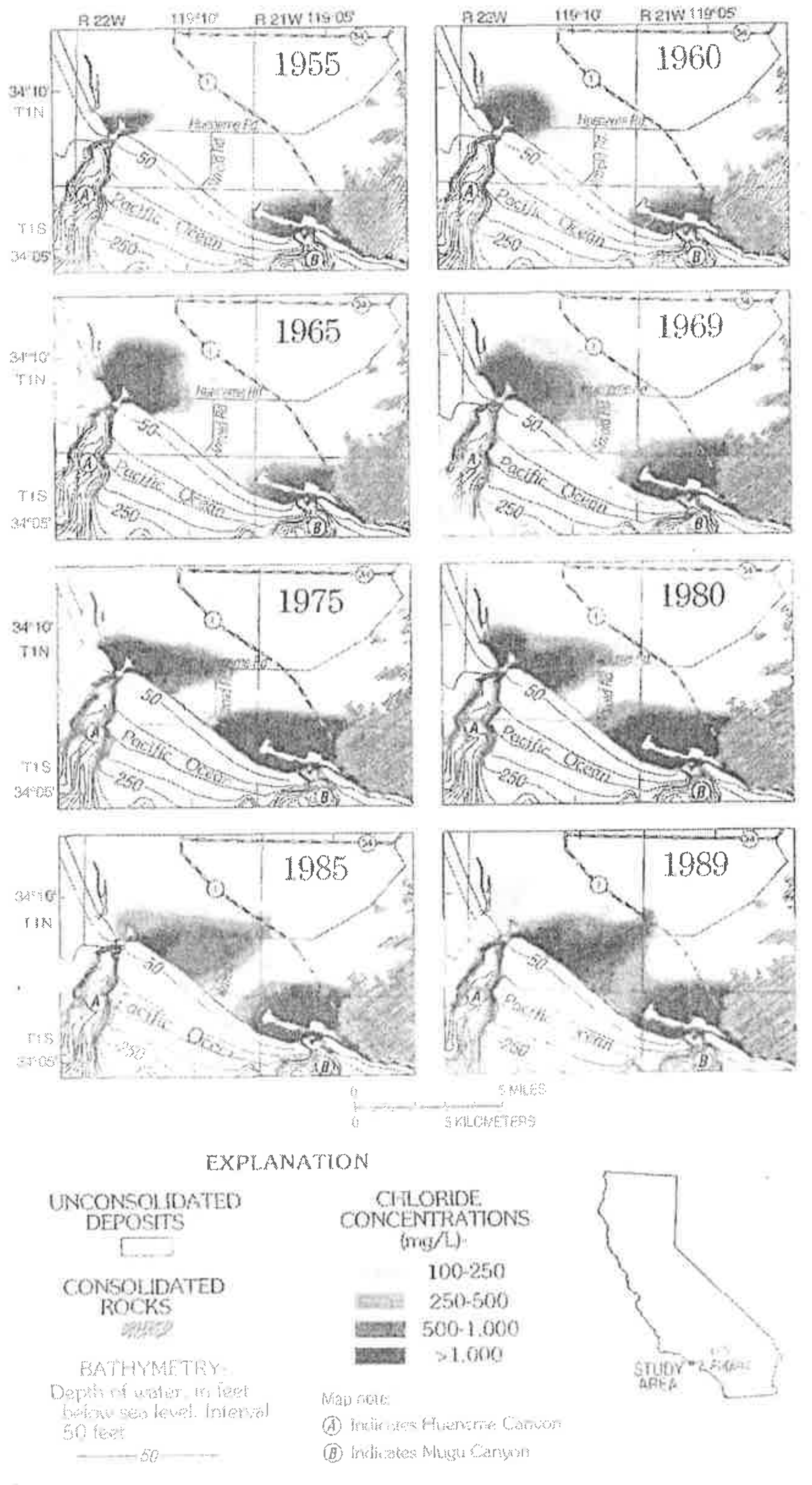

Figure 1. Chloride concentrations in water from wells in the upper aquifer system in the Oxnard Plain, 1955-89. (Data from California Department of Water Resources and County of Ventura Public Works Agency.)

MORE STORIES ABOUT

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Beyond current water replenishment projects -- such as a Santa Clara River diversion dam, settling ponds and recharge basins near Saticoy -- Hanson said Ventura County water agencies need to end coastal pumping during droughts that draws down water tables and allows greater saltwater intrusion.

"I think they're on the right track; they're one of the better sets of water agencies [in California] as far as trying to get something going," Hanson said. "What they still need to do is align their management strategies with climatic cycles."

For example, during the last big drought from 1985 to 1991, well pumping in some coastal areas increased 11%, Hanson said. He said a better response would have been for farmers and water agencies to sharply cut back on pumping near the coast, because freshwater basins there were already low from lack of rain.

Of course, farmers need to pump more water during droughts because so little rain bathes their fields in the winter and spring. So local water officials have built a dam-and-pipeline system designed to capture Santa Clara River water five miles inland and deliver it to the coastal Oxnard Plain and the over-pumped Pleasant Valley area south of Camarillo.

"Replacing water near the coast with inland well water has been our strategy for a long time," said Steve Bachman, groundwater manager for the United Water Conservation District. "The USGS is just confirming what we're attempting to do. We've been working with them."

Getting that done has been a costly and lengthy process.

The centerpiece of the United system is the $31-million Freeman Diversion Dam, completed in 1990, and a two-pronged set of pipelines that deliver river water either directly to coastal farms for immediate use or to settling ponds or gravel pit reservoirs, where the water filters down into underground basins for storage.

The dam is designed to capture about 12,700 acre-feet of Santa Clara River water each year. An acre-foot is 326,000 gallons, or enough water to supply two typical homes for 12 months. The county uses about 480,000 acre-feet of water a year, two-thirds of it on agriculture.

In recent years, much of the captured water has been funneled into the shallow Oxnard Aquifer, which has been substantially replenished in the last decade, Bachman said.

The problem now is United's inability to pump the water out when needed, because the district's wells have traditionally reached into deeper basins where water would still be available during drought. So United last year began a $2-million project to drill four new wells into the Oxnard basin near Saticoy.

Pumping from the shallow basin will allow the area's deeper basins -- which are seriously over-pumped -- to refill, Bachman said. In time, both shallow and deep basins will be replenished, he said. "You just hope that during the good times, you've done enough water management that you can survive a prolonged drought," Bachman said. "If we're not pumping from the coast during wet years, that will slow the [saltwater] intrusion during dry ones."

Very wet years in 1992, 1995 and 1998 have helped Ventura County's water basins. Bachman said conversion of three additional gravel pits near the river as part of the huge RiverPark community planned along Vineyard Avenue will add 10,000 to 15,000 acre-feet of storage.

A state-authorized groundwater management agency has also imposed pumping limits and fines on cities and farmers, cutting pumping substantially from historic levels.

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FARMBUREAU UVR.
PDF RDB RD7 COMMENTS

WATER WISE

OPENING STATEMENT

"Salts Threaten Water Supply in the Santa Clara River Watershed...a Collaborative Effort in Finding Solutions"

The chloride threat to beneficial uses in the Santa Clara River watershed has resulted in one of the most significant examples of strategic alliances and collaborative efforts in finding a solution for all of its stakeholders. The story begins with a finding by the Los Angeles Regional Water Quality Control Board to adopt a more stringent Water Quality Objective for chloride in the upper Santa Clara River. Two wastewater treatment plants operated the Los Angeles County Sanitation Districts were discharging in excess of 8,000 pounds of chloride annually into the upper Santa Clara River on an annual basis. The chloride was having a substantial impact upon salt-sensitive crops such as avocados, nursery stock and strawberries across the county line in Ventura.

In 2003, the Los Angeles Regional Water Quality Control Board adopted a stringent Water Quality Objective of 100 mg/L for chloride discharged at the two wastewater treatment plants. It also developed, pursuant to negotiations with the Sanitation Districts, a Chloride Total Maximum Daily Load (TMDL) Implementation Plan to assist the Board in developing a proper WQO for chloride. This Plan consisted of a number of projects to be implemented in phases under the Plan. The first aspect of the Plan involved Literature Review Evaluation of salt-sensitive crops. A second study involved the creation of a Groundwater Surface Water Interaction Model to estimate how chloride would move through the Santa Clara River. The last study undertook an evaluation of threatened and endangered species in the Santa Clara River.

Once these studies were completed, the next phase of the Plan involved the establishment of Site Specific Objectives and an Anti-Degradation Analysis.

The third aspect of the Implementation Plan involved the construction of two reverse osmosis facilities at the Valencia and Santa Clarita WRPs, as well as a 43-mile brineline through Ventura County to the Pacific Ocean.

Estimates on the total cost of this Implementation Plan were projected between $300 to $500 million to Santa Clarita Valley rate-payers.

The project was expected to take approximately 15 years, plus additional time if needed under the Plan. This time estimate does not consider delays resulting from third-party litigation!

In the meantime, chloride discharges in excess of 150 mg/L and higher, at times, were being discharged into the upper Santa Clara River making their way downstream degrading surface and groundwater and adversely impacting beneficial uses such as agriculture. At the time this was occurring, much of the attention County's agricultural industry was being devoted to the Calleguas Water Management Plan. Many of us in agriculture believed that something was going on in Los Angeles County that affected agriculture in Ventura County, but it was not until certain individuals within the County avocado and strawberry industries raised a flag about the potential harm to salt-sensitive crops from the chloride effluent that the agricultural industry reacted.

The response was formation of the Ventura County Agricultural Water Quality Coalition to participate in this public process out of a concern for the downstream beneficial users of the River water. The Coalition consists of over 1,000 local farmers and major agricultural trade associations, the California Strawberry Commission, California Avocado Commission, the Association of Water Agencies, and the Ventura County Economic Development Association. The Coalition represents one of the broadest and diverse coalitions ever created in the history of Ventura County. Through its participation in the public chloride TMDL process, the Coalition obtained successful rulings from the Los Angeles Regional Water Quality Control Board and the State Water Resources Control Board, on limiting the timeline of the Chloride TMDL Implementation Plan and inclusion of benchmarks for time-certain treatment tasks for limiting the discharge of chloride into the River.

The Coalition provided a catalyst to the ongoing public process and has since become a major stakeholder in this process.

Most recently, the Coalition collaborated with the Sanitation Districts and United Water Conservation District to implement an Alternative Water Management Plan for the ***entire*** Santa Clara River watershed as an alternative solution to the Chloride TMDL Implementation Plan. This Alternative Plan could not have been accomplished without the leadership of the stakeholders to this process. Today, you will be educated on the specifics of this Alternative Water Management Plan from Mr. Phil Friess, Departmental Engineer, Technical Services, Los Angeles County Sanitation Districts, and from Dr. Steven Bachman, the Groundwater Program Manager for United Water Conservation Districts. Without the tireless efforts of these individuals, including other consultants and water professionals who have brought this Alternative Water Management Plan from a concept to a potential "win-win" solution for all of the stakeholders in this precious watershed, we would not be here today.

Indeed, following a recent presentation of the Alternative Water Management Plan to the Regional Board's staff, it was opined that this collaborative effort should be a template for other groups throughout the State who are confronted with similar adversity. The Ventura County Agricultural Water Quality Coalition wishes to thank all of its participants and contributors, consultants, benefactors, and others who have supported, and continue to support its efforts in this important collaborative process to reduce chloride in the Santa Clara River and protect the beneficial uses.

Final - September 3, 2008

MEMORANDUM OF UNDERSTANDING FOR THE IMPLEMENTATION OF AN ALTERNATIVE WATER RESOURCES MANAGEMENT PROGRAM

This Memorandum of Understanding for the Implementation of an Alternative Water Resources Management Program ("MOU") is entered into effective October 23, 2008, by and among CASTAIC LAKE WATER AGENCY ("CLWA"), CLWA's SANTA CLARITA WATER DIVISION ("SCWD"), VALENCIA WATER COMPANY ("VWC"), NEWHALL COUNTY WATER DISTRICT ("NCWD"), and LOS ANGELES COUNTY WATERWORKS DISTRICT NO. 36 ("LACWD"), which are collectively referred to as the "UPPER BASIN WATER PURVEYORS ("UBWPs")," the SANTA CLARITA VALLEY SANITATION DISTRICT OF LOS ANGELES COUNTY ("SCVSD"), the UNITED WATER CONSERVATION DISTRICT ("UWCD"), and the VENTURA COUNTY AGRICULTURAL WATER QUALITY COALITION ("VCAWQC"), individually referred to as a "Party" and collectively as the "Parties."

RECITALS

A. A total maximum daily load (TMDL) for chloride in the Upper Santa Clara River (Reaches 5 and 6) was adopted by the California Regional Water Quality Control Board – Los Angeles Region ("Regional Board") and became effective on May 5, 2005. The TMDL established waste load allocations of 100 mg/L for the SCVSD's Saugus and Valencia Water Reclamation Plants (WRPs). The TMDL implementation schedule allows for several special studies to determine whether existing water quality objectives and waste-load allocations for chloride can be revised, and provides for an 11-year schedule to attain compliance with the final water quality objectives and waste-load allocations for chloride.

B. The conventional approach to achieving compliance with the existing 100 mg/L water quality objective and waste-load allocations for chloride would be through constructing desalination facilities at the SCVSD's Saugus and Valencia WRPs and a 43-mile brine line through the Santa Clara River Watershed to an ocean outfall off the Ventura coast. The Parties have collaboratively developed an alternative approach to water resources management that will achieve TMDL compliance, which is set forth in an exhibit to this MOU (Exhibit 1) and entitled "the Alternative Water Resources Management Program" ("the AWRM Program"). This program uses a basin water supply management approach to achieve the final water quality objectives and waste load allocation for chloride determined through the TMDL collaborative process. The AWRM Program, in comparison with the conventional approach, would have economic, public acceptance, feasibility, timing, environmental quality, and water supply benefits.

C. The Parties recognize that the AWRM Program provides multiple benefits for stakeholders in Los Angeles and Ventura Counties. These benefits include the revision of water quality objectives, provision of tertiary recycled water and potential provision of desalinated recycled water that will support increased water recycling and thereby increase water supplies in the City of Santa Clarita and unincorporated areas of Los Angeles County. In addition, the AWRM Program will implement water supply facilities in Ventura County and provide desalinated recycled water to these water supply facilities that will allow for the conjunctive use of groundwater and surface water resources to increase water supplies and improve water quality in groundwater and surface waters of the Santa Clara River watershed.

II. Majority Report

Four of the members of the TAP, Steve Grattan, Ken Tanji, Ben Faber, and Oleg Daugovish reached a consensus decision on their response to the LRE. Ben Faber and Steve Grattan prepared an overall response representing this consensus that appears below. This group will be referred to as the TAP Majority. In addition, the majority report section contains supplemental information presented by Steve Grattan and Ken Tanji, as well as the individual responses of each of the four TAP members.

A. Overall Responses to Key Issues

Steve Grattan and Ben Faber wrote the following responses to the six key issues on behalf of the TAP Majority. The individual members of the TAP Majority approved each response before it was included in the majority report.

S.R. Grattan and Ben Faber
Agricultural Chloride Threshold Study Technical Advisory Panel

1: Adequacy of the Literature

The TAP majority concurs with the findings of the LRE that there is very little scientific literature to base an interim guide for a TMDL on strawberry and nursery crops. The TAP majority believes however that there is sufficient documentation for avocado to set an interim guideline. In the process of setting such a guideline for avocado, because of this tree's very sensitive nature, it would be protective for most other sensitive crops as well. However, it is uncertain that all nursery crops would be protected. The lower limit at which chloride would be unlikely to cause damage to avocado is somewhere around 100 mg/L. The upper limit, however, is much less clear to the panelists. The TAP majority suggests that 117 mg/L would be the conservative upper-protective limit. Of these three panelists, one suggested that a range of 100 to 140 mg/l is appropriate depending upon site specific conditions where a higher value is more appropriate where other factors affecting avocado are not restricting while a lower value is more appropriate where the trees are prone to additional stresses, inflexibilities in water delivery, and poorer management. The other TAP majority members concur with this assessment. The panelists indicate that these are not threshold values but guideline ranges that would be acceptable.

2: Relative Impacts of TDS and Chloride

It seems clear that TDS has an impact on avocado as it does with other salt-sensitive crops. Chloride can be a contributor to salinity and a number of studies have shown that avocado is sensitive to this specific ion producing tree injury. The TAP majority is uncertain whether chloride or TDS is the most the limiting factor and feel the current literature is insufficient to make this distinction. Separating the two effects (TDS and chloride) might be possible by controlled experiments, but it would be extremely difficult and long-term in nature. Moreover, there would be uncertainty regarding extrapolation of the results to develop irrigation water-quality guidelines.

3: Need for an Experimental Study

The TAP majority believe it would be possible to do controlled greenhouse or laboratory studies that would give a correct range of chloride values that caused damage to avocados with a particular scion/rootstock combination. Nevertheless, TAP majority members indicated that it would be difficult to extrapolate those lab results to the field.

#7

I. Introduction and Summary of Key Findings

A. Purpose

The Upper Santa Clara River (USCR) Chloride TMDL Collaborative Process was instituted to determine a threshold for chloride in the eastern end of reach 4, as well as the entirety of reaches 5 and 6 of the Santa Clara River. As part of the Collaborative Process, an Agricultural Chloride Threshold Study (ACT Study) was conducted. This study consisted of a Literature Review and Evaluation (LRE) prepared by CH2M Hill, which was then examined by a panel of experts in the fields of agriculture, chemistry, and soil science. This panel of experts, known as the Technical Advisory Panel (TAP) met several times over the course of the study to provide oversight and advice to the stakeholders and consulting teams. In their final meeting on July 11th 2005, they were asked to examine a draft of the LRE, and come to a decision as to its accuracy. During their deliberation, six key questions were developed. These questions served to guide the overall discussion of the TAP as they made their decision.

The TAP identified six key scientific issues to structure their discussion:

1. *Please comment on the adequacy of the literature for supporting an interim number or guideline for the level of chloride that will reduce plant yields. Please comment specifically on the adequacy of the literature to justify the avocado threshold recommendations in the Literature Review Evaluation and provide your opinion on the accuracy of CH2M Hill's conclusion that there is insufficient literature to provide a recommended number or range for strawberries and nursery crops. If you are not in agreement with the range provided in the LRE, how would you modify it to feel the guideline concentration range would prevent detrimental impacts on avocado yields?*
2. *What are the relative impacts of TDS and chloride on avocado yield? Do you believe that it is scientifically possible to separate the effects of the two stresses? Please document the evidence supporting your conclusions.*
3. *Would you recommend that an experimental study be conducted to produce more meaningful information than is available in the current literature? Why or why not? If yes, what elements or characteristics should such a study include?*
4. *How can local knowledge best be integrated into the study? Describe, "what works" based on information from local experience.*
5. *Please discuss the validity of plant injury, growth, and yield as metrics of injury. Do you conclude that if there is plant injury there will be a reduction in yield? On what do you base your conclusion?*
6. *Please provide any general comments on the Literature Review Evaluation.*

The TWG, which is comprised of a variety of stakeholders representing growers, water purveyors, elected officials, public agencies, environmental organizations, and other interested parties, examined the Literature Review Report and then generated a list of comments which were then forwarded to the TAP for their consideration. The TAP response to comments is included as an appendix to this document.

B. TAP Membership Information

Oleg Daugovish, Ph.D.

Dr. Daugovish works with the Ventura County Cooperative Extension, where he serves as the farm advisor for strawberry and vegetable crops in Ventura County. He conducts research and educational programs with emphases on pest control and environmental quality of production, addressing the needs of organic farmers in Ventura County. He has also served as a research assistant with the Department of Plant, Soil and Entomological Sciences at the University of Idaho; Department of Agronomy at the University of Nebraska; and the Stensund Ecological Center. Dr. Daugovish received his Ph.D. from the

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University of Idaho; M.S. from the University of Nebraska, B.S. from Latvia University of Agriculture. He is the author and co-author of 4 technical publications, 4 abstracts, and 6 technical proceedings.

Ben A. Faber, Ph.D.

Dr. Faber works with the Ventura County Cooperative Extension, serving as the soils/water/subtropical horticulture advisor in Ventura County. He has research experience in plant nutrition and soil management. His current research focuses on irrigation requirements of avocado and citrus, methods of controlling groundwater nitrate pollution, effects of yard waste mulches on citrus production and various methods for controlling micronutrient deficiencies in avocado. Dr. Faber received his Ph.D. from the University of California, Davis; M.S. Soil Fertility, University of California, Davis; B.S. Biology, University of California, Santa Cruz. He is the author and co-author of multiple technical papers and publications, including 18 publications developed over the last six years.

S.R. Grattan, Ph.D.

Dr. Grattan is a professor at the University of California, Davis, where he serves as the plant-water relations specialist in the Department of Land, Air, and Water Resources, Hydrologic Science Division. His research areas include irrigation management with saline water; plant response in saline environments; uptake of nutrients and trace elements by plants in saline environments; and crop water use. He also performs international consulting work with the World Bank, USDA/OICD, and USAID, and has previously served as a research assistant with the University of California, Riverside, and as a research plant physiologist at the USDA/ARS Salinity Laboratory. Dr. Grattan received his Ph.D. in Soil Science from the University of California, Riverside; M.S. in Soil Science from the University of California, Riverside; B.S. Soil and Water Science from the University of California, Davis. He is the author and co-author of 15 technical proceedings/presentations, 74 refereed publications, and over 100 reports.

John Letey, Jr. Ph.D.

Dr. Letey is Professor Emeritus of Soil Science, Soil and Water Sciences Unit, University of California, Riverside and Director of the Center for Water Resources, University of California, Riverside. He has also served as the Chair, Department of Soil and Environmental Sciences; Director, University of California Kearney Foundation of Soil Science; Associate Director, University of California Water Resources Center; California State Water Quality Coordinator; and Director, University of California Salinity/Drainage Program. His research areas include irrigation, salinity, drainage, and plant-water relationships. He received his Ph.D. in Soil Science from the University of Illinois, and his B.S. in Agronomy from Colorado State University, and has served on numerous state, federal and international advisory committees; University of California and Soil Science Society of America task forces and committees; and editorial boards. He is the author and co-author of over 80 international presentations, technical papers, publications and reports.

Darrell H. Nelson, B.S.

Mr. Nelson is a consultant with Fruit Growers Laboratory, and a farm operations manager and farmer in Ventura County. He is the former President and Laboratory Director of the Santa Paula and Stockton Fruit Growers Laboratory. He received his B.S. in Soil and Water Science from the University of California, Davis, and has made presentations on the use of scientific information to implement best management practices and the use of nutrient budgets. He has also been active in the appraisal of drinking water quality for regulatory purposes and irrigation water for suitability to specific crops. He has advised the Los Angeles Regional Water Quality Control Board on Best Management Practices and the use of Nutrient Budgets as they relate to Total Maximum Daily Loads (TMDLs), and is currently serving on the California Avocado Commission Research Committee as co-chairman of the management and physiology sub committee.

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Kenneth K. Tanji, Sc.D.

Dr. Tanji is Professor Emeritus of Hydrology, Department of Land, Air and Water Resources, University of California, Davis. He has also served as the Senior and Principal Laboratory Technician, Department of Irrigation; Lecturer in Water Science, Department of Water Science and Engineering; Professor of Water Science, Department of Land, Air and Water Resources; Vice Chair and Chair, Department of Land, Air and Water Resources; and Professor of Hydrology, Department of Land, Air and Water Resources. He has more than 45 years of research experience dealing with salinity in agricultural lands in California, the Western U.S. and foreign countries, and is currently involved with developing a salinity management guide for irrigation of landscapes using recycled water. Dr. Tanji received his Sc.D. in Agricultural Science-Irrigation, Drainage and Hydrological Engineering from Kyoto University; M.S. in Soil Science-Soil Chemistry from the University of California, Davis; B.S. in Chemistry from the University of Hawaii. He is the author and co-author of 6 books, 28 book chapters, 158 papers, and more than 200 technical reports and proceedings.

C. Definitions

In an effort to clarify the work of the Agricultural Chloride Study, the TAP developed the following definitions to differentiate the terms "Threshold" and "Guideline":

Threshold Concentration for Chloride Injury: A specific and absolute numerical value of chloride concentration beyond which, according to the scientific literature, plant injury will occur. In the case of avocados this refers to the concentration beyond which leaf injury will occur.

Guideline Concentration for Chloride Injury: A range of numerical values of chloride concentration beyond which, according to the scientific literature, plant injury is likely to occur. The range establishes the likely lowest value at which injury might begin to occur and the likely highest value at which injury might begin to occur. For example, a guideline range for a hypothetical constituent might begin at 3 ppm as the lower bound or 5 ppm as the upper, depending on conditions.

D. Summary of Findings

The key differences between the majority report and the two minority reports center on three key issues: threshold value, the importance of TDS and ion-specific effects, and handling the need for incorporating local knowledge into the study. The chart below summarizes the positions of the majority and two minority reports on each of these issues.

	Threshold Value	TDS Vs. Ion-Specific Effects	Local Conditions
Majority Report	The lower limit at which chloride would be unlikely to cause damage to avocados on Mexican rootstock is somewhere around 100 mg/L. The upper limit, however, is much less clear to the panelists. The TAP majority suggests that 117 mg/L would be a conservative upper-protective limit and a limit of 140 mg/L may be protective but only under ideal, non-restricting conditions.	It seems clear that TDS has a negative impact on avocado as it does with other salt-sensitive crops. Chloride is a contributor to salinity, and studies have shown that avocado is sensitive to this specific ion. Separating the two effects (TDS and chloride) might be possible by controlled experiments, but it would be extremely difficult and long-term in nature. Extrapolating the results back to irrigation water Cl guidelines would again be difficult.	A correlational survey of local water quality, yield and management practices would provide useful information. However, establishing a precise relationship between chloride and yield may not be possible in light of the large number of management and environmental factors that can impact tree yield.
Minority Report 1	Using the soil concentration range of 355 to 540 mg/L from table 4 results in a range of 177 to 270 mg/L in the irrigation water.	All of the experimental evidence strongly leads to the conclusion that TDS is the critical factor for avocados and chloride is minor except to the extent that it contributes to TDS.	Although I agreed that a survey-based study to document local information on water quality and yield would be helpful, the probability of gaining definitive information is very low.
Minority Report 2	To utilize a level above 100 mg/l, which has been used successfully for the past 40 plus years, would be detrimental to the continued health of these crops.	I feel that the difference between the effects of chloride and total dissolved solids (TDS) are easily observed in the field and can therefore be separated in research trials.	Local knowledge and experience must be integrated into the study process for the determination of chloride thresholds for the plants in question.

#9

shallow as 150 to 175 feet or as deep as 500 to 600 feet. Cost to pump water from this depth is more expensive than surface-water diversion; therefore, surface-water diversion is used as much as possible.

Avocado Production on Camulos Ranch

Avocado production has been conducted on Camulos Ranch for nearly 60 years. A 12-acre orchard exists that has been in production for approximately that duration. This orchard contains many varieties of avocado; however, most are on Mexican rootstock. Another 60-acre orchard is about 3 to 4 years old. The goal of Camulos Ranch is to have 150 to 200 acres of avocados in the future. Mr. Freeman said that "diversity of agricultural production and crop type on Camulos Ranch is essential to a sustainable farming operation, and avocados are an essential part of that." He was hired as ranch manager, partly, to provide that diversity.

The avocado trees on Camulos Ranch "commonly have tip burn" (see photographic documentation provided to the interviewer by Mr. Freeman). In addition, Mr. Freeman said that he believes the citrus trees are also experiencing burn and yield loss because of unsuitable irrigation water quality. At the time of the site visit, the avocado trees on Camulos Ranch essentially did not have leaf-tip burn. It was mentioned that "very little leaf tip burn was visible at this time due to the excessive leaching provided by the winter and spring rains of this past year." However, older leaves (<1 year old) did show signs of past leaf-tip burn.

One hundred seventeen acres of avocados were recently planted in Piru Canyon owned by Rancho Temiscal.

Mr. Freeman indicated that in his experience "most people actually under-irrigate avocados." Applied water for avocado irrigation in the area can range from "3 to 5 feet," but mostly on the lower end of this range.

In general, avocado production on Camulos Ranch does not vary significantly from other areas visited with respect to irrigation method and cultural practices.

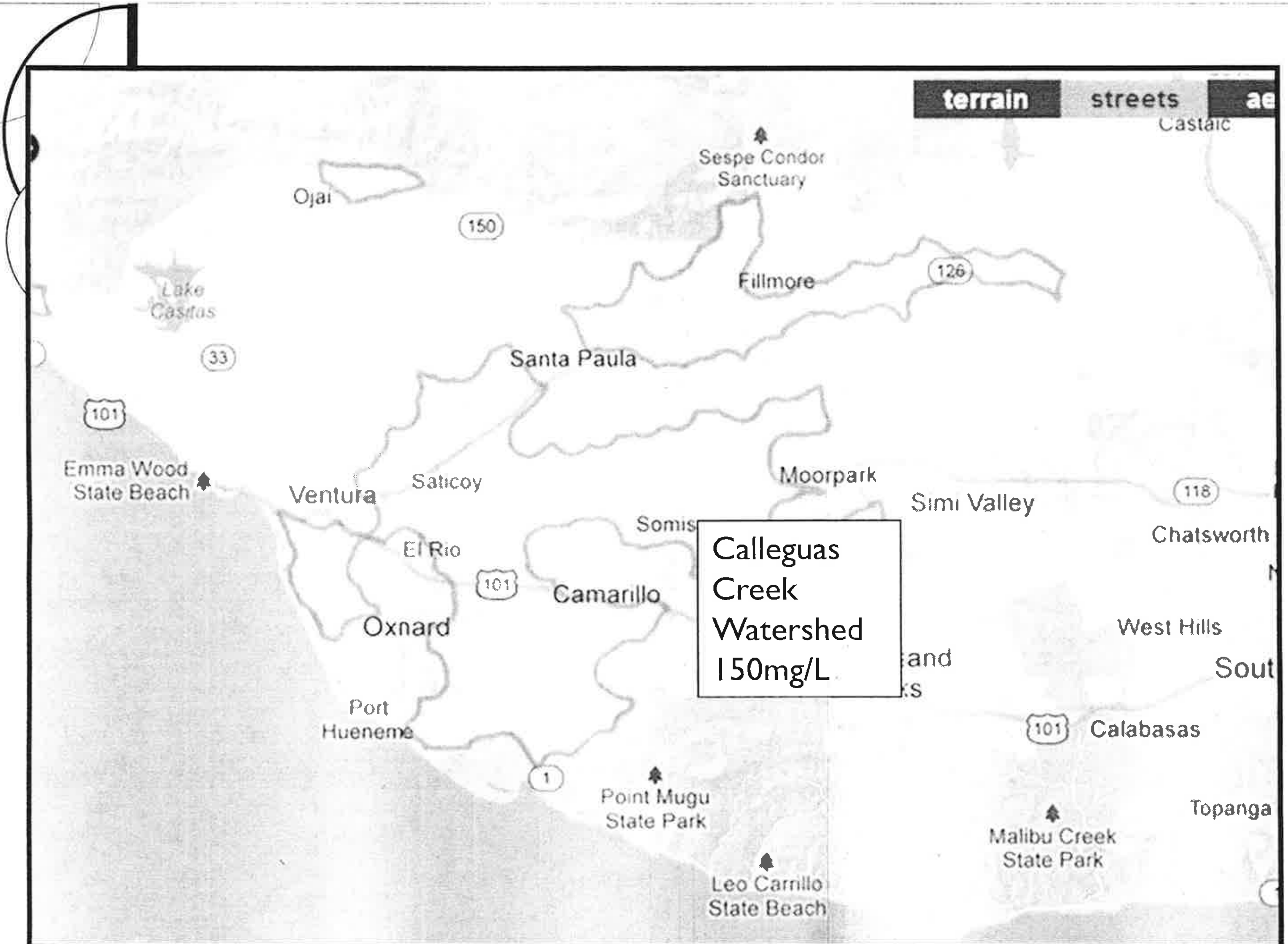
#10

Agricultural Chloride Thresholds by Regional Board

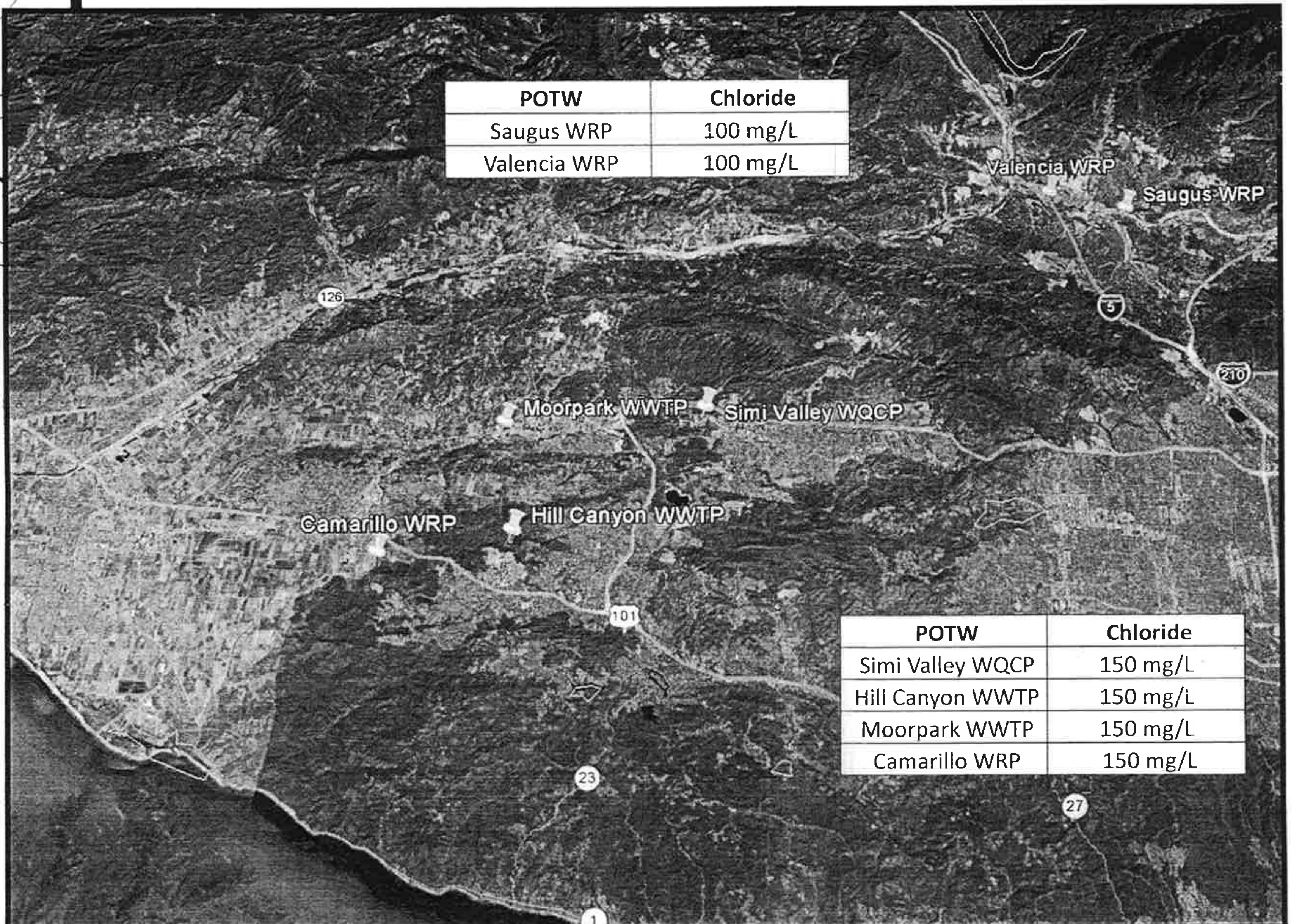
Region	No.	AGR Cl Threshold
North Coast	1	None
San Francisco	2	< 142 mg/L Cl
San Luis Obispo	3	< 142 mg/L Cl
Los Angeles	4	100 - 355 mg/L Cl *
Central Valley	5	None
Lahontan	6	None
Colorado River	7	None
Santa Ana	8	< 175 mg/L Cl
San Diego	9	< 140 mg/L Cl

* The 100 mg/L threshold is located in the Santa Clara River watershed.

#11


terrain
streets
Castaic
Sespe Condor Sanctuary
Ojai
150
Fillmore
126
Lake Casitas
33
Santa Paula
101
Emma Wood State Beach
Ventura
Saticoy
Moorpark
Simi Valley
118
Chatsworth
Somis
El Rio
101
Camarillo
Oxnard
Calleguas Creek Watershed 150mg/L
West Hills
Port Hueneme
101
Calabasas
1
Point Mugu State Park
Topanga
Malibu Creek State Park
Leo Carrillo State Beach

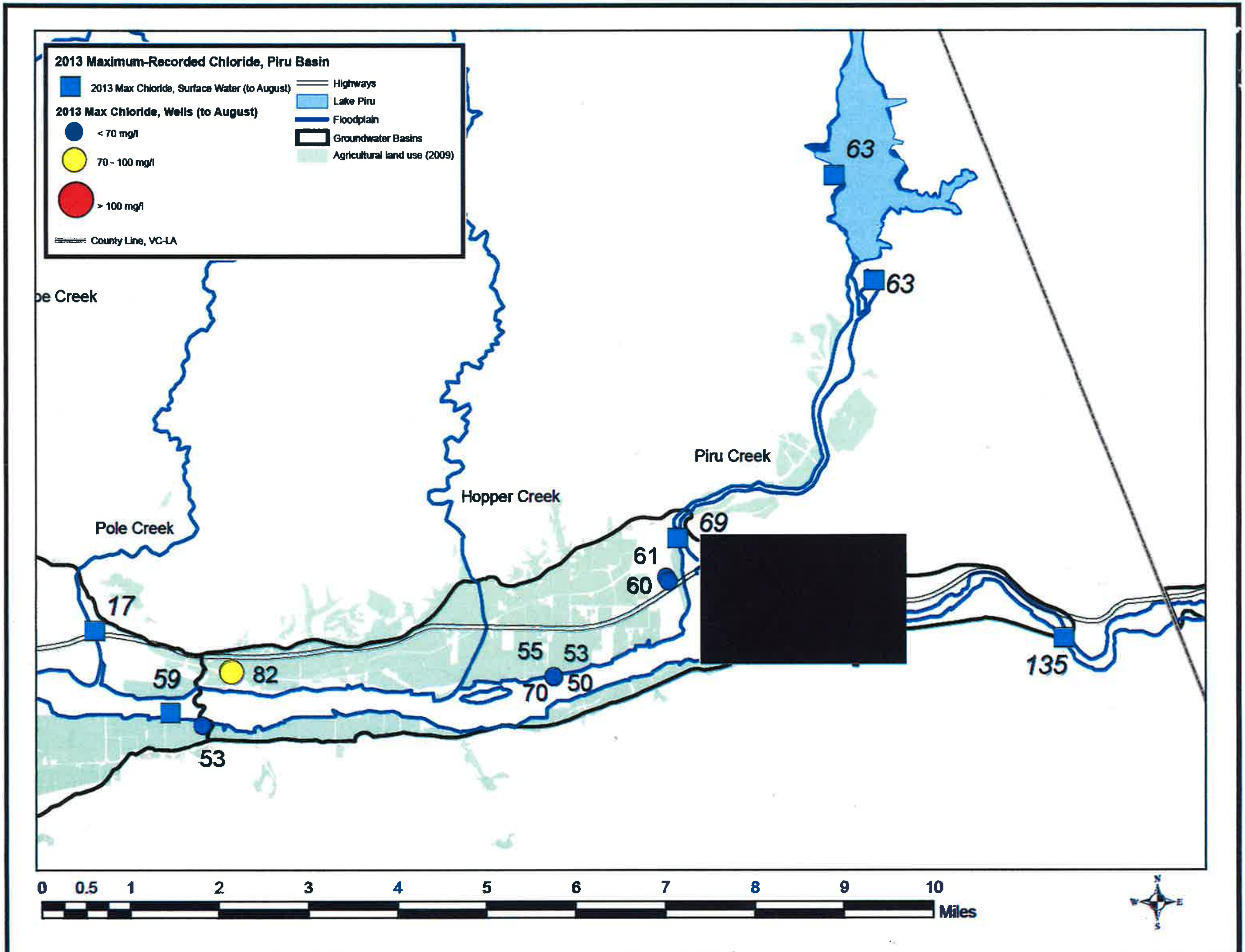
#12



POTW	Chloride
Saugus WRP	100 mg/L
Valencia WRP	100 mg/L

POTW	Chloride
Simi Valley WQCP	150 mg/L
Hill Canyon WWTP	150 mg/L
Moorpark WWTP	150 mg/L
Camarillo WRP	150 mg/L

#12



2013 Maximum-Recorded Chloride, Piru Basin
2013 Max Chloride, Surface Water (to August)
2013 Max Chloride, Wells (to August)
< 70 mg/l
70 - 100 mg/l
> 100 mg/l
County Line, VC-LA
Highways
Lake Piru
Floodplain
Groundwater Basins
Agricultural land use (2009)
pe Creek
Pole Creek
Hopper Creek
Piru Creek
63
63
69
61
60
17
59
82
55
53
70
50
53
135
0
0.5
1
2
3
4
5
6
7
8
9
10
Miles
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S

TABLE 1
Santa Clara River Chloride TMDL
Groundwater Monitoring – Fourth Quarter 2013

Parameter	Sample Date	Units	Result	Method	ML	MDL	RDL	Lab Sample ID
Camulos Well 17-USCR								
Chloride	11/25/2013	mg/l	122	EPA 300.0		0.12	8	13112500556
Residue, Filterable (TDS)	11/25/2013	mg/l	1100	SM 2540C		10.8	100	13112500556
Sulfate	11/25/2013	mg/l	413	EPA 300.0		1.7	5	13112500556
Camulos Well 23-USCR								
Chloride	11/25/2013	mg/l	127	EPA 300.0		0.075	5	13112500557
Residue, Filterable (TDS)	11/25/2013	mg/l	1150	SM 2540C		10.8	100	13112500557
Sulfate	11/25/2013	mg/l	434	EPA 300.0		1.7	5	13112500557
Camulos Well 10-USCR								
Chloride	11/25/2013	mg/l	128	EPA 300.0		0.075	5	13112500558
Residue, Filterable (TDS)	11/25/2013	mg/l	1000	SM 2540C		10.8	100	13112500558
Sulfate	11/25/2013	mg/l	341	EPA 300.0		1.7	5	13112500558
Saugus Well S-6								
Chloride	10/21/2013	mg/L	120	EPA 300.0		0.120	8.00	13102100507
Residue, Filterable (TDS)	10/21/2013	mg/L	782	SM 2540C		5.4	50.0	13102100507
Sulfate	10/21/2013	mg/L	165	EPA 300.0		0.680	2.00	13102100507
Valencia Well OldC[1]								
Chloride	N/A							
Residue, Filterable (TDS)	N/A							
Sulfate	N/A							

1 The Sanitation District currently conducts semi-annual monitoring at this well location owned by Newhall Land. The Sanitation District has requested to increase the frequency of the monitoring at this well location to quarterly in accordance with the USCR Chloride TMDL monitoring requirements.

Table 2
Santa Clara River Chloride TMDL
Surface Water - Residue, Filterable (TDS)
Fourth Quarter 2013

Location	Sample Date	Units	Result	Method	ML	MDL	RDL	Lab Sample ID
SCR_SAU_RA[1]	N/A							
SCR_SAU_RB	10/08/2013	mg/l	546	SM 2540C		5.4	50.0	13100800479
SCR_SAU_RB	11/05/2013	mg/l	600	SM 2540C		5.4	50.0	13110600248
SCR_SAU_RB	12/03/2013	mg/l	632	SM 2540C		5.4	50.0	13120400190
SCR_VAL_RC	10/08/2013	mg/l	1090	SM 2540C		5.4	50.0	13100800483
SCR_VAL_RC	11/05/2013	mg/l	1060	SM 2540C		5.4	50.0	13110600251
SCR_VAL_RC	12/03/2013	mg/l	988	SM 2540C		10.8	100	13120400191
				SM 2540C				
SCR_VAL_RD	10/08/2013	mg/l	708	SM 2540C		5.4	50.0	13100800484
SCR_VAL_RD	11/05/2013	mg/l	684	SM 2540C		5.4	50.0	13110600252
SCR_VAL_RD	12/03/2013	mg/l	684	SM 2540C		5.4	50.0	13120400192
SCR_VAL_RE	10/08/2013	mg/l	776	SM 2540C		5.4	50.0	13100800474
SCR_VAL_RE	11/05/2013	mg/l	726	SM 2540C		5.4	50.0	13110600253
SCR_VAL_RE	12/04/2013	mg/l	760	SM 2540C		5.4	50.0	13120400506
SCR_VAL_RF	10/08/2013	mg/l	994	SM 2540C		5.4	50.0	13100800475
SCR_VAL_RF	11/05/2013	mg/l	918	SM 2540C		5.4	50.0	13110600254
SCR_VAL_RF	12/03/2013	mg/l	896	SM 2540C		10.8	100	13120400193

[1] No results are reported for SCR_VAL_RA during the reporting period because the sample location was dry at the time of sampling.

Table 3
Santa Clara River Chloride TMDL
Surface Water - Sulfate
Fourth Quarter 2013

Location	Sample Date	Units	Result	Method	ML	MDL	RDL	Lab Sample ID
SCR_SAU_RA[1]	N/A							
SCR_SAU_RB	10/08/2013	mg/l	107	EPA 300.0		0.85	2.5	13100800479
SCR_SAU_RB	11/05/2013	mg/l	132	EPA 300.0		0.68	2	13110600248
SCR_SAU_RB	12/03/2013	mg/l	115	EPA 300.0		0.588	2	13120400190
SCR_VAL_RC	10/08/2013	mg/l	364	EPA 300.0		1.7	5	13100800483
SCR_VAL_RC	11/05/2013	mg/l	360	EPA 300.0		0.85	2.5	13110600251
SCR_VAL_RC	12/03/2013	mg/l	347	EPA 300.0		0.735	2.5	13120400191
SCR_VAL_RD	10/08/2013	mg/l	198	EPA 300.0		0.85	2.5	13100800484
SCR_VAL_RD	11/05/2013	mg/l	180	EPA 300.0		0.85	2.5	13110600252
SCR_VAL_RD	12/03/2013	mg/l	183	EPA 300.0		0.588	2	13120400192
SCR_VAL_RE	10/08/2013	mg/l	218	EPA 300.0		0.85	2.5	13100800474
SCR_VAL_RE	11/05/2013	mg/l	205	EPA 300.0		0.85	2.5	13110600253
SCR_VAL_RE	12/04/2013	mg/l	219	EPA 300.0		0.588	2	13120400506
SCR_VAL_RF	10/08/2013	mg/l	338	EPA 300.0		1.7	5	13100800475
SCR_VAL_RF	11/05/2013	mg/l	312	EPA 300.0		0.85	2.5	13110600254
SCR_VAL_RF	12/03/2013	mg/l	299	EPA 300.0		0.735	2	13120400193

1 No results are reported for SCR_VAL_RA during the reporting period because the sample location was dry at the time of sampling.

Table 4
Santa Clara River Chloride TMDL
Surface Water – Chloride
Fourth Quarter 2013

Location	Sample Date	Units	Result	Method	ML	MDL	RDL	Lab Sample ID
SCR_SAU_RA[1]	N/A							
SCR_SAU_RB	10/01/13	mg/l	119	EPA 300.0		0.15	10	13100100514
SCR_SAU_RB	10/08/13	mg/l	117	EPA 300.0		0.15	10	13100800480
SCR_SAU_RB	10/08/13	mg/l	116	EPA 300.0		0.15	10	13100800479
SCR_SAU_RB	10/15/13	mg/l	121	EPA 300.0		0.12	8	13101500498
SCR_SAU_RB	10/22/13	mg/l	125	EPA 300.0		0.12	8	13102200432
SCR_SAU_RB	10/29/13	mg/l	128	EPA 300.0		0.12	8	13102900448
SCR_SAU_RB	11/05/13	mg/l	130	EPA 300.0		0.12	8	13110600262
SCR_SAU_RB	11/05/13	mg/l	127	EPA 300.0		0.12	8	13110600248
SCR_SAU_RB	11/12/13	mg/l	127	EPA 300.0		0.12	8	13111300171
SCR_SAU_RB	11/19/13	mg/l	127	EPA 300.0		0.12	8	13111900450
SCR_SAU_RB	11/26/13	mg/l	121	EPA 300.0		0.12	8	13112600497
SCR_SAU_RB	12/03/13	mg/l	126	EPA 300.0		0.412	8	13120400217
SCR_SAU_RB	12/03/13	mg/l	127	EPA 300.0		0.412	8	13120400190
SCR_SAU_RB	12/10/13	mg/l	129	EPA 300.0		0.412	8	13121000454
SCR_SAU_RB	12/16/13	mg/l	129	EPA 300.0		0.412	8	13121600544
SCR_SAU_RB	12/23/13	mg/l	131	EPA 300.0		0.412	8	13122300495
SCR_VAL_RC	10/01/13	mg/l	108	EPA 300.0		0.15	10	13100100515
SCR_VAL_RC	10/08/13	mg/l	116	EPA 300.0		0.15	10	13100800483
SCR_VAL_RC	10/15/13	mg/l	113	EPA 300.0		0.12	8	13101500499
SCR_VAL_RC	10/22/13	mg/l	112	EPA 300.0		0.12	8	13102200434
SCR_VAL_RC	10/29/13	mg/l	110	EPA 300.0		0.12	8	13102900449
SCR_VAL_RC	11/05/13	mg/l	109	EPA 300.0		0.15	10	13110600251
SCR_VAL_RC	11/12/13	mg/l	111	EPA 300.0		0.12	8	13111300172
SCR_VAL_RC	11/19/13	mg/l	111	EPA 300.0		0.12	8	13111900451

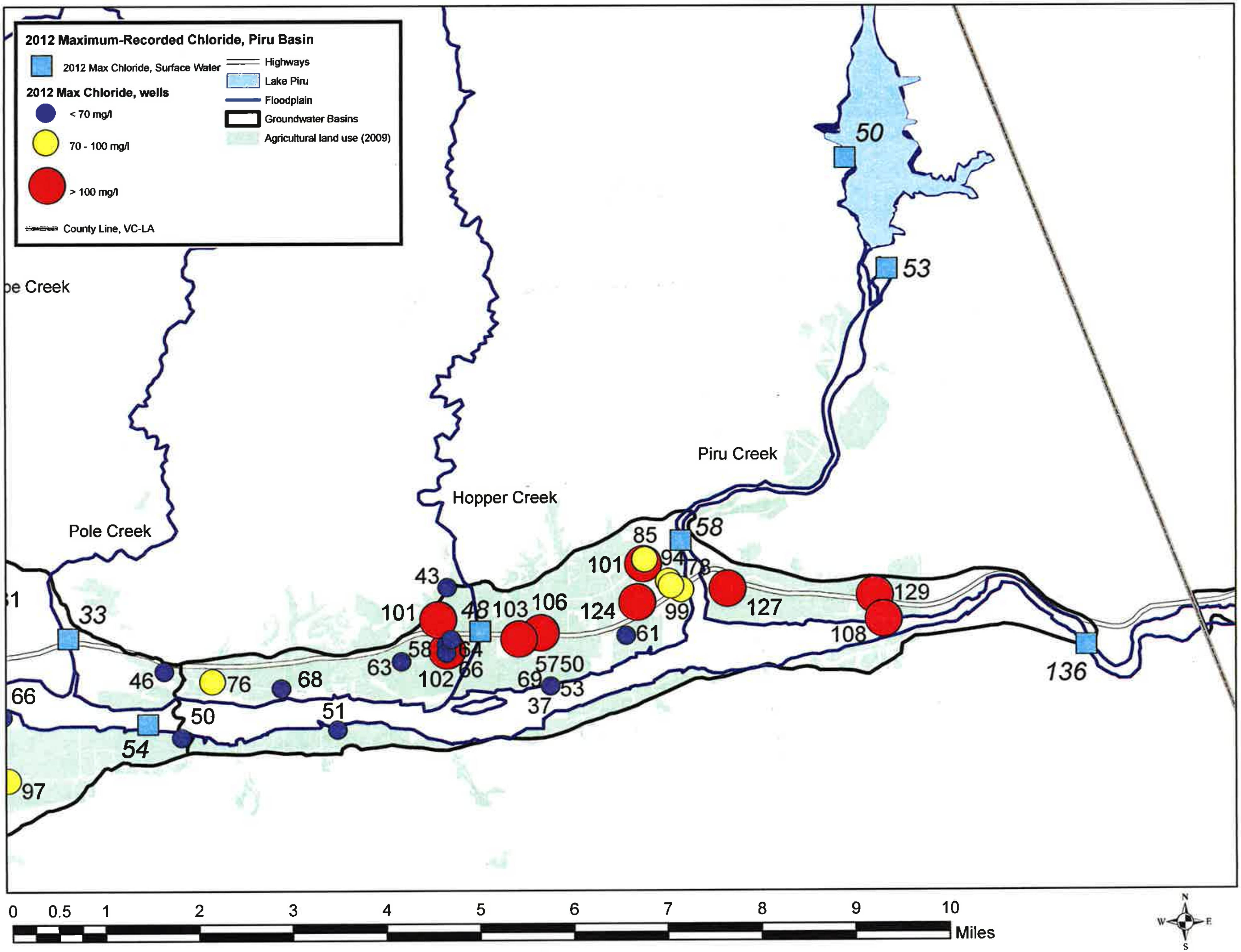
Table 4
Santa Clara River Chloride TMDL
Surface Water – Chloride
Fourth Quarter 2013

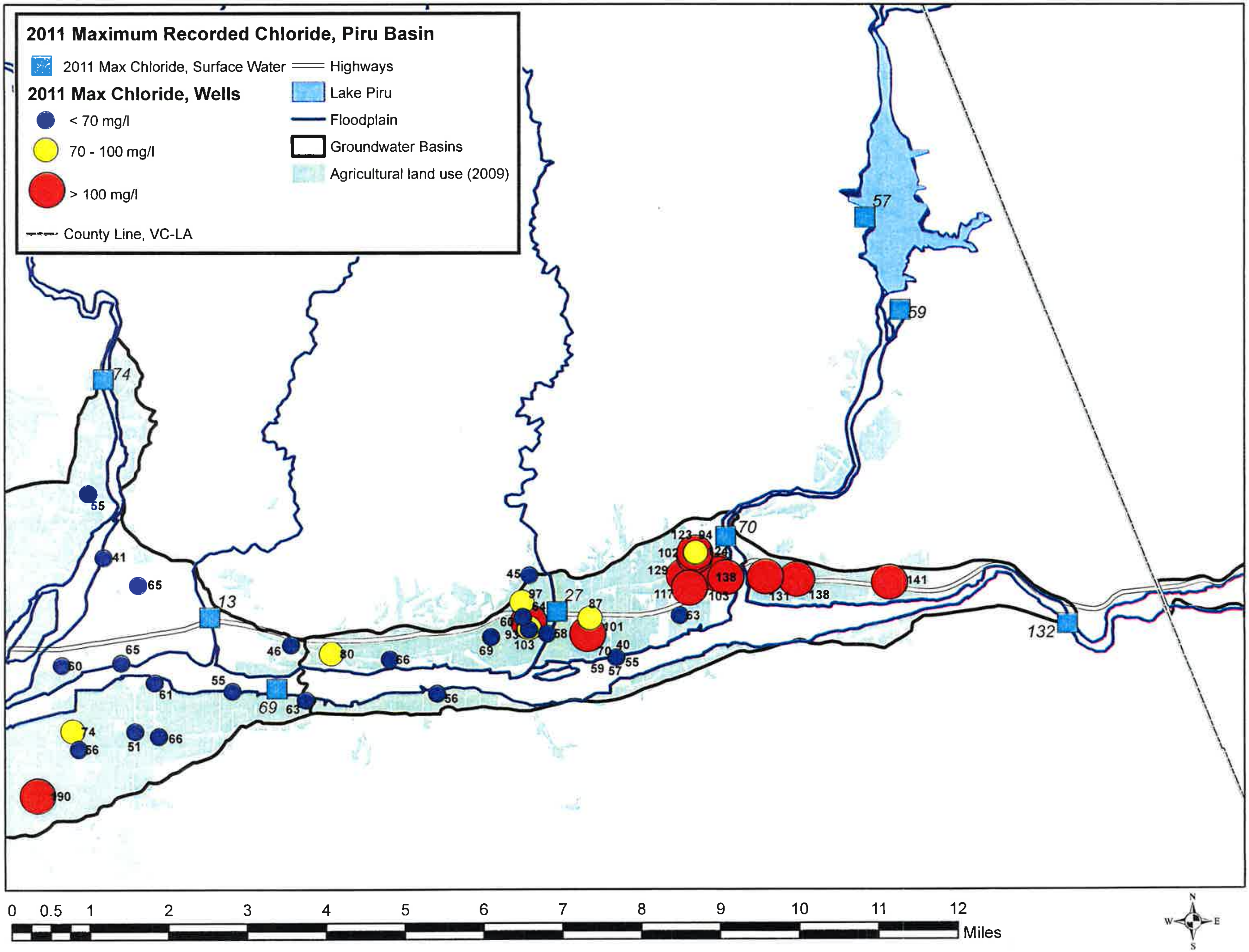
Location	Sample Date	Units	Result	Method	ML	MDL	RDL	Lab Sample ID
SCR_VAL_RC	11/26/13	mg/l	111	EPA 300.0		0.12	8	13112600498
SCR_VAL_RC	12/03/13	mg/l	108	EPA 300.0		0.515	10	13120400191
SCR_VAL_RC	12/10/13	mg/l	108	EPA 300.0		0.412	8	13121000455
SCR_VAL_RC	12/16/13	mg/l	112	EPA 300.0		0.258	5	13121600546
SCR_VAL_RD	10/01/13	mg/l	122	EPA 300.0		0.15	10	13100100516
SCR_VAL_RD	10/08/13	mg/l	121	EPA 300.0		0.15	10	13100800476
SCR_VAL_RD	10/08/13	mg/l	132	EPA 300.0		0.15	10	13100800484
SCR_VAL_RD	10/15/13	mg/l	125	EPA 300.0		0.12	8	13101500500
SCR_VAL_RD	10/22/13	mg/l	129	EPA 300.0		0.12	8	13102200435
SCR_VAL_RD	10/29/13	mg/l	126	EPA 300.0		0.12	8	13102900450
SCR_VAL_RD	11/05/13	mg/l	129	EPA 300.0		0.12	8	13110600264
SCR_VAL_RD	11/05/13	mg/l	124	EPA 300.0		0.15	10	13110600252
SCR_VAL_RD	11/12/13	mg/l	129	EPA 300.0		0.12	8	13111300173
SCR_VAL_RD	11/19/13	mg/l	127	EPA 300.0		0.12	8	13111900452
SCR_VAL_RD	11/26/13	mg/l	123	EPA 300.0		0.12	8	13112600499
SCR_VAL_RD	12/03/13	mg/l	126	EPA 300.0		0.412	8	13120400194
SCR_VAL_RD	12/03/13	mg/l	123	EPA 300.0		0.412	8	13120400192
SCR_VAL_RD	12/10/13	mg/l	126	EPA 300.0		0.412	8	13121000456
SCR_VAL_RD	12/16/13	mg/l	125	EPA 300.0		0.412	8	13121600547
SCR_VAL_RD	12/23/13	mg/l	129	EPA 300.0		0.206	4	13122300497
SCR_VAL_RE	10/01/13	mg/l	112	EPA 300.0		0.15	10	13100100517
SCR_VAL_RE	10/08/13	mg/l	113	EPA 300.0		0.15	10	13100800474
SCR_VAL_RE	10/15/13	mg/l	116	EPA 300.0		0.15	10	13101500501
SCR_VAL_RE	10/22/13	mg/l	118	EPA 300.0		0.12	8	13102200436
SCR_VAL_RE	10/29/13	mg/l	114	EPA 300.0		0.12	8	13102900451
SCR_VAL_RE	11/05/13	mg/l	123	EPA 300.0		0.15	10	13110600253
SCR_VAL_RE	11/12/13	mg/l	117	EPA 300.0		0.12	8	13111300174
SCR_VAL_RE	11/19/13	mg/l	117	EPA 300.0		0.12	8	13111900453

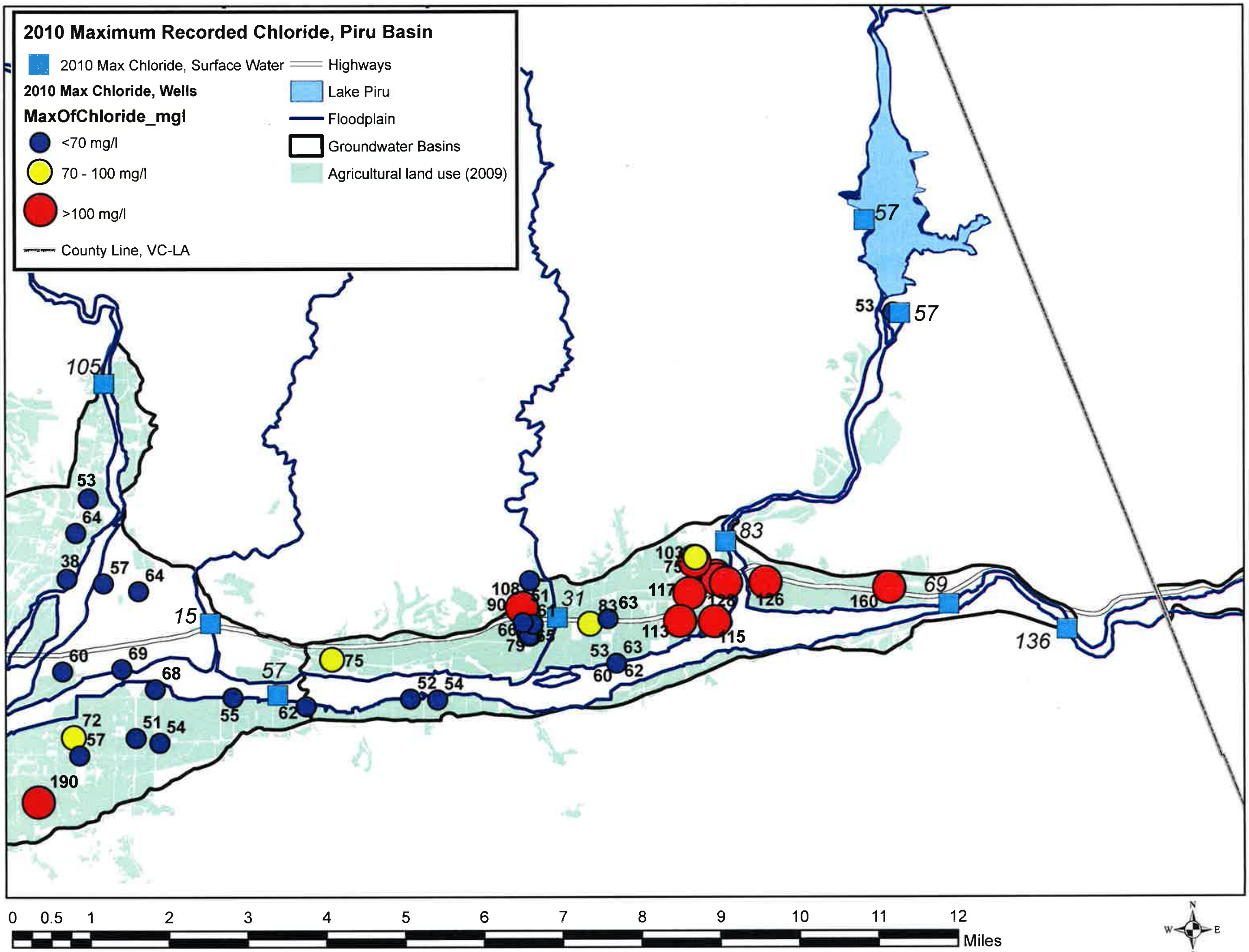
Table 4
Santa Clara River Chloride TMDL
Surface Water – Chloride
Fourth Quarter 2013

Location	Sample Date	Units	Result	Method	ML	MDL	RDL	Lab Sample ID
SCR_VAL_RE	11/26/13	mg/l	117	EPA 300.0		0.12	8	13112600502
SCR_VAL_RE	12/04/13	mg/l	115	EPA 300.0		0.12	8	13120400506
SCR_VAL_RE	12/10/13	mg/l	113	EPA 300.0		0.412	8	13121000457
SCR_VAL_RE	12/16/13	mg/l	115	EPA 300.0		0.412	8	13121600548
SCR_VAL_RE	12/23/13	mg/l	118	EPA 300.0		0.258	5	13122300498
SCR_VAL_RF	10/01/13	mg/l	125	EPA 300.0		0.15	10	13100100518
SCR_VAL_RF	10/08/13	mg/l	134	EPA 300.0		0.15	10	13100800475
SCR_VAL_RF	10/15/13	mg/l	126	EPA 300.0		0.15	10	13101500502
SCR_VAL_RF	10/22/13	mg/l	127	EPA 300.0		0.12	8	13102200437
SCR_VAL_RF	10/29/13	mg/l	123	EPA 300.0		0.12	8	13102900452
SCR_VAL_RF	11/05/13	mg/l	134	EPA 300.0		0.15	10	13110600254
SCR_VAL_RF	11/12/13	mg/l	124	EPA 300.0		0.12	8	13111300175
SCR_VAL_RF	11/19/13	mg/l	127	EPA 300.0		0.12	8	13111900454
SCR_VAL_RF	11/26/13	mg/l	126	EPA 300.0		0.12	8	13112600503
SCR_VAL_RF	12/03/13	mg/l	122	EPA 300.0		0.515	10	13120400193
SCR_VAL_RF	12/10/13	mg/l	123	EPA 300.0		0.412	8	13121000458
SCR_VAL_RF	12/16/13	mg/l	122	EPA 300.0		0.412	8	13121600549
SCR_VAL_RF	12/23/13	mg/l	128	EPA 300.0		0.206	4	13122300499

[1] No results are reported for SCR_VAL_RA during the reporting period because the sample location was dry at the time of sampling.


2012 Maximum-Recorded Chloride, Piru Basin
2012 Max Chloride, Surface Water
2012 Max Chloride, wells
< 70 mg/l
70 - 100 mg/l
> 100 mg/l
County Line, VC-LA
Highways
Lake Piru
Floodplain
Groundwater Basins
Agricultural land use (2009)
Pole Creek
Hopper Creek
Piru Creek
0 0.5 1 2 3 4 5 6 7 8 9 10
Miles


2011 Maximum Recorded Chloride, Piru Basin
2011 Max Chloride, Surface Water
Highways
2011 Max Chloride, Wells
Lake Piru
< 70 mg/l
Floodplain
70 - 100 mg/l
Groundwater Basins
Agricultural land use (2009)
> 100 mg/l
County Line, VC-LA
0 0.5 1 2 3 4 5 6 7 8 9 10 11 12
Miles
N
E
S
W


2010 Maximum Recorded Chloride, Piru Basin
2010 Max Chloride, Surface Water
Highways
2010 Max Chloride, Wells
Lake Piru
MaxOfChloride_mgl
Floodplain
<70 mg/l
Groundwater Basins
70 - 100 mg/l
Agricultural land use (2009)
>100 mg/l
County Line, VC-LA
0 0.5 1 2 3 4 5 6 7 8 9 10 11 12
Miles
N
W
E
S

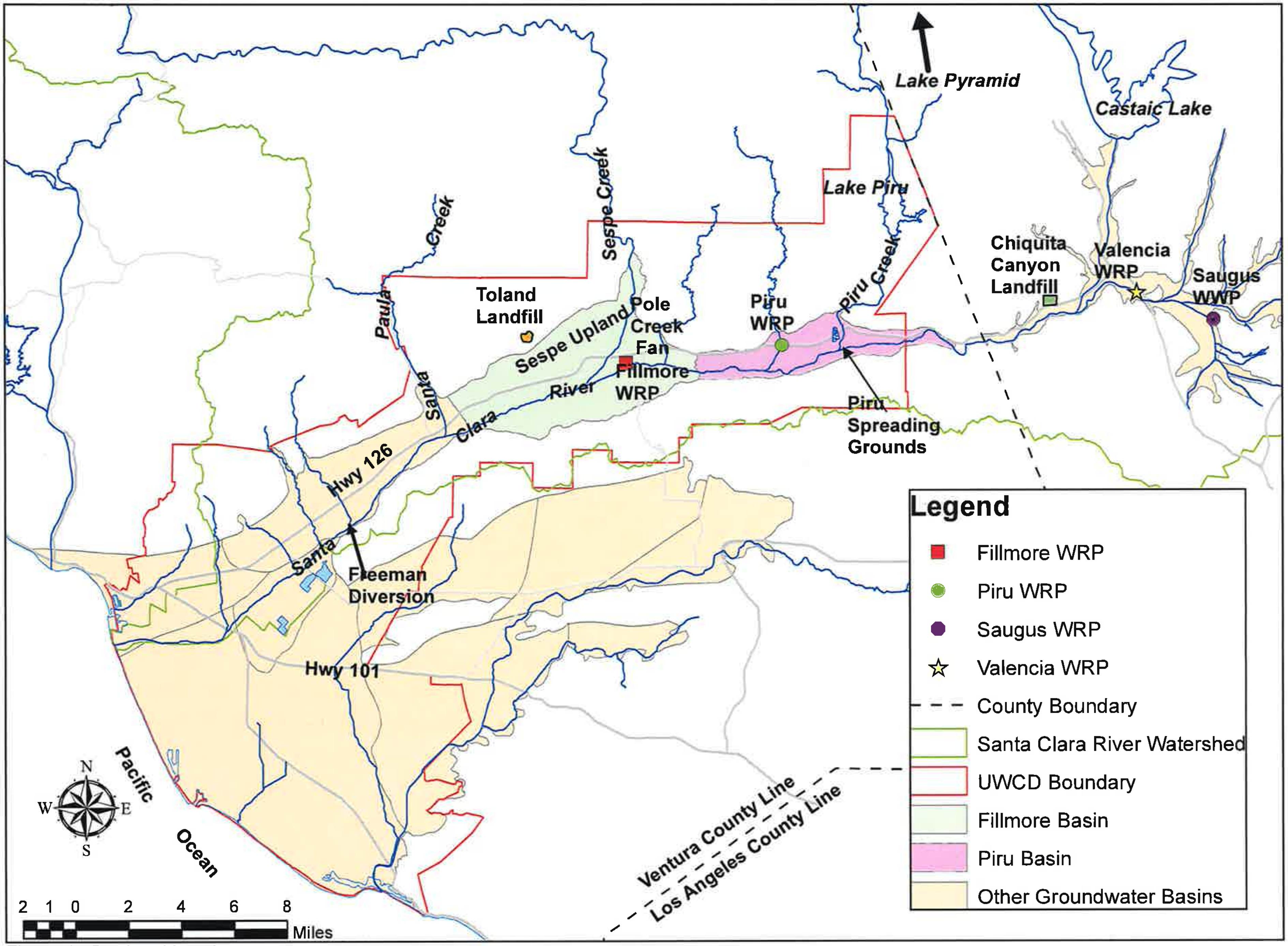


Figure 1. Regional location map

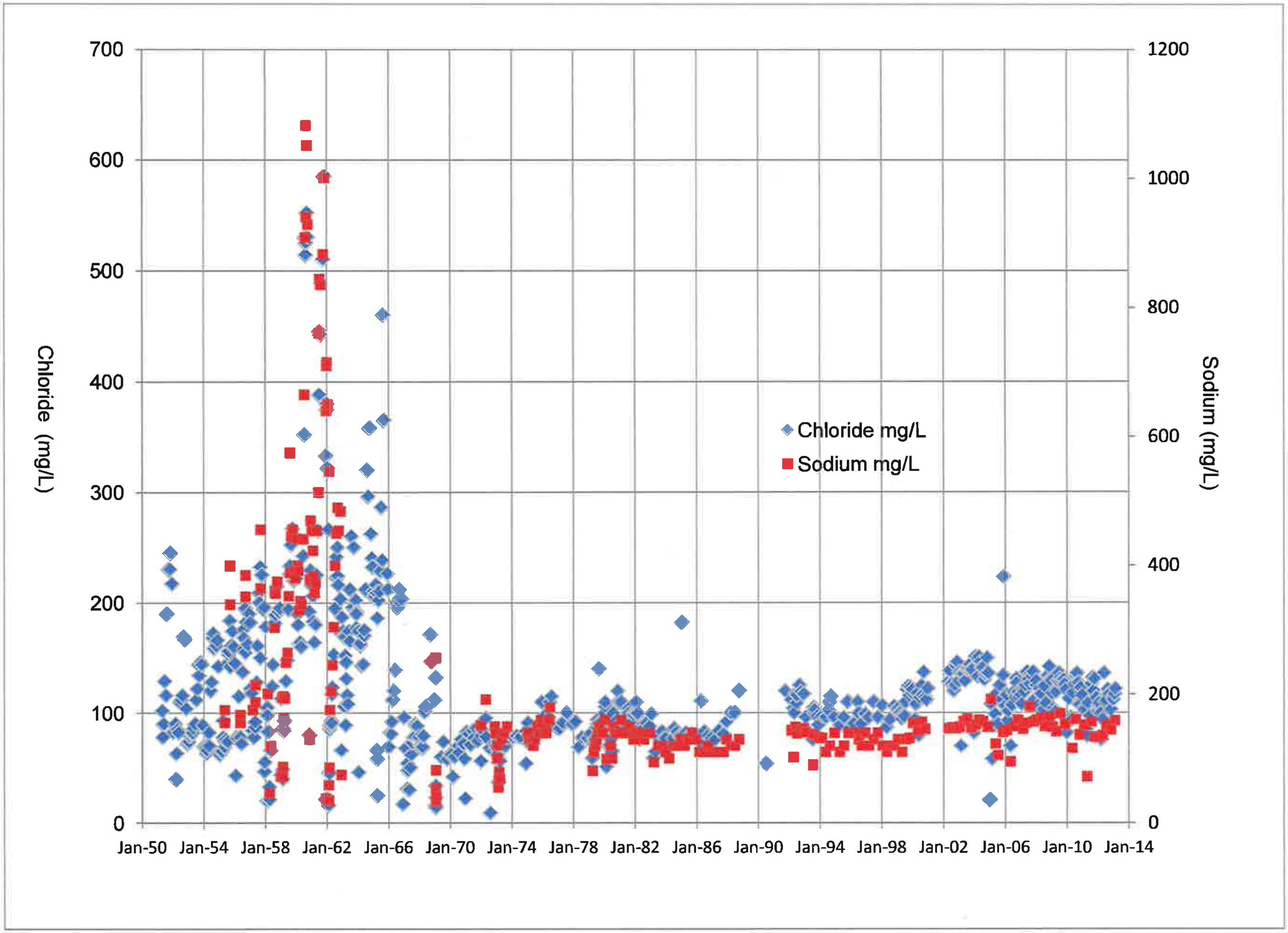


Figure 14. Chloride and Sodium Time Series Graph for the Santa Clara River at Ventura /L.A. County Line

COUNTY SANITATION DISTRICTS
OF LOS ANGELES COUNTY

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www.lacsd.org

STEPHEN R. MAGUIN
Chief Engineer and General Manager

July 13, 2011

Mr. Samuel Unger, Executive Officer
California Regional Water Quality Control Board
Los Angeles Region
320 W. 4th Street, Suite 200
Los Angeles, CA 90013

Dear Mr. Unger:

Upper Santa Clara River Chloride TMDL

The Santa Clarita Valley Sanitation District of Los Angeles County (Sanitation District) submits the enclosed technical memorandum, "*Comments on United Water Conservation District Conclusions Regarding Recent Chloride Data, Upper Santa Clara River Chloride TMDL*" prepared by AMEC Geomatrix (AMEC), dated July 12, 2011.

In a letter dated June 1, 2011 and in testimony before the California Regional Water Quality Control Board, Los Angels Region (Regional Board) at the June 2, 2011 Board Meeting, representatives from the United Water Conservation District (UWCD) made statements that recent chloride levels are indicative of ongoing degradation of water quality in the Piru Basin and a clear and unequivocal indications of a westward moving plume of high chloride. UWCD's representatives, E.Michael Solomon, General Manger of UWCD and Dr. Stephen Bachman, Consulting Groundwater Geologist for UWCD, also stated that the Groundwater/Surface Water Interaction (GSWI) study, developed as part of the chloride TMDL, indicated a progressive westward movement of high chloride concentrations in groundwater and support the claims of a long-term trend of increasing chloride concentrations in the Piru Basin.

The Sanitation District requested AMEC to prepare the enclosed technical memorandum to address the validity of these statements based on their knowledge of the GSWI model and the available groundwater data. AMEC's review was performed by Dr. Sorab Panday, who was one of the principal designers of the GSWI model developed by CH2M Hill and Hydrogeologic Inc., and Mr. Jeff Weaver, who served as a technical support member of the GSWI Technical Working Group.

Based on their review, AMEC found that the available data and results of the GSWI study do not support the general conclusions presented by UWCD in its letter of June 1, 2011 and the testimony presented at the June 2, 2011 Regional Board meeting. AMEC indicates that while chloride concentrations have recently increased in some wells in the Piru Basin, the increases are likely part of a longer-term pattern of fluctuations in chloride concentrations rather than the result of a westward-moving plume of high chloride concentrations in groundwater emanating from the WRPs.

The Sanitation District strongly urges the Regional Board to consider AMEC's analysis during its review of the Sanitation District's responses to the Notices of Violation for the Valencia and Saugus Water Reclamation Plants submitted on June 27, 2011. If you have any questions, please contact me at 562-908-4288, extension 2501.

Very truly yours,

Stephen R. Maguin

Philip L. Friess
Department Head
Technical Services

PLF:FG:lmb
Enclosure

cc: Jenny Newman, LARWQCB
Michael Solomon, UWCD
Rob Roy, VCAWQC

Memo

To	**Ray Tremblay**	Project no	**10354.000.0**
From	**Jeff Weaver** **Dr. Sorab Panday**	cc	
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Date	**July 12, 2011**		

Subject **Comments on United Water Conservation District Conclusions Regarding Recent Chloride Data, Upper Santa Clara River Chloride TMDL**

AMEC Geomatrix, Inc. (AMEC) has prepared this technical memorandum presenting our comments on recent conclusions made by representatives of the United Water Conservation District (UWCD) based on recent groundwater chloride data from wells in the Piru Basin. We have also reviewed statements made by UWCD regarding results of the Groundwater/Surface Water Interaction (GSWI) study performed as part of the Upper Santa Clara River Chloride Total Maximum Daily Load (TMDL) Program. The Santa Clarita Valley Sanitation District of Los Angeles County (SCVSD) requested that AMEC staff review conclusions and statements made by UWCD representatives to the California Regional Water Quality Control Board, Los Angeles Region (LARWQCB; Board) in a letter dated June 1, 2011 and in testimony to the Board in a meeting on June 2, 2011. AMEC staff also reviewed chloride concentration data for groundwater samples collected from various wells in the Piru Basin since completion of the GSWI study. AMEC's review was performed by Dr. Sorab Panday, who was instrumental in developing and applying the GSWI numerical groundwater flow and chloride transport model, and Mr. Jeff Weaver, who served as a technical support member of the GSWI Technical Working Group. Dr. Panday and Mr. Weaver participated in all phases of the GSWI study and have extensive knowledge of the GSWI numerical model and the overall results of the GSWI study.

In general, statements made in the June 1 letter (primarily Issue #3, by Mr. E. Michael Solomon) and in testimony at the June 2 meeting (by Dr. Steven Bachman) focus on recent groundwater chloride concentrations in the Piru Basin both east and west of Piru Creek. Conclusions provided by UWCD are summarized as follows:

- Recent chloride levels observed in the Piru Basin are indicative of overall, long-term increases in chloride in the Basin;
- There is a clear and unequivocal westward moving plume of high chloride concentrations groundwater;
- Results from the GSWI model indicated a general westward movement of high chloride concentrations in groundwater and support a long-term trend of increasing chloride concentrations in the Piru Basin; and

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- The observed increases in chloride and the plume of chloride in groundwater are a direct result of past and ongoing discharges from SCVSD's Saugus and Valencia Water Reclamation Plants (WRPs).

Based on our review of existing data and our knowledge of the GSWI study, we believe the conclusions made by UWCD are not adequately supported by the available chloride data, do not adequately account for complexities in the surface and groundwater systems as characterized during the GSWI study, and are not consistent with results from the GSWI model. The following sections discuss results of the GSWI study and recent chloride data in light of the conclusions developed by UWCD.

Results of the GSWI Study

Overall results of the GSWI study were based primarily on development and application of the GSWI model, which simulated long-term fluctuations in surface water and groundwater flow conditions in response to changes in regional climate and hydrology. Changes in chloride concentrations over time were also simulated for past and potential future hydrologic conditions. Results of the GSWI model were provided in the Task 2B-1 Report (CH2M Hill-HGL, 2008)[1] and the Task 2B-2 Report (Geomatrix, 2009)[2]. The model was used to simulate potential fluctuations in chloride concentrations in response to a variety of chloride treatment and management options. Results of the GSWI model that bear on the current discussion include the following:

- Model results indicated that evapoconcentration of chloride at the land surface from application of irrigation water is an important source of local and regional chloride loading to the Santa Clara River and Piru Basin groundwater, especially during drier climatic periods. This important additional source of chloride impacted the ability to achieve existing water quality objectives (WQOs) in the Santa Clara River downstream of the Los Angeles-Ventura County line in treatment-only management scenarios.

- As a result of evapoconcentration effects from water applied for irrigation, and chloride loading unrelated to WRP discharges, reducing chloride concentrations in WRP discharge to 100 mg/L (Scenario 1a, CH2M Hill-HGL, 2008) did not result in meeting WQO's in all stream reaches at all times. This key result led to development of approaches that used other management options to achieve WQOs in the Santa Clara River downstream of the Los Angeles-Ventura County line.

- Fluctuations in chloride concentrations in both surface water near and downstream of the Los Angeles-Ventura County line, and groundwater in Piru Basin are generally correlated with long-term climatic conditions and chloride concentrations in the general

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[1] CH2M HILL and HydroGeoLogic, 2008, Task 2B-1 – Numerical Model Development and Scenario Results, East and Piru Subbasins, Upper Santa Clara River Chloride TMDL Collaborative Process, Prepared for Sanitation Districts of Los Angeles County and Los Angeles Regional Water Quality Control Board, March.

[2] AMEC Geomatrix, Inc., 2009, Final Task 2B-2 Report – Assessment of Alternatives for Compliance Options Using the Groundwater/Surface Water Interaction Model, Upper Santa Clara River Chloride TMDL Collaborative Process, Upper Santa Clara River Valley, Los Angeles and Ventura Counties, California, Prepared for County Sanitation Districts of Los Angeles County, August 20.

water supply (i.e., State Project Water and other water supply sources). This was clearly demonstrated in a predictive simulation that included no WRP discharges yet resulted in the maximum predicted chloride concentrations in surface water of any simulation.

- With regard to allegations of a westward moving chloride plume, actual chloride concentrations in groundwater generally increase during drier climatic periods and are reduced and flushed from the system during wetter climatic periods. Concentrations vary in response to both local and regional climatic conditions. As such, there is no consistent, westward moving plume of chloride in groundwater predicted by the GSWI model. Higher and lower chloride concentrations were predicted to move through the Piru Basin depending upon shorter-term climatic conditions.

The overall GSWI study resulted in an enhanced understanding of the complex interplay between source water concentrations, local climatic conditions, water reuse, WRP discharges, and chloride concentrations in surface water and groundwater.

An example of this complexity is shown on Figure 1 (reproduced from Figure 5-10 of the Task 2B report, Geomatrix, 2008). The figure presents simulated future surface water chloride conditions at Blue Cut predicted based on scenarios both with and without WRP discharges to the Santa Clara River. For the simulation that assumed no WRP discharges, chloride concentrations were predicted to fluctuate in a pattern similar to those shown by the simulations that included WRP discharges. The model predicted steadily increasing concentrations of chloride between model years 8 to 16, a period of over nine years, without the influence of WRP discharges. Maximum concentrations of chloride in surface water predicted for this scenario were higher than those predicted by simulations that assumed the presence of WRP discharges, indicating that the WRPs were providing a positive diluting effect at Blue Cut during these peak drought periods.

Similar chloride fluctuations were predicted for groundwater in the eastern portion of the Piru Basin, as depicted on Figure 2 (reproduced from Figure 5-15 of the Task 2B-2 Report, Geomatrix, 2008). As with surface water concentrations, the GSWI model predicted a steady increase in groundwater chloride concentrations over a simulated nine-year period. The trend in groundwater concentrations predicted by this simulation is independent of WRP discharges.

The timing of climate-related responses in simulated concentrations in both surface water near and downstream the Los Angeles-Ventura County line and Piru Basin groundwater reflect the complexities of both short and long-term variations in chloride loading in the basin. For example, the first significant rainfall of the season may result in increased concentrations in surface water as chlorides that have built up in the land surface and vadose zone are flushed into the river, while wetter seasonal climate results in a dilution of chloride concentrations. Multi-year changes in climate and water supply concentrations can result in both excess water that provides longer-term dilution or long-term buildup in chlorides from drought conditions. In general, the GSWI model predicted that up to 3 years may be required for groundwater chlorides within the Piru Basin to respond fully to longer-term climatic variations.

Therefore, it is again noted that the timing and trends in chloride concentrations are a function primarily of climatic and water supply concentrations. This finding was discussed in detail with all stakeholders during the GSWI study process.

Recent Chloride Data

UWCD representatives presented chloride levels in groundwater in the Piru Basin and concluded that recent increases in concentrations in some wells represent a clear and unequivocal long-term increase due to a westward moving chloride plume. AMEC staff has reviewed available chloride data provided by SCVSD. Figures 3 and 4 present well locations for wells used in the GSWI study that have recent chloride data. Figure 5 presents chloride concentrations since the early 1990s in wells in the eastern Piru Basin (east of Piru Creek). Chloride trends in the wells can be summarized as follows:

- Well V-0012 – concentrations generally increased from 1999 through 2006, followed by a significant decline in concentrations in 2006-2007. Concentrations then generally increased from 2008 through 2010. The maximum concentration was observed in February, 2006.
- Well V-0036 – concentrations generally increased from 1998 through 2004. Concentrations then generally decreased from 2004 through 2010. The maximum concentration was observed in January, 2004.
- Well V-0031 – concentrations are generally variable in the early 1990s and show a general decrease through 1998. No data are available through the early 2000s. The concentration measured in 2010 is similar concentrations measured in the early 1990s.

Figure 6 presents chloride concentrations in wells located west of Piru Creek and south of the Piru Spreading Grounds. Chloride trends in these wells can be summarized as follows:

- V-0053 – concentrations were generally similar from the early 1990s through 2000, with concentrations decreasing between 2000 and 2002, increasing between 2002 and 2003, decreasing between 2003 and 2005, and increasing between 2005 and 2010. The maximum concentration was observed in May 2003.
- V-0077 – concentrations generally increased from 2005 through 2010. No data for dates prior to 2005 are available for this well. The maximum concentration was observed in August, 2010.
- V-0042 – concentrations were higher in 2004 than in 1991. Concentrations generally decreased between 2004 and 2006, and generally increased between 2006 and 2010. The maximum concentration was observed in May, 2005.
- V-0121 – concentrations generally decreased between 2005 and 2010. The maximum concentration was observed in August, 2006.

Figure 7 presents chloride concentrations in wells located west of Piru Creek and north of the Piru Spreading Grounds. Chloride trends in these wells can be summarized as follows:

- V-0061 – concentrations generally declined between 1990 and 2002. Concentrations generally increased between 2002 and 2005, decreased between 2005 and 2006, and increased between 2006 and 2010. The maximum concentration was observed in May 2005.

- V-0060 – concentrations generally decreased between the early 1990s and 2001. Concentrations increased between 2001 and 2004, and decreased between 2004 and 2008. The maximum concentration was observed in June 1992.

- V-0062 – chloride data for years prior to 2006 are not available for this well. Concentrations were generally stable between 2006 and 2008, and increased between 2008 and 2010. The maximum concentration was observed in May 2010.

- V-0049 – chloride data for years prior to 2008 are not available for this well. Concentrations generally increased between 2008 and 2010. The maximum concentration was observed in April 2010.

- V-0052 – chloride data for years prior to 2008 are not available for this well. Concentrations generally increased between 2008 and 2010. The maximum concentration was observed in July 2010.

As noted above, the chloride trends noted in wells east or west of Piru Creek are not indicative of a long-term increase due to a westward moving plume of chloride in groundwater. Concentrations in the wells show periods of increase and periods of decrease. Chloride concentrations show multi-year variations similar to those simulated using the GSWI model, with the timing and trends being a function of the complex interplay between local and regional climate, source water concentrations, evapoconcentration of salts at the land surface, and WRP discharges.

Summary

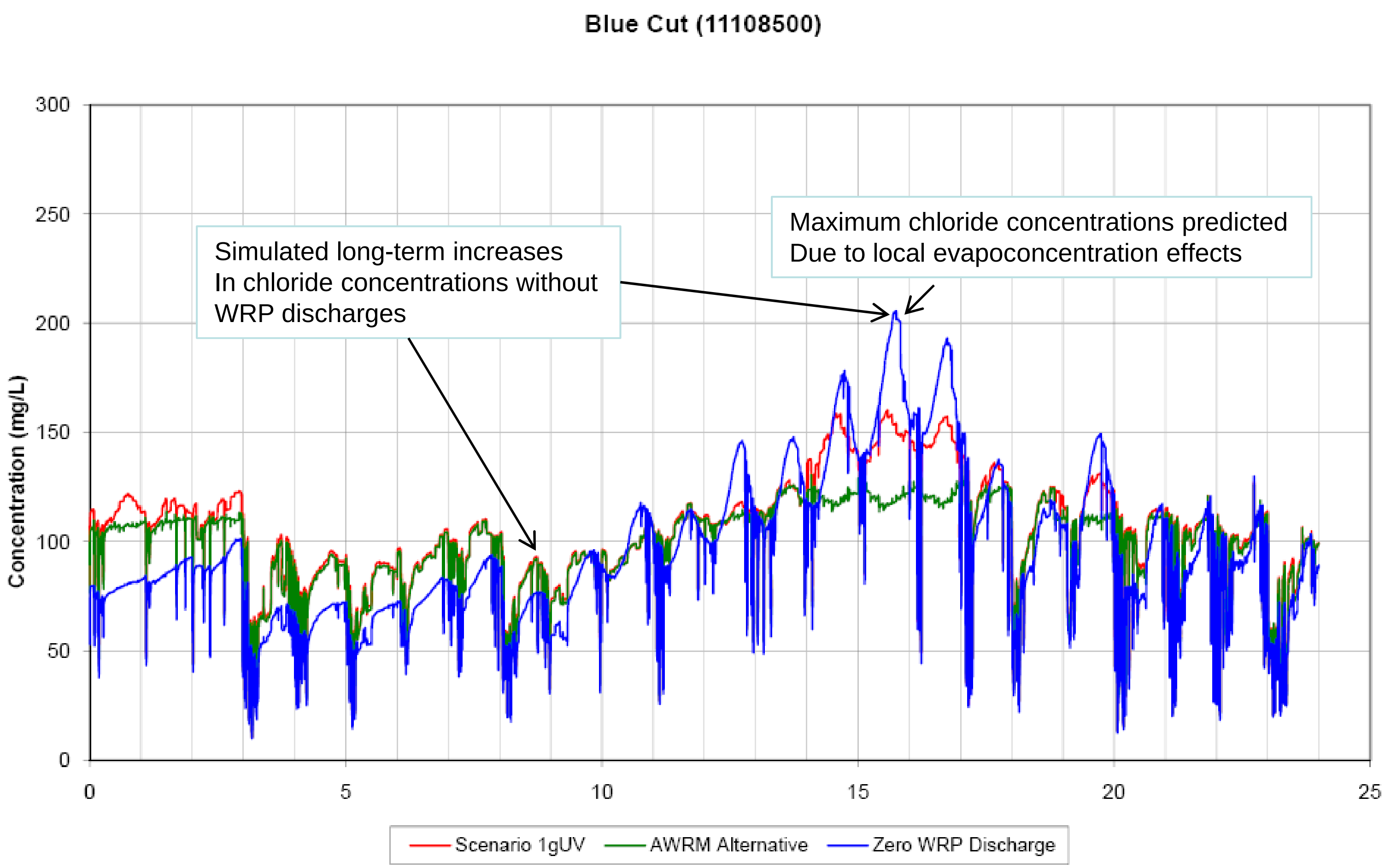
Based on our review of concentrations of chloride in groundwater in the Piru Basin, along with our understanding of the GSWI model and results from the overall GSWI study, we do not agree with the general conclusions presented by UWCD in its letter of June 1, 2011 and statements made to the LARWQCB on June 2, 2011. Recent improvements in chloride concentrations have been noted in both water supply concentrations and WRP discharges. While, chloride concentrations have recently increased in some wells in the Piru Basin, these increases are likely part of a longer term pattern of fluctuations in chloride concentrations rather than the result of a westward-moving plume of high chloride concentrations in groundwater emanating from the WRPs. Rather, long-term chloride concentration fluctuations and trends are consistent with results from the GSWI study, which indicted that chloride levels are subject to the complexities of chloride mass loading and transport at the watershed scale. GSWI model simulations clearly demonstrated the primary importance of climatic variability and water supply concentration on long-term chloride levels in the basin, and that short-term chloride trends are not soley influenced by WRP discharge concentrations.

Sincerely yours,
AMEC Geomatrix, Inc.

Dr. Sorab Panday
Principal Engineer

Jeff Weaver
Senior Hydrogeologist

Attachments:
Figure 1 – Simulated Chloride Concentrations at Blue Cut
Figure 2 – Simulated Chloride Concentrations in Piru Basin Groundwater
Figure 3 – Piru Basin Well Locations – East of Piru Creek
Figure 4 – Piru Basin Well Locations – West of Piru Creek
Figure 5 – Chloride in Eastern Piru Basin Wells
Figure 6 – chloride in Western Piru Basin Wells South of Piru Spreading Grounds
Figure 7 – Chloride in Western Piru Basin Wells North of Piru Spreading Grounds



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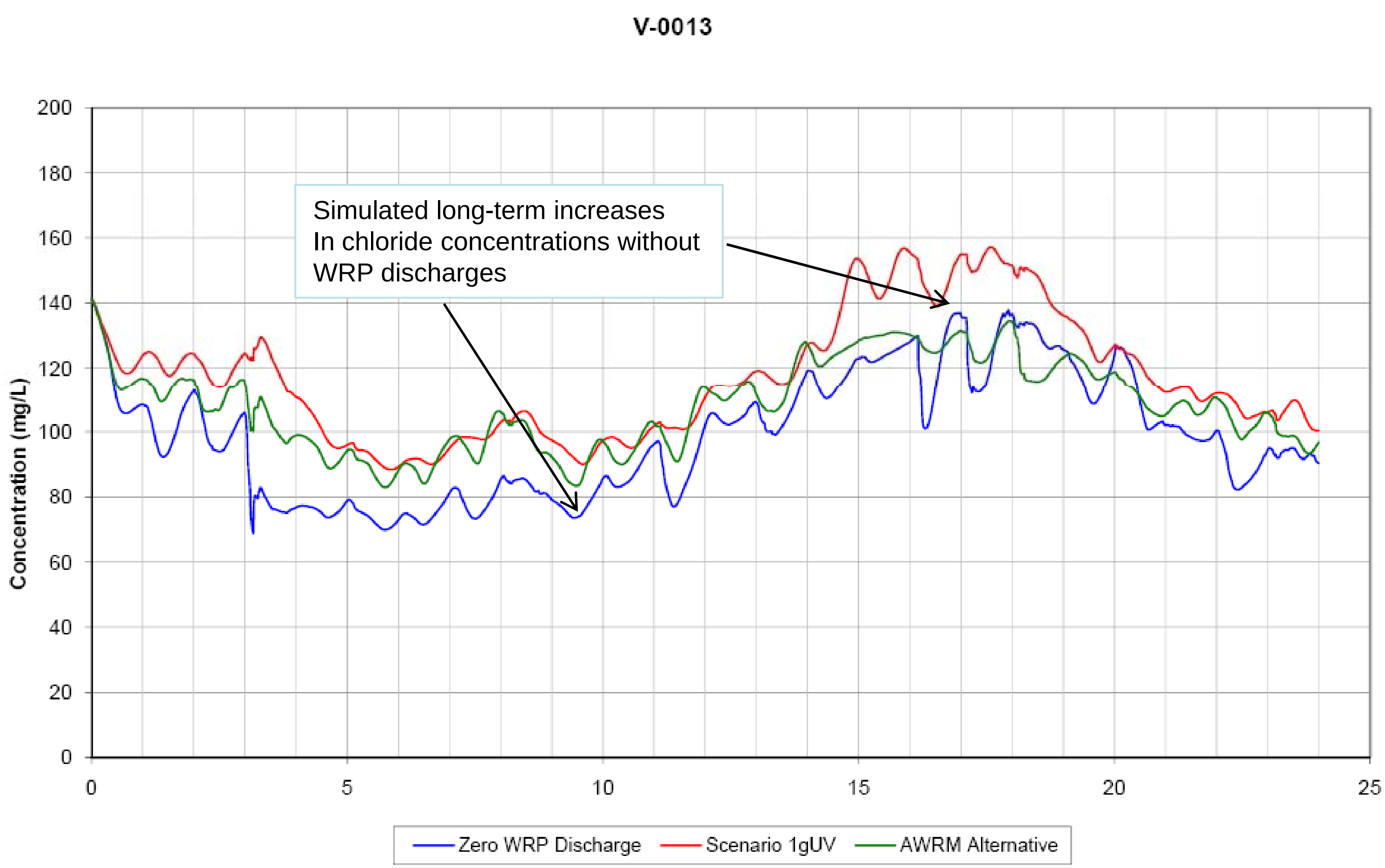
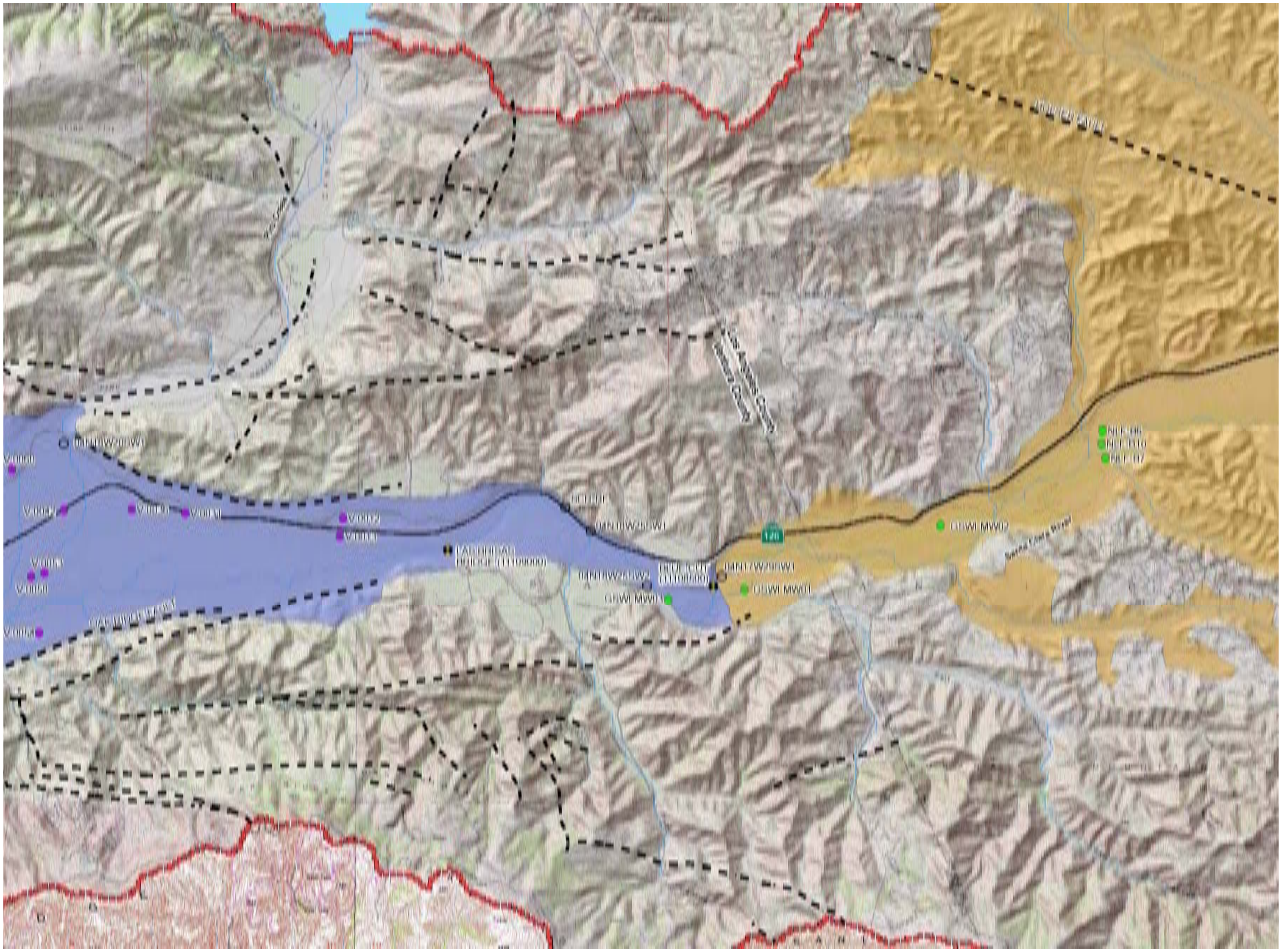
SIMULATED CHLORIDE CONCENTRATIONS AT BLUE CUT

Project No.	010354000
Figure	1



amec	SIMULATED CHLORIDE CONCENTRATIONS IN PIRU BASIN GROUNDWATER	Project No. 010354000
		Figure 2



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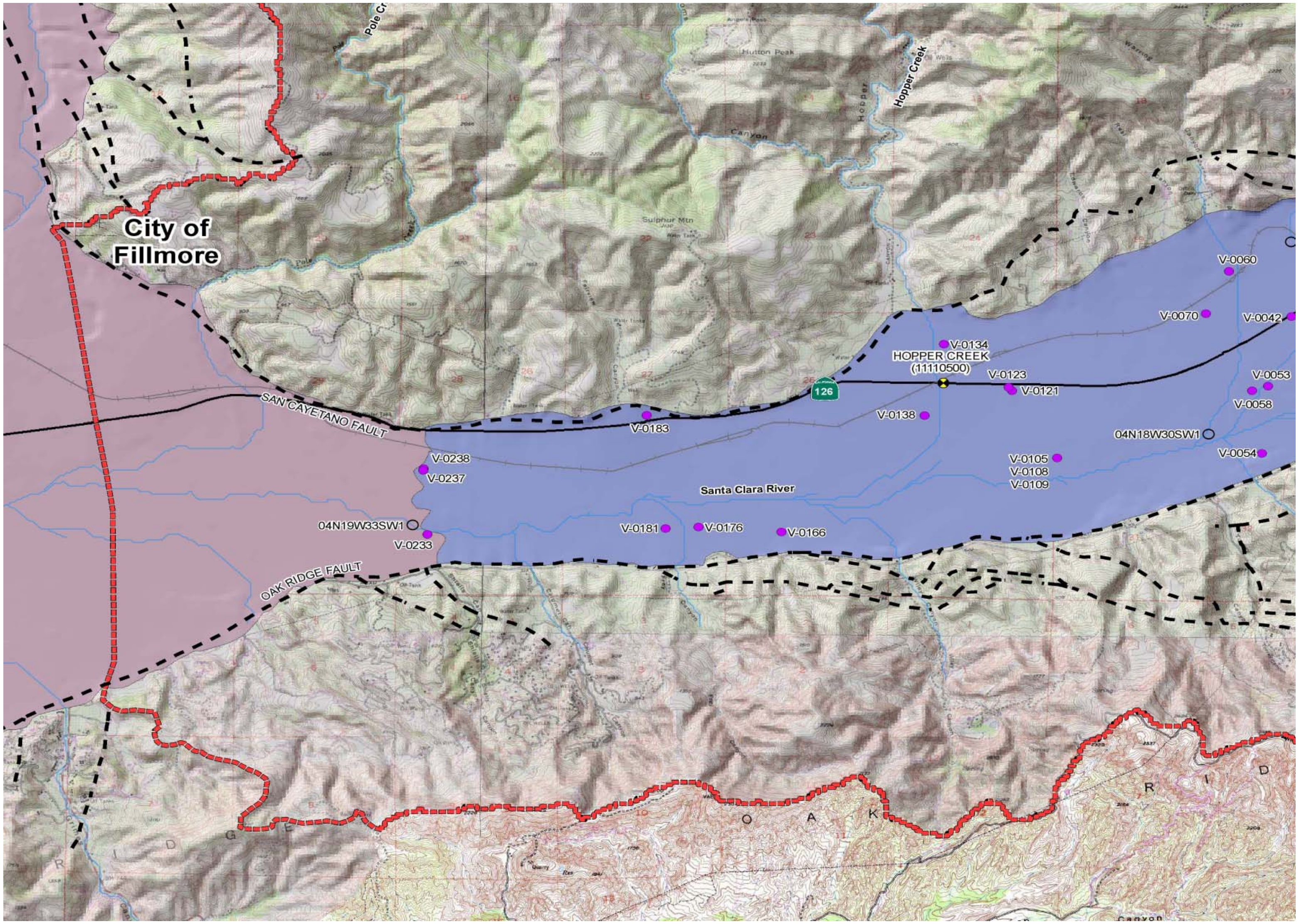
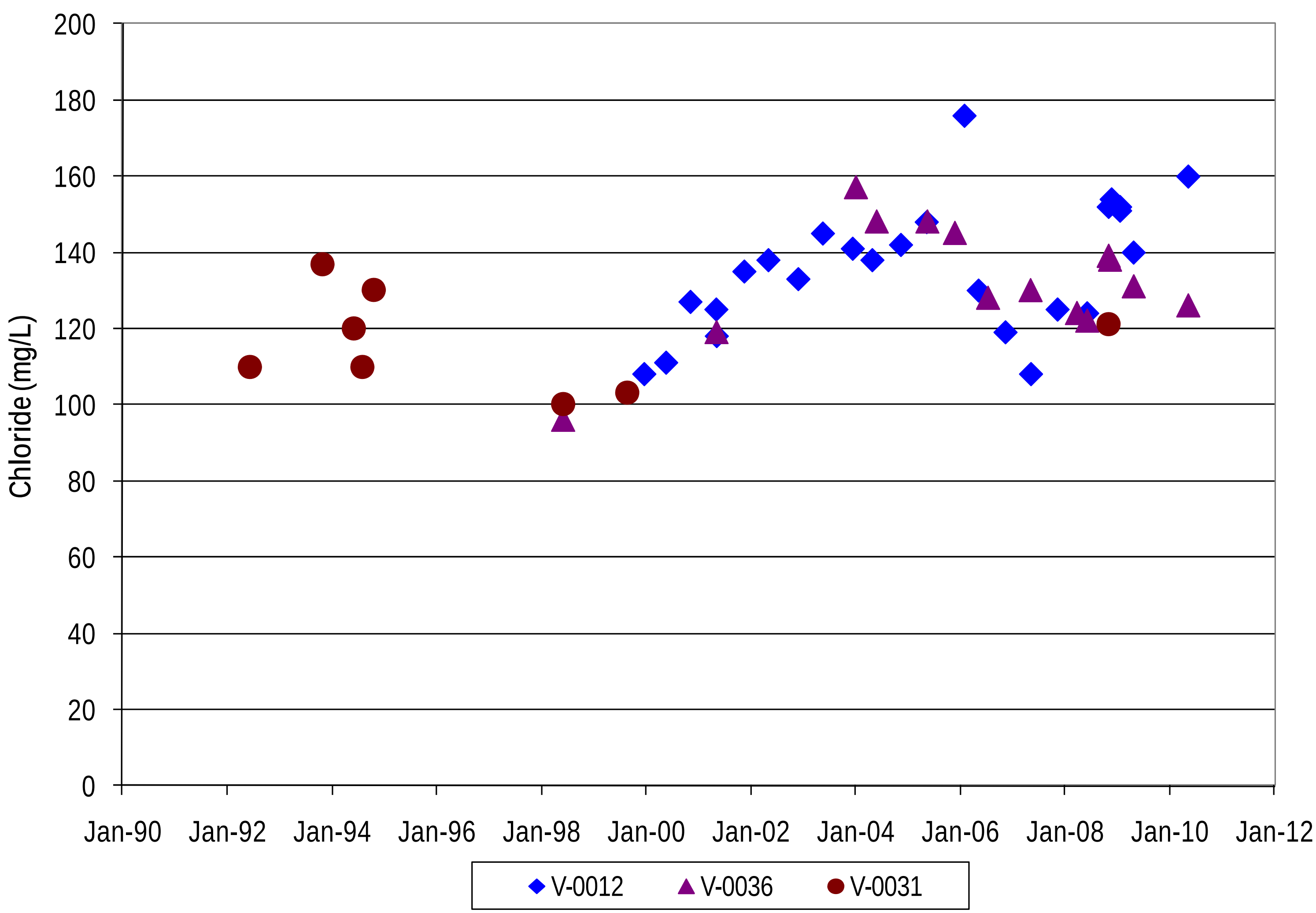
PIRU BASIN WELL LOCATIONS – EAST OF PIRU CREEK

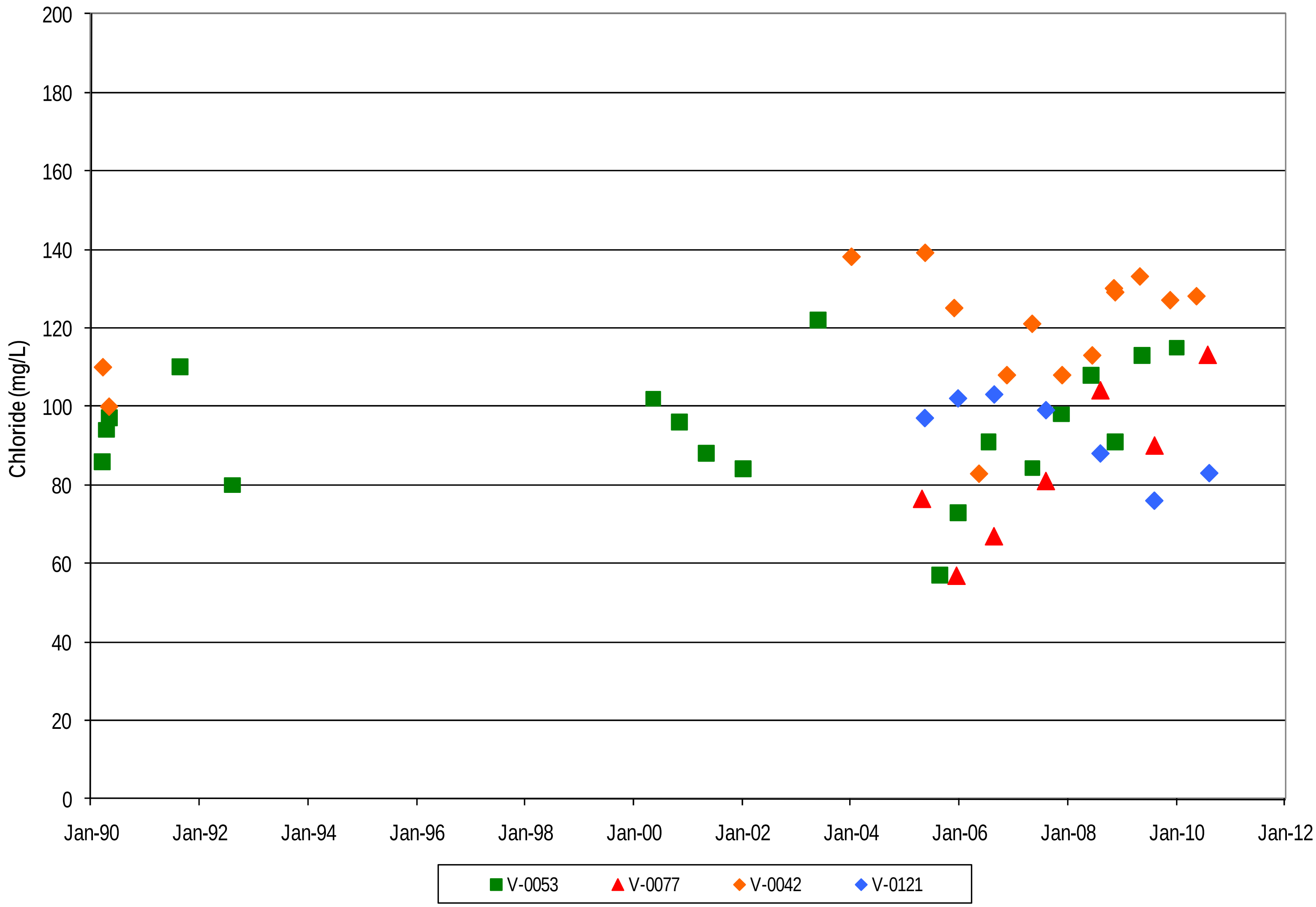
Project No.	010354000
Figure	3



amec	PIRU BASIN WELL LOCATIONS – WEST OF PIRU CREEK	Project No. 010354000
		Figure 4



amec	CHLORIDE IN EASTERN PIRU BASIN WELLS	Project No. 010354000
		Figure 5



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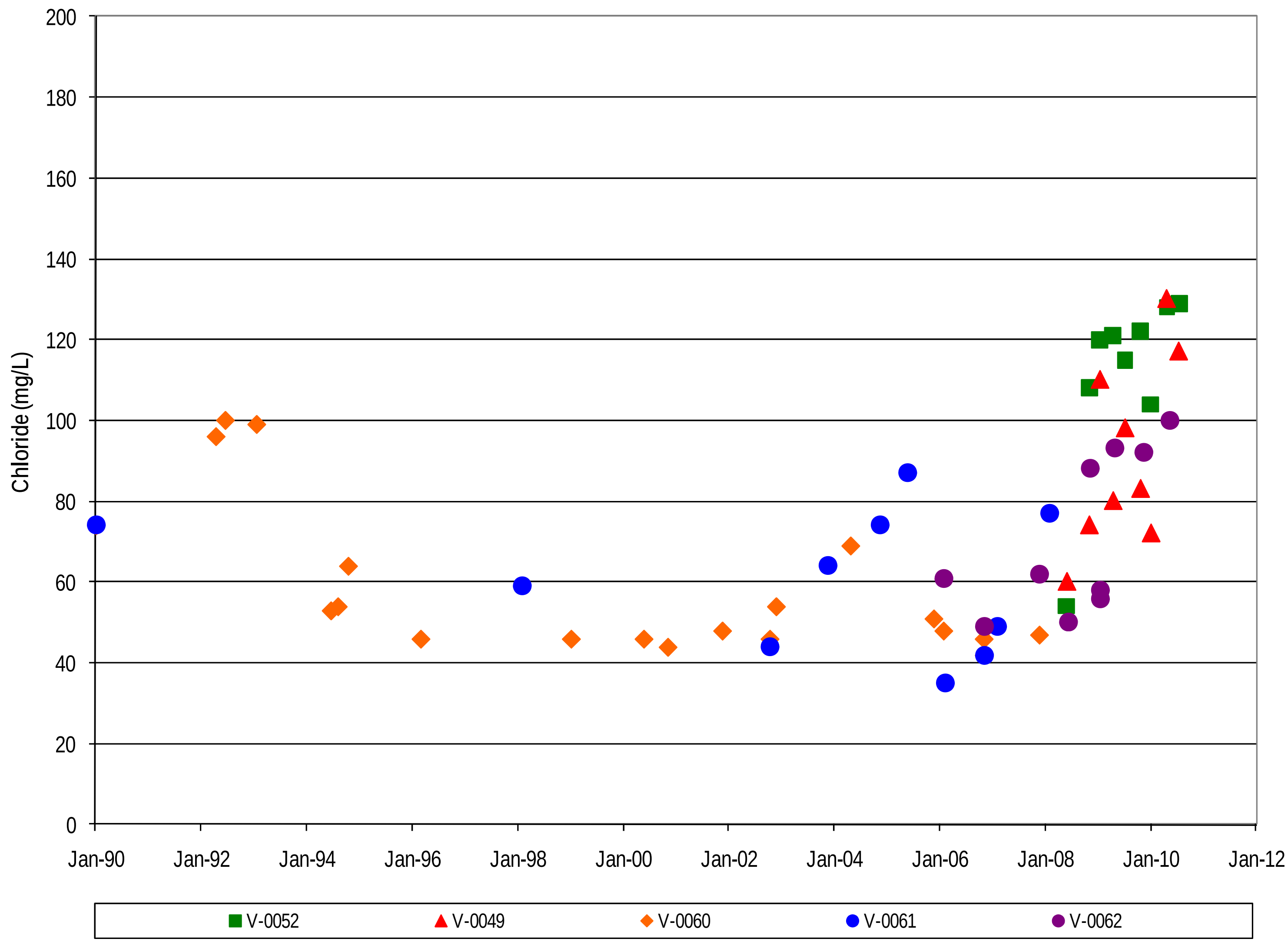
CHLORIDE IN WESTERN PIRU BASIN WELLS
SOUTH OF PIRU SPREADING GROUNDS

Project No. 010354000

Figure 6



amec	CHLORIDE IN WESTERN PIRU BASIN WELLS NORTH OF PIRU SPREADING GROUNDS	Project No. 010354000 Figure 7