2. EPA Remedial Investigation Field Activities

This section of the RI report summarizes the OU2 field activities conducted by CH2M HILL between March 2004 and July 2007, and additional activities performed in 2009 and 2010. Additional monitoring well construction and groundwater analytical data provided by other parties are included to support the RI objectives, including the development of a hydrogeologic conceptual model of the Omega Site, assessment of the nature and extent of regional groundwater contamination and contaminant sources, assessment of risk to human health and the environment posed by groundwater contamination, and development of a future FS.

The initial planning documents prepared by CH2M HILL include the FSP (CH2M HILL, 2004a) and quality assurance project plan (QAPP; CH2M HILL, 2004b). The FSP provides a detailed description of field methods and sampling protocols associated with the RI. Activities discussed include routine groundwater sampling, well construction and development, aquifer testing, surveying, and containment and disposal of investigation-derived waste (IDW). The FSP was developed in accordance with *EPA Guidance for Preparation of a U.S. EPA Region IX, Field Sampling Plan for EPA-Lead Superfund Projects* (EPA, 1993).

The QAPP presents sampling and analytical protocols, as well as the quality assurance (QA) and quality control (QC) procedures for the RI. Data quality objectives (DQOs) also are included in the QAPP. The QAPP follows EPA guidelines contained in *EPA Guidance for Quality Assurance Project Plans* (EPA, 2002b) and *EPA Requirements for Quality Assurance Project Plans* (EPA, 2001a).

CH2M HILL prepared FSP and QAPP addenda in November 2006 to provide a description of field methods and sampling/analytical protocol for additional field activities including well installation, aquifer testing, discrete (HydroPunch®) sampling, CPT, depth-discrete sampling during well construction, soil gas probe installation and sampling, and in situ soil sampling. The addenda were prepared as supplements to the existing FSP and QAPP; therefore, sections that were previously included in the original planning documents were not repeated.

A summary of the previously mentioned CH2M HILL planning documents is provided as follows:

- *Field Sampling Plan for Omega Chemical Superfund Site Operable Unit 2, Remedial Investigation/Feasibility Study* (CH2M HILL, 2004a)
- *Quality Assurance Project Plan, Omega Chemical Superfund Site Operable Unit 2, Remedial Investigation/Feasibility Study* (CH2M HILL, 2004b)
- *Field Sampling Plan for Omega Chemical Superfund Site Operable Unit 2, Remedial Investigation/Feasibility Study Addendum 1* (CH2M HILL, 2006a)

- *Quality Assurance Project Plan, Omega Chemical Superfund Site Operable Unit 2, Remedial Investigation/Feasibility Study Addendum 1* (CH2M HILL, 2006b)

Three other parties have installed monitoring wells within OU2 that have been sampled by CH2M HILL as part of the RI. These parties include the following:

- **CDM (Consultant for OPOG)** – Constructed 11 monitoring wells (OW1A, OW1B, OW2, OW3A, OW3B, OW4A, OW5B, OW6, OW7, OW8A, and OW8B) at OU1 and OU2 between 1996 and 2006, as part of the OU1 RI. Boring logs, downhole geophysical logs, and well completion diagrams are included in Appendix A.1. CDM has performed groundwater sampling of these wells on a semiannual basis. CH2M HILL sampled the OPOG wells on a semiannual basis in 2004 to acquire complete quarterly sampling results.

- **Weston (Consultant for EPA)** – Constructed 18 monitoring wells at 11 locations (MW1 to MW11) in December 2001, as part of the Omega Phase 2 Site Characterization Study. These include Wells MW1A, MW1B, MW2, MW3, MW4A, MW4B, MW4C, MW5, MW6, MW7, MW8A, MW8B, MW8C, MW8D, MW9A, MW9B, MW10, and MW11. Boring logs, geophysical logs, and well completion diagrams are included in Appendix A.1. Each well was completed with a dedicated bladder pump and sampled using the low-flow method. Weston performed quarterly monitoring of these wells between February 2002 and August 2003. CH2M HILL has performed sampling of these wells at least semiannually since March 2004.

- **ARCADIS (Consultant for OSVOG)** – Constructed 23 monitoring wells at 12 locations (MW12 to MW23), and one extraction well (EW1) between May 2005 and April 2006. Wells MW12, MW14, MW15, MW19, MW21, and MW22 were completed as single-screen wells. Wells MW16, MW17, MW18, MW20, and MW23 were completed as triple-nested wells, and Well MW13 was completed as a double-nested well. Well EW1 was completed as a single-screen 4-inch-diameter extraction well. Dedicated bladder pumps were installed in all but three monitoring wells (MW13A, MW17A, and MW19). Following one round of groundwater sampling, OSVOG transferred the new wells to EPA. CH2M HILL currently performs semiannual groundwater monitoring of these wells.

As requested by EPA, CH2M HILL evaluated the sampling results and identified several data gaps after completion of the OSVOG well installation. The main data gaps included the lateral and vertical extent of the contamination in groundwater and characterization of sources of groundwater contamination within OU2. To address these data gaps, the EPA directed CH2M HILL to perform additional field investigations that included (1) the installation of four single-screen (MW23A, MW28, MW29, and MW30) and four quadruple-nested (MW24, MW25, MW26, and MW27) monitoring wells to characterize the vertical and lateral extent of the contaminant plume; (2) HydroPunch® groundwater sampling to identify sources of VOC contamination (other than the former Omega facility); and (3) soil gas investigation to characterize the risk of soil gas vapor intrusion into residential buildings. The soil gas investigation (also referred to as the residential area investigation) included soil gas probe installation and sampling, soil sampling for geotechnical analysis, CPT, and HydroPunch® groundwater sampling. Additionally, CH2M HILL performed aquifer testing to characterize the aquifer properties.

The following discussion summarizes the field methods used during CH2M HILL's routine groundwater monitoring between March 2004 and July 2007, and the supplemental field activities conducted between January 2007 and July 2007. CH2M HILL's planning documents describe the field methodology in greater detail.

2.1 Routine Groundwater Sampling

The OU2 monitoring well network includes both OPOG and EPA wells. OPOG well names begin with the prefix "OW"; the EPA wells begin with the prefix "MW." Each prefix is followed by a sequential number (e.g., MW8) followed by a suffix "A" through "D," denoting the relative depth to the screened interval ("A" is used for the shallowest wells and "D" for the deepest wells). A map of all Omega (OPOG and EPA) monitoring wells is presented in Figure 2-1. Well construction details are provided in Table 2-1.

Dedicated pumps were not installed in the OPOG wells, only dedicated tubing. A 2-inch-diameter portable submersible pump was used for purging and sampling groundwater. Typically, three casing volumes are purged before sample collection (that is, OPOG does not use the low-flow sampling method).

Table 2-2 presents a summary of the OPOG routine groundwater monitoring schedule (conducted by CDM). The initial two sampling events were conducted at Well OW1A in July 1996 and at Wells OW1A, OW1B, OW2, and OW3A in July 1999. Quarterly sampling of Wells OW1A to OW6 was initiated in May 2001. Semiannual sampling of Wells OW1A to OW8A was initiated in February 2002 and has continued on a semiannual basis through August 2007. Parameters most frequently monitored include VOCs, 1,4-dioxane, and 1,2,3-trichloropropane (1,2,3-TCP). Less frequently monitored parameters include semivolatile organic compounds (SVOCs), dissolved metals, pesticides and polychlorinated biphenyls (PCBs), perchlorate, n-nitrosodimethylamine (NDMA), hexavalent chromium, and general chemistry (biochemical oxygen demand [BOD], chemical oxygen demand [COD], total organic carbon [TOC], total dissolved solids [TDS], alkalinity, and anions). A detailed description of the field methods and analytical protocol is provided in the following OPOG work plans:

- *Sampling and Analysis Plan Addendum for Additional Data Collection in the Phase 1a Area, Omega Chemical Superfund Site* (CDM, 2002)
- *Downgradient Well Installation and Groundwater Monitoring Sampling and Analysis Plan, Omega Chemical Superfund Site* (CDM, 2001b)
- *Final Sampling and Analysis Plan, Phase 1a Field Investigation* (CDM, 1999a)

Table 2-3 presents a summary of the Weston groundwater sampling schedule. Samples were collected on a quarterly basis between February 2002 and August 2003. Weston also sampled Wells OW1A to OW8A during these quarterly events. A 2-inch-diameter portable submersible pump was used to sample the OPOG wells. Three casing volumes were purged prior to sample collection. The EPA and OPOG well samples were analyzed for the following parameters: VOCs, SVOCs, dissolved metals, pesticides and PCBs, 1,4-dioxane, 1,2,3-TCP, perchlorate, cyanide, and general chemistry (TOC, TDS, alkalinity, and anions). A detailed description of the field sampling methods and analytical protocol is provided in the Weston sampling and analysis plan (SAP; Weston, 2001) and Phase 2 groundwater characterization study (Weston, June 2003). Weston discontinued their monitoring program after August 2003.

ARCADIS measured VOCs, SVOCs, dissolved metals, pesticides and PCBs, 1,4-dioxane, 1,2,3-TCP, perchlorate, NDMA, cyanide, and general chemistry (TOC, TDS, total Kjeldahl nitrogen [TKN], and anions). A complete description of the analytical and field methods is provided in the ARCADIS FSP plan (ARCADIS, 2005) and final project completion report (ARCADIS, 2007).

Table 2-4 presents a summary of the CH2M HILL routine groundwater sampling schedule. Quarterly sampling of EPA Wells MW1A to MW11 was initiated in March 2004. Samples were analyzed for the following parameters: VOCs, SVOCs, dissolved metals (including boron and silica), 1,4-dioxane, 1,2,3-TCP, perchlorate, NDMA, hexavalent chromium, anions (bromide, chloride, fluoride, nitrate-nitrogen, nitrite-nitrogen, orthophosphate-phosphorous, and sulfate), and other general chemistry parameters (alkalinity [total and bicarbonate], ammonia, BOD, COD, TKN, and total phosphorous). CH2M HILL also collected samples from Wells OW1A to OW8A in June 2004 and November 2004. Samples were analyzed for the same parameters as the EPA wells. A detailed description of the sampling methods and groundwater sampling results for 2004 is presented in the CH2M HILL *Draft 2004 Annual Groundwater Monitoring Report* (CH2M HILL, 2005).

EPA directed CH2M HILL to discontinue sampling of the OPOG wells after November 2004 because CDM monitors these wells on a semiannual basis during the same quarters as the CH2M HILL sampling events. Since the OPOG field QA and QC procedures are under EPA's direct oversight, the groundwater data provided by OPOG were deemed acceptable to use for this RI and the HHRA. To further maintain QA and QC of the data, CH2M HILL collects split groundwater samples during each OPOG groundwater sampling event. Typically, three split groundwater samples are collected and submitted to the EPA Region 9 laboratory for VOCs and 1,4-dioxane analysis. Split sampling results will be presented in a separate report for the OU1 oversight project.

Since February 2005, Wells MW1 to MW11 were sampled by CH2M HILL on a semiannual basis and with a reduced analyte list, which includes VOCs and emergent compounds (1,4-dioxane, 1,2,3-TCP, perchlorate, NDMA, or hexavalent chromium). Wells MW12 to MW22, MW23B, MW23C, and MW23D also were sampled on a semiannual basis and with a reduced analyte list since completion of these wells in early 2006. SVOCs were discontinued because, with the exception of bis(2-ethylhexyl)phthalate, no SVOC exceeded its respective maximum contaminant level (MCL). Monitoring of total cyanide, dissolved metals, anions, and general chemistry parameters also was discontinued. These constituents were analyzed primarily to evaluate groundwater treatment alternatives and treated groundwater discharge options. The sampling results indicated that most of these compounds are not COPCs within OU2. Lastly, all newly constructed wells were sampled for the full suite of analytes (e.g., VOCs, SVOCs, dissolved metals, etc.) immediately after well construction, and will be sampled for the reduced analyte list (VOCs and emergent compounds) during subsequent sampling events.

The most recent CH2M HILL sampling round was conducted in July through August 2007, after the construction of the new wells. This included four single-screen wells (MW23A, MW28, MW29, and MW30) and four quadruple-nested wells (MW24, MW25, MW26, and

MW27). Wells MW1A to MW22, MW23B, MW23C, and MW23D were analyzed for VOCs and emergent compounds. Wells MW23A and MW24 to MW30 were analyzed for the full suite of analytes (same as 2004 analyte list).

A discussion of the sampling procedures and analytical methods for groundwater data collected by CH2M HILL follows.

2.1.1 Sample Collection Methods

The following subsections describe CH2M HILL's general sample collection procedures for groundwater sampling at the OU2 monitoring well network. Groundwater sampling purge forms are provided in Appendix B.

2.1.1.1 EPA Well Sampling

The EPA monitoring wells are equipped with dedicated pump tubing and bladder pumps to allow sampling using low-flow sampling techniques. Low-flow sampling is the process of purging and sampling wells at low-flow rates from within the well screen zone to minimize the volume of extracted water and improve sample quality (EPA, 2004a). During well purging, careful continuous measurement of field parameters including specific conductance, pH, temperature, dissolved oxygen (DO), oxidation-reduction potential (ORP), and turbidity were used to assess when purged water had reached equilibrium. A flow-through cell was used to ensure that the purge water was continuously monitored. Each well was pumped until conductance, pH, and temperature stabilized within 10 percent over three successive readings prior to collecting samples.

Well MW13A could not be sampled because this well has been dry since construction. Slow-producing wells include Wells MW12, MW17A, and MW19. Well MW12 is sampled using a passive sampling approach (i.e., the well is sampled without purging the bladder pump discharge tubing). No pumps are installed in Wells MW17A and MW19. A disposable polyethylene bailer and new polyethylene string were used to sample these two wells.

2.1.1.2 OPOG Well Sampling

The OPOG sampling procedures are the same as described in the previous section for EPA wells, with the exception that a portable 2-inch-diameter stainless-steel pump was used for purging and sampling. OPOG wells have dedicated pump tubing but not dedicated pumps. The portable pump was decontaminated between sampling of different wells using procedures described in the FSP. To minimize cross-contamination, wells were typically sampled from least- to most-contaminated wells. CH2M HILL used the low-flow method for sampling the OPOG wells. A bailer was sometimes used to sample Well OW1A since it is a slow-producing well.

2.1.1.3 Field Parameters Measurement

A digital conductivity-pH-temperature-DO-ORP-turbidity meter (the QED MP20) was used for specific conductance, pH, temperature, DO, ORP, and turbidity measurements. Turbidity measurements also were made with a digital readout turbidity meter (e.g., Hach 2100P). A photoionization detector (PID) was used to measure organic vapor measurements (headspace) inside the well immediately after opening the well caps. Equipment used to measure field parameters was maintained and calibrated daily according to the manufacturer's specifications.

2.1.1.4 Depth to Water Measurement

Depth to groundwater was measured at monitoring wells immediately prior to well purging and sampling activities to establish a static water level. Water levels were measured with a decontaminated electronic water level indicator (sounder) to the nearest 0.01 foot. Water levels also were measured at regular intervals during purging activities to ensure that a constant drawdown was maintained during pumping. A final water level was recorded after sample collection. The reference point for water level measurements was the top of the casing.

2.1.2 Laboratory Assignments and Sample Analysis

The EPA Region 9 Laboratory in Richmond, California, provided and coordinated the analytical support for the routine groundwater sampling at the Omega Site. Select laboratories were contracted by the EPA Region 9 Laboratory as part of its Contract Laboratory Program (CLP) to assist with the analysis of groundwater samples. The contracted laboratories include the following:

- Shealy Environmental Services of West Columbia, South Carolina
- Ceimic of Narragansett, Rhode Island
- Sentinel of Huntsville, Alabama
- A4 Scientific of The Woodlands, Texas
- Bonner Analytical Testing of Hattiesburg, Missouri

Other non-CLP laboratories subcontracted by the United States Army Corps of Engineers (USACE) include the following:

- Severn Trent Laboratory (STL) of West Sacramento, California
- Applied P & Ch Laboratory (APCL) of Chino, California
- Test America of Irvine, California

MWH of Monrovia, California, and EMAX of Torrance, California, were contracted directly by CH2M HILL for the analysis of NDMA, COD, and hexavalent chromium during the February 2004 sampling event. A summary of the analytical parameters and assigned laboratories is provided in Table 2-5. Chain-of-custody forms are provided in Appendix C.

A detailed discussion of the analytical methods, bottle requirements, and hold-times for routine groundwater sampling activities is provided in the planning documents for Omega. All groundwater samples were analyzed using EPA-approved methods.

Analytical methods, as presented in the QAPP, are as follows:

- VOCs—EPA Method 524.2 or CLP Method SOM01.1
- SVOCs (plus 1,4-dioxane)—EPA Method 8270C or CLP Method SOM01.1
- NDMA—Modified EPA Method 1625
- Perchlorate—EPA Method 314

- Hexavalent Chromium—EPA Method 218.6
- 1,2,3-TCP—Method and QA/QC followed the California state guidance to achieve the regulatory limit of 0.005 micrograms per liter (µg/L)
- Metals (dissolved) plus boron and silica—EPA Methods 200.7, 200.8, and 245.1/CLP Method ILM05.3
- Cyanide—EPA Method 335.4
- TKN—EPA Method 351.2
- Ammonia—EPA Method 350.2
- Total Phosphorus—EPA Method 365.4
- TDS—EPA Method 160.1
- Alkalinity—EPA Method 2320B
- Bicarbonate—SM 2320B
- TOC—EPA Method 415.1
- BOD—EPA Method 405.1
- COD—EPA Method 410.1
- Anions (bromide, chloride, fluoride, nitrate-N, nitrite-N, orthophosphate-P, total sulfate)—EPA Method 300.0

2.2 Pre-Field Activities for Additional Fieldwork

The following sections describe activities that were performed prior to the start of the field investigation.

2.2.1 Permitting and Private Access Agreements

CH2M HILL assisted EPA with coordination of the efforts to obtain the well drilling permits required by local agencies for installation of groundwater monitoring wells, soil gas probes, and HydroPunch® borings. The wells and soil borings are located in the cities of Whittier, Santa Fe Springs, and Norwalk, California. CH2M HILL coordinated with each city to (1) gain public acceptance of the field activities, (2) notify nearby residents of the upcoming activities, and (3) create adequate traffic and noise control systems at each site. Permit fees were waived by all cities due to EPA's exemption from paying permit fees per Superfund regulations. Site location maps and excavation permit applications were provided to the cities prior to the implementation of the fieldwork. Permits were not obtained from the LACDHS, also due to EPA's exemption under Superfund regulations.

Access agreements were obtained for each well and soil boring located on private property. Agreements were signed by EPA and the property owner(s), and in some instances by CH2M HILL. No city or county permits or permitting fees were required for wells and soil borings located on private property.

2.2.2 Utility Clearance

CH2M HILL contacted Underground Service Alert (USA), a utility notification service, at least 72 hours prior to initiation of drilling. USA notified the appropriate utility companies and provided CH2M HILL with a Dig Alert permit. A geophysical utility locating subcontractor also was used to confirm that subsurface structures or utilities were not present beneath the proposed well or soil boring locations. In addition, the upper 5 feet of each location was hand-augered to detect and avoid any subsurface features not previously identified by USA or the geophysical utility subcontractor. No subsurface or aboveground utilities were disturbed during the investigation.

2.3 HydroPunch® Sampling for Well Placement

HydroPunch® groundwater sampling was conducted to assist with the placement of Wells MW27, MW28, MW29, MW30, and MW31. The results of the sampling also were used to characterize the downgradient extent of contamination in the shallow aquifer. Gregg Drilling and Testing, of Signal Hill, California, was retained as the subcontractor for the HydroPunch® sampling. A total of 53 temporary soil boring locations in the cities of Santa Fe Springs and Norwalk were necessary for final well placement. Soil boring depths ranged between approximately 35 and 120 feet below ground surface (bgs).

2.3.1 General Approach

HydroPunch® samples were collected from temporary soil borings advanced with a 25-ton truck-mounted CPT rig. The HydroPunch® is designed to collect a single-point sample in a single direct-push hole with one probe entry. The HydroPunch® is essentially a temporary well system consisting of a steel cone-shaped drive tip and slotted polyvinyl chloride (PVC) well screen (screen-point sampler). When the desired groundwater sampling depth is reached, a hollow push rod with an enclosed 5-foot-long screen and sampler is driven into the native materials in advance of the borehole. The sampler is then drawn upward approximately 3 feet, exposing the screen of the sampler directly to the formation water. The steel tip and PVC well screen are left in the boring after each sample is collected.

A nominal 0.5-inch-diameter stainless-steel bailer tied to a polyethylene string was lowered into the hollow push rods to collect groundwater samples. After pulling the bailer out of the push rods, groundwater was poured directly from the bailer into four 40-milliliter (mL) volatile organic analysis (VOA) vials pre-preserved with hydrochloric acid (HCL). Samples were immediately packaged and stored in coolers until shipment. HydroPunch® samples, for VOC analysis, were shipped to Datachem Laboratories, Inc. (Datachem), of Salt Lake City, Utah. Datachem served as a contract laboratory to the EPA Region 9 Laboratory. EPA's CLP SOW Method SOM01.1 with select ion mode (SIM) was used for VOC and 1,4-dioxane analyses.

An attempt was made to collect two discrete groundwater samples at each boring location. Generally, one sample was collected immediately below the water table and one sample was collected approximately 10 feet below the water table. Only one sample was collected if refusal was encountered at the deeper depth or if refusal was expected to be encountered at the deeper sample depth. Two discrete samples were attempted at each location to increase the likelihood of detecting contamination; historical single-depth discrete sampling at OU2 provided somewhat inconsistent results because some samples missed high VOC concentrations.

After HydroPunch® sampling was completed, each soil boring was plugged to land surface with 5 percent bentonite cement. The analytical results for the discrete sampling are discussed in detail in Section 5.

2.3.2 Well MW27 Placement

Well MW27 was installed to monitor the vertical extent of contamination in an area of moderate to high VOCs further downgradient of a high VOC concentration zone. Seven soil borings were used to determine the placement of this well. The initial four borings (HP27-2 to HP27-5) were installed along Lakeland Boulevard between January 25 and February 15, 2007. These borings were spaced approximately 250 feet apart (Figure 2-2). Two discrete groundwater samples were collected in each boring. The shallow samples ranged between 87 and 95 feet bgs; the deeper samples were between 97 and 105 feet bgs. The depth to water in this area is approximately 80 feet bgs.

After a review of the initial data and taking into account the logistical constraints along Lakeland Boulevard, Well MW27 was sited near the intersection of Clark Street and Norwalk Boulevard. Additional soil borings (HP27-6 to HP27-9) were installed along Clark Street on March 13 and 14, 2007, to finalize the placement of Well MW27. The borings were spaced approximately 200 feet apart (Figure 2-2). An attempt was made to collect two discrete groundwater samples per location. Refusal was encountered during the collection of the deeper samples in Borings HP27-6, HP27-7, and HP27-9; therefore, only one discrete sample was collected at these locations. Two discrete samples were collected from HP27-9. This included samples at 89.5 and 98 feet bgs.

Analytical data for samples collected along Clark Street indicate that the highest concentrations of VOCs in this area are present immediately south of Norwalk Boulevard near HP27-7. Maximum PCE and TCE concentrations at HP27-7 were 200 and 100 μg/L, respectively. Based on these results, Well MW27 was sited at this location.

2.3.3 Well MW28 Placement

Well MW28 was installed to monitor the western extent of the contaminant plume. Five soil borings (HP28-1 to HP28-5) were installed along Lakeland Boulevard to site this well. These borings were installed between January 22 and January 25, 2007, and were spaced approximately 500 feet apart (Figure 2-3). Two discrete groundwater samples were collected at HP28-1, HP28-2, HP28-4, and HP28-5. Refusal was encountered at HP28-3 during the collection of the deeper sample; therefore, only one groundwater sample was collected at this location. Shallow discrete samples were collected at 90 feet bgs. The deeper samples ranged between 92 and 100 feet bgs.

Analytical data for the HP28 samples indicate that the western extent of the contaminant plume lies near the intersection of Pioneer Avenue and Lakeland Boulevard. PCE and TCE concentrations were generally less than the MCL of 5 μg/L. Based on the results, it was decided to install Well MW-28 in the southwest corner of Little Lake Park, which is owned by the city of Santa Fe Springs.

2.3.4 Wells MW29 and MW30 Placement

The purpose of the downgradient monitoring well(s) is to monitor the lateral extent of the contaminant plume in the shallow aquifer, typically where VOC concentrations are near the MCL (5 µg/L for PCE and TCE). Determination of monitoring well placement was assisted by a series of HydroPunch® sampling events.

The initial phase of HydroPunch® sampling indicated a more widespread contamination extending directly south beneath Norwalk Boulevard toward Imperial Highway and southeast of Norwalk Boulevard near its intersection with Allard Street. A total of four rounds of sampling were performed to gain insight regarding PCE/TCE distributions in this area and to finalize the placement of monitoring wells.

After a thorough review of the HydroPunch® sampling data, Well MW29 was installed near the intersection of Gettysburg Drive and Norwalk Boulevard, and Well MW30 was installed at the east end of Civic Center Drive to monitor the south and southeast lobes of the downgradient plume, respectively (Figure 2-4).

A more detailed discussion of the HydroPunch® sample results is presented in Section 5.

2.3.5 Well MW31 Placement

The purpose of this cross-gradient monitoring well is to monitor the groundwater quality immediately downgradient of the TCE source area at Whittier Boulevard. Determination of monitoring well placement was assisted by a series of HydroPunch® sampling events.

After a thorough review of the HydroPunch® sampling data, Well MW31 was installed on the frontage road along the south of Whittier Boulevard, across from the intersection of Whittier Boulevard and Mar Vista Street.

2.4 Monitoring Well Installation

CH2M HILL constructed several new groundwater monitoring wells in OU2 to characterize the vertical and lateral extent of the groundwater contaminant plume. These include four single-screen wells (MW23A, MW28, MW29, and MW30) and four multiple-screen (nested) monitoring wells (MW24, MW25, MW26, and MW27). A discussion of the well installation methodology is presented in the following.

Figure 2-1 shows the locations of all EPA and OPOG monitoring wells. The locations for Wells MW23A, MW24, MW25, and MW26 slightly deviate from their originally proposed locations, as presented in the FSP Addendum (CH2M HILL, 2006a). This is due, in part, to property access agreement issues or logistical reasons (e.g., drilling rig access, power line hazards, underground utilities, etc.). The locations of Wells MW27, MW28, MW29, and MW30 are based on the HydroPunch® sampling results as discussed previously in the previous subsection.

2.4.1 Multiple-Screen Monitoring Wells

Water Development Corporation (WDC), of Montclair, California, drilled boreholes for installation of Wells MW24, MW25, MW26, and MW27. Fieldwork started on February 19, 2007, at Well MW26. Wells MW24, MW25, MW26, and MW27 were drilled using the direct-(mud)-rotary technique and a nominal 14- or 16-inch-diameter drill bit.

Prior to drilling, new heavyweight plastic sheeting was placed beneath the drill rig to prevent motor oil, compressor and hydraulic fluids, or other products from contaminating the surrounding asphalt and soils. Drilling equipment was thoroughly cleaned to ensure that contaminants were not transported from one sampling location to another. All drilling equipment (i.e., casing, drill stem, and sampling rods) used downhole were steam cleaned prior to use.

Drilling mud was used to prevent the collapse of boreholes and to remove cuttings from the boreholes. Drilling mud reduces the possibility of cross-contamination of groundwater zones because the mud invades the formation along the borehole walls, forming a low-permeability mud cake. The mud is removed later from the borehole during well development. To prevent collapse of the borehole, the drilling mud properties were monitored and maintained, and the mud generally was kept circulating throughout the borehole. Drilling mud properties were monitored and maintained by WDC until the well casing was ready to be installed.

Drilling mud consisted of bentonite and water. No drilling additives were used at any of the wells. Water used for drilling mud was obtained from fire hydrants owned by the cities of Whittier and Santa Fe Springs. WDC obtained the required permits and water meters to access the water from the hydrants. WDC transferred hydrant water to their flat-bed water truck for storage until mud-rotary drilling commenced. CH2M HILL collected samples from WDC’s water truck to ensure that no contaminants were introduced into the monitoring wells during drilling. Water truck samples were collected during construction of Wells MW24, MW26, and MW27. Sample containers included four 40-mL VOA vials, pre-preserved with HCL. The Well MW24 water truck sample was submitted to the EPA Region 9 Laboratory for VOC analysis using EPA Method 524.2. Wells MW26 and MW27 water truck samples were submitted to Datachem for VOC analysis using CLP Method SOM01.1 with SIM.

Table 2-6 presents a summary of detections for samples collected from WDC’s water truck. Detections for bromodichloromethane, bromoform, and dibromomethane were reported in all three water samples. Detections ranged between 0.3J and 12 µg/L for bromodichloromethane, 4.9 and 13J µg/L for bromoform, and 1.3 and 11 µg/L for dibromomethane. An isolated detection of chloroform (9.1 µg/L) was reported in the Well MW27 sample. Bromodichloromethane, bromoform, dibromomethane, and chloroform are part of a class of compounds known as trihalomethanes (THMs), common byproducts formed during chlorination (treatment) of drinking water to kill bacteria. The maximum combined concentration of THMs (45.1 µg/L) is less than the most stringent regulatory action level of 80 µg/L (EPA Primary MCL for total THMs). Other isolated detections include 1,4-dioxane (3.4J µg/L) and TCE (0.2J µg/L), both of which were reported in the Well MW26 water truck sample. The 1,4-dioxane detection slightly exceeded the California Department of Public Health Services (CDPHS) notification level (NL) of 3 µg/L. The TCE detection of 0.2J µg/L was below the California primary MCL of 5 µg/L. The low concentrations of 1,4-dioxane and TCE in the Well MW26 water truck sample could have been a result of cross-contamination from an unknown source inside the water truck storage tank or at the tank discharge point. Since Monitoring Well MW26 was fully developed after well completion, it is unlikely that any water used during well construction would have impacted background water quality.

2.4.1.1 Lithologic Logging

The field geologist collected and logged drill cuttings from the boreholes at 10-foot intervals, or at significant changes in borehole lithology. Approximately 1 gallon of drill cuttings was collected from the drilling rig "mud shaker" using a fine mesh screen attached to a broomstick handle. The cuttings were then placed in a 200-millimeter (mm) sieve pan and rinsed in a 5-gallon bucket filled with potable water. The field geologist then visually inspected the cuttings for Unified Soil Classification System (USCS) soil type, color, moisture content, relative density or consistency, grain sizes and relative percentages, angularity, mineralogy, weathering, or other descriptors. Drill cuttings were later placed in labeled, plastic, fishing tackle boxes for review of the visual description. Boring logs are presented in Appendix A.1.

2.4.1.2 Discrete-Depth Sampling

In situ, discrete-depth soil and groundwater samples were collected during drilling of Well MW24 using a Maxiprobe Simulprobe® Sampling System (Simulprobe) to identify zones of groundwater contamination. The purpose of the probe is to collect soil and groundwater samples concurrently while advancing the well borehole. The Simulprobe consists of three primary sections—the cutting shoe and screen-coupling assembly, the soil core barrel, and the water storage canister. Together, the Simulprobe is approximately 4 feet long with an outside diameter (OD) of 3.38 inches.

Prior to sampling, all parts of the Simulprobe were washed with nonphosphate detergent (Alconox) and triple rinsed. Then the Simulprobe was assembled and lowered to the bottom of the borehole. The Simulprobe was pounded approximately 2 to 3 feet into the soil, allowing for the collection of a soil sample and positioning the device for collection of a groundwater sample.

Simulprobe samples were collected beginning at 10 feet below the water table (approximately 50 feet bgs) to the total depth of the boring (200 feet bgs) with the intent to sample every 10 feet. The actual sample depths deviated slightly and were selected based on encountered lithology with the goal of sampling permeable (coarse-grained) units. Soil samples were used for lithologic description by the field geologist. Groundwater samples were used to assist with the selection of the well screen intervals. An attempt was made to collect groundwater samples at 10-foot intervals; however, groundwater recovery was only achieved at 60, 80, 140, and 155 feet bgs. This was due, in part, to mechanical problems with the Simulprobe sampler or to the low permeability of the lithologic unit sampled. Groundwater was poured directly from the sampler into three 40-mL VOA vials, pre-preserved with HCL. Samples were packaged, stored in an iced cooler, then shipped to the EPA Region 9 Laboratory for VOC analysis (EPA Method 524.2). Table 2-7 provides a summary of VOC detections for the discrete-depth samples.

2.4.1.3 Geophysical Logging

Pacific Surveys of Claremont, California, a subcontractor to WDC, performed geophysical logging of each mud-rotary-drilled borehole prior to the installation of Wells MW24, MW25, MW26, and MW27. The results from the geophysical logging were used in conjunction with lithological logs to aid in selection of the well screen intervals. Logs performed include electric (16- and 64-inch normal resistivity, spontaneous potential, guard resistivity), gamma ray, and caliper. Electronic copies of the geophysical logs (in image and American Standard Code for Information Interchange [ASCII] format) can be found in Appendix A.2.

Electric logs incorporated four separate measurements—spontaneous potential (SP), short normal resistivity (SNR; 16-inch normal), long normal resistivity (LNR; 64-inch normal), and single-point (guard) resistivity. In general, resistance increases with increasing grain size and decreases with increasing borehole diameter, fracture density, and dissolved solids concentration in groundwater. Electrical logs are useful in the determination of lithology, water quality, and location of fracture zones.

SP logs record the voltage between the logging tool electrodes; this voltage is a measure of natural electric potential that develops between the borehole fluid and surrounding formation.

SNR and LNR logs record the electrical resistivity of the borehole environment and surrounding rocks and water as measured by variably spaced potential electrodes on the logging probe. Resistivity logging uses a source of alternating current to induce electric potential in the formation-borehole fluid system via current electrodes. Typical spacing for potential electrodes is 16 inches for SNR and 64 inches for LNR. Normal resistivity logs are affected by bed thickness, borehole diameter, and borehole fluid. Guard resistivity records the electrical resistivity of the borehole and surrounding formation and water with a focused beam of electrical current. This provides a higher resolution of the contacts between the soil layers than that provided by the SP, SNR, and LNR logs.

Gamma ray logs record the amount of natural gamma radiation emitted by the rocks surrounding the borehole. The most significant naturally occurring sources of gamma radiation are potassium-40 and daughter products of the uranium- and thorium-decay series. Clay- and shale-bearing rocks commonly emit relatively high gamma radiation because they include weathering products of potassium feldspar and mica and tend to concentrate uranium and thorium by ion adsorption and exchange. Layers of volcanic ash are distinguished by high gamma emissions. High potassium feldspar content in arcosic sands derived from weathered granitic rocks can mask the signature of clays on a gamma log.

Caliper logs record borehole diameter using three arms. Changes in borehole diameter are related to well construction, such as casing or drilling bit size, and to fracturing or caving along the borehole wall. Because borehole diameter commonly affects other geophysical logging method responses, the caliper log is useful in the analysis of other geophysical logs. In addition, caliper data can be used to evaluate wash-out areas, and to provide total and annular volumes for gravel and cement volume calculations.

2.4.1.4 Well Construction

After reviewing the geophysical logs and designing the well, the drilling mud was thinned back to allow for proper installation of the well casing, screen, and annular materials. Wells were constructed using either 2- or 4-inch-OD, Schedule 80, threaded PVC casing; 0.020-inch slot, Schedule 80, threaded PVC well screen; and 5 feet of blank PVC casing to serve as a well sump. Wells MW24, MW25, and MW27 were quadruple-nested, with two 2-inch-diameter casings and two 4-inch-diameter casings completed in a single borehole. Well MW26 also was quadruple-nested, but with three 2-inch-diameter casings and one 4-inch-diameter casing completed in a single borehole.

Concentric stainless-steel centralizers were installed at the top and bottom of each well screen to assist with maintaining a minimum of 2 inches of annular space between each well casing. Centralizers were not installed shallower than the top of each well screen to avoid obstruction of the downhole tremie pipe used to install the annular materials.

After the well casings and screens were lowered to the proper depths, a nominal 2-inch-diameter steel tremie pipe was lowered to approximately 5 to 10 feet below the top of the deepest well screen for the installation of the filter pack. A cyclone pump was used to mix and pump all annular materials though the tremie pipe. A weighted measuring tape was used to tag annual materials during placement. The tremie pipe was lifted sequentially during placement of each layer of filter pack and annular seal.

The annular space of the borehole surrounding each screen was backfilled with Lone Star Monterey Sand (No. 3 or No. 2/12 grade). Filter pack selection was based on the well construction design of existing EPA monitoring wells, lithologic logs, and visual observation of drilling cuttings. Filter pack was placed around each screen zone, generally extending 3 to 5 feet above and below each screen. Prior to installing the annular seals, the screens were swabbed with a bailer or surge-block device to facilitate the settling of the filter pack.

Medium bentonite chips (5-foot minimum thickness) were placed above the top of the filter packs to provide an annular seal between each screen interval. A 1:1 mixture (by dry volume) of granular bentonite and No. 3 Monterey sand were placed above the bentonite chip seal to provide an additional seal between screen intervals. The remaining annular space of the borehole above the uppermost screen was backfilled with Portland Type II 5 percent bentonite cement to the ground surface.

Well construction details for Wells MW24, MW25, MW26, and MW27 are presented in Table 2-1.

2.4.2 Single-Screen Monitoring Wells

Prosonic, Inc. (acquired by Boart Longyear later in 2007), of Santa Fe Springs, California, drilled 8-inch-diameter boreholes for installation of 4-inch-diameter Wells MW23A, MW28, MW29, and MW30. These boreholes were drilled using rotosonic (sonic) drilling methods. The sonic drilling method employs the use of a high-frequency mechanical vibration to advance the drill string through unconsolidated, and to a limited extent, consolidated materials. The sonic rig uses an oscillator, or head, with eccentric weights driven by hydraulic motors to generate high sinusoidal force in a rotating drill pipe. The frequency of vibration of the core bit can be varied to allow optimum penetration of subsurface materials. Sonic drilling can use water as a drilling fluid, if necessary.

Sonic drilling was conducted using a nominal 7-inch-diameter inner casing (core barrel) equipped with a cutting shoe, followed by an 8-inch-diameter outer casing. After advancing the core barrel at 10-foot intervals, the core barrel was removed from the borehole, and the soil core was removed and transferred to the field geologist for lithologic description. The core barrel was placed back into the borehole and advanced another 10 feet. An additional 10 feet of outer casing was added to the outer casing that was below ground and then advanced to meet the bottom of the core barrel. This process was continued until the total depth was reached. Sonic drilling does not produce soil cuttings, but may generate waste water by removing groundwater with the core barrel.

2.4.2.1 Lithologic Logging

The field geologist collected and logged the sample cores continuously during advancement of the borehole. The field geologist visually inspected the cores for USCS soil type, color, moisture content, relative density or consistency, grain sizes and relative percentages, angularity, mineralogy, weathering, or other descriptors. After logging the soil, samples were placed in labeled, plastic fishing tackle boxes for long-term storage. Boring logs for Wells MW23A, MW28, MW29, and MW30 are presented in Appendix A.1.

An organic vapor analyzer (OVA) was used for select soil samples during lithologic logging. A MiniRAE 2000 PID with 10.6-electron-volt (eV) lamp was used for OVA measurements. The PID was calibrated daily using 100 parts per million (ppm) isobutylene, according to the manufacturer's specifications. For field screening, a soil sample was placed and sealed in a resealable plastic bag before being disagreggated. After the disaggregated soil sample was allowed to volatilize for approximately 5 minutes in the bag, the bag was pierced with the head of the PID, and the concentration of VOCs in the headspace of the plastic bag was measured and recorded on the boring log.

2.4.2.2 Well Construction

Single-screen wells were constructed using 4-inch-OD, Schedule 80, threaded PVC casing; 0.020-inch-slot, Schedule 80, threaded PVC well screen; and 5 feet of blank PVC casing to serve as a well sump. Centralizer and annular material installation generally followed the same procedures used to install the nested monitoring wells (see Section 2.4.1.4) except that no drilling mud was used. Well construction details for Wells MW23A, MW28, MW29, and MW30 are presented in Table 2-1.

2.4.3 Well Development

Initial well development activities included a combination of bailing and swabbing the entire length of each well screen. At times during swabbing, the swab assembly was raised and lowered to create a simultaneous surging action of water adjacent to the well screen. After a reduction of sediment and turbidity was observed (and all drilling mud was removed from the nested wells), a 2-inch-diameter submersible pump was lowered to the screen interval and the interval was pumped until it was clean (i.e., free of color and sediment and low turbidity). Pumping rates varied between 2-inch- and 4-inch-diameter wells, but generally ranged from 1 to 5 gallons per minute (gpm). After pumping the well clean, the pump was removed from the well and the swab assembly was then lowered to the well screen for additional surging. This process was repeated until the water was free of sediment and turbidity levels were below 10 nephelometric turbidity units (NTUs).

Field parameters (i.e., turbidity, pH, electric conductivity [EC], DO, ORP, and temperature) were measured during well development to determine the state of development. Well screen development generally was considered complete when turbidity measured less than 10 NTUs, and all other field parameters indicated a stable trend. Well development logs containing field parameter measurements are included in Appendix A.3.

2.4.4 Dedicated Bladder Pump Installation

Dedicated bladder pumps, manufactured by QED Environmental Systems (QED), were installed in new EPA Monitoring Wells MW23A and MW24 to MW30. Design details and pump specifications are included in Appendix A.4. Two types of pump designs were used—Well System A and Well System L. Well System A pumps include a QED Model T1200M bladder pump equipped with a bottom-attached pump inlet screen. The pump body is constructed of stainless steel. Premeasured and cut polyethylene tubing is attached to each pump for air injection and water discharge. The tubing is attached to hose-barbs on a recessed well cup (which sits inside the well casing). All tubing attachments were tested by the manufacturer for tightness. Pumps were installed using System A in Wells MW23A, MW24A, MW24B, MW25A, MW25B, MW26A, MW26B, MW26C, MW27A, MW27B, MW28, MW29, and MW30.

Well System L uses a similar design with one exception—the pump inlet is attached to the bottom of the pump via premeasured lengths of extension tubing. This setup was used where there was over 100 feet of water column above the proposed inlet depth. Using this design, the pump can be set at a shallower depth, thus requiring less gas pressure to operate. This allows faster discharge rates and uses less gas. Wells equipped with System L type pumps include MW24C, MW24D, MW25C, MW25D, MW26D, MW27C, and MW27D.

For shallow wells where the water table is near or within the well-screen interval, the pump inlets were generally installed 5 feet above the bottom of the screen. For deeper wells where the well screens are totally submerged, the pump inlets were installed between 5 and 10 feet above the bottom of the screen.

Prior to the installation of the pumps, CH2M HILL staff measured the depth to water and total depth in each of the wells. The pumps were installed on July 5, 2007, under the supervision of Mr. David Corder of QED.

2.5 Surveying

All HydroPunch® soil boring locations were surveyed by CH2M HILL staff using a Trimble® GeoXT™ hand-held global positioning system (GPS). Boring locations were surveyed in Universal Transverse Mercator (UTM) meters, North American Datum (NAD) 83 Zone 11. Survey results are presented in Appendix A.5.

An engineering survey of new well locations and elevations was conducted on June 13, 2007, by Calvada Surveyors, Inc. (Calvada), of Corona, California. Wells MW1 to MW11 also were surveyed on June 15, 2007, to verify the accuracy of the previous survey conducted by Weston in 2001. Calvada is a licensed land surveyor in the state of California. Well locations were surveyed in California State Plane, NAD 83, Zone 5, and wellhead reference point elevations in National Geodetic Vertical Datum (NGVD) 88 (to the nearest 0.01 foot).

National Geodetic Survey Monument DYHS (Downey High School) was used as a benchmark for the survey. A copy of Calvada's survey report is included in Appendix A.5.

2.6 Aquifer Testing

The objective of the aquifer testing at the Omega Site was to estimate aquifer properties that can be used in numerical modeling and calculations in support of remedial alternatives analysis in the future FS. Slug testing and step-drawdown testing were included as part of the aquifer testing program. The aquifer testing included slug tests and pumping tests. Slug tests are relatively fast and result in a minimum amount of waste generated; they were performed on all Omega wells at OU2 to characterize the distribution of hydraulic conductivity. The more expensive pumping tests were performed at selected well locations only.

2.6.1 Slug Tests

Slug testing is a type of aquifer test where water or an object that displaces water is added or removed from a well, the change in hydraulic head is monitored through time, and a mathematical model is fitted to the field data to determine the near-well aquifer characteristics. Slug testing data are generally representative of a much smaller volume of aquifer materials in comparison to the volume of representative aquifer materials that can be assessed using data from pumping tests.

Slugs were constructed of 1.30- and 2.36-inch-OD, Schedule 40, threaded PVC casing with prefabricated lengths of 5, 10, and 15 feet. A 3-foot-long piece of steel rebar was placed inside each of the slugs to offset buoyancy effects from the air trapped inside of the slugs. PVC end caps were threaded to both ends to prevent water from leaking into the slugs. The bottom caps were pointed to prevent the water hammer effect when the slug is dropped. A stainless-steel eyebolt screw was installed on the top end cap to provide a connection between the slug and polyethylene rope that was used to raise and lower the slugs.

Prior to initiating slug testing, a submersible pressure transducer was installed in each well to monitor pressure changes over time. A transducer rated at 20 pounds per square inch (psi) was lowered between 10 and 30 feet below the static depth to water in each well. The final depth of the transducer was dependent on the total depth of the well in relation to static depth to water. The transducer cable was connected to an In Situ Hermit® 3000 data logger, capable of recording pressure readings on a logarithmic scale.

The general procedure for conducting a slug test is as follows:

- Measure static depth to water with an electronic water level sounding device
- Install pressure transducer to 10 to 30 feet below static depth to water
- Lower the PVC slug to approximately 5 feet above the static depth to water
- Start recording pressure readings with the Hermit data logger using the logarithmic programming mode
- Drop the slug so that the top of the slug is submerged approximately 5 feet below the static depth to water

- Continue recording pressure data until water levels have stabilized
- Stop recording pressure data for falling-head test (slug submerged into water, or slug-in test)
- Prepare for rising-head test (slug removed from the water, or slug-out test)
- Repeat start recording pressure readings with the Hermit data logger using the logarithmic programming mode
- Pull slug out until the bottom of the slug is approximately 5 feet above the static depth to water
- Continue recording pressure data until water levels have stabilized
- Review data and repeat steps above if necessary; the tests were generally repeated twice (for a total of two slug-in and two slug-out tests) to ensure test repeatability and assess data noise

The slugs, transducers, and transducer cables were decontaminated with Alconox and deionized water between wells to reduce the potential for cross-contamination. In addition, the field crew typically conducted slug tests in order of least- to most-contaminated wells during each day of testing. The dry portion of the polyethylene rope used to raise and lower the slugs was reused between wells. New rope was typically used at the beginning of each day of testing.

Slug testing was conducted in the following five phases at the Omega Site:

- **Phase 1** – Conducted between May 15 and May 24, 2006, and included tests in Wells OW3B, OW4A, OW4B, OW5, OW6, OW7, OW8B, MW1A, MW1B, MW2, MW3, MW4A, MW4B, MW4C, MW5, MW6, MW7, MW8A, MW8B, MW8C, MW8D, MW9A, MW9B, MW10, MW11, MW13B, MW15, MW16A, MW18A, MW18B, MW18C, MW23B, MW23C, and MW23D
- **Phase 2** – Conducted between August 7 and August 9, 2006, and included tests in Wells MW12, MW14, MW16B, MW16C, MW17A, MW17B, MW17C, MW20A, MW20B, MW20C, MW21, and MW22
- **Phase 3** – Conducted between May 1 and May 5, 2007, and included tests in Wells MW25A, MW25B, MW25C, MW25D, MW26A, MW26B, MW26C, MW26D, MW27A, MW27B, MW27C, and MW27D
- **Phase 4** – Conducted between June 15 and June 18, 2007, and included Wells MW23A, MW24A, MW24B, MW24C, MW24D, MW28, MW29, and MW30
- **Phase 5** – Conducted in September 2009 and included Well MW31

An average of two rising-head and two falling-head slug tests were conducted in each well. The exact number of tests was dependent on aquifer response and quality of recorded data. A summary of rising and falling slug tests conducted during all phases of the investigation is presented in Table 2-8. A discussion of the results is presented in Section 4.

2.6.2 Pumping Tests

Pumping tests were performed on selected wells to provide estimates of aquifer properties representative of a larger aquifer volume than the results from the slug tests and to assess hydraulic communication between aquifer units. The tests also provided information on well yield for the future FS. The pumping rate was increased in a step-wise fashion during each test to avoid over-pumping the test wells (a pumping well would go dry at a discharge rate that is too high), estimate the well loss, and estimate the well-specific capacity. The step-wise test pumping eliminated the need for a preliminary test to estimate the well yield (as is usually done prior to a constant-rate pumping test) and resulted in a smaller volume of wastewater compared to that from a constant-rate test at high discharge rate.

A large-scale pumping test was planned (CH2M HILL, 2006a) to investigate the hydraulic response in the Omega wells to pumping from Production Well 2S/11W-30R3 (Santa Fe Springs No. 1). The test was not performed because it would have required interrupting the water supply for the city of Santa Fe Springs.

2.6.2.1 Extraction Well

Well EW1 was installed as an extraction well for a pumping test conducted to help characterize the aquifer properties and hydraulic communication between aquifer units near Well MW8, upgradient of Production Well SFS#1 (Weston, 2002; CH2M HILL, 2004a). Pumping was initiated on November 20, 2006.

Prior to testing, a 30-psi-rated pressure transducer (In-Situ Level TROLL® 700 Series) was installed in the pumping well approximately 35 to 45 feet below static depth to water. Water levels were programmed to be recorded at 30-second intervals in Well EW1. Pressure transducers also were installed in nearby Wells MW8A, MW8B, MW8C, and MW8D. Water levels were programmed to be recorded at 5-minute intervals in these wells. The purpose of the transducers was to record water levels during background (static), pumping, and recovery periods. The collection of background data was initiated on November 17, 2006. Recovery data were collected until water levels stabilized to near background conditions. Manual depth-to-water readings were collected with a sounder to confirm the accuracy of the transducer data.

A 3-inch-diameter stainless-steel submersible pump was used for extracting groundwater. A 2-inch-diameter in-line digital flowmeter with totalizer was used to calculate flow rate measurements in units of gpm. In addition, a premeasured 5-gallon bucket was used to verify the digital flowmeter readings by recording the time required to fill 5 gallons. Totalizer measurements were collected before, during, and at the end of each test.

Six consecutively increasing pumping rates were maintained—5, 8, 10, 11.9, 18, and 30 gpm. The first three rates were maintained for approximately 2 hours each, the fourth rate was maintained for 10 hour,; the fifth rate was maintained for 6.8 hour,; and the last rate was maintained for 1.9 hours. Extracted water was discharged directly to a 21,000-gallon Baker tank located immediately adjacent to the monitoring wells. Approximately 19,300 gallons of purge water was generated during the test.

2.6.2.2 Monitoring Wells

Step-drawdown pumping tests were conducted at Monitoring Wells MW23A, MW24A, MW24C, MW26A, MW26B, MW27A, MW27B, and MW30 between June 20 and July 2, 2007. Prior to testing, a 30-psi-rated pressure transducer (In-Situ Level TROLL® 700 Series) was installed in the pumping wells to record water levels at 1-second intervals during background, pumping, and recovery periods. During the tests conducted at Wells MW24, MW25, MW26, and MW27, pressure transducers were installed in at least two other wells completed in the same borehole. Observation well transducers were programmed to record water levels at one-minute intervals

On June 19, 2007, one In-Situ BaroTROLL® was installed inside the vault of Well MW8A to monitor atmospheric pressure changes during pumping and recovery periods of all tested wells. Barometric pressure readings were programmed to be recorded at 1-minute intervals. In addition, pressure transducers were installed in Wells MW23C and MW23D to monitor background water levels at 1-minute intervals.

Either a 2- or 3-inch-diameter stainless-steel submersible pump was used for extracting groundwater. A 2-inch-diameter in-line digital flowmeter with totalizer was used to calculate flow rate measurements. Totalizer and manual depth-to-water measurements were collected before, during, and at the end of each test.

The details of the step-drawdown pumping tests for all testing and monitoring wells are tabulated in Table 2-9.

2.7 Source Area Investigation

The OU2 plume extends under a large commercial-industrial area where past activities may have resulted in groundwater contamination. The distribution of contaminants characterized during EPA's investigations indicated the presence of sources of groundwater contamination in OU2 other than the former Omega facility. In addition, CH2M HILL conducted a file review to identify facilities that are potential sources of groundwater contamination. Investigations were conducted at such facilities, for which there was insufficient information to determine whether they have caused groundwater contamination.

Five commercial facilities were investigated to identify potential sources of VOC contamination other than the former Omega facility. These facilities were identified as potential VOC sources based on the distribution of VOCs in groundwater at OU2 and on the findings of the state and local agency file review. These include Site D, Site E, Earl Manufacturing, Site F, and the TCE source at Whittier Boulevard (Figures 2-5 to 2-9). The general approach was to collect discrete groundwater samples from temporary soil borings positioned upgradient and downgradient of each suspected source area. A net increase of VOC concentrations or a change in VOC composition downgradient of an investigated facility would indicate that the facility is a likely source of groundwater contamination.

At least four downgradient soil borings were installed at each facility. In general, a 100-foot spacing was used. A smaller spacing of 50 feet was used at Site D so that at least four downgradient borings could be installed. An attempt was made to collect two discrete groundwater samples at each boring location—one sample immediately below the water table and one sample approximately 10 feet below the water table. Two sampling depths were attempted at each location to obtain a better characterization of contaminant distribution than single-depth discrete samples would allow. The sample identification of discrete samples includes the boring location followed by an "A" for the shallow depth (e.g., HPT-1A) or "B" for the deeper depth (e.g., HPT-1B).

CPTs also were implemented at some facilities to assist with the selection of discrete sampling intervals in areas with predominantly fine-grained sands and slow groundwater recharge. A description of CPT methodology is provided in Section 2.8.1.

Gregg Drilling and Testing, of Signal Hill, California, was retained as the subcontractor for conducting CPT and HydroPunch® sampling.

2.7.1 Site D, 8421 South Chetle Avenue, Santa Fe Springs, California

Site D is located at 8421 South Chetle Avenue, Santa Fe Springs, California, and is currently known as L.A. Pipe and Supply. This facility served as a transporter of dry cleaning waste (such as liquid tetrachloroethene [PCE] and solids contaminated with PCE) between 1996 and 2002. Wastes were typically transferred or loaded to other vehicles at the facility. No previous soil or groundwater data are available. Investigations were recommended based on the history of PCE storage at the facility and its location in an area of high VOC contamination (greater than 500 μg/L PCE).

HydroPunch® sampling at Site D was conducted between February 21 and 23, 2007. A total of five borings (HPT-1 to HPT-5) were installed as part of this investigation (Figure 2-5). Boring HPT-1 was installed along the north side of Chetle Avenue, in the city of Santa Fe Springs right-of-way. HPT-1 served as an upgradient sampling point. Downgradient Borings HPT-2 to HPT-5 were installed in a parking lot just south of Site D. The adjacent facility is known as Moranth Fabrication and is located at 8433 Chetle Avenue. The borings were spaced at approximately 50-foot intervals.

Two discrete groundwater samples were collected at 40 and 50 feet bgs at all boring locations. Field duplicate samples were collected during the collection of Samples HPT-3B and HPT-5B. Samples were collected in four 40-mL VOA vials pre-preserved with HCL, then shipped to Datachem for VOC and 1,4-dioxane analysis (CLP Method SOM01.1 with SIM).

2.7.2 Site E, 12200 Los Nietos Road, Santa Fe Springs, California

Site E is located at 1200 Los Nietos Road, Santa Fe Springs, California. This facility served as a paint manufacturing company between 1953 and 2001; the company produced water- and solvent-based paints and stored solvents (TCE) and other raw materials in both aboveground storage tanks (ASTs) and USTs. VOCs were detected in both soil and groundwater during a 1995 investigation. Some of the groundwater contamination found at this facility may have originated upgradient. However, because this facility is not located directly downgradient from a known source area, the historical facility data are an indication of a possible release of contamination.

HydroPunch® sampling near Site E was conducted on January 26, May 2, February 21, and February 23, 2007. A total of six borings (HPF-1 to HPF-6) were installed as part of this investigation (Figure 2-6). The two upgradient HydroPunch® borings (HPF-1 and HPF-2) were installed north of Los Nietos Road, in parking lots located at 12139 and 12207 Los Nietos Road, Santa Fe Springs. Downgradient soil borings (HPF-3 to HPF-6) were installed along Pike Street, immediately adjacent to the Triangle Distribution Company (12065 Pike Street), between February 21 and February 23, 2007. These borings were located on the city of Santa Fe Springs right-of-way.

Discrete groundwater samples were collected at 77 and 87 feet bgs at upgradient Borings HPF-1 and HPF-2. Discrete samples were collected at 80 and 90 feet bgs at Borings HPF-3, HPF-4, and HPF-6. At HPF-5, discrete samples were collected at 75 and 85 feet bgs. Groundwater samples were collected in four 40-mL VOA vials pre-preserved with HCL, then shipped to Datachem for VOC and 1,4-dioxane analysis (CLP Method SOM01.1 with SIM).

2.7.3 Earl Manufacturing, 11862 Burke Street, Santa Fe Springs, California

Earl Manufacturing is located at 11862 Burke Street, Santa Fe Springs, California, and is currently known as FTR Associates. This facility also is located immediately south of Techni-Braze, a known source of VOC contamination. An onsite monitoring well, screened from 22 to 42 feet bgs, was installed near a former UST in 1999. Subsequent groundwater sampling revealed PCE and TCE concentrations in the shallow aquifer were 13,700 and 1,730 µg/L, respectively. The high concentrations of VOCs detected at this facility warranted further investigation.

A total of seven soil borings (HPE-1 to HPE-7) were installed as part of the Earl Manufacturing investigation (Figure 2-7). Borings HPE-1 and HPE-2 were installed on January 23, 2007, in a parking lot located just east of FTR Associates, and served as the upgradient sampling points. The parking lot is part of the Steven Label property, located at 11876 Burke Street. Downgradient Borings HPE-3 to HPE-7 were installed on March 16 and March 19, 2007, in a parking lot located immediately south of FTR Associates. This parking lot is part of the business complex located at 8708 Dice Road.

Discrete groundwater samples were collected at 35 and 45 feet bgs at HPE-1 and HPE-2. Discrete samples were generally collected at 35 and 48 feet bgs at Borings HPE-3 to HPE-7. The deeper sample at HPE-3 was collected at 52 feet bgs, primarily due to poor recharge at the initial target depth of 48 feet bgs. Groundwater samples were collected in four 40-mL VOA vials pre-preserved with HCL, then shipped to Datachem for VOC and 1,4-dioxane analysis (CLP Method SOM01.1 with SIM).

2.7.4 Site F, 8623 Dice Road, Santa Fe Springs, California

Site F is located at 8623 South Dice Road, Santa Fe Springs, California. This facility manufactures wire fasteners and has been in operation since 1964. In 1972, operations were expanded from manufacturing wire fasteners to include zinc plating. The facility consists of three buildings containing offices, a machine shop, a zinc plating area, and a warehouse. Violations for two sodium cyanide spills along Burke Street were reported in 1974 and 1978. A violation for the discharge of oil liquids to an adjacent culvert, west of the property, was reported in 1981. No onsite soil or groundwater data is available to confirm contamination from VOCs or metals at this facility.

HydroPunch® sampling near Site F was conducted between March 5 and 12, 2007, and on May 9, 2007. CPTs also were conducted at Borings HPW-1 and HPW-6 to assist with the selection of discrete sampling intervals. The CPT was used to maximize the potential for sampling in zones with coarse-grained units because initial attempts to collect groundwater samples required long times for the sampler to fill with water. Electronic copies of the CPT logs are presented in Appendix A.6.

A total of 10 soil borings (HPW-1 to HPW-10) were installed as part of this investigation (Figure 2-8). The upgradient sample locations include HPW-1, HPW-2, HPW-9, and HPW-10. Discrete groundwater samples were collected at 50 and 70 feet bgs at HPW-1, 38 and 50 feet bgs at HPW-2, and 53 feet bgs at HPW-9 and HPW-10. A total of six soil borings (HPW-3 to HPW-8) were installed at locations downgradient of the facility. Of these, five soil borings (HPW-3 to HPW-7) were positioned approximately 100 feet apart along Burke Street in the city of Santa Fe Springs right-of-way. The remaining downgradient boring (HPW-8) was positioned along Westman Avenue, approximately 230 feet south of Site F. Discrete samples were collected at 35 and 50 feet at HPW-3, 40 and 50 feet bgs at HPW-4 and HPW-5, 45 and 53 feet bgs at HPW-6, 53 feet bgs at HPW-7, and 35 and 53 feet at HPW-8.

Due to slow groundwater recharge at this facility, groundwater in some direct-push rods was allowed to recharge overnight before collecting groundwater samples. This was accomplished by pushing the rods to the first sample depth, retracting the screen, then leaving the push rods in the ground overnight. The next morning, a bailer was lowered into the push rods for sample collection.

In addition to VOCs and 1,4-dioxane, hexavalent chromium and dissolved metals samples were collected during this investigation. Hexavalent chromium samples were bailed into a 250-mL polyethylene bottle. Metals samples were initially bailed into a clean 1-liter polyethylene bottle, then pumped through a 0.45-micron filter using a peristaltic pump, and finally transferred to a 1-liter polyethylene bottle pre-preserved with nitric acid. Metals samples were not collected in the shallow discrete sample at Borings HPW-3, HPW-4, or HPW-5 due to insufficient sample volume. Samples collected for VOCs and 1,4-dioxane were submitted to Datachem for analysis using CLP Method SOM01.1 with SIM. Samples collected for dissolved metals were shipped to Ceimic for analysis using CLP Method ILM05.3. Hexavalent chromium samples were analyzed by Test America using EPA Method 218.6. Due to the 24-hour hold time restrictions on hexavalent chromium, a courier was assigned by Test America to transport samples on a daily basis.

2.7.5 TCE Source at Whittier Boulevard, in the Vicinity of Whittier Boulevard and Mar Vista Street, Whittier, California

The TCE source at Whittier Boulevard is located on the east side of Whittier Boulevard immediately north of Mar Vista Street. Several automotive repair and maintenance facilities currently occupy the northern parcel of the site. The former facility that occupied the northern parcel served as a furniture manufacturing company with a painting booth and dip tank located onsite. A preliminary environmental assessment was conducted at the site in September 1987 and a follow-up soil investigation was completed in October 1987. No groundwater investigation has been conducted at this former facility, and it is unclear when the business ceased operations. Further investigations near this facility were warranted based on the history of chemical usage, as well as the presence of relatively high TCE concentrations (greater than 100 µg/L) in groundwater immediately downgradient of the site.

The southern parcel consists of a dirt lot owned by the city of Whittier. The city plans to use this area as part of its Greenway Trail Project. Past industrial activities at this parcel included a fuel tank farm with a pumping station and storage and dispensing of pesticides. The complete history of this parcel of land is currently unknown.

A total of 13 soil borings (HPA-1, HPA-6 to HPA-10, and HPA-12 to HPA-18) were installed as part of this investigation (Figure 2-9). Borings HPA-6 to HPA-10 were installed along a California Department of Transportation (Caltrans) greenbelt right-of-way between February 15 and 20, 2007. An access agreement with Caltrans was executed on January 21, 2007. On February 19, 2007, boring HPA-1 was installed in the city of Whittier street right-of-way, near the intersection of Baldwin Place and the Whittier Boulevard frontage road. Borings HPA-1 and HPA-6 to HPA-10 served as downgradient sampling points.

Borings HPA-12 to HPA-18 were installed on March 21 and March 22, 2007. Borings HPA-12, HPA-13, HPA-14, and HPA-15 served as downgradient sampling points. Borings HPA-16, HPA-17, and HPA-18 served as upgradient sampling points. All borings are located in a dirt lot owned by the city of Whittier. The property address of the lot is 725 Whittier Square, Whittier, California.

CPTs also were conducted at Borings HPA-1 and HPA-8 to assist with the selection of discrete sampling intervals. Electronic copies of the CPT logs are included in Appendix A.6. Due to slow groundwater recharge in the study area, groundwater inside the direct-push rods was allowed to recharge overnight before collecting groundwater samples. Only one discrete sample was collected per boring location. Discrete sampling depths ranged between 95 and 110 feet bgs. Groundwater samples were collected in four 40-mL VOA vials pre-preserved with HCL, then shipped to Datachem for VOC and 1,4-dioxane analysis (CLP Method SOM01.1 with SIM).

Following the completion of the Omega OU2 draft RI report (CH2M HILL, 2009a), CH2M HILL prepared a SAP Addenda for additional field investigations throughout OU2 with the objective to characterize in more detail potential groundwater contamination sources identified in the OU2 draft RI report. SAP Addendum 4 was prepared to investigate the TCE source at Whittier Boulevard (CH2M HILL, 2009b). Field investigations planned in SAP Addendum 4 included direct-push groundwater (Hydropunch®) and soil sampling, and the installation of one shallow groundwater monitoring well (Figure 5-8).

The additional field investigation proposed in SAP Addendum 4 has been partially completed. Specifically, soil sampling was completed at two of the three proposed locations—Samples SS4-1 and SS4-2 were collected near the former sump in the empty lot on September 3, 2009, and Samples SS4-3 and SS4-4 were collected near the former dip tank west of HPA-17 (Figure 5-8). SS4-1 and SS4-3 were collected at the depth interval between 10 and 11 feet bgs and SS4-2 and SS4-4 were collected at the depth interval between 30 and

31 feet bgs. The third soil sampling location (near a former painting booth) could not be accessed with the direct-push rig due to uneven terrain and, subsequently, access to the sampling location could not be obtained. Ultimately, CH2M HILL and EPA determined that it was not necessary to sample this location for the purpose of completing this RI report For similar reasons, the planned Hydropunch® sampling has not been conducted.

2.8 Residential Area Investigation

The residential area investigation included the installation and sampling of four nested soil gas probes in the Whispering Fountains Apartment Community, located at 12251 Washington Boulevard, Whittier, California. The purpose of this investigation was to determine existing VOC concentrations in soil gas and evaluate the potential for soil gas vapor intrusion into indoor air (including potential human health risks). The residential area was of potential concern due to the relatively shallow depth of groundwater (approximately 35 feet bgs) and elevated concentrations of VOCs in groundwater beneath this area. Soil sampling (for geotechnical analysis) and HydroPunch® sampling was conducted to provide data for the vapor transport modeling and human health and ecological risk assessment. CPTs also were conducted to assist with the selection of soil gas probe screen intervals, and discrete groundwater and soil sample depths.

Four boring locations (RA-1, RA-2, RA-3, and RA-4) were positioned at each corner of the apartment community boundaries for this investigation (Figure 2-10). CPT, HydroPunch®, soil, and soil gas borings were installed at these locations. These four locations were approved by EPA and were considered to be a representative data set for this area. A fifth location was originally proposed in the center of the apartments; however, site access restraints limited sampling activities to the apartment streets.

Gregg Drilling and Testing was selected as the subcontractor to perform all drilling and sampling activities at this site.

2.8.1 CPT Activities

CPTs were conducted during the advancement of four direct-push borings on January 9 and 10, 2007. A 25-ton truck-mounted CPT/direct-push rig was used to advance the borings. CPT borings were advanced to 46 feet bgs at RA-3 and 60 feet bgs at Borings RA-2, RA-3, and RA-4.

The CPT procedure consists of pushing a cone-tipped cylindrical probe into the ground while simultaneously measuring the resistance to penetration. The CPT rig is a type of direct-push technology rig that is similar to Geoprobe™. The rig uses the weight of the truck in addition to the force of its hydraulic mechanism to drive the probe and sampling equipment to the target depth. The CPT probe contains two strain-gauge load cells that measure the soil-bearing resistance acting on the conical tip of the probe and the frictional resistance sensed along a friction sleeve. The cone is typically advanced at a rate of 2 centimeters per second (cm/sec) with the driving force provided by hydraulic rams in the CPT rig.

The CPT log was used to obtain a stratigraphic interpretation of the subsurface to determine screen depths for the soil gas probes, discrete groundwater samples, and soil sample intervals. The stratigraphic interpretation is based on relationships between tip resistance (qc), sleeve friction (fs), and penetration porewater pressure (U). The friction ratio (Rf) is a calculated parameter that is used to infer soil behavior type. Generally, cohesive soils (clays) have higher friction ratios, lower tip resistance, and generate large excess porewater pressures. Cohesionless soils (sands) have lower friction ratios, higher tip resistance, and generate little excess porewater pressure. The interpretation of soils follows correlations by Robertson and Campanella (1990).

Electronic copies of each CPT log are included in Appendix A.6.

2.8.2 HydroPunch® Sampling

Four soil borings (HPRA-1 to HPRA-4) were advanced with the CPT rig on January 9 and 10, 2007, for the purposes of discrete (HydroPunch®) groundwater sampling. Discrete samples were generally collected immediately below depth to water (35 feet bgs), and 10 feet below depth to water. The sample identification of discrete samples includes "HP" and the boring location (e.g., HPRA-1) followed by an "A" for the shallow depth (e.g., HPRA-1A) or "B" for the deeper depth (e.g., HPRA-1B).

Discrete groundwater samples were collected from each boring after a review of the CPT logs. The selected sampling intervals were predominantly coarse-grained sands. Discrete samples were collected at 43 and 53 feet bgs at HPRA-1 and HPRA-2, 50 and 60 feet bgs at HPRA-3, and 47 and 57 feet bgs at HPRA-4. A stainless-steel bailer was used to transfer groundwater from inside the direct-push rods to four 40-mL VOAs pre-preserved with HCL. Samples were immediately placed in coolers containing ice, then shipped to Datachem for VOC and 1,4-dioxane analysis (CLP Method SOM01.1 with SIM).

2.8.3 Soil Sampling

Discrete soil samples were collected from four soil borings (SSRA-1 to SSRA-4) on January 11 and 12, 2007. The borings were advanced with a truck-mounted HSA rig equipped with 6-inch-OD HSA flights. A California-modified ring sampler (split-barrel device) was used for the collection of 2-inch-diameter soil samples. The California-modified ring sampler allowed for undisturbed or in situ soil cores to be collected. The split-barrel sampling device is constructed of high-strength alloy steel with a tongue-and-groove arrangement running the length of the tube, allowing it to be split in half. The two halves are held together by a threaded-drive head assembly at the top and a hardened shoe at the bottom with a beveled cutting tip. The sampler, approximately 24 inches in length, is driven by a 140-pound weight dropped through a 30-inch interval. When the sampling barrel was brought to the surface, it was disassembled and the 2-inch-diameter brass rings (containing the soil cores) were removed. Undisturbed (in situ) soil samples were collected from soil borings, located immediately adjacent to the CPT, HydroPunch®, and soil gas borings. The purpose of the soil samples is to provide physical (geotechnical) data as input for soil vapor transport modeling in support of the HHRA.

Three discrete soil samples were collected from each of the four soil borings. Soil sample intervals were selected based on the review of the CPT logs. The sample identification of discrete samples includes "SS" and the boring location (e.g., SSRA-1) followed by an "A" for the shallow sample (e.g., SSRA-1A), "B" for the middle sample (e.g., SGRA-1B), and "C" for the deepest sample (e.g., SGRA-1C). The general approach was to collect samples from intervals with coarser-grained sands. Following is a summary of sample intervals that were submitted for laboratory analysis:

- SSRA-1: 11.5 to 12 feet bgs, 18.5 to 19 feet bgs, 28.5 to 29 feet bgs
- SSRA-2: 7 to 7.5 feet bgs, 12.5 to 13 feet bgs, 28.5 to 29 feet bgs
- SSRA-3: 12 to 12.5 feet bgs, 18.5 to 19 feet bgs, 28.5 to 29 feet bgs
- SSRA-4: 11 to 11.5 feet bgs, 18 to 18.5 feet bgs, 32 to 32.5 feet bgs

The 2-inch-diameter soil cores were capped with Teflon® sheets and plastic end caps, secured in a cooler, then transported by CH2M HILL staff to PTS Laboratories of Santa Fe Springs, California, for geotechnical analysis.

The analysis included the following parameters:

- Air-filled porosity (calculated and reported by laboratory)
- Atterberg limits (ASTM International [ASTM] D4318)
- Bulk density (ASTM D2937)
- Grain density (ASTM D422)
- Grain size (API RP40)
- Moisture content (ASTM D2216)
- Total porosity (calculated and reported by laboratory)
- USCS soil type

Copies of the geotechnical reports are provided in Appendix D.

2.8.4 Soil Gas Probe Installation and Sampling

On January 11, 2007, four triple-nested soil gas probes (SGRA-1 to SGRA-4) were installed at each corner of the Whispering Fountains Apartments, immediately adjacent to the CPT and HydroPunch® soil borings. Probes were installed using a 25-ton truck-mounted CPT rig. Direct-push methods were used to advance a nominal 2-inch-diameter boring at each location. The sample identification of soil gas probes includes “SG” and the boring location (e.g., SGRA-1) followed by an “A” for the shallow screen (e.g., SGRA-1A), “B” for the middle screen (e.g., SGRA-1B), and “C” for the deepest screen (e.g., SGRA-1C). Course-grained lithologic units at least 3 feet above the water table were targeted as screen intervals.

Three individual soil gas probes were installed in each 2-inch-diameter borings. The probes consisted of three 6-inch-long, stainless-steel mesh screen implants attached to three 0.25-inch inside diameter (ID) Teflon® tubing with three labeled gas-tight valves at ground surface. The screen implants were surrounded by approximately 1.5 feet of filter pack consisting of No. 3 Monterey sand. A 0.5-foot, fine-grained sand interval (No. 60 transition sand) was placed over the top of the filter pack; 1 foot of dry granular bentonite was placed on top of the transition sand. Hydrated granular bentonite was then placed on top of the dry granular bentonite to within 1 to 1.5 feet of the bottom of each successive soil gas probe. A summary of soil gas probe completion details is presented in Table 2-10.

Soil gas samples were collected from the soil gas probes on January 15, 2007, after approximately 4 days of equilibration time. Figure 2-11 presents a schematic diagram of the purge and sample train used for sampling with an electric pump. The soil gas purge train consisted of a water and dust trap, vacuum gauge connected by copper tubing, calibrated flowmeter, and electric (oil-free) vacuum pump. The sample train consisted of a flow regulator, compression or Swagelok® fittings, and 400-mL SUMMA canister provided by the EPA Region 9 Laboratory. All SUMMA canisters were verified for full vacuum pressure (approximately 29 inches of mercury) prior to sampling.

To ensure that stagnant or ambient air was removed from the sampling system and that samples collected were representative of subsurface conditions, approximately three system volumes (300 mL) were purged prior to collecting samples. The vacuum purge rate was maintained at 100 milliliters per minute (mL/min). A stainless-steel, three-way switching valve was used to divert soil gas flow to the SUMMA canister after purging was complete. After purging, the vacuum pump was shut off, and the three-way switch valve was turned to allow flow to be diverted to the SUMMA canister. After approximately 5 minutes, the switch valve was closed and the SUMMA canister was detached from the sample train. Vacuum pressure was then measured in each canister to verify sample collection. All but three canisters were confirmed to have zero inches of mercury pressure. After sample collection, the brass plug caps were placed and tightened over the swage fittings. Samples were shipped immediately shipped to the EPA Region 9 Laboratory for VOCs analysis (EPA Method TO-15).

A leak test was conducted at each nested soil gas probe location during soil gas sampling. The leak check was performed at locations where ambient air could have entered the sampling system, typically near the base of the sampling probes at ground surface. Commercial-grade Bernzomatic® butane was used as the leak test compound. Butane was selected because it has not been measured in soil gas samples collected at the Omega property. Prior to purging each probe, butane was released near the base of the probe at ground surface. A 4-inch-diameter plastic cap was placed over the butane discharge point and the base of the soil gas probes to maintain a “cloud” of butane for the duration of sampling.

2.9 Production Well Sampling

On February 17, 2010, CH2M HILL conducted a one-time sampling event at Golden State Water Company (GSWC) Production Wells Pioneer 1, Pioneer 2, Pioneer 3, and Dace 1, located in Santa Fe Springs, California. The objective of the sampling was to confirm the presence of VOCs in the groundwater extracted by these wells.

Roy Damron of GSWC was present during the sampling. Samples were analyzed for VOCs, SVOCs, 1,4-dioxane, dissolved metals, and general chemistry parameters (alkalinity, anions, and TDS). The EPA Region 9 Laboratory analytical request form is included in Appendix F-2. The list of analytes for this sampling event was reduced from the standard Region IX analyte list (Appendix F-2) at the request of GSWC.

Samples were collected from sample taps located at the main raw water line near each wellhead. Approximately three well volumes were purged prior to collection of samples from Dace 1 and Pioneer 1. Pioneer 3 was active prior to and during sampling, so no well purging was necessary. The sample from well Pioneer 2 could not be collected because the well pump malfunctioned.

Samples were poured directly from the sample taps to the laboratory grade sample containers. A 0.45-micron filter was used to field filter water samples for dissolved metals analysis. One field duplicate sample was collected at Pioneer 3 and one laboratory QC sample was collected from Dace 1. Dissolved metals samples were shipped via Fed-Ex to Bonner Analytical in Hattiesburg Mississippi. The VOCs, SVOCs, 1,4-dioxane, and general chemistry samples were shipped to the EPA's Region 9 Laboratory in Richmond, California. The analytical results are discussed in Section 5.

2.10 Field Quality Assurance/Quality Control Procedures

QC samples were collected or prepared to assist in determining data reliability. QC samples collected in this investigation include field duplicates, ambient blanks, equipment blanks, trip blanks, and laboratory QC samples (matrix spike/matrix spike duplicate [MS/MSD]). A description of each sample follows.

2.10.1 Field Duplicates

The field duplicate is an independent sample collected as close as possible to the original sample from the same source and is used to document sampling precision. The duplicate samples were labeled and packaged in the same manner as other samples so that the laboratory could not distinguish between samples and duplicates. An attempt was made to take the duplicate sample from a location that is expected or known to be moderately contaminated. Each duplicate was taken using the same sampling and preservation method as other samples. Field duplicates were collected at a minimum frequency of one in every 10 samples. For soil gas sampling, a T-connector fitting was used to fill primary and field duplicate samples simultaneously.

2.10.2 Ambient Blanks

Ambient blanks were collected to verify that contamination was not introduced to samples during collection, handling, or shipping of the samples. They were prepared by pouring blank water directly into the sample bottles. Analyte-free water was used for organic analyses using the same preservation methods and packaging and sealing procedures used during collection of groundwater samples. Ambient blanks were prepared and labeled in the same manner as the field samples and sent "blind" to the laboratory. Ambient blanks were collected at a minimum frequency of one in every 10 samples.

2.10.3 Equipment Blanks

Equipment blanks were collected to verify that contamination was not introduced to samples through the use of decontaminated equipment. Equipment blanks were prepared by pouring deionized water over the sampling device and into pre-preserved VOAs for VOC analysis. Equipment blanks were prepared following decontamination for each piece of reusable sampling equipment. No equipment blanks were collected during soil gas sampling.

2.10.4 Trip Blanks

The purpose of trip blanks is to verify that volatile contamination is not introduced to samples during transportation or through transportation materials. For groundwater sampling, trip blanks were prepared by the laboratory and were analyzed for VOCs only. The trip blanks were carried in a sample cooler throughout the day and returned to the laboratory with the field samples. In accordance with direction from EPA, no trip blanks were to be submitted to the EPA's Region 9 Laboratory if an equipment blank or ambient blank was collected for a particular day of sampling.

For soil gas sampling, empty SUMMA canisters provided by the EPA Region 9 Laboratory were shipped to the laboratory then filled with ultra-pure nitrogen and analyzed as a normal sample (this constitutes a trip/equipment blank sample). The SUMMA canisters were not opened in the field and remained under vacuum until they arrived at the laboratory. Trip blanks were collected at a minimum frequency of one in every 10 samples.

2.10.5 Laboratory QC Samples

Laboratory QC samples (i.e., MS/MSDs) were collected during routine groundwater sampling and HydroPunch® sampling. One MS/MSD sample was designated for every 20 field samples or for each 14-day sampling period, whichever was the more frequent. A double volume of sample was collected when MS/MSD samples were required. The first sample volume is for the target sample; the second volume is for the MS and MSD analysis. Collection of MS/MSDs was coordinated with the laboratory. The sample was identified and denoted as "Lab QC" on the sample container and the chain-of-custody record.

2.11 Investigation-Derived Waste

IDW generated during the implementation of this field investigation included solids and liquids. Solids include soil cuttings and drilling mud (bentonite and water) from drilling and soil sampling activities. Liquid waste includes decontaminant rinsate water, well development water, groundwater sampling purge water, and aquifer testing purge water. Analytical profiling samples were collected for both matrixes and submitted to the EPA Region 9 Laboratory for analysis.

Solids were analyzed for VOCs (EPA Method 8260B), California Assessment Manual (CAM) 17 metals (EPA Method 6010B), pH (EPA Method 9040B/9045C), total petroleum hydrocarbons as gasoline (TPH-g) (EPA Method 8015B), and total petroleum hydrocarbons as diesel (TPH-d) (EPA Method 8015B). Grab samples were collected using a clean stainless-steel trowel or shovel. Sample containers for VOCs and TPH-g included six 40-mL glass VOA vials, pre-weighed with stir bars. Six 5-gram encore containers were used in lieu of VOA vials if the soil was competent enough for soil sample extraction using an encore sampling device. A 12-ounce glass jar was used as a container for the remaining solids analysis.

Water samples were analyzed for VOCs (EPA Method 524.2), CAM 17 total metals (EPA Method 200.7/245.1), pH (EPA Method 150.1), 1,4-dioxane (EPA Method 8270C), hexavalent chromium (EPA Method 218.6), TPH-g (EPA Method 8015B), and TPH-d (EPA Method 8015B). Grab samples were collected using a disposable polyethylene bailer connected to a clean polyethylene rope. Samples collected for VOCs were placed in three 40-mL glass VOA vials pre-preserved with HCL. Samples collected for metals were placed in a 1-liter polyethylene bottle pre-preserved with nitric acid. Samples collected for 1,4-dioxane were placed in two 1-liter glass amber bottles. Samples collected for hexavalent chromium and pH were placed in one 250-mL polyethylene bottle.

Transportation waste manifests are presented in Appendix E.

2.11.1 Monitoring Well Construction – Nested Wells

Waste generated from the construction of Nested Wells MW24, MW25, MW26, and MW27 included soil cuttings, drilling mud, and well development water. In general, the drill cuttings and drilling mud were segregated from well development water at each well location and stored in plastic-lined, 20-cubic-yard (yd^3) roll-off bins. Up to six roll-off bins were stored at each well location.

Haz Mat Trans of San Bernardino, California, was retained as the subcontractor to WDC for the storage and removal of waste. Both solid and liquid waste was transported under nonhazardous manifest to the Chemical Waste Management facility in Kettleman City, California.

2.11.2 Monitoring Well Construction – Single-Screen Wells

Waste generated from the construction of single-screen Wells MW23A, MW28, MW29, and MW30 included soil cuttings and well development water. The drill cuttings were stored in one 20-yd^3 roll-off bin, and the well development water was stored in a 5,000-gallon Baker tank. The roll-off bin and Baker tank were staged in the northeast corner of the Little Lake Park parking lot, located off Lakeland Boulevard in Santa Fe Springs, California.

Clear Blue Environmental of Los Alamitos, California, was retained as the subcontractor to Boart Longyear for the storage and removal of waste. Solid waste was transported under nonhazardous manifest to the Chemical Waste Management facility in Kettleman City, California. Liquid waste was transported under nonhazardous manifest to the Siemens Water Technologies facility in Vernon, California.

2.11.3 HydroPunch® and Soil Sampling

Waste generated from the HydroPunch® and residential area investigations included both liquid and solid waste. The decontamination of direct-push equipment used for the HydroPunch® sampling generated liquid wastes. Solid waste included soil cuttings generated from the HSA drilling and soil sampling. Both liquid and solid waste was stored in Department of Transportation (DOT)-approved 55-gallon drums, which were staged at the city of Whittier storage lot located at 1201 Hadley Street, Whittier, California.

American Integrated Services (AIS) of Long Beach, California, was retained as a subcontractor to Gregg Drilling for the storage and transportation of waste. Solid waste was transported under nonhazardous manifest to the Crosby and Overton facility in Long Beach, California. Liquid waste was transported under nonhazardous and RCRA-hazardous manifest to the Crosby and Overton facility.

2.11.4 Routine Groundwater Sampling

Groundwater sampling purge water was generated during the routine collection of groundwater samples from the EPA and OPOG monitoring wells. DOT-approved 55-gallon drums were used to containerize the waste. The drums were staged behind the Three Kings Construction parking lot, located at 12512 Whittier Boulevard.

Asbury Environmental Services of Compton, California, and Clear Blue Environmental were retained by CH2M HILL for the storage and removal of waste. Liquid waste was transported under nonhazardous and non-RCRA hazardous manifest to the Demenno/ Kerdoon facility in Compton, California.

2.11.5 Aquifer Testing

Liquid waste generated during aquifer testing included decontaminant rinsate water and purge water. A small quantity of decontaminant rinsate water was generated during slug testing activities. This water was stored in DOT-approved 55-gallon drums and staged behind the Three Kings Construction parking lot. Clear Blue Environmental was retained by CH2M HILL for the profiling and transport of the liquid waste. The waste was transported under nonhazardous manifest to the U.S. Filter Recovery Service of Vernon, California.

Purge water was generated during aquifer testing of Wells EW1, MW23A, MW24, MW26, MW27, and MW30. Purge water was stored in 13,000- or 21,000-gallon Baker tanks located immediately adjacent to each well. After profiling, the water was pumped directly from each Baker tank into 5,000-gallon capacity vacuum trucks for transport. Approximately 19,300 gallons of water was generated during testing of EW1. This waste was transported by Enviroserve of Signal Hill, California, under nonhazardous waste manifest to the Lakeland Processing facility in Santa Fe Springs, California. Approximately 40,000 gallons of purge water was generated during testing of Wells MW23A, MW24, MW26, MW27, and MW30. This water also was transported by Enviroserve under nonhazardous manifest to the Crosby and Overton facility.

2.12 Community Involvement

Community involvement for this investigation included a fact sheet (September 2009), and communication with state of California, cities (Whittier, Santa Fe Springs, and Norwalk), local agencies (Water Replenishment District of Southern California [WRD], OCSD), water purveyors, and PRP employees and legal representatives. In cases where private access agreements were executed, communication was limited to private property owners, tenants, employees, and legal representatives.

The contacted parties were informed about the purpose and scope of the investigation. No public flyers regarding field work were distributed during the investigation.

Upon the publication of the draft RI report in March 2009, the document was made available on a file transfer protocol (FTP) site and the contacted parties were notified; hard copies of the document were provided to the DTSC. EPA also held regular meetings with the PRP group OPOG and multiple meetings with the DTSC, WRD, and water purveyors regarding the progress and results of the RI/FS.

Table 2-1
Omega Well Construction Details
Omega Chemical Superfund Site

Well ID	X Coordinate (meters)	Y Coordinate (meters)	Surface Elevation (feet amsl)	TOC Elevation (feet amsl)	Depth to Screen Top (feet bgs)	Depth to Screen Bottom (feet bgs)	Total Depth (feet bgs)	Total Depth Drilled (feet bgs)	Borehole Diameter (inches)	Casing Diameter (inches)	Screen Material	Screen Slot Size (inches)	Casing Material	Filter Pack Grade	Filter Pack Top (feet bgs)	Filter Pack Bottom (feet bgs)	Drilling Method	Annular Seal Material	Annular Seal Top (feet bgs)	Annular Seal Bottom (feet bgs)
OW1A	403554.4000	3759242.1000	209.99	212.50	63	77.5	77.5	80	10	4	SST	0.02	SCH40 PVC	2/12	59	78	hollow stem auger	neat slurry	3.5	56.2
OW1B	403542.8490	3759236.7550	207.37	207.18	110	120	120	130	10	4	SST	0.02	Mild Steel	2/12	99	130	hollow stem auger	95/5 slurry bentonite pellets	0 96	96 99
OW2	403461.2000	3759246.6000	203.24	202.30	60	80	80	85	10	4	SST	0.02	Mild Steel	2/12	55	85	hollow stem auger	95/5 slurry bentonite pellets	0 50	50 55
OW3A	403503.4000	3759170.1000	199.08	198.53	63	83	83	85	10	4	SST	0.02	Mild Steel	2/12	58	85	hollow stem auger	95/5 slurry bentonite pellets	0 53	53 58
OW3B*	403522.0000	3759148.0000	197.77	197.06	112	122	122	139	10	4	SST	0.01	SCH40 PVC	2/12	106	126	mud rotary	95/5 slurry bentonite chips #30 transition sand	0 99 105	99 105 107
OW4A	403320.6000	3759071.9000	184.93	184.67	49.8	69.8	69.8	80	10	4	SST	0.02	Mild Steel	2/12	47.7	75.7	hollow stem auger	95/5 slurry bentonite pellets	2 42.5	42.5 47.7
OW4B	403317.0360	3759072.3480	184.95	184.50	112	122.3	122.3	132	10	4	SST	0.02	Mild Steel	2/12	109.5	132	hollow stem auger	95/5 slurry bentonite pellets	2 105	105 109.5
OW5	402744.6000	3758929.8000	154.88	154.16	30	50	50	52	10	4	SST	0.02	SCH40 PVC	2/12	25	51	hollow stem auger	95/5 slurry bentonite	0 20	20 25
OW6	403207.7000	3758942.3000	173.14	172.74	38	58	58	61.5	10	4	SST	0.02	Mild Steel	2/12	36	59	hollow stem auger	95/5 slurry bentonite chips	2 30.5	30.5 36
OW7	403600.4000	3759301.6000	215.54	214.21	70.9	90.9	90.9	92	10	4	SST	0.02	Mild Steel	2/12	65	92.5	hollow stem auger	95/5 slurry bentonite pellets	2 60.6	60.6 65
OW8A	403481.6370	3759209.4910	201.20	200.64	60.4	80	80	81	10	4	SST	0.02	Mild Steel	2/12	55	81	hollow stem auger	95/5 slurry bentonite pellets	2 51	51 55
OW8B	403480.0430	3759212.7890	201.43	200.82	116	126	126	143	10	4	SST	0.01	SCH40 PVC	2/12	111.3	128	mud rotary	95/5 slurry	2	110
MW1A	402749.8678	3759022.8370	157.81	157.71	45	60	60	60	10	4	SCH40 PVC	0.02	SCH40 PVC	3	41.5	60	hollow stem auger	95/5 slurry medium chips	1 35	35 42
MW1B	402749.9621	3759020.3187	158.10	158.05	75	85.4	85.4	95	10	4	SCH40 PVC	0.02	SCH40 PVC	3	72	86	hollow stem auger	95/5 slurry bentonite pellets	1 67	67 72
MW2	402799.4810	3758870.1561	154.24	154.21	45	60	60	60	10	4	SCH40 PVC	0.02	SCH40 PVC	3	42.5	60	hollow stem auger	95/5 slurry bentonite pellets	1 38	38 42
MW3	402931.5361	3758376.4901	151.86	151.48	38	48	48	51.3	10	4	SCH40 PVC	0.02	SCH40 PVC	3	35.5	48	hollow stem auger	95/5 slurry bentonite chips	1 32	32 36
MW4A	402537.1475	3758403.1393	147.02	146.80	42.7	53	53	53	10	4	SCH40 PVC	0.02	SCH40 PVC	3	38.5	53	hollow stem auger	95/5 slurry bentonite chips	1 36	36 38.5
MW4B	402539.6698	3758404.8988	147.00	146.84	69.7	80	80	125	10	2	SCH40 PVC	0.02	SCH40 PVC	3	67	80	mud rotary	95/5 slurry bentonite chips/pellets	1 61.5	61.5 67
MW4C	402539.8674	3758404.7150	147.39	147.10	88.7	99	99	125	10	2	SCH40 PVC	0.02	SCH40 PVC	3	85	99.5	mud rotary	bentonite pellets	80	85
MW5	402519.7145	3758707.9616	150.84	150.60	43.3	53.3	53.3	53	10	4	SCH40 PVC	10.00	SCH40 PVC	3	40.5	53.3	hollow stem auger	95/5 slurry bentonite chips	1 34	34 40.5
MW6	402213.7998	3758823.5521	150.39	150.28	37.1	47.5	47.5	47.5	10	4	SCH40 PVC	0.02	SCH40 PVC	3	35	47.5	hollow stem auger	95/5 slurry bentonite pellets	1 32	32 35
MW7	402772.1185	3757891.0470	143.59	143.28	35.8	46	46	46	10	4	SCH40 PVC	0.02	SCH40 PVC	3	31	46	hollow stem auger	95/5 slurry bentonite chips	1 28	28 31
MW8A	402025.0430	3758460.7972	150.44	150.14	30	45	45	45	10	4	SCH40 PVC	0.02	SCH40 PVC	3	27	45	hollow stem auger	95/5 slurry bentonite chips	1 22	22 27

Table 2-1
Omega Well Construction Details
Omega Chemical Superfund Site

Well ID	X Coordinate (meters)	Y Coordinate (meters)	Surface Elevation (feet amsl)	TOC Elevation (feet amsl)	Depth to Screen Top (feet bgs)	Depth to Screen Bottom (feet bgs)	Total Depth (feet bgs)	Total Depth Drilled (feet bgs)	Borehole Diameter (inches)	Casing Diameter (inches)	Screen Material	Screen Slot Size (inches)	Casing Material	Filter Pack Grade	Filter Pack Top (feet bgs)	Filter Pack Bottom (feet bgs)	Drilling Method	Annular Seal Material	Annular Seal Top (feet bgs)	Annular Seal Bottom (feet bgs)
MW8B	402028.6156	3758457.7772	150.33	150.03	65	75	75	93	10	2	SCH40 PVC	0.02	SCH40 PVC	3	63	75	hollow stem auger	95/5 slurry bentonite pellets	1 59	59 63
MW8C	402028.4773	3758457.8119	150.33	150.03	86.7	91.7	91.7	93	10	2	SCH40 PVC	0.02	SCH40 PVC	3	84	93	hollow stem auger	bentonite pellets	75	83.5
MW8D	402021.5454	3758462.1309	150.09	149.91	110	120	120	150	10	4	SCH40 PVC	0.02	SCH40 PVC	3	108	122.5	mud rotary	95/5 slurry bentonite pellets	1 103	103 108
MW9A	401709.5798	3758510.4304	148.88	148.84	25	35	35	90	10	4	SCH40 PVC	0.02	SCH40 PVC	3	23	35	hollow stem auger	95/5 slurry bentonite chips	1 18	18 23
MW9B	401711.8963	3758510.1513	149.06	148.90	49.8	60	60	65	10	4	SCH40 PVC	0.02	SCH40 PVC	3	47	65	hollow stem auger	95/5 slurry bentonite pellets	1 44	44 47
MW10	402019.5356	3757645.7219	147.40	147.45	52	62	62	65	10	4	SCH40 PVC	0.02	SCH40 PVC	3	49	65	hollow stem auger	95/5 slurry bentonite pellets	1 45	45 49
MW11	402265.9120	3757445.4058	150.94	150.89	40	50	50	55	10	4	SCH40 PVC	0.02	SCH40 PVC	3	38	55	hollow stem auger	95/5 slurry bentonite chips	1 31	31 37
MW12	403349.1800	3759544.0500	220.53	220.87	82	97	102.18	102	6	2	SCH80 PVC	0.01	SCH80 PVC	30	80	102	sonic	95/5 slurry	1	80
MW13A	403429.2800	3759304.2900	206.33	206.02	56	66	72.2	71	10	2	SCH80 PVC	0.02	SCH80 PVC	2/16	54	69	mud rotary	95/5 slurry medium chips	1 52	52 54
MW13B	403429.2800	3759304.2900	206.33	205.88	123	133	138.4	138	10	2	SCH80 PVC	0.02	SCH80 PVC	2/16	121	139	mud rotary	medium chips 1:1 medium chips	69 71 119	71 119 121
MW14	403113.1900	3759053.8700	172.97	172.63	60	75	79.91	80	6	2	SCH80 PVC	0.02	SCH80 PVC	2/12	57	80	sonic	95/5 slurry medium chips	1 55	55 57
MW15	402532.6800	3758539.7300	148.65	148.28	50	70	74.95	75	6	2	SCH80 PVC	0.01	SCH80 PVC	2/12	48	75	sonic	95/5 slurry medium chips	1 46	46 48
MW16A	401492.7800	3757951.1300	153.47	153.19	45	60	65.93	65	8.75	2	SCH80 PVC	0.02	SCH80 PVC	2/16	43	60	mud rotary	95/5 slurry medium chips	1 40	40 43
MW16B	401492.7800	3757951.1300	153.47	153.19	106	116	120.19	121	8.75	2	SCH80 PVC	0.02	SCH80 PVC	2/16	104	118	mud rotary	1:1 medium chips	65 102	102 104
MW16C	401492.7800	3757951.1300	153.47	153.26	149	164	169.7	169	8.75	2	SCH80 PVC	0.02	SCH80 PVC	3	147	169	mud rotary	medium chips 1:1 medium chips	118 121 145	121 145 147
MW17A	401264.1800	3757463.4200	159.40	159.03	56	71	75.67	76	8.75	2	SCH80 PVC	0.02	SCH80 PVC	2/16	54	73	mud rotary	95/5 slurry medium chips	1 52	52 54
MW17B	401264.1800	3757463.4200	159.40	158.90	94	104	109.7	109	8.75	2	SCH80 PVC	0.02	SCH80 PVC	2/16	92	107	mud rotary	medium chips 1:1 medium chips	73 76 90	76 90 92
MW17C	401264.1800	3757463.4200	159.40	159.00	172	182	187.15	187	8.75	2	SCH80 PVC	0.02	SCH80 PVC	2/16	170	190	mud rotary	medium chips 1:1 medium chips	107 109 168	109 168 170
MW18A	402590.5500	3757631.0500	144.32	143.73	56	71	75.95	76	8.75	2	SCH80 PVC	0.02	SCH80 PVC	2/16	54	76	mud rotary	95/5 slurry medium chips	1 52	52 54
MW18B	402590.5500	3757631.0500	144.32	143.83	90	100	105.47	105	8.75	2	SCH80 PVC	0.02	SCH80 PVC	2/16	88	103	mud rotary	1:1 medium chips	76 86	86 88
MW18C	402590.5500	3757631.0500	144.32	143.83	146	161	166.6	166	8.75	2	SCH80 PVC	0.02	SCH80 PVC	2/16	144	164	mud rotary	medium chips 1:1 medium chips	103 105 142	105 142 144
MW19	401687.0600	3756760.8500	159.01	158.73	56	71	74.8	76	6	2	SCH80 PVC	0.02	SCH80 PVC	2/16	54	76	sonic	95/5 slurry medium chips	1 52	51 54
MW20A	400670.8400	3756601.7200	142.07	141.31	75	90	94.7	95	10	2	SCH80 PVC	0.02	SCH80 PVC	2/12	73	87	mud rotary	95/5 slurry medium chips	1 70	70 73

Table 2-1
Omega Well Construction Details
Omega Chemical Superfund Site

Well ID	X Coordinate (meters)	Y Coordinate (meters)	Surface Elevation (feet amsl)	TOC Elevation (feet amsl)	Depth to Screen Top (feet bgs)	Depth to Screen Bottom (feet bgs)	Total Depth (feet bgs)	Total Depth Drilled (feet bgs)	Borehole Diameter (inches)	Casing Diameter (inches)	Screen Material	Screen Slot Size (inches)	Casing Material	Filter Pack Grade	Filter Pack Top (feet bgs)	Filter Pack Bottom (feet bgs)	Drilling Method	Annular Seal Material	Annular Seal Top (feet bgs)	Annular Seal Bottom (feet bgs)
MW20B	400670.8400	3756601.7200	142.07	141.32	122	132	137.7	137	10	2	SCH80 PVC	0.02	SCH80 PVC	2/12	120	137	mud rotary	medium chips 1:1 medium chips	87 89 118	89 118 120
MW20C	400670.8400	3756601.7200	142.07	141.35	180	190	195.2	195	10	2	SCH80 PVC	0.02	SCH80 PVC	2/12	178	196	mud rotary	medium chips 1:1 medium chips	132 134 176	134 176 178
MW21	400223.2600	3756893.9900	129.27	128.81	64	79	84.8	84	6	2	SCH80 PVC	0.02	SCH80 PVC	2/16	61	83	sonic	95/5 slurry medium chips	1 59	59 61
MW22	400466.1900	3757381.9000	151.47	150.82	74	89	93.83	94	6	2	SCH80 PVC	0.02	SCH80 PVC	2/16	71	94	sonic	95/5 slurry medium chips	1 68	68 71
MW23A	402207.2296	3758346.3553	149.07	148.76	35	55	60.00	62	8	4	SCH80 PVC	0.02	SCH80 PVC	3	32	62	sonic	95/5 slurry medium chips	1 26	26 32
MW23B	402203.7800	3758349.1800	149.36	149.06	82	97	101.6	102	10	2	SCH80 PVC	0.02	SCH80 PVC	2/16	86	99	mud rotary	95/5 slurry transitional sand	1 85	85 86
MW23C	402203.7800	3758349.1800	149.36	149.07	145	160	164.55	165	10	2	SCH80 PVC	0.02	SCH80 PVC	2/16	143	162	mud rotary	medium chips 1:1 transitional sand	99 102 142	102 142 143
MW23D	402203.7800	3758349.1800	149.36	148.04	175	185	189.8	190	10	2	SCH80 PVC	0.02	SCH80 PVC	2/16	173	190	mud rotary	medium chips 1:1 transitional sand	161 164 171	164 171 173
MW24A	402993.5009	3758908.7331	162.44	162.04	50	70	75	200	16	4	SCH80 PVC	0.02	SCH80 PVC	3	47	75	mud rotary	95/5 slurry medium chips	1 40	40 47
MW24B	402993.3534	3758908.7679	162.44	162.03	110	125	130	200	16	2	SCH80 PVC	0.02	SCH80 PVC	3	107	130	mud rotary	1:1 medium chips	75 100	100 107
MW24C	402993.4479	3758908.9665	162.44	162.02	140	160	165	200	16	4	SCH80 PVC	0.02	SCH80 PVC	3	137	163	mud rotary	medium chips	130	137
MW24D	402993.5391	3758908.8547	162.44	162.05	173	178	183	200	16	2	SCH80 PVC	0.02	SCH80 PVC	3	170	185	mud rotary	medium chips	163	170
MW25A	401814.5784	3757890.5951	148.25	147.90	45	65	70	220	14.5	4	SCH80 PVC	0.02	SCH80 PVC	3	41	71	mud rotary	95/5 slurry medium chips	1 35	35 41
MW25B	401814.5418	3757890.6288	148.25	147.84	90	110	115	220	14.5	2	SCH80 PVC	0.02	SCH80 PVC	3	85	116	mud rotary	1:1 medium chips	71 80	80 85
MW25C	401814.5418	3757890.6288	148.25	147.86	140	150	155	220	14.5	4	SCH80 PVC	0.02	SCH80 PVC	3	135	156	mud rotary	1:1 medium chips	116 130	130 135
MW25D	401814.5418	3757890.6288	148.25	147.87	194	209	214	220	14.5	2	SCH80 PVC	0.02	SCH80 PVC	3	189	220	mud rotary	1:1 medium chips	156 184	184 189
MW26A	401270.0608	3757125.1557	155.98	155.62	70	90	95	250	14.5	4	SCH80 PVC	0.02	SCH80 PVC	3	65	93	mud rotary	95/5 slurry medium chips	1 57	57 65
MW26B	401269.9123	3757125.0907	155.98	155.45	105	120	125	250	14.5	2	SCH80 PVC	0.02	SCH80 PVC	3	100	126.5	mud rotary	medium chips	93	100
MW26C	401270.0435	3757125.2668	155.98	155.41	145	160	165	250	14.5	2	SCH80 PVC	0.02	SCH80 PVC	3	140	166	mud rotary	1:1 medium chips	126.5 135	135 140
MW26D	401269.9045	3757125.2349	155.98	155.37	185	205	210	250	14.5	2	SCH80 PVC	0.02	SCH80 PVC	3	180	212	mud rotary	1:1 medium chips	166 175	175 180
MW27A	400902.9714	3755901.7834	139.47	139.24	90	110	115	225	14.5	4	SCH80 PVC	0.02	SCH80 PVC	2/12	87	115	mud rotary	95/5 slurry medium chips	1 78	78 87
MW27B	400903.0537	3755901.6938	139.47	139.18	144	164	169	225	14.5	4	SCH80 PVC	0.02	SCH80 PVC	2/12	141	168	mud rotary	1:1 medium chips	115 130	130 141
MW27C	400902.8870	3755901.6623	139.47	139.17	180	190	195	225	14.5	2	SCH80 PVC	0.02	SCH80 PVC	2/12	177	193	mud rotary	medium chips	168	177

Table 2-1
Omega Well Construction Details
Omega Chemical Superfund Site

Well ID	X Coordinate (meters)	Y Coordinate (meters)	Surface Elevation (feet amsl)	TOC Elevation (feet amsl)	Depth to Screen Top (feet bgs)	Depth to Screen Bottom (feet bgs)	Total Depth (feet bgs)	Total Depth Drilled (feet bgs)	Borehole Diameter (inches)	Casing Diameter (inches)	Screen Material	Screen Slot Size (inches)	Casing Material	Filter Pack Grade	Filter Pack Top (feet bgs)	Filter Pack Bottom (feet bgs)	Drilling Method	Annular Seal Material	Annular Seal Top (feet bgs)	Annular Seal Bottom (feet bgs)
MW27D	400902.9879	3755901.5947	139.47	139.13	200	210	215	225	14.5	2	SCH80 PVC	0.02	SCH80 PVC	2/12	197	225	mud rotary	medium chips	193	197
MW28	400066.1942	3755133.6448	120.40	119.91	85	105	110	112	8	4	SCH80 PVC	0.02	SCH80 PVC	3	80	112	sonic	95/5 slurry medium chips	1 74	74 80
MW29	400888.7643	3753618.8894	107.34	107.10	90	110	115	117	8	4	SCH80 PVC	0.02	SCH80 PVC	3	87	117	sonic	95/5 slurry medium chips	1 80	80 87
MW30	401820.1912	3753277.4081	107.24	106.70	95	115	120	130	8	4	SCH80 PVC	0.02	SCH80 PVC	3	91	120	sonic	95/5 slurry medium chips medium chips	1 85 120	85 91 130
MW31	403391.2061	3759680.342	233.00	232.67	106	121	126	126	8	2	SCH80 PVC	0.01	SCH80 PVC	2/16	103	126	hollow stem auger	95/5 slurry bentonite chips #60 transition sand	1 99.5 102.6	99.5 102.6 103
EW1	402022.7900	3758460.3700	150.02	149.51	65	75	80	80	8.75	4	SCH80 PVC	0.02	SCH80 PVC	2/12	63	78	mud rotary	95/5 slurry medium chips	1 60	60 63

Notes:
* Survey information for OW3B is not currently available. Coordinates are approximate.
X and Y coordinates surveyed in UTM meters, NAD 83, Zone 11
Surface and TOC elevations surveyed in NGVD 88 datum, benchmark of DYHS (Downey High School)

Abbreviations:
amsl = above mean sea level
bgs = below ground surface
SCH = schedule
PVC = polyvinyl chloride
SST = stainless steel
TOC = top of casing

Table 2-2
CDM Groundwater Monitoring Schedule
Omega Chemical Superfund Site

Well	2nd QTR 1996 Jun 6	3rd QTR 1999 Jul 2	2nd QTR 2001 May 15 to May 16	3rd QTR 2001 Aug 16 to Aug 17	4th QTR 2001 Nov 15 to Nov 16	1st QTR 2002 Feb 14 to Mar 27	3rd QTR 2002 Aug 20 to Aug 22	1st QTR 2003 Feb 19 to Mar 13	1st QTR 2003 Mar 10 to Mar 13	3rd QTR 2003 Aug 26 to Aug 28	4th QTR 2003 Nov 20	1st QTR 2004 Feb 24 to Feb 27	3rd QTR 2004 Aug 24 to Aug 27	1st QTR 2005 Feb 23 to Feb 25	3rd QTR 2005 Aug 22 to Aug 25	1st QTR 2006 Feb 17 to Feb 22	1st QTR 2006 Mar 13	3rd QTR 2006 Aug 22 to Aug 24	1st QTR 2007	3rd QTR 2007
OW1A	VOCs, Metals, Alk, Anions, TDS	VOCs, 1,2,3-TCP	VOCs, SVOCs, 1,2,3-TCP, Perchlorate, Metals, Pest	VOCs, SVOCs, 1,2,3-TCP, Perchlorate, Metals, Pest	VOCs, SVOCs, 1,4-D, 1,2,3-TCP, Perchlorate, Metals, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP, Cr^{+6}, Anions, Pest	-----	VOCs, 1,4-D, 1,2,3-TCP	-----	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, SVOCs, 1,4-D, 1,2,3-TCP, Perchlorate, NDMA, Metals, Alk, Anions, TDS	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP
OW1B	-----	VOCs, 1,2,3-TCP	VOCs, SVOCs, 1,2,3-TCP, Perchlorate, Metals, Pest	VOCs, SVOCs, 1,2,3-TCP, Perchlorate, Metals, Pest	VOCs, SVOCs, 1,4-D, 1,2,3-TCP, Perchlorate, Metals, Pest	VOCs, SVOCs, 1,4-D, 1,2,3-TCP, Perchlorate, Metals	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP, Cr^{+6} Perchlorate, Anions, Pest	-----	VOCs, 1,4-D, 1,2,3-TCP	-----	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	-----	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP
OW2	-----	VOCs, 1,2,3-TCP	VOCs, 1,2,3-TCP	VOCs, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP, Cr^{+6} Perchlorate, Anions, Pest	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	-----	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	-----	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP
OW3A	-----	VOCs, 1,2,3-TCP	VOCs, 1,2,3-TCP	VOCs, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP, Cr^{+6} Perchlorate, Anions, Pest	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	-----	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	-----	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP
OW3B	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	VOCs, 1,4-D, 1,2,3-TCP, Perchlorate, Metals, Anions, TDS	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP
OW4A	-----	-----	-----	VOCs, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP, Cr^{+6} Perchlorate, Anions, Pest	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	-----	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	-----	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP
OW4B	-----	-----	VOCs, 1,2,3-TCP	VOCs, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP, Cr^{+6} Perchlorate, Anions, Pest	-----	VOCs, 1,4-D, 1,2,3-TCP	-----	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	-----	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP
OW5	-----	-----	-----	VOCs, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,2,3-TCP	VOCs, 1,2,3-TCP	-----	VOCs, 1,4-D, 1,2,3-TCP	-----	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	-----	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP
OW6	-----	-----	VOCs, 1,2,3-TCP	VOCs, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,2,3-TCP	VOCs, 1,2,3-TCP	-----	VOCs, 1,4-D, 1,2,3-TCP	-----	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	-----	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP
OW7	-----	-----	-----	-----	-----	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,2,3-TCP	VOCs, 1,2,3-TCP	-----	VOCs, 1,4-D, 1,2,3-TCP	-----	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	-----	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP
OW8A	-----	-----	-----	-----	-----	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP, Cr^{+6} Perchlorate, Anions, Pest	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP		VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP, Metals, Alk, Anions	VOCs, 1,4-D, 1,2,3-TCP	VOCs, SVOCs, 1,4-D, 1,2,3-TCP, Perchlorate, NDMA, Metals, Alk, Anions, TDS	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP
OW8B	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP		VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP	VOCs, 1,4-D, 1,2,3-TCP

Notes:
1) ---- No sample was collected or well was not constructed at this time

Abbreviations:
VOCs = volatile organic compounds
SVOCs = semi-volatile organic compounds
1,4-D = 1,4-dioxane
Cr+6 = hexavalent chromium
NDMA = n-nitrosodimethylamine
1,2,3-TCP = 1,2,3-trichloropropane
CN = total cyanide
TDS = total dissolved solids
Alk = alkalinity
Pest = Pesticides

Table 2-3
Weston Solutions Groundwater Monitoring Schedule
Omega Chemical Superfund Site

Well	1st QTR 2002 Feb 13 to Feb 26	2nd QTR 2002 May 21 to May 31	3rd QTR 2002 Aug 20 to Aug 29	4th QTR 2002 Nov 13 to Nov 26	1st QTR 2003 Feb 18 to Feb 23	2nd QTR 2003 May 13 to May 22	3rd QTR 2003 Aug 19 to Aug 28
OPOG Monitoring Wells							
OW1A	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest, GChem	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, Perchlorate, Metals, CN, GChem	VOCs, 1,4-D, Perchlorate, Metals, CN	VOCs, 1,4-D, Perchlorate, Metals, CN
OW1B	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest, GChem	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, 1,4-D, Perchlorate, Metals, CN, GChem	VOCs, 1,4-D, Perchlorate, Metals, CN	VOCs, 1,4-D, Perchlorate, Metals, CN
OW2	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest, GChem	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, Perchlorate, Metals, CN, GChem	VOCs, Perchlorate, Metals, CN	VOCs, Perchlorate, Metals, CN
OW3A	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest, GChem	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, Perchlorate, Metals, CN, GChem	VOCs, Perchlorate, Metals, CN	VOCs, Perchlorate, Metals, CN
OW4A	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest, GChem	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, 1,4-D, Perchlorate, Metals, CN, GChem	VOCs, Perchlorate, Metals, CN	VOCs, 1,4-D, Perchlorate, Metals, CN
OW4B	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest, GChem	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, Perchlorate, Metals, CN, GChem	VOCs, Perchlorate, Metals, CN	VOCs, Perchlorate, Metals, CN
OW5	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest, GChem	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, 1,4-D, Perchlorate, Metals, CN, GChem	VOCs, 1,4-D, Perchlorate, Metals, CN	VOCs, 1,4-D, Perchlorate, Metals, CN
OW6	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest, GChem	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, 1,4-D, Perchlorate, Metals, CN, GChem	VOCs, 1,4-D, Perchlorate, Metals, CN	VOCs, 1,4-D, Perchlorate, Metals, CN
OW7	-----	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, Perchlorate, Metals, CN, GChem	VOCs, Perchlorate, Metals, CN	VOCs, Perchlorate, Metals, CN
OW8A	-----	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, 1,4-D, Perchlorate, Metals, CN, GChem	VOCs, 1,4-D, Perchlorate, Metals, CN	VOCs, 1,4-D, Perchlorate, Metals, CN
EPA Monitoring Wells							
MW1A	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest, GChem	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, Perchlorate, Metals, CN, GChem	VOCs, Perchlorate, Metals, CN	VOCs, Perchlorate, Metals, CN
MW1B	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest, GChem	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, Perchlorate, Metals, CN, GChem	VOCs, Perchlorate, Metals, CN	VOCs, Perchlorate, Metals, CN
MW2	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest, GChem	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, Perchlorate, Metals, CN, GChem	VOCs, Perchlorate, Metals, CN	VOCs, 1,4-D, Perchlorate, Metals, CN
MW3	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest, GChem	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, Perchlorate, Metals, CN, GChem	VOCs, Perchlorate, Metals, CN	VOCs, Perchlorate, Metals, CN
MW4A	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest, GChem	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, 1,4-D, Perchlorate, Metals, CN, GChem	VOCs, 1,4-D, Perchlorate, Metals, CN	VOCs, 1,4-D, Perchlorate, Metals, CN
MW4B	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest, GChem	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, 1,4-D, Perchlorate, Metals, CN, GChem	VOCs, 1,4-D, Perchlorate, Metals, CN	VOCs, 1,4-D, Perchlorate, Metals, CN
MW4C	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest, GChem	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, Perchlorate, Metals, CN, GChem	VOCs, Perchlorate, Metals, CN	VOCs, Perchlorate, Metals, CN
MW5	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest, GChem	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, Perchlorate, Metals, CN, GChem	VOCs, Perchlorate, Metals, CN	VOCs, 1,4-D, Perchlorate, Metals, CN
MW6	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest, GChem	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, Perchlorate, Metals, CN, GChem	VOCs, 1,4-D, Perchlorate, Metals, CN	VOCs, 1,4-D, Perchlorate, Metals, CN
MW7	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest, GChem	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, Perchlorate, Metals, CN, GChem	VOCs, Perchlorate, Metals, CN	VOCs, Perchlorate, Metals, CN
MW8A	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest, GChem	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, 1,4-D, Perchlorate, Metals, CN, GChem	VOCs, 1,4-D, Perchlorate, Metals, CN	VOCs, 1,4-D, Perchlorate, Metals, CN
MW8B	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest, GChem	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, Perchlorate, Metals, CN, GChem	VOCs, Perchlorate, Metals, CN	VOCs, Perchlorate, Metals, CN
MW8C	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest, GChem	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, Perchlorate, Metals, CN, GChem	VOCs, Perchlorate, Metals, CN	VOCs, Perchlorate, Metals, CN

Table 2-3
Weston Solutions Groundwater Monitoring Schedule
Omega Chemical Superfund Site

Well	1st QTR 2002 Feb 13 to Feb 26	2nd QTR 2002 May 21 to May 31	3rd QTR 2002 Aug 20 to Aug 29	4th QTR 2002 Nov 13 to Nov 26	1st QTR 2003 Feb 18 to Feb 23	2nd QTR 2003 May 13 to May 22	3rd QTR 2003 Aug 19 to Aug 28
MW8D	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest, GChem	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, Perchlorate, Metals, CN, GChem	VOCs, Perchlorate, Metals, CN	VOCs, Perchlorate, Metals, CN
MW9A	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest, GChem	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, Perchlorate, Metals, CN, GChem	VOCs, Perchlorate, Metals, CN	VOCs, Perchlorate, Metals, CN
MW9B	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest, GChem	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, Perchlorate, Metals, CN, GChem	VOCs, Perchlorate, Metals, CN	VOCs, Perchlorate, Metals, CN
MW10	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest, GChem	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, 1,4-D, Perchlorate, Metals, CN, GChem	VOCs, 1,4-D, Perchlorate, Metals, CN	VOCs, 1,4-D, Perchlorate, Metals, CN
MW11	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, Pest, GChem	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, Perchlorate, Metals, CN, Pest	VOCs, SVOCs, 1,4-D, Perchlorate, Metals, CN, Pest	VOCs, Perchlorate, Metals, CN, GChem	VOCs, Perchlorate, Metals, CN	VOCs, Perchlorate, Metals, CN

Notes:

1) GChem compounds include TDS, TOC, alkalinity, anions
2) ---- No sample was collected as the well was not constructed at this time

Abbreviations:
VOCs = volatile organic compounds
SVOCs = semi-volatile organic compounds
1,4-D = 1,4-dioxane
CN = total cyanide
TOC = total organic carbon
TDS = total dissolved solids
Gchem = general chemistry analytes
Pest = pesticides and polychlorinated biphenyls

Table 2-4
CH2M HILL Groundwater Monitoring Schedule
Omega Chemical Superfund Site

Well	1st QTR 2004 Mar 2 to Mar 5	2nd QTR 2004 Jun 15 to Jun 24	3rd QTR 2004 Sep 13 to Sep 16	4th QTR 2004 Nov 30 to Dec 9	1st QTR 2005 Feb 28 to Mar 3	3rd QTR 2005 Aug 30 to Sep 2	1st QTR 2006 Mar 6 to Mar 15	3rd QTR 2006 Aug 28 to Sep 11	1st QTR 2007 Feb 26 to Mar 7	3rd QTR 2007 Jul 9 to Jul 26
OPOG Monitoring Wells										
OW1A	**X** (CDM)	VOCs, SVOCs, Emergents, Metals, CN, GChem	**X** (CDM)	VOCs, SVOCs, Emergents, Metals, CN, GChem	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)
OW1B	**X** (CDM)	VOCs, SVOCs, Emergents, Metals, CN, GChem	**X** (CDM)	VOCs, SVOCs, Emergents, Metals, CN, GChem	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)
OW2	**X** (CDM)	VOCs, SVOCs, Emergents, Metals, CN, GChem	**X** (CDM)	VOCs, SVOCs, Emergents, Metals, CN, GChem	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)
OW3A	**X** (CDM)	VOCs, SVOCs, Emergents, Metals, CN, GChem	**X** (CDM)	VOCs, SVOCs, Emergents, Metals, CN, GChem	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)
OW3B	-----	-----	-----	-----	-----	-----	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)
OW4A	**X** (CDM)	VOCs, SVOCs, Emergents, Metals, CN, GChem	**X** (CDM)	VOCs, SVOCs, Emergents, Metals, CN, GChem	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)
OW4B	**X** (CDM)	VOCs, SVOCs, Emergents, Metals, CN, GChem	**X** (CDM)	VOCs, SVOCs, Emergents, Metals, CN, GChem	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)
OW5	**X** (CDM)	VOCs, SVOCs, Emergents, Metals, CN, GChem	**X** (CDM)	VOCs, SVOCs, Emergents, Metals, CN, GChem	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)
OW6	**X** (CDM)	VOCs, SVOCs, Emergents, Metals, CN, GChem	**X** (CDM)	VOCs, SVOCs, Emergents, Metals, CN, GChem	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)
OW7	**X** (CDM)	VOCs, SVOCs, Emergents, Metals, CN, GChem	**X** (CDM)	VOCs, SVOCs, Emergents, Metals, CN, GChem	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)
OW8A	**X** (CDM)	VOCs, SVOCs, Emergents, Metals, CN, GChem	**X** (CDM)	VOCs, SVOCs, Emergents, Metals, CN, GChem	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)
OW8B [1]	-----	-----	**X** (CDM)	VOCs, SVOCs, Emergents, Metals, CN, GChem	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)	**X** (CDM)
EPA Monitoring Wells										
MW1A	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, 1,4-D, Cr+6, 1,2,3-TCP, NDMA	VOCs, Emergents	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW1B	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, 1,4-D, Cr+6, 1,2,3-TCP, NDMA	VOCs, Emergents	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW2	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, 1,4-D, Cr+6, 1,2,3-TCP, NDMA	VOCs, Emergents	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW3	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, 1,4-D, Cr+6, 1,2,3-TCP, NDMA	VOCs, Emergents	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW4A	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, 1,4-D, Cr+6, 1,2,3-TCP, NDMA	VOCs, Emergents	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW4B	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, 1,4-D, Cr^{+6}, 1,2,3-TCP, NDMA	VOCs, Emergents	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW4C	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, 1,4-D, Cr^{+6}, 1,2,3-TCP, NDMA	VOCs, Emergents	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW5	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, 1,4-D, Cr^{+6}, 1,2,3-TCP, NDMA	VOCs, Emergents	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW6	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, 1,4-D, Cr^{+6}, 1,2,3-TCP, NDMA	VOCs, Emergents	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW7	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, 1,4-D, Cr^{+6}, 1,2,3-TCP, NDMA	VOCs, Emergents	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW8A	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, 1,4-D, Cr^{+6}, 1,2,3-TCP, NDMA	VOCs, Emergents	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW8B	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, 1,4-D, Cr^{+6}, 1,2,3-TCP, NDMA	VOCs, Emergents	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW8C	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, 1,4-D, Cr^{+6}, 1,2,3-TCP, NDMA	VOCs, Emergents	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW8D	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, 1,4-D, Cr^{+6}, 1,2,3-TCP, NDMA	VOCs, Emergents	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW9A [2]	**Dry Well**	**Dry Well**	**Dry Well**	**Dry Well**	**Dry Well**	VOCs, Emergents	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW9B	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, 1,4-D, Cr^{+6}, 1,2,3-TCP, NDMA	VOCs, Emergents	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW10	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, 1,4-D, Cr^{+6}, 1,2,3-TCP, NDMA	VOCs, Emergents	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW11 [3]	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	VOCs, SVOCs, Emergents, Metals, CN, GChem	**Dry Well**	**Dry Well**	VOCs, Emergents	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW12	-----	-----	-----	-----	-----	-----	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents

Table 2-4
CH2M HILL Groundwater Monitoring Schedule
Omega Chemical Superfund Site

Well	1st QTR 2004 Mar 2 to Mar 5	2nd QTR 2004 Jun 15 to Jun 24	3rd QTR 2004 Sep 13 to Sep 16	4th QTR 2004 Nov 30 to Dec 9	1st QTR 2005 Feb 28 to Mar 3	3rd QTR 2005 Aug 30 to Sep 2	1st QTR 2006 Mar 6 to Mar 15	3rd QTR 2006 Aug 28 to Sep 11	1st QTR 2007 Feb 26 to Mar 7	3rd QTR 2007 Jul 9 to Jul 26
MW13A	-----	-----	-----	-----	-----	-----	**Dry Well**	**Dry Well**	**Dry Well**	**Dry Well**
MW13B	-----	-----	-----	-----	-----	-----	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW14	-----	-----	-----	-----	-----	-----	-----	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW15	-----	-----	-----	-----	-----	-----	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW16A	-----	-----	-----	-----	-----	-----	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW16B	-----	-----	-----	-----	-----	-----	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW16C	-----	-----	-----	-----	-----	-----	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW17A	-----	-----	-----	-----	-----	-----	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW17B	-----	-----	-----	-----	-----	-----	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW17C	-----	-----	-----	-----	-----	-----	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW18A	-----	-----	-----	-----	-----	-----	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW18B	-----	-----	-----	-----	-----	-----	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW18C	-----	-----	-----	-----	-----	-----	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW19	-----	-----	-----	-----	-----	-----	-----	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW20A	-----	-----	-----	-----	-----	-----	-----	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW20B	-----	-----	-----	-----	-----	-----	-----	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW20C	-----	-----	-----	-----	-----	-----	-----	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW21	-----	-----	-----	-----	-----	-----	-----	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW22	-----	-----	-----	-----	-----	-----	-----	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW23A	-----	-----	-----	-----	-----	-----	-----	-----	-----	VOCs, SVOCs, Emergents, Metals, CN, GChem
MW23B	-----	-----	-----	-----	-----	-----	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW23C	-----	-----	-----	-----	-----	-----	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW23D	-----	-----	-----	-----	-----	-----	VOCs, Emergents	VOCs, Emergents	VOCs, 1,4-D, Cr^{+6}	VOCs, Emergents
MW24A	-----	-----	-----	-----	-----	-----	-----	-----	-----	VOCs, SVOCs, Emergents, Metals, CN, GChem
MW24B	-----	-----	-----	-----	-----	-----	-----	-----	-----	VOCs, SVOCs, Emergents, Metals, CN, GChem
MW24C	-----	-----	-----	-----	-----	-----	-----	-----	-----	VOCs, SVOCs, Emergents, Metals, CN, GChem
MW24D	-----	-----	-----	-----	-----	-----	-----	-----	-----	VOCs, SVOCs, Emergents, Metals, CN, GChem
MW25A	-----	-----	-----	-----	-----	-----	-----	-----	VOCs, 1,4-D, Cr^{+6}	VOCs, SVOCs, Emergents, Metals, CN, GChem
MW25B	-----	-----	-----	-----	-----	-----	-----	-----	VOCs, 1,4-D, Cr^{+6}	VOCs, SVOCs, Emergents, Metals, CN, GChem
MW25C	-----	-----	-----	-----	-----	-----	-----	-----	VOCs, 1,4-D, Cr^{+6}	VOCs, SVOCs, Emergents, Metals, CN, GChem
MW25D	-----	-----	-----	-----	-----	-----	-----	-----	VOCs, 1,4-D, Cr^{+6}	VOCs, SVOCs, Emergents, Metals, CN, GChem
MW26A	-----	-----	-----	-----	-----	-----	-----	-----	VOCs, 1,4-D, Cr^{+6}	VOCs, SVOCs, Emergents, Metals, CN, GChem
MW26B	-----	-----	-----	-----	-----	-----	-----	-----	VOCs, 1,4-D, Cr^{+6}	VOCs, SVOCs, Emergents, Metals, CN, GChem

Table 2-4
CH2M HILL Groundwater Monitoring Schedule
Omega Chemical Superfund Site

Well	1st QTR 2004 Mar 2 to Mar 5	2nd QTR 2004 Jun 15 to Jun 24	3rd QTR 2004 Sep 13 to Sep 16	4th QTR 2004 Nov 30 to Dec 9	1st QTR 2005 Feb 28 to Mar 3	3rd QTR 2005 Aug 30 to Sep 2	1st QTR 2006 Mar 6 to Mar 15	3rd QTR 2006 Aug 28 to Sep 11	1st QTR 2007 Feb 26 to Mar 7	3rd QTR 2007 Jul 9 to Jul 26
MW26C	-----	-----	-----	-----	-----	-----	-----	-----	VOCs, 1,4-D, Cr^{+6}	VOCs, SVOCs, Emergents, Metals, CN, GChem
MW26D	-----	-----	-----	-----	-----	-----	-----	-----	VOCs, 1,4-D, Cr^{+6}	VOCs, SVOCs, Emergents, Metals, CN, GChem
MW27A	-----	-----	-----	-----	-----	-----	-----	-----	-----	VOCs, SVOCs, Emergents, Metals, CN, GChem
MW27B	-----	-----	-----	-----	-----	-----	-----	-----	-----	VOCs, SVOCs, Emergents, Metals, CN, GChem
MW27C	-----	-----	-----	-----	-----	-----	-----	-----	-----	VOCs, SVOCs, Emergents, Metals, CN, GChem
MW27D	-----	-----	-----	-----	-----	-----	-----	-----	-----	VOCs, SVOCs, Emergents, Metals, CN, GChem
MW28	-----	-----	-----	-----	-----	-----	-----	-----	-----	VOCs, SVOCs, Emergents, Metals, CN, GChem
MW29	-----	-----	-----	-----	-----	-----	-----	-----	-----	VOCs, SVOCs, Emergents, Metals, CN, GChem
MW30	-----	-----	-----	-----	-----	-----	-----	-----	-----	VOCs, SVOCs, Emergents, Metals, CN, GChem

Notes:

1) Emergent compounds include 1,4-dioxane, Cr+6, perchlorate, NDMA, 1,2,3-TCP

2) GChem compounds include alkalinity (total and bicarbonate), ammonia, BOD, boron, COD, silica, TKN, total phosphorous, TDS, TOC, and anions (bromide, chloride, fluoride, nitrate-nitrogen, nitrite-nitrogen, orthophosphate-phosphorous, sulfate)

3) Metals (dissolved) include aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, potassium, selenium, silver, sodium, thallium, vanadium, zinc, boron, silicon

4) ---- No sample was collected as the well was not constructed at this time

Abbreviations:

VOCs = volatile organic compounds
SVOCs = semi-volatile organic compounds
1,4-D = 1,4-dioxane
Cr+6 = hexavalent chromium
NDMA = n-nitrosodimethylamine
1,2,3-TCP = 1,2,3-trichloropropane
BOD = biological oxygen demand
COD = chemical oxygen demand
CN = total cyanide
TOC = total organic carbon
TKN = total Kjeldahl nitrogen
TDS = total dissolved solids
Gchem = general chemistry analytes
CDM = Camp Dresser and McKee

Table 2-5
Analytical Parameters and Assigned Laboratories
Omega Chemical Superfund Site

Laboratory	Organics		Inorganics			Emergent Compounds					General Chemistry		
	VOCs plus MTBE	SVOCs	Dissolved Metals (Al, Ca, Mg, K, Na)	Dissolved Metals [1]	Total Cyanide	1,4-Dioxane	Perchlorate	1,2,3-TCP	NDMA	Cr^{+6}	Anions [2]	TDS, Alkalinity, Total phosphorous, TKN, BOD, TOC	COD
1st QTR 2004 - March 2 to March 5													
EPA Region 9						X	X	X			X	X	
Shealy	X	X											
Ceimic			X	X	X								
MWH									X				X
EMAX										X			
2nd QTR 2004 - June 15 to June 24													
EPA Region 9						X	X				X	X	
Shealy	X	X											
Ceimic			X	X	X								
STL								X	X				X
APCL										X			
3rd QTR 2004 - September 13 to September 16													
EPA Region 9						X	X				X	X	
Shealy	X	X											
Ceimic			X	X	X								
STL								X	X				X
APCL										X			
4th QTR 2004 - November 30 to December 9													
EPA Region 9						X	X				X	X	
Shealy	X	X											
Ceimic			X										
Sentinel				X	X								
STL								X	X				X
APCL										X			
1st QTR 2005 - February 28 to March 3													
EPA Region 9						X							
Shealy	X												
STL								X	X				
APCL	X									X			
3rd QTR 2005 - August 30 to September 2													
EPA Region 9						X	X						
STL								X	X				
APCL										X			
A4 Scientific	X												
1st QTR 2006 - March 6 to March 15													
EPA Region 9	X					X	X						
APCL								X	X	X			
3rd QTR 2006 - August 28 to September 11													
EPA Region 9	X					X	X						
Test America								X	X	X			
1st QTR 2007 - February 28 to march 7													
Test America										X			
Mitkem	X					X							
3rd QTR 2007 - July 9 to July 26													
EPA							X				X	X	
Shealy	X	X				X							
Bonner			X	X	X								
Test America								X	X	X			X

Notes:
[1] Dissolved metals include antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, zinc, boron, silicon
[2] Anions include bromide, chloride, fluoride, nitrate-nitrogen, nitrite-nitrogen, orthophosphate-phosphorous, sulfate
X — Indicates that a particular analyte was analyzed by the selected laboratory

Abbreviations:
VOCs = volatile organic carbon
MTBE = methyl-tert-butyl-ether
SVOCs = semivolatile organic carbon
Al = aluminum
Ca = calcium
Mg = magnesium
K = potassium
Na = sodium
1,2,3-TCP = 1,2,3-trichloropropane
NDMA = N-nitrosodimethylamine
Cr+6 = hexavalent chromium
TDS = total dissolved solids
TKN = total kjeldahl nitrogen
BOD = biological oxygen demand
TOC = total organic carbon
COD = carbonaceous oxygen demand

Laboratory Abbreviations:
EPA Region 9 = EPA Region 9 Laboratory
Shealy = Shealy Environmental Services (EPA contract lab program)
Ceimic = Ceimic Corporation (EPA contract lab program)
Sentinel = Sentinel, Inc. (EPA contract lab program)
A4 = A4 Scientific (EPA contract lab program)
Bonner = Bonner Analytical Testing (EPA contract lab program)
STL = Severn Trent Laboratories Sacramento (U.S. Army Corp of Engineers contract lab)
APCL = APC Laboratories (U.S. Army Corp of Engineers contract lab)
Test America = (U.S. Army Corp of Engineers contract lab)
MWH = MWH Laboratories (CH2M HILL contract lab)
EMAX = EMAX Laboratories (CH2M HILL contract lab)

Table 2-6

Summary of Detections from WDC's Water Truck

Omega Chemical Superfund Site

		Sample ID	OC2-MW24HY-W-0-560	OC2-HYD1-W-0-461	OC2-HYD-W-0-443
		Sample Location	MW24 Hydrant	MW26 Hydrant	MW27 Hydrant
		Sample Date	6/1/2007	2/26/2007	4/11/2007
Analyte	Screening Level	Units	Analytical Results		
Emergents					
1,4-Dioxane (p-dioxane)	3	µg/L	---	**3.4 J**	---
Volatile Organics					
Bromodichloromethane	80	µg/L	0.3 J	0.83 J	12
Bromoform	80	µg/L	5.3 J	13 J	4.9
Chloroform	80	µg/L	---	---	9.1
Dibromochloromethane	80	µg/L	1.3	4.4 J	11
Trichloroethene	5	µg/L	---	0.22 J	---
Total Volatile Organics					
TVOC	NE	µg/L	6.9	18.45	37

Notes:

Sample depth in feet below ground surface.
Bold indicates result is above screening level.
ND (250) = Not detected above listed reporting limit.
-- = Not detected or not analyzed.
J = Estimated value
R = Rejected
ug/L = micrograms per Liter

Table 2-7

Summary of VOCs Detections, Discrete-Depth Simulprobe Samples

Omega Chemical Superfund Site

		Sample ID	**OC2-MW24DD60-W-0-553**	**OC2-MW24DD60-W-1-554**	**OC2-MW24DD80-W-0-555**	**OC2-MW24DD140-W-0-557**	**OC2-MW24DD155-W-0-558**
		Sample Location	**MW24 Discrete Depth**	**MW24 Discrete Depth**	**MW24 Discrete Depth**	**MW24 Discrete Depth**	**MW24 Discrete Depth**
		Sample Date	**5/29/2007**	**5/29/2007**	**5/30/2007**	**5/31/2007**	**6/1/2007**
Analyte	**Screening Level**	**Units**	**Analytical Results**				
Volatile Organics							
1,1,1-Trichloroethane	200	µg/L	ND (0.50)	ND (0.50)	1.5	ND (0.50)	ND (0.50)
1,1,2-Trichloro-1,2,2-trifluoroethane	1200	µg/L	96 J	90	**1,400**	2.9	ND (0.50)
1,1,2-Trichloroethane	5	µg/L	ND (0.50)	ND (0.50)	2.7	ND (0.50)	ND (0.50)
1,1-Dichloroethane	5	µg/L	ND (0.50)	ND (0.50)	**10**	ND (0.50)	ND (0.50)
1,1-Dichloroethene	6	µg/L	**66 J**	**65**	**2,400**	ND (0.50)	ND (0.50)
1,2-Dichloroethane	0.5	µg/L	ND (0.50)	ND (0.50)	**68**	ND (0.50)	ND (0.50)
Benzene	1	µg/L	ND (0.50)	ND (0.50)	**3**	ND (0.50)	ND (0.50)
Bromodichloromethane	80	µg/L	0.3 J	0.3 J	4.1	ND (0.50)	ND (0.50)
Carbon tetrachloride	0.5	µg/L	ND (0.50)	ND (0.50)	0.3 J	ND (0.50)	ND (0.50)
Chlorobenzene	70	µg/L	ND (0.50)	ND (0.50)	0.3 J	ND (0.50)	ND (0.50)
Chloroform	80	µg/L	7.5	7.9	**820**	ND (0.50)	ND (0.50)
cis-1,2-Dichloroethene	6	µg/L	ND (0.50)	ND (0.50)	5.4	ND (0.50)	ND (0.50)
Dibromochloromethane	80	µg/L	0.2 J	0.2 J	ND (0.50)	ND (0.50)	ND (0.50)
Dichlorodifluoromethane (Freon 12)	1000	µg/L	ND (0.50)	ND (0.50)	3	ND (0.50)	ND (0.50)
Methyl ethyl ketone	NE	µg/L	4.9 J	ND (4.00)	ND (4.00) J	ND (4.00) J	ND (4.00) J
Methyl tert-butyl ether	13	µg/L	ND (2.00)	ND (2.00)	2.4	ND (2.00)	ND (2.00)
Methylene chloride	5	µg/L	ND (0.50)	ND (0.50)	0.6	ND (0.50)	ND (0.50)
Tetrachloroethene	5	µg/L	**65 J**	**61**	**3,800**	0.4 J	0.6
trans-1,2-Dichloroethene	10	µg/L	ND (0.50)	ND (0.50)	7	ND (0.50)	ND (0.50)
Trichloroethene	5	µg/L	**12 12**		**610**	1	ND (0.50)
Trichlorofluoromethane (Freon 11)	150	µg/L	45 J	40	**620**	1.4	ND (0.50)
Vinyl chloride	0.5	µg/L	ND (0.50)	ND (0.50)	0.3 J	ND (0.50)	ND (0.50)
Total Volatile Organics							
TVOC	NE	µg/L	296.9	276.4	9,759	5.7	0.6

Notes:

Sample depth in feet below ground surface.
Bold indicates result is above screening level.
ND (250) = Not detected above listed reporting limit.
-- = Not detected or not analyzed.
J = Estimated value
R = Rejected
ug/L = micrograms per Liter

Table 2-8
Slug Test Field Data Summary
Omega Chemical Superfund Site

Well	Test Date	Phase	Slug OD (inches)	Slug Length (feet)	Volume of Water Displaced by Slug (ft^3)	No. Rising Tests	No. Falling Tests	Casing ID (inches)
OW3B	5/15/2006	1	2.36	10	6.18	2	2	3.998
OW3B	5/23/2006	1	2.36	10	6.18	1	1	3.998
OW3B	5/23/2006	1	2.36	15	9.27	1	1	3.998
OW4A	5/17/2006	1	2.36	10	6.18	2	2	4.026
OW4B	5/17/2006	1	2.36	10	6.18	2	2	4.026
OW5	5/24/2006	1	2.36	10	6.18	2	2	3.998
OW6	5/19/2006	1	2.36	10	6.18	2	2	4.026
OW7	5/18/2006	1	2.36	10	6.18	2	2	4.026
OW8B	5/17/2006	1	2.36	10	6.18	2	2	3.998
MW1A	5/23/2006	1	2.36	10	6.18	2	2	3.998
MW1B	5/23/2006	1	2.36	10	6.18	2	2	3.998
MW2	5/24/2006	1	2.36	10	6.18	2	2	3.998
MW2	5/24/2006	1	2.36	15	9.27	1	1	3.998
MW3	5/18/2006	1	2.36	10	6.18	2	2	3.998
MW4A	5/19/2006	1	2.36	10	6.18	2	2	3.998
MW4B	5/19/2006	1	1.30	15	5.11	2	2	2.049
MW4C	5/19/2006	1	1.30	15	5.11	2	2	2.049
MW5	5/24/2006	1	2.36	10	6.18	2	2	3.998
MW6	5/23/2006	1	2.36	10	6.18	2	2	3.998
MW7	5/18/2006	1	2.36	10	6.18	2	2	3.998
MW8A	5/16/2006	1	2.36	5	3.09	4	4	3.998
MW8B	5/16/2006	1	1.30	15	5.11	2	2	2.049
MW8C	5/16/2006	1	1.30	15	5.11	3	3	2.049
MW8D	5/16/2006	1	2.36	10	6.18	3	3	3.998
MW9A	5/24/2006	1	2.36	5	3.09	2	2	3.998
MW9B	5/16/2006	1	2.36	10	6.18	2	2	3.998
MW10	5/23/2006	1	2.36	10	6.18	2	2	3.998
MW11	5/18/2006	1	2.36	10	6.18	2	2	3.998
MW12	8/7/2006	2	1.30	15	5.11	2	3	1.913
MW13B	5/15/2006	1	1.30	15	5.11	3	3	1.913
MW14	8/9/2006	2	1.30	15	5.11	3	3	1.913
MW15	5/24/2006	1	1.30	15	5.11	3	3	1.913
MW16A	5/18/2006	1	1.30	10	3.40	2	2	1.913
MW16B	8/7/2006	2	1.30	15	5.11	2	2	1.913
MW16C	8/7/2006	2	1.30	15	5.11	2	2	1.913
MW17A	8/9/2006	2	1.30	10	3.40	2	2	1.913
MW-17B	8/9/2006	2	1.30	15	5.11	3	3	1.913
MW17C	8/9/2006	2	1.30	15	5.11	3	3	1.913
MW18A	5/17/2006	1	1.30	15	5.11	2	2	1.913
MW18B	5/17/2006	1	1.30	15	5.11	3	3	1.913
MW18C	5/17/2006	1	1.30	15	5.11	2	2	1.913
MW20A	8/8/2006	2	1.30	15	5.11	2	2	1.913
MW20B	8/8/2006	2	1.30	15	5.11	2	2	1.913
MW20C	8/8/2006	2	1.30	15	5.11	2	2	1.913
MW21	8/8/2006	2	1.30	15	5.11	2	2	1.913
MW22	8/8/2006	2	1.30	15	5.11	2	2	1.913
MW23A	6/19/2007	4	2.36	15	9.27	2	2	3.786
MW23B	5/15/2006	1	1.30	15	5.11	2	2	1.913
MW23C	5/15/2006	1	1.30	15	5.11	3	3	1.913
MW23D	5/15/2006	1	1.30	15	5.11	2	2	1.913
MW24A	6/18/2007	4	2.36	15	9.27	2	2	3.786
MW24B	6/18/2007	4	1.30	15	5.11	2	2	1.913
MW24C	6/18/2007	4	2.36	15	9.27	2	2	3.786
MW24D	6/18/2007	4	1.30	15	5.11	2	2	1.913
MW25A	5/1/2007	3	2.36	15	9.27	2	4	3.786
MW25B	5/1/2007	3	1.30	15	5.11	2	2	1.913
MW25C	5/1/2007	3	2.36	15	9.27	2	2	3.786
MW25D	5/1/2007	3	1.30	15	5.11	2	2	1.913
MW26A	5/2/2007	3	2.36	15	9.27	2	2	3.786
MW26B	5/2/2007	3	1.30	15	5.11	2	2	1.913
MW26C	5/2/2007	3	1.30	15	5.11	2	2	1.913
MW26D	5/2/2007	3	1.30	15	5.11	2	2	1.913
MW27A	5/3/2007	3	2.36	15	9.27	2	2	3.786
MW27B	5/3/2007	3	2.36	15	9.27	3	3	3.786

Table 2-8
Slug Test Field Data Summary
Omega Chemical Superfund Site

Well	Test Date	Phase	Slug OD (inches)	Slug Length (feet)	Volume of Water Displaced by Slug (ft^3)	No. Rising Tests	No. Falling Tests	Casing ID (inches)
MW27C	5/2/2007	3	1.30	15	5.11	2	2	1.913
MW27D	5/2/2007	3	1.30	15	5.11	2	2	1.913
MW28	6/19/2007	4	2.36	15	9.27	2	2	3.786
MW29	6/19/2007	4	2.36	15	9.27	2	2	3.786
MW30	6/19/2007	4	2.36	15	9.27	2	2	3.786

Notes:
ID = inside diameter
OD = outside diameter

Table 2-9
Summary of Step-Testing Field Data - Monitoring Wells
Omega Chemical Superfund Site

Date		Well	Static DTW (feet bgs)	Pressure Transducer Depth (feet bgs)	Head Above Pressure Transducer (feet)	Pressure Transducer Recording Frequency	Casing Diameter (inches)	Pump Diameter (inches)	Step	Flow Rate (gpm)	Duration (minutes)	Discharge (gallons)
19-Jun-07	Observation Well	MW23C	31.73	56.29	18.89	1 minute	2	---	---	---	---	---
	Observation Well	MW23D	32.55	44.49	17.93	1 minute	2					
20-Jun-07	Pump Well	MW27B	76.75	100.55	23.8	1 second	4	3	1	7.4	62	480
	Observation Well	MW27A	76.91	101.47	24.56	1 minute	4		2	15.4	60	950
	Observation Well	MW27C	88.92	100.86	11.94	1 minute	2		3	20.7	78	1647
									4	23.6	58	1335
										Total	258	4412
21-Jun-07	Pump Well	MW27A	76.88	101.2	24.32	1 second	4	3	1	5.5	65	366
	Observation Well	MW27B	76.71	100.45	23.74	1 minute	4		2	13.7	57	784
	Observation Well	MW27C	89.03	100.79	11.76	1 minute	2		3	19.5	60	1174
									4	23.8	120	2826
										Total	302	5150
22-Jun-07	Pump Well	MW26B	67.02	100.65	33.63	1 second	2	2	1	1	30	34
	Observation Well	MW26A	66.95	87.03	20.08	1 minute	4		2	2.2	61	109
	Observation Well	MW26C	78.99	101.27	22.28	1 minute	4		3	3	60	182
									4	4.7	60	295
										Total	211	620
25-Jun-07	Pump Well	MW26A	66.99	87.99	21	1 second	4	3	1	5	60	300
	Observation Well	MW26B	67.05	100.72	33.67	1 minute	2		2	10.3	60	640
	Observation Well	MW26C	78.72	100.2	21.48	1 minute	4		3	15	60	860
									4	19.8	60	1151
									5	27.5	120	3349
										Total	360	6300
26-Jun-07	Pump Well	MW24C	41.72	84.62	42.9	1 second	4	3	1	5.3	60	315
	Observation Well	MW24B	41.38	76.58	35.2	1 minute	2		2	14.9	60	895
	Observation Well	MW24D	42.09	71.92	29.83	1 minute	2		3	20	60	1200
									4	29.4	135	3977
										Total	315	6387
28-Jun-07	Pump Well	MW24A	36.9	62.82	25.92	1 second	4	3	1	5.1	60	310
	Observation Well	MW24B	41.42	76.44	35.02	1 minute	2		2	12.3	60	719
									3	20.3	60	1251
									4	31.4	120	3720
										Total	300	6000
29-Jun-07	Pump Well	MW23A	27.9	48.56	20.66	1 second	4		1	5.5	60	330
	Observation Well	MW23B	n/a	n/a	41.32	1 minute	2		2	13.2	70	935
									3	20.2	60	1165
									4	34.8	110	3830
										Total	300	6260
2-Jul-07	Pump Well	MW30	92.58	110.44	17.86	1 second	4		1	5.5	80	430
									2	11.4	57	640
									3	19.8	61	1212
									4	26.6	88	2360
										Total	286	4642

Notes:
feet bgs =feet below ground surface
DTW = depth to water
gpm = gallons per minute
n/a = information not available
---- not applicable

Table 2-10
Soil Gas Probe Completion Details
Omega Chemical Superfund Site

										Screen Interval			Filter Pack Interval			Annular Seal Interval	
Probe ID	**Northing**	**Easting**	**Drilling Method**	**Borehole Diameter (inches)**	**TD of Borehole (ft bgs)**	**Tubing Depth (ft bgs)**	**Tubing Diameter (inches)**	**Tubing Material**	**Screen Material**	**From**	**To**	**Filter Pack Material**	**From**	**To**	**Annular Seal**	**From**	**To**
															granular bentonite (dry)	1	4
															medium chips (hydrated)	4	10.5
															granular bentonite (dry)	10.5	11.5
SGRA1A	3759066.602	402901.838	Direct Push	2.5	32.5	12.5	0.25	Polyethylene	SST	12.5	13	#3 Sand	12	13.5	#60 transition sand	11.5	12
															medium chips (hydrated)	13.5	19.5
															granular bentonite (dry)	19.5	20.5
SGRA1B	3759066.602	402901.838	Direct Push	2.5	32.5	21.5	0.25	Polyethylene	SST	21.5	22	#3 Sand	21	22.5	#60 transition sand	20.5	21
															medium chips (hydrated)	22.5	29.5
															granular bentonite (dry)	29.5	30.5
SGRA1C	3759066.602	402901.838	Direct Push	2.5	32.5	31.5	0.25	Polyethylene	SST	31.5	32	#3 Sand	31	32.5	#60 transition sand	30.5	31
															granular bentonite (dry)	1	4
															medium chips (hydrated)	4	5
															granular bentonite (dry)	5	6
SGRA2A	3759093.890	402839.001	Direct Push	2.5	30	7	0.25	Polyethylene	SST	7	7.5	#3 Sand	6.5	8	#60 transition sand	6	6.5
															medium chips (hydrated)	8	10.5
															granular bentonite (dry)	10.5	11.5
SGRA2B	3759093.890	402839.001	Direct Push	2.5	30	12.5	0.25	Polyethylene	SST	12.5	13	#3 Sand	12	13.5	#60 transition sand	11.5	12
															medium chips (hydrated)	13.5	26.5
															granular bentonite (dry)	26.5	27.5
SGRA2C	3759093.890	402839.001	Direct Push	2.5	30	28.5	0.25	Polyethylene	SST	28.5	29	#3 Sand	28	30	#60 transition sand	27.5	28
															granular bentonite (dry)	1	4
															medium chips (hydrated)	4	10
															granular bentonite (dry)	10	10.5
SGRA3A	3759191.470	402874.101	Direct Push	2.5	30	11.5	0.25	Polyethylene	SST	11.5	12	#3 Sand	11	12.5	#60 transition sand	10.5	11
															medium chips (hydrated)	12.5	17
															granular bentonite (dry)	17	17.5
SGRA3B	3759191.470	402874.101	Direct Push	2.5	30	18.5	0.25	Polyethylene	SST	18.5	19	#3 Sand	18	19.5	#60 transition sand	17.5	18
															medium chips (hydrated)	19.5	27
															granular bentonite (dry)	27	27.5
SGRA3C	3759191.470	402874.101	Direct Push	2.5	30	28.5	0.25	Polyethylene	SST	28.5	29	#3 Sand	28	30	#60 transition sand	27.5	28
															granular bentonite (dry)	1	4
															medium chips (hydrated)	4	8.5
															granular bentonite (dry)	8.5	9.5
SGRA4A	3759152.545	402962.721	Direct Push	2.5	31.5	10.5	0.25	Polyethylene	SST	10.5	11	#3 Sand	10	11.5	#60 transition sand	9.5	10
															medium chips (hydrated)	11.5	16
															granular bentonite (dry)	16	17
SGRA4B	3759152.545	402962.721	Direct Push	2.5	31.5	18	0.25	Polyethylene	SST	18	18.5	#3 Sand	17.5	19	#60 transition sand	17	17.5
															medium chips (hydrated)	19	28.5
															granular bentonite (dry)	28.5	29.5
SGRA4C	3759152.545	402962.721	Direct Push	2.5	31.5	30.5	0.25	Polyethylene	SST	30.5	31	#3 Sand	30	31.5	#60 transition sand	29.5	30

Notes:
ft bgs = feet below ground surface
SST = stainless steel
Northing and easting coordinates are referenced to UTM (meters) Zone 11, NAD83