

Appendix I

Perchlorate Contamination and Impact on Groundwater Supplies in the
Santa Clarita Valley

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Introduction

The detection of perchlorate in Santa Clarita Valley groundwater supplies has raised concerns over the reliability of those supplies, in particular the Saugus Formation where six wells have been impacted as a result of perchlorate. As discussed below, planning and implementation of remediation of the perchlorate, and restoration of impacted well capacity, have been substantially undertaken. While that work continues, non-impacted production facilities can be relied upon for the quantities of water projected to be available from the Alluvial Aquifer and Saugus Formation during the time necessary to fully restore perchlorate-impacted wells. CLWA, the local retail water purveyors, the California Department of Toxic Substances Control (DTSC) and the U.S. Army Corps of Engineers (ACOE) continue to work closely on the perchlorate contamination issue, which reasonably ensures a prompt response to any significant changes in conditions.

The following is a discussion of pertinent events related to perchlorate contamination. It illustrates that work toward the ultimate remediation of the perchlorate contamination, including the reactivation of impacted groundwater supply wells, has progressed on several integrated fronts over the last ten years. The following discussion is organized into several sections that focus on various aspects of the offsite impacts of perchlorate on water supply wells and the ongoing activities to remediate that problem and restore the impacted well capacity.

On-Site Investigations and Clean-up

On-site investigation and clean-up have continued at the former Whittaker-Bermite facility. The on-site investigation and clean-up activities at the source of the contamination are under the regulatory authority and control of DTSC.

Background

The Whittaker-Bermite site is located in the center of the Santa Clarita Valley and was operated as an explosives and munitions manufacturing, testing and storage facility since the late 1930's. It was first owned by the Los Angeles Powder Company and later by Golden State Fireworks, the Halifax Explosives Company, the Bermite Powder Company and the Whittaker Corporation (Whittaker), which assumed ownership of the site in 1967. Under contracts with the U.S. Department of Defense, Whittaker Corporation used perchlorate in the manufacture of solid propellants for rockets and missiles until operations ceased in 1987. There was a long history of perchlorate use and other chemical use at the site, and surface and subsurface investigations at the site revealed the presence of perchlorate and other contaminants in soil and groundwater.

The contaminants found in the soil that require clean-up are perchlorate and volatile organic compounds (VOCs). These chemicals were used in the manufacturing and testing of fireworks, dynamite, oil-field explosives, and munitions. The site encompasses 996 acres, with actual production facilities occupying approximately 50 acres. The property is characterized by chaparral covering the undisturbed portions of the site, fire breaks, dirt roads and remnants of facility foundations and buildings. The surrounding areas include commercial, light industrial and residential land uses. The facility was closed in 1987 and most of the structures on the property were removed at or about that time.

Between 1987 and 1998, Whittaker conducted environmental investigations and clean-up activities under the supervision of DTSC and its predecessor agency. In 1994, Whittaker entered into an enforceable agreement with DTSC to conduct a comprehensive site-wide investigation of areas of concern. In early 1997, with the remedial investigations under way, DTSC informed Whittaker that the soils, groundwater and surface runoff would have to be reassessed for the presence of perchlorate









In 1998, Whittaker sold the property to Santa Clarita LLC, a brownfield development company. In addition to assuming all clean-up responsibilities, Santa Clarita LLC acquired the right to develop the property contingent upon the full clean-up and certification of the property's reuse by DTSC. Between 1999 and 2001, Santa Clarita LLC expanded the site investigation and clean-up programs that had been initiated by Whittaker under the 1994 agreement. In 2002, however, with Santa Clarita LLC unable to fund additional site work due to financial difficulties, DTSC initiated negotiations with Whittaker to resume site investigation and clean-up work. In November 2002, DTSC issued an Order that required Whittaker to complete the site investigations and feasibility studies for all contaminants of concern under a tight time schedule.

Perchlorate Impacted Water Purveyor Wells

Perchlorate was initially detected in four Saugus Formation production wells operating near the former Whittaker-Bermite site in 1997. These wells – CLWA Santa Clarita Water Division's (SCWD) Wells Saugus 1 and Saugus 2, Newhall County Water District's (NCWD) Well NC-11 and Valencia Water Company's (VWC) Well V-157 – were removed from service. In 2002, perchlorate was detected in the SCWD Stadium well located directly adjacent to the Whittaker-Bermite site. This Alluvial well was also removed from service and subsequently capped in 2009. It was replaced with a new well, the SCWD Santa Clara well, also in 2009. Locations of the impacted wells and other nearby non-impacted wells, relative to the Whittaker-Bermite site are shown on Figure I-1. The restoration and/or replacement of these wells to service is discussed below.

Since the initial detection of perchlorate and resultant inactivation of impacted wells, the retail water purveyors have continued to conduct regular monitoring of active wells near the Whittaker-Bermite site. In late March 2005, that monitoring detected the presence of perchlorate in VWC's Well Q2, an Alluvial well located immediately northwest of the confluence of Bouquet Creek and the Santa Clara River.

Legend

-  Former Whittaker Corporation Bermite Facility
-  Surface Water Divide
- Fault**
 -  Fault Trace
 -  Fault Approximate
 -  Fault Concealed
 -  Fault Inferred
- Existing Well Location**
 -  Alluvium Production Well
 -  Saugus Production Well

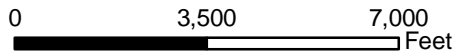
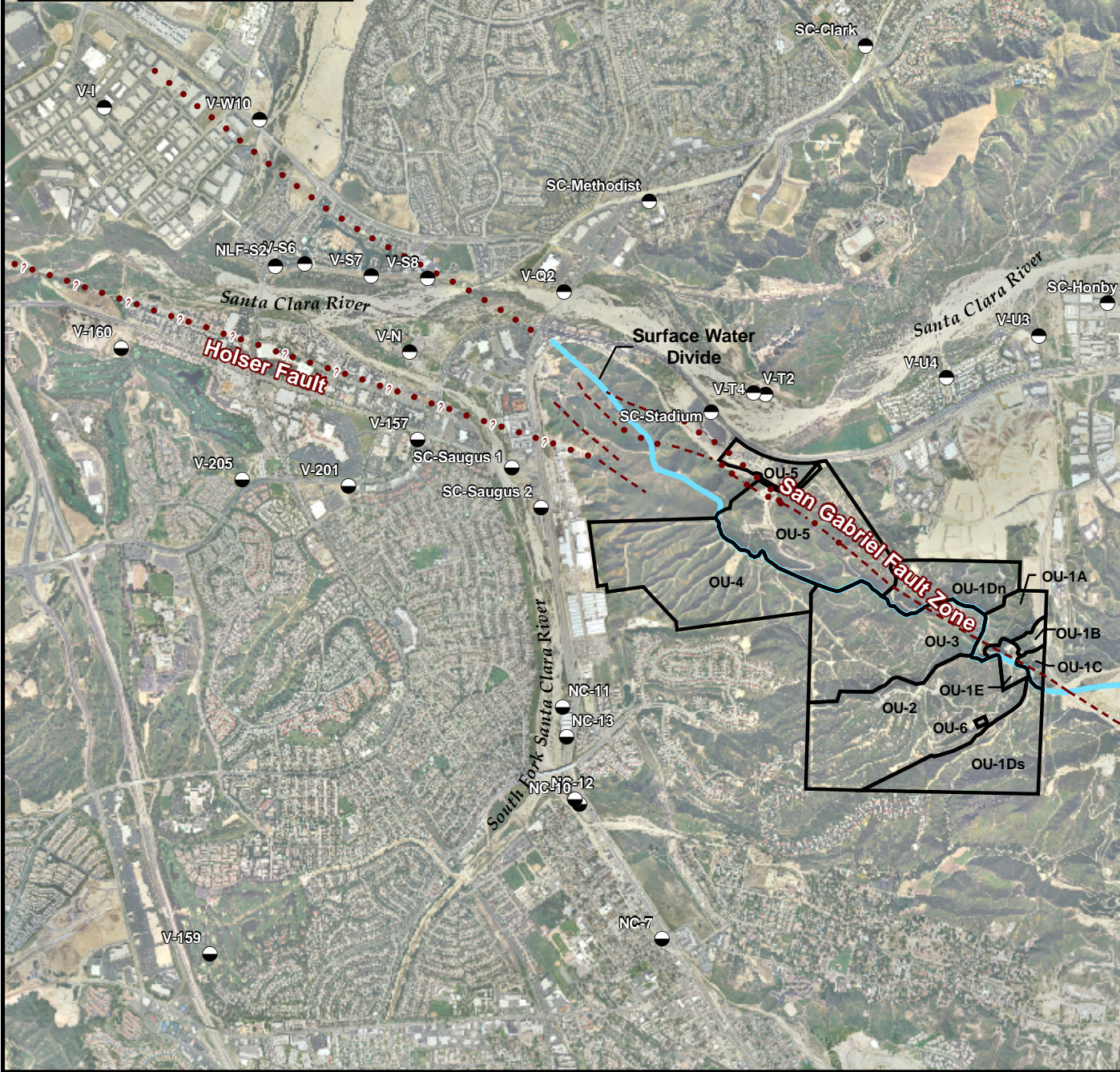


Figure I-1
Site Location
Former Whittaker-Bermite Facility

As a result of the detection and confirmation of perchlorate in its Well Q2, VWC removed the well from active service and immediately pursued permitting and installation of wellhead treatment. The well was returned to water supply service in October 2005.

In 2006, Saugus well NCWD Well NC-13 had detectable concentrations of perchlorate below drinking water standards; it has remained in active water supply service.

Most recently, in August 2010, VWC's water sample tests, taken from August 2010 through April 2011, confirmed the presence of perchlorate above the regulatory standard at VWC's Saugus Well 201, located downgradient from the Whittaker Bermite site and downgradient from the initially impacted Saugus 1 and 2 and V-157 wells. VWC immediately took the well out of service and notified the California Department of Public Health (DPH). VWC continues to monitor the inactive well on a monthly basis. The most recent sample confirmed that perchlorate is still present and that remediation is needed as outlined by the 2007 Whittaker-Bermite Litigation Settlement Agreement (Settlement Agreement; discussed below in the section entitled "Water Supplier Litigation and Settlement Agreements").

VWC is currently evaluating remediation alternatives and intends to pursue restoration of the well's capacity through such means as wellhead treatment as provided for in the Settlement Agreement. This and several other wells were identified as being potentially threatened by perchlorate in the Settlement Agreement. Therefore, provisions were made in the Settlement Agreement to provide for treatment for any additional wells that may be impacted by perchlorate.

Analysis of the planned program for restoration of originally impacted wells using the basin groundwater model estimated that perchlorate-contaminated groundwater would be contained and captured by pumping Saugus 1 and 2. Ultimately, however, the combination of litigation, settlement, permitting and construction constrained actual implementation of the containment program until 2010, six years after the impact of the containment program on perchlorate migration in groundwater was analyzed. That time, combined with the preceding seven years since perchlorate first impacted water supply wells, resulted in a greater risk of downgradient migration of perchlorate in the Saugus Formation, and is interpreted to be the primary reason for the recent detection of perchlorate in VWC Well 201. However, as mentioned above, that possibility was addressed in the Settlement Agreement as it includes provisions for providing treatment to wells that are impacted by perchlorate not contained or captured by the original containment program.

Regulatory Standards for Perchlorate

Perchlorate is a chemical salt and is very soluble in water. It is also very mobile in water and is persistent (i.e., does not degrade) under typical environmental conditions. The maximum contaminant level (MCL) for perchlorate of 6 micrograms per liter (ug/L) was established by DPH in October 2007. MCLs are based on health protection, technical treatment feasibility, analytical detection limits and costs.

Water Supplier Litigation and Settlement Agreements

On November 29, 2000, CLWA and the local retail water purveyors filed suit against the current and prior owners of the Whittaker-Bermite facility. The lawsuit included causes of action relating to payment of all necessary costs of response, removal of the perchlorate contamination, payment of remediation action costs and compensation for other damages associated with the perchlorate contamination. CLWA and the local retail water purveyors had incurred substantial response costs and other expenses as a result of production lost on account of the contamination

In late summer 2003, CLWA, the local retail water purveyors, Whittaker and Remediation Financial, Inc. (RFI) and Santa Clarita LLC (SCLLC) entered into an interim settlement agreement, in which the parties agreed to work cooperatively for a minimum of one year to further define long-term costs and possibly achieve a long-term settlement. The interim settlement agreement specified that Whittaker, RFI and SCLLC and/or their insurers would reimburse certain past costs as well as fund studies and prepare cost estimates for the clean-up plan to restore water production and capacity of the impacted wells and protect other wells from future contamination. The interim settlement provided for a one-year stay of the lawsuit between the parties and was subsequently amended to extend the stay through January 31, 2005. This allowed the parties to focus on the final elements of the clean-up plan, which was submitted to the regulatory agencies in early 2005 and approved in 2007.

In May 2007, a comprehensive settlement was executed by CLWA, the retail purveyors and Whittaker, RFI and SCLLC (Settlement Agreement). The water suppliers were reimbursed certain costs incurred as a result of the perchlorate contamination and funds were deposited in escrow to pay for the costs of restoration of wells and construction of treatment facilities and related pipelines. The Settlement Agreement also provides funds to pay for operation and maintenance costs for the treatment system for up to 30 years, which the agencies estimate to cost as much as \$50,000,000.

Approximately \$31,000,000 has been reimbursed to the agencies for past expenditures pursuant to the Perchlorate Contamination Settlement. Another \$5,000,000 to \$10,000,000 will be used to construct wells and pipelines to supply water that will replace capacity lost from impacted wells. An additional \$10,000,000 is available to allow the water suppliers to immediately treat any additional wells that could become impacted by perchlorate in the future (i.e., the "Rapid Response Fund").

DTSC/CLWA/Purveyor Environmental Oversight Agreement

In February 2003, DTSC and CLWA, NCWD, SCWD, and VWC entered into an Environmental Oversight Agreement (Agreement) whereby DTSC provides review and oversight of the response activities being undertaken by CLWA and the local retail water purveyors relating to the detection of perchlorate in the initially impacted wells.

The significance of the Agreement lies in the response actions to be undertaken in its "Scope of Work" (Exhibit B to the Agreement). Under the Scope of Work, CLWA and the retail water purveyors prepared (1) Well Characterization Reports, (2) a Health-Based Risk Assessment,

(3) a Regional Groundwater Flow Model and (4) a Treatment Technology Evaluation Report. The regional groundwater flow model and the treatment technology evaluation were key inputs to the permitting for restoring the impacted wells by returning them to water supply service as described below. Both were completed and utilized in conjunction to control contamination migration and restore impacted water supply well capacity. Most important, under the Scope of Work, CLWA and the retail water purveyors prepared and implemented a Remedial Action Plan (RAP) that is being used in connection with water treatment programs and/or well relocation. The RAP remains important to the retail water purveyors, who have been working cooperatively with DTSC to implement the groundwater clean-up.

Treatment Technology

A number of full scale perchlorate treatment systems were evaluated by a technical group to ensure the most efficient and cost-effective process to remove perchlorate was selected. The technical group was comprised of representatives from CLWA, the retail water purveyors and consultants retained by Whittaker-Bermite. It initially agreed to solicit competitive bids for the design, construction and operation of two treatment systems – ion exchange and biological.

After thorough evaluation of several bids, the technical group determined that ion exchange was the preferred technology based upon treatment performance, ease of regulatory compliance and comparison of costs associated with construction and operations and maintenance.

The preferred single-pass ion exchange treatment technology does not generate a concentrated perchlorate waste stream that would require additional treatment before discharge to a sanitary sewer or a brine line (if one is available). This technology incorporates an active resin (a material that attracts perchlorate molecules) that safely removes the perchlorate from water. The resin is contained in pressure vessels and the water is pumped through the vessel. The resin is eventually replaced with new resin after a period of time. The old resin is removed and transported by truck to an approved waste disposal site where it is safely destroyed. This technology is robust and reliable for use in drinking water systems.

DPH has approved operation of the perchlorate treatment plants currently in operation at the following locations:

- La Puente Valley Water District (2,500 gpm)
- San Gabriel Valley Water Company, El Monte (7,800 gpm)
- California Domestic Water Company, Whittier (5,000 gpm)
- City of Riverside (2,000 gpm)
- West San Bernardino Water District, Rialto (2,000 gpm)
- City of Rialto (2,000 gpm)
- City of Colton (3,500 gpm)
- Fontana Union WC (5,000 gpm)
- City of Pomona (10,000 gpm)
- Valencia Water Company (1,700 gpm)
- CLWA Santa Clarita Water Division (2,400 gpm)

Based on (1) the results of CLWA's investigation of perchlorate removal technologies, (2) the technical group's evaluation and (3) DPH's approval of single-pass ion exchange for treatment in other settings, CLWA and the local retail water purveyors selected and installed single-pass ion exchange as the treatment technology for restoration of impacted capacity (wells). The perchlorate treatment facility includes an ion exchange process located at the Rio Vista Intake Pump Station. The same single-pass ion exchange wellhead treatment is being considered for installation at the recently impacted VWC Well 201 to restore that impacted Saugus well capacity. This same treatment also was successfully implemented at VWC Well Q2 in 2007.

Restoration of Perchlorate Impacted Water Supply

Since the detection of perchlorate in the four Saugus wells in 1997, CLWA and the retail water purveyors recognized that one element of an overall remediation program would include pumping from impacted wells, or from other wells in the immediate area, to establish hydraulic conditions that would control the migration of contamination from further impacting the aquifer in a downgradient (westerly) direction. Thus, CLWA and the retail water purveyors expected that the overall perchlorate remediation program could include dedicated pumping from some or all of the impacted wells, with appropriate treatment, such that two desirable objectives could both be achieved. The first objective is control of subsurface flow and protection of downgradient wells and the second is restoration of some or all of the contaminated water supply. Not all of the initially impacted pumping capacity is required for control of groundwater flow. Some of the remaining capacity has been replaced by construction of replacement wells at other nonimpacted locations; and some capacity remains to be replaced by future new wells.

In cooperation with state regulatory agencies and investigators working for Whittaker-Bermite, CLWA and the local retail water purveyors developed an off-site plan that focuses on the above concepts of groundwater flow control and restored pumping capacity and is compatible with onsite and possibly other off-site remediation activities. Specifically relating to water supply, the plan includes the following:

- Constructing and operating a water treatment process that removes perchlorate from two impacted wells such that the produced water can be used for municipal supply
- Hydraulically containing the perchlorate contamination moving from the Whittaker-Bermite site toward the impacted wells by pumping the wells at rates that will capture water from all directions around them
- Protecting the downgradient non-impacted wells through the same hydraulic containment that results from pumping two of the impacted wells
- Restoring the annual volumes of water that were pumped from the impacted wells before they were inactivated, and also restoring the wells' total capacity to produce water in a manner consistent with the retail water purveyor's operational plan for groundwater supply.

An extended test of the wells that were eventually returned to service was performed as part of restoring a portion of the impacted well capacity and controlling the migration of perchlorate in the aquifer. Concurrent with the testing of the wells, several specific ion exchange resins were also tested to evaluate their performance and longevity.

The Final Interim Remedial Action Plan for containment and extraction of perchlorate was completed and approved by DTSC in January 2006. Construction of the perchlorate treatment facility and related distribution system, the main components of the “pump and treat program,” began in November 2007 and was completed in May 2010. In combination with start-up of the treatment system, the SCWD Saugus 1 and 2 wells (two of the four wells that were taken out of service in 1997) were returned to service in January 2011 after DPH issued an amendment to CLWA’s Operating Permit in December 2010 (see discussion of “Compliance with DPH Policy Memo 97-005” below). After consideration of groundwater modeling results and engineering analysis, the parties to the Settlement Agreement agreed to operate the Saugus 1 and 2 wells at 1,100 gallons per minute (gpm) each (2,200 gpm total) in order to optimize both the contaminant plume containment and well production.

Additionally, VWC well 157 that was taken out of service in 1997 was replaced by Well 206 in 2005.

In light of the preceding, with regard to the adequacy of groundwater as the local component of water supply in this UWMP, the impacted capacity of the previously out of service wells (not including VWC Well 201) is being restored by a combination of treatment (i.e., Saugus 1 and 2) and new wells in non-impacted areas (all funded by the Settlement Agreement), providing well capacity that is sufficient to meet near-term normal and dry-year water requirements. Achievement of the full range of normal and multiple dry-year groundwater supply as provided in the groundwater operating plan will require additional new well construction, as well as restoration of the recently impacted VWC Well 201.

Compliance with DPH Policy Memo 97-005

Returning contaminated wells to municipal water supply service by installing treatment requires issuance of permit from DPH before the water can be considered potable and safe for delivery to customers. The permit requirements are contained in DPH Policy Memo 97-005 for direct domestic use of impaired water sources. Before issuing a permit to a water utility for use of an impaired source as part of the utility’s overall water supply permit, DPH requires that studies and engineering work be performed to demonstrate that pumping the wells and treating the water will be protective of public health for users of the water. The Policy Memo requires that DPH review the local retail water purveyor’s plan, establish appropriate permit conditions for the wells and treatment system and provide overall approval of returning the impacted wells to service for potable use. Ultimately, CLWA and the local retail water purveyors’ plan and the DPH requirements are intended to ensure that the water introduced to the potable water distribution system has no detectable concentration of perchlorate.

The DPH 97-005 Policy Memo requires, among other things, the completion of a source water assessment for the impacted wells intended to be returned to service. The purpose of the assessment is to determine the extent to which the aquifer is vulnerable to continued migration of perchlorate and other contaminants of interest from the Whittaker-Bermite site. The assessment includes the following:

- Delineation of the groundwater capture zone caused by operating the impacted wells

- Identification of contaminants found in the groundwater at or near the impacted wells
- Identification of chemicals or contaminants used or generated at the Whittaker-Bermite facility
- Determination of the vulnerability of pumping the impacted wells to these contaminant sources

CLWA worked directly with the retail water purveyors and its consultants on the development of the DPH 97-005 Policy Memo permit application. Drafts of all six elements of the 97-005 Policy Memo were submitted to DPH and the retail purveyors for review, including the Source Water Assessment, Raw Water Quality Characterization, Source Protection Plan, Effective Monitoring and Treatment Evaluation, Human Health Risk Assessment and the Alternatives Sources Evaluation. The Engineer's Report, which summarizes these six elements for the 97-005 process, was completed in 2005.

As noted above, CLWA and the local retail water purveyors recognized the need for some form of pumping in or near the impacted wells to extract contamination and protect downgradient non-impacted wells. As part of the permitting for use of impacted wells with treatment, DPH 97-005 Policy Memo requires an analysis to demonstrate contaminant capture and protection of other nearby water supply wells. The development and calibration of a numerical groundwater flow model of the entire basin was initiated as a result of a 2001 Memorandum of Understanding among the Upper Basin Water Purveyors (CLWA, CLWA SCWD, LACWWD #36, NCWD and VWC) and the United Water Conservation District in Ventura County.

The basin-wide groundwater model was initially intended for use in analyzing the yield and sustainability of groundwater in the Basin. That model, and the current updated model, was used to develop the sustainable groundwater pumping rates reflected in Section 3 of this UWMP. The model was also used to analyze both the sustainability of groundwater under an operational scenario that includes full restoration of perchlorate-contaminated supply and the containment of perchlorate near the Whittaker-Bermite property (i.e., by pumping some of the contaminated wells), including preventing movement of perchlorate contamination to other portions of the aquifer system. DTSC reviewed and approved the construction and calibration of the regional model as described in the final model report "Regional Groundwater Flow Model for the Santa Clarita Valley, Model Development and Calibration" (CH2M Hill, April 2004).

After DTSC's approval of the model, it was used to simulate the capture and control of perchlorate by restoring impacted wells, with treatment, as described above. The results of that work were summarized in a second report "Analysis of Perchlorate Containment in Groundwater Near the Whittaker-Bermite Property, Santa Clarita, California" (CH2M Hill, December 2004).

The modeling analysis indicated that the pumping of impacted wells Saugus 1 and Saugus 2 at a rate of 1,200 gpm each on a nearly continual basis would effectively contain perchlorate migrating westward in the Saugus Formation from the Whittaker-Bermite property (as previously noted, subsequent technical analysis resulted in the selection of a pumping rate of 1,100 gpm for each well). The analysis also indicates that (1) no new production wells are needed in the Saugus Formation to meet the perchlorate containment objective, (2) impacted well NCWD-11 is not a required component of the containment program and (3) pumping at Saugus 1 and 2 is

necessary to prevent continued migration of perchlorate to other portions of the Saugus Formation. The modeling report also includes the general design of a sentinel groundwater monitoring network and program required by DPH as part of its 97-005 Policy Memo permitting. The perchlorate containment report was approved by DTSC in November 2004. With that approval, the model was then used to support the source water assessment and the remainder of the permitting process required by DPH under its 97-005 Policy Memo.

Conclusions Regarding VWC Well 201

As noted above and in Section 3, perchlorate was detected in VWC Well 201 in the August 2010. This well was taken out of service and its capacity is not included in active groundwater sources delineated in Table 3-9 of this UWMP. VWC plans to actively seek remediation under the settlement agreement and rapidly restore the impacted well capacity. Given its experience of (1) bringing its Q2 well back into production, (2) actions under the DPH 97-005 Policy Memo, (3) participating in bringing treatment facilities on line for the Saugus 1 and Saugus 2 wells and (4) replacing capacity for its Well 157, VWC has determined that it could either install wellhead treatment to bring the well back into service or replace the capacity with a new well within two years.