2012 Annual Performance Evaluation Report
Volume 1

Baldwin Park Operable Unit of the
San Gabriel Valley Superfund Sites
Los Angeles County, California

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Submitted to:

Baldwin Park Operable Unit Cooperating Respondents

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Abbreviations

1,1-DCE	1,1-Dichloroethene
1,2-DCA	1,2-Dichloroethane
1,2,3-TCP	1,2,3-Trichloropropane
AAWC	Azusa Agricultural Water Company
AJ	Aerojet
ALR	Azusa Land Reclamation Company, Inc.
AMEC	AMEC Earth & Environmental, Inc. (formerly AMEC Geomatrix, Inc.)
ARARs	Applicable or Relevant and Appropriate Requirements
AVWC	Azusa Valley Water Company
bgs	below ground surface
BPOU	Baldwin Park Operable Unit
BPOUSC	Baldwin Park Operable Unit Steering Committee
CC	Conrock Company
CDM	Camp, Dresser, and McKee
CDWC	California Domestic Water Company
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cis-1,2-dce	Cis-1,2-Dichloroethene
COC	Chemical of Concern
COI	City of Industry
CRs	Cooperating Respondents
DPH	California Department of Public Health, Drinking Water Section (formerly Department of Health Services [DHS]).
DQO	Data Quality Objectives
EDB	Ethylene Dibromide
EPA	U.S. Environmental Protection Agency
ERM	ERM-West, Inc.
ESD	Explanation of Significant Differences
FSP	Field Sampling Plan
f.k.a	Formerly Known As
GAC	Granular Activated Carbon
gpm	gallons per minute
HLA	Harding Lawson Associates
ISEP	Calgon Ionic Separation Process
LACO	Los Angeles County
LACFD	Los Angeles County Flood Control District
LACDPW	Los Angeles County Department of Public Works
LACSD	Los Angeles County Sanitation Districts
LDC	Laboratory Data Consultants, Inc.
LPGAC	Liquid-Phase Granular Activated Carbon
LPVCWD	La Puente Valley County Water District
MCL	Maximum Contaminant Level
MICR	Maximum Individual Cancer Risk
MS	Matrix spike
MSD	Matrix spike duplicate
msl	Mean Sea Level
NDMA	N-Nitrosodimethylamine
NL	Drinking Water Notification Level
ng/L	Nanograms Per Liter
PCE	Tetrachloroethene
PE	Performance Evaluation
PHG	Public Health Goal

PRP	Potentially Responsible Party
PSEP	Performance Standards Evaluation Plan
PVOU	Puente Valley Operable Unit
QAPP	Quality Assurance Project Plan
QC	Quality Control
RFP	Request for Proposal
RFQ	Request for Qualifications
RI	Remedial Investigation
ROD	Record of Decision
RMSE	Root-mean squared error
RRF	Relative Response Factor
RWQCB	Regional Water Quality Control Board – Los Angeles Region
SA	Subarea
SCAQMD	South Coast Air Quality Management District
SGVWC	San Gabriel Valley Water Company
SOW	Statement of Work
SMR	Self Monitoring Reports
SVOC	Semi-Volatile Organic Compound
SWS	Suburban Water Systems
TIC	Tentatively Identified Compound
TCE	Trichloroethene
UAO	Unilateral Administrative Order
µg/L	Micrograms Per Liter
UV	Ultraviolet
VCWD	Valley County Water District
VFD	Variable Frequency Drive
VOC	Volatile Organic Compound
VPGAC	Vapor-Phase Granulated Activated Carbon
WE	Water Entity
WY	Water Year

2012 ANNUAL PERFORMANCE EVALUATION REPORT
Baldwin Park Operable Unit
San Gabriel Valley, California

1.0 INTRODUCTION

This document presents the 2012 Annual Performance Evaluation (PE) Report for the Baldwin Park Operable Unit (BPOU) of the San Gabriel Valley Superfund Sites, located in the San Gabriel Basin, Los Angeles County, California. This report was prepared jointly by AMEC Environment & Infrastructure, Inc. (AMEC) and ERM-West, Inc. (ERM), on behalf of the BPOU Cooperating Respondents (CRs). The CRs are:

- Aerojet-General Corporation
- Azusa Land Reclamation Company, Inc. (ALR)
- Hartwell Corporation
- Chemical Waste Management, Inc. (as successor to Oil and Solvent Process Company)
- Reichhold, Inc.
- Winco Enterprises Inc. (formerly known as [f.k.a.] Wynn Oil Company)

This report meets the requirements for the Annual PE Report, as required by Unilateral Administrative Order 2000-13 (UAO) and the supporting Statement of Work (SOW), issued by the U.S. Environmental Protection Agency (EPA) Region IX on June 30, 2000, and amended on February 28, 2002.

1.1 Background

Beginning in 1979, volatile organic compounds (VOCs) were detected in groundwater within the San Gabriel Basin (the Basin). In May 1984, four areas of groundwater contamination were listed as San Gabriel Valley Areas 1-4 on EPA's National Priorities List based on available water-quality data. Subsequent investigation by EPA and others revealed widespread VOC contamination in the Basin. As a result, EPA subsequently divided the Basin into seven Remedial Investigation (RI) areas to focus characterization on the extent of contamination and plan remedial actions. EPA later designated some of these RI areas as operable units. RI Area 5 was designated as the BPOU.

Although many of the figures provided in this report depict a generalized boundary to the area of impacted groundwater in the BPOU (Figure 1-1), the precise boundary of the BPOU has not been determined, but an approximate boundary is presented to provide a point of reference on the figures.

Since 1986, EPA, various Potentially Responsible Parties (PRPs), and numerous other entities have compiled and evaluated groundwater-quality data from the Basin. Initial field investigations conducted by EPA in the BPOU included the installation and sampling of one multiport monitoring well and the sampling of water-supply wells. In 1990, EPA issued a Basin-wide Technical Plan that described options for remediation of VOC plumes through the Basin. In 1992, EPA published an Interim RI Report for the Basin.

In 1993, EPA issued a Feasibility Study Report for the BPOU. This report evaluated various remedial alternatives for the remediation of groundwater in the BPOU. In 1994, EPA issued a Record of Decision (ROD) for the BPOU interim remedy. The ROD identified 17 chemicals of concern (COCs), all of which were VOCs. EPA's selected remedy consisted of pumping and treating approximately 19,000 gallons per minute (gpm) of contaminated groundwater. In approximately 1995, the Baldwin Park Operable Unit Steering Committee (BPOUSC) began to perform pre-remedial design activities, including additional characterization of the extent of VOC-contaminated groundwater and the development of a groundwater extraction plan. Eight multiport monitoring wells were installed and sampled and 26 existing water-supply and monitoring wells were sampled to provide additional characterization of the extent of VOC contamination in the BPOU. The results of these pre-remedial design activities were submitted to EPA in the Draft Pre-Remedial Design Report, dated December 1996 (Camp, Dresser, and McKee [CDM], 1996). The groundwater extraction plan was revised on several occasions. Following review and comment by EPA, the Final Draft Pre-Remedial Design Report, dated September 1997 (CDM, 1997), was issued.

In mid-1997 and then in 1998, certain constituents that were not previously considered as COCs in the ROD, including perchlorate, N-nitrosodimethylamine (NDMA), and 1,4-dioxane were discovered in groundwater within the BPOU. Consequently, EPA requested that the BPOUSC characterize the distribution of these constituents, as well as conduct further characterization of VOCs in groundwater within the BPOU. As a result, the BPOUSC installed and sampled four additional multiport monitoring wells and conducted additional groundwater sampling to evaluate the extent of VOCs, perchlorate, NDMA, and 1,4-dioxane in groundwater in the BPOU.

The results of these investigations and several groundwater extraction plan options were presented to EPA in the Draft Addendum to the Pre-Remedial Design Report, dated January 14, 1999 (Harding Lawson Associates [HLA], 1999). Throughout 1999, these groundwater extraction plan options were refined and new options were formulated. These changes were made in response to comments from EPA and the Main San Gabriel Basin Watermaster (Watermaster). This resulted in a range of candidate groundwater extraction plans with total groundwater extraction rates ranging from 19,500 to 21,500 gpm.

In May 1999, EPA issued an Explanation of Significant Differences (ESD) to supplement the 1994 ROD. The ESD depicted an expanded area of the groundwater contamination in the southern portion of the BPOU to reflect the results of the additional investigations related to the characterization of perchlorate, NDMA, and 1,4-dioxane in groundwater. The ESD also added perchlorate, NDMA, and 1,4-dioxane to the list of COCs defined in the ROD. In June 2000, EPA issued the UAO, requiring various PRPs (identified in the UAO as “Respondents”), including but not limited to the CRs, to design, construct, and operate the BPOU interim remedy identified in the ROD, as revised by the ESD. In addition, beginning in the late 1990s, various water agencies, producers, and other water entities (collectively, the “Water Entities” or “WEs”) with regulatory oversight and/or financial or other interests in the BPOU groundwater filed lawsuits or asserted claims against the BPOU PRPs for damages allegedly suffered as a result of contamination of the groundwater and water-supply wells in the BPOU area. Thereafter, the CRs entered into negotiations with the WEs, which culminated in March 2002 with the CRs and WEs executing the BPOU Project Agreement to implement the BPOU Project. The BPOU Project Agreement was declared effective as of May 9, 2002.

While the BPOU Project Agreement negotiations were underway, the CRs prepared the Final Remedial Design/Remedial Action Work Plan and the Draft Final Conceptual Design Report for the implementation

of the remedy (HLA, 2000a and HLA, 2000b). The Preliminary Design Report was prepared by the WEs and submitted to EPA in April, 2001 (Watermaster, 2001).

In January 2006, EPA's Remedial Project Manager notified the CRs that EPA was concerned about the detection of 1,2,3-trichloropropane (1,2,3-TCP) in certain wells within the BPOU. This compound does not have a federal Maximum Contaminant Level (MCL), but does have a California state Drinking Water Notification Level (NL) of 5 nanograms per liter (ng/L)[1]. In response to EPA's requirements, the CRs funded a further modification of the Valley County Water District (VCWD) Lante Treatment Plan to include Liquid-Phase Granular Activated Carbon (LPGAC) treatment to address EPA's concerns about the presence of 1,2,3-TCP.

In August 2006, EPA requested that the CRs include in the BPOU monitoring program additional sampling for non-COC VOCs and non-target volatile and semi-volatile compounds (Tentatively Identified Compounds, or TICs) including 1,2,3-TCP (1,2,3-TCP was subsequently added as a COC). In response to EPA's request, the CRs provided a proposal for non-COC groundwater analysis and reporting in a technical memorandum dated August 24, 2006 (Geomatrix, 2006a). This proposal included the following:

- Information on sampling and analysis of 1,2,3-TCP;
- A proposal for reporting results for non-COC VOCs in a subset of multiport monitoring wells located upgradient of each groundwater extraction and treatment facility (i.e. "early warning" wells);
- A proposal for monitoring of non-target VOCs and semi-volatile organic compounds (SVOCs) in a subset of multiport monitoring wells located upgradient of each groundwater extraction and treatment facility (i.e. "early warning" wells), and;
- A proposal for periodic analysis of 1,2,3-TCP in selected wells.

EPA approved the August 24, 2006, proposal in a letter dated September 13, 2006, subject to the addition of several wells. The complete requirements for non-COC groundwater analysis and reporting were summarized in a technical memorandum dated September 29, 2006 (ERM, 2006).

On October 3, 2006, EPA provided a letter approving the BPOU Quality Assurance Project Plan (QAPP) and Field Sampling Plan (FSP) subject to submittal of final versions of these documents with the complete requirements for non-COC groundwater analysis and reporting. Final versions of the QAPP and FSP for groundwater were submitted in November 2006 (Geomatrix, 2006b; Stetson, 2006a) and were approved by EPA in a letter dated February 12, 2007. In the February 12, 2007 letter EPA also requested that a data management plan be prepared as an addendum to the QAPP. The report, Data Management Plan for the Baldwin Park Operable Unit Performance Standards Evaluation Plan Monitoring Program, was submitted to EPA on May 17, 2007 (Laboratory Data Consultants, Inc. [LDC] 2007).

A separate FSP for Off-Gas Air, Waste Brine, and Treated Water was submitted to EPA on August 14, 2006 (Stetson 2006b) and the corresponding QAPP for Air, Brine, and Treated Water was submitted on

[1] In August 2009, the State of California's Office of Environmental Health Hazard Assessment adopted a final Public Health Goal (PHG) for 1,2,3-trichloropropane of 0.7 nanograms per liter, or 0.0007 parts per billion. While DPH considers a PHG in setting a state MCL, to date no final MCL has been established.

March 16, 2007 (Geomatrix, 2007a). An updated version of the FSP is currently under preparation whereas an updated version of the QAPP (Rev. 2) was submitted to EPA on September 14, 2012 (AMEC, 2012a).

Numerous minor modifications have been proposed and approved for the BPOU PSEP monitoring program since 2007. In 2010, the QAPP for Groundwater (AMEC Geomatrix, 2010a), the FSP for Groundwater (AMEC Geomatrix, 2010b), and the Revised Final Performance Standards Evaluation Plan (PSEP) were updated (AMEC Geomatrix, 2010c) to incorporate the modifications that were approved after the previous versions of these documents were issued. An updated version of the PSEP (Rev. 3) was submitted to EPA on April 13, 2012 (AMEC, 2012b) to address comments received from EPA on July 1 and October 12, 2011. EPA provided comments and requested additional modifications to the PSEP in e-mail correspondence dated September 21, 2012, November 28, 2012, February 28, 2013, and March 8, 2013. As a result, a revised version of the PSEP (Rev. 4) is currently under preparation to address these comments. The revised PSEP (Rev. 4) will address EPA comments regarding the addition of 1,2,3-TCP as a COC, clarification of monitoring and reporting requirements for non-COCs such as ethylene dibromide (EDB), and the modification of remedial action objectives outlined in Sections 2.2.1 and 2.2.2. Modifications to the various monitoring components of the PSEP are described in detail in Section 3.0 of this report.

1.2 Overview of Remedial Action

The UAO and SOW direct the Respondents to design, construct, and implement the remedy described in the ROD and ESD, and to achieve the Performance Standards in accordance with the UAO. In a letter to the CRs dated February 28, 2002, EPA indicated that the implementation of the BPOU Project Agreement described in Section 1.1 above provided the CRs with a means to satisfy the work requirements of the UAO. The WEs (either directly or through contractors) designed the groundwater extraction and treatment facilities (Subprojects), and construction has been completed although equipment modifications are in progress. The WEs are now operating the Subprojects, which provide for groundwater extraction and treatment in two general areas of the BPOU (Figure 1-2). The treated groundwater is supplied for direct potable use.

The EPA approved groundwater extraction plan associated with the various Subprojects consists of the extraction of a total of approximately 21,750 gpm of groundwater: 6,000 gpm from the northern portion of the plumes (Subarea 1), and 15,750 gpm from the southern portion of the plumes (Subarea 3). Extracted groundwater is to be treated using a treatment train that is designed to remove all COCs to levels acceptable for direct potable use. The treatment train varies among the treatment plants but generally consists of a series of contaminant treatment processes including air stripping and/or LPGAC to remove VOCs, ion exchange to remove perchlorate, and ultraviolet (UV)/oxidation to remove 1,4-dioxane and NDMA.

1.3 Summary of Remedial Action Objectives and Performance Standards

Two of the key performance standards are defined in the UAO as follows:

> *The remedial objectives of the Baldwin Park OU are to prevent future increases in, and begin to reduce concentrations of, trichloroethene, tetrachloroethene, carbon tetrachloride, and other*

VOCs, along with perchlorate, N-nitrosodimethylamine, and 1,4-dioxane in groundwater in the Baldwin Park area (hereafter referred to as contaminants or contaminated groundwater) by limiting further migration of contaminated groundwater into clean and less contaminated areas or depths that would benefit most from additional protection and by removing contaminants from the aquifer.

The BPOU Project involves the design, installation, operation, and maintenance of groundwater extraction systems in two areas of the BPOU. The two areas are designated in the ROD and ESD as Subarea 1 (the upper area) and Subarea 3 (the lower area). Remedial objectives for the two Subareas are described below.

1.3.1 Subarea 1 Remedial Objectives

In Subarea 1, the movement of COCs in groundwater will be limited by groundwater extraction at rates and locations that will establish the necessary groundwater flow field, such that the resultant capture zone limits migration from known or suspected source areas and depths and removes chemical mass. Source areas and depths include locations believed to contain a significant mass of soil contamination (i.e., vadose zone) or a subsurface source of dissolved-phase groundwater contamination. The capture zone is to include all significant depth intervals where COC concentrations exceed MCLs. As part of the groundwater extraction process, chemical mass will be removed from Subarea 1 groundwater.

1.3.2 Subarea 3 Remedial Objectives

In Subarea 3, the movement of COCs in groundwater will be limited by groundwater extraction at rates and locations that will establish the necessary groundwater flow field to reduce the potential for groundwater containing unacceptable concentrations of tetrachloroethene (PCE), trichloroethene (TCE), carbon tetrachloride, perchlorate, NDMA, 1,4-dioxane or other COCs from moving into areas where these chemicals are not present at unacceptable concentrations. Subarea 3 groundwater extraction is to result in a hydraulic capture zone that includes all significant depth intervals where COC concentrations exceed MCLs. As part of the groundwater extraction process, chemical mass will be removed from Subarea 3 groundwater.

1.3.3 Performance Standards

Two distinct performance standards have been derived from the Remedial Objectives cited above: 1) limit further migration of COCs in groundwater, and 2) remove COCs from groundwater. Achievement of these performance standards will prevent future increases in concentrations, begin to reduce concentrations, and prevent the spread of COCs from more contaminated areas to less contaminated areas. These two performance standards are described in more detail below.

1.3.3.1 *Performance Standard 1 - Limit Migration of Chemicals of Concern*

The BPOU extraction plan was developed using an EPA-approved three-dimensional finite-element groundwater flow model, DYNFLOW. In 2002, the model was updated using a similar code, FEFLOW. The construction and calibration of this model relies on many years of data collection activities in the BPOU, including water level measurements and water-quality sampling. The model was initially calibrated using water level data from a 20-year period (1982 to 2002). Following calibration, the model

was run in a forward/predictive manner to select locations and depths of groundwater extraction wells that would allow the remedy to achieve the objectives described above. Review of geophysical logs from exploratory borings at the extraction well locations as well as logs from other wells in the BPOU suggested the presence of relatively thick, fine-grained layers that can be correlated across Subarea 3 but do not extend north to Subarea 1. These layers are present at approximately -200 and -500 feet mean sea level (msl). As a result, the well screened intervals for new extraction wells in Subarea 3 were designed so that they could capture the entire vertical extent of contaminated groundwater without creating hydraulic connections across these layers. Therefore, shallow extraction wells were screened above the layer at -500 feet msl and deep extraction wells were screened below the layer at -500 feet msl. Aquifer testing in the extraction wells confirmed that the layer at -500 feet msl acts as a confining unit that provides hydraulic separation between the shallow and deep elevation intervals. In 2005, the groundwater flow model was modified to incorporate the confining units in Subarea 3. The groundwater flow model is updated annually with quarterly pumping and recharge data that are compiled from various sources. The CR group will continue to make refinements to the groundwater model to incorporate the results of field testing and other information, such as aquifer testing at new extraction and production wells, and thereby improve the model's ability to simulate observed groundwater conditions in localized areas. Updates and refinements to the groundwater model will be reported in Annual PE Reports as necessary. The calibrated model is the primary tool that will be used to assess system performance in terms of limiting the migration of COCs.

1.3.3.2 *Performance Standard 2 - Removal of Chemical Mass*

This performance standard, removal of chemical mass, will be met through extraction and treatment of groundwater from the BPOU plumes. Documentation of the removal of chemical mass will use measured flow rates from groundwater extraction wells and results of water-quality sampling and analysis for these same extraction wells. Using these data, the mass removal for selected COCs will be estimated on an annual basis. Cumulative chemical mass removed from the aquifer will also be reported.

1.4 Approach to Performance Monitoring and Evaluation

Performance monitoring and evaluation focuses on the operation of the proposed groundwater extraction system as it relates to: 1) limiting further migration of groundwater contamination into less contaminated areas, and 2) removing chemical mass from groundwater. As described in the PSEP (AMEC, 2012b), the CRs' approach to performance monitoring relies upon: 1) past and future basin-wide groundwater monitoring activities performed by the Watermaster, 2) performance monitoring data collected by the Water Entities, the CRs, or other agents acting on behalf of the CRs, and 3) the use of an EPA-approved groundwater flow model to predict the effectiveness of the groundwater extraction system. At any time, should EPA determine that Performance Standards related to migration control and mass removal are not being met, the CRs will use these same methods of data collection and modeling to modify operation of the groundwater extraction system such that Performance Standards are achieved.

Watermaster basin-wide monitoring activities have served as the baseline monitoring program from which additional monitoring needs have been defined. The Watermaster has the responsibility to ensure that comprehensive water-quality monitoring meets their court-decreed mission of managing Basin water production and quality, provides for predictive vulnerability assessments, and provides for monitoring so

that California Department of Public Health (DPH; formerly the Department of Health Services ([DHS]) requirements for public water supplies are met. The Watermaster performs routine basin-wide water level monitoring of over 170 wells on a semi-annual basis.

In summary, the approach to performance monitoring and evaluation consists of the following, components:

- Potentiometric head measurements in BPOU piezometers and multiport monitoring wells. These data are used to generate potentiometric surface maps for comparison to model simulation results;
- Groundwater flow modeling and particle tracking to evaluate hydraulic performance of the extraction system as it relates to limiting further migration of groundwater contamination;
- Water-quality sampling of production and multiport monitoring wells to provide information on the distribution of chemicals of concern in BPOU groundwater, specifically to produce plume maps;
- Integration of the results of groundwater modeling with current plume maps and known source locations to determine whether the groundwater extraction systems are appropriately limiting the migration of COCs;
- Water-quality sampling and measurement of extraction well pumping rates and production volumes; and
- Use of flow rate and water-quality data from extraction wells to calculate the mass of chemicals of concern removed from the aquifer by the extraction and treatment system.

1.5 Content of Performance Evaluation Reports

As outlined in the PSEP, the Annual PE Reports should generally contain the following:

- Potentiometric maps to assist in evaluating changes in groundwater flow patterns in the BPOU;
- Groundwater plume maps and chemical cross sections and an evaluation of any changes in the extent of groundwater contamination within the BPOU;
- Time-concentration plots for selected key constituents for selected monitoring wells;
- Contaminant mass-removal estimates for each extraction well using average flow rates and water-quality sampling results from the extraction wells;
- Results of computer model simulations of extraction system performance and a description of any refinements to groundwater flow models used to evaluate system performance;
- An overall assessment of remedial system performance in relation to Performance Standards related to the remediation of groundwater; and
- Recommendations for changes to the monitoring program outlined in the PSEP including scheduled changes to the monitoring frequency or monitoring locations.

Although not specifically outlined in the PSEP, EPA has requested that Annual PE Reports also address the performance of the BPOU Project in relation to “Other Performance Standards” that are not directly related to the remediation of groundwater, but rather relate to the operational performance of, or discharge requirements for, the various Subprojects following construction. These “Other Performance Standards” include the following:

- Achievement of treated-water effluent requirements in accordance with DPH domestic water supply permits, EPA Applicable or Relevant and Appropriate Requirements (ARARs), and California DPH (CDPH) requirements;
- Air-emission monitoring requirements in accordance with EPA ARARs and the risk limits identified in the June 15, 2009 letter from Wayne Praskins, EPA to Scott Goulart, Aerojet as further explicated in EPA’s February 3, 2011 letter. Note that in August 2006, by mutual agreement among EPA, South Coast Air Quality Management District [SCAQMD], and VCWD, air stripper and off gas control systems permits with SCAQMD were cancelled and EPA assumed compliance oversight with respect to operations formerly covered by the SCAQMD permits;
- Monitoring and reporting of brine discharges to the Los Angeles County Sanitation Districts (LACSD) system in accordance with Industrial waste discharge permits;
- Demonstration of proper disposal of waste associated with treatment operations. Applicable waste streams include, but are not limited to, spent granular activated carbon and spent ion exchange resins. Wastes treated or disposed of offsite must comply with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) offsite rule;
- Compliance with substantive portions of the National Pollutant Discharge Elimination System (NPDES) discharge requirements for any treated water discharged to surface water;
- Compliance with the Los Angeles Regional Water Quality Control Board's Water Quality Control Plan for the Los Angeles River Basin (the "Basin Plan"), which incorporates State Water Resources Control Board Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California," for any discharge to land, including recharge at a spreading basin or discharge to surface water;
- The installation and operation of treatment systems needed to ensure that the nitrate concentration in any discharge to land, to a spreading basin, or to a surface water is similar to or lower than the concentration in the receiving water, except for EPA-approved CERCLA Section 104(b) activities that will result in temporary high flow, high volume discharges;
- Compliance with substantive requirements in 22 CCR Sections 66264.601 -.603 for miscellaneous units, and related substantive closure requirements in 22 CCR Sections 66264.111-.115 for air strippers or granular activated carbon (GAC) contactors; and
- Compliance with DPH requirements for Emergency Preparedness Plans including Spill/Release Response Plans for the various subprojects.

2.0 STATUS OF REMEDIAL ACTIONS

This section presents the status of remedial actions undertaken in 2012 to implement the BPOU interim remedy. These actions include operation of the Valley County Water District (VCWD) Lante Subproject in Subarea 1; and operation of the La Puente Valley County Water District (LPVCWD) Subproject, the San Gabriel Valley Water Company (SGVWC) B6 Subproject and the SGVWC B5 Subproject in Subarea 3. The status of the BPOU Subprojects is also described in the monthly progress reports submitted to EPA pursuant to Paragraph 85, Section XV of the UAO.

2.1 Subarea 1 Remedial Action Status

Subarea 1 remedial actions consist of groundwater extraction from the VCWD SA1-1, SA1 2, and SA1-3 (Lante) wells and treatment at the VCWD Lante Treatment Plant, which is owned and operated by VCWD. The report, "Revised Draft Interim Remedial Action Report" (Stetson, 2005), prepared and submitted to EPA in March 2005, provides a summary of the VCWD Lante Subproject background, construction, and completion activities. Construction of the VCWD Lante Treatment Plant began in 2002 and was completed in 2005. The original construction activities included drilling and equipping two new extraction wells (SA1-1 and SA1-2), re-equipping the SA1-3 (Lante) well, installing associated piezometers, constructing raw and treated water pipelines, and constructing the treatment plant. Additional construction work in 2006 and 2007 included adding LPGAC treatment and replacing the resin-based vapor control system with vapor-phase granular activated carbon (VPGAC). The treatment plant consists of four air-stripping towers and associated VPGAC off-gas treatment units for VOC removal, LPGAC for 1,2,3-TCP removal, two regenerable ion exchange carousels (Calgon Ionic Separation Process [ISEP]) for perchlorate removal, and four UV/oxidation units for 1,4-dioxane and NDMA removal. Treated water is conveyed via a treated water pipeline to Suburban Water Systems (SWS) Plant 121; however, a portion of the treated water can be directed to the VCWD distribution system if desired.

On November 11, 2005, DPH issued domestic water supply Permit Amendment 1910009PA 003, authorizing VCWD to operate the VCWD Lante Treatment Plant. In January 2006, 1,2,3-TCP was detected in the VCWD extraction wells and subsequent testing confirmed the presence of 1,2,3-TCP. Beginning on February 21, 2006, VCWD began discharging treated water to Big Dalton Wash while a 1,2,3-TCP treatment technology was selected and constructed. LPGAC was selected as the treatment technology and the design and construction of a LPGAC system was completed in Spring 2007. LPGAC startup testing was completed in May 2007 and on July 18, 2007, DPH issued an amended permit to VCWD to resume delivering potable water.

As a result of operational problems, the resin-based off-gas control system was removed and replaced with VPGAC. A temporary VPGAC system was installed while a permanent system was designed and constructed. The temporary system was operational in June 2007 and the permanent system became fully operational in April 2008. The permanent VPGAC system consists of four 20,000 pound adsorbers with associated heaters operated in parallel.

The air strippers also experienced operational problems with calcium carbonate precipitation in the towers and packing. Tower cleaning was initiated in October 2007 and was completed in February 2008. A study was conducted to evaluate precipitation mitigation alternatives that included anti-scalant dosing, acid cleaning, and packing replacement. Anti-scalant testing began in October 2008 and is on hold

pending resolution of potential impact downstream treatment processes and final decisions for nitrate management. One air stripper was acid washed in December 2008 to test the efficacy and cost of this alternative. The results of the acid wash testing were summarized in a February 18, 2009 memorandum "Summary and Evaluation Air Stripper No. 4 Acid Cleaning" (Stetson 2009a). Based on the pilot testing, the acid washing was not a cost effective method to mitigate calcium carbonate precipitation problems. Air strippers are now routinely inspected and the towers and packing cleaned and replaced as necessary. In addition, calcification of piping downstream of the air strippers has caused VCWD to consider modifications to the acid injection system, which will be performed in 2013.

The process to replace the ISEP with single pass ion exchange was initiated in 2008. A request for proposal was released in January 2008 and bids were received and evaluated in April and May of 2008. The work was awarded to RC Foster and a notice to proceed was issued in August 2008. California Environmental Quality Act (CEQA) work associated with the single pass ion exchange was completed in September 2008 and design work was completed in early 2009. As part of the ISEP replacement work, nitrate treatment alternatives were also evaluated (Malcolm Pirnie, 2008).

Design and construction of the single pass ion exchange system was completed in 2009. The associated booster pump upgrade was completed in November 2009. Start-up testing of the single pass ion exchange system is on hold until issues regarding nitrate treatment, ISEP by-pass configurations, and ISEP modifications are evaluated and resolved. Although the ISEP by-pass piping bids were received and reviewed, the ISEP by-pass piping bids and the CDPH permit application and related documents for CDPH approval of the single pass ion exchange system for the VCWD system are on hold while the Project Committee determines how to address the nitrate treatment issue. In October 2010, VCWD and the CRs released a Request for Qualifications (RFQ) requesting process engineering and nitrate management qualifications to selected engineering firms. Qualifications were received, reviewed, and CDM Smith was selected as the firm to provide process treatment and nitrate management engineering expertise. CDM Smith began reviewing nitrate management alternatives in 2011 and a report with recommendations was submitted in March of 2012. Per the CRs request, CDM submitted an addendum to their report on nitrate management in November of 2012, summarizing alternatives which include blending using the Lante two million gallon reservoir.

The CRs also submitted an evaluation of extraction system performance for Subarea 1 in August 2012 (CDM Smith, 2012). EPA provided comments on this evaluation in a letter dated October 12, 2012 and the CRs responded to EPA comments on November 7, 2012. In a subsequent letter dated December 12, 2012, EPA concluded that groundwater extraction of 5,000 gpm at the SA1-3 location and 1,000 gpm at the SA1-1 well provides adequate hydraulic containment while optimizing mass removal in Subarea 1.

Other VCWD Lante Treatment Plant improvements or evaluations initiated in 2012 included:

- Rehabilitation work on Well SA1-2 was completed in January of 2012. VCWD completed the redevelopment work in March 2012 and approximately 60,000 gallons of redevelopment water was treated through carbon and resin vessels before being discharged back into the well;
- In January the analog card controlling the 7% brine valves was replaced;
- Four fans on Well SA1-3 VFD were replaced in March;

- In April, the brine meters were calibrated to within acceptable limits;
- In June, a visual inspection was conducted on Air Stripper No. 3 based on scheduled flowrate inspection intervals. The inspection revealed that the bottom grid and packing are showing signs of moderate to significant calcification and may need replacement in 2013;
- A backwash meter was replaced in September;
- Inspections for Air Stripper No. 1, 2, and 4 were conducted in September and revealed no critical issues;
- In October calcification was discovered in the spent liquid phase carbon during change out, as well as in two of the pumps in the air stripper booster station. In addition, flow restrictions, possibly caused by calcification in the piping, were observed in the discharge piping of Air Stripper #2. Booster Pumps No. 3 and 5 in the air stripper wet well were pulled and cleaned in November due to the calcium buildup. VCWD continues to investigate the cause of the calcification. VCWD is currently evaluating acid injection changes to mitigate calcification downstream of the air strippers; and
- An inspection on Air Stripper No. 1, 3, and 4 was conducted in December and the results indicated that Air Stripper No.3 should be cleaned and the packing replaced.

Technical performance reports are prepared under Provision 42 of the DPH operating permit and are required to be submitted annually to DPH. The most recent of these reports, "2011 Annual Technical Performance Report for the Lante Plant" (Stetson, 2012a), describes the status and performance of the VCWD Lante Treatment Plant for the period January 1, to December 31, 2011. In addition, VCWD submits monthly compliance reports to DPH; these compliance reports are included in the monthly progress reports provided to EPA.

In 2012, VCWD treated 8,579 acre-feet of water with an average flowrate of 5,301 gpm (Table 2-1) which is approximately 88% of the approved extraction rate of 6,000 gpm as approved in EPA's letter titled *EPA Approval of Changes to the Subarea 1 Groundwater Extraction Plan* dated December 12, 2012. Production increased from the prior year's average flowrate of 4,149 gpm. However, production remained below the EPA-approved extraction rate mainly due to ISEP limitations. Rehabilitation of Well SA1-2 was completed in January of 2012 and redevelopment performed in March 2012; however, the well has not yet been put back into service, primarily because of elevated nitrate concentrations.

VCWD experienced a brine waste spill of approximately 1,500 gallons at the sampling vault on January 25, 2012. The volume of the spill was below reportable quantities; however, a BPOU Spill Report documenting the incident was prepared and emailed to Mr. Wayne Praskins (EPA) on January 27, 2012. The estimated quantity of perchlorate released was 0.0054 pounds assuming a perchlorate concentration of 430 parts per billion in the brine.

2.2 Subarea 3 Remedial Action Status

Subarea 3 remedial actions consist of the operation of the LPVCWD, SGVWC B6, and SGVWC B5 Subprojects. These Subprojects are to extract and treat an average flowrate of 16,250 gpm (design capacity 18,100 gpm) as discussed below.

2.2.1 La Puente Valley County Water District Subproject Status

The LPVCWD Subproject extracts, treats, and delivers water to the public under a DPH permit that was issued on February 15, 2001, and amended as Permit No. 1910060PA-000 issued on May 8, 2002 with subsequent amendments. The LPVCWD Subproject consists of extraction wells LPVCWD 2, LPVCWD 3, LPVCWD 5, two air strippers and associated off-gas treatment for VOC removal, single pass ion exchange (replacing ISEP in July 2010) for perchlorate removal, and UV/oxidation for 1,4-dioxane and NDMA removal operating at a capacity of up to 2,500 gpm (EPA approved extraction rate is 2,250 gpm). Treated water is conveyed to LPVCWD's distribution system and, when available, a portion of the treated water is also provided to SWS.

To address sanding problems in LPVCWD 2 and 3, a new well, LPVCWD 5, was drilled and installed in 2007. The LPVCWD 5 well was equipped, developed, and tested in 2008. On December 19, 2008, DPH issued an amended permit to allow LPVCWD 5 to be used as a drinking water source. The well became operational in January 2009 and is LPVCWD's primary water supply well, with LPVCWD 2 and 3 used as backup water supply wells. The LPVCWD 5 well installation activities are summarized in, "Well No. 5 Well Completion Report" prepared by Stetson and submitted in final on July 2, 2008 (Stetson 2008). DPH issued a permit amendment for the operation of the LPVCWD 5 well on December 19, 2008.

To mitigate perchlorate-bearing brine discharges to the LACSD brine line, the LPVCWD Subproject Committee approved replacing the ISEP with single pass ion exchange equipment. The single pass ion exchange system was designed and construction was completed in 2009. A draft Compliance Test Plan and Operation, Maintenance, and Monitoring Plan for the single pass ion exchange were prepared and submitted to DPH for review. In June 2009, the EPA issued a letter supporting temporary discharges of water during startup testing of the new single-pass ion exchange system to the Walnut Wash. The Los Angeles County Department of Public Works (LACDPW) issued a discharge permit for LPVCWD on November 17, 2009. The ion exchange system was tested during startup activities in December 2009. The CDPH issued an amended permit for the single pass ion exchange system on June 15, 2010 and the system became operational on July 30, 2010.

Technical performance reports are prepared under Provision 33 of the DPH operating permit and are required to be submitted annually to DPH. The most recent of these reports, "Technical Performance Report (2011 – 2012) for the La Puente Valley County Water District Treatment Facility" (Stetson, 2013b), was submitted in January 2013 and describes the status and performance of the LPVCWD facility for the period August 1, 2011, to July 31, 2012. In addition, LPVCWD submits monthly compliance reports to DPH; these compliance reports are included in the monthly progress reports provided to EPA.

Treatment system improvements or evaluations initiated in 2012 included:

- LPVCWD air strippers inspection was performed on January 31, 2012 and the inspection report was distributed for review on May 9, 2012. The inspection determined that the packing along the bottom of the tower wall shows moderate calcification for Air Stripper No. 2. The report recommended removal and replacement of the packing material;
- Cleaning and disinfection of Air Strippers 1 and 2 was performed in August; and
- In December, CivilTec completed a draft of the report evaluating the optimization of peroxide, orthophosphate, and sodium hypochlorite dosing and the report is being reviewed by LPVCWD.

On April 25, 2012, approximately 2,000 pounds of carbon was released and contained on site. No Reportable Quantities were exceeded during this release. The release was due to a damaged lower screen on the large air stripper tower carbon adsorption system. The screen was repaired and the lost carbon was replaced on April 27. LPVCWD distributed a Spill Report of the incident on April 27, 2012.

In 2012, approximately 3,444 acre-feet of groundwater were extracted and treated equating to an average annual flowrate of 2,127 gpm (Table 2-1). This average annual flowrate was approximately 94.5% of the EPA approved extraction rate of 2,250 gpm. This was slightly below last year's production of 3,662 acre-feet and 2,271 gpm). This is due to slightly lower production rates from February to June because of minor operational issues.

2.2.2 San Gabriel Valley Water Company B6 Subproject Status

The SGVWC B6 Subproject remedial action consists of groundwater extraction from the SGVWC B25A, B25B, B26A, and B26B wells (with B6C and B6D included as backup wells) and treatment at the SGVWC B6 Treatment Plant, which is owned and operated by SGVWC. Construction of the SGVWC B6 Subproject began in 2002 and the SGVWC B6 Treatment Plant was completed in 2005. Construction activities included drilling, installing, and equipping the new extraction wells, installing associated piezometers, constructing raw and treated water pipelines, and constructing the treatment plant. The treatment plant consists of four air-stripping towers and associated carbon off-gas treatment units for VOC removal, two ISEP carousels for perchlorate removal, and four UV/oxidation units for 1,4-dioxane and NDMA removal. Treated water is conveyed to the SGVWC distribution system. The "Interim Remedial Action Report" (Stetson, 2004) prepared and submitted to EPA in September 2004 provides a summary of SGVWC B6 Subproject background, construction, and completion activities.

On June 8, 2005, DPH issued domestic water supply Permit Amendment No. 1910039PA-002, authorizing SGVWC to operate the SGVWC B6 Treatment Plant using the existing onsite B6C and B6D wells. SGVWC began delivering potable water from the SGVWC B6 Treatment Plant to customers on July 12, 2005. The permit was further amended by DPH with Permit Amendment No. 1910039-004 on February 17, 2006, to incorporate the operation of offsite wells B25A, B25B, B26A, and B26B.

To mitigate perchlorate-bearing brine discharges to the LACSD brine line, the SGVWC B6 Subproject Committee approved replacing the ISEP with single pass ion exchange equipment. The single pass ion exchange design was initiated in June 2008. Since there is limited space at the SGVWC B6 Treatment Plant, the ion exchange equipment was constructed on three properties that were purchased on the north side of Corak Street. Geotechnical work was completed on the properties in July and existing structures were demolished in the fall of 2008. CEQA work related to the single ion exchange project was filed and the public review process closed on October 6, 2008, without any comments received. Construction of the single pass ion exchange system was completed in November 2009. Startup testing and operation of the ion exchange system has been on hold while SGVWC evaluates nitrate treatment or management alternatives. One alternative to the management of nitrate concentrations for the SGVWC B6 Subproject was evaluated and discussed with EPA in 2009 and 2010. This alternative consisted of a slight shift in groundwater extraction from shallow extraction wells containing higher nitrate concentrations to deeper extraction wells with lower nitrate concentrations.

On November 1, 2010, SGVWC issued an RFP to selected engineering firms to provide design services for an ion exchange system to treat nitrate. SGVWC awarded the contract to Worley Parsons for the design of additional treatment for nitrates at the B6 treatment plant. The nitrate treatment system design for the B6 treatment plant was submitted to City of Baldwin Park for review in September 2011. WQA received approval for project funding under Proposition 84 in June of 2012 and is coordinating with CDPH to receive the actual contracts and finalize the funding amounts. SGVWC is in the process of purchasing another property as part of the nitrate treatment and the CEQA document has been updated accordingly.

The treatment plant operational capacity was reduced from approximately 6,200 gpm to approximately 2,300 gpm in September and then again to 2,200 gpm in December due to high back pressure on the ISEP units. SGVWC is working with CDPH to obtain authorization to operate the single pass IX facility to bypass the ISEP system before the nitrate specific IX system is in operation. Once permitted by CDPH the new perchlorate and nitrate IX treatment systems are expected to allow production to meet the EPA-approved target rate of 6,500 gpm.

Technical performance reports are prepared under Provision 15 of the DPH operating permit and are required to be submitted annually to DPH. The most recent report, "Technical Performance Report for the San Gabriel Valley Water Company Plant B6 Water Treatment Facility" (Stetson, 2012d), describes the status and performance of the SGVWC B6 Treatment Plant for the period April 1, 2010, to March 31, 2011. The technical performance report for the period April 1, 2011, to March 31, 2012 is currently in draft and has not yet been submitted to DPH. SGVWC also submits monthly compliance reports to DPH; these compliance reports are included in the monthly progress reports provided to EPA. Treatment system improvements or evaluations initiated in 2012 included:

- Excluding controls, installation of the single pass IX systems was completed in early 2012;
- A faulty VFD drive for the 7% brine pump and an eight point output module were replaced in January;
- In February and March 2012, perchlorate was detected in fully treated water at a concentration exceeding the MCL. SGVWC notified CDPH of the exceedance and also conducted public notifications. SGVWC corrected a three-way valve believed to be the cause of the problem. The plant was shut off to drinking water for approximately 410 hours while coordinating with CDPH on the perchlorate exceedance issue. On March 26, 2012, SGVWC Plant B6 was approved by CDPH to resume potable water supply service;
- In March, a calcium carbonate blockage in the 24-inch water main was removed;
- The brine meter was replaced and calibrated in March;
- Annual inspections on all four air strippers were performed in April. An inspection report on the air strippers was distributed in June, indicating possible channeling of water and airflow to the packing, and recommended continued monthly observations of the VOC removal efficiencies;
- SGVWC B6 plant experienced continued low level resin issues in their treatment vessels during 2012. This resulted in additional resin being added to vessels that contained low levels between March and August 2012; and
- Wells B25A and B26B as well as all motors and pumps were serviced in October.

Perchlorate was detected in the fully treated water leaving the plant at a concentration of 16 parts per billion, exceeding the MCL for a sample collected on February 24 and at 12 parts per billion on March 5. SGVWC notified CDPH of the exceedance and also conducted public notifications. SGVWC reviewed the problem causing this exceedance and corrected the three-way valve in the ISEP believed to be the cause of the problem. The plant was shut off to drinking water for approximately 410 hours while coordinating with CDPH on the perchlorate exceedance issue. On March 26th, SGVWC Plant B6 was approved by CDPH to resume potable water service. CDPH issued a Citation of Noncompliance on June 8, 2012, which summarizes the exceedance event.

In 2012, the SGVWC B6 Subproject extracted and treated approximately 4,827 acre-feet of water equating to an average annual flowrate of 2,980 gpm (Table 2-1). This average annual flowrate was 45.8% of the EPA-approved extraction rate of 6,500 gpm. This was a significant drop from the the prior year's annual average flowrate of 4,827 gpm. The 2012 production problems were due primarily to operational problems with the ISEP systems. ISEP resin back pressure continues to be an issue preventing the treatment plant to meet its target extraction rate. The downtime of the treatment plant associated with the perchlorate exceedance also significantly reduced the plant production. SGVWC B6 plant experienced continued low level resin issues in their treatment vessels during 2012. This resulted in additional resin being added to vessels that contained low levels between March and August. The new IX treatment system for nitrates and perchlorate are being completed. Once permitted by CDPH the new perchlorate and nitrate IX treatment systems are expected to allow production to meet the target extraction rate.

2.2.3 San Gabriel Valley Water Company B5 Subproject Status

The SGVWC B5 Subproject remedial actions consist of groundwater extraction from the SGVWC B5B, B5E, and City of Industry (COI) 5 wells and treatment at the SGVWC B5 Treatment Plant, which is owned and operated by SGVWC. In addition, the SGVWC B5D well is used as a standby water source. The treatment plant consists of LPGAC for VOC removal, single-pass ion exchange for perchlorate removal, and UV/oxidation units for 1,4-dioxane and NDMA removal. The "Interim Remedial Action Report" (Stetson, 2006c) prepared and submitted to EPA in September 2006 provides a summary of SGVWC B5 Subproject background, construction, and completion activities. Construction was largely completed in early 2007.

Startup testing conducted to support permitting was completed in March 2007 and DPH issued amended drinking water permit 1910039PA-008 for the B5 Treatment Plant on April 21, 2008. SGVWC began delivering potable water to their system on July 8, 2008. Prior to delivering potable water, extracted water was treated and discharged to the San Gabriel River. The DPH issued a permit amendment to allow for the addition of the COI 5 well in July 2009. The COI 5 well went online in July 2009.

Technical performance reports are prepared under Provision 53 of the DPH operating permit and are required to be submitted annually to DPH. The annual report, "Technical Performance Report for the San Gabriel Valley Water Company Plant B5 Water Treatment Facility" (Stetson, 2012e), describes the status and performance of the SGVWC B5 Treatment Plant for the period July 1, 2010, to June 30, 2011. The technical performance report for the period July 1, 2011, to June 30, 2012 is currently in draft and has not yet been submitted to DPH. In addition, SGVWC submits monthly compliance reports to DPH; these compliance reports are included in the monthly progress reports provided to EPA.

In 2012, the SGVWC B5 Subproject extracted and treated approximately 12,244 acre-feet of water equating to an average flowrate of 7,569 gpm (Table 2-1), exceeding the EPA-approved extraction rate of 7,000 gpm, and exceeding last year's production (11,573 acre-feet and 7,170 gpm).

3.0 PERFORMANCE MONITORING ACTIVITIES

As described in the PSEP, monitoring activities for the assessment of the interim remedy performance consist of two phases. The first phase consisted of baseline potentiometric and water-quality monitoring prior to extraction well startup and was completed in April 2005. The second phase involves more frequent potentiometric and water-quality monitoring during startup and initial operation of the extraction wells, followed by reduced monitoring frequencies after several years of continuous operation. The second phase of monitoring began in April 2005, although not all of the extraction wells were fully operational at that time. Potentiometric monitoring was performed on an increased frequency, as required, from April 2005 through November 2006. Water-quality monitoring was performed on an increased frequency, as required, during all of 2006. As described in Section 1.1 of this report, the CRs recommended several modifications to the PSEP, including reduced monitoring frequencies, in technical memoranda dated August 24, September 29, and November 2, 2006 (Geomatrix, 2006a; ERM, 2006; Geomatrix, 2006c) and the changes were incorporated into the final versions of the FSP and QAPP dated November 6, 2006 (Stetson, 2006a; Geomatrix, 2006b). The FSP and QAPP were approved with the modifications to the PSEP by EPA in a letter dated February 12, 2007 but have been periodically updated to address modifications to the performance monitoring components of the PSEP. The most recent updates to the FSP (Rev. 6) and QAPP (Rev. 4) were submitted to EPA in September 2012 (AMEC, 2012c and AMEC, 2012d). The FSP and QAPP are currently under revision to address comments received by EPA in late 2012 and early 2013 and will be reissued in early April 2013.

In accordance with the approved modifications to the PSEP, reduced monitoring frequencies and several other changes to monitoring activities began in December 2006, as follows:

- Potentiometric monitoring in piezometers and multiport wells was reduced from monthly to quarterly beginning in December 2006.
- Water-quality sampling at MW 5-24, MW 5-25, MW 5-26, and MW 5-27 was reduced from quarterly to semi-annual beginning in Spring 2007.
- Low-flow sampling was implemented at the Key Well beginning in 2007 to reduce the volume of purge water requiring disposal.
- At the request of EPA, annual monitoring for “non-target” VOC and SVOC TICs was implemented in a subset of the multiport wells and in VCWD Big Dalton beginning in 2007.
- At the request of EPA, annual monitoring for non-COC VOCs (including analysis of ethylene dibromide [EDB] by EPA Method 504.1) was implemented in a subset of the multiport wells and in VCWD Big Dalton in 2007.
- At the request of EPA, annual monitoring for 1,2,3-TCP was implemented in a subset of the multiport wells beginning in Fall 2006.

As proposed by the CRs and approved by EPA, the requirements for monitoring of additional constituents including VOC and SVOC TICs, non-COC VOCs (including EDB), and 1,2,3-TCP were to be re-evaluated after the first sampling event (1,2,3-TCP was subsequently added as a COC as indicated in Section 1.1). Results for these constituents in the BPOU were presented in the 2007 Annual PE Report (Geomatrix and ERM, 2008). Based on the results, the CRs included recommendations for additional modifications

to monitoring activities in the 2007 Annual PE Report (Geomatrix and ERM, 2008). The CRs refined the recommended modifications in a memorandum to EPA dated September 9, 2008 (AMEC Geomatrix, 2008). EPA approved the recommended modifications with several changes via e-mail correspondence on September 24, 2008, and the recommendations were implemented beginning in October 2008 as follows:

- Potentiometric monitoring in the multiport wells was reduced from quarterly to semi-annual.
- Water-quality sampling in selected multiport wells was reduced from semi-annual to annual. Semi-annual sampling continued in MW 5-03 (ports 5-10), MW 5-19 (ports 3-5), MW 5-24 (all ports), MW 5-25 (all ports), MW 5-26 (all ports), and MW 5-27 (all ports).
- Based on the distribution of 1,4-dioxane, the sampling frequency for 1,4-dioxane was reduced to annual and the number of monitoring locations for 1,4-dioxane was also reduced.
- Based on the limited detections of non-COC VOCs (including EDB) and VOC and SVOC TICs, and based on the redundancy between the PSEP and DPH sampling requirements, monitoring for these compounds as part of the PSEP monitoring program was reduced beginning in 2009. EPA agreed to accept the DPH-required monitoring for these compounds to fulfill the requirements of the PSEP as long as the results are maintained in the BPOU project database and are provided to EPA in monthly progress reports. The results for non-COC VOCs (including EDB) and VOC and SVOC TICs are also summarized in Annual PE Reports.

The CRs recommended two additional modifications to the PSEP in the 2008 Annual PE Report (AMEC Geomatrix and ERM, 2009) and in a memorandum to EPA dated June 5, 2009 (AMEC Geomatrix, 2009). The recommended modifications were as follows:

- Continue to work with EPA to eliminate redundancies between DPH-required monitoring and the PSEP monitoring program, and
- Consistent with the recommendation above, reduce quarterly sampling in the BPOU Project extraction wells under the PSEP program since this sampling is redundant with sampling that is required under each of the BPOU treatment plant's DPH drinking water permits.

EPA agreed via e-mail correspondence on June 23, 2009, to reduce PSEP sampling of the extraction wells beginning in the third quarter of 2009 provided that the CRs provide additional information to EPA to compare the PSEP and DPH monitoring requirements. The CRs provided the additional information to EPA, including a table comparing PSEP and DPH monitoring requirements, via e-mail on August 5, 2009. EPA approved the additional modifications via e-mail on March 25, 2009, thus allowing the DPH-required monitoring in the extraction wells to fulfill the requirements of the PSEP as long as the results are maintained in the BPOU project database and are also summarized in Annual PE Reports. As described in Section 1.1 of this report, the QAPP for Groundwater (AMEC Geomatrix, 2010a), the FSP for Groundwater (AMEC Geomatrix, 2010b), and the Revised Final PSEP (Rev. 2) were updated in 2010 (AMEC Geomatrix, 2010c) to incorporate numerous modifications that were approved since the previous versions of these documents were issued. Additional modifications were proposed in the Revised Final PSEP (Rev. 2) which were subsequently approved in comments received from EPA in correspondence dated July 1 and October 12, 2011. As a result, another version of the PSEP (Rev. 3) was submitted to

EPA on April 13, 2012 (AMEC, 2012b) to document the following modifications to the PSEP monitoring program:

- Removal of three inactive production wells (CDWC 14, SWS 139W4, and SWS 140W3) from the PSEP water quality monitoring program. These wells are no longer active and are therefore inaccessible for water quality sampling due to logistical constraints and regulatory approvals needed to discharge purge water to surface water features. Sampling results from these wells were not needed to assess remedy performance because monitoring of adjacent production wells provides water quality data for this purpose.
- Removal of four conventional monitoring wells (AJ MW-1, AJ MW-2, AJ MW-3, and AJ MW-5) from the PSEP monitoring program and the addition of the following wells into the monitoring program: AJ MW-2R, AJ MW-6, ALR MW-1R, and ALR MW-8, and ALR MW-9. No additional sampling is required of these wells beyond what is currently required by the Los Angeles Regional Water Quality Control Board.
- Removal of production wells in the basin-wide potentiometric monitoring program implemented by the Watermaster from the PSEP monitoring program. Potentiometric monitoring data from these wells are not used in the development of potentiometric surface maps in the BPOU and are not used to assess remedy performance. It is assumed that the Watermaster will continue to perform basin-wide potentiometric monitoring and report the results in various Watermaster publications.
- The incorporation of the MW5-28 monitoring well cluster (MW5-28S, MW5-28I, and MW5-28D) into the PSEP groundwater quality monitoring program. Previously this well cluster had been used to provide supplemental groundwater quality data but was not formally included in the PSEP monitoring program.

As described in Section 1.1, a revised version of the PSEP (Rev. 4) is currently under preparation to address comments received from EPA in late 2012 and early 2013. The revised PSEP (Rev. 4) will address EPA comments regarding the addition of 1,2,3-TCP as a COC, clarification of monitoring and reporting requirements for non-COCs such as ethylene dibromide, and the modification of remedial action objectives outlined in Sections 2.2.1 and 2.2.2.

Potentiometric monitoring, water-quality monitoring, and groundwater modeling activities that were completed in support of performance assessment activities during 2012 are discussed in the following sections.

3.1 Potentiometric Monitoring

Potentiometric monitoring of wells included in the PSEP monitoring program continued to be conducted by the Watermaster and CRs throughout 2012. Locations of the wells included in the BPOU potentiometric monitoring program are shown on Figure 3-1 and their monitoring schedules are presented in Table 3-1. Potentiometric monitoring completed for the PSEP monitoring program during 2012 is summarized below.

- Potentiometric data were collected quarterly in 11 extraction wells.

- Potentiometric data were collected quarterly in 17 piezometer clusters and one inactive production well.
- Potentiometric data were collected semi-annually in 18 multiport monitoring wells.
- Potentiometric data were collected weekly in one conventional monitoring well, the LACO Key Well, by the Main San Gabriel Basin Watermaster.

3.2 Water-Quality Monitoring

Water-quality monitoring of existing wells included in the PSEP continued to be conducted by the Watermaster and the CRs throughout 2012. Locations of wells included in the BPOU groundwater-quality monitoring program are shown on Figure 3-2 and their monitoring schedules are presented in Table 3-2. Groundwater samples were analyzed for the 21 COCs listed in PSEP Table 2-1, including: 1,4-dioxane, NDMA, perchlorate, and VOCs. Groundwater samples were also analyzed for nitrate and sulfate because of their importance to treatment plant operations and potable use. Groundwater-quality monitoring completed for the PSEP monitoring program during 2012 is summarized below.

- Monthly DPH-required groundwater samples collected in 11 extraction wells were used to fulfill the quarterly monitoring requirements for the PSEP with a few exceptions as follows:
    - Limited groundwater samples were collected from SA1-2 because this well was only operated in May of 2012.
    - Groundwater samples from wells COI 5, SGVWC B5B and SGVWC B5E were not analyzed for sulfate because these analytes are not required by DPH.
    - Groundwater samples in extraction wells were not analyzed for acetone and carbon disulfide because these analytes are not required by DPH.
- Groundwater samples were collected annually in all ports in all 17 multiport wells and for the MW 5-28 monitoring well cluster. In addition, groundwater samples were collected on a semi-annual basis from selected ports at six multiport wells.
- Groundwater samples were collected annually from seven conventional monitoring wells consisting of monitoring wells AJMW-2R, AJMW-4, AJMW-6, ALRMW-1R, ALRMW-8, ALRMW-9, and the LA County Key Well.
- Groundwater samples were collected annually from 11 production wells. Conrock Company (CC) E Durbin and Covina Irrigation Company (CIC) Baldwin 1 were not sampled because these two wells were not operational during 2012.

In addition to groundwater-quality monitoring required by the PSEP, other groundwater-quality monitoring was performed to supplement the PSEP monitoring program during 2012 including the following:

- Groundwater-quality samples for the COCs and chemicals of interest were collected quarterly from the conventional monitoring wells AJ MW-2R, AJ MW-4 and AJ MW-5.
- Additional groundwater-quality monitoring was performed by the WEs to satisfy the requirements of DPH drinking water permits. As described in Sections 1.1 and 3.0, EPA has agreed to accept the results of the DPH required monitoring to satisfy certain PSEP

monitoring requirements. These results are to be presented in monthly progress reports and summarized in BPOU Annual PE Reports. The DPH monitoring requirements are summarized in Table 3-3.

Results of the water-quality monitoring are presented in Section 5.2.

3.3 Groundwater Modeling

As described in Section 5.1 of the PSEP (AMEC Geomatrix, 2010c), the BPOU groundwater model is the primary tool for assessing extraction system performance. Annual simulations of basin-wide groundwater flow conditions consist of the addition of pumping, recharge, and model boundary water level and flux estimates averaged quarterly over the water year. The BPOU groundwater model is described in the Comprehensive Groundwater Modeling Report, dated July 29, 2005 (Geomatrix, 2005). Previous updates to the model are described in the Addendum to the Comprehensive Groundwater Modeling Report, dated September 8, 2006, (Geomatrix, 2006d), a technical memorandum dated December 14, 2007 (Geomatrix, 2007b), the 2007 Annual PE Report (Geomatrix, and ERM, 2008), and in the 2010 Annual PE Report (AMEC and ERM, 2011). Updates to the groundwater model are described in Section 3.3.1 below and updated model results are described in Section 5.3.

In addition, supplemental modeling work is being conducted by CDM Smith on behalf of the CRs to assess remedy performance in Subarea 1 (CDM Smith 2012) and Subarea 3 (in preparation). These evaluations are being prepared and submitted under separate cover, independent of the 2012 Annual Report.

3.3.1 Model Update

The groundwater model was updated through the end of water year (WY) 2011-12 with current recharge, pumping, and water level data. Water level data from WY2011-12 were obtained from LACDPW to update the time-variant head boundaries that are used to simulate inflows to the flow system from the Chino Basin and groundwater outflows to Whittier Narrows.

Spreading basin recharge data for WY 2011-12 were obtained from LACDPW. Table 3-4 summarizes the quarterly recharge rates for each spreading basin and river reach used in the model for the entire model simulation period (WY1982-2012). Records for WY2011-12 were obtained from LACDPW for the precipitation stations used to update the portion of basin recharge that is assumed to be derived from precipitation and irrigation return flows. Two LACDPW precipitation stations that were previously used for precipitation recharge data were either temporarily or permanently discontinued during WY2010-11. Precipitation data from other LACDPW precipitation stations near these discontinued stations were not available for the entire model simulation period. As a result, data from currently active stations near these discontinued stations were combined with data from discontinued stations to provide a continuous record of precipitation data over the entire simulation period.

As described in the 2010 Annual PE Report (AMEC and ERM, 2011), recharge from irrigation return flows was modified on a trial and error basis to ensure a an acceptable match between simulated and observed water levels during the 30-year period simulated by the groundwater model, with emphasis on ensuring a reasonable match to peak high and low water levels. Table 3-5 summarizes the quarterly recharge rates from precipitation and irrigation return flows for each precipitation zone used in the model for the entire

simulation period. Figure 3-3 shows the quarterly recharge volumes from all water conservation facilities (spreading basins and river reaches) and from aerially distributed recharge (precipitation and irrigation return flows) for the entire model simulation period.

Groundwater pumping for WY2011-12 was updated based on production records obtained from the Watermaster. Figure 3-4 shows the quarterly pumping from all wells for the entire simulation period. Groundwater pumping in WY2011-12 continued to exhibit similar seasonal trends as previous years; the largest amount of pumping occurred during the peak of the dry season in the third quarter of the calendar year, and the smallest amount of pumping occurred during the peak of the wet season in the first quarter of the calendar year. Figure 3-5 shows a comparison of annual recharge and annual pumping throughout the entire model simulation period. As shown on Figure 3-5, annual recharge was slightly exceeded by annual pumping during WY2011-12.

3.3.2 Model Simulations of Extraction System Performance

Model simulations of extraction system performance were conducted using the updated BPOU groundwater model and transient particle tracking methods with the updated FETRAC-II code described in the 2010 Annual PE Report (AMEC and ERM, 2011). As requested by EPA, transient forward particle tracking methods were used to evaluate the hydraulic performance of the project extraction wells under actual pumping conditions for three-year time periods ending at the end of each quarter of WY2011-12. As described in the Comprehensive Groundwater Modeling Report (Geomatrix, 2005) and in the PSEP, the groundwater model simulates transient boundary conditions using quarterly stress periods. Therefore, groundwater withdrawals from project extraction wells and other production wells are simulated using average quarterly pumping rates. The average quarterly pumping rates for each well are estimated by measuring the total volume (in acre-feet) that was pumped during the quarter, dividing the total volume by the number of days in the quarter, and then converting the result to an average quarterly pumping rate (in gpm). Simulated pumping rates are summarized in Table 3-6.

In response to requests from EPA, forward particle tracking was conducted to evaluate the hydraulic effects of the operation of project extraction wells beginning in the 2010 Annual PE Report. Following the convention established in the 2010 Annual PE Report, forward particle tracking was performed for this reporting period by starting particles at the beginning of each quarterly stress period in WY2008-09 and then simulating the forward paths of the particles under the transient groundwater flow conditions through the corresponding quarterly stress period in WY2011-12. The starting locations for the particles were developed to represent the approximate horizontal and vertical extent of various contaminants in areas upgradient of the Subarea 1 and Subarea 3 extraction wells. The release of these particles is not intended to display actual contaminant sources nor the actual locations. They are designed to simply track the movement of groundwater originating from locations upgradient of project extraction wells. The particles do not represent contaminant mass; rather, they solely represent the movement of groundwater in order to depict the likely zones of hydraulic capture as the particles flow downgradient in groundwater. The resulting particle tracks cannot be utilized to infer, suggest, or demonstrate the source of any contamination with any degree of precision. Further, since these particles do not represent mass and are not representative of solute transport, they do not incorporate processes such as retardation and degradation.

Given the limitations of forward particle tracking results, depictions of hydraulic capture presented in this report should not be considered representative of longer-term extraction system performance. Results of forward particle tracking to evaluate extraction system performance are presented in Section 5.3.2 and an overall discussion of the hydraulic capture at various extraction well locations is presented in Section 7.1.1.

4.0 TREATMENT PLANT MONITORING ACTIVITIES

This section summarizes methods used to monitor treatment plant performance. Treatment plant operational results are presented in Section 6.0.

4.1 Subarea 1 – Valley County Water District Lante Treatment Plant

The VCWD Lante Treatment Plant operated on a nearly full-time basis in 2012, experiencing downtime associated with routine maintenance and unplanned operational interruptions. Elevated nitrate and sulfate concentrations in the raw water combined with ISEP limitations resulted in a reduced total extraction rate for the VCWD system.

Raw water, partially treated water, and fully treated water were routinely sampled and analyzed for COCs including 1,2,3-TCP, inorganic chemicals, and other diagnostic parameters to evaluate the effectiveness of treatment processes and to monitor the quality of the fully treated water. Treated water was primarily delivered to SWS Plant 121. Water-quality data, as obtained, are summarized in the DPH compliance reports appended to the monthly progress reports to EPA.

In August 2006, by mutual agreement among EPA, South Coast Air Quality Management District (SCAQMD), and VCWD, air stripper and off gas control system permits with SCAQMD were cancelled and EPA assumed compliance oversight with respect to operations formerly covered by the SCAQMD permits. The air stripper vapor abatement equipment consists of four 20,000-pound carbon adsorption systems equipped with heaters. Air compliance samples were collected according to the revised protocol approved by EPA on February 3, 2011. The revised protocol requires air sampling immediately after a carbon change out, every other month for 6 months, and then monthly thereafter. The CRs submitted a revised QAPP for air and waste water discharges to the EPA in September of 2012 (AMEC, 2012a) and are currently updating the Field Sampling Plan for air and waste water discharges.. All air samples were analyzed by EPA Method TO-15.

VPGAC change outs occurred in February, March, and April, where 20,000 lbs of VPGAC were replaced during each event. Three liquid phase carbon change outs occurred in 2012. In March, 200,000 lbs of LPGAC were replaced. Another 160,000 lbs were replaced between October 21 and 25. An additional 20,000 lbs was replaced on December 12. Carbon and resin change outs are summarized in Table 4-1. Spent carbon and resin are managed at facilities that are authorized to accept Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) wastes. As they are received, certificates of disposal and reactivation are provided to EPA in the monthly progress reports.

Waste brine and water softener wastes produced by the ISEP system were discharged under Industrial Wastewater Permit No. 016112 from the LACSD, issued on August 5, 2004 and subsequently revised and reissued on March 23, 2010. Brine discharges occurred throughout 2012 while the treatment plant was operating. Brine discharge samples were collected and analyzed in accordance with permit requirements. Self-Monitoring Reports (SMRs) were submitted to LACSD and EPA on a semi-annual basis covering January to June and July to December 2012, respectively. The SMRs summarize flow, and brine quality data collected during the reporting period. A deficiency notice was received from LACSD on February 19, 2013 for the brine waste sample collected on November 14, 2012 for the July 1, 2012 to December 31, 2012 SMR reporting period. This deficiency notice was issued because the sample for this reporting period was analyzed for an incorrect suite of analyses. A replacement sample

was collected on January 17, 2013 and the results were submitted to LACSD on March 20, 2013. Per a LACSD discharge permit revision, continuous pH monitoring is no longer required.

4.2 Subarea 3 – La Puente Valley County Water District Treatment Plant

The LPVCWD Treatment Plant operated on a full-time basis in 2012, experiencing periodic downtime associated with routine maintenance and infrequent and unplanned operational interruptions. In general, LPVCWD experienced a minimal amount of unplanned downtimes during 2012. The 2012 extraction volume for LPVCWD was approximately 94.5% of the EPA approved extraction rate. Raw and treated water sampling was performed in accordance with the DPH permit and included weekly sampling for VOCs, perchlorate, 1,4-dioxane, NDMA, 1,2,3-TCP, and various inorganic and physical parameters. The weekly sampling results are included in monthly progress reports submitted to DPH as a requirement of LPVCWD's drinking water permit. These results are also included in the monthly progress reports to EPA.

In August 2006, by mutual agreement among EPA, SCAQMD, and LPVCWD, air strippers and off-gas unit permits were cancelled and EPA assumed compliance oversight with respect to operations formerly covered by the SCAQMD permits. The VOC treatment equipment consists of a 30 foot tall air-stripping tower with a single 7,000 pound VPGAC adsorber and a 41 foot tall air-stripping tower with a single 20,400 pound VPGAC adsorber. Air compliance samples were collected and analyzed by EPA Method TO-15 according to the revised protocol approved by EPA on February 3, 2011. The revised protocol requires air sampling immediately after a carbon change out and monthly thereafter. The CRs submitted a revised QAPP for air and waste water discharges to the EPA in September of 2012 (AMEC, 2012a) and are currently updating the Field Sampling Plan for air and waste water discharges.

Approximately 27,400 lbs of VPGAC was changed out in July 2012. The VPGAC is managed at facilities approved by EPA to accept CERCLA wastes. As they are received, copies of disposal manifests for change out of spent VPGAC are provided to EPA in the monthly progress reports. Eight-hundred and fifty cubic feet of spent resin was changed out in June 2012. As they are received, copies of disposal manifests for spent carbon and resin are provided to EPA in the monthly progress reports. Carbon and resin change outs are summarized in Table 4-1.

Waste brine and water-softener wastes were discharged under temporary Industrial Wastewater Discharge Permit 017128 issued by LACSD. A new permit was issued for the LPVCWD Treatment Facility on August 10, 2011. This new permit reflects the transition of treatment technology from the ISEP to the single-pass IX process on July 30, 2010. As a result of this transition, the continuous discharge of brine to the sewer has stopped. Semi-annual waste water discharge sampling was performed in accordance with permit requirements during 2012. SMRs were prepared and submitted to LACSD and EPA covering the January to June and July to December periods.

4.3 Subarea 3 – San Gabriel Valley Water Company B6 Treatment Plant

The SGVWC B6 Treatment Plant experienced continued operational issues, primarily related to ISEP problems, during 2012. ISEP resin back pressure continues to be an issue, which resulted in the SGVWC B6 treatment plant operational limit being reduced to approximately 2,200 gpm in December 2012. The SGVWC B6 Treatment Plant operated at approximately 45.8% of the target extraction rate during 2012. The construction of the new IX treatment systems for nitrate and perchlorate treatment have

been completed. Once permitted by CDPH the new perchlorate and nitrate IX treatment systems are expected to allow production to meet the target rate of 6,500 gpm. Production was primarily from B26A and B26B whereas Wells B25A and B25B operated only intermittently throughout the year, with their major production months being January, February, March, May and July. Wells B25A and B25B produced a minimal amount of water during the second half of 2012; standby wells B6C and B6D were infrequently operated to supplement drinking water sources.

Raw and treated water sampling were performed in accordance with the DPH permit and included sampling for COCs, 1,2,3-TCP, inorganic chemicals, and other diagnostic parameters. Water-quality data are summarized in monthly reports to DPH and are included in the monthly progress reports to EPA.

In August 2006, by mutual agreement among EPA, SCAQMD, and SGVWC, permits for the four air strippers and off-gas units were cancelled and EPA assumed compliance oversight with respect to operations formerly covered by the SCAQMD permits. Air compliance samples were collected according to the revised protocol approved by EPA on February 3, 2011. The revised protocol requires air sampling immediately after a carbon change out, every other month for 6 months, and then monthly thereafter. The air compliance sampling data were included in the monthly progress reports to EPA. The CRs submitted a revised QAPP for air and waste water discharges to the EPA in September of 2012 (AMEC, 2012a) and are currently updating the Field Sampling Plan for air and waste water discharges.

In May, 20,000 lbs of VPGAC was changed out. The VPGAC is managed at facilities approved by EPA to accept CERCLA wastes. As they are received, copies of disposal manifests for change out of spent VPGAC are provided to EPA in the monthly progress reports. Carbon change outs are summarized in Table 4-1.

Waste brine and water-softener wastes produced by the ISEP system were discharged under Industrial Wastewater Permit No. 016499 issued on February 17, 2004. Brine discharges occurred throughout 2012. Quarterly brine discharge sampling is required, and was performed for VOCs, SVOCs, perchlorate, 1,4-dioxane, sulfide, oil and grease, chloride, alkalinity, calcium, magnesium, total toxic organics, suspended solids, and chemical oxygen demand. Four quarterly SMRs that summarize 2012 discharges and brine quality data were submitted to LACSD and EPA on or before April 15, July 15, and October 15, 2012, and January 15, 2013.

4.4 Subarea 3 – San Gabriel Valley Water Company B5 Treatment Plant

The SGVWC B5 Treatment Plant operated continuously in 2012, experiencing periodic downtime associated with routine maintenance and infrequent unplanned interruptions. Production was primarily from wells B5B, B5E, and COI 5, with average annual production rates of 3,100 gpm; 3,068 gpm; and 1,195 gpm; respectively. SGVWC B5D was used as a standby drinking water source, making increased contributions in January and May of 2012. B5D is typically used while LPGAC change outs are scheduled.

Raw and treated water sampling was performed in accordance with the DPH permit and included sampling for COCs, 1,2,3-TCP, inorganic chemicals, and other diagnostic parameters. Water-quality data are summarized in monthly reports to DPH and are included in the monthly progress reports to EPA.

VOCs are removed using LPGAC and the carbon was replaced in January, February, March, April, May, June, July, September, and November 2012. Single pass ion exchange resin used to remove perchlorate

was replaced in May and July 2012. Copies of disposal manifests for change out of spent carbon and resin are provided in monthly progress reports to EPA, as they are received. Carbon and resin change outs are summarized in Table 4-1.

5.0 PERFORMANCE MONITORING RESULTS

Potentiometric and groundwater-quality monitoring data obtained for the PSEP monitoring program during 2012 were collected in support of performance monitoring during continued construction, testing, and operation of the BPOU remedy. Results of potentiometric monitoring, water-quality sampling, and groundwater modeling activities are presented in the following sections.

5.1 Potentiometric Monitoring Results

The primary objective of the potentiometric monitoring described in Section 3.1 is to verify that the BPOU groundwater flow model accurately reflects the observed flow field and to verify that the remedy is limiting further migration of COCs in groundwater. As noted in Section 5.2 of the PSEP, results from potentiometric monitoring are also used to develop potentiometric surface maps to assist in evaluating changes in groundwater flow patterns in the BPOU.

Key components of the assessment of potentiometric data include the following:

- Regional water level fluctuations due to basin-wide recharge and pumping conditions;
- Local-scale water level fluctuations due to ongoing groundwater production and extraction system pumping;
- Regional and local-scale lateral hydraulic gradients and flow directions; and
- Regional and local-scale vertical hydraulic gradients and flow directions.

Potentiometric monitoring results for 2012 are discussed in the following sections.

5.1.1 Water Level Fluctuations

Long-term regional water level conditions in the BPOU are evaluated using water level data for the LACO Key Well. Figure 5-1 shows the water levels measured in the Key Well from 1982 through 2012. During 2012, groundwater levels in the LACO Key Well decreased from approximately 234 feet mean sea level (msl) in January 2012 to approximately 213.5 feet msl in December 2012. Review of 2012 monitoring data suggests that the observed water level decrease in the LACO Key Well occurred in response to pump discharge volumes exceeding groundwater recharge in WY2011-12 as described in Section 3.3.1.

Figures 5-2 and 5-3 show water levels in multiport monitoring wells MW 5-03 and MW 5-20. The hydrographs for MW 5-03 and MW 5-20 represent water level conditions in Subarea 1, in the northern portion of the BPOU, and in Subarea 3, in the southern portion of the BPOU, respectively. As shown on Figures 5-2 and 5-3, water levels in both Subarea 1 and Subarea 3 decreased in 2012 as compared to the prior year's recorded water levels. Water levels in Subarea 1 decreased approximately 28.3 to 31.0 feet between November 2011 and October 2012, while water levels in Subarea 3 decreased approximately 11.2 to 17.7 feet during the same period. Water level data depicted on Figure 5-2 indicate that water levels in all ports in MW 5-03 exhibit similar trends. Figure 5-3 also indicates declining water

levels in all ports of MW 5-20 (Ports 1 – 7) from October 2011 to October 2012. As discussed in Section 1.3.3.1, the difference in the observed water level trend between the shallow and deep ports is likely the result of confining units in Subarea 3 that provide hydraulic separation between pumping in different elevation intervals.

5.1.2 Lateral Hydraulic Gradients

Generalized potentiometric surface maps for the shallow and deep elevation intervals were developed based on water level data collected in the multiport monitoring wells to assess observed groundwater flow patterns and hydraulic gradients across the BPOU. Figures 5-4 and 5-5 show observed groundwater flow conditions in the shallow (above -500 feet msl) and deep (below -500 feet msl) elevation intervals in May 2012. Figures 5-6 and 5-7 show observed groundwater flow conditions in the shallow and deep elevation intervals in October/ November 2012. Evaluation of observed groundwater flow patterns on a more detailed scale is limited by spatial variations in hydrostratigraphy and significant short-term water level fluctuations that occur in response to variations in local recharge and pumping.

As shown on Figures 5-4 through 5-7, lateral hydraulic gradients are towards the west-southwest, with a more westerly gradient in Subarea 3 in the vicinity of the SGVWC B5 Subproject and the CDWC Bassett wellfield. Although it is difficult to generalize groundwater flow directions given the seasonality of pumping and recharge in the San Gabriel Basin, groundwater flow directions are generally more southerly during higher water level conditions and are more westerly during lower water level conditions.

Regional-scale lateral hydraulic gradients were estimated using water levels measured in MW 5-03 and MW 5-20 during May and October/November 2012. Estimated lateral hydraulic gradients are summarized in Table 5-1. The following observations are presented based on the results shown in Table 5-1:

- Estimated lateral hydraulic gradients in the shallow elevation interval ranged from 7.5×10^{-4} to 7.8×10^{-4} foot/foot toward the west-southwest.
- Estimated lateral hydraulic gradients in the deep elevation interval ranged from 9.5×10^{-4} to 1.0×10^{-3} foot/foot toward the west-southwest.
- Lateral hydraulic gradients continue to be flatter in the shallow elevation interval above -500 feet msl compared to lateral hydraulic gradients in the deep elevation interval below -500 feet msl.

5.1.3 Vertical Hydraulic Gradients

Water level measurements in multiport monitoring wells and piezometer clusters installed near extraction wells indicate that vertical hydraulic gradients vary throughout the BPOU. As discussed in Section 5.1.1, hydrographs shown on Figures 5-2 and 5-3 represent water level conditions in Subarea 1 (MW 5-03), in the northern portion of the BPOU, and in Subarea 3 (MW 5-20), in the southern portion of the BPOU, respectively. As shown on Figure 5-2, hydrographs for ports at different depths in MW 5-03 plot essentially on top of each other, indicating that there is no significant vertical hydraulic gradient in Subarea 1. However, as shown on Figure 5-3, water levels measured at different depths in MW 5-20 are separated by up to 16.4 feet, indicating that there are significant downward vertical hydraulic gradients in Subarea 3.

Vertical hydraulic gradients calculated at selected multiport wells and piezometer clusters located in Subarea 1 and Subarea 3 are summarized in Table 5-2. The estimates summarized in Table 5-2 are based on semi-annual water level conditions in May 2012 and October 2012. As shown in Table 5-2, vertical hydraulic gradients continue to be lower in Subarea 1 compared to vertical hydraulic gradients in Subarea 3. Estimated vertical hydraulic gradients in Subarea 1 ranged from 2.7×10^{-4} to 7.9×10^{-4} foot/foot in the downward direction, and 4.6×10^{-4} to 6.6×10^{-4} foot/foot in the upward direction. Estimated vertical hydraulic gradients in Subarea 3 ranged from 8.8×10^{-3} to 2.3×10^{-2} foot/foot and are consistently downward.

5.2 Groundwater Quality

Groundwater samples were collected from wells in the PSEP monitoring program to evaluate groundwater-quality conditions in the BPOU. As described in Section 3.2, groundwater samples were analyzed for the 21 COCs listed in PSEP Table 2-1 including: 1,4-dioxane, NDMA, perchlorate, and VOCs. Groundwater samples were also analyzed for nitrate and sulfate because of their importance to treatment plant operations and potable use. As described in Section 3.2, groundwater-quality monitoring data collected to satisfy DPH permit requirements were used to supplement the PSEP monitoring program during 2012. Groundwater-quality monitoring results for 2012 are discussed in the following sections.

5.2.1 Water-Quality Results

Groundwater-quality results for the PSEP monitoring program in 2012 are summarized in Table 5-3. The presentation of groundwater-quality results in this report focuses on the evaluation of the spatial distribution and temporal trends for seven selected COCs in groundwater including: 1,2-dichloroethane (1,2-DCA); 1,4-dioxane; carbon tetrachloride; NDMA; perchlorate; PCE; and TCE. This evaluation relies on approximate depictions of the interpreted current spatial distribution and concentration trends of the seven COCs in groundwater. The depictions are approximate and are further evaluated in Sections 5.2.3 and 5.2.4 as well as Section 4.0 of Appendix A.

Results for other water-quality monitoring that was performed by the WEs to satisfy the requirements of DPH drinking water permits presented in Table 3-3 are summarized as follows:

- The DPH-required monitoring for the BPOU COCs in the extraction wells fulfills the requirements of the PSEP, and the DPH requirements also include more frequent monitoring (weekly or monthly) in these wells than the PSEP requires (quarterly). Therefore, in some instances Table 5-3 includes additional water-quality results for BPOU COCs in the extraction wells as required by DPH.
- Water-quality results for 1,2,3-TCP are presented in Table 5-3. Concentrations of 1,2,3-TCP were detected at a level that exceeds the NL (5 ng/L) at ALR MW-9, MW 5-11 (ports 1-3) and SA1-3 (Lante). As shown in Table 5-3, DPH-required monitoring data for a few monitoring events were not available at the time of this report. Table 5-3 also provides results from several additional monitoring events that were not required under either the PSEP or DPH monitoring requirements as presented in Table 3-3.

- Water-quality results for non-COC VOCs, including EDB, are presented in Table 5-4. All available DPH-required data are included. Six non-COC VOCs were detected in various wells at levels below their respective MCLs or NLs. Table 5-4 also provides results from several additional monitoring events that were not required according to the DPH monitoring requirements as presented in Table 3-3. For non-COC VOCs that have no MCL and NL, EPA Regional Screening Levels for drinking water (EPA, 2012) are shown in Table 5-4 as requested by EPA.
- Water-quality results for VOC and SVOC TICs are presented in Table 5-5. All available DPH-required data are included. Toluene was tentatively identified below the MCL in COI 5. Tetrachloroethene was tentatively identified above the MCL in SA1-3 (Lante), SGVWC B25A, MW 5-04 (ports 1-3), MW 5-08 (port 4) and MW 5-11 (port 3) using SVOC analysis; this compound is currently monitored using EPA Method 8260 and is addressed by the remedy for VOC treatment within the BPOU. Three other compounds were tentatively assigned a specific chemical association with no current regulatory standard or limit. Table 5-5 also provides results from several additional monitoring events that were not required according to the DPH monitoring requirements as presented in Table 3-3.

5.2.2 Data Validation and Data Quality Assessment

Data management activities for the BPOU Project are managed by LDC under contract to the Watermaster. LDC utilizes EDMSi, an EQUIS web-based database, for the management of historical data that was compiled from the EPA San Gabriel Basin database, CRs, WEs, and other relevant sources. New water-quality data that are collected for the PSEP monitoring program are reported to LDC by laboratories and are validated in EDMSi as part of the real-time automated Tier 1A/1B process and Tier 3 selection. As specified by the QAPP (AMEC, 2012d), Tier 1A/1B validation was performed by LDC on all water-quality data collected in support of the PSEP monitoring program and Tier 3 review was performed on approximately ten percent of the PSEP monitoring data. Results of the data validation are used to evaluate laboratory performance and ensure that data quality is acceptable to meet BPOU Project objectives.

Data qualifiers that were assigned during the Tier 1A/1B and Tier 3 reviews are shown with the groundwater-sampling results summarized in Table 5-3. Based on the data validation efforts and the evaluation of field quality control (QC) samples, all analytical sample results are considered usable to support the BPOU Project Data Quality Objectives (DQOs). Results of the Tier 3 review are described as follows:

- No results for VOCs were qualified.
- No results for 1,4-dioxane were qualified.
- No results for nitrate as N, sulfate or perchlorate were qualified.
- The result for NDMA was qualified as UJ (non-detect) due to internal standard area limits for the sample collected on May 30, 2012 in WHICO MP-1 Port 3.
- The result for NDMA was qualified as U (non-detect) due to laboratory blank contamination and field blank contamination for the sample collected on May 30, 2012 in MW 5-28I.

- The results for NDMA were qualified as U (non-detect) due to field blank contamination for the samples collected on May 30, 2012 in WHICO MP-1 Ports 1, 2, 3, 4 and 6.
- The results for NDMA were qualified as UJ (non-detect) due to field blank contamination and percent differences between the initial calibration relative response factor (RRF) and continuing calibration RRF being outside of the limit range for the samples collected on October 22, 2012 in MW 5-03 Ports 5, 6, 7, and 8.

Final Tier 3 validation reports were submitted by LDC to the Watermaster on August 16, 2012 and March 25, 2013 (LDC, 2012 and 2013). The Tier 3 results were submitted by the Watermaster to EPA via e-mail and are also posted on a secure LDC BPOU web portal.

5.2.3 Distribution of Selected Chemicals of Concern

Consistent with previous Annual PE Reports, water-quality data from wells screened at selected depths within the aquifer were interpreted using the three-dimensional geospatial modeling software, EarthVision®. A detailed description of the approach used for the development of plume maps and chemical cross sections for the seven selected COCs is presented in Appendix A. Isoconcentration contours for these seven COCs are shown on the generalized distribution maps on Figures 5-8 through 5-14. The isoconcentration contours shown on the generalized distribution maps represent the composite lateral extent of each individual chemical at all depths in groundwater. The lateral distribution of the selected COCs is also shown in plan view at three specific elevation intervals in Appendix A. The three elevation intervals are as follows:

- Elevations between the water table (or potentiometric surface) and -200 feet msl;
- Elevations between -200 feet and 500 feet msl; and
- Elevations below 500 feet msl.

The plume maps for the three elevation intervals shown in Appendix A include two sets of isoconcentration contours on each map. Isoconcentration contours at “discrete” elevations are shown for horizontal slices through the plumes at -50, -350 and -550 feet msl. Isoconcentration contours for “composite” elevation intervals are also shown through the plumes for elevation intervals extending from the water table to -200 feet msl, between -200 and -500 feet msl, and below -500 feet msl.

Given the three-dimensional nature of the plumes, the reader should consider the three-dimensional visualization that is inset in the corner of each figure when reviewing the two-dimensional plume maps and chemical cross sections. The three-dimensional visualizations provide the appropriate context within which to review the two-dimensional isoconcentration contours shown on each plume map and chemical cross section. It should be noted that the water-quality data used to create the three-dimensional plume interpretations are posted on the plume maps according to the composite elevation intervals described above. Therefore, in many instances the discrete contours may not appear to correspond to water-quality data that are within the composite elevation interval but that are either above or below the elevation of the discrete contours.

Chemical cross sections showing the vertical distribution of selected COCs along four discrete transects are also shown in Appendix A. Cross section A-A’ represents a north-south transect that is aligned

generally with the longitudinal axis of the COC plumes. Cross sections B-B', C-C', and D-D' represent east-west or northwest-southeast transects that are aligned generally perpendicular to the dominant groundwater flow direction in the BPOU. Cross sections B-B', C-C', and D-D' show the distribution of the COC plumes in the upgradient, mid-plume, and downgradient areas of the BPOU and include various production wells that are vulnerable to lateral migration of COC plumes towards the west or east.

The depictions of plume geometry presented in Appendix A and summarized on Figures 5-8 through 5-14 represent the estimates of the distribution of the COCs in the BPOU in 2012. However, as with any approach used to interpolate data between known data points, there are uncertainties and limitations to the approach that may result in alternative interpretations of the distribution of COCs in groundwater. These uncertainties and limitations are summarized as follows:

- For clarity, and as requested by EPA, we have depicted the seven principal COCs in separate plume maps at three elevations. Plumes for the various COCs overlap (and/or diverge) at various depths throughout the impacted areas.
- The plume maps and chemical cross sections attempt to depict the dynamic and temporally changing three-dimensional distribution of COCs in groundwater with static two-dimensional images. While these maps and cross sections show two-dimensional isoconcentration contours of the COC plumes in plan view and in profile, they represent interpolated approximations of the distribution of COCs in groundwater based on available data. The exact subsurface distribution of the COCs cannot be completely ascertained given these and other potential limitations. The spatial and temporal spread of the chemical data may not encompass the entire distribution of chemicals in the groundwater (i.e., additional assumptions are necessary as to chemical concentrations in areas that may not be completely represented by monitoring wells). In particular, results of the interpolation should be carefully evaluated in areas where available data are limited or concentrations change significantly over short distances.
- Alternative interpretations of the distribution of the COC plumes are possible and may differ from the plume depicted here by utilizing plumes drawn manually using professional judgment. For example, plume maps and chemical cross sections for certain COCs portray discontinuous plumes in areas where the plumes may in fact be continuous.
- As described in Appendix A, the plume interpretations generally incorporate water-quality data collected in May 2012. However, where data were not available for that time period, data from the next closest date during the May through October 2012 time period were utilized. While using such an expanded data set is helpful to some degree in the contouring exercise, it introduces additional uncertainties in comparing data taken from different time periods and assuming that the ultimate projection is a consistent one. Moreover, even using this temporally diverse data set, there are inevitable gaps in the existing data that limit our ability to define the distribution of COCs in groundwater completely. In addition, the EarthVision® software used to create the plume maps and chemical cross sections utilizes certain algorithms to interpolate or "fill in" data gaps in order to provide a more comprehensive picture of the distribution of COCs. Although the EarthVision® software objectively applies the selected interpolation scheme, other software and other interpolation

schemes may be applied that may generate reasonable, yet differing, results, each appropriately honoring the available monitoring data. This is not a unique limitation of the EarthVision® software, but simply a limitation of any methodology with limited data. Consequently, the interpretation may result in differences between actual and interpreted concentrations at any given point in the area of interest.

- The Duarte Fault is represented as a diffuse zone of faulting on the plume maps and chemical cross sections. However, no faulting was explicitly represented in any way in the three-dimensional grid used to interpolate the plumes. The diffuse fault zone is considered to be a reasonable representation of the uncertainty in the fault's location as it has several fault splays concealed beneath alluvial deposits.
- The northern-most limits of some COCs depicted on the plume maps are uncertain due to the limited amount of data available to the CR group from other EPA-named PRPs, including the Mobil/Lockheed/Valspar group, as well as other entities that may be PRPs in the northern portions of the BPOU. In consideration of the lack of recent available groundwater data from several PRP facilities and historical detections of several COCs such as TCE and PCE in the area north of the Duarte Fault zone, isoconcentration contours for TCE and PCE are truncated at the downgradient (southern) extent of the Duarte Fault zone.

Evaluation of both the generalized plume maps shown on Figures 5-8 through 5-14 and the detailed elevation-specific plume maps and chemical cross sections that are shown in Appendix A resulted in the following general observations of the spatial distribution of COCs in the BPOU:

- The longitudinal extent of the longest COC plumes extends from north of the Duarte Fault zone in Subarea 1, approximately 7.5 miles towards the southwest, where the plumes terminate near the confluence of Avocado Creek and the San Gabriel River.
- The maximum lateral extent of the various COC plumes generally overlap throughout their extent, with the exception of the perchlorate plume, which extends slightly farther to the east in the mid-plume area in comparison to other COC plumes.
- The vertical extent of the various COC plumes ranges from depths of approximately 600 feet below ground surface (bgs) to the north of Arrow Highway, in Subarea 1, to approximately 1,000 feet bgs in Subarea 3.

In addition to the general observations described above, minor changes in the COC concentrations in various wells resulted in slightly different interpretations of the extent of the COC plumes compared to the previous year. In particular, concentrations of COCs in several wells that are located near the edges of the plumes changed relative the respective MCL (or NL); the concentrations of some COCs in some wells located near the edges of the plumes increased above MCLs (or NLs) whereas the concentrations of some COCs in some wells decreased below MCLs (or NLs). Such changes in concentration resulted in a slightly different location of the isoconcentration contours at the MCL (or NL) compared to the previous year. Changes in the concentrations of COCs relative to the MCL (or NL) that resulted in a different location of the isoconcentration contours at the MCL (or NL) compared to the previous year are as follows:

- In Subarea 3, the interpreted 1,2-DCA plume does not extend as far south at shallower elevations compared to the previous year due to a lack of detections in Port 5 of MW-5-19 and SGVWC B6C, as seen in Figure A-2. However, the interpreted 1,2-DCA plume extends further southwest at deeper elevations due to the concentrations in SGVWC B5E and MW 5-20 (Port 1) as shown on figures A-3 and A-5.
- In Subarea 1, the interpreted 1,4-dioxane plume extends further east due to higher concentrations of 1,4-dioxane in WHICO MP-1, MW 5-11 (Port 3), ALR MW-1R, and ALR MW-8 as shown on Figure A-9.
- In Subarea 3, the interpreted 1,4-dioxane plume extends further southwest due to higher concentrations of 1,4-dioxane in MW-5-19 (Port 4) and appears narrower due to a lower concentration in LPVCWD 2 as shown on Figure A-10.
- In Subarea 1, the northeastern extent of the interpreted carbon tetrachloride plume appears to be significantly reduced due to non-detect values in AJMW-2R, AJMW-4, ALR MW-9, WHICO MP-1 (Port 5) and MW 5-11(Port 3) as shown on Figure A-16.
- In Subarea 3, the interpreted carbon tetrachloride plume appears to be narrower due to the non-detect values in VCWD Paddy Lane, port 4 of MW 5-08 and LACO Key as seen in Figure A-16.
- In Subarea 3, the NDMA concentrations in VCWD Paddy Lane and port 6 of MW 5-24 have decreased below 100 ng/L, modifying the shallowest part of the interpreted higher concentrations of the NDMA plume as shown on Figure A-23. NDMA concentrations above 100 ng/L in SGVWC B5E, SGVWC B26B, and SGVWC B6D extend the interpreted higher concentrations in the plume to lower elevations, as shown on figures A-24 and A-25.
- In Subarea 1, the interpreted perchlorate plume does not extend as far to the east in comparison to the previous year due to lower concentrations in the SA1-1 and VCWD Morada wells as shown on Figure A-30. The interpreted perchlorate plume appears to extend further to the north than the previous year due to higher concentrations in the AJ MW-2R, AJ MW-4, AJ MW-6 and ALR MW-9 wells as shown on Figure A-30.
- In Subarea 3, the deepest part of the interpreted perchlorate plume does not extend as far to the east as the previous year due to a lower concentration in SWS 139W6, as shown on Figure A-32.
- In Subarea 1, the interpreted PCE plume extends further east incorporating ALR MW-1R and ALR MW-8 as seen in Figure A-37 and does not extend as far to the west as the previous year's plume due to lower concentrations in AJ MW-2R, AJ MW-4 and AJ MW-6, as shown on Figure A-32.
- In Subarea 1, the higher concentrations of the interpreted TCE plume at shallow elevations extend farther north compared to the previous year's plume to include Huffy MW-1 and Huffy MW-2. Lower concentrations of TCE in MW 5-11 (port 3), WHICO MP-1 (port 4), MW 5-13 (port 4), AJ MW-2R, AJ MW-4, and ALR MW-9 result in the higher concentration of the interpreted plume not extending as far south as it had the previous year, as seen in Figure A-

44. In Subarea 3, the deepest part of the interpreted TCE plume does not extend as far to the west due to a lower concentration in SGVWC B25B and extends further south to include MW 5-20 (Port 1) as shown on Figure A-46.

When reviewing the evaluation presented above, apparent changes in the interpreted spatial distribution of a particular COC plume from year to year should be evaluated with considerable caution. Historical variations in chemical concentrations have been observed seasonally and from year to year as basin water levels vary. In some instances, very slight differences in measured concentrations at or above the RL, or values that are qualified (J-flagged) may result in apparent changes in the interpreted extent of a particular COC plume as depicted on the plume maps and chemical cross sections. Such short-term changes in the interpreted extent of a particular COC plume may or may not be representative of a particular seasonal or annual change. But, particularly with concentrations that are measured at very low levels, such apparent short-term changes should not be considered as representative of longer-term (multi-year) trends until such observations can be confirmed over several years. This is particularly important for wells located along the perimeter of the COC plumes.

5.2.4 Temporal Trends

Temporal trends in chemical concentrations for the seven selected COCs were evaluated by updating time-concentration graphs for all wells in the PSEP water-quality monitoring network as presented on Figures 5-15 through 5-21. Time-concentration graphs were updated for selected multiport wells included in the BPOU water-quality monitoring program for the most recent five-year period from 2008 through December 2012 using available data in the BPOU Project database. The graphs include data that were collected for BPOU performance monitoring activities as well as DPH and other regulatory agency monitoring requirements. Concentrations of chemicals detected in groundwater samples are plotted using closed circles; chemicals not detected in groundwater samples were plotted at the RL using open circles. Groundwater-quality results in multiport monitoring wells are grouped on the time-concentration graphs according to measurement port elevations in three elevation intervals as follows: between the water table and -200 feet msl, between -200 and -500 feet msl, and below -500 feet msl.

Based on a review of the time-concentration graphs shown on Figures 5-15 through 5-21, the following observations were noted:

- Monitoring wells MW 5-11, MW 5-13, and MW 5-18 are located in the upgradient area of the COC plumes, north of Arrow Highway in the Subarea 1 portion of the BPOU. These wells are considered to be general indicators of the quality of groundwater that is flowing toward downgradient extraction wells installed for the VCWD Lante Subproject. Concentrations of most COCs in these wells were generally consistent in 2012 in comparison to the previous year with a few exceptions: NDMA increased in Port 2 of MW 5-11 and PCE increased in Port 3 of MW 5-18.
- Monitoring wells MW 5-24 and MW 5-25 are located in the south of Arrow Highway downgradient of the Subarea 1 extraction wells. As a result, these wells are considered to be general indicators of the quality of groundwater that is flowing downgradient away from the Subarea 1 extraction wells. Monitoring results for these wells were generally consistent with

previous year's concentrations with the following exceptions: NDMA concentrations increased above the MCL in Port 2 of MW 5-24 and in Port 5 of MW 5-25.

- Monitoring wells MW 5-05, MW 5-08, and MW 5-15 are located in the mid-plume area of the COC plumes, downgradient of Subarea 1 and upgradient of Subarea 3. These wells are considered to be general indicators of the quality of groundwater that is flowing downgradient toward the SGVWC B5, SGVWC B6, and LPVCWD Subproject extraction wells. Concentrations of COCs remain generally unchanged in these multiport wells compared to the previous year, with COC concentrations below applicable MCLs and NLs.
- Monitoring wells MW 5-19 and MW 5-23 are located within Subarea 3, upgradient of the SGVWC B5 Subproject extraction wells and the CDWC Bassett wellfield. These wells are considered to be general indicators of groundwater quality in the southern portion of the BPOU and representative of the quality of groundwater that is flowing downgradient toward the SGVWC B5 Subproject extraction wells and CDWC Bassett wellfield. Concentrations of most COCs remain generally unchanged in these two multiport wells compared to the previous year with the exception of ports 3 and 4 in MW 5-19, which indicated increases of PCE concentrations to above the MCL.
- Monitoring wells MW 5-26 and MW 5-27 are located within Subarea 3, downgradient of the SGVWC B5 Subproject extraction wells and the CDWC Bassett wellfield. These wells are considered to be general indicators of groundwater quality in the southern portion of the BPOU and representative of the quality of groundwater that is flowing downgradient away from the SGVWC B5 Subproject extraction wells and CDWC Bassett wellfield. Monitoring results for these wells were generally consistent with previous years.

Observed increases or decreases in the concentration of a particular COC during a single sampling event should not be considered as a significant change in the overall trend of chemical concentrations at a particular well. Historical variations in chemical concentrations have been observed seasonally and from year to year as basin water levels vary.

5.3 Groundwater Modeling Results

As described in Section 3.3, the BPOU groundwater model was updated with pumping and recharge data through the end of WY2011-12 and recalibrated for a 30-year simulation period extending from WY1982-83 through WY2011-12. The adequacy of groundwater model calibration continued to be evaluated using water level observations at 76 monitoring and production well locations that were selected as long-term basin-wide calibration targets, including 36 targets located in the BPOU area. Water level observations for WY2011-12 were updated from the San Gabriel Basin Database, California Department of Water Resources, LACDPW, the United States Geological Survey National Water Information System, and from data collected as part of the PSEP monitoring program.

5.3.1 Updated Model Calibration Results

Updated model calibration statistics are summarized in Table 5-6. The average basin-wide model residual (the average difference between model simulated and observed heads) for the 30-year simulation period is 0.70 feet. The average model residual for the 36 observation wells within the BPOU

area is 0.48 feet for the same period. The root-mean squared error (RMSE) for the calibrated model is 16.00 feet for the entire model and 6.42 feet for the BPOU area. The updated annual model water balance for each water year is summarized in Table 5-7.

In the BPOU, simulated and observed water levels for the entire 30-year model simulation period are compared on hydrographs that are presented on Figures 5-22 through 5-26. As shown on the figures, simulated water levels in the Subarea 1 (Figures 5-22 through 5-24) and Subarea 3 (Figures 5-25 and 5-26) portions of the BPOU generally are within six feet of observed water levels throughout the 30-year model simulation period. However, in Subarea 3, simulated water levels in the shallowest ports in MW 5-23 (ports 4 through 6), generally are underestimated by up to 15 feet (Figure 5-25). These differences are most likely attributable to the smaller (local) scale of heterogeneities that are present in the aquifer compared to the broader scale of heterogeneities that are represented in the model. Potentiometric surfaces simulated using the BPOU groundwater model are compared to observed water levels in Fall 2011 and Spring 2012 on Figures 5-27 through 5-34. The simulated results were exported from the model for approximately the same time period as the observed water levels. As shown on Figures 5-27 and 5-28, simulated water levels in Subarea 1 are generally within five feet (higher and lower) of observed water levels in Fall 2011and generally about 10 feet lower than observed water levels in Spring 2012. Simulated potentiometric surfaces in Subarea 3 are compared to observed water levels on Figures 5-29 through 5-34 for three different elevations intervals, including above -200 feet msl, between -200 and -500 feet msl, and below -500 feet msl. These elevation intervals correspond to the approximate elevations of hydrostratigraphic separating units interpreted in Subarea 3. As shown on Figures 5-29 through 5-34, simulated water levels at all three elevation intervals in Subarea 3 are generally within five feet (higher and lower) of observed water levels in Fall 2011 and generally within 10 feet (higher and lower) of observed water levels in Spring 2012. Locally, differences occur in the immediate vicinity of the SGVWC B5 and CDWC pumping wells above -200 feet msl in Subarea 3 (Figures 5-29 and 5-32). The largest differences likely occur in this area because CDWC frequently cycles their pumping between different wells as compared to the average pumping rates that are simulated using quarterly stress periods in the model.

In summary, the BPOU groundwater flow model provides an accurate representation of water level conditions for the purpose of simulating extraction system performance. The overall quality of the model calibration demonstrates that the model is capable of adequately simulating transient water levels and groundwater flows for the entire 30-year period of the historical observations and is capable of simulating the historical minimum and maximum water levels and groundwater flows that occur in response to changes in recharge and pumping stresses.

5.3.2 Results of Performance Evaluation Simulations

As described in Section 3.3.2, groundwater flow simulations with forward particle tracking were performed on quarterly basis to evaluate the performance of the groundwater extraction system as requested by EPA. Simulations were performed by simulating groundwater flow conditions and actual groundwater extraction for four transient three-year periods through the end of each quarterly period of WY2011-12. Results of transient three-year model simulations of extraction system performance are presented in plan view for Subarea 1 on Figures 5-35 through 5-38. Results for Subarea 3 are presented in plan view at three elevation intervals on Figures 5-39 through 5-50. Figures 5-51 through 5-54 present the particle

tracking results in cross section. Particle tracks are color coded on these figures; particles that are captured by project extraction wells are shown as green tracks, particles captured by the CDWC production wells are shown in blue, and particles not captured during the three-year simulation period are shown in gray. Starting particle locations are shown on the figures as solid circles located at the upgradient end of each particle track. As described in Section 3.3.2, the starting locations for the particles were assigned to provide a generalized representation groundwater originating within the approximate horizontal and vertical extent of various COCs in areas upgradient of the Subarea 1 and Subarea 3 extraction wells. To aid the reader in evaluating the results, the interpreted extent of the TCE plume in 2011 is shown on Figures 5-35 through 5-54 for reference.

Given the limitations of quarterly forward particle tracking results described in Section 3.3.2, depictions of short-term hydraulic control presented in this report should not be considered representative of long-term extraction system performance. Additional discussion of forward particle tracking results in relation to remedy performance is presented in Section 7.1.4.

5.4 Groundwater Extraction and Chemical Mass Removal

Monthly groundwater extraction volumes for 2012 were compiled from monthly reports submitted to DPH and EPA in monthly progress reports. Groundwater extraction volumes for all extraction wells that were operational in 2012 are shown in Table 2-1. Average monthly and average annual extraction rates are also provided in Table 2-1 together with design extraction rates for each extraction well, target operational extraction rates, and EPA-approved extraction rates for each well. Design extraction rates are based on the peak design capacity of the treatment plants whereas target operational extraction rates generally assume ten percent downtime for each well for treatment plant maintenance. The EPA-approved extraction rates shown in Table 2-1 are based on groundwater flow model simulations performed in 2000 and 2001 and represent the average extraction rates necessary to achieve the remedial action objectives.

Estimates of chemical mass removed from extracted groundwater in 2012 for the VCWD Lante, LPVCWD, SGVWC B6, and SGVWC B5 Subprojects are presented in Section 6.0.

6.0 TREATMENT PLANT PERFORMANCE RESULTS

This section presents a summary of the 2012 operational performance results for the BPOU Subproject treatment plants.

6.1 Subarea 1 – Valley County Water District Lante Subproject

As described earlier in this report, the VCWD Lante Treatment Plant operated throughout 2012. Approximately 8,579 acre-feet of groundwater were extracted and treated from the production wells equating to an annualized production rate of approximately 5,301 gpm.

Water-quality data collected from the individual production wells and from the fully treated water are summarized in Table 6-1. A single sample was collected from SA1-2 in May 2012. Table 6-1 also includes the design concentrations and expected average influent concentrations for the VCWD Lante Treatment Plant together with applicable MCLs and NLs for the COCs. Raw water concentrations for the compounds reported in Table 6-1 did not exceed design concentrations. No COCs were detected at concentrations exceeding MCLs or NLs in the fully treated water. Figures 6-1 to 6-15 illustrate raw and treated water concentration trends relative to the applicable MCL or NL. With the exception of nitrate and sulfate, SA1-3 consistently showed higher concentrations of the COCs than SA1-1. In general, COC concentrations appeared to be relatively constant or slightly decreasing in the two production wells. One exception to this was nitrate. For both wells SA1-1 and SA1-3, nitrate concentrations increased slightly over the course of the year. SA1-1 remained above the MCL, while SA1-3 was below the MCL throughout the year. In 2011, NDMA showed a slightly increasing trend in SA1-1 during the summer months. This, however, was not the case in 2012, where NDMA concentration remained relatively constant or had a slight decreasing trend. Previously concentrations of 1,1-DCE in SA1-1 showed increasing trends during the first part of 2011, but in 2012, concentrations decreased throughout the entire year at concentrations below the MCL. Carbon tetrachloride, PCE, TCE, and cis-1,2-DCE concentrations in SA1-3 displayed a steady decrease during the first three quarters of 2012, but increased during the fourth quarter. Concentrations of 1,2,3-TCP in SA1-3 decreased throughout 2012. The decreasing trend in 1,2,3-TCP concentrations observed in SA1-3 during 2012 appears to be a continuation of the decreasing trend observed in 2011. Compared to 2011, NDMA concentrations in SA1-3 were below the MCL of 0.01 μg/L throughout most of 2012; only August and April showed concentrations above the MCL, whereas in 2011, all samples taken throughout the year had elevated concentrations. Treated water COC concentrations remained below the MCLs/NLs. COC concentrations in the treated water were generally below detection limits, except for nitrate, where concentrations in treated water displayed a slight increase during 2012. However, the nitrate highest detection in the fully treated water was 20 μg/L, well below the MCL of 45 μg/L. Average concentrations for the raw water influent to the treatment plant are summarized in Table 6-2.

Mass removed was calculated by using the average raw water concentration for each COC from each of the three production wells and multiplying that result by the volume of water treated, with the appropriate dimensional conversion. In these calculations, concentrations below the detection limit were treated as zero. For the compounds considered, approximately 4,352 pounds of chemical mass were removed by the VCWD Lante Treatment Plant in 2012. This is approximately 60 percent of the 7,024 pounds of mass removed in 2011. The decrease in total mass removed is partly a result of lower concentrations of COCs

in the influent waters. As stated above, the extracted water continues to be treated to below drinking water standards. Similar to 2011, perchlorate, TCE, PCE, 1,1 DCE and cis-1,2-DCE represent most of the total mass removed, with TCE and PCE representing the vast majority of the total mass removed. The chemical mass associated with the approximately 127 acre-feet of water extracted from SA1-2 in May and June of 2012 was not included in the estimated 4,352 pounds of chemical mass removed. The chemical mass in the SA1-2 water could not be estimated because SA1-2 was not sampled for VOCs during its brief operation in 2012.

Inlet and exhaust air quality data for 2012 are summarized in Table 6-3 for the four air strippers and carbon off-gas abatement systems. As expected from water-quality data, PCE, TCE, 1,1-DCE, and cis-1,2-DCE were the primary VOCs detected in the vapor phase. Elevated concentrations of Freon-12 and chloroform were also observed in the vapor phase. Table 6-4 provides a summary of air risk and hazard calculated from compounds detected in the air exhaust. Risk was calculated using SCAQMD Tier 4 procedures and compared against ARARs. Calculated risk and hazard values were below ARARs for the MICR, acute hazard, chronic hazard, and cancer burden.

In 2012, the VCWD Treatment Plant discharged approximately 91,298,191 gallons of waste brine to the LACSD sewer with an annual average discharge rate of approximately 173 gpm, which was greater than the 131 gpm averaged in 2011. Discharges met permit requirements. Per LACSD discharge permit revision, continuous pH monitoring is no longer required. Continuous pH values have not been recorded since Dec. 7, 2010. Brine flow data are summarized in Table 6-5.

6.2 Subarea 3 – La Puente Valley County Water District Subproject

In 2012, the average annual flowrate at the LPVCWD Treatment Plant was 2,127 gpm, which was slightly below the EPA-approved extraction rate of 2,250 gpm. Approximately 3,444 acre-feet of groundwater were extracted during 2012. LPVCWD 5 extracted the majority of water treated from July until December 2012. Water-quality data are summarized in Table 6-6. Figures 6-16 to 6-26 illustrate raw and treated water concentration trends relative to the applicable MCL or NL for selected COCs. All treated water concentrations were below the MCLs and NLs. With the exception of nitrate, COC concentrations in LPVCWD 2 were greater than those observed in LPVCWD 3 and LPVCWD 5. Approximately 2,500 acre-feet of water was extracted from LPVCWD 5, as compared to 940 acre-feet from LPVCWD 2 and LPVCWD 3 combined. For most COCs, concentrations were generally stable to decreasing during the year. However, NDMA concentrations in LPVCWD 2 showed an increasing trend during 2012. COC concentrations in the primary extraction well, LPVCWD 5, were either steady or showed a slight decreasing trend during 2012. 1,2-DCA, CTC, 1,4-dioxane, perchlorate, and cis-1,2-DCE concentrations in LPVCWD 5 typically have a slight increase in concentration during the summer months.

Average chemical concentrations for the treatment plant raw water influent are summarized in Table 6-7 together with the volume of water treated and the total mass removed per chemical. In these calculations, concentrations below the detection limit were treated as zero. For the COCs considered, approximately 472 pounds of chemical mass were removed from the aquifer. This is less than the 639 pounds removed in 2011. The decrease in mass removal is mainly a result of the decrease in production during 2012.

Air quality data collected weekly from the Small Tower and Large Tower inlet and outlet are summarized in Table 6-8. A summary of the air risk and hazard associated with the off-gas GAC systems is provided in Table 6-9. The MICR, acute hazard, chronic hazard, and cancer burden ARARs were not exceeded in 2012.

Because brine discharges from the ISEP were eliminated when perchlorate treatment changed to single pass ion exchange, only about 14,819 gallons of waste water was discharged to the LACSD sewer in 2012. Waste water flows are summarized in Table 6-10. Permit revisions from 2011 no longer require pH monitoring. Discharges met permit requirements.

6.3 Subarea 3 – San Gabriel Valley Water Company B6 Subproject

In 2012, the average annual flowrate at the SGVWC B6 Treatment Plant was 2,980 gpm, which was below the EPA-approved extraction rate of 6,500 gpm, due to operational problems associated with the ISEP. Approximately 4,827 acre-feet of groundwater were extracted and treated in 2012.

SGVWC B6 Treatment Plant raw water-quality data are collected monthly and treated water data are collected weekly (Table 6-11). Table 6-11 also includes the design and expected average influent concentrations for the SGVWC B6 Treatment Plant together with applicable MCLs and NLs for the COCs. In general, raw water concentrations did not exceed design concentrations at the SGVWC B6 plant. However, in wells B26B and B25B, carbon tetrachloride concentrations exceeded design concentrations in 17 samples, cis-1,2-DCE levels in B25A exceeded design concentrations in one sample, B26B and B6D contained TCE at concentrations above design concentrations in four samples, and well B25A contained 1,1-DCE above design concentrations in three samples.

On February 24 and March 5, 2012 perchlorate concentrations in the fully treated water exceeded the MCL. SGVWC notified CDPH of the exceedances and also conducted public notifications. SGVWC corrected the three-way valve in the ISEP that was believed to be the cause of the problem. No perchlorate exceedances occurred for the remainder of 2012. No other COCs were detected at concentrations exceeding MCLs or NLs in the fully treated water.

Figures 6-27 to 6-38 illustrate raw and treated water concentration trends relative to the applicable MCL or NL. In general COC concentrations in the extraction wells displayed a stable or slightly decreasing trend through the year. Well B6D appears to be an exception, displaying an increasing trend in many of the COCs. PCE concentrations in Well B25A overall had a decreasing trend which contrasts from the increasing trend observed over the past two years. However, PCE concentration in B25A is significantly higher than the other wells. In Well B25A, both cis-1,2-DCE, and 1,1-DCE decreased from 2011 to 2012, and TCE remained stable. Well B25A also showed a slight increasing trend in nitrate from 2011 levels.

Average chemical concentrations for raw influent to the treatment plant are summarized in Table 6-12, together with the volume of water treated and the total mass removed per chemical. In these calculations, concentrations below the detection limit were treated as zero. For the compounds considered, approximately 1,099 pounds of chemical mass were removed from the aquifer, which represents a decrease from 2011 (2,036 pounds removed). Carbon tetrachloride, perchlorate, PCE, and TCE represented nearly 93 percent of the mass removed, with TCE and perchlorate alone accounting for 79 percent of the mass removed.

SGVWC B6 Treatment Plant air quality data are summarized in Table 6-13. Table 6-14 provides summary of air risk and hazard calculated from compounds detected in the air exhaust. Risk was calculated using SCAQMD Tier 4 procedures and compared against ARARs. The annual 52-week average rolling MICR ARAR of 1×10^{-6} was not exceeded in 2012. The acute hazard, chronic hazard and cancer burden ARARs were also not exceeded in 2012.

The SGVWC B6 Treatment Plant discharged approximately 30,653,921 gallons of waste brine to the LACSD sewer in 2012 equating to an average flowrate of 76 gpm. Brine flows are summarized in Table 6-15. Permit revisions from 2011 no longer require pH monitoring. Discharges met permit requirements.

6.4 Subarea 3 – San Gabriel Valley Water Company B5 Subproject

The average annual extraction rate for the SGVWC B5 Subproject was about 7,569 gpm, which exceeded the EPA-approved extraction rate of 7,000 gpm. Approximately 12,244 acre-feet of water were extracted and treated.

Raw and treated water-quality data for the SGVWC B5 Treatment Plant are provided in Table 6-16, which also includes the design and expected average influent concentrations for the SGVWC B5 Treatment Plant and applicable MCLs and NLs for the COCs. Raw water concentrations did not exceed design concentrations in the production wells. COCs were not detected at concentrations exceeding MCLs or NLs in the fully treated water during 2012. Figures 6-39 to 6-47 show raw and treated water concentration trends relative to the applicable MCL or NL. COC concentrations in the raw water were relatively constant or displayed slightly decreasing trends during 2012, with the following exceptions. Consistent with 2011 data, TCE and 1,2-DCA concentrations in B5E showed an increasing trend in 2012, PCE concentrations in COI 5 continued the increasing trend observed in 2011. A slight increase in PCE concentrations was observed in B5B during 2012. Perchlorate concentrations in B5E decreased during the first half of 2012, but then displayed an increasing trend after May. Concentrations of 1,4-dioxane and 1,2-DCA did not exceed their respective MCLs in any of the extraction wells. With the exception of PCE, COCs monitored in COI 5 during 2012 did not exceed their respective MCLs or NLs. Although B5B NDMA concentrations increased slightly during 2011, they remained stable throughout 2012.

Average chemical concentrations for the raw influent to the treatment plant are summarized in Table 6-17, together with the volume of water treated and the total mass removed per chemical. In these calculations, concentrations below the detection limit were treated as zero. For the compounds considered, approximately 604 pounds of chemical mass were removed from the aquifer, compared to 526 pounds in 2011. Perchlorate accounted for nearly 41percent of the mass removed. Perchlorate, PCE, and TCE represented approximately 92 percent of the mass removed.

7.0 EVALUATION OF REMEDY PERFORMANCE AND TREATMENT PLANT OPERATIONS

7.1 Groundwater Extraction System Performance

As described in the PSEP and Section 3.0 of this report, the evaluation of remedy performance involves both short-term and long-term evaluation of groundwater extraction system performance. Annual PE Reports evaluate the short-term performance of the groundwater extraction system using groundwater modeling and empirical data to assess whether extraction well operation is limiting further migration of

groundwater contamination into less contaminated areas. Groundwater extraction system performance is discussed in the following sections.

7.1.1 Extraction Well Performance

As described in the PSEP and Section 3.0 of this report, the evaluation of remedy performance involves both short-term and long-term evaluation of groundwater extraction system performance. Annual PE Reports evaluate the short-term performance of the groundwater extraction system using groundwater modeling and empirical data to assess whether extraction well operation is limiting further migration of groundwater contamination into less contaminated areas. Groundwater extraction system performance is discussed in the following sections. The CRs are currently performing more detailed evaluations of groundwater extraction system performance in both Subareas 1 and 3. The CRs submitted an evaluation of extraction system performance for Subarea 1 in August 2012 (CDM Smith, 2012) and anticipates the submittal of an analysis of the Subarea 3 extraction system by the end of March 2013.

Based on step-drawdown testing, aquifer testing, and DPH-permitted operation, the VCWD Lante, LPVCWD, SGVWC B6, and SGVWC B5 Subproject wells are capable of achieving design extraction rates. In addition to the three existing and permitted wells, SA1-1, SA1-2, and SA1-3, VCWD and the CRs are evaluating the use of the Arrow well as an alternative extraction location based on lower nitrate concentrations and higher mass removal. Rehabilitation of Well SA1-2 was completed in January of 2012 and redevelopment performed in March 2012 and the well remains on standby status due to elevated nitrate concentrations. LPVCWD 5 replaced LPVCWD 2 and 3 as the primary extraction well at the LPVCWD Subproject in early 2009. However, from January to June of 2012 the majority of water extracted at LPVCWD came from LPVCWD 2 and 3. LPVCWD 5 functioned as the primary extraction well from July to December. The CRs are evaluating various pumping alternatives at the SGVWC B6 Subproject to flow balance nitrate loading among the four extraction wells, B25A/B and B26A/B. During 2012, the SGVWC B6 extraction wells operated below design capacities due to the ISEP operational limitations. At SGVWC B5, the COI 5 well was permitted and became operational in 2009. SGVWC B5 planted exceeded its design extraction capacity during 2012, with the majority of the raw water coming from wells B5B, B5E and COI 5.

7.1.2 Groundwater-Quality Trends

Spatial and temporal trends in groundwater quality in the BPOU as observed during 2012 are described in Sections 5.2.3 and 5.2.4. Short-term changes in groundwater quality are observed seasonally and from year-to-year. These short-term changes occur primarily in response to variations in both local and regional groundwater flow conditions throughout the Basin. Changes in groundwater quality that result from the operation of the remedy will likely be discernable only over longer timeframes (e.g. 5 to 10 or more years of continuous operation of the project extraction wells).

7.1.3 Groundwater Extraction and Chemical Mass Removal

The VCWD, LPVCWD, SGVWC B6, and SGVWC B5 Treatment Plants were all operational in 2012.

- The VCWD Treatment Plant operated at 5,301 gpm, or about 88% of the EPA approved average annual extraction rate of 6,000 gpm. Although production in 2012 increased from 2011, production remained below the EPA-approved extraction rate mainly due to ISEP limitations and elevated nitrate.
- The LPVCWD Treatment Plant achieved an annual average extraction rate of 2,127 gpm, which is 94.5% the EPA-approved extraction rate of 2,250 gpm. LPVCWD operated using LPVCWD 5 as the primary well in January and from July to December of 2012, with production supplemented by LPVCWD 2 and 3 when LPVCWD 5 was offline.
- The SGVWC B6 Treatment Plant experienced continued operational problems with the ISEP systems throughout the year. Due to high back pressure on the ISEP units the SGVWC B6 treatment plant capacity was limited. In September, the a maximum flowrate was reduced to about 2,600 gpm, and reduced again in December to 2,200 gpm. The B6 Treatment Plant operated at 2,980 gpm, or about 46% of the 6,500 gpm EPA approved average annual extraction rate.
- The SGVWC B5 Treatment Plant operated at an annual average flowrate of 7,569 gpm, exceeding the EPA-approved extraction rate of 7,000 gpm.
- Overall, BPOU extraction from the combined four primary treatment facilities averaged 17,977 gpm on an annual basis, compared to the EPA-approved extraction rate of 21,750 gpm, or approximately 83% of the target operational rate of 23,350 gpm.

The chemical mass removed at the VCWD Lante, LPVCWD, SGVWC B6 and SGVWC B5 Treatment Plants was 4,352 pounds, 472 pounds, 1,099 pounds, and 604 pounds, respectively. The BPOU project-wide total mass removed in 2012 was 6,526 pounds (2012 combined average extraction rate of 17,977 gpm, or 363 lbs/1,000 gpm), which was less than last year's total of 10,225 pounds (2011 combined average flow rate of 18,893 gpm, or 541 lbs/1,000 gpm). Since 2004, the cumulative chemical mass removed is 58,660 pounds (Table 6-18).

7.1.4 Assessment of Migration Control

As described in Section 5.1 of the PSEP and in Section 3.3 of this report, the BPOU groundwater model is the primary tool for assessing extraction system performance. Evaluations of extraction system performance were performed using the updated BPOU groundwater model and forward particle tracking based on actual pumping and water level conditions from WY2008-09 through WY2011-12. Results of the extraction system performance simulations are presented in Section 5.3 and mass removal is discussed in Sections 6.1 through 6.4. As described in Section 3.3.2, particle tracking results based on short-term simulations of groundwater flow are subject to various limitations and should not be considered representative of long-term extraction system performance.

Based on the evaluation of forward particle tracking results and chemical mass removal rates presented in this report, the following general observations regarding extraction system performance were developed:

- Operation of the VCWD Lante extraction well in 2012 had a significant effect on hydraulic control and chemical mass removal in Subarea 1. Pumping of the SA1-extraction well had a

lesser effect on hydraulic control and chemical mass removal due to the location of this well in relation to the distribution of COCs, and the resultant lower COC concentrations in groundwater extracted from this well. The SA1-2 extraction well was operated in only May of 2012.

- Although the SGVWC B6 Subproject extraction wells continued to experience reduced pumping rates in 2012 because of operational problems associated with the ISEP treatment system, groundwater extraction from these wells contributed to hydraulic control and chemical mass removal in Subarea 3.
- Operation of the SGVWC B5 extraction wells combined with the operation of the CDWC production wells provided significant hydraulic control in the downgradient portion of Subarea 3 in 2011, although mass removal at SGVWC B5 was significantly lower than for other BPOU extraction and treatment facilities, particularly when considering the volume of water treated. Consistent with previous years, operation of the COI No. 5 extraction well provided little benefit relative to hydraulic control or chemical mass removal.
- The operation of LPVCWD extraction well(s) continue to provide consistent hydraulic control and chemical mass removal throughout 2012.

In summary, the overall performance of project extraction wells, as supplemented by production wells in the CDWC Bassett wellfield, continued to limit the migration of COCs in groundwater and removed chemical mass consistent with the Performance Standards established in the PSEP.

7.2 Treatment System Operations

The treatment plant operations that were described in detail earlier in this report are summarized below.

7.2.1 Subarea 1 – Valley County Water District Lante Subproject

The VCWD Lante Treatment Plant operated under its DPH drinking water permit and delivered fully treated water to SWS. The treatment plant reliably treated extracted groundwater to drinking water standards. Improvements, operational problems, and issues that impacted operations and performance in 2012 are provided in Section 2.1.

Future operational improvements include:

- The VCWD Subproject Committee will determine how to proceed with regard to nitrate management, the VCWD ISEP bypass piping, and ISEP modifications;
- Nitrate management alternatives continue to be evaluated;
- VCWD will prepare a UV testing plan to optimize operations of the VCWD UV treatment system; and
- VCWD continues to work towards bringing the single pass IX system into service.

As described in Section 2.1, the CRs completed an evaluation of the effectiveness of the groundwater remedy in Subarea 1 in August 2012 (CDM-Smith, 2012). The evaluation concluded that the Subarea 1 extraction plan could be modified and still achieve remedy objectives. EPA approved a modified

extraction scheme consisting of 5,000 gpm of groundwater extraction in the vicinity of well SA1-3 (either using the Arrow Well or a new well) and 1,000 gpm of extraction from SA1-1. Once the evaluation of nitrate management alternatives is completed in 2013, the revised extraction scheme and plant operational changes to manage nitrate will be implemented.

7.2.2 Subarea 3 – La Puente Valley County Water District Subproject

The LPVCWD Subproject extracted and treated groundwater at an annual rate of about 2,127 gpm, which was 94.5% of the extraction target. The plant reliably treated raw water to drinking water standards for all COCs.

Improvements, operational problems, and issues that impacted operations and performance in 2012 are provided in Section 2.2.1. Future operational issues include:

- Plans continue to be developed to decommission the ISEP system;
- LPVCWD will prepare a cost-benefit evaluation on alternative disposal methods for the two salt tanks from the ISEP facility;
- LPVCWD will prepare a letter to CDPH requesting authorization to use alternative IX resins at the treatment plant;
- LPVCWD will change out the resin at the single pass IX system;
- LPVCWD will review and distribute draft tech memos regarding optimization of dosing of sodium hydroxide and pipe loop testing for dosing of orthophosphate;
- LPVCWD will perform Phase 1 of a study to reconfigure the treatment train; and
- LPVCWD air strippers will be inspected in 2013.

7.2.3 Subarea 3 – San Gabriel Valley Water Company B6 Subproject

The SGVWC B6 Treatment Plant extracted and treated water at an annual rate of 2,980 gpm, primarily limited by continued ISEP operational problems. The downtime of the treatment plant associated with the perchlorate exceedance also significantly reduced the plant production. With the exception of the perchlorate exceedances in February and March 2012, the plant reliably treated raw water to drinking water standards for all COCs.

Improvements, operational problems, and issues that impacted operations and performance in 2012 are provided in Section 2.2.2. Future operational improvements include:

- SGVWC is in the process of purchasing another property as part of the nitrate treatment construction and the CEQA document has been updated accordingly;
- SGVWC B6 air strippers will be inspected in 2013; and
- SGVWC continues to work with CDPH to permit the new perchlorate and nitrate IX treatment systems, which are expected to allow production to meet the original target rate of 6,500 gpm.

As with the VCWD Treatment Plant, the SGVWC B6 Treatment Plant experienced downtime associated with ISEP systems. The operational capacity of the treatment plant capacity was reduced from approximately 6,200 gpm to approximately 2,300 gpm in September 2012 and then again to 2,200 gpm in December 2012 due to the high back pressure on the ISEP units. SGVWC has installed single pass ion exchange treatment to replace the ISEP systems, but these have not yet been tested or permitted because of nitrate management issues. Once the nitrate treatment problem is resolved, the B6 Treatment Plant is capable of achieving the original target extraction rate of 6,500 gpm.

The CRs are in the process of evaluating the Subarea 3 extraction plan and the findings of this evaluation may result in recommended modifications to groundwater extraction from the B6 extraction wells.

7.2.4 Subarea 3 – San Gabriel Valley Water Company B5 Subproject

The SGVWC B5 Treatment Plant operated at an average annual flowrate of 7,569 gpm. The plant reliably treated raw water to drinking water standards for all COCs.

Improvements, operational problems, and issues that impacted operations and performance in 2012 and future operational improvements will include the construction of the SGVWC B5 treated water pipeline.

The CRs are in the process of evaluating the Subarea 3 extraction plan and the findings of this evaluation may result in recommended modifications to extraction from the B5 extraction wells.

8.0 SUMMARY AND RECOMMENDATIONS

Although one of the four operating treatment facilities (SGVWC B6) experienced significant operational interruptions in 2012, operation of project extraction wells as supplemented by production wells and treatment facilities in the CDWC Bassett wellfield continued to limit the migration of COCs in groundwater and removed chemical mass consistent with the remedial objectives established in the UAO. The CRs completed a detailed evaluation of the groundwater extraction system performance in Subarea 1 in August 2012 and anticipate submitting a detailed analysis of Subarea 3 by April 2013. The CRs submitted an evaluation of extraction system performance for Subarea 1 in August 2012 (CDM Smith, 2012) and anticipate the submittal of an analysis of the Subarea 3 extraction system performance by April 1, 2013.

Recommendations and operational issues to be addressed for the BPOU treatment plants in 2013 include:

- Implement the EPA approved modified extraction scheme in Subarea 1 consisting of 5,000 gpm of extraction in the vicinity of well SA1-3 (using the Lante Well and either the Arrow Well or a new well, or by increasing the capacity of the Lante Well) and 1,000 gpm from SA1-1;
- Complete an analysis of the Subarea 3 extraction system performance and submit to EPA by April 1, 2013;
- Complete an assessment of nitrate-related management and/or treatment alternatives for the VCWD Lante Treatment facility;
- Continue to track carbon and resin change outs and provide disposal certificates to EPA in the monthly progress reports;
- Continue inspection and maintenance of the VCWD Lante, LPVCWD, and SGVWC B6 air strippers;
- Continue efforts with CDPH to permit the new perchlorate and nitrate IX treatment systems for the SGVWC B6 Subproject, which are expected to allow production to meet the original target rate of 6,500 gpm; and
- Continue to evaluate and improve operational efficiency of the LPVCWD, VCWD Lante, SGVWC B6, and SGVWC B5 Subprojects.

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