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Lawrence Livermore National Laboratory



University of California, Livermore, California 94550

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LLNL
Ground Water Project
2006 Annual Report

Technical Editors

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Environmental Protection Department

Environmental Restoration Program and Division

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Summary

In 2006, restoration activities for the Lawrence Livermore National Laboratory (LLNL) Livermore Site Ground Water Project included:

- Removing nearly 78 kilograms (kg) of VOCs from ground water and over 177 kg from soil vapor (Table Summ-1).
- Operating 27 ground water treatment facilities and 9 soil vapor treatment facilities.
- Operating a network of 92 ground water extraction wells, 1 ground water injection well, 34 dual extraction¹ wells, 19 soil vapor extraction (SVE) wells, and 1 soil vapor injection well.
- Installing 7 dual extraction wells, 2 ground water extraction wells, 2 ground water monitoring wells, and 11 soil vapor monitoring wells.
- Installing one anode (cathodic protection) well and decommissioning (drilling out old equipment and grouting the borehole) one anode well for the LLNL Plant Engineering Department.
- Placing and grouting geophones in two monitoring wells for a seismic experiment conducted by UC Berkeley.
- Conducting two hydraulic tests, three SVE tests, and four dual extraction tests.
- Meeting all regulatory and U. S. Department of Energy (DOE) milestones by constructing or upgrading treatment facilities and beginning remediation at:
 - Treatment Facility D East Traffic Circle North Source Area
 - Building 419 Source Area
 - Treatment Facility C Hotspot
 - Buildings 511/514 Source Area
 - Treatment Facility 5475 South
- Completing all of the milestones specified in the Remedial Action Implementation Plan and "build-out" as defined by DOE's Office of Environmental Management. Responsibility of the Livermore Site project was subsequently transferred from DOE's Office of Environmental Management to the DOE National Nuclear Security Administration.
- Continuing hydraulic control and treatment of plumes along the western margin of the site, where concentrations of Volatile Organic Compounds (VOCs) continued to decline.
- Reducing trichloroethylene concentrations in extraction well W-1604 from 2,100 parts per billion (ppb) to 480 ppb at Treatment Facility 5475-2. This is the first treatment of contaminants in HSU-4 in the TF5475 area.
- Reducing concentrations of Freon 11 to below the Maximum Contaminant Levels (MCL) in one hydrostratigraphic unit within the interior of the site.
- Confirming that tritium activities in ground water samples from all wells remained below the 20,000 picocuries per liter MCL and continued to decline by radioactive decay.

Ground water concentration and hydraulic data collected and analyzed during 2006 continued to provide evidence for the collapse of offsite contaminant plumes and hydraulic containment along the western and southern boundaries of the site, as well as progress towards cleanup of interior plumes and source areas.

Since remediation began in 1989, over 3.1 billion gallons of ground water and over 258 million cubic feet of soil vapor have been treated, removing nearly 2,298 kg of VOCs (Table Summ-2).

¹Extraction of ground water using a downhole pump with concurrent application of vacuum to the well. Ground water and soil vapor are removed in separate pipe manifolds and treated.

Table Summ-1. Summary of 2006 Livermore Site VOC remediation.

Treatment area ^a	Volume of ground water treated (Mgal) ^b	Estimated VOC mass removed from ground water (Kg) ^c	Volume of soil vapor treated (Kft ³) ^b	Estimated VOC mass removed from soil vapor (Kg) ^c	Estimated VOC mass removed (Kg) ^{c, d}
TFA	96.5	5.7	na	na	5.7
TFB	25.7	2.7	na	na	2.7
TFC	39.2	6.2	na	na	6.2
TFD	74.1	46.4	20,657	14.3	60.6
TFE	26.2	11.1	36,654	11.8	22.9
TFG	7.2	1.1	na	na	1.1
TFH	10.9	4.6	26,005	151.2	155.8
Total ^d	279.8	77.8	83,315	177.3	255.0

Notes:

Mgal = Millions of gallons.

Kg = Kilograms.

Kft³ = Thousands of cubic feet.

na = Not applicable.

^a Treatment areas and facilities (Refer to Table 2 for abbreviations):

TFA area: TFA, TFA-E

TFB area: TFB

TFC area: TFC, TFC-E, TFC-SE

TFD area: TFD, TFD-E, TFD-HPD, TFD-S, TFD-SE, TFD-SS, TFD-W, VTFD-ETCS, VTFD-HPD, VTFD-HS

TFE area: TFE-E, TFE-HS, TFE-NW, TFE-SE, TFE-SW, TFE-W, VTFE-ELM, VTFE-HS

TFG area: TFG-1, TFG-N

TFH area: TF406, TF406-NW, VTF406-HS, VTF511, TF518-N, VTF518-PZ, TF5475-1, TF5475-2, TF5475-3, VTF5475

^b Approximate total volumes for each treatment area.

^c The VOC mass values are the best estimate based on measurement uncertainties in both flow rates and chemical analyses.

^d Rounded numbers.

Table Summ-2. Summary of cumulative Livermore Site VOC remediation.

Treatment area	Volume of ground water treated (Mgal) ^a	Estimated VOC mass removed from ground water (Kg) ^b	Volume of soil vapor treated (Kft ³) ^a	Estimated VOC mass removed from soil vapor (Kg) ^b	Estimated VOC mass removed (Kg) ^{b, c}
TFA	1,398	184	na	na	184
TFB	322	68	na	na	68
TFC	294	78	na	na	78
TFD	700	696	41,690	80	777
TFE	250	184	102,862	135	318
TFG	45	8	na	na	8
TFH	118	27	114,026	837	865
Total^c	3,127	1,246	258,578	1,052	2,298

Notes:

Mgal = Millions of gallons.

Kg = Kilograms.

Kft³ = Thousands of cubic feet.

na = Not applicable.

^a Approximate volumes for each treatment area.^b The VOC mass values are the best estimate based on measurement uncertainties in both flow rates and chemical analyses.^c Rounded numbers.

1. Introduction

This report summarizes the Lawrence Livermore National Laboratory (LLNL) Livermore Site Ground Water Project (GWP) activities for calendar year 2006. This report describes actions taken to ensure regulatory compliance, field investigations, flow and transport modeling, remedial action program, ground water discharges, and trends in ground water analytical results.

The treatment areas, treatment facilities, and wells at the Livermore Site are shown in Figures 1 and 2 (a, b, c, d). Well information is summarized in Table 1 and Appendix A. The treatment facilities and their abbreviations are presented in Table 2. Wells that were installed during the year are listed by treatment facility area in Table 3. The hydraulic, soil vapor extraction (SVE), and dual extraction test wells and results are presented in Tables 4 and 5 as well as Appendices B and C. The Remedial Action Implementation Plan (RAIP) milestones and completion dates are provided in Table 6. The treatment facilities and their discharge sampling locations are listed in Table 7. The annual performance of the extraction wells is presented in Table 8. The 2007 sampling schedule for ground water monitor wells is summarized in Appendix D. The monitoring program at Lake Haussmann (formerly called the Drainage Retention Basin) is provided in Appendix E.

The U.S. Department of Energy (DOE)/LLNL completed all of the milestones specified in the RAIP. Responsibility of the Livermore Site project was subsequently transferred from DOE's Office of Environmental Management to the DOE National Nuclear Security Administration (NNSA).

2. Regulatory Compliance

In 2006, DOE/LLNL submitted the GWP 2005 Annual Report (Karachewski et al., 2006) and GWP quarterly self-monitoring reports on schedule (Yow and Wong 2006a, b, c, and 2007). In addition, DOE/LLNL completed five 2006 RAIP milestones (Table 6) (Dresen et al., 1993).

Livermore Site community relations activities in 2006 included communications and meetings with neighbors and local, regional, and national interest groups and other community organizations; making public presentations; producing and distributing the Environmental Community Letter; maintaining the Information Repositories and the Administrative Record; conducting tours of site environmental activities; and responding to public and news media inquiries. In addition, DOE/LLNL met with members of Tri-Valley Communities Against a Radioactive Environment and their scientific advisor as part of the activities funded by a U.S. Environmental Protection Agency (EPA) Technical Assistance Grant. Community questions were also addressed via electronic mail, and project documents, letters, and public notices were posted on a public website:

<http://www-envirinfo.llnl.gov/>

3. Field Investigations

3.1. Ground Water Samples

LLNL Environmental Restoration Division (ERD) and Water Guidance and Monitoring Group (WGMG) personnel evaluated data quality objectives, analytical results, historical trends, the Cost-Effective Sampling (CES) algorithm, and hydraulic data to determine the frequency, chemical analyses, and methods for collecting ground water samples. The ground water samples were analyzed for Volatile Organic Compounds (VOCs), fuel hydrocarbons, polychlorinated biphenyls, metals, radionuclides, or combinations thereof depending upon the location.

In 2006, the GWP collected 919 ground water samples from 330 wells during 720 sampling events. The methods and numbers of samples collected were:

- Specific-Depth Grab Sampling (SDGS) using the Voss EasyPump: 464 events (64%).
- Three-volume purge using a dedicated electric submersible pump: 77 events (11%).
- Low-volume purge: 44 events (6%).
- Other (bailer, electronic submersible pump, etc.): 135 events (19%).

Ongoing and significant cost reduction was achieved again in 2006 through the use of SDGS and low-volume purge methods. The benefits of these methods included:

- Eliminating the need to replace dedicated pumps and related sampling equipment.
- Increasing technician efficiency and reducing sampling time.
- Increasing personnel safety through the use of low voltage equipment.
- Eliminating collection, treatment, and disposal of more than 50,000 gallons of purge water, including water that would be considered mixed waste due to the presence of both VOCs and tritium.

SDGS is the preferred method for collecting ground water samples, especially at well locations where the purge water might contain mixed waste.

3.2. Source Investigations

Gore-Sorber investigations and drilling activity continued to focus on source areas. During 2006, passive soil vapor investigations were conducted to fill data gaps in the TFC Hotspot, Building 511, TF406 Hotspot, and Building 518 areas (Whetzel, 2006a, b, c). The Gore-Sorber modules were installed to a depth of approximately three feet below the surface and were left in the ground between two and three weeks before analysis for VOCs.

In the TFC Hotspot area, VOCs were not detected at 12 of the 14 locations and where present, the tetrachloroethene (PCE) and 1,1-dichloroethene (1,1-DCE) levels were very low (maximum 0.35 micrograms [μg] and 0.18 μg , respectively). In the Building 511 and adjacent TF406 Hotspot area, VOCs were not detected at 13 of the 28 locations. Where present, the trichloroethene (TCE), PCE, and 1,1,1-trichloroethane (1,1,1-TCA) levels were relatively low (maximum 5.45 μg , 5.38 μg , and 0.13 μg , respectively). In the Building 518 area, VOCs were detected at 10 of the 15 locations. The maximum TCE and PCE levels were also relatively low (4.74 μg and 0.96 μg , respectively).

3.3. Well Testing

Hydraulic, SVE, and dual extraction tests were conducted in the TFD and TFH (Building 419 and 511) areas. The test wells are listed in Tables 4 and 5 and the results are summarized in Appendices B and C. The test results were incorporated into the design, startup, and operation of the RAIP milestone-related treatment facilities.

Hydraulic testing was performed in two TFD area wells in 2006. These tests were conducted to estimate near-well hydraulic conductivity of the aquifer and to quantify the level of hydraulic communication between neighboring wells. The test results were considered in deciding which wells to connect the TFD East facility as part of the TFD East Traffic Circle North Source Area remediation milestone. Table 4 lists the wells on which hydraulic tests were conducted and results of the tests are summarized in Appendix B.

Six SVE and/or dual extraction tests were conducted in the TFH area in 2006. These tests were conducted to further characterize the level of vadose zone contamination in the TFH area, to assess pneumatic communication between wells, to determine the well radius of influence, and to estimate air permeability values. The results of these tests were incorporated into the design of the VTF511 to meet the Building 419 and Buildings 511/514 Source Area remediation milestones. Table 5 lists the wells on which SVE and/or dual extraction tests were conducted and the results of the tests are summarized in Appendix C.

4. Flow and Transport Modeling

Ground water flow and contaminant transport models were used at the Livermore Site to optimize the design and operation of remediation systems; to support ongoing subsurface characterization activities; and to improve the ability to forecast, monitor, and interpret the progress of the remediation program.

The focus in 2006 was mainly on developing small scale models that simulate multi-phase processes in the source areas. These models are capable of simulating the dual-extraction remediation systems currently operating in the source areas. The source area models, combined with the existing multi-dimensional regional-scale ground water models, are used to optimize the operation of the dual-extraction remediation systems. They also allow for evaluating the potential benefit of using other conventional or innovative source area cleanup technologies in the future. Pilot tests on one or more technologies are planned and will be discussed in future reports.

5. Summary of Remedial Action Program

This section summarizes the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remedial action program at the Livermore Site. The 2006 activities included designing and constructing new treatment facilities; modifying existing systems; performance monitoring; conducting treatability tests; installing wells; and testing monitor, ground water, SVE, and dual extraction wells.

In 2006, DOE/LLNL operated 27 ground water treatment facilities in the TFA, TFB, TFC, TFD, TFE, TFG, and TFH (TF406, TF518, and TF5475) areas (Fig. 1 and Table 7). The

92 ground water extraction wells and 34 dual extraction wells produced over 279 million gallons of ground water and the treatment facilities removed nearly 78 kilograms (kg) of VOCs (Fig. 3, Table Summ-1, and Table 8). In 2005 the ground water treatment facilities removed approximately 71 kg of VOCs. The higher mass removal in 2006 is due to adding new extraction wells to existing or upgraded treatment facilities in contaminant source areas. Since remediation began in 1989, over 3.1 billion gallons of ground water have been treated, resulting in removal of approximately 1,246 kg of VOCs (Fig. 3 and Table Summ-2).

In 2006, DOE/LLNL also operated nine soil vapor treatment facilities in the TFD, TFE, and TFH areas (Fig. 1 and Table 7). The 19 soil vapor extraction wells and 34 dual extraction wells produced over 83 million standard cubic feet (scf) of soil vapor, and the treatment facilities removed approximately 177 kg of VOCs (Table Summ-1 and Table 8). In 2005 the soil vapor treatment facilities removed approximately 196 kg of VOCs. The lower rate of mass removal in 2006 is due to decreasing VOC concentrations and cleanup of the vadose zone in the TFD and TFE source areas. In contrast, there was a significant increase in VOC mass removed in the TFH source areas, from 110.5 kg in 2005 to 151.2 kg in 2006 due to ongoing operation of existing treatment facilities, especially at VTF406 Hotspot, and startup of a new treatment facility at VTF511. Since initial operation, more than 258 million cubic feet of soil vapor has been extracted and treated, removing over 1,052 kg of VOCs (Fig. 3 and Table Summ-2).

Treatment facility performance is evaluated using multiple data sets. Figures 4 through 9 show the estimated hydraulic capture areas in Hydrostratigraphic Units (HSUs) 1B, 2, 3A, 3B, 4, and 5, respectively, based on ground water elevation data collected during the fourth quarter of 2006. Figures 10 through 15 are isoconcentration maps showing total VOCs above Maximum Contaminant Levels (MCLs) in the same six HSUs during the third quarter of 2006. Contaminant concentration trends (Section 7) are also used to evaluate hydraulic capture and performance of treatment facilities.

5.1. Treatment Facility A Area

Two treatment facilities, TFA and TFA East (Figs. 1 and 2b), operated in compliance with all permit requirements throughout 2006.

Offsite well W-404 was converted from a monitor well to an extraction well in the fourth quarter of 2006 to capture a VOC plume within a hydraulic stagnation zone west of TFA (Figs. 5 and 11). DOE/LLNL started extraction well W-404 in January 2007 and is pumping filtered ground water to the sanitary sewer for treatment at the Livermore Water Reclamation Plant (LWRP).

To assist with a UC Berkeley seismic experiment, geophones were systematically placed and grouted in monitoring well W-591, located on Sandia property (Fig. 11). This monitoring well was selected because VOCs have not been detected in it since 1996. This study is ongoing and preliminary results were summarized in a poster presentation at an American Geophysical Union conference (Mangriotis et al., 2006).

Except at two locations (wells W-552 and W-404), TFA extraction wells continue to hydraulically control all of the VOC plumes in HSUs 1B and 2, based on estimated capture zones (Figs. 4 and 5) and isoconcentration maps (Figs. 10 and 11). While HSU-1B well W-552 is below MCLs for all contaminants of concern, PCE concentrations in HSU-2 well W-404 remain above 20 parts per billion (ppb) (24 ppb, May 2006). To ensure hydraulic capture and

treatment of this offsite plume, W-404 was converted into an extraction well as discussed above. Pumping continues at offsite extraction well W-408 to ensure hydraulic control of the HSU-1B plume at wells W-506 and W-1425 (Fig. 10). Six of the eight HSU-1B and 2 extraction wells in the TFA South area remained offline in 2006 due to continued declines in VOC concentrations. In HSU-3A, pumping at extraction well W-712 continues to capture a low-concentration carbon tetrachloride plume near Vasco Road. VOC concentrations in offsite HSU-3A well W-505 remain below MCLs for all contaminants of concern (Figs. 6 and 12).

5.2. Treatment Facility B Area

TFB (Figs. 1 and 2a) operated in compliance with all permit requirements throughout 2006. However, on September 11, 2006, approximately 100 gallons of untreated sampling purge water from well W-315 were inadvertently from a portable tank near the facility onto the ground. A sample of remaining water was analyzed and contained 31.7 ppb of total VOCs. Approximately 12 milligrams (mg) of total VOCs was released due to the incident. The San Francisco Bay Regional Water Quality Control Board (RWQCB) was notified on September 11, 2006 and corrective action was taken to repair the tank and fittings.

Except for two small offsite areas in HSU-1B that are below MCLs for all contaminants of concern (wells W-517 and W-571), the TFB area extraction wells hydraulically control the VOC plumes in HSUs 1B and 2, based on estimated capture zones (Figs. 4 and 5), isoconcentration maps (Figs. 10 and 11), and stable or declining VOC concentrations in the area. To improve hydraulic capture of the HSU-2 plume along Vasco Road, the flow rates for extraction wells W-621 and W-655 were increased in early April.

5.3. Treatment Facility C Area

Three treatment facilities, TFC, TFC East, and TFC Southeast, (Figs. 1 and 2c), operated in compliance with all permit requirements throughout 2006. Although the TFC effluent meet all discharge limits in 2006, a discharge pump at TFC Southeast failed on July 24, 2006 causing 300 to 400 gallons of treated water to spill onto the ground. A courtesy notification was made to the San Francisco Bay RWQCB on July 24, 2006. The discharge pump was repaired and TFC Southeast returned to operation on August 17, 2006.

One ground water extraction well W-2201 (Fig. 2c) was installed in 2006 in an area where VOC concentrations in HSU-1B exceeded 200 ppb. The TFC Hotspot remediation milestone was completed on April 24, 2006 with the addition of well W-2201 to TFC Southeast.

In the central and western TFC area, VOCs are limited to HSU-1B. In the eastern TFC area, VOCs are in both HSUs 1B and 2. The TFC area extraction wells hydraulically control the VOC plumes in HSUs 1B and 2, based on estimated capture zones (Figs. 4 and 5) and isoconcentration maps (Figs. 10 and 11).

5.4. Treatment Facility D Area

Ten treatment facilities operated in the TFD area during 2006 (Figs. 1 and 2c): TFD, TFD East, TFD Helipad, TFD South, TFD Southeast, TFD Southshore, TFD West, VTFD East Traffic Circle South, VTFD Helipad, and VTFD Hotspot. The TFD treatment facilities operated in compliance with all permit requirements throughout 2006.

A ground water extraction well (W-2203), a monitor well (W-2304), and an anode well for cathodic protection were installed in the TFD area in 2006 (Fig. 2c and Table 3). The previous anode well was also decommissioned. The 2006 TFD area hydraulic tests are listed in Table 4 and the test results are summarized in Appendix B.

The TFD East Traffic Circle North Source area milestone was completed on August 2, 2006. This milestone consisted of adding five ground water extraction wells W-1404, W-2203, W-2006, W-1253, and W-1255 to TFD East.

The TFD area extraction wells exert significant hydraulic control over VOC plumes in HSUs 3A, 3B, and 4 and over large portions of VOC plumes in HSUs 2 and 5 based on estimated capture zones (Figs. 5, 6, 7, 8, and 9) and isoconcentration maps (Figs. 11, 12, 13, 14, and 15). Distal portions of VOC plumes in HSUs 1B and 2 (Figs. 4, 5, 10, and 11) in the western TFD area are being hydraulically contained by TFC East. Distal portions of the VOC plume in HSU-3A in the northwestern TFD area are being hydraulically contained by extraction wells at TFD West and TFD (Figs. 6 and 12).

5.5. Treatment Facility E Area

Eight treatment facilities operated in the TFE area during 2006 (Figs. 1 and 2d): TFE East, TFE Hotspot, TFE Northwest, TFE Southeast, TFE Southwest, TFE West, VTFE Eastern Landing Mat, and VTFE Hotspot. The treatment facilities operated in compliance with all permit requirements throughout 2006.

The TFE East, TFE Northwest, TFE Southeast, TFE Southwest, TFE Hotspot, and TFE West extraction wells hydraulically contain portions of the VOC plume in HSU-3A and most of the VOC plumes in HSUs 2, 3A, 3B, 4, and 5 based on estimated capture zones (Figs. 5, 6, 7, 8, and 9) and isoconcentration maps (Figs. 11, 12, 13, 14, and 15).

5.6. Treatment Facility G Area

Two treatment facilities, TFG-1 and TFG North (Figs. 1 and 2d) operated in compliance with all permit requirements throughout 2006.

Extraction well W-1111 hydraulically controls most of the VOC plume in HSU-2 in the southern TFG-1 area based on the capture zone (Fig. 5) and isoconcentration map (Fig. 11). Extraction wells W-1806 and W-1807 hydraulically control a significant portion of the VOC plumes in HSUs 1B and 2, respectively, in the northern portion of the TFG area (Figs. 4, 5, 10, and 11).

5.7. Treatment Facility H Area

The TFH area in the southeast corner of the Livermore Site includes the TF406, Building 419, Buildings 511/514, TF518, and TF5475 facilities. Activities in the TFH area are discussed below.

5.7.1. Treatment Facilities Near Building 406

Three treatment facilities, TF406, TF406 Northwest, and VTF406 Hotspot (Figs. 1 and 2d) operated in compliance with all permit requirements in 2006. Passive bioremediation of fuel hydrocarbons (Berg et al., 1997) in HSUs 3A and 3B continued during 2006.

The TF406, TF406 Northwest, and adjacent TF518 North (see Section 5.7.2) extraction wells hydraulically control most of the VOC plume in HSU-5 and provide significant hydraulic control of VOC plumes in HSUs 3A and 4 based on estimated capture zones (Figs. 6, 8, and 9), isoconcentration maps (Figs. 12, 14, and 15), and stable or declining VOC concentrations.

5.7.2. Treatment Facilities Near Building 518

Three treatment facilities, TF518 North, VTF518 Perched Zone, and VTF511 (Figs. 1 and 2d), were in compliance with all permit requirements in 2006.

To assist with a UC Berkeley seismic experiment, geophones were systematically placed and grouted in monitoring well W-019. This monitoring well was selected because of its long history of non-detectable VOCs.

The Buildings 511/514 Source Area and Building 419 Source Area milestones were completed on September 20, 2006. These milestones consisted of constructing new pipelines in highly developed areas and connecting nine dual extraction wells to a new vapor treatment facility (VTF511) to implement vadose zone cleanup in the source areas. The dual extraction wells are currently removing only soil vapor from the subsurface. DOE/LLNL are planning to extract ground water from these wells in the future.

VTF518 Perched Zone continued to treat soil vapor and collect perched ground water. The ground water from the dual extraction wells is stored in a 500-gallon tank (TF518-HDTANK) and periodically transferred to TF406 Northwest for treatment.

Extraction wells at TF518 North, TF406, and TFE Southeast continue to hydraulically control most of the HSU-4 and 5 VOC plumes in the area based on estimated capture zones (Figs. 8 and 9) and isoconcentration maps (Figs. 14 and 15). HSU-5 remained largely dewatered throughout the area. The sustained dewatering in HSU-5 increases hydraulic control by widening the capture areas of existing extraction wells.

5.7.3. Treatment Facilities Near Trailer 5475

Two ground water treatment facilities, TF5475-1, TF5475-3 and one vapor treatment facility, VTF5475 (Figs. 1 and 2d) operated in compliance with all permit requirements throughout 2006. TF5475-1 and TF5475-3 use catalytic reductive dehalogenation (CRD) to remediate VOCs in ground water. TF5475-2 and VTF5475 use granular activated carbon to remediate VOCs.

Discharge from TF5475-2 was out of compliance in December 2006. Approximately 194,000 gallons of ground water were treated at this facility during December with a total VOC concentration in the effluent of 20.9 ppb. This condition was noticed and the facility was shut down on February 6, 2007 and the San Francisco Bay RWQCB was notified on February 8, 2007. Before resuming operation, new carbon canisters were installed at TF5475-2. In addition, a monitoring program consisting of more frequent periodic sampling between carbon canisters and timely notification of VOC breakthrough between carbon canisters was implemented to prevent reoccurrence.

The TF5475 South milestone was met on June 6, 2006. This milestone consisted of adding well W-1604 to TF5475-3, as well as increasing the treatment capacity of TF5475-2 by replacing a solar treatment unit with a granular activated carbon treatment unit to accommodate flow from new ground water extraction well W-1108. In addition, the operation of two existing HSU-5

wells was modified at TF5475-3 to optimize reinjection of treated ground water with tritium, by using well W-1609 for extraction and well W-1610 for injection.

6. Ground Water Discharges

In 2006, approximately 233 millions of gallons (Mgal) of treated ground water were discharged to Arroyo Las Positas, and approximately 47 Mgal of treated ground water was discharged to Arroyo Seco.

7. Trends in Ground Water Analytical Results

In 2006, concentrations continued to decrease in most Livermore Site VOC plumes. The decline in VOC concentrations is primarily attributed to active remediation and reflects the removal of approximately 255 kg of VOCs by the ground water, soil vapor, and dual extraction wells during the year (Tables Summ-1 and 8). These data are consistent with the longer-term trends detailed in the 2007 Draft Third Five-Year Review for the Lawrence Livermore National Laboratory, Livermore Site (Berg et al., 2007) that show steady cleanup in both offsite and onsite areas of the site. Notable trends and results from the third quarter 2005 through the third quarter 2006 are discussed below. The isoconcentration contour maps (Figs. 10 through 15) display total VOCs above MCLs by HSU.

VOC concentrations on the western margin of the site generally continued to decline slowly, indicating continued hydraulic control of the boundary plumes in the TFA, TFB, and TFC areas (Fig. 10). Offsite, VOCs in HSU-1B remained below MCLs, except at well W-1425, which is currently fluctuating above and below the PCE MCL (1.2 ppb PCE, December 2006). A large area east of the TFA north pipeline (including wells W-115, W-213, and W-604) fell below MCLs for the first time. The entire offsite and onsite TFA HSU-2 VOC plume remained below 25 ppb in 2006 (Fig. 11). The highest PCE levels offsite continue to be at wells W-404 and W-654, where maximum 2006 concentrations were 24 ppb and 13 ppb, respectively. To ensure hydraulic containment and to reduce the concentration of PCE at well W-404, TFA West was activated in January 2007. At TFB, concentrations rose along the western margin at well W-422 (9.6 ppb TCE, December 2006). A hydraulic test is being conducted to determine whether additional ground water extraction will be required to prevent offsite migration of the VOC plume at this location. Concentrations in all TFA, TFB, and TFC source areas remained relatively unchanged, except at the TFC Hotspot area where TCE increased from 260 ppb (October 2005) to 300 ppb (July 2006) in HSU-1B well SIP-501-007 (Fig. 10). Ground water remediation began in this area in April 2006 as part of the TFC Hotspot RAIP milestone.

VOC concentrations in a mobile HSU-2 plume located in the central TFE area increased slightly over the last year. Concentration increases observed at wells W-1202 (from 42 ppb to 79 ppb TCE), W-271 (23 to 29 ppb TCE) and W-1508 (17 to 32 ppb TCE) should be hydraulically captured and treated at downgradient treatment facility TFE-W. TCE concentrations in this plume's source area, TFE Eastern Landing Mat, declined over the last year from 1,600 ppb to 1,400 ppb in well SIP-543-101 due to ongoing operation of soil vapor and dual extraction wells.

The entire HSU-3A TFD area Freon 11 plume dropped below MCLs (Fig. 12) for the first time in response to ground water extraction at TFD West. In the TFB area, PCE and TCE

increased slightly in HSU-3A well W-310 (5.7 ppb and 3.4 ppb, respectively). Hydraulic testing is planned to determine the cause of this increase. After increasing for several years, TCE concentrations at TFE well W-276 declined slightly during 2006, probably due to ongoing ground water extraction and treatment at TF406 Northwest. The W-276 area will continue to be evaluated to determine whether hydraulic containment and ground water treatment is needed to prevent westward migration of this plume under the high security southwest corner of the site. In the Building 419 area, concentrations in source area well W-1414 declined from 3,409 ppb to 1,705 ppb TCE. Soil vapor clean up in the Building 419 source area began in September 2006. Elsewhere in HSU-3A, VOC concentrations remained largely unchanged.

Concentrations in the HSU-3B plume emanating from the TFD Southeast area increased slightly during the period (Fig. 13). TCE concentrations at extraction well W-1403 rose from 420 ppb to 490 ppb, while TCE at downgradient monitor well W-1511 increased from 270 to 390 ppb. Ground water extraction and treatment at TFD Southeast and at TFD South are expected to reduce these concentrations over time. Elsewhere in HSU-3B, VOC concentrations remained relatively unchanged.

Concentrations in HSU-4 generally declined in several areas under remediation (Fig. 14). Near the south side of Trailer 5475, where ground water extraction and treatment began in June 2006, TCE in extraction well W-1604 dropped from 2,100 ppb to 480 ppb. At TFD Southeast, TCE in extraction well W-314 declined significantly from 300 ppb to 250 ppb. TFD Main TCE concentrations in HSU-4 extraction well W-351 decreased from 310 ppb to 100 ppb, while at TFD Southshore, TCE declined in extraction well W-1523 from 320 ppb to 230 ppb. Elsewhere, concentration levels were relatively unchanged.

Concentrations continued to decline in HSU-5 on Sandia property in response to continued ground water extraction at TF406, with only TCE remaining above its MCL in two offsite wells (11 ppb in well W-509 and 5 ppb in well W-1113 (Fig. 15). At extraction well W-359, TCE increased from 350 ppb to 390 ppb. Soil vapor extraction and dual extraction that began in the Building 511 Source Area in September 2006 is expected to reduce concentrations at well W-359 over time. Elsewhere in HSU-5, very little change was evident during 2006.

At extraction well W-359, TCE increased from 350 ppb to 390 ppb. Soil vapor extraction and dual extraction that began in the Building 511 Source Area in September 2006 is expected to reduce concentrations at well W-359 over time. Elsewhere in HSU-5, very little change was evident during 2006.

During 2006, tritium activities in ground water from all wells at the Livermore Site, including those in the Trailer 5475 and Building 292 areas, remained below the 20,000 picocuries per liter MCL and continued to decline by radioactive decay.

8. References

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Figures

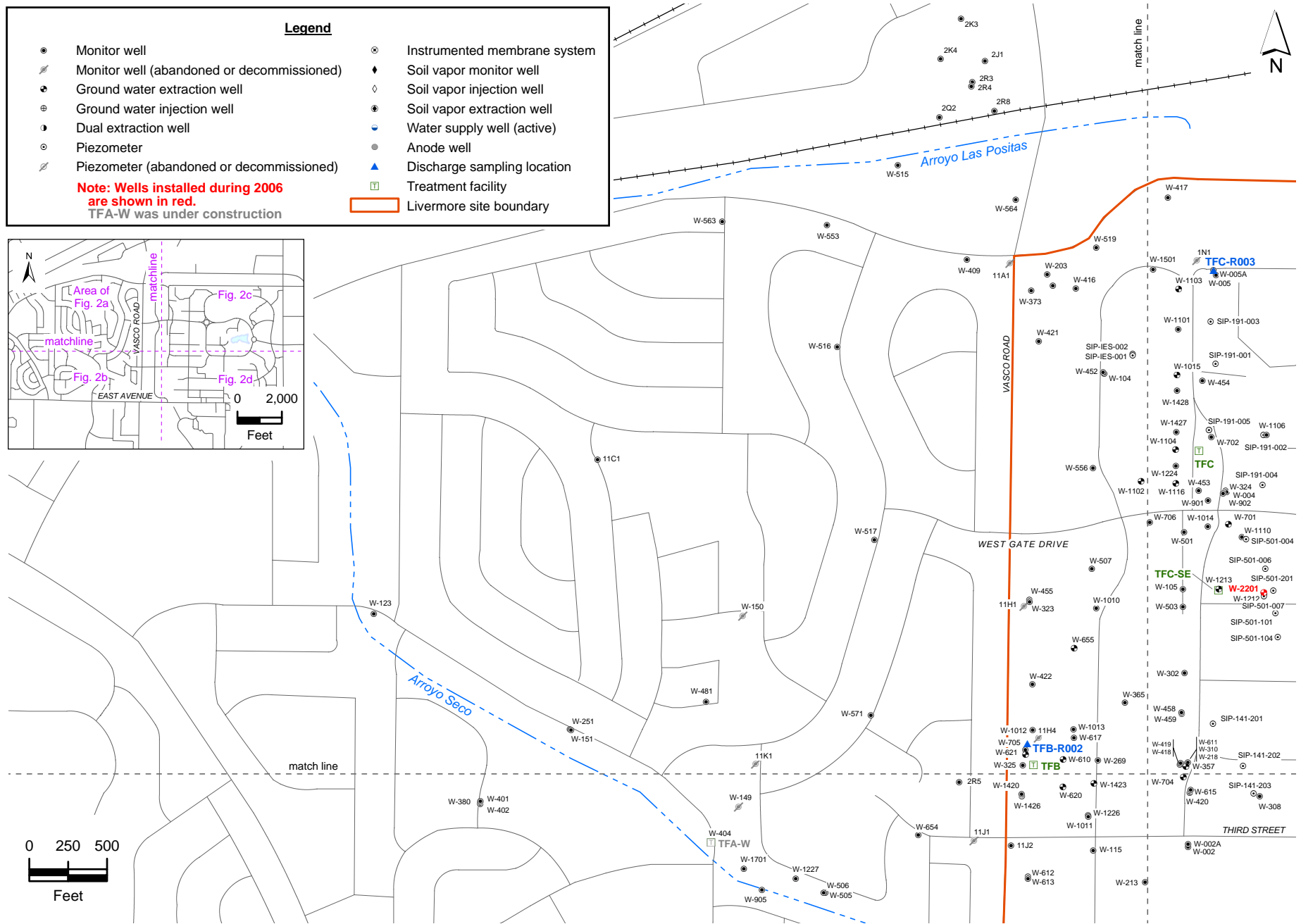


Figure 2a. Locations of Livermore Site wells and treatment facilities, December 2006.

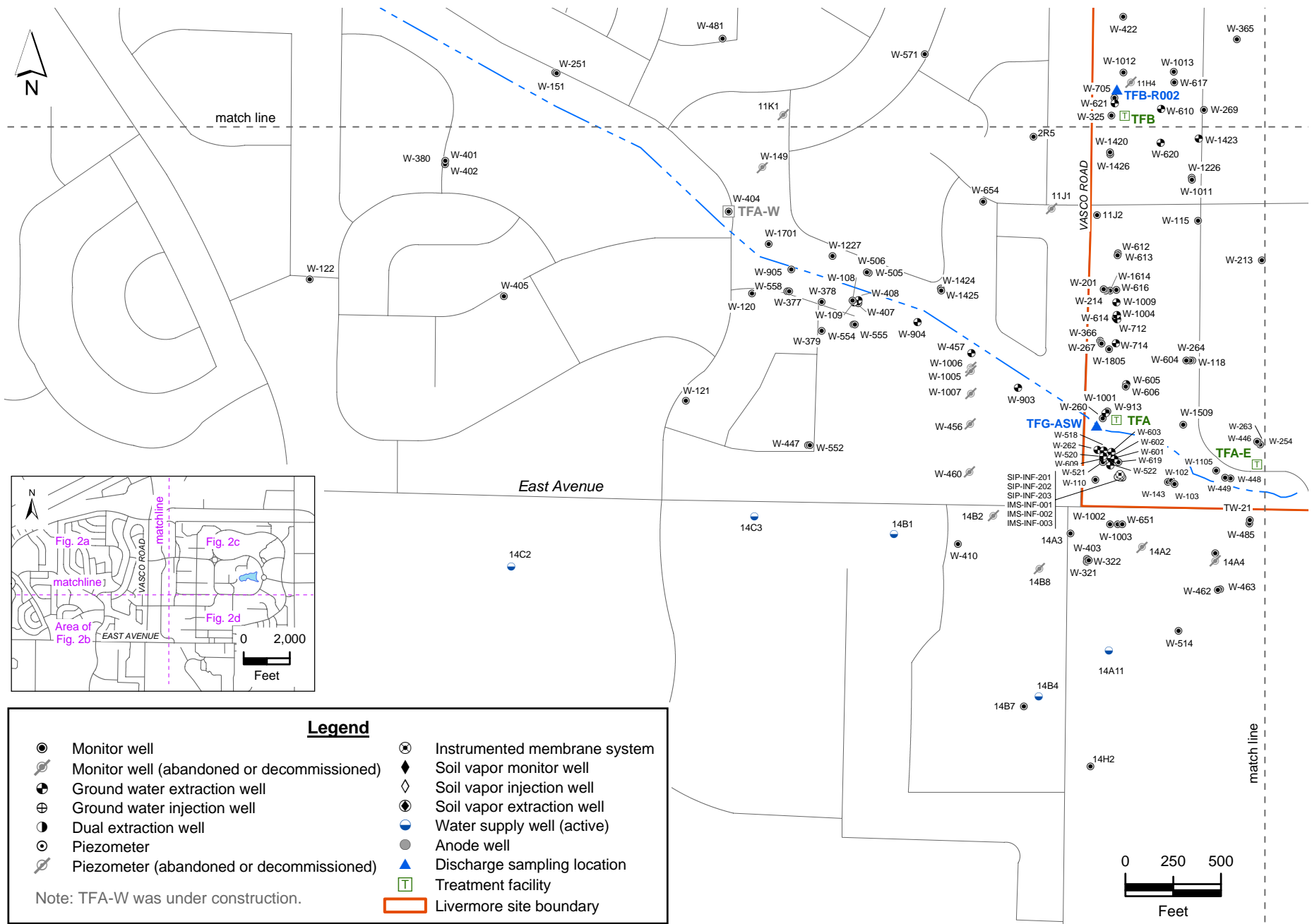


Figure 2b. Locations of Livermore Site wells and treatment facilities, December 2006.

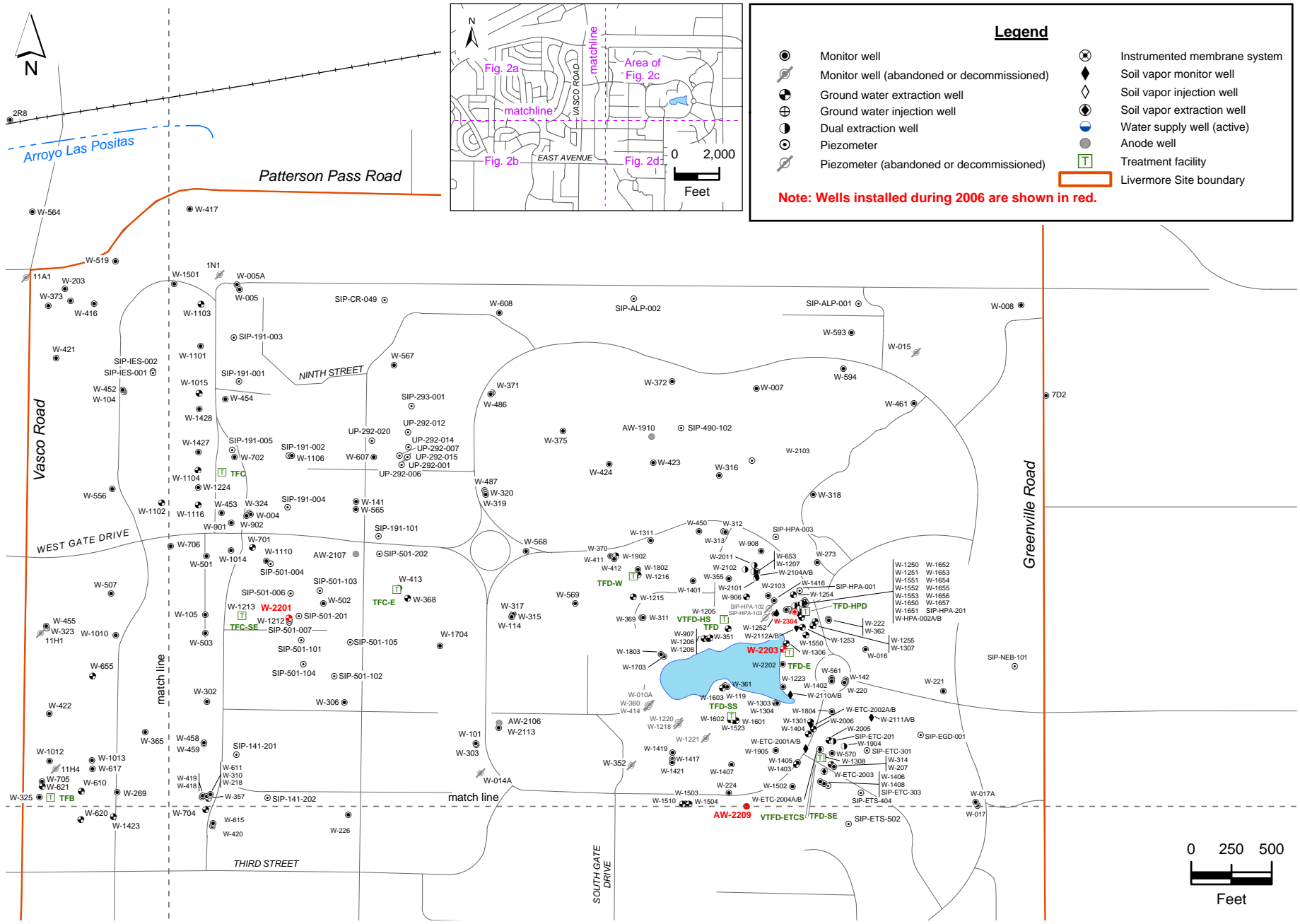
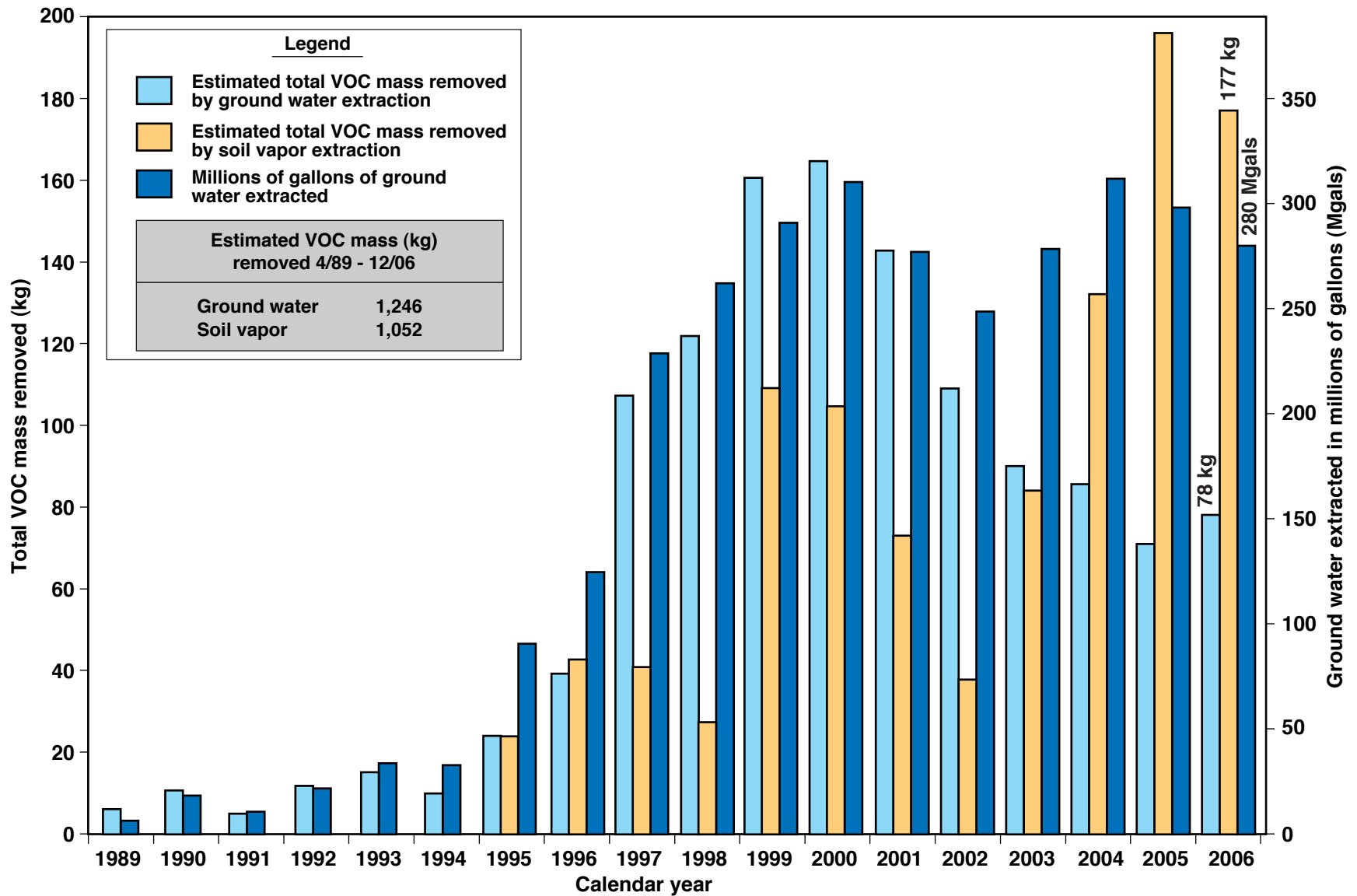


Figure 2c. Locations of Livermore Site wells and treatment facilities, December 2006.



ERD-LSR-07-0006

Figure 3. Estimated total VOC mass removed from the Livermore Site subsurface since 1989. All values are rounded numbers.

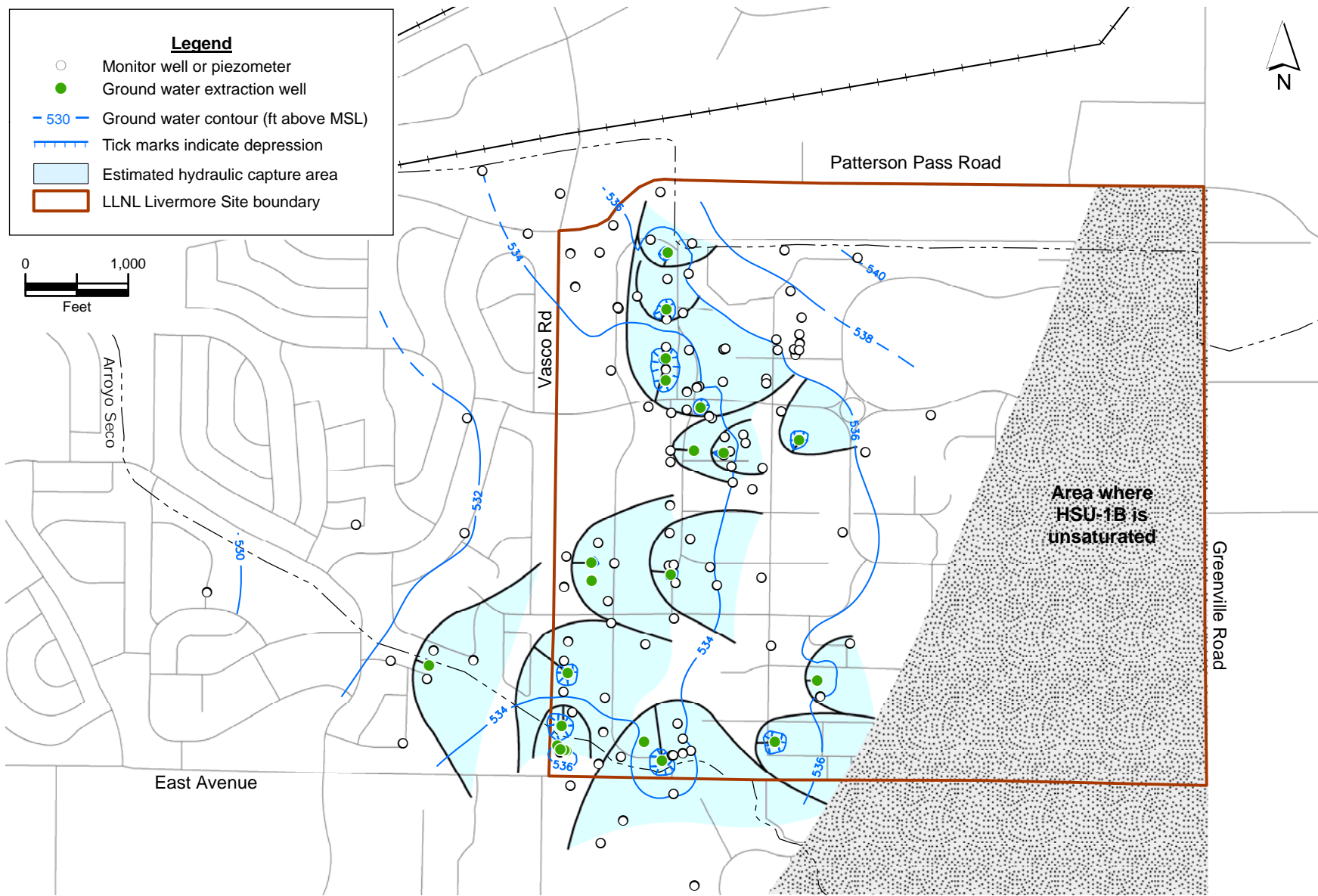


Figure 4. Ground water elevation contour map based on 135 wells completed within HSU-1B showing estimated hydraulic capture areas, LLNL and vicinity, November 2006.

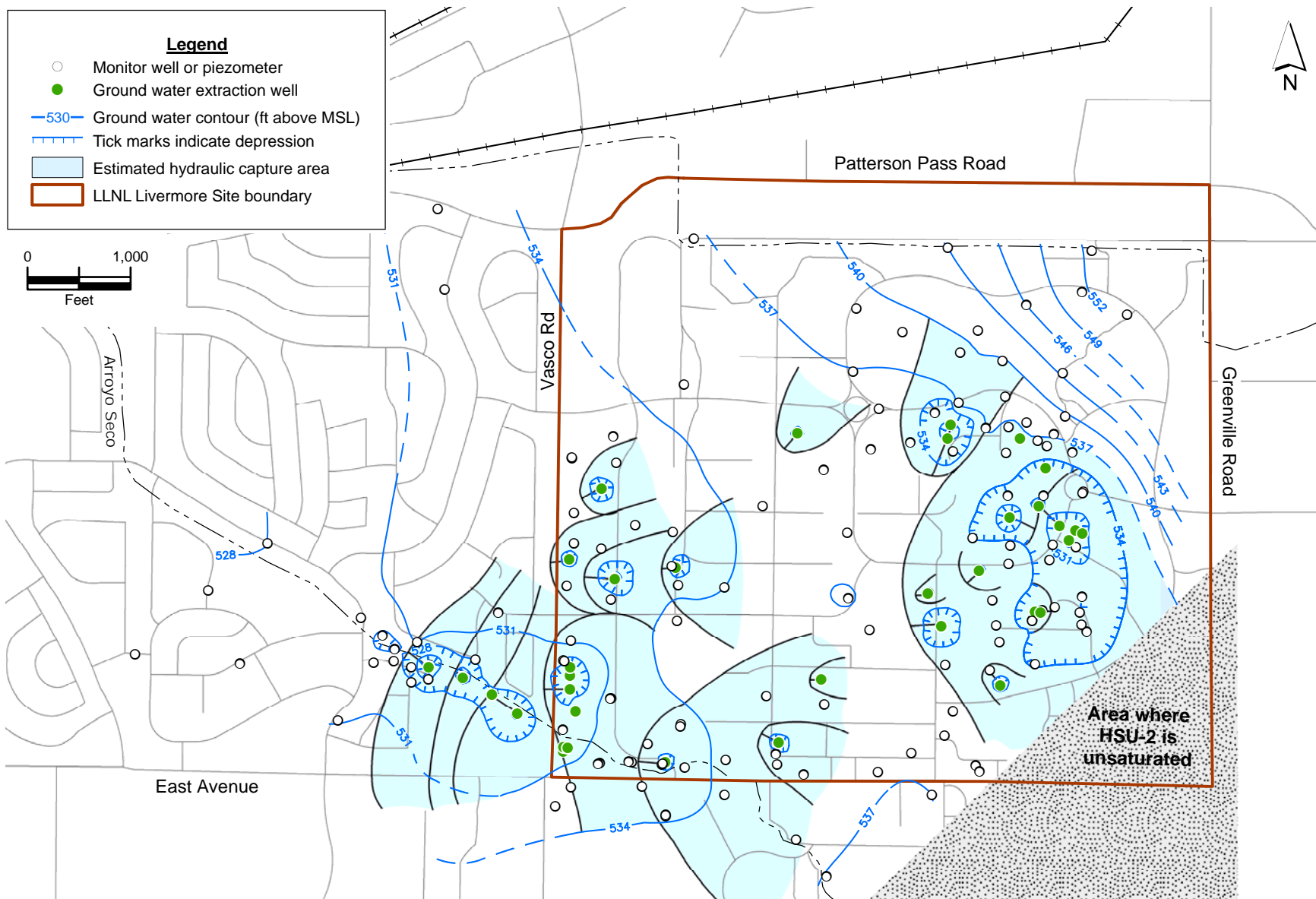


Figure 5. Ground water elevation contour map based on 182 wells completed within HSU-2 showing estimated hydraulic capture areas, LLNL and vicinity, December 2006.

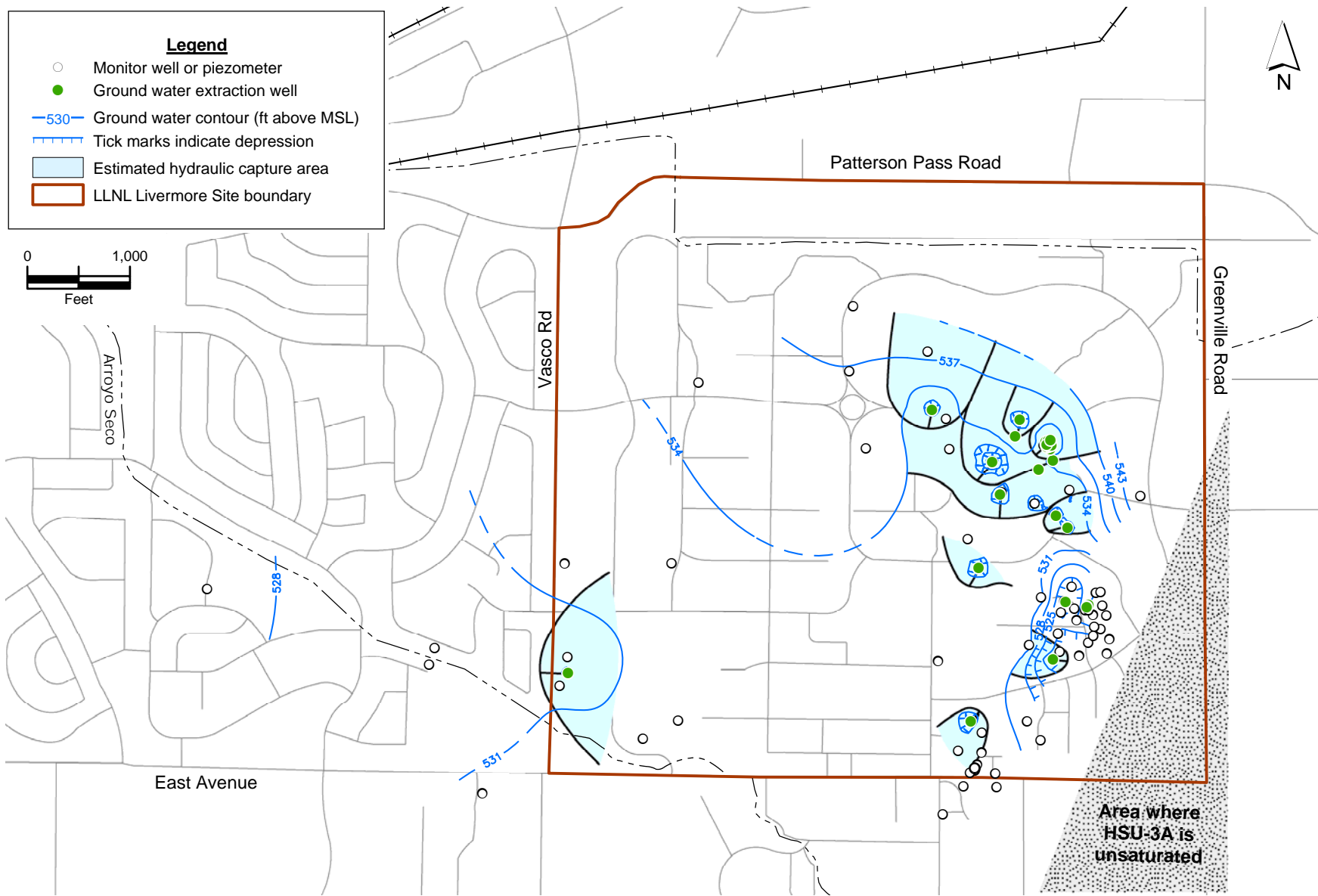


Figure 6. Ground water elevation contour map based on 102 wells completed within HSU-3A showing estimated hydraulic capture areas, LLNL and vicinity, December 2006.

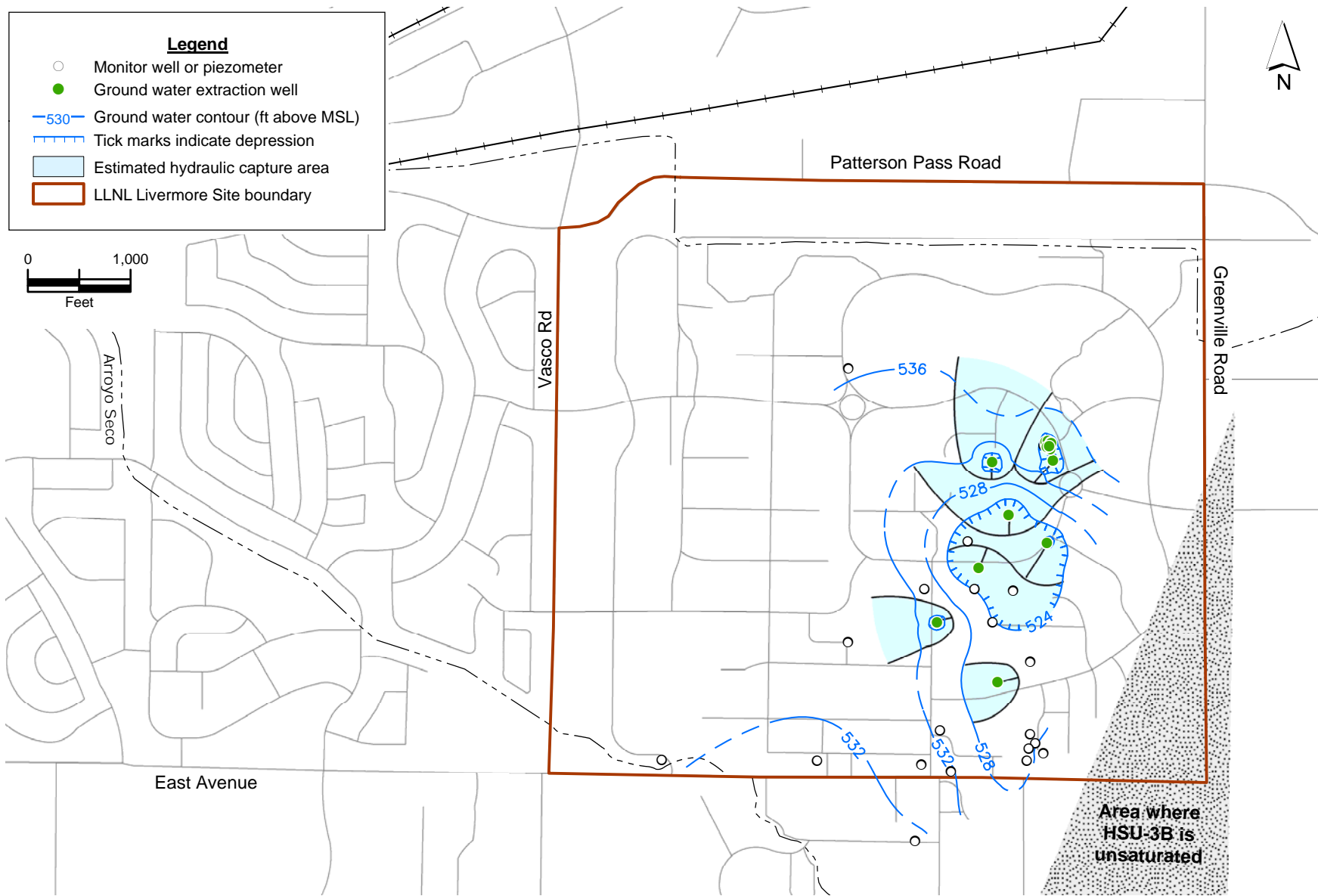


Figure 7. Ground water elevation contour map based on 34 wells completed within HSU-3B showing estimated hydraulic capture areas, LLNL and vicinity, December 2006.

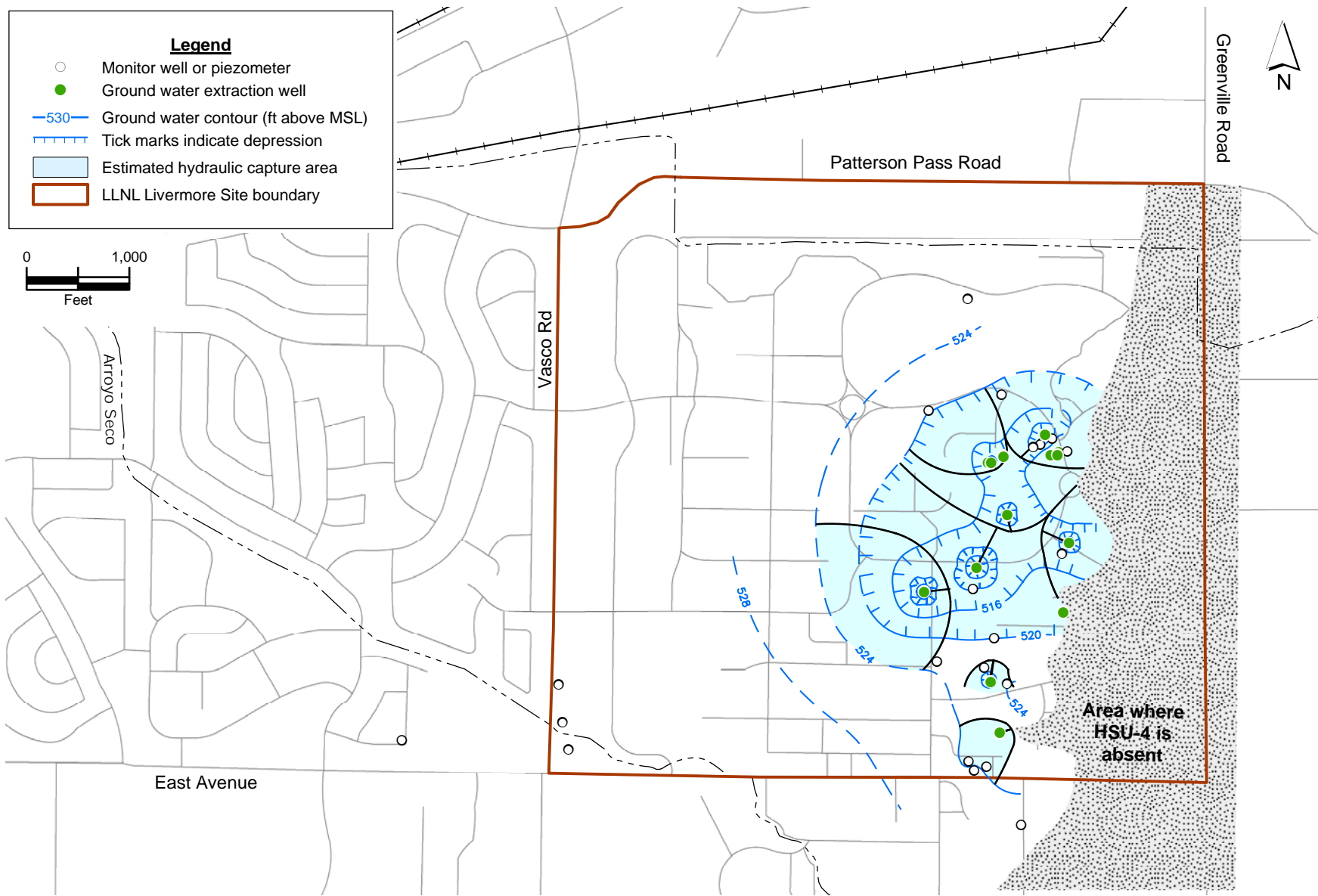


Figure 8. Ground water elevation contour map based on 39 wells completed within HSU-4 showing estimated hydraulic capture areas, LLNL and vicinity, December 2006.

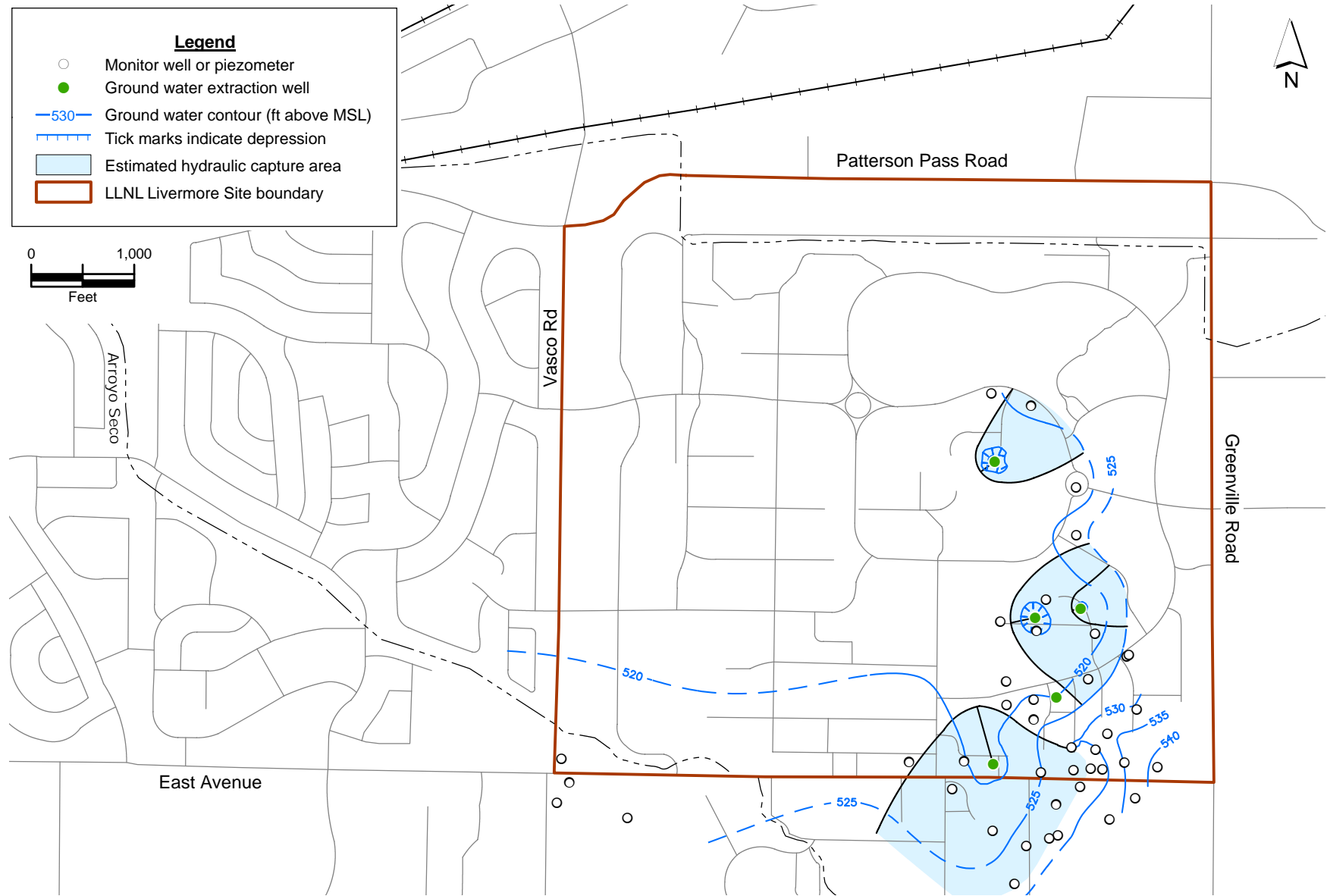


Figure 9. Ground water elevation contour map based on 51 wells completed within HSU-5 showing estimated hydraulic capture areas, LLNL and vicinity, December 2006.

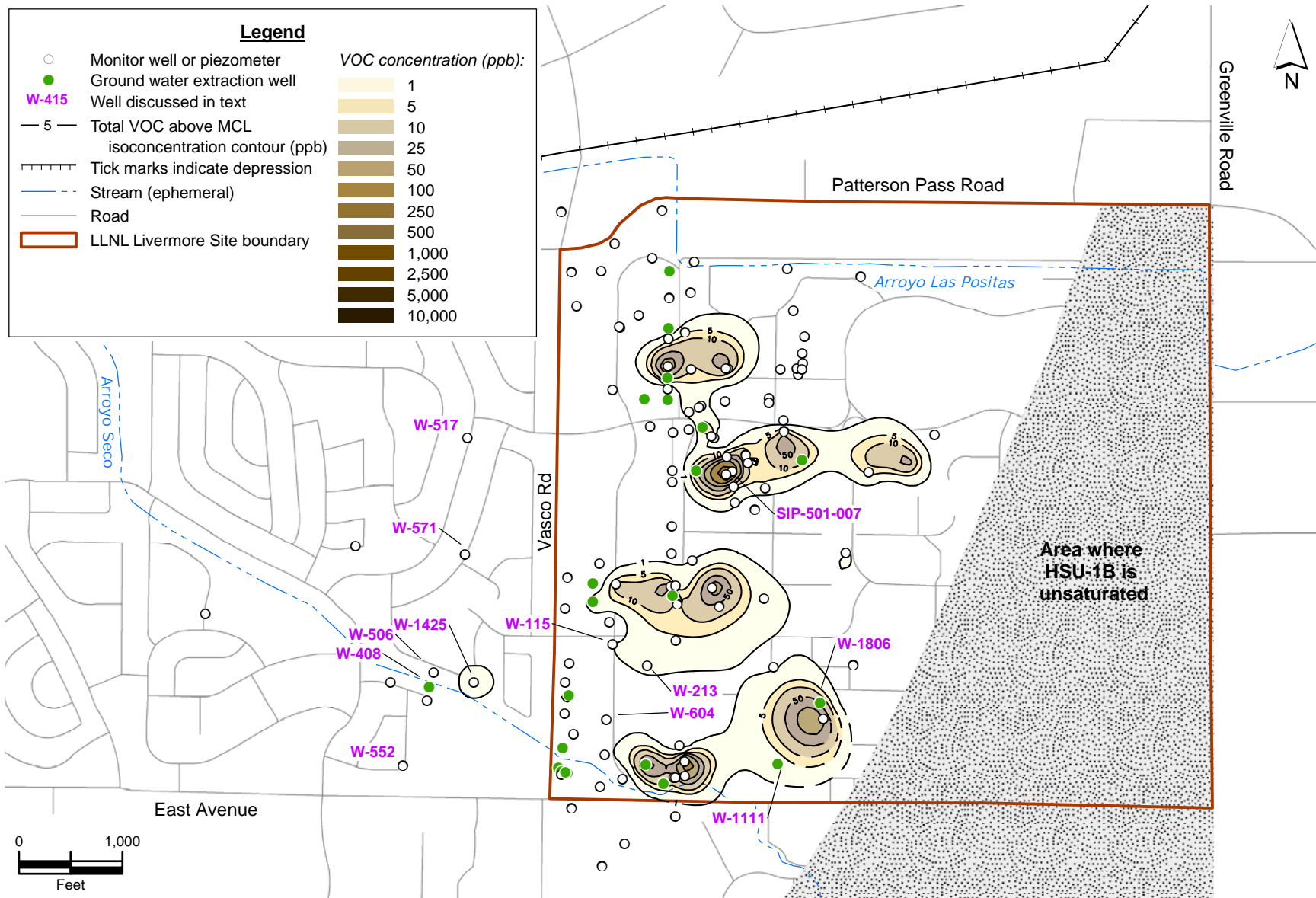


Figure 10. Isoconcentration contour map of total VOCs above MCLs from 135 wells completed within HSU-1B, fourth quarter 2006 (or the next most recent data), and supplemented with soil chemistry data from 38 borehole locations.

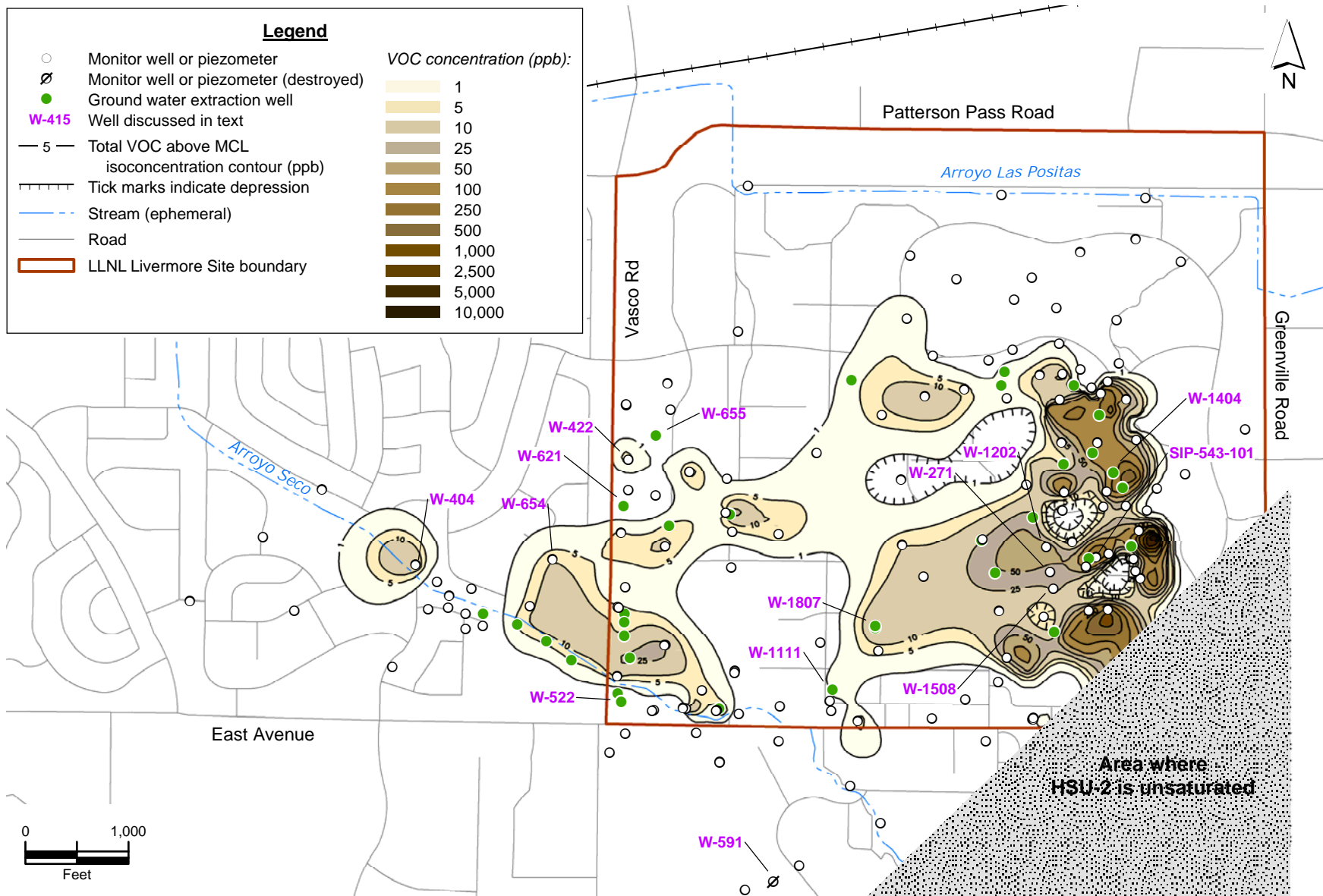


Figure 11. Isoconcentration contour map of total VOCs above MCLs from 192 wells completed within HSU-2, fourth quarter 2006 (or the next most recent data), and supplemented with soil chemistry data from 80 borehole locations.

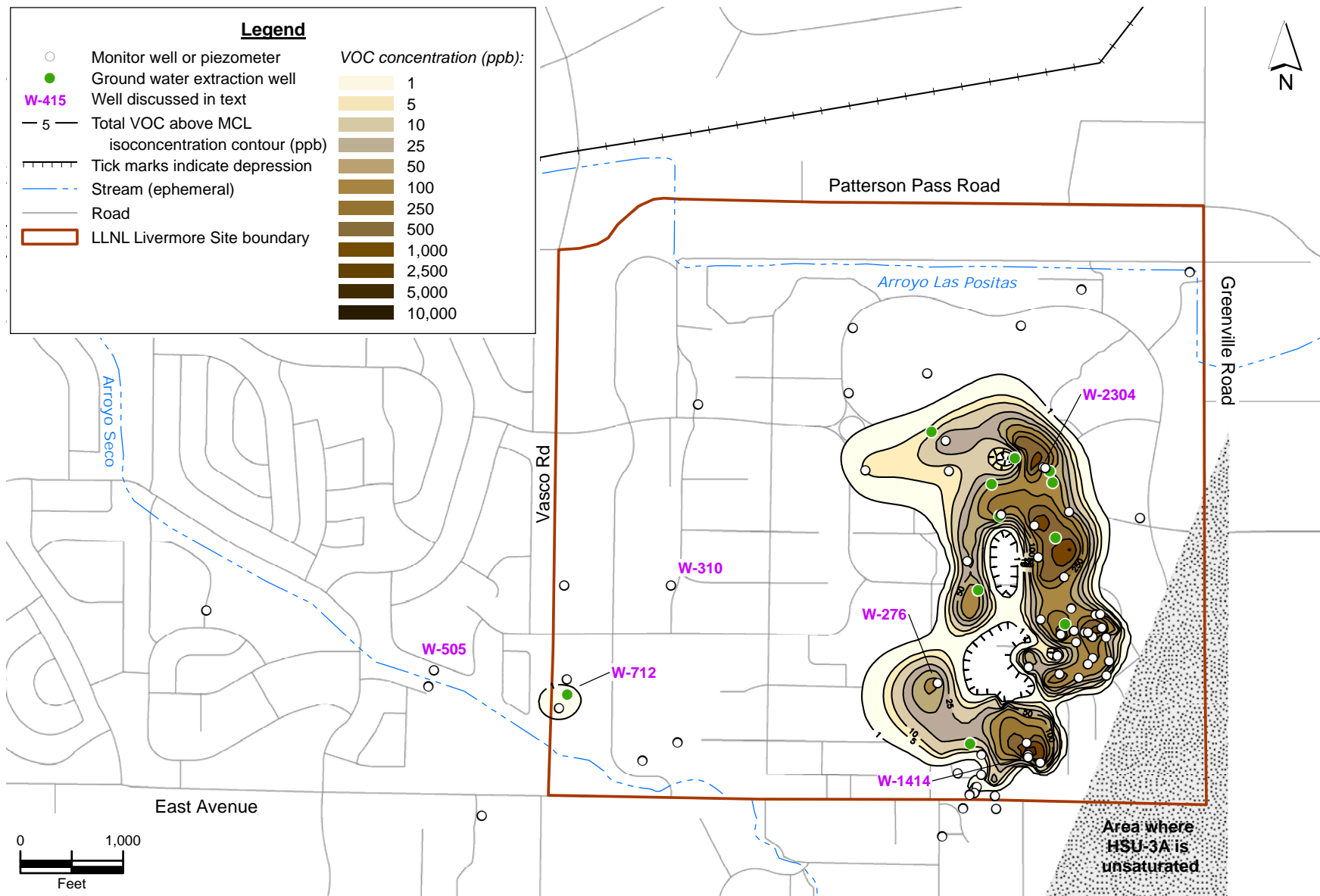


Figure 12. Isoconcentration contour map of total VOCs above MCLs from 103 wells completed within HSU-3A, fourth quarter 2006 (or the next most recent data), and supplemented with soil chemistry data from 141 borehole locations.

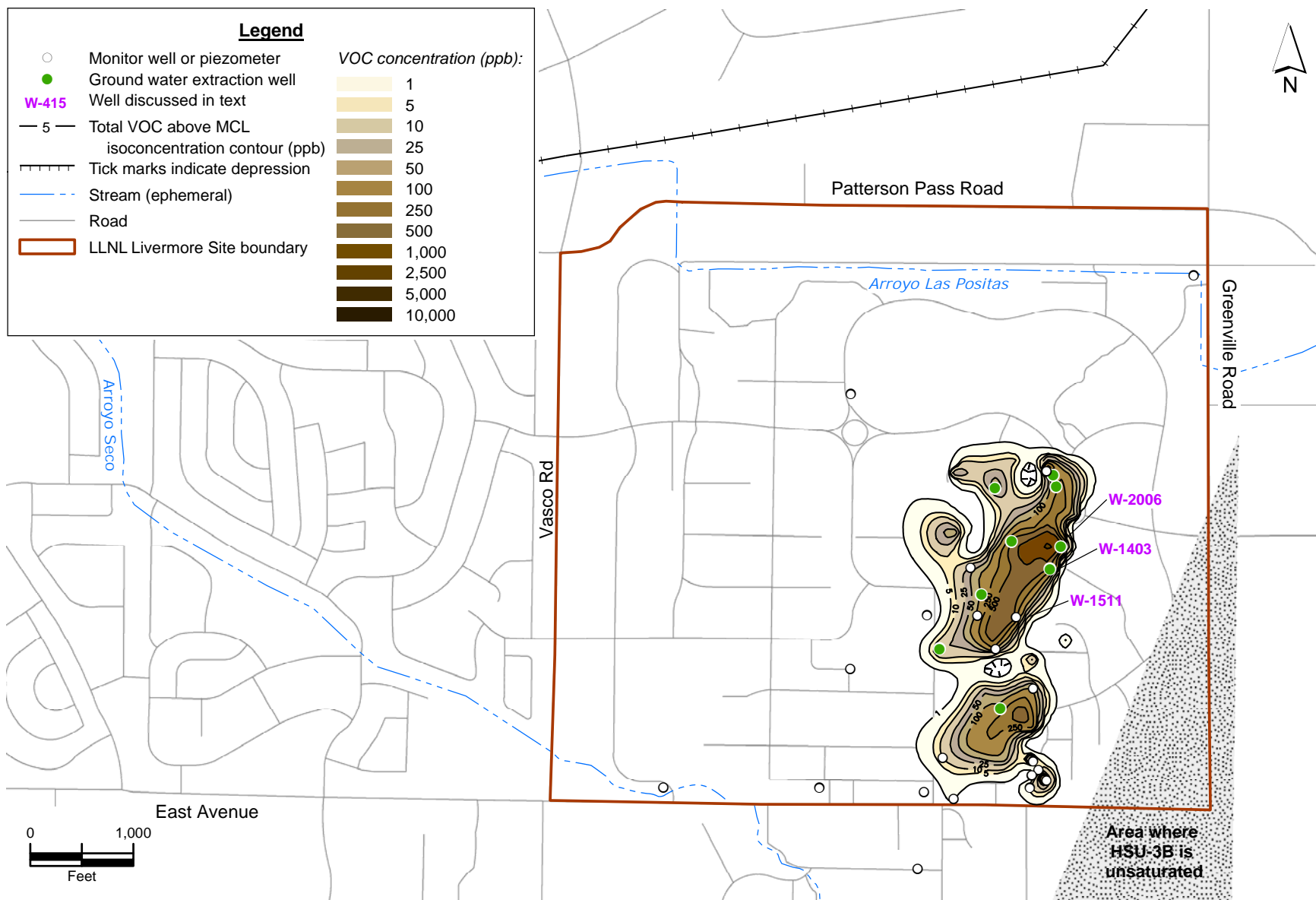


Figure 13. Isoconcentration contour map of total VOCs above MCLs from 39 wells completed within HSU-3B, fourth quarter 2006 (or the next most recent data), and supplemented with soil chemistry data from 108 borehole locations.

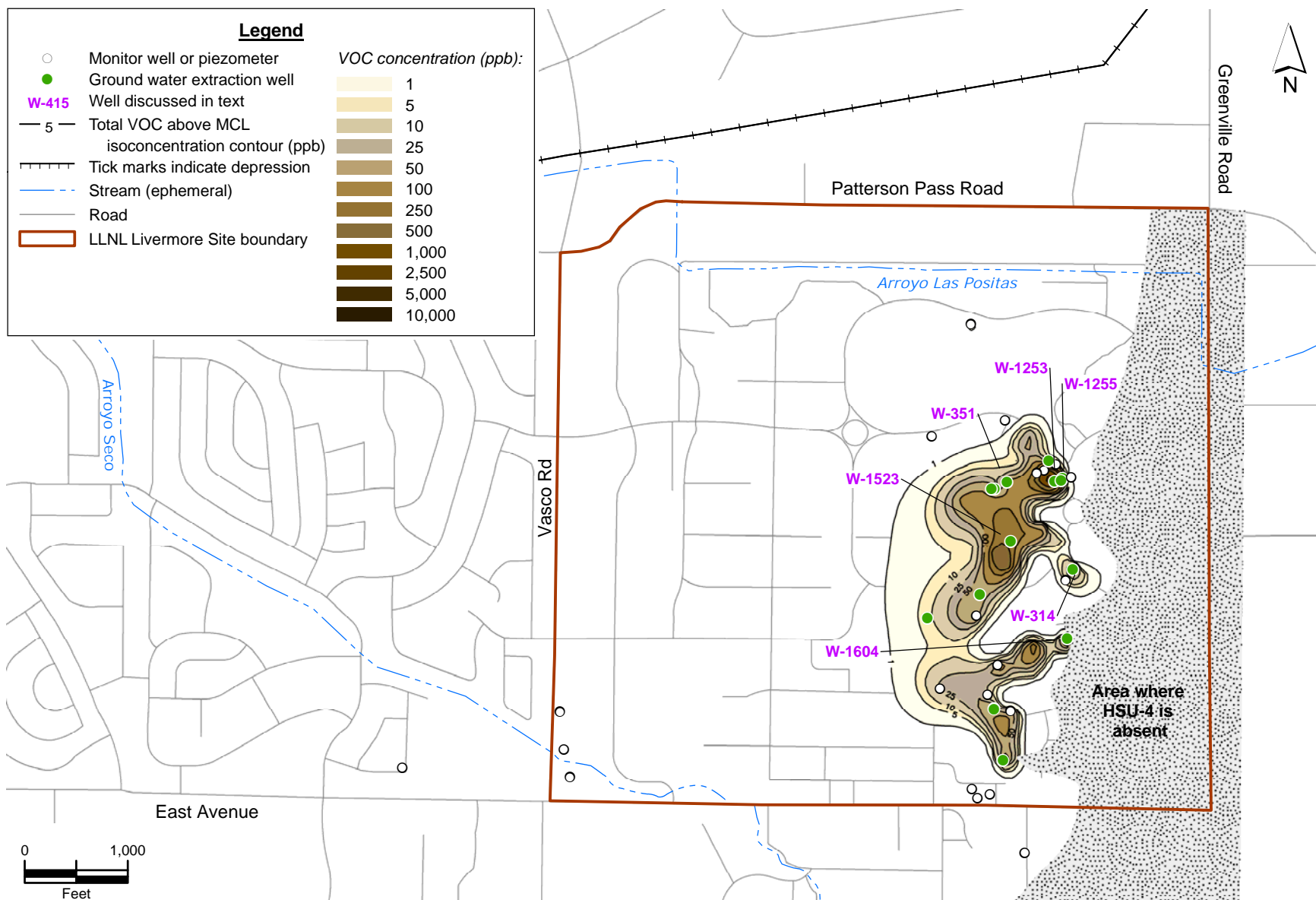


Figure 14. Isoconcentration contour map of total VOCs above MCLs from 41 wells completed within HSU-4, fourth quarter 2006 (or the next most recent data), and supplemented with soil chemistry data from 55 borehole locations.

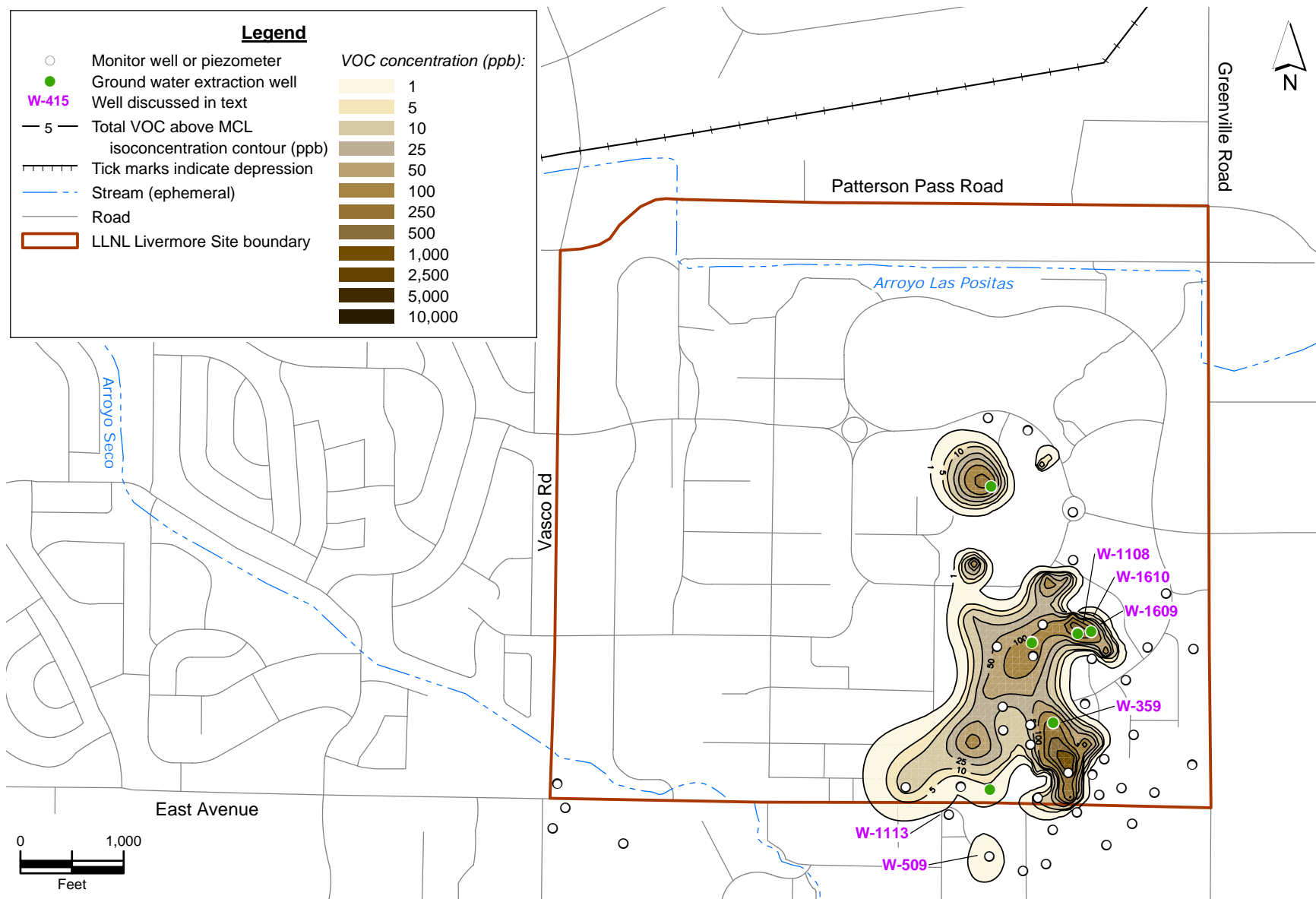


Figure 15. Isoconcentration contour map of total VOCs above MCLs from 54 wells completed within HSU-5, fourth quarter 2006 (or the next most recent data), and supplemented with soil chemistry data from 86 borehole locations.

Tables

Table 1. Livermore Site types and numbers of wells.

Well type	Number of wells
Air Inlet	1
Anode wells (cathodic protection)	9
Dual Extraction ¹	34
FLUTe	1
Ground Water Extraction	92
Ground Water Injection	1
Ground Water Monitor ^a	388
Instrumented Membrane Systems	9
Piezometer	107
Soil Vapor Extraction	19
Soil Vapor Injection	1
Soil Vapor Monitor	30
Total	692

Notes:

The number of Livermore Site wells is current through the end of December 2006.

A FLUTe liner was installed to monitor ground water chemistry in multiple HSUs. Instrumented Membrane Systems were installed in the vadose zone to measure moisture content, pressure, temperature, and VOCs.

Table 7 lists extraction wells and Table A-1 of Appendix A summarizes all wells.

^a Does not include 35 offsite private or agency wells that are occasionally monitored by ERD.

¹Extraction of ground water using a downhole pump with concurrent application of vacuum to the well. Ground water and soil vapor are removed in separate pipe manifolds and treated.

Table 2. Livermore Site treatment facility abbreviations.

Treatment facility	Abbreviation
TFA	TFA
TFA East	TFA-E
TFA West ^a	TFA-W
TFB	TFB
TFC	TFC
TFC East	TFC-E
TFC Southeast	TFC-SE
TFD	TFD
TFD East	TFD-E
TFD Helipad	TFD-HPD
TFD South	TFD-S
TFD Southeast	TFD-SE
TFD Southshore	TFD-SS
TFD West	TFD-W
VTFD East Traffic Circle South	VTFD-ETCS
VTFD Helipad	VTFD-HPD
VTFD Hotspot	VTFD-HS
TFE East	TFE-E
TFE Hotspot	TFE-HS
TFE Northwest	TFE-NW
TFE Southeast	TFE-SE
TFE Southwest	TFE-SW
TFE West	TFE-W
VTFE Eastern Landing Mat	VTFE-ELM
VTFE Hotspot	VTFE-HS
TFG-1	TFG-1
TFG North	TFG-N
TF406	TF406
TF406 Northwest	TF406-NW
VTF406 Hotspot	VTF406-HS
VTF511	VTF511
TF518 North	TF518-N
VTF518 Perched Zone	VTF518-PZ
TF5475-1	TF5475-1
TF5475-2	TF5475-2
TF5475-3	TF5475-3
VTF5475	VTF5475

Notes:

TF = Ground water treatment facility.

VTF = Soil vapor treatment facility.

^a Pipeline and instrumentation completed in fall of 2006. Ground water from W-404 will be treated at the Livermore Water Reclamation Plant (LWRP) in 2007.

Table 3. Livermore Site wells installed in 2006.

Treatment facility area	Wells ^a
TFA	None
TFB	None
TFC	W-2201
TFD	W-2203, AW-2209, W-2304
TFE	None
TF406	None
TFG	None
TFH	W-2204, W-2205, W-2206, W-2207A, W-2207B, W-2208A, W-2208B, W-2211, W-2212, W-2214A, W-2214B, W-2215A, W-2215B, W-2216A, W-2216B, W-2217A, W-2217B, W-2301A, W-2301B

Notes:

An Anode well was installed by the Environmental Restoration Division for LLNL Plant Engineering to provide cathodic protection for infrastructure.

See Figure 2 for well locations.

^a Boreholes B-2210 and B-2213 were not completed as wells. Boreholes B-2302 and B-2303 will be completed as wells in 2007.

Table 4. Hydraulic tests conducted in 2006.

Treatment facility area	Wells
TFD	W-2202, W-2203

Notes:

See Figure 2 for well locations.

Table 5. Soil vapor and dual extraction tests conducted in 2006.

Treatment facility area	Wells ^b
TFH	W-2204, W-2205 ^a , W-2206, W-2207A, W-2208A ^a

Notes:

See Figure 2 for well locations.

^a Dual extraction test, but insufficient data for hydraulic analysis.

^b Dual extraction tests were attempted at W-2207B and W-2208B, but were unsuccessful due to a lower permeability formation and well development problems, respectively.

Table 6. Summary of 2006 Livermore Site Remedial Action Implementation Plan milestones.

Milestone	Milestone date	Completion date
Begin TFD East Traffic Circle North Source Area remediation	9-29-06	8-2-06
Begin Building 419 Source Area remediation	9-29-06	9-20-06
Begin TFC Hotspot remediation	9-29-06	4-24-06
Begin Buildings 511/514 Source Area remediation	9-29-06	9-20-06
Begin TF5475 South remediation	9-29-06	6-6-06

Table 7. Summary of treatment facilities and discharge sampling locations.

Treatment facility	Discharge sampling location
TFA	Arroyo Seco (TFG-ASW) and West Perimeter Drainage Channel (TFB-R002)
TFA East	Arroyo Seco (TFG-ASW)
TFB	West Perimeter Drainage Channel (TFB-R002)
TFC	Arroyo Las Positas (TFC-R003)
TFC East	Arroyo Las Positas (TFC-R003)
TFC Southeast	Arroyo Las Positas (TFC-R003)
TFD	Arroyo Las Positas (TFC-R003)
TFD East	Arroyo Las Positas (TFC-R003)
TFD Helipad	Arroyo Las Positas (TFC-R003)
TFD Southeast	Arroyo Las Positas (TFC-R003)
TFD Southshore	Arroyo Las Positas (TFC-R003)
TFD West	Arroyo Las Positas (TFC-R003)
VTFD East Traffic Circle South	Treated vapor to atmosphere
VTFD Helipad	Treated vapor to atmosphere
VTFD Hotspot	Treated vapor to atmosphere
TFE East	Arroyo Las Positas (TFC-R003)
TFE Hotspot	Arroyo Las Positas (TFC-R003)
TFE Northwest	Arroyo Las Positas (TFC-R003)
TFE Southeast	Arroyo Las Positas (TFC-R003)
TFE Southwest	Arroyo Las Positas (TFC-R003)
TFE West	Arroyo Las Positas (TFC-R003)
VTFE Eastern Landing Mat	Treated vapor to atmosphere
VTFE Hotspot	Treated vapor to atmosphere
TFG-1	Arroyo Seco (TFG-ASW)
TFG North	Arroyo Las Positas (TFC-R003)
TF406	Arroyo Las Positas (TFC-R003)
TF406 Northwest	Arroyo Las Positas (TFC-R003)
VTF406 Hotspot	Treated vapor to atmosphere
VTF511	Treated vapor to atmosphere
TF518 North	Arroyo Las Positas (TFC-R003)
VTF518 Perched Zone	Treated vapor to atmosphere
TF5475-1	CRD-1 injection (W-1302)
TF5475-2	Arroyo Las Positas (TFC-R003)
TF5475-3	CRD-2 injection (W-1610)
VTF5475	Injection (SVI-ETS-505)

Notes:

Discharge sampling locations are shown in Figures 2a and b.

Table 8. Performance Summary for 2006 Livermore Site.

Treatment Area	HSU	Ground Water Treatment Facility	Extraction Well	Volume of ground water treated (Kgal)	Estimated VOC mass removed from ground water (Kg) ^a	Soil Vapor Treatment Facility	Volume of soil vapor treated (Kft ³)	Estimated VOC mass removed from soil vapor (Kg) ^a
TFA	1B	TFA	W-262	-	-	-	-	-
TFA	1B	TFA	W-408	4,102	0.02	-	-	-
TFA	1B	TFA	W-520	-	-	-	-	-
TFA	1B	TFA	W-601	-	-	-	-	-
TFA	1B	TFA	W-602	-	-	-	-	-
TFA	1B	TFA	W-1001	1,342	0.01	-	-	-
TFA	1B	TFA	W-1004	4,514	0.12	-	-	-
TFA	1B/2	TFA	W-415	14,908	1.30	-	-	-
TFA	2	TFA	W-109	11,186	0.13	-	-	-
TFA	2	TFA	W-457	4,782	0.28	-	-	-
TFA	2	TFA	W-518	2,777	0.15	-	-	-
TFA	2	TFA	W-522	6,545	0.19	-	-	-
TFA	2	TFA	W-603	-	-	-	-	-
TFA	2	TFA	W-605	3,855	0.54	-	-	-
TFA	2	TFA	W-609	-	-	-	-	-
TFA	2	TFA	W-614	4,640	0.24	-	-	-
TFA	2	TFA	W-714	2,387	0.19	-	-	-
TFA	2	TFA	W-903	9,451	0.56	-	-	-
TFA	2	TFA	W-904	13,390	0.70	-	-	-
TFA	2	TFA	W-1009	9,078	0.99	-	-	-
TFA	3A	TFA	W-712	3,250	0.20	-	-	-
TFA	1B	TFA East	W-254	343	0.11	-	-	-
TFB	1B	TFB	W-610	3,615	0.16	-	-	-
TFB	1B	TFB	W-620	1,826	0.11	-	-	-
TFB	1B	TFB	W-704	7,750	1.25	-	-	-
TFB	2	TFB	W-357	3,601	0.65	-	-	-
TFB	2	TFB	W-621	2,812	0.08	-	-	-
TFB	2	TFB	W-655	2,361	0.05	-	-	-
TFB	2	TFB	W-1423	3,743	0.36	-	-	-

Table 8. Performance Summary for 2006 Livermore Site.

Treatment Area	HSU	Ground Water Treatment Facility	Extraction Well	Volume of ground water treated (Kgal)	Estimated VOC mass removed from ground water (Kg) ^a	Soil Vapor Treatment Facility	Volume of soil vapor treated (Kft ³)	Estimated VOC mass removed from soil vapor (Kg) ^a
TFC	1B	TFC	W-701	6,602	1.30	-	-	-
TFC	1B	TFC	W-1015	3,699	0.14	-	-	-
TFC	1B	TFC	W-1102	1,383	0.05	-	-	-
TFC	1B	TFC	W-1103	676	0.01	-	-	-
TFC	1B	TFC	W-1104	12,854	2.36	-	-	-
TFC	1B	TFC	W-1116	521	0.03	-	-	-
TFC	1B	TFC East	W-368	1,283	0.31	-	-	-
TFC	2	TFC East	W-413	6,508	1.04	-	-	-
TFC	1B	TFC Southeast	W-1213	2,485	0.36	-	-	-
TFC	1B	TFC Southeast	W-2201	3,149	0.62	-	-	-
TFD	2/3A	TFD	W-906	1,439	0.12	-	-	-
TFD	3A	TFD	W-653	50	0.26	VTFD Hotspot	24	0.05
TFD	3A	TFD	W-2011	91	0.02	VTFD Hotspot	10	0.00
TFD	3A	TFD	W-2101	118	0.43	VTFD Hotspot	16	0.04
TFD	3A	TFD	W-2102	42	0.17	VTFD Hotspot	19	0.02
TFD	3A/3B	TFD	W-1208	7,719	4.57	-	-	-
TFD	4	TFD	W-351	0	0.00	-	-	-
TFD	4	TFD	W-1206	3,835	0.44	-	-	-
TFD	5	TFD	W-907-2	3,200	0.65	-	-	-
TFD	2	TFD East	W-1303	382	0.35	-	-	-
TFD	2	TFD East	W-1306	44	0.02	-	-	-
TFD	2	TFD East	W-1404	78	0.07	-	-	-
TFD	3	TFD East	W-2006	6	0.02	-	-	-
TFD	3A	TFD East	W-1301	221	0.42	-	-	-
TFD	3A	TFD East	W-1550	427	0.41	-	-	-
TFD	3A	TFD East	W-2203	85	0.06	-	-	-
TFD	4	TFD East	W-1253	-	0.00	-	-	-
TFD	4	TFD East	W-1255	-	0.00	-	-	-
TFD	4	TFD East	W-1307	831	0.08	-	-	-

Table 8. Performance Summary for 2006 Livermore Site.

Treatment Area	HSU	Ground Water Treatment Facility	Extraction Well	Volume of ground water treated (Kgal)	Estimated VOC mass removed from ground water (Kg) ^a	Soil Vapor Treatment Facility	Volume of soil vapor treated (Kft ³)	Estimated VOC mass removed from soil vapor (Kg) ^a
TFD	2/3A	TFD Helipad	W-1655	179	0.06	VTFD Helipad	78	0.03
TFD	2/3A/3B	TFD Helipad	W-1651	231	0.90	VTFD Helipad	13	0.00
TFD	3A	TFD Helipad	W-1551	374	0.28	-	-	-
TFD	3A	TFD Helipad	W-1552	106	0.05	VTFD Helipad	41	0.00
TFD	3A	TFD Helipad	W-1650	-	-	VTFD Helipad	36	0.01
TFD	3A	TFD Helipad	W-1653	175	0.19	VTFD Helipad	6	0.00
TFD	3A	TFD Helipad	W-1654	59	0.03	VTFD Helipad	8	0.00
TFD	3A	TFD Helipad	W-1656	1,394	1.70	VTFD Helipad	32	0.01
TFD	3A/3B	TFD Helipad	W-1652	86	0.14	VTFD Helipad	9	0.01
TFD	3A/3B	TFD Helipad	W-1657	48	0.09	VTFD Helipad	9	0.00
TFD	4	TFD Helipad	W-1254	5,524	0.40	-	-	-
TFD	2	TFD South	W-1510	1,075	0.17	-	-	-
TFD	3A/3B	TFD South	W-1504	1,021	0.49	-	-	-
TFD	4	TFD South	W-1503	7,961	2.78	-	-	-
TFD	2	TFD Southeast	SIP-ETC-201	94	0.25	VTFD East Traffic Circle South	1,887	1.54
TFD	2	TFD Southeast	W-1308	1,681	2.71	-	-	-
TFD	2	TFD Southeast	W-1904	3	0.00	VTFD East Traffic Circle South	2,370	1.75
TFD	3A	TFD Southeast	W-2005	563	0.66	-	-	-
TFD	3B	TFD Southeast	W-1403	1,705	4.25	-	-	-
TFD	4	TFD Southeast	W-314	5,917	5.86	-	-	-
TFD	2	TFD Southshore	W-1602	1,901	0.13	-	-	-
TFD	3A	TFD Southshore	W-1603	5,317	5.18	-	-	-
TFD	3B	TFD Southshore	W-1601	290	0.57	-	-	-
TFD	4	TFD Southshore	W-1523	3,753	5.01	-	-	-
TFD	2	TFD West	W-1215	4,495	0.81	-	-	-
TFD	2	TFD West	W-1216	4,665	1.91	-	-	-
TFD	3A	TFD West	W-1902	6,965	3.63	-	-	-
TFE	1B	-	W-543-1908	-	-	VTFE Eastern Landing Mat	232	0.02
TFD	1B	-	W-ETC-2003	-	-	VTFD East Traffic Circle South	3,363	0.76

Table 8. Performance Summary for 2006 Livermore Site.

Treatment Area	HSU	Ground Water Treatment Facility	Extraction Well	Volume of ground water treated (Kgal)	Estimated VOC mass removed from ground water (Kg) ^a	Soil Vapor Treatment Facility	Volume of soil vapor treated (Kft ³)	Estimated VOC mass removed from soil vapor (Kg) ^a
TFD	1B/2	-	W-ETC-2004A	-	-	VTFD East Traffic Circle South	2,653	1.36
TFD	2	-	W-ETC-2004B	-	-	VTFD East Traffic Circle South	3,878	6.53
TFD	1B	-	W-HPA-002A	-	-	VTFD Helipad	-	-
TFD	2	-	W-HPA-002B	-	-	VTFD Helipad	6,206	2.14
TFE	1B	-	W-ETS-2008A	-	-	VTFE Hotspot	3,546	0.2
TFE	1B/2	-	W-ETS-2010A	-	-	VTFE Hotspot	3,527	0.24
TFE	2	TFE East	W-1109	848	1.07	-	-	-
TFE	2	TFE East	W-1903	43	0.02	VTFE Eastern Landing Mat	290	0.10
TFE	5	TFE East	W-566	2,005	1.20	-	-	-
TFE	2	TFE Hotspot	W-2105	10	0.02	VTFE Hotspot	432	0.99
TFE	3A	TFE Hotspot	W-2012	2,167	2.59	-	-	-
TFE	2	TFE Northwest	W-1409	979	0.13	-	-	-
TFE	4	TFE Northwest	W-1211	9,167	0.57	-	-	-
TFE	2	TFE Southwest	W-1518	596	0.07	-	-	-
TFE	3B	TFE Southwest	W-1522	1,049	0.67	-	-	-
TFE	4	TFE Southwest	W-1520	438	0.17	-	-	-
TFE	5	TFE Southeast	W-359	1,476	2.37	-	-	-
TFE	2	TFE West	W-305	4,712	1.75	-	-	-
TFE	3B	TFE West	W-292	2,690	0.44	-	-	-
TFE	2	-	W-543-001	-	-	VTFE Eastern Landing Mat	5,190	0.65
TFE	2	-	W-543-003	-	-	VTFE Eastern Landing Mat	13,513	3.34
TFE	2	-	W-ETS-2008B	-	-	VTFE Hotspot	3,019	3.51
TFE	2	-	W-ETS-2009	-	-	VTFE Hotspot	3,012	0.49
TFE	2	-	W-ETS-2010B	-	-	VTFE Hotspot	3,894	2.22
TFG	1B/2	TFG-1	W-1111	4,439	0.70	-	-	-
TFG	1B	TFG North	W-1806	624	0.09	-	-	-
TFG	2	TFG North	W-1807	2,117	0.29	-	-	-
TFH	5	TF406	W-1310	6,294	0.27	-	-	-
TFH	3A	TF406 Northwest	W-1801	2,126	0.29	-	-	-

Table 8. Performance Summary for 2006 Livermore Site.

Treatment Area	HSU	Ground Water Treatment Facility	Extraction Well	Volume of ground water treated (Kgal)	Estimated VOC mass removed from ground water (Kg) ^a	Soil Vapor Treatment Facility	Volume of soil vapor treated (Kft ³)	Estimated VOC mass removed from soil vapor (Kg) ^a
TFH	1B/2	-	W-514-2007A	-	-	VTF406 Hotspot	1,767	1.05
TFH	2/5	-	W-514-2007B	-	-	VTF406 Hotspot	5,616	59.73
TFH	5	-	W-217	-	-	VTF406 Hotspot	8,673	52.26
TFH	1B	-	W-2207A	-	-	VTF511	38	0.46
TFH	2	-	W-274	-	-	VTF511	1	0.00
TFH	2	-	W-1517	-	-	VTF511	4	0.00
TFH	2	-	W-2204	-	-	VTF511	232	0.92
TFH	2	-	W-2205	-	-	VTF511	186	0.64
TFH	2	-	W-2206	-	-	VTF511	21	0.05
TFH	2	-	W-2207B	-	-	VTF511	97	2.93
TFH	2	-	W-2208A	-	-	VTF511	50	1.98
TFH	2	-	W-2208B	-	-	VTF511	134	13.33
TFH	4	TF518 North	W-1410	1,209	0.53	-	-	-
TFH	1B	TF518 Perched Zone	W-518-1914	-	-	VTF518 Perched Zone	369	0.60
TFH	1B/2	TF518 Perched Zone	W-1615	-	0.00	VTF518 Perched Zone	660	6.05
TFH	2	TF518 Perched Zone	SVB-518-201	0	0.00	VTF518 Perched Zone	944	1.59
TFH	2	TF518 Perched Zone	SVB-518-204	1	0.00	VTF518 Perched Zone	907	3.04
TFH	2	TF518 Perched Zone	W-518-1913	0	0.00	VTF518 Perched Zone	257	1.05
TFH	2	TF518 Perched Zone	W-518-1915	2	0.05	VTF518 Perched Zone	161	0.49
TFH	3A	TF5475-1	W-1302-2	79	0.21	-	-	-
TFH	2	TF5475-2	W-1415	44	0.04	-	-	-
TFH	5	TF5475-2	W-1108	1,092	3.19	-	-	-
TFH	2	-	SVI-ETS-504	-	-	VTF5475	4,453	2.63
TFH	3A	TF5475-3	W-1605	0	0.00	VTF5475	348	0.53
TFH	3A	TF5475-3	W-1606	-	-	VTF5475	632	1.44
TFH	3A	TF5475-3	W-1607	-	-	VTF5475	200	0.15
TFH	3A	TF5475-3	W-1608	0	0.00	VTF5475	255	0.29
TFH	4	TF5475-3	W-1604	12	0.03	-	-	-
TFH	5	TF5475-3	W-1609	2	0.00	-	-	-

Table 8. Performance Summary for 2006 Livermore Site.

Treatment Area	HSU	Ground Water Treatment Facility	Extraction Well	Volume of ground water treated (Kgal)	Estimated VOC mass removed from ground water (Kg) ^a	Soil Vapor Treatment Facility	Volume of soil vapor treated (Kft ³)	Estimated VOC mass removed from soil vapor (Kg) ^a
TFH	5	TF5475-3	W-1609	2	0.00	-	-	-
TFH	5	TF5475-3	W-1610	1	0.00	-	-	-

Notes:

Wells without ground water or soil vapor data did not operate in 2006 due to dynamic wellfield operation, but are still connected to a treatment facility.

Kgal = Thousands of gallons.

Kg = Kilograms.

Kft³ = Thousands of cubic feet.

^a The VOC mass values are a best estimate based on measurement uncertainties for both flow rates and chemical analyses.

Appendix A
Well Construction and Closure Data

Table A-1. Well construction data, LLNL Livermore Site and vicinity, Livermore, California.

Well	Well type	Date Completed	Borehole depth (ft)	Casing depth (ft)	Screen position	Screen interval (ft)	HSU	Initial flow rate (gpm)
W-001	GW Monitor	21-Oct-80	122.5	116	1	95-100	1B	6
					2	104-114	2	6
W-001A	GW Monitor	12-Apr-84	180	156	1	145-156	2	5.3
W-002	GW Monitor	29-Aug-80	102.5	101	1	86-101	1B	2.8
W-002A	GW Monitor	2-Apr-84	185	164	1	150-164	2	9.3
W-004	GW Monitor	28-Jul-80	92	92	1	75-90	1B	7
W-005	GW Monitor	24-Oct-80	93.5	90	1	56-71	1B	7
					2	81-86	1B	7
W-005A	GW Monitor	9-Apr-84	115	105	1	95-105	2	11.5
W-007	GW Monitor	3-Oct-80	110.5	100	1	76-81	2	1.5
					2	88-98	3A	1.5
W-008	GW Monitor	14-May-81	110	105	1	72-77	3A	7
					2	92-102	3B	7
W-011	GW Monitor	3-Jun-81	252	191	1	136-141	5	8.5
					2	177-187	5	8.5
W-012	GW Monitor	14-Aug-80	115.8	115	1	99-114	2	5
W-016	GW Monitor	30-Oct-80	122.7	119	1	NA	NA	NA
W-017	GW Monitor	8-Oct-80	114	109	1	94-109	5	0.4
W-017A	GW Monitor	20-May-81	181.4	160	1	127-132	7	5.5
					2	147-157	7	5.5
W-101	GW Monitor	25-Jan-85	77	72	1	62-72	1B	2
W-102	GW Monitor	12-Feb-85	396.5	171.5	1	151.5-171.5	2	6.6
W-103	GW Monitor	14-Feb-85	96	89.5	1	79.5-89.5	1B	6.2
W-104	GW Monitor	21-Feb-85	61.5	56.5	1	38.75-56.5	1B	3.1
W-105	GW Monitor	26-Feb-85	69	62	1	42-62	1B	1
W-106	GW Monitor	6-Mar-85	144	134.5	1	127.5-134.5	5	0.3
W-107	GW Monitor	13-Mar-85	128	122	1	115-122	5	2.5
W-108	GW Monitor	21-Mar-85	113.5	69	1	57-69	1A	13
W-109	GW Extraction	2-Apr-85	289	147	1	137-147	2	13
W-110	GW Monitor	26-Apr-85	371	365	1	340-365	5	16
W-111	GW Monitor	2-May-85	122	117	1	97-117	2	3.4
W-112	GW Monitor	10-May-85	129	123.5	1	111-123.5	5	3.5
W-113	GW Monitor	16-May-85	124	115	1	100-115	5	0.4
W-114	GW Monitor	23-May-85	70.5	66	1	51-63	1B	0.5
W-115	GW Monitor	3-Jun-85	106	95	1	88-95	1B	5.4

Table A-1. Well construction data, LLNL Livermore Site and vicinity, Livermore, California.

Well	Well type	Date Completed	Borehole depth (ft)	Casing depth (ft)	Screen position	Screen interval (ft)	HSU	Initial flow rate (gpm)
W-116	GW Monitor	14-Jun-85	181	92.6	1	86-91	1B	0.3
W-117	GW Monitor	27-Jun-85	202	150.1	1	138-148	7	6
W-118	GW Monitor	19-Jul-85	206.5	110	1	99-110	2	10
W-119	GW Monitor	2-Aug-85	139	102.5	1	87.5-102.5	2	9
W-120	GW Monitor	19-Aug-85	195	153	1	147-153	2	3.5
W-121	GW Monitor	23-Aug-85	194	171	1	159-171	2	6
W-122	GW Monitor	17-Aug-85	189	132	1	125-132	2	13.4
W-123	GW Monitor	1-Oct-85	174	47.7	1	37.3-47.7	1A	6
W-141	GW Monitor	23-Mar-85	61.5	60	1	45-60	1B	0.5
W-142	GW Monitor	29-Mar-85	74.2	72	1	62-72	2	0.5
W-143	GW Monitor	12-Apr-85	130	126	1	121-126	2	6
W-146	GW Monitor	16-Jul-85	225	125	1	115-125	2	9.4
W-147	GW Monitor	26-Jul-85	137	87	1	77-87	1B	0.5
W-148	GW Monitor	8-Aug-85	152	98	1	83-98	1B	0.5
W-151	GW Monitor	30-Sep-85	247	158	1	148.5-157.5	2	8
W-201	GW Monitor	17-Oct-85	211	161	1	151-161	2	14
W-202	GW Monitor	17-Oct-85	191	109	1	99-109	2	0.4
W-203	GW Monitor	15-Nov-85	87	41	1	31-41	1A	5
W-204	GW Monitor	22-Nov-85	160	110	1	100-110	2	2.5
W-205	GW Monitor	9-Dec-85	180	117	1	107-117	3B	0.3
W-206	GW Monitor	19-Dec-85	188	118	1	106-118	3A	NA
W-207	GW Monitor	24-Jan-86	150	85	1	69-85	2	0.4
W-210	GW Monitor	11-Mar-86	176	113	1	108-113	3B	0.3
W-212	GW Monitor	28-Mar-86	183	136	1	124-136	5	1.3
W-213	GW Monitor	4-Apr-86	174	100	1	94-100	1B	4
W-214	GW Monitor	11-Apr-86	146	141.5	1	134-141.5	2	18
W-217	SV Extraction	20-May-86	200	112.5	1	98.5-112.5	5	0.3
W-218	GW Monitor	30-May-86	201	71	1	64.5-71	1B	10
W-219	GW Monitor	13-Jun-86	214	148	1	141-148	5	4.5
W-220	GW Monitor	25-Jun-86	196	92.5	1	82.5-92.5	2	0.4
W-221	GW Monitor	7-Jul-86	178	95	1	82-95	3A	2
W-222	GW Monitor	17-Jul-86	197	83	1	63-83	2	15
W-223	GW Monitor	15-Aug-86	202	153	1	146-153	2	4.2
W-224	GW Monitor	26-Aug-86	199	88	1	78-88	2	8.1
W-225	GW Monitor	9-Sep-86	238	166	1	152-166	5	4.2

Table A-1. Well construction data, LLNL Livermore Site and vicinity, Livermore, California.

Well	Well type	Date Completed	Borehole depth (ft)	Casing depth (ft)	Screen position	Screen interval (ft)	HSU	Initial flow rate (gpm)
W-226	GW Monitor	25-Sep-86	173	86	1	71-86	1B	0.5
W-251	GW Monitor	3-Oct-85	50	47.5	1	35.5-47.5	1A	7.9
W-252	GW Monitor	18-Oct-85	197	126	1	108-126	2	6
W-253	GW Monitor	30-Oct-85	180	128	1	112.5-128	2	2.3
W-254	GW Extraction	21-Oct-85	277	89	1	82-89	1B	2
W-255	GW Monitor	5-Dec-85	187	124	1	115-124	5	10
W-256	GW Monitor	19-Dec-85	187	137	1	132-137	5	6
W-257	GW Monitor	15-Jan-86	197	96.5	1	82.5-96.5	2	0.5
W-258	GW Monitor	31-Jan-86	157	121.5	1	116.5-121.5	3A	NA
W-259	GW Monitor	7-Feb-86	200	99	1	93.5-99	2	0.3
W-260	GW Monitor	27-Feb-86	215	151	1	141-151	2	5.1
W-261	GW Monitor	12-Mar-86	225	118.5	1	109-118.5	5	0.5
W-262	GW Extraction	20-Mar-86	256	100	1	91-100	1B	12
W-263	GW Monitor	7-Apr-86	146	130	1	123-130	2	3
W-264	GW Monitor	14-Apr-86	170	151	1	141-151	2	15
W-265	GW Monitor	25-Apr-86	216	211	1	205-211	3A	2.5
W-267	GW Monitor	27-May-86	196	179	1	172.5-179	3A	3.3
W-268	GW Monitor	4-Apr-86	213	150.5	1	138-150.5	5	6
W-269	GW Monitor	16-Jun-86	185	92	1	79-92	1B	6.8
W-270	GW Monitor	26-Jun-86	185	127	1	113-127	5	0.3
W-271	GW Monitor	7-Jul-86	201	112	1	105-112	2	7.2
W-272	GW Monitor	18-Jul-86	226	110	1	95-110	2	1.3
W-273	GW Monitor	11-Aug-86	203	84	1	64-84	2	3.4
W-274	Dual Extraction	21-Aug-86	217	95	1	90-95	2	NA
W-275	GW Monitor	5-Sep-86	262	184	1	179-184	5	5.9
W-276	GW Monitor	17-Sep-86	267	170	1	153.5-169.5	3A	12
W-277	GW Monitor	3-Oct-86	254	169	1	163-169	3B	6
W-290	GW Monitor	8-Jul-86	181	126	1	119.5-126	5	0.3
W-291	GW Monitor	24-Jul-86	194	137	1	127-137	5	0.3
W-292	GW Extraction	14-Aug-86	250	184.5	1	176-184.5	3B	NA
W-293	GW Monitor	27-Aug-86	229	155	1	145-155	5	5
W-294	GW Monitor	15-Sep-86	251	139	1	122-139	5	6
W-301	GW Monitor	7-Oct-86	203	141	1	136-141	2	10
W-302	GW Monitor	22-Oct-86	191	83.5	1	78-83.5	1B	2
W-303	GW Monitor	28-Oct-86	197	128	1	124-128	2	24

Table A-1. Well construction data, LLNL Livermore Site and vicinity, Livermore, California.

Well	Well type	Date Completed	Borehole depth (ft)	Casing depth (ft)	Screen position	Screen interval (ft)	HSU	Initial flow rate (gpm)
W-304	GW Monitor	12-Nov-86	207	200	1	195-200	4	0.7
W-305	GW Extraction	18-Nov-86	146	138	1	128-138	2	16.2
W-306	GW Monitor	4-Dec-86	207	110	1	98-110	2	8.3
W-307	GW Monitor	15-Dec-86	214	102	1	93-102	1B	1.4
W-308	GW Monitor	13-Jan-87	194	113	1	107-113	2	2.4
W-310	GW Monitor	4-Feb-87	202	184.5	1	176.5-184.5	3A	20
W-311	GW Monitor	20-Feb-87	226.5	147.5	1	134.5-147.5	3A	NA
W-312	GW Monitor	5-Mar-87	224.5	168	1	160-168	4	16.7
W-313	GW Monitor	12-Mar-87	99	85	1	80-85	2	7.8
W-314	GW Extraction	20-Mar-87	228	142	1	129-142	4	19
W-315	GW Monitor	3-Apr-87	215	156	1	141-156	3A	15
W-316	GW Monitor	15-Apr-87	196	72	1	68-71	2	7
W-317	GW Monitor	20-Apr-87	100	95	1	88-95	2	14
W-318	GW Monitor	28-Apr-87	200	81	1	74-81	2	6
W-319	GW Monitor	5-May-87	198	125	1	119-125	3A	15
W-320	GW Monitor	11-May-87	106	99	1	94-99	2	5
W-321	GW Monitor	29-May-87	356	321.5	1	305-321.5	5	17
W-322	GW Monitor	1-Jul-87	565.5	152	1	142-152	2	8
W-323	GW Monitor	4-Aug-87	200	127	1	122-127	2	5.6
W-324	GW Monitor	17-Aug-87	219	189	1	184-189	3A	15
W-325	GW Monitor	28-Aug-87	312	170	1	158-170	3A	10
W-351	GW Extraction	17-Oct-86	191	152	1	146-152	4	6.5
W-353	GW Monitor	12-Nov-86	205	101	1	95.5-101	2	2.4
W-354	GW Monitor	24-Nov-86	185	179	1	163-179	4/5	17.6
W-355	GW Monitor	5-Dec-86	202	107	1	102-107	2	1.7
W-356	GW Monitor	18-Dec-86	237	137	1	133-137	3B	5
W-357	GW Extraction	12-Jan-87	197	123	1	107-123	2	13.6
W-359	GW Extraction	10-Feb-87	195	150.5	1	138-150.5	5	5
W-361	GW Monitor	5-Mar-87	257	135	1	125-135	3A	6
W-362	GW Monitor	13-Mar-87	151	145	1	131-145	4	15
W-363	GW Monitor	24-Mar-87	195	129	1	117-129	3A	6
W-364	GW Monitor	31-Mar-87	195	165	1	155-165	3B	6.5
W-365	GW Monitor	9-Apr-87	187	125	1	120-125	2	10
W-366	GW Monitor	20-Apr-87	273	251	1	240-251	4	17.6
W-368	GW Extraction	6-May-87	206	78	1	70-78	1B	3.5

Table A-1. Well construction data, LLNL Livermore Site and vicinity, Livermore, California.

Well	Well type	Date Completed	Borehole depth (ft)	Casing depth (ft)	Screen position	Screen interval (ft)	HSU	Initial flow rate (gpm)
W-369	GW Monitor	14-May-87	204	113	1	107-113	2	7
W-370	GW Monitor	29-May-87	286	208	1	196.5-208	4	10
W-371	GW Monitor	12-Jun-87	233	162	1	155-162	3A	5
W-372	GW Monitor	25-Jun-87	218	152.5	1	147.5-152.5	4	7.5
W-373	GW Monitor	6-Jul-87	178	99	1	89-99	1B	9
W-375	GW Monitor	29-Jul-87	223	71	1	65-71	2	0.4
W-376	GW Monitor	27-Aug-87	249	172	1	162-172	2	4
W-377	GW Monitor	4-Sep-87	159	144	1	141.5-144	2	0.5
W-378	GW Monitor	9-Sep-87	155	150	1	146-150	2	0.5
W-379	GW Monitor	14-Sep-87	155	150	1	146-150	2	0.5
W-380	GW Monitor	1-Oct-87	195	182	1	170-182	3A	9.1
W-401	GW Monitor	5-Nov-87	159	153	1	109-153	2	18
W-402	GW Monitor	13-Oct-87	104	102	1	92-102	1B	20
W-403	GW Monitor	16-Nov-87	585	495	1	485-495	7	15
W-404	GW Monitor	4-Dec-87	245	158	1	150-158	2	20
W-405	GW Monitor	4-Jan-88	244	162	1	132-162	2	20
W-406	GW Monitor	20-Jan-88	213	94	1	79-84	1B	5
W-407	GW Monitor	4-Feb-88	215	205	1	192-205	3A	10
W-408	GW Extraction	16-Feb-88	131	122.5	1	101-122.5	1B	20
W-409	GW Monitor	7-Mar-88	272	78	1	71-78	1B	20
W-410	GW Monitor	30-Mar-88	369	205	1	193-205	3A	16
W-411	GW Monitor	12-Apr-88	192	138	1	131-138	2	20
W-412	GW Monitor	18-Apr-88	104	74	1	67-74	1B	4
W-413	GW Extraction	28-Apr-88	163	115	1	100-115	2	12
W-415	GW Extraction	12-Aug-88	205	183.7	1	79-179	1B/2	50
W-416	GW Monitor	10-Jun-88	152	80.5	1	72-80.5	1B	20
W-417	GW Monitor	20-Jun-88	152	60	1	51-60	1B	5
W-418	GW Monitor	24-Jun-88	124	124	1	108-118	2	0.5
W-419	GW Monitor	29-Jun-88	82	82	1	62.5-75.5	1B	0.5
W-420	GW Monitor	26-Jul-88	127	111	1	105-111	2	4
W-421	GW Monitor	23-Aug-88	181	90	1	75-90	1B	5
W-422	GW Monitor	2-Sep-88	203	139.5	1	133-139.5	2	9
W-423	GW Monitor	9-Sep-88	308	118	1	106-118	2	19
W-424	GW Monitor	4-Oct-88	208	144	1	137-144	3A	6
W-441	GW Monitor	14-Oct-87	250	144	1	135-144	5	3

Table A-1. Well construction data, LLNL Livermore Site and vicinity, Livermore, California.

Well	Well type	Date Completed	Borehole depth (ft)	Casing depth (ft)	Screen position	Screen interval (ft)	HSU	Initial flow rate (gpm)
W-446	GW Monitor	18-Dec-87	202	196	1	186-196	3A	0.5
W-447	GW Monitor	05-Feb-88	353	274	1	256-274	4	8
W-448	GW Monitor	17-Feb-88	235	127.5	1	120.5-127.5	2	20
W-449	GW Monitor	7-Mar-88	172	165	1	152-165	2	6
W-450	GW Monitor	21-Mar-88	300	200	1	193-200	5	6
W-451	GW Monitor	6-Apr-88	202	112	1	106-112	2	3
W-452	GW Monitor	15-Apr-88	210	79.5	1	64-79.5	1B	7
W-453	GW Monitor	27-Apr-88	185	130	1	121-130	2	8
W-454	GW Monitor	9-May-88	196	83	1	73-83	1B	3
W-455	GW Monitor	19-May-88	184	162.5	1	148-162.5	2	5
W-457	GW Extraction	22-Jun-88	289	149.5	1	130-149.5	2	20
W-458	GW Monitor	30-Jun-88	212.5	116	1	108-116	2	2
W-459	GW Monitor	20-Jul-88	76	73	1	59.5-73	1B	0.5
W-461	GW Monitor	16-Aug-88	133	50.5	1	41.5-50.5	2	0.5
W-462	GW Monitor	12-Sep-88	385	337	1	331-336.5	5	10
W-463	GW Monitor	16-Sep-88	93	92.8	1	87-92.5	1B	20
W-464	GW Monitor	30-Sep-88	253	104.5	1	96-104.5	2	7
W-481	GW Monitor	4-Nov-88	224.5	105	1	100-105	1B	2
W-482	GW Monitor	15-Jan-88	218	170	1	165-170	2	0.5
W-483	GW Monitor	26-Jan-88	140	130	1	115-130	2	0.5
W-484	GW Monitor	11-Feb-88	255	188	1	185-188	3A	0.5
W-485	GW Monitor	25-Feb-88	249	157	1	151-157	2	0.5
W-486	GW Monitor	11-Mar-88	167	110	1	100-108	2	6
W-487	GW Monitor	17-Mar-88	180	151	1	148-151	3B	5
W-501	GW Monitor	13-Oct-88	174	92	1	84-92	1B	6
W-502	GW Monitor	25-Oct-88	158	59	1	55-59	1B	0.5
W-503	GW Monitor	2-Nov-88	187	80	1	74-80	1B	2
W-504	GW Monitor	21-Nov-88	358	167	1	157-167	2	8
W-505	GW Monitor	15-Dec-88	278	180	1	167-180	3A	18
W-506	GW Monitor	12-Dec-88	120	115	1	101-115	1B	9
W-507	GW Monitor	18-Jan-89	158	139	1	129-139	2	15
W-509	GW Monitor	3-Mar-89	305	184	1	179-184	5	2
W-510	GW Monitor	15-Mar-89	300	119.1	1	111-119	2	0.5
W-511	GW Monitor	31-Mar-89	316	176	1	167-176	3B	2
W-512	GW Monitor	13-Apr-89	261	176.5	1	166-176	5	2.5

Table A-1. Well construction data, LLNL Livermore Site and vicinity, Livermore, California.

Well	Well type	Date Completed	Borehole depth (ft)	Casing depth (ft)	Screen position	Screen interval (ft)	HSU	Initial flow rate (gpm)
W-513	GW Monitor	26-Apr-89	259	115	1	102-115	2	1
W-514	GW Monitor	17-May-89	386	115.5	1	92-115.5	1B	2
W-515	GW Monitor	30-May-89	211	78	1	68-78	1B	3
W-516	GW Monitor	9-Jun-89	203	119	1	114-119	2	10
W-517	GW Monitor	20-Jun-89	215	88.2	1	80-88	1B	8
W-518	GW Extraction	8-Aug-89	251	139.3	1	131-139	2	6.7
W-519	GW Monitor	14-Aug-89	186.5	80.6	1	60-80.5	1B	20
W-520	GW Extraction	30-Aug-89	160	101.5	1	94-101.5	1B	10
W-521	GW Monitor	13-Sep-89	166	95.4	1	86-95	1B	1.5
W-522	GW Extraction	5-Oct-89	145.5	141.5	1	134-141.5	2	16
W-551	GW Monitor	18-Oct-88	308	155.5	1	151-155.5	2	9
W-552	GW Monitor	25-Oct-88	70.5	64.5	1	48.5-64	1B	15
W-553	GW Monitor	3-Nov-88	186	106.5	1	99-106.5	2	2
W-554	GW Monitor	22-Nov-88	239	141.5	1	126.5-141.4	2	15
W-555	GW Monitor	5-Dec-88	122	116.5	1	102.5-116.5	1B	14.5
W-556	GW Monitor	15-Dec-88	192	81.5	1	76-81.5	1B	15
W-557	GW Monitor	22-Dec-88	122.5	118	1	102-118	2	10
W-558	GW Monitor	17-Jan-89	117	110.5	1	101-110.5	1B	20.5
W-559	GW Monitor	24-Jan-89	105	100	1	93-100	1B	1.2
W-560	GW Monitor	7-Feb-89	263	206.5	1	201-206.5	3B	5
W-561	GW Monitor	23-Feb-89	180	152	1	143-152	5	1
W-562	GW Monitor	8-Mar-89	263	158.5	1	145-158	5	1.5
W-563	GW Monitor	17-Mar-89	192	105.5	1	95-105	2	8
W-564	GW Monitor	30-Mar-89	184	85	1	79.5-85	1B	3.5
W-565	GW Monitor	6-Apr-89	177	82.5	1	75-82.5	1B	15
W-566	GW Extraction	19-Apr-89	317	207.5	1	197-207	5	15
W-567	GW Monitor	27-Apr-89	194	61.5	1	51-61	1B	10.5
W-568	GW Monitor	5-Jun-89	156	101	1	97-101	2	10
W-569	GW Monitor	16-May-89	215	109.5	1	101-109.5	2	3
W-570	GW Monitor	9-Jun-89	180	175	1	161-175	5	2
W-571	GW Monitor	15-Jun-89	223.5	107.5	1	102-107	1B	20
W-592	GW Monitor	12-Dec-88	136.5	113	1	101-112	2	1.2
W-593	GW Monitor	6-Feb-89	159	92.5	1	82-92.5	3A	2.1
W-594	GW Monitor	27-Feb-89	156	61	1	55-61	2	0.5
W-601	GW Extraction	13-Oct-89	146	96	1	88-96	1B	12

Table A-1. Well construction data, LLNL Livermore Site and vicinity, Livermore, California.

Well	Well type	Date Completed	Borehole depth (ft)	Casing depth (ft)	Screen position	Screen interval (ft)	HSU	Initial flow rate (gpm)
W-602	GW Extraction	6-Nov-89	268	100.2	1	90-100	1B	11
W-603	GW Extraction	15-Nov-89	150	147	1	141-147	2	6
W-604	GW Monitor	27-Nov-89	111	83	1	76-82	1B	0.4
W-605	GW Extraction	8-Dec-89	246	136	1	130-136	2	5
W-606	GW Monitor	21-Dec-89	145	89	1	73-89	1B	0.4
W-607	GW Monitor	24-Jan-90	186	55.1	1	49-55	1B	2
W-608	GW Monitor	7-Feb-90	162	66.3	1	55-66	1B	2
W-609	GW Extraction	21-Feb-90	120	112	1	104-112	2	3
W-610	GW Extraction	16-Mar-90	453	84.5	1	69-84.5	1B	5
W-611	GW Monitor	4-Apr-90	161	98	1	87.5-98	1B	3
W-612	GW Monitor	19-Apr-90	222	137	1	126-136	2	10
W-613	GW Monitor	2-May-90	93	88	1	81.5-88	1B	4.5
W-614	GW Extraction	18-May-90	262	123	1	100-123	2	6
W-615	GW Monitor	1-Jun-90	121	99.3	1	91-99	1B	5
W-616	GW Monitor	14-Jun-90	255	188	1	178-188	3A	4
W-617	GW Monitor	26-Jun-90	200	110	1	103-110	2	3
W-618	GW Monitor	17-Jul-90	357	205	1	201-205	3B	3
W-619	GW Monitor	7-Jul-90	330	252	1	232-252	3B/4	20
W-620	GW Extraction	3-Aug-90	206	88.5	1	75-88.5	1B	6
W-621	GW Extraction	9-Sep-90	149	120	1	113-120	2	3.5
W-622	GW Monitor	28-Sep-90	206	112.25	1	104-112	5	0.3
W-651	GW Monitor	22-Feb-90	155	89	1	82-89	1B	0.4
W-652	GW Monitor	15-Mar-90	318	256	1	245-256	7	2
W-653	Dual Extraction	29-Mar-90	225	128	1	122-128	3A	1
W-654	GW Monitor	11-Mar-90	240	158	1	140-158	2	20
W-655	GW Extraction	25-Mar-90	193	130	1	121-129.5	2	15
W-701	GW Extraction	10-Oct-90	159	86	1	74-86	1B	14
W-702	GW Monitor	24-Oct-90	180.5	95	1	77-95	1B	4
W-703	GW Monitor	3-Dec-90	586	325	1	298-325	5	NA
W-704	GW Extraction	2-Feb-91	135	107	1	67-76	1B	20
					2	88-97	1B	20
W-705	GW Monitor	26-Dec-90	126	90	1	77-90	1B	1
W-706	GW Monitor	10-Jan-91	178	85	1	71-85	1B	NA
W-712	GW Extraction	13-Jun-91	200	185.5	1	170-185.5	3A	8
W-714	GW Extraction	26-Jun-91	128.5	128	1	107-128	2	NA

Table A-1. Well construction data, LLNL Livermore Site and vicinity, Livermore, California.

Well	Well type	Date Completed	Borehole depth (ft)	Casing depth (ft)	Screen position	Screen interval (ft)	HSU	Initial flow rate (gpm)
W-750	GW Monitor	10-Apr-91	152	150	1	130-150	5	NA
W-901	GW Monitor	1/8/93	97.8	88	1	80-83	1B	1
W-902	GW Monitor	1/15/93	95.5	88	1	80-83	1B	1
W-903	GW Extraction	3/16/93	223	145	1	132-140	2	20
W-904	GW Extraction	3/23/93	212	154	1	121-133	2	30
					2	140-149	2	30
W-905	GW Monitor	3/31/93	221	144.5	1	134-144	2	3.5
W-906	GW Extraction	7/19/93	200	132	1	58-132	2/3A	8
W-907	GW Extraction	8/3/93	239	222	1	172.7-188.7	4	40
					2	204.5-215	5	40
W-908	GW Monitor	8/10/93	239	197	1	180-197	5/6	0.4
W-909	GW Monitor	9/10/93	252	113.5	1	80.5-113.5	2	2.5
W-911	GW Monitor	9/17/93	180	113.65	1	73.65-108.65	2	1.5
W-912	GW Monitor	9/24/93	239	174	1	168-174	5	3.5
W-913	GW Monitor	11/18/93	454	255	1	235-255	4	30
W-1001	GW Extraction	12/15/93	105	92	1	85-92	1B	1.5
W-1002	GW Monitor	1/13/94	293	260	1	246-260	5	20
W-1003	GW Monitor	2/2/94	184	147	1	140-147	2	1.5
W-1004	GW Extraction	2/16/94	100	97	1	71-91	1B	5
W-1008	GW Monitor	4/13/94	246	238	1	229.5-238	7	9.5
W-1009	GW Extraction	4/27/94	191	140	1	134-140	2	25
W-1010	GW Monitor	5/10/94	463	142	1	130-142	2	25
W-1011	GW Monitor	6/1/94	106	89	1	75-89	1B	2
W-1012	GW Monitor	6/15/94	161	117	1	96-112	2	2.5
W-1013	GW Monitor	6/27/94	147	73	1	65-73	1B	1.5
W-1014	GW Monitor	7/14/94	99	89	1	65-89	1B	30
W-1015	GW Extraction	8/4/94	437	94	1	84-94	1B	25
W-1101	GW Monitor	11/7/94	200	79	1	76-79	1B	1
W-1102	GW Extraction	11/30/94	163	95.6	1	76-94	1B	11
W-1103	GW Extraction	12/15/94	200	82	1	70-82	1B	4.5
W-1104	GW Extraction	1/11/95	165	99.3	1	77-87	1B	35
W-1105	GW Monitor	1/18/95	105	93	1	78-93	1B	3.75
W-1106	GW Monitor	2/2/95	245	86	1	76-85	1B	17.5
W-1107	GW Monitor	2/23/95	199.5	93	1	74-88	1B	1.5
W-1108	GW Extraction	3/14/95	250	156	1	142-156	5	22.5

Table A-1. Well construction data, LLNL Livermore Site and vicinity, Livermore, California.

Well	Well type	Date Completed	Borehole depth (ft)	Casing depth (ft)	Screen position	Screen interval (ft)	HSU	Initial flow rate (gpm)
W-1109	GW Extraction	4/5/95	121	113	1	94-113	2	6.5
W-1110	GW Monitor	5/4/95	252	92.9	1	68-92	1B	NA
W-1111	GW Extraction	5/18/95	152	129	1	88-108	1B/2	NA
					2	120-124	2	NA
W-1112	GW Monitor	6/19/95	263	210	1	201-210	5	NA
W-1113	GW Monitor	7/11/95	260	214	1	204-214	5	NA
W-1115	GW Monitor	10/12/95	126.5	118	1	108-118	3A	0.5
W-1116	GW Extraction	8/14/95	214.8	101	1	72-98	1B	NA
W-1117	GW Monitor	8/21/96	154	132.2	1	122-132	3A	1
W-1118	GW Monitor	9/20/95	225	125	1	115-125	3A	NA
W-1201	GW Monitor	10/18/95	225	133	1	125-133	3A	1
W-1202	GW Monitor	10/25/95	99.3	99	1	83-99	2	5
W-1203	GW Monitor	11/7/95	224	206.2	1	196-206	5	18
W-1204	GW Monitor	11/20/95	225	126.2	1	118-126	3A	2.5
W-1205	GW Monitor	11/27/95	91	82	1	72-82	2	1
W-1206	GW Extraction	12/6/95	220	191	1	174-186	4	40
W-1207	GW Monitor	12/13/95	92	90	1	70-90	2	1
W-1208	GW Extraction	1/9/96	166	163	1	135-163	3A/3B	40
W-1209	GW Monitor	1/26/96	210	164	1	148-164	4	3
W-1210	GW Monitor	2/12/96	250	223	1	213-223	5	3
W-1211	GW Extraction	3/5/96	273	205	1	185-200	4	25
W-1212	GW Monitor	3/19/96	150	75	1	52-75	1B	3
W-1213	GW Extraction	4/2/96	129	76	1	64-76	1B	5
W-1214	GW Monitor	4/22/96	180	100	1	80-100	1B	2
W-1215	GW Extraction	4/17/96	175	120	1	108-118	2	8.5
W-1216	GW Extraction	5/7/96	200	124	1	94-124	2	14
W-1217	GW Monitor	5/15/96	182	98.5	1	78-98	1B	0.25
W-1219	GW Monitor	6/4/96	201	142	1	138-142	4	0.18
W-1222	GW Monitor	6/26/96	175	125.2	1	115-125	3A	6
W-1223	GW Monitor	7/23/96	175	102	1	87-97	2	4
W-1224	GW Monitor	9/5/96	125	104.5	1	99-104	1B	4.3
W-1225	GW Monitor	8/14/96	150	121.2	1	113-121	3A	2
W-1226	GW Monitor	8/6/96	155	126.5	1	116-126	2	1
W-1227	GW Monitor	10/9/96	200	134	1	126-134	2	11
W-1250	GW Monitor	6/7/96	210	200.3	1	130-135	4	0.25

Table A-1. Well construction data, LLNL Livermore Site and vicinity, Livermore, California.

Well	Well type	Date Completed	Borehole depth (ft)	Casing depth (ft)	Screen position	Screen interval (ft)	HSU	Initial flow rate (gpm)
W-1251	GW Monitor	7/3/96	210	200.3	1	134-139	4	1.3
W-1252	GW Monitor	7/25/96	208	202.3	1	135-140	4	0.15
W-1253	GW Extraction	8/8/96	206	200.3	1	127-132	4	0.15
W-1254	GW Extraction	8/20/96	210	200	1	131-141	4	26
W-1255	GW Extraction	9/3/96	208	200.7	1	124-129	4	0.2
W-1301	GW Extraction	12/4/96	180	120.3	1	112-120	3A	15
W-1302	GW Extraction	1/21/97	145	138.9	1	116.5-121.2	3A	7.5
					2	125.8-133.8	3A	7.5
W-1303	GW Extraction	2/6/97	199.5	107	1	78-102	2	10
W-1304	GW Monitor	2/20/97	149.5	125	1	120-125	3A	0.75
W-1306	GW Extraction	5/6/97	200	106	1	81-101	2	3.3
W-1307	GW Extraction	7/2/97	150	141	1	126-136	4	20
W-1308	GW Extraction	8/13/97	154	116	1	81-111	2	7
W-1309	GW Monitor	10/13/97	220	157	1	142-152	4	6
W-1310	GW Extraction	9/15/97	220	198	1	173-193	5	28
W-1311	GW Monitor	10/26/97	150	120.5	1	100-120	2	14
W-1401	GW Monitor	11/17/97	254	120	1	105-120	2	7.8
W-1402	GW Monitor	12/10/97	135	112	1	102-112	3A	4.1
W-1403	GW Extraction	7/16/98	175	142.5	1	132-142	3B	5
W-1404	GW Extraction	3/30/98	162	97.7	1	87-97	2	3.1
W-1405	GW Monitor	3/30/98	100	97.8	1	87-97	2	4.5
W-1406	GW Monitor	4/2/98	201	150	1	139.2-149.2	4	9.2
W-1407	GW Monitor	3/27/98	224	118	1	105-118	2	2
W-1408	GW Monitor	3/27/98	134	128	1	118-128	3A	3.8
W-1409	GW Extraction	6/11/98	143	140	1	80-135	2	13
W-1410	GW Extraction	5/13/98	208.5	131.1	1	126-131	4	9
W-1411	GW Monitor	2/4/98	133	128.1	1	114-128	3A	10.6
W-1412	GW Monitor	5/21/98	201	108	1	92-107	3A	1
W-1413	GW Monitor	6/1/98	163.5	163.5	1	147-157	5	1
W-1414	GW Monitor	4/6/98	128	107.5	1	97-107	3A	0.018
W-1415	GW Extraction	6/3/98	182	104.72	1	74.5-104.5	2	2
W-1416	GW Monitor	6/19/98	194.5	105	1	85-100	2	10.8
W-1417	GW Monitor	6/25/98	225	155	1	130-150	3A	8.9
W-1418	GW Monitor	9/22/98	252.5	190	1	176-190	4	9
W-1419	GW Monitor	7/15/98	175	115.5	1	90-110	2	4.45

Table A-1. Well construction data, LLNL Livermore Site and vicinity, Livermore, California.

Well	Well type	Date Completed	Borehole depth (ft)	Casing depth (ft)	Screen position	Screen interval (ft)	HSU	Initial flow rate (gpm)
W-1420	GW Monitor	6/29/98	175.5	112.5	1	102-112	2	20
W-1421	GW Monitor	6/29/98	230	172	1	157-167	3B	2.1
W-1422	GW Monitor	8/28/98	173.5	169.1	1	162-169	3B	11
W-1423	GW Extraction	10/21/98	175	134.5	1	99.5-109.5	2	22.4
					2	119.5-129.5	2	22.4
W-1424	GW Monitor	9/25/98	225.3	146	1	126-146	2	6.2
W-1425	GW Monitor	9/25/98	115	100.5	1	88.5-100.5	1B	1
W-1426	GW Monitor	9/28/98	89	85	1	70-85	1B	10
W-1427	GW Monitor	1/6/98	104	80.2	1	70-80	1B	17.7
W-1428	GW Monitor	1/11/99	104	78.2	1	63-78	1B	30
W-1501	GW Monitor	11/12/98	126.1	88	1	72-88	1B	7.5
W-1502	GW Monitor	3/11/99	204	98.7	1	88-98	2	1.7
W-1503	GW Extraction	11/16/98	234	181.5	1	171-181	4	24
W-1504	GW Extraction	2/17/99	165.2	162.5	1	140-160.4	3A/3B	21.7
W-1505	GW Monitor	4/21/99	276	184.5	1	174-184	4	10
W-1506	GW Monitor	4/12/99	160	120.5	1	110-120	2	3
W-1507	GW Monitor	4/16/99	201.5	169.5	1	159-169	5	0.5
W-1508	GW Monitor	3/3/99	135	128.5	1	118-128	2	0.75
W-1509	GW Monitor	3/24/99	175	88.5	1	73-88	1B	8
W-1510	GW Extraction	4/9/99	114.5	113.5	1	93-113	2	5
W-1511	GW Monitor	4/27/99	229	146	1	138-146	3B	15
W-1512	GW Monitor	5/3/99	100	100	1	88-98	2	0.5
W-1513	GW Monitor	5/11/99	122	120	1	108-120	2/3A	NA
W-1514	GW Monitor	5/24/99	127.5	126	1	103-121	2/3A	6.5
W-1515	GW Monitor	6/8/99	130	121.5	1	102-120	2/3A	3
W-1516	GW Monitor	6/17/99	204.5	200.25	1	188-200	5	17
W-1517	Dual Extraction	6/6/99	154	122.4	1	87-97	2	0.1
W-1518	GW Extraction	7/8/99	184	115	1	84-107	2	3
W-1519	GW Monitor	8/3/99	245	238	1	222-237	5	30
W-1520	GW Extraction	7/27/99	178.3	173	1	160-168	4	3.5
W-1522	GW Extraction	8/11/99	169	161	1	141-156	3B	9
W-1523	GW Extraction	9/7/99	216	172.3	1	164-172	4	15
W-1550	GW Extraction	6/24/99	200	130	1	98-125	3A	10
W-1551	GW Extraction	7/15/99	153	129	1	93-124	3A	10.5
W-1552	Dual Extraction	6/24/99	153.5	130	1	97.2-124.5	3A	2

Table A-1. Well construction data, LLNL Livermore Site and vicinity, Livermore, California.

Well	Well type	Date Completed	Borehole depth (ft)	Casing depth (ft)	Screen position	Screen interval (ft)	HSU	Initial flow rate (gpm)
W-1553	GW Monitor	8/17/99	153	130	1	98-125	3A/3B	1
W-1601	GW Extraction	10/13/99	169	160	1	150-155	3B	2.7
W-1602	GW Extraction	11/3/99	115.5	110.7	1	80-90	2	8
W-1603	GW Extraction	11/16/99	144	140	1	130-135	3A	71.2
W-1604	GW Extraction	12/2/99	194	148.7	1	138-148	4	8
W-1605	Dual Extraction	3/7/00	120.5	112	1	90-107	3A	NA
W-1606	SV Extraction	1/27/00	175	112	1	90-107	3A	NA
W-1607	SV Extraction	2/10/00	155.4	112	1	90-107	3A	0.1
W-1608	Dual Extraction	2/28/00	155	112	1	90-107	3A	NA
W-1609	GW Extraction	4/17/00	155	135	1	110-130	5	0.1
W-1610	GW Injection	5/4/00	155.3	135	1	110-130	5	0.5
W-1613	GW Monitor	4/27/00	219	173.4	1	168.4-173.4	3B	NA
W-1614	GW Monitor	5/15/00	100	89.8	1	79-89	1B	3
W-1615	Dual Extraction	8/17/00	55	48	1	15-48	1B/2	NA
W-1650	Dual Extraction	1/19/00	145	126	1	96-121	3A	2
W-1651	Dual Extraction	1/27/00	145	129	1	94-124	2/3A/ 3B	1
W-1652	Dual Extraction	2/9/00	145	127	1	92-122	3A/3B	0.5
W-1653	Dual Extraction	2/24/00	144	124	1	94-119	3A	1.2
W-1654	Dual Extraction	2/25/00	146.5	128	1	93-123	3A	1
W-1655	Dual Extraction	3/8/00	145	125	1	90-120	2/3A	0.5
W-1656	Dual Extraction	3/14/00	145	125.3	1	95.1-120.1	3A	5
W-1657	Dual Extraction	3/23/00	145	128	1	95-123	3A/3B	0.5
W-1701	GW Monitor	6/27/01	185	180.8	1	140-155	2	15
					2	165-175	2	15
W-1702	GW Monitor	6/15/01	15	14.25	1	4-13	2	NA
W-1703	GW Monitor	8/15/01	358	341.5	1	331-341	LL	22.6
W-1704	GW Monitor	9/17/01	240	118.8	1	98-118	2	2
W-1705	FLUTe	10/4/01	225	208.8	1	93-103	2	5
					2	123-128	3A	5
					3	138-143	3B	5
					4	203-208	5	5
W-1801	GW Extraction	3/13/02	143	134.4	1	124-134	3A	5
W-1802	GW Monitor	3/27/02	175	162.2	1	147-157	3A	NA
W-1803	GW Monitor	4/24/02	245	240.8	1	175-185	4	15
					2	225-235	5	15

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Well	Well type	Date Completed	Borehole depth (ft)	Casing depth (ft)	Screen position	Screen interval (ft)	HSU	Initial flow rate (gpm)
W-1804	GW Monitor	3/16/02	155	110.8	1	80-95	3A	0.5
					2	100-105	3B	0.5
W-1805	GW Monitor	8/20/02	110	100.8	1	70-80	1B	6
					2	85-95	1B	6
W-1806	GW Extraction	9/10/02	260	106.2	1	80.7-101.2	1B	3
W-1807	GW Extraction	10/1/02	165	130	1	115-125	2	10
W-1901	GW Monitor	10/23/02	175	127	1	92-97	1B	7
					2	107-122	2	7
W-1902	GW Extraction	11/13/02	175	165	1	140-145	3A	20
					2	150-160	3A	20
W-1903	Dual Extraction	12/9/02	120	109	1	84-104	2	0.5
W-1904	Dual Extraction	1/15/03	120	101	1	75-100	2	0.5
W-1905	GW Monitor	5/14/03	210	123.5	1	103-113	3A	2.5
					2	118-123	3A	2.5
W-1909	Air Inlet	6/19/03	110	106.35	1	86-106	2	1.5
W-2005	GW Extraction	1/27/04	160	125	1	109-119	3A	2
W-2006	GW Extraction	2/18/04	160	132.5	1	122-132	3B	NA
W-2011	Dual Extraction	9/28/04	155	116.3	1	106-116	3A	0.3
W-2012	GW Extraction	10/19/04	155	136.6	1	111-116	3A	4
					2	126-131	3A	4
W-2101	Dual Extraction	11/16/04	160	135.3	1	110-130	3A	0.25
W-2102	Dual Extraction	12/8/04	160	138.35	1	118-133	3A	0.33
W-2103	GW Monitor	1/12/05	160	133.35	1	113-128	3A	0.5
W-2104A	SV Monitor	2/2/05	80	45.5	1	30-45	1B	NA
W-2104B	SV Monitor	2/2/05	80	72.55	1	52-72	2	NA
W-2105	Dual Extraction	2/17/05	126	115.33	1	90-110	2	0.25
W-2110A	SV Monitor	6/7/05	100	58.49	1	38-58	1B/2	NA
W-2110B	SV Monitor	6/7/05	100	85.49	1	65-85	2	NA
W-2111A	SV Monitor	6/22/05	90	40.3	1	25-40	1B	NA
W-2111B	SV Monitor	6/22/05	90	75.3	1	60-75	2	NA
W-2112A	SV Monitor	6/23/05	100	58.49	1	38-58	1B/2	NA
W-2112B	SV Monitor	6/23/05	100	78.49	1	68-78	2	NA
W-2113	GW Monitor	7/12/05	220	201.5	1	190.5-200.5	4	9
W-2201	GW Extraction	1/26/06	130	98.8	1	43.4-53.4	1B	12
					2	73.4-93.4	1B	12

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Well	Well type	Date Completed	Borehole depth (ft)	Casing depth (ft)	Screen position	Screen interval (ft)	HSU	Initial flow rate (gpm)
W-2202	GW Monitor	12/14/05	140	122.25	1	102-107	3A	0.4
					2	112-117	3A	0.4
W-2203	GW Extraction	1/9/06	136.5	131.4	1	121-126	3A	1
W-2204	Dual Extraction	1/19/06	120	111.38	1	41-66	2	0.1
					2	71-76	2	0.1
					3	91-106	2/3A	0.1
W-2205	Dual Extraction	3/29/06	127	125.4	1	40-65	2	NA
					2	70-80	2	NA
					3	90-120	2/3A	NA
W-2206	Dual Extraction	2/8/06	91.5	78.05	1	40-75	2	NA
W-2207A	Dual Extraction	3/1/06	103	60.41	1	25-35	1B	NA
W-2207B	Dual Extraction	3/1/06	103	100.4	1	65-95	2	NA
W-2208A	Dual Extraction	3/22/06	104	71.38	1	36-66	2	0.1
W-2208B	Dual Extraction	3/22/06	104	95.63	1	75.2-95.2	2	0.25
W-2211	SV Monitor	5/30/06	106.5	105.3	1	75-105	2	NA
W-2212	SV Monitor	6/13/06	115.4	115.4	1	90-115	3A	1
W-2214A	SV Monitor	7/13/06	135	39.3	1	6-39	1B/2	NA
W-2214B	SV Monitor	7/13/06	135	88.3	1	48-83	2	NA
W-2215A	SV Monitor	8/8/06	121.5	82.4	1	47-82	2	NA
W-2215B	SV Monitor	8/8/06	121.5	120.5	1	100-120	5	NA
W-2216A	SV Monitor	8/31/06	131.5	65.4	1	40-65	2	NA
W-2216B	GW Monitor	8/31/06	131.5	126.4	1	106-121	3A	0.2
W-2217A	SV Monitor	10/3/06	131.5	48.4	1	18-48	2	NA
W-2217B	SV Monitor	10/3/06	131.5	95.4	1	55-75	5	NA
					2	85-95	5	NA
W-2301A	SV Monitor	10/31/06	121	57.4	1	32-57	2	NA
W-2301B	SV Monitor	10/31/06	121	94.8	1	64.5-94.5	2/3A	NA
W-2304	GW Monitor	12/19/06	130	124.3	1	114-119	3A	0.15
SIP-141-005	Piezometer	NA	NA	NA	NA	NA	NA	NA
SIP-141-201	Piezometer	2/2/96	77	74.2	1	57-74	1B	0.5
SIP-141-202	Piezometer	2/12/96	80	74	1	64-74	1B	0.5
SIP-141-203	Piezometer	2/20/96	87	83	1	72-83	1B	NA
SIP-191-001	Piezometer	11/16/94	50	NA	1	NA	1A	NA
SIP-191-002	Piezometer	4/21/94	66	61	1	45-61	1B	NA
SIP-191-003	Piezometer	4/26/94	50.5	45	1	35-45	1B	NA

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Well	Well type	Date Completed	Borehole depth (ft)	Casing depth (ft)	Screen position	Screen interval (ft)	HSU	Initial flow rate (gpm)
SIP-191-004	Piezometer	4/29/94	57.5	NA	1	NA	1B	NA
SIP-191-005	Piezometer	5/4/94	54	48	1	42-48	1A	NA
SIP-191-101	Piezometer	11/17/94	68.5	64	1	58-64	1B	NA
SIP-212-101	Piezometer	3/14/96	94	90.5	1	87-90.5	2	NA
SIP-293-001	Piezometer	12/4/90	56.5	50	1	45-50	1B	NA
SIP-331-001	Piezometer	9/20/95	122	116.5	1	106.5-116.5	2	NA
SIP-419-101	Piezometer	9/7/95	127	123	1	112-123	3B	NA
SIP-419-202	Piezometer	3/6/96	110	106.5	1	97-106.5	3A	NA
SIP-490-101	Piezometer	11/1/95	60	58	1	53-56	2	NA
SIP-490-102	Piezometer	11/8/95	75	73.5	1	53.5-73.5	2	0.5
SIP-501-004	Piezometer	10/19/92	60	56.9	1	48.5-56.9	1B	NA
SIP-501-006	Piezometer	11/11/92	59.5	56	1	50-56	1B	NA
SIP-501-007	Piezometer	11/16/92	64	59	1	53-59	1B	NA
SIP-501-101	Piezometer	5/10/94	77.5	73	1	69-73	1B	NA
SIP-501-102	Piezometer	5/13/94	77	73	1	67-73	1B	NA
SIP-501-103	Piezometer	5/19/94	63	57.5	1	51-57.5	1B	NA
SIP-501-104	Piezometer	5/25/94	67	62	1	50-62	1B	NA
SIP-501-105	Piezometer	6/2/94	73	68	1	63-68	1B	NA
SIP-501-201	Piezometer	11/30/94	65	58.5	1	54-58.5	1B	NA
SIP-501-202	Piezometer	7/1/95	70	64.5	1	58-64.5	1B	NA
SIP-511-101	Piezometer	1/25/96	110	106.7	1	100-106.7	3A	0.5
SIP-511-102	Piezometer	4/2/96	114	110	1	108-110	3B	0.5
SIP-514-107	Piezometer	1/3/90	21.5	17	1	9-17	1B	NA
SIP-514-109	Piezometer	1/5/90	21.5	21.5	1	7-21.5	1B	NA
SIP-514-112	Piezometer	1/8/90	21.5	18	1	7-18	1B	NA
SIP-514-114	Piezometer	1/9/90	21.5	17	1	4-17	1B	NA
SIP-514-116	Piezometer	1/10/90	21.5	17	1	7-17	1B	NA
SIP-514-117	Piezometer	1/11/90	21.5	17.5	1	6-17.5	1B	NA
SIP-514-119	Piezometer	1/12/90	21.5	16	1	5-16	1B	NA
SIP-514-123	Piezometer	6/19/90	26.5	23	1	11.5-23	1B	NA
SIP-514-124	Piezometer	1/17/90	21.5	17	1	6-17	1B	NA
SIP-514-125	Piezometer	1/18/90	21.5	15	1	6-15	1B	NA
SIP-514-126	Piezometer	1/18/90	26.5	21.5	1	4-21.5	1B	NA
W-514-2007A	SV Extraction	3/18/04	110	45.5	1	15-45	1B/2	NA
W-514-2007B	SV Extraction	3/18/04	110	102.5	1	72-102	2/5	NA

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Well	Well type	Date Completed	Borehole depth (ft)	Casing depth (ft)	Screen position	Screen interval (ft)	HSU	Initial flow rate (gpm)
SIP-518-101	SV Monitor	9/20/90	125	61	1	55-61	2	NA
SVB-518-201	Dual Extraction	3/3/93	59.8	50	1	34-50	2	NA
SVB-518-202	SV Monitor	11/3/93	120.6	73.7	1	19-73.7	1B/2	NA
SIP-518-203	Piezometer	10/19/93	132.1	127	1	121-127	5	NA
SVB-518-204	Dual Extraction	10/28/93	121.5	50	1	24-46	2	NA
SEA-518-301	SEAMIST	6/22/95	102.6	39.3	1	NA	NA	NA
SVB-518-302	GW Monitor	6/22/95	104.5	39.5	1	11-39	NA	NA
SEA-518-304	SEAMIST	6/26/95	100	NA	1	NA	NA	NA
IMS-518-1616	IMS	8/16/00	55	NA	1	3-3.5	NA	NA
					2	8-8.5	NA	NA
					3	13-13.5	NA	NA
					4	18-18.5	NA	NA
					5	23-23.5	NA	NA
					6	28-28.5	NA	NA
					7	33-33.5	NA	NA
					8	38-38.5	NA	NA
					9	43-43.5	NA	NA
					10	48-48.5	NA	NA
W-518-1913	Dual Extraction	10/1/03	63	61	1	50.5-60.5	2	NA
W-518-1914	Dual Extraction	10/8/03	18	16	1	5.5-15.5	1B	NA
W-518-1915	Dual Extraction	6/28/95	104.5	41	1	30.5-40.5	2	NA
W-543-001	SV Extraction	2/20/03	71.5	67.5	1	52-67	2	NA
W-543-002A	SV Monitor	3/4/03	96	65.4	1	45-65	2	NA
W-543-002B	SV Monitor	3/4/03	96	82.5	1	72-82	2	NA
W-543-003	SV Extraction	3/18/03	95	80	1	69-79	2	NA
W-543-004A	SV Monitor	3/27/03	95	64.5	1	49-64	2	NA
W-543-004B	SV Monitor	3/27/03	95	80.5	1	70-80	2	NA
SIP-543-101	Piezometer	7/1/95	111	104	1	93-103	2	NA
W-543-1908	SV Extraction	6/11/03	40.8	40.4	1	20-40	1B	NA
SIP-ALP-001	Piezometer	5/2/90	66.5	60	1	45-60	2	NA
SIP-ALP-002	Piezometer	5/4/90	62	57.5	1	47.5-57.5	1B/2	NA
SIP-AS-001	Piezometer	4/27/90	100.5	90.5	1	81-90.5	1B	NA
SIP-CR-049	Piezometer	2/26/90	41.5	40	1	36-40	1B	NA
SIP-EGD-001	Piezometer	10/15/90	101.5	85	1	75-85	2	NA
SIP-ETC-201	Dual Extraction	3/26/96	106	100	1	80-100	2	0.5

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Well	Well type	Date Completed	Borehole depth (ft)	Casing depth (ft)	Screen position	Screen interval (ft)	HSU	Initial flow rate (gpm)
SIP-ETC-301	Piezometer	4/9/99	102	NA	1	NA	NA	NA
SIP-ETC-303	Piezometer	5/24/99	111	88	1	82-88	2	NA
W-ETC-2001A	SV Monitor	11/10/03	95	23.5	1	18-23	1B	NA
W-ETC-2001B	SV Monitor	11/10/03	95	88.5	1	78-88	2	NA
W-ETC-2002A	SV Monitor	11/14/03	95	64.5	1	34-64	1B/2	NA
W-ETC-2002B	SV Monitor	11/14/03	95	85.5	1	75-85	2	NA
W-ETC-2003	SV Extraction	12/4/03	95	45.5	1	20-45	1B	NA
W-ETC-2004A	SV Extraction	12/15/03	95	53.5	1	28-53	1B/2	NA
W-ETC-2004B	SV Extraction	12/15/03	95	88.5	1	63-68	2	NA
SIP-ETS-101	Piezometer	6/13/90	100	NA	1	NA	NA	NA
SIP-ETS-201	Piezometer	12/11/90	95	90	1	85-90	3A	NA
SIP-ETS-204	Piezometer	5/7/91	102.5	97	1	87-97	3A	NA
SIP-ETS-205	Piezometer	6/20/91	103	95	1	89.5-95	3A	NA
SIP-ETS-209	Piezometer	7/25/91	96.6	90.5	1	79.5-89.5	2	NA
SIP-ETS-211	Piezometer	8/6/91	103	98.5	1	95-98.5	3A	NA
SIP-ETS-212	Piezometer	8/14/91	106.5	102.5	1	97.5-102.25	2	NA
SIP-ETS-213	Piezometer	11/15/91	118.5	116.5	1	108.5-116.5	3A	NA
SIP-ETS-214	Piezometer	11/22/91	101	101	1	86-101	3A	NA
SIP-ETS-215	Piezometer	12/3/91	94.5	94.5	1	84.5-94.5	3A	NA
SIP-ETS-302	Piezometer	3/30/92	117.4	113	1	97-113	3A	NA
SIP-ETS-303	Piezometer	4/2/92	110.7	102	1	95-102	3A	NA
SIP-ETS-304	Piezometer	8/27/92	100	97	1	90-97	3A	NA
SEA-ETS-305	SEAMIST	9/2/92	85	NA	1	NA	NA	NA
SIP-ETS-306	Piezometer	9/11/92	101	93	1	80.5-93	3A	NA
SIP-ETS-307	Piezometer	12/8/92	105.5	NA	NA	NA	NA	NA
SIP-ETS-401	Piezometer	7/27/95	122	122	1	116-121	3A	NA
SIP-ETS-402	Piezometer	8/8/95	110	110	1	97-107	2	NA
SIP-ETS-404	Piezometer	8/21/95	99	99	1	83.5-95.5	2	NA
SIP-ETS-405	Piezometer	8/28/95	126	126	1	114.5-123	5	NA
SIP-ETS-501	Piezometer	11/16/95	110	106.5	1	100-106.5	3A	NA
SIP-ETS-502	Piezometer	12/5/95	95	88	1	80-88	2	NA
SVI-ETS-504	SV Extraction	7/9/96	76.5	67	1	42-67	2	NA
SVI-ETS-505	SV Injection	7/18/96	80	77.5	1	45-75	2	NA
SEA-ETS-506	SEAMIST	7/24/96	75	75	NA	NA	1B/2	NA
W-ETS-507	SV Monitor	7/29/96	75	65.5	1	25.1-65.1	1B/2	NA

Table A-1. Well construction data, LLNL Livermore Site and vicinity, Livermore, California.

Well	Well type	Date Completed	Borehole depth (ft)	Casing depth (ft)	Screen position	Screen interval (ft)	HSU	Initial flow rate (gpm)
SIP-ETS-601	Piezometer	6/7/99	115.5	104.8	1	98.3-104.8	2	NA
W-ETS-2008A	SV Extraction	3/31/04	110	40.5	1	20-40	1B	NA
W-ETS-2008B	SV Extraction	3/31/04	110	85.5	1	50-85	2	NA
W-ETS-2009	SV Extraction	4/26/04	120	79.5	1	54-79	2	NA
W-ETS-2010A	SV Extraction	5/12/04	110.3	70.5	1	35-70	1B/2	NA
W-ETS-2010B	SV Extraction	5/12/04	110.3	100.5	1	80-100	2	NA
SIP-HPA-001	Piezometer	4/12/90	92.75	75	1	65-75	2	NA
W-HPA-001A	SV Monitor	4/9/03	80	45.5	1	30-45	1B	NA
W-HPA-001B	SV Monitor	4/9/03	80	73.5	1	63-73	2	NA
W-HPA-002A	SV Extraction	4/23/03	80	43	1	32.5-42.5	1B	NA
W-HPA-002B	SV Extraction	4/23/03	80	72.5	1	52-72	2	NA
SIP-HPA-003	Piezometer	4/17/90	91.5	66	1	61-66	2	NA
SIP-HPA-201	Piezometer	5/14/96	97.5	76	1	71-76	2	NA
SIP-IES-001	Piezometer	9/16/92	50	46.5	1	44-46.5	1B	NA
SIP-IES-002	Piezometer	10/2/92	41.5	39.2	1	33-39.2	1A	NA
IMS-INF-001	IMS	NA	67	NA	1	NA	NA	NA
IMS-INF-002	IMS	NA	67	NA	1	NA	NA	NA
IMS-INF-003	IMS	NA	67	NA	1	NA	NA	NA
SIP-INF-201	Piezometer	NA	87.4	86.5	1	66-86.5	NA	35
SIP-INF-202	Piezometer	NA	87	85.5	1	65.5-85.5	NA	0.5
IMS-INF-203	IMS	NA	63	63	1	NA	NA	NA
SIP-ITR-001	Piezometer	4/17/91	121.5	115	1	105-115	5	NA
SIP-ITR-002	Piezometer	4/1/91	100	84	1	79-84	5	NA
SIP-ITR-003	Piezometer	4/23/91	121.5	106	1	98.66-106	5	NA
SIP-NEB-101	Piezometer	9/22/92	68.7	66	1	57-66	2	NA
SIP-PA-002	Piezometer	1/29/90	16.5	16.5	1	4-16.5	1B	NA
SIP-PA-003	Piezometer	1/26/90	18	14	1	4-14	1B	NA
SIP-PA-005	Piezometer	1/4/90	11.5	8	1	3-8	1B	NA
SIP-PA-006	Piezometer	1/4/90	13.5	12	1	5-12	1B	NA
SIP-PA-007	Piezometer	1/4/90	11.5	5	1	1-5	1B	NA
SIP-PA-010	Piezometer	1/26/90	11.5	9	1	3-9	1B	NA
SIP-PA-012	Piezometer	1/29/90	11.5	9	1	2-9	1B	NA
SIP-PA-013	Piezometer	1/24/90	16.5	13	1	8-13	1B	NA
SIP-PA-015	Piezometer	1/26/90	21.5	17.5	1	2-17.5	1B	NA
SIP-PA-016	Piezometer	1/24/90	11.5	11.5	1	7-11.5	1B	NA

Table A-1. Well construction data, LLNL Livermore Site and vicinity, Livermore, California.

Well	Well type	Date Completed	Borehole depth (ft)	Casing depth (ft)	Screen position	Screen interval (ft)	HSU	Initial flow rate (gpm)
SIP-PA-017	Piezometer	1/24/90	16.5	14	1	7-14	1B	NA
SIP-PA-018	Piezometer	1/26/90	11.5	8	1	6-8	1B	NA
SIP-PA-019	Piezometer	1/26/90	16.5	12	1	2-12	1B	NA
SIP-PA-021	Piezometer	1/23/90	11.5	10	1	2-10	1B	NA
SIP-PA-024	Piezometer	1/23/90	16.5	15	1	5-15	1B	NA
SIP-PA-025	Piezometer	1/23/90	11.5	7	1	4-7	1B	NA
SIP-PA-026	Piezometer	1/29/90	11.5	10	1	2-10	1B	NA
SIP-PA-027	Piezometer	1/29/90	8.5	7	1	2-7	1B	NA
SIP-PA-028	Piezometer	1/23/90	11	8	1	5-8	1B	NA
SIP-PA-030	Piezometer	1/24/90	11.5	8	1	4-8	1B	NA
SIP-PA-034	Piezometer	1/4/90	6.5	5	1	3-5	1B	NA
SIP-PA-035	Piezometer	1/4/90	11.5	11.5	1	6.5-11.5	1B	NA
TW-11	GW Monitor	6/9/81	112.5	107	1	97-107	2	NA
TW-11A	GW Monitor	3/16/84	163	160	1	133-160	2	6
TW-21	GW Monitor	6/12/81	111.5	95	1	85-95	1B	3
UP-292-006	Piezometer	11/6/90	74	57.5	1	47.5-57.5	1B	NA
UP-292-007	Piezometer	11/26/90	71	56	1	46-56	1B	NA
UP-292-012	Piezometer	10/31/91	67.7	60	1	45-60	1B	NA
UP-292-014	Piezometer	11/6/91	66	66	1	50-60	1B	NA
UP-292-015	Piezometer	11/9/91	61.5	61.5	1	49.5-60.5	1B	NA
UP-292-020	Piezometer	10/28/92	68.5	68.5	1	56.5-64	1B	NA
GEW-710	GW Monitor	5/17/91	159	158	1	94-137	2/3A	NA
GEW-808	GW Monitor	3/19/92	150	150	1	50-140	2/3A	NA
GEW-816	GW Monitor	8/4/92	161.7	150	1	50-140	2/3A	NA
GIW-813	GW Monitor	8/5/92	140.7	127	1	67-87	2	NA
					2	89-99	2	NA
					3	107-127	2/3A	NA
GIW-814	GW Monitor	8/5/92	149.6	141	1	86.5-106.5	2	NA
					2	110-120	3A	NA
					3	121-141	3A/3B	NA
GIW-815	GW Monitor	8/5/92	143	137.5	1	77-97	2	NA
					2	102-112	2/3A	NA
					3	112.8-132.5	3A	NA
GIW-817	GW Monitor	NA	NA	NA	1	NA	NA	NA
GIW-818	GW Monitor	8/5/92	150	140	1	82-102	2	NA

Table A-1. Well construction data, LLNL Livermore Site and vicinity, Livermore, California.

Well	Well type	Date Completed	Borehole depth (ft)	Casing depth (ft)	Screen position	Screen interval (ft)	HSU	Initial flow rate (gpm)
					2	110-120	3A	NA
					3	120-140	3A/3B	NA
GIW-819	GW Monitor	8/5/92	150	141	1	78.6-98.6	2	NA
					2	108-118	2/3A	NA
					3	121-141	3A/3B	NA
GIW-820	GW Monitor	8/5/92	143.3	132	1	85-105	2	NA
					2	112-132	3A	NA
GSW-004	GW Monitor	2/22/85	112	106	1	86-106	2	NA
GSW-006	GW Monitor	2/28/86	212	137	1	121-137	3A	11
GSW-007	GW Monitor	3/14/86	176.5	123.4	1	110.8-123.4	3A	5
GSW-008	GW Monitor	4/1/86	176	133	1	127.5-133	3A	2
GSW-009	GW Monitor	4/14/86	197.5	152.5	1	147-152.5	3B	5
GSW-011	GW Monitor	5/7/86	182.5	126	1	116-126	3A	5
GSW-013	GW Monitor	6/27/86	198	134.5	1	125-134.5	3A	NA
GSW-016	GW Monitor	10/19/87	146	145	1	23-28	1B	NA
					2	38-43	1B	NA
					3	50-55	2	NA
					4	61-66	2	NA
					5	78-83	2	NA
					6	95-105	2	NA
					7	120-130	3A	NA
GSW-215	GW Monitor	4/22/86	214	133.5	1	127-133.5	3A	6
GSW-216	GW Monitor	5/9/86	193	120.5	1	110.5-120.5	3A	7
GSW-266	GW Monitor	5/8/86	220	166	1	159-166	3B	3
GSW-326	GW Monitor	10/2/87	230	134	1	129-134	4	NA
GSW-367	GW Monitor	4/29/87	159	124	1	114-124	2	7
GSW-442	GW Monitor	10/27/87	270	145	1	138-145	3A	1
GSW-443	GW Monitor	11/9/87	291	141	1	123-141	2	5
GSW-444	GW Monitor	11/20/87	278	120	1	110-120	3B	NA
GSW-445	GW Monitor	12/9/87	319	161	1	155-161	4	3
HW-GP-001	GW Monitor	4/16/92	120	113	NA	NA	NA	NA
HW-GP-002	GW Monitor	5/11/94	120	117	NA	NA	NA	NA
HW-GP-003	GW Monitor	5/18/92	119	119	NA	NA	NA	NA
HW-GP-102	GW Monitor	8/13/93	140	137.5	1	70-132.5	NA	NA
HW-GP-103	GW Monitor	8/23/93	138	137.5	1	71.5-131.5	NA	NA

Table A-1. Well construction data, LLNL Livermore Site and vicinity, Livermore, California.

Well	Well type	Date Completed	Borehole depth (ft)	Casing depth (ft)	Screen position	Screen interval (ft)	HSU	Initial flow rate (gpm)
HW-GP-104	GW Monitor	9/2/93	138	137.2	1	72.2-132.5	NA	NA
HW-GP-105	GW Monitor	9/28/93	138	137.5	1	72.5-132.5	NA	NA
GSP-SNL-001	GW Monitor	1/8/92	147	131	1	99-104	NA	NA
HW-SNL-002	GW Monitor	NA	NA	NA	NA	NA	NA	NA
HW-SNL-003	GW Monitor	NA	NA	NA	NA	NA	NA	NA
MW-NLF-1	GW Monitor	3/13/91	26	NA	1	NA	NA	NA
MW-NLF-2	GW Monitor	3/13/91	NA	NA	1	NA	NA	NA
MW-NLF-3	GW Monitor	3/13/91	20	NA	1	NA	NA	NA
MW-NLF-4	GW Monitor	3/13/91	26	NA	1	NA	NA	NA
MW-NLF-20	GW Monitor	NA	NA	NA	1	NA	NA	NA
MW-NLF-21	GW Monitor	NA	NA	NA	1	NA	NA	NA
MW-NLF-22	GW Monitor	NA	NA	NA	1	NA	NA	NA
					2	118-131	NA	NA
SNL-1B	Piezometer	NA	NA	NA	1	NA	NA	NA
SNL-2A	Piezometer	NA	NA	NA	1	NA	NA	NA
SNL-4D	Piezometer	NA	NA	NA	1	NA	NA	NA
MW-SNL-20B	GW Monitor	6/28/84	140	140	1	90-105	NA	NA
MW-SNL-20C	GW Monitor	7/16/84	165	156	1	140-155	NA	NA
11C1	GW Monitor	6/8/76	68	66	1	56.2-61.2	1B	1
11J2	GW Monitor	4/26/79	112	112	1	90-92	1B	5
					2	102-108	2	5
11JD2	GW Monitor	NA	NA	NA	NA	NA	NA	NA
14A11	Water-supply (pumping)	12/20/83	NA	NA	NA	NA	NA	NA
14A3	GW Monitor	12/7/77	110	110	1	100-105	1B	NA
14B1	Water-supply (pumping)	8/13/59	300	300	1	146-149	2	NA
					2	192-195	3A	NA
					3	209-213	3A	NA
14B4	Water-supply (pumping)	8/1/60	260	260	1	143-148	2	NA
					2	155-159	2	NA
					3	186-189	3A	NA
					4	205-215	3A	NA
					5	245-250	4	NA
14B7	GW Monitor	8/25/87	NA	NA	NA	NA	NA	NA
14C2	Water-supply (pumping)	1/7/88	217	NA	1	135-150	2	NA

Table A-1. Well construction data, LLNL Livermore Site and vicinity, Livermore, California.

Well	Well type	Date Completed	Borehole depth (ft)	Casing depth (ft)	Screen position	Screen interval (ft)	HSU	Initial flow rate (gpm)
14C3	Water-supply (pumping)	1/19/88	405	NA	1	160-388	2/3A/ 3B/4/5	NA
14H1	GW Monitor	12/21/83	NA	288	1	0-288	NA	NA
14H2	GW Monitor	8/28/87	NA	NA	NA	NA	NA	NA
14JD1	GW Monitor	NA	NA	NA	NA	NA	NA	NA
14K1	GW Monitor	NA	372	361	1	153-157	NA	NA
					2	193-202	NA	NA
					3	217-251	NA	NA
					4	279-290	NA	NA
					5	300-336	NA	NA
					6	345-349	NA	NA
					7	354-361	NA	NA
15A3	GW Monitor	NA	NA	NA	NA	NA	NA	NA
15A5	GW Monitor	NA	NA	NA	NA	NA	NA	NA
15A8	GW Monitor	NA	NA	NA	NA	NA	NA	NA
15B1	GW Monitor	6/24/49	423	NA	NA	NA	NA	NA
18D1	Water-supply (pumping)	4/20/84	NA	NA	1	NA	7	12
2J1	GW Monitor	NA	NA	NA	NA	NA	NA	NA
2J2	GW Monitor	1/4/90	NA	NA	1	NA	NA	NA
2K3	GW Monitor	3/6/91	35	NA	1	NA	NA	NA
2K4	GW Monitor	3/6/91	35	NA	1	NA	1B	NA
2Q2	GW Monitor	3/6/91	40	NA	1	NA	1B	NA
2R3	GW Monitor	3/5/91	37	NA	1	NA	1B	NA
2R4	GW Monitor	3/5/91	37	NA	1	NA	NA	NA
2R5	GW Monitor	NA	37	NA	NA	NA	NA	NA
2R8	GW Monitor	3/6/91	40	NA	1	NA	1B	NA
3S1E-1P2	Water-supply (pumping)	10/7/60	144	NA	NA	NA	NA	NA
3S2E-16B1	Water-supply (pumping)	7/1/44	410	NA	NA	NA	NA	NA
3S2E-16C1	Water-supply (pumping)	2/18/58	584	NA	NA	NA	NA	NA
3S2E-7C2	Water-supply (pumping)	NA	NA	NA	NA	NA	NA	NA
3S2E-8P1	Water-supply (pumping)	NA	NA	NA	NA	NA	NA	NA
3S2E-9Q1	Water-supply (pumping)	12/21/51	576	NA	NA	NA	NA	NA
7D2	GW Monitor	6/7/76	74	72	1	63-68	3A	NA

Notes and footnotes appear on the following page.

Table A-1. Well construction data, LLNL Livermore Site and vicinity, Livermore, California.**Notes.**

- ft = Feet.
- gpm = Gallons per minute.
- GW = Ground Water.
- HSU = Hydrostratigraphic Units.
- IMS = Instrumented Membrane Systems.
- NA = Not available.
- SV = Soil Vapor.

In wells with more than one screen, the screen positions are numbered consecutively downward within a single well. Well numbers ending in A and B, indicate two wells installations in the same borhole. The "A" refers to the shallow well and "B" refers to the deeper well.

Hydrostratigraphic Units (HSUs) are numbered consecutively downward from ground surface. An HSU is defined as sediments that are grouped together based on their hydrogeologic and contaminant transport properties. The permeable layers within an HSU are considered to be in good hydraulic communication, whereas permeable layers in different HSUs are considered to be in poor hydraulic communication. HSU contacts are interpreted and are periodically revised based on new data.

Well numbers were changed in December 1988 to be consistent with Alameda County Flood Control and Water Conservation District, Zone 7 well identification. Well number changes made on this table are:

4A6 -----> 14H2
 18D81 -----> 18D1
 14A84 -----> 14A11

Wells installed for the Dynamic Underground Stripping Demonstration Project include extraction wells (GEW series), injection wells (GIW series), gasoline spill piezometer (GSP series), and heating wells (HW series).

A FLUTE liner was installed to monitor ground water chemistry in multiple HSUs. Instrumented Membrane Systems were installed in the vadose zone to measure moisture content, pressure, temperature, and VOCs.

Piezometer SVI-518-303 was drilled out and replaced by SVW-518-1915.

Table A-2. Well closure data, LLNL Livermore Site and vicinity, Livermore, California.

Well number	Well type	Date installed	Borehole depth (ft)	Casing depth (ft)	Screen interval(s) (ft)	HSU monitored	Closure date
11A1	Other non-LLNL	8-Jun-76	66	64.7	54.7-59.7	NA	18-Aug-88
11BA ^a	Other non-LLNL	2-Mar-87	NA	NA	NA	NA	10-Jun-87
11H1	Other non-LLNL	4-Nov-41	NA	519	157-161 169-177 224-228 243-245 254-256 306-314 319-327 339-342 414-419 424-431 477-479	2/3A/4/5/6/7	31-Oct-88
11H4	Other non-LLNL	5-Apr-60	272	272	166-170 174-176 183-185 200-202 211-214 224-230 250-252 260-265	3/4/5	7-Oct-88
11J1	Other non-LLNL	1-Jan-41	160	160	NA	2	3-Aug-88
11J4	Other non-LLNL	1-Jan-65	NA	NA	NA	NA	11-Oct-88
11K1	Other non-LLNL	6-Jan-42	621	621	247-255 272-276 297-304 322-339 554-557 580-602	4/5/6	26-Sep-88
11K2	Other non-LLNL	NA	NA	232	NA	NA	3-Oct-88
11Q2	Other non-LLNL	20-Dec-83	NA	264	NA	NA	16-Aug-88
11Q3	Other non-LLNL	20-Dec-83	NA	120	NA	NA	10-Aug-88
11Q6	Other non-LLNL	20-Dec-83	NA	280	NA	NA	11-Jan-89
11R3	Other non-LLNL	8-May-61	140	117	NA	NA	3-Sep-85
11R4	Other non-LLNL	28-Oct-58	268	NA	165-177 252-258	NA	3-Sep-85
11R5	Other non-LLNL	19-Dec-83	NA	NA	NA	NA	26-Jul-85

Table A-2. Well closure data, LLNL Livermore Site and vicinity, Livermore, California.

Well number	Well type	Date installed	Borehole depth (ft)	Casing depth (ft)	Screen interval(s) (ft)	HSU monitored	Closure date
12M1	Other non-LLNL	12-Sep-42	702	702	375-657 420-426 452-473 560-564 609-621 626-657		14-Apr-84
12N1	Other non-LLNL	14-Apr-42	702	NA	392-399 478-483 492-496 514-518 527-536 666-670 678-681	7	24-Jan-89
13D1	Other non-LLNL	29-Oct-56	402	400	200-400	3B/4/5/6	23-Aug-88
14A1	Other non-LLNL	12-Jul-43	246	227	102-107 113-119 144-148 176-179 188-190 192-194 219-222 223-227	NA NA NA NA NA NA NA NA	13-Sep-88
14A2	Other non-LLNL	15-Nov-56	229	229	122-130 140-150 160-180	2/3A	12-Sep-88
14A4	Other non-LLNL	15-Jun-59	252	248	167-170 175-179 192-202 235-246	3/4	29-Aug-88
14A8	Other non-LLNL	NA	NA	86	NA	NA	22-Jul-88
14B2	Other non-LLNL	22-Aug-56	312	312	185-312	3A/3B/4/5	11-Nov-88
14B8	Other non-LLNL	3-May-88	385	306	NA	NA	NA
1N1	Other non-LLNL	15-Jan-88	600	600	427-442 450-453 465-469 500-515 575-588	7	21-Oct-88
2R9 (11A5)	Other non-LLNL	NA	NA	NA	NA	NA	19-Jul-88
GEW-711	Extraction	24-May-91	167.5	157	94-137	3A/3B	16-Jun-92
GSW-001	Monitor	5-Feb-85	112	109	85-106	2	6-Jun-86

Table A-2. Well closure data, LLNL Livermore Site and vicinity, Livermore, California.

Well number	Well type	Date installed	Borehole depth (ft)	Casing depth (ft)	Screen interval(s) (ft)	HSU monitored	Closure date
GSW-001A	Monitor	12-Jun-86	208	133	115-133	3A	NA
GSW-002	Monitor	14-Feb-85	113	107	87-107	2	NA
GSW-003	Monitor	7-Feb-85	115	105	85-105	2	NA
GSW-005	Monitor	19-Mar-85	110	104	94-104	2	NA
GSW-010	Monitor	29-Apr-86	205.5	127.5	114-127.5	3A	28-Jan-98
GSW-012	Monitor	27-May-86	205	191	186.5-191	5	NA
GSW-015	Monitor	14-Aug-87	148	145	20.5-28 38-44 50-56 60-64 68-73 77-83 95-105 120-130	2/3A	NA
GSW-020	Monitor	18-May-84	134	101.3	95-101.3	2	3-Sep-87
GSW-208	Monitor	6-Feb-86	211	123	108-118	3A	NA
GSW-209	Monitor	27-Feb-86	204	135.2	112.8-132.8	3A	15-Aug-94
GSW-403-6	Monitor	11-May-84	138	100	90-110	2	NA
SIP-419-201	Monitor	29-Feb-96	126	107	97-107	3A/3B	NA
SIP-490-101	Piezometer	1-Nov-95	59	56	53-56	2	21-Dec-95
SIP-514-101	Piezometer	28-Dec-89	26	22	7-22	1B	3-Sep-96
SVI-518-303	Monitor	29-Jun-95	104.5	40	6-40	1B	NA
SIP-ETC-302	Piezometer	22-Apr-99	104	89.4	79-89	2	26-Apr-99
SIP-ETS-105	Piezometer	11-Dec-90	110	103	87-103	3A	6-Dec-93
SIP-ETS-207	Piezometer	11-Jul-91	103	98.5	89.75-98.5	3A	5-Jan-00
SIP-HPA-102	Piezometer	8-Dec-94	76	72	67-72	2	9-Apr-02
SIP-HPA-103	Piezometer	1-Mar-95	77	73.5	67-72.5	2	9-Apr-02
SIP-PA-029	Piezometer	22-Jan-90	11.5	7	5-7	1B	18-Nov-93
UP-292-001	Piezometer	7-Jan-91	54.5	49.5	44.5-49.5	1B	25-Sep-95
W-010A	Monitor	8-Sep-80	110.7	110	85-95 100-105	2	26-Feb-02
W-014A	Monitor	26-Aug-80	112.8	109	79 94 104	2	11-Dec-87
W-015	Monitor	17-Nov-80	285	267	239-265	7	13-May-88
W-018	Monitor	22-Aug-80	161	152	80-90 100-105 112-117 128-133 143-152	2 3A 5 5	11-Nov-85

Table A-2. Well closure data, LLNL Livermore Site and vicinity, Livermore, California.

Well number	Well type	Date installed	Borehole depth (ft)	Casing depth (ft)	Screen interval(s) (ft)	HSU monitored	Closure date
W-019	Monitor	19-Sep-80	164.8	161	147-157	7	7-Jun-06
W-149	Monitor	23-Aug-85	201	169	161-169	2	3-Sep-96
W-150	Monitor	13-Sep-85	212	162	157-162	2	11-Apr-90
W-211	Monitor	19-Mar-86	215.5	193	183-193	7	13-Jun-02
W-352	Monitor	29-Oct-86	235	201	181-201	4	5-Jan-98
W-358	Monitor	4-Feb-87	248	239	230-239	7	13-Apr-94
W-360	Monitor	24-Feb-87	260	204.5	181.5-204.5	4	26-Feb-02
W-414	Monitor	20-May-88	179	74	69.5-74	2	26-Feb-02
W-456	Monitor	9-Jun-88	343	180.5	172-180.5	3A	15-Nov-00
W-460	Monitor	22-Jul-88	361	140.5	135-140.5	2	15-Nov-00
W-508	Monitor	17-Feb-89	316	306	287-305	7	NA
W-591	Monitor	29-Nov-88	112	107.5	97-107.5	2	18-Apr-06
W-1005	Monitor	14-Mar-94	192	110	98-110	1B	13-Nov-00
W-1006	Monitor	10-Mar-94	154	149	141-149	2	14-Nov-00
W-1007	Monitor	31-Mar-94	199.5	182	172-182	3A	14-Nov-00
W-1114	Monitor	7-Aug-95	223	205	177-200	5	23-Apr-97
W-1218	Monitor	29-May-96	240	145.5	127-145	3A	27-Feb-02
W-1220	Monitor	12-Jun-96	120	117	90-112	2	27-Feb-02
W-1221	Monitor	1-Jul-96	220	172	162-172	4	28-Feb-02
TEP-GP-001	Dynamic Stripping	21-Jan-92	165	97	87-97	2	9-Feb-93
				117	107-117	2/3A	
				160.5	NA	NA	
TEP-GP-002	Dynamic Stripping	24-Jun-92	161.4	NA	102-112.5	2/3A	13-Feb-93
				133	122-133	3A	
				161	NA	NA	
TEP-GP-003	Dynamic Stripping	28-Jan-92	161	129.5	124.5-129.5	3A	13-Feb-93
				161	NA	NA	
TEP-GP-004	Dynamic Stripping	5-Feb-92	161	106	96-106	2	13-Feb-93
				134	124-134	3A	
				161	NA	NA	
TEP-GP-005	Dynamic Stripping	18-Feb-92	161	124.5	114.5-124.5	3A	13-Feb-93
				161	NA	NA	
TEP-GP-006	Dynamic Stripping	26-Feb-92	161	127	107-127	2/3A	13-Feb-93
				161	NA	NA	
TEP-GP-007	Dynamic Stripping	13-Mar-92	161	125.5	115.5-125.5	3A	13-Feb-93
				161	NA	NA	
TEP-GP-008	Dynamic Stripping	3-Mar-92	161	110	100-110	2	13-Feb-93
				129	119-129	3A	
				161	NA	NA	

Table A-2. Well closure data, LLNL Livermore Site and vicinity, Livermore, California.

Well number	Well type	Date installed	Borehole depth (ft)	Casing depth (ft)	Screen interval(s) (ft)	HSU monitored	Closure date
TEP-GP-009	Dynamic Stripping	6-May-92	161.7	107 130.5 161	98-107 120.5-130.5 NA	2 3A NA	13-Feb-93
TEP-GP-010	Dynamic Stripping	24-Mar-92	161	124.5 161	114.5-124.5 NA	3A NA	12-Feb-93
TEP-GP-011	Dynamic Stripping	7-Apr-92	161	108 161	98-108 NA	2 NA	13-Feb-93
TEP-GP-106	Dynamic Stripping	21-Sep-93	137.5	135.5	NA	NA	NA
CPRS-02	Anode Well	NA	290	NA	NA	NA	
CPRS-03 (B482)	Anode Well	NA	180	NA	NA	NA	26-Sep-03
CPRS-06 (B543)	Anode Well	NA	NA	NA	NA	NA	29-Aug-06
CPS-1-325CT (B323)	Anode Well	24-Feb-77	290	NA	NA	NA	30-Oct-03
CPS-622	Anode Well	14-Feb-77	290	NA	NA	NA	15-Jan-04
CPS SC-5	Anode Well	NA	290	NA	NA	NA	21-Jul-05
W-1218	Monitor	29-May-96	240	145.5	127-145	3A	27-Feb-02
W-1220	Monitor	12-Jun-96	120	117	90-112	2	27-Feb-02
W-1221	Monitor	1-Jul-96	220	172	162-172	4	28-Feb-02

Notes appear on following page.

Table A-2. Well closure data, LLNL Livermore Site and vicinity, Livermore, California.**Notes:**

ft = Feet.

HSU = Hydrostratigraphic unit.

NA = Not available.

Well numbers were changed in December 1988 to be consistent with Alameda County Flood Control and Water Conservation District, Zone 7 well identification. Well number changes made on this table are:

11J81 -----> J4

11R81 -----> R5

11Q81 -----> Q6

13D81 -----> D1

14A81 -----> A1

14A82 -----> A2

14A83 -----> A4

Well 11A5 was renamed 2R9 by the Alameda County Flood Control and Water Conservation District, Zone 7 in November 1997. Well 11A5 now applies to monitor well W-409.

"Other non-LLNL" refers to agricultural, private or agency wells.

Piezometer SVI-518-303 was drilled out and replaced by well SVW-518-1915.

Temperature monitoring wells (TEP series) consist of a blank fiberglass 2-in. inside diameter (ID) casing instrumented with geophysical sensors. The blank fiberglass casing has no screened interval. Some boreholes also had one or two 1-inch piezometers installed adjacent to the blank casing. Therefore, the casing depths with accompanying screened intervals refer to the piezometers.

^a Well 11BA not recognized by Alameda County Flood Control and Water Conservation District, Zone 7.

Appendix B
Hydraulic Test Results

Table B-1. Results of hydraulic tests^a.

Well	Date	Type of test ^b	Flow rate (Q) (gpm)	Transmissivity (T) (gpd/ft)	Hydraulic conductivity (K) ^c (gpd/sq ft)	Data quality ^d
W-001	1-Dec-83	Drawdown	5.7	2,000	110	Fair
W-001	23-Jan-85	Drawdown	7.1	3,100	170	Good
W-001A	22-Jan-85	Drawdown	1.4	190	19	Good
W-002	1-Dec-83	Slug	NA	110	34	Poor
W-002A	24-Jan-85	Drawdown	10.3	2,700	200	Good
W-004	1-Dec-83	Drawdown	3.3	63	13	Good
W-005	1-Dec-83	Drawdown	4.3	110	20	Good
W-005	24-Jan-85	Drawdown	7.9	1,100	210	Fair
W-005A	23-Jan-85	Drawdown	13.0	1,300	130	Poor
W-007	1-Dec-83	Slug	NA	43	14	Fair
W-008	1-Dec-83	Drawdown	2.9	29	4.9	Fair
W-011	1-Dec-83	Drawdown	4.1	130	15	Good
W-017	1-Dec-83	Slug	NA	38	2.5	Good
W-017	21-Feb-86	Slug	NA	85	5.7	Good
W-018	1-Dec-83	Drawdown	2.6	20	2.7	Poor
W-102	25-Mar-86	Drawdown	6.4	1,100	76	Good
W-102	5-Sep-86	Drawdown	24.0	770	53	Good
W-102	15-Sep-86	Longterm	27.5	4,200	290	Good
W-103	25-Apr-86	Drawdown	6.7	15,000	1,500	Good
W-104	3-Mar-88	Drawdown	5.4	1,200	170	Fair
W-104	25-Mar-88	Drawdown	3.3	450	45	Fair
W-105	6-Apr-87	Drawdown	0.8	73	7.3	Fair
W-106	19-Feb-86	Slug	NA	7.4	1.3	Excel
W-107	17-Jun-85	Drawdown	1.0	94	9.4	Poor
W-108	29-Oct-85	Drawdown	7.9	750	63	Poor
W-109	5-Mar-86	Drawdown	8.1	3,200	530	Good
W-109	4-Sep-87	Drawdown	20.0	1,600	270	Good
W-109	29-Sep-87	Longterm	11.6	130	22	Fair
W-109	16-Oct-87	Drawdown	8.0	2,300	380	Fair
W-110	18-Jun-85	Drawdown	5.0	1,300	130	Good
W-111	13-Jun-85	Drawdown	1.0	370	37	Good
W-111	21-Nov-85	Drawdown	1.0	370	37	Good
W-112	18-Nov-86	Drawdown	13.4	2,100	170	Fair
W-112	15-Dec-86	Longterm	13.2	3,100	260	Fair
W-112	5-Nov-96	Longterm	13.7	3,300	260	Fair
W-113	17-Apr-86	Slug	NA	7.4	1.2	Excel
W-115	5-Mar-86	Drawdown	1.1	180	30	Good
W-116	24-Dec-85	Slug	NA	37	7.5	Good

Table B-1. Results of hydraulic tests^a.

Well	Date	Type of test ^b	Flow rate (Q) (gpm)	Transmissivity (T) (gpd/ft)	Hydraulic conductivity (K) ^c (gpd/sq ft)	Data quality ^d
W-117	20-Feb-86	Slug	NA	2	0.4	Good
W-118	5-Mar-86	Drawdown	10.0	2,100	230	Good
W-119	8-Aug-85	Drawdown	2.0	1,600	110	Good
W-120	22-Apr-86	Drawdown	1.1	23	5.6	Poor
W-121	10-Sep-85	Drawdown	2.0	120	7.5	Good
W-121	23-Sep-85	Drawdown	4.0	23	1.5	Excel
W-121	14-Oct-85	Drawdown	3.0	34	2.2	Excel
W-121	15-Oct-85	Drawdown	4.5	45	3.0	Excel
W-122	28-Oct-85	Drawdown	10.8	490	49	Good
W-123	28-Oct-85	Drawdown	5.8	40	4.4	Poor
W-142	3-Mar-88	Slug	NA	2,600	330	Excel
W-143	3-Mar-88	Slug	NA	1,200	240	Excel
W-149	9-Sep-85	Drawdown	4.0	120	19	Good
W-149	11-Sep-85	Drawdown	8.0	95	16	Excel
W-149	11-Oct-85	Drawdown	4.8	58	9.7	Excel
W-149	11-Oct-85	Drawdown	7.0	70	12	Good
W-150	2-Oct-85	Drawdown	3.1	640	210	Fair
W-150	3-Oct-85	Drawdown	6.0	720	240	Fair
W-150	10-Oct-85	Drawdown	8.8	630	210	Fair
W-150	10-Oct-85	Drawdown	12.0	620	210	Fair
W-151	28-Oct-85	Drawdown	5.8	550	61	Poor
W-201	5-Mar-86	Drawdown	10.0	740	86	Excel
W-203	2-Mar-88	Drawdown	6.6	1,100	110	Good
W-204	23-Jan-86	Drawdown	1.9	100	15	Fair
W-205	14-Feb-86	Slug	NA	5.9	1.9	Good
W-205	18-Feb-86	Slug	NA	5.9	1.9	Good
W-206	14-Apr-86	Slug	NA	120	11	Good
W-207	2-Mar-88	Slug	NA	380	32	Excel
W-210	9-Jun-86	Slug	NA	0.6	0.1	Good
W-211	22-Oct-86	Drawdown	2.9	37	12	Fair
W-211	8-Dec-86	Longterm	1.0	44	15	Fair
W-211	16-Sep-97	Longterm	1.1	14	1.4	Good
W-212	12-May-86	Drawdown	0.8	18	3.1	Poor
W-213	22-Apr-86	Drawdown	3.8	190	38	Good
W-214	7-Oct-86	Longterm	27.6	2,300	350	Good
W-217	15-Jul-86	Slug	NA	750	120	Good
W-218	17-Jun-86	Drawdown	11.7	6,400	1,100	Good
W-218	12-Nov-86	Longterm	7.7	4,000	670	Good

Table B-1. Results of hydraulic tests^a.

Well	Date	Type of test ^b	Flow rate (Q) (gpm)	Transmissivity (T) (gpd/ft)	Hydraulic conductivity (K) ^c (gpd/sq ft)	Data quality ^d
W-219	15-Jul-86	Drawdown	4.3	620	76	Good
W-219	23-Feb-87	Longterm	5.2	66	8.0	Fair
W-220	21-Aug-86	Slug	NA	28	5.5	Excel
W-221	5-Aug-86	Drawdown	2.1	120	16	Fair
W-222	12-Aug-86	Drawdown	16.0	1,700	160	Excel
W-222	8-Mar-85	Longterm	7.7	1,100	180	Good
W-223	27-Aug-86	Drawdown	4.0	510	110	Good
W-224	28-Oct-86	Drawdown	7.6	3,600	400	Excel
W-225	23-Oct-86	Drawdown	4.0	85	11	Good
W-225	12-Jan-87	Longterm	2.0	62	8.5	Fair
W-226	31-Mar-87	Slug	NA	1,700	160	Fair
W-252	4-Nov-85	Drawdown	4.0	920	50	Fair
W-252	19-Nov-85	Drawdown	5.6	800	43	Fair
W-254	27-Jan-86	Drawdown	4.2	340	38	Fair
W-254	27-Feb-86	Drawdown	3.2	370	41	Good
W-255	21-Jan-86	Drawdown	5.0	2,800	250	Fair
W-255	21-Jan-86	Drawdown	6.0	2,000	180	Fair
W-255	6-Jan-87	Longterm	2.0	400	36	Fair
W-256	11-Apr-86	Slug	NA	11	5.5	Good
W-257	15-Apr-86	Slug	NA	120	24	Good
W-258	5-Jun-86	Slug	NA	35	9.0	Excel
W-258	29-Oct-86	Slug	NA	32	8.0	Good
W-259	26-Mar-88	Slug	NA	15	5.0	Good
W-260	25-Mar-86	Drawdown	3.0	140	22	Good
W-260	1-Oct-86	Longterm	1.4	120	18	Good
W-261	27-May-86	Slug	0.0	7	2.3	Excel
W-262	11-Apr-86	Drawdown	12.5	2,000	250	Excel
W-262	23-Sep-86	Longterm	22.0	2,750	340	Good
W-262	27-Apr-87	Longterm	23.1	6,800	810	Good
W-263	22-Apr-86	Drawdown	1.2	37	7.4	Poor
W-263	4-Nov-86	Longterm	1.8	76	15	Excel
W-264	7-May-86	Drawdown	8.1	930	100	Good
W-264	29-Oct-86	Longterm	23.0	480	50	Good
W-265	19-May-86	Drawdown	0.7	180	34	Fair
W-267	2-Jun-86	Drawdown	0.5	420	85	Poor
W-268	14-Nov-86	Drawdown	5.0	230	18	Good
W-269	14-Jul-86	Drawdown	5.0	570	95	Good
W-270	30-Dec-86	Slug	NA	14	2.0	Good

Table B-1. Results of hydraulic tests^a.

Well	Date	Type of test ^b	Flow rate (Q) (gpm)	Transmissivity (T) (gpd/ft)	Hydraulic conductivity (K) ^c (gpd/sq ft)	Data quality ^d
W-271	4-Aug-86	Drawdown	5.5	340	76	Fair
W-272	19-Aug-86	Drawdown	0.8	150	30	Fair
W-273	27-Aug-86	Drawdown	3.2	600	90	Good
W-274	25-Mar-85	Slug	NA	38	7.6	Fair
W-274	2-Feb-99	Slug	NA	10	2	Fair
W-275	30-Oct-86	Drawdown	7.0	730	150	Fair
W-275	2-Mar-87	Longterm	5.5	830	170	Fair
W-276	21-Nov-86	Drawdown	13.0	960	110	Good
W-276	04-May-87	Longterm	24.0	2,700	300	Fair
W-277	3-Nov-86	Drawdown	0.9	74	25	Fair
W-290	5-Jan-87	Slug	NA	14	4.0	Excel
W-291	27-Jan-87	Slug	NA	25	7.1	Fair
W-292	28-Aug-86	Drawdown	6.0	400	56	Excel
W-294	29-Dec-86	Drawdown	5.3	5,300	29	Fair
W-294	29-Dec-86	Drawdown	5.9	5,400	300	Good
W-301	30-Oct-86	Drawdown	6.0	460	100	Good
W-302	18-Nov-86	Drawdown	1.0	100	27	Good
W-302	18-Nov-86	Drawdown	2.0	76	21	Fair
W-303	12-Nov-86	Drawdown	11.1	210	70	Good
W-304	13-Mar-87	Drawdown	0.9	74	25	Fair
W-305	26-Nov-86	Drawdown	19.0	720	72	Excel
W-305	18-May-87	Longterm	20.1	640	64	Excel
W-306	31-Mar-87	Drawdown	9.5	270	68	Good
W-307	26-Mar-87	Drawdown	0.9	66	33	Fair
W-308	4-Dec-87	Drawdown	2.6	27	5.4	Good
W-310	17-Feb-87	Drawdown	6.7	58	850	Good
W-311	19-Mar-87	Drawdown	9.8	130	12	Good
W-311	17-Nov-87	Longterm	9.9	370	26	Good
W-312	27-Mar-87	Drawdown	20.5	1,800	300	Poor
W-312	3-Nov-87	Longterm	18.8	1,700	280	Good
W-313	25-Mar-87	Drawdown	7.9	3,000	600	Good
W-313	5-Oct-87	Longterm	9.6	3,400	680	Good
W-314	10-Apr-87	Drawdown	26.4	2,900	390	Good
W-314	13-Jul-87	Longterm	13.6	2,500	330	Fair
W-314	14-Oct-97	Longterm	12	1,400	100	Fair
W-315	9-Apr-87	Drawdown	15.4	150	11	Good
W-315	5-Jan-85	Longterm	24.5	571	41	Excel
W-316	4-May-87	Drawdown	7.8	1,400	280	Good

Table B-1. Results of hydraulic tests^a.

Well	Date	Type of test ^b	Flow rate (Q) (gpm)	Transmissivity (T) (gpd/ft)	Hydraulic conductivity (K) ^c (gpd/sq ft)	Data quality ^d
W-317	12-May-87	Drawdown	12.1	300	43	Fair
W-317	15-Dec-87	Longterm	8.2	120	17.1	Good
W-318	7-Aug-87	Slug	NA	120	16	Good
W-319	29-Jul-87	Drawdown	48.0	7,200	1,500	Good
W-320	15-May-87	Drawdown	1.8	58	17	Fair
W-320	15-May-87	Drawdown	3.0	22	3.7	Fair
W-320	26-Jun-87	Drawdown	2.1	49	14	Fair
W-321	28-Jul-87	Drawdown	40.0	6,600	450	Good
W-322	3-Aug-87	Drawdown	3.1	85	15	Good
W-323	11-Aug-87	Drawdown	3.4	205	59	Good
W-324	10-Sep-87	Drawdown	6.6	200	50	Good
W-325	10-Sep-87	Drawdown	6.0	160	13	Excel
W-351	12-Nov-86	Drawdown	5.7	27	14	Poor
W-352	30-Dec-86	Drawdown	20.0	280	14	Good
W-352	7-Jul-87	Longterm	19.5	120	6.0	Excel
W-353	20-Nov-86	Drawdown	2.1	60	17	Good
W-354	30-Dec-86	Drawdown	17.6	2,000	220	Fair
W-354	30-Dec-86	Drawdown	18.0	2,400	260	Good
W-354	20-Apr-87	Longterm	17.8	310	34	Good
W-355	29-Dec-86	Drawdown	2.1	19	5.0	Fair
W-356	17-Mar-87	Drawdown	5.7	180	59	Good
W-356	16-Jul-96	Longterm	4.9	230	57	Poor
W-357	18-Feb-87	Drawdown	15.0	1,300	110	Good
W-357	21-Jul-87	Longterm	9.2	210	18	Good
W-358	18-Mar-87	Drawdown	9.2	210	32	Excel
W-359	9-Mar-87	Longterm	19.0	2,800	290	Fair
W-359	20-Mar-87	Drawdown	18.6	1,100	110	Good
W-360	22-May-87	Drawdown	30.0	4,800	210	Excel
W-361	16-Mar-87	Drawdown	4.3	67	11	Good
W-361	12-Jan-85	Longterm	5.3	178	30	Good
W-362	23-Mar-87	Drawdown	16.4	470	49	Good
W-362	21-Sep-87	Longterm	13.6	370	39	Good
W-363	24-Jul-87	Slug	NA	20	3.0	Excel
W-364	8-Apr-87	Drawdown	8.6	51	10	Fair
W-364	1-Jun-87	Longterm	4.8	110	22	Good
W-365	14-May-87	Drawdown	10.0	36	15	Fair
W-366	11-May-87	Drawdown	19.0	780	92	Fair
W-368	11-May-87	Drawdown	2.9	81	8.5	Fair

Table B-1. Results of hydraulic tests^a.

Well	Date	Type of test ^b	Flow rate (Q) (gpm)	Transmissivity (T) (gpd/ft)	Hydraulic conductivity (K) ^c (gpd/sq ft)	Data quality ^d
W-368	31-Jul-01	Step	6.0	2,600	350	Fair
W-369	25-Jun-87	Drawdown	7.0	580	96	Good
W-369	10-Nov-87	Longterm	5.5	89	18	Good
W-370	23-Jun-87	Drawdown	4.4	84	10	Fair
W-371	24-Jun-87	Drawdown	3.3	15	3.0	Good
W-372	23-Nov-87	Slug	NA	310	62	Excel
W-373	28-Jul-87	Drawdown	4.0	660	77	Fair
W-373	28-Jul-87	Drawdown	6.5	50	6.0	Poor
W-376	26-Jan-88	Drawdown	2.9	65	8.5	Fair
W-380	23-Oct-87	Drawdown	4.0	33	4.7	Excel
W-401	23-Oct-87	Drawdown	42.0	950	24	Excel
W-402	22-Oct-87	Drawdown	41.0	13,500	1,400	Good
W-403	3-Dec-87	Drawdown	9.7	370	26	Good
W-404	4-Feb-85	Drawdown	45.0	3,200	530	Good
W-405	16-Feb-85	Drawdown	47.2	546	14	Good
W-406	28-Jan-85	Drawdown	7.4	7,500	940	Fair
W-407	23-Feb-85	Drawdown	14.4	75	7.5	Fair
W-408	5-Apr-85	Drawdown	45.0	43,000	3,100	Good
W-409	22-Mar-85	Drawdown	20.0	230	38	Good
W-410	28-Apr-85	Drawdown	35.0	6,800	570	Fair
W-411	5-May-85	Drawdown	14.0	50	83	Good
W-412	6-May-88	Drawdown	4.1	700	64	Fair
W-413	30-Aug-01	Drawdown	20.0	9,400	790	Good
W-414	27-Jul-85	Slug	NA	150	38	Good
W-415	31-Aug-85	Drawdown	10.0	3,100	78	Fair
W-416	11-Jul-85	Drawdown	50.0	2,600	330	Good
W-417	27Jun-88	Drawdown	5.3	340	57	Fair
W-420	16-Aug-85	Drawdown	3.5	710	100	Excel
W-421	12-Sep-85	Drawdown	4.8	320	27	Excel
W-422	19-Sep-85	Drawdown	8.6	230	42	Good
W-423	12-Oct-85	Drawdown	22.0	1,500	130	Good
W-424	17-Oct-85	Drawdown	4.5	130	19	Good
W-441	30-Oct-87	Drawdown	6.0	500	56	Good
W-441	13-Apr-88	Drawdown	13.0	2,200	240	Poor
W-441	19-Apr-88	Longterm	14.0	470	52	Good
W-447	26-Feb-88	Drawdown	7.1	124	850	Poor
W-448	24-Mar-85	Drawdown	24.5	4,200	600	Good
W-449	21-Mar-85	Drawdown	6.2	170	11	Good

Table B-1. Results of hydraulic tests^a.

Well	Date	Type of test ^b	Flow rate (Q) (gpm)	Transmissivity (T) (gpd/ft)	Hydraulic conductivity (K) ^c (gpd/sq ft)	Data quality ^d
W-450	14-Apr-88	Drawdown	3.3	38	650	Fair
W-451	27-Apr-88	Drawdown	2.1	80	16	Good
W-452	2-May-88	Drawdown	5.2	310	21	Excel
W-453	3-May-88	Drawdown	5.8	67	7.4	Fair
W-455	22-Jun-88	Drawdown	5.8	160	13	Good
W-456	14-Jul-85	Drawdown	4.5	260	33	Fair
W-457	29-Jul-85	Drawdown	20.5	450	24	Excel
W-458	2-Aug-85	Drawdown	0.8	24	150	Fair
W-460	1-Sep-85	Drawdown	17.0	1,900	380	Fair
W-461	7-Sep-85	Slug	NA	690	140	Good
W-462	27-Sep-85	Drawdown	19.0	360	60	Good
W-463	11-Oct-85	Drawdown	24.0	1,600	200	Good
W-464	8-Nov-88	Drawdown	9.0	370	53	Good
W-481	2-Dec-87	Drawdown	1.1	8	1.7	Good
W-486	23-Mar-85	Drawdown	6.0	230	30	Good
W-487	14-Apr-88	Drawdown	2.2	45	15	Good
W-501	21-Oct-85	Drawdown	9.7	170	21	Good
W-502	14-Nov-85	Slug	NA	12	30	Good
W-503	11-Nov-88	Drawdown	1.3	15	3.0	Fair
W-504	8-Dec-85	Drawdown	10.0	590	84	Good
W-505	21-Mar-89	Drawdown	34.2	653	76	Good
W-506	10-Feb-89	Drawdown	31.0	7,423	460	Good
W-507	6-Feb-89	Drawdown	39.0	2,900	290	Good
W-508	29-Mar-89	Drawdown	30.0	47,000	2,600	Good
W-509	11-May-89	Drawdown	0.9	10	2.0	Fair
W-510	11-May-89	Slug	NA	220	110	Good
W-511	11-May-89	Drawdown	1.7	63	11	Fair
W-512	27-Apr-89	Drawdown	2.9	85	9.4	Good
W-513	9-May-89	Drawdown	0.6	33	3.0	Fair
W-514	26-May-89	Drawdown	1.4	84	530	Fair
W-515	6-Jun-89	Drawdown	2.8	37	4.2	Fair
W-516	19-Jun-89	Drawdown	19.5	1,428	286	Good
W-517	27-Jun-89	Drawdown	7.3	370	53	Good
W-518	10-Aug-89	Drawdown	6.2	1,421	178	Good
W-519	31-Aug-89	Drawdown	31.5	5,700	475	Excel
W-520	24-Jan-90	Drawdown	22.8	3,300	560	Excel
W-521	1-Feb-90	Drawdown	0.6	44	4.9	Fair
W-522	5-Feb-90	Drawdown	20.0	3,700	620	Fair

Table B-1. Results of hydraulic tests^a.

Well	Date	Type of test ^b	Flow rate (Q) (gpm)	Transmissivity (T) (gpd/ft)	Hydraulic conductivity (K) ^c (gpd/sq ft)	Data quality ^d
W-551	8-Nov-85	Drawdown	37.0	350	88	Good
W-552	12-Dec-88	Drawdown	38.0	4,700	390	Good
W-553	17-Nov-85	Drawdown	2.2	55	7.9	Fair
W-554	10-Jan-89	Drawdown	21.5	1,800	150	Good
W-555	28-Dec-88	Drawdown	14.0	460	23	Fair
W-556	25-Jan-89	Drawdown	17.0	850	170	Fair
W-557	23-Jan-89	Drawdown	1.2	570	36	Poor
W-558	23-Mar-89	Drawdown	24.7	5,200	650	Good
W-560	8-Mar-89	Drawdown	1.7	30	7.6	Fair
W-561	13-Mar-89	Drawdown	1.1	12	2.1	Fair
W-562	28-Mar-89	Drawdown	1.0	16	2.3	Fair
W-563	31-Mar-89	Drawdown	1.1	14	2.3	Fair
W-564	26-Apr-89	Drawdown	1.6	44	5.0	Poor
W-565	18-Apr-89	Drawdown	15.6	1,600	260	Good
W-566	2-May-89	Drawdown	17.0	780	86	Good
W-566	31-Aug-93	Longterm	22.5	2,580	520	Fair
W-567	4-May-89	Drawdown	10.4	2,600	320	Excel
W-568	20-Jun-89	Drawdown	18.3	620	160	Fair
W-569	24-May-89	Drawdown	2.8	100	15	Fair
W-570	8-Jun-89	Drawdown	1.1	7	1.1	Fair
W-571	17-Jul-89	Drawdown	17.7	1,000	200	Excel
W-592	23-Jan-89	Drawdown	2.2	2,200	280	Poor
W-593	22-Feb-89	Drawdown	2.2	57	11.4	Good
W-594	16-Mar-89	Slug	NA	380	54	Excel
W-601	8-Feb-90	Drawdown	22.5	6,900	770	Excel
W-602	29-Jan-90	Drawdown	24.0	5,300	620	Good
W-603	7-Feb-90	Drawdown	6.1	100	20	Fair
W-604	20-Feb-90	Slug	NA	380	63	Good
W-605	28-Feb-90	Drawdown	4.8	50	12	Good
W-606	21-Feb-90	Slug	NA	120	20	Fair
W-607	22-Feb-90	Drawdown	1.4	800	100	Good
W-608	28-Feb-90	Drawdown	1.2	230	30	Fair
W-609	9-Mar-90	Drawdown	6.7	470	70	Good
W-610	28-Mar-90	Drawdown	5.8	5,500	380	Good
W-611	16-Apr-90	Drawdown	3.5	1,000	110	Fair
W-612	24-May-90	Drawdown	13.5	550	55	Good
W-612	5-Apr-94	Longterm	14	230	40	Good
W-613	23-May-90	Drawdown	4.8	2,550	360	Good

Table B-1. Results of hydraulic tests^a.

Well	Date	Type of test ^b	Flow rate (Q) (gpm)	Transmissivity (T) (gpd/ft)	Hydraulic conductivity (K) ^c (gpd/sq ft)	Data quality ^d
W-614	7-Jun-90	Drawdown	6.7	1,650	130	Good
W-615	21-Jun-90	Drawdown	1.3	130	19	Fair
W-616	27-Jun-90	Drawdown	2.0	390	40	Fair
W-617	12-Jul-90	Drawdown	2.8	53	6.8	Good
W-618	1-Aug-90	Drawdown	1.9	24	4.8	Fair
W-619	30-Aug-90	Drawdown	11.8	190	11	Good
W-620	1-Oct-90	Drawdown	5.8	6,500	650	Good
W-621	4-Oct-90	Drawdown	3.8	310	39	Good
W-622	12-Oct-90	Slug	NA	130	16	Fair
W-651	16-Mar-90	Slug	NA	530	180	Fair
W-652	22-Mar-90	Drawdown	1.0	11	3.8	Good
W-653	11-Apr-90	Drawdown	0.3	2	2.0	Fair
W-653	16-Mar-05	Drawdown	0.45	1.0	1.0	Good
W-654	25-Apr-90	Drawdown	21.7	390	25	Fair
W-655	12-May-90	Drawdown	12.2	1,000	220	Good
W-701	23-Oct-90	Drawdown	14.5	6,800	650	Good
W-701	3-Oct-92	Step	16.5	5,200	430	Good
W-701	1-Apr-93	Drawdown	24.0	3,700	370	Good
W-702	29-Nov-90	Drawdown	2.5	150	30	Good
W-702	25-Feb-93	Step	4.6	36	7	Poor
W-703	19-Dec-90	Drawdown	7.0	230	9.1	Good
W-704	4-Mar-91	Drawdown	19.0	1,800	140	Fair
W-705	20-Feb-91	Drawdown	0.8	40	6.1	Fair
W-706	29-Jan-91	Drawdown	0.2	8	1	Fair
W-712	25-Feb-92	Drawdown	7.8	750	48	Good
W-712	18-Mar-93	Longterm	15.1	1,440	93	Good
W-714	6-Dec-91	Drawdown	2.9	140	6.7	Good
W-902	25-Mar-93	Drawdown	0.6	6	2	Fair
W-909	18-Oct-95	Drawdown	2.7	150	5.1	Good
W-911	2-Feb-96	Drawdown	1.4	53	2.1	Good
W-912	10-Nov-95	Drawdown	4.1	65	11	Poor
W-913	16-Aug-95	Drawdown	23.5	730	36	Good
W-1001	13-Aug-95	Drawdown	1.3	170	25	Fair
W-1002	19-Jun-97	Drawdown	16.8	680	49	Good
W-1003	26-Jun-97	Drawdown	1.2	5.1	0.7	Poor
W-1006	17-Jun-97	Drawdown	17.4	180	23	Fair
W-1007	23-Sep-95	Drawdown	1.6	13	1.3	Fair
W-1008	17-Jan-97	Drawdown	7.3	110	13	Good

Table B-1. Results of hydraulic tests^a.

Well	Date	Type of test ^b	Flow rate (Q) (gpm)	Transmissivity (T) (gpd/ft)	Hydraulic conductivity (K) ^c (gpd/sq ft)	Data quality ^d
W-1010	10-Jul-95	Drawdown	20.3	1,650	140	Fair
W-1011	11-Jul-95	Drawdown	3.8	240	17	Good
W-1012	13-Jul-95	Drawdown	3.3	35	2.2	Fair
W-1013	13-Jul-95	Drawdown	2.7	2,000	250	Poor
W-1014	28-Aug-96	Drawdown	31.1	7,700	320	Good
W-1101	22-Nov-95	Drawdown	0.8	9.9	3.3	Good
W-1102	29-Jan-96	Drawdown	14.7	81	4.5	Fair
W-1103	29-Nov-95	Drawdown	3	19	1.6	Fair
W-1105	17-Jul-95	Drawdown	2.4	320	26	Fair
W-1106	24-Jul-96	Drawdown	7.1	5,200	580	Good
W-1107	9-Apr-97	Drawdown	6.7	3,500	250	Poor
W-1107	4-May-99	Drawdown	6.6	4,300	310	Fair
W-1108	3-Nov-95	Drawdown	12.3	950	68	Good
W-1108	25-Jun-96	Longterm	11.6	1,000	70	Poor
W-1108	1-Nov-05	Drawdown	7.1	800	57	Fair
W-1109	26-Jun-95	Drawdown	8.7	460	33	Fair
W-1109	4-Jun-96	Longterm	6.8	760	40	Poor
W-1110	22-Jan-96	Drawdown	6.3	690	29	Fair
W-1111	20-Oct-95	Drawdown	15.8	2,100	95	Good
W-1111	9-Dec-96	Longterm	11.2	160	7.9	Poor
W-1112	24-May-96	Drawdown	6.4	94	10	Fair
W-1113	26-Aug-96	Drawdown	1	5.5	0.6	Good
W-1114	27-Oct-95	Longterm	15.1	270	12	Fair
W-1116	23-Feb-96	Drawdown	6.6	290	11	Fair
W-1117	23-Aug-96	Drawdown	0.7	3.4	0.34	Fair
W-1118	18-Jan-96	Drawdown	5.6	350	35	Good
W-1201	1-Nov-96	Drawdown	1	8.3	0.92	Poor
W-1203	2-May-96	Drawdown	18.8	900	90	Good
W-1204	22-Feb-96	Drawdown	1.3	17	2.2	Poor
W-1205	27-Nov-96	Slug	NA	330	33	Fair
W-1207	27-Nov-96	Slug	NA	900	45	Poor
W-1209	17-May-96	Drawdown	0.98	11	0.69	Good
W-1210	30-May-96	Drawdown	3.8	7.3	0.73	Fair
W-1211	26-Jul-96	Drawdown	28.6	5,000	330	Good
W-1212	14-May-96	Drawdown	1.9	35	2.5	Good
W-1212	10-Sep-96	Longterm	1.3	85	3.6	Poor
W-1213	22-Jul-96	Drawdown	11.6	500	42	Fair
W-1213	30-Jul-96	Longterm	9.6	440	37	Poor

Table B-1. Results of hydraulic tests^a.

Well	Date	Type of test ^b	Flow rate (Q) (gpm)	Transmissivity (T) (gpd/ft)	Hydraulic conductivity (K) ^c (gpd/sq ft)	Data quality ^d
W-1214	28-Apr-97	Drawdown	2.2	110	5.4	Fair
W-1215	15-Aug-96	Drawdown	11.6	610	61	Fair
W-1215	8-Oct-96	Longterm	9.8	3,000	300	Poor
W-1216	14-Aug-96	Drawdown	11.4	210	6.9	Good
W-1216	15-Oct-96	Longterm	11.1	160	5.4	Poor
W-1218	11-Nov-96	Drawdown	5.8	83	4.6	Fair
W-1218	8-Jul-97	Longterm	4.8	210	12	Fair
W-1219	27-May-97	Drawdown	0.4	2.5	0.63	Poor
W-1220	13-Nov-96	Drawdown	20.3	2,600	120	Good
W-1220	15-Jul-97	Longterm	20.0	4,700	210	Fair
W-1221	27-Dec-96	Drawdown	3.1	29	2.9	Fair
W-1222	31-Oct-96	Drawdown	6.1	430	43	Good
W-1224	22-May-97	Drawdown	5.0	55	11	Good
W-1225	31-Mar-97	Drawdown	4.1	83	10	Good
W-1226	27-Feb-97	Drawdown	2.2	14	1.4	Excel
W-1227	11-Apr-97	Drawdown	15.1	380	48	Fair
W-1254	19-Nov-96	Longterm	18.9	1,130	110	Fair
W-1301	10-Mar-97	Longterm	4.7	120	15	Fair
W-1303	18-Mar-97	Longterm	7.8	490	21	Fair
W-1304	2-Jul-97	Drawdown	0.7	2.6	0.52	Poor
W-1306	30-Apr-97	Drawdown	2.8	24	1.2	Good
W-1306	18-Jun-97	Longterm	1.6	54	2.7	Poor
W-1307	31-Jul-97	Drawdown	11.6	1,100	110	Good
W-1308	14-Aug-97	Drawdown	6.5	150	5.1	Good
W-1308	7-Oct-97	Longterm	4.0	530	18	Fair
W-1309	15-Oct-97	Drawdown	9.1	90	8.9	Fair
W-1310	10-Mar-97	Drawdown	27.9	1,060	53	Good
W-1311	29-Oct-97	Drawdown	12.2	290	15	Good
W-1401	11-Nov-97	Drawdown	7.0	100	6.8	Excel
W-1402	12-Dec-97	Drawdown	2.6	100	10.2	Fair
W-1403	21-Jul-98	Drawdown	5.4	95	13	Good
W-1404	21-Apr-98	Drawdown	6.5	210	84	Good
W-1405	23-Apr-98	Drawdown	6.4	1,300	360	Fair
W-1406	17-Apr-98	Drawdown	11.1	3,600	360	Good
W-1407	3-Apr-98	Drawdown	1.1	8.7	1.0	Excellent
W-1408	15-Apr-98	Drawdown	2.7	85	28	Fair
W-1410	29-Jun-98	Drawdown	11.5	3,000	500	Poor
W-1410	8-Sep-99	Step	6.5	3,800	650	Poor

Table B-1. Results of hydraulic tests^a.

Well	Date	Type of test ^b	Flow rate (Q) (gpm)	Transmissivity (T) (gpd/ft)	Hydraulic conductivity (K) ^c (gpd/sq ft)	Data quality ^d
W-1411	15-May-98	Drawdown	12.3	14,700	1,300	Poor
W-1412	29-May-98	Slug	NA	2	0.67	Fair
W-1413	8-Jun-98	Drawdown	0.63	8.7	3.5	Fair
W-1415	11-Jun-98	Drawdown	0.87	18	1.2	Fair
W-1416	28-Jul-98	Drawdown	12.3	1,300	180	Good
W-1417	1-Jul-98	Drawdown	15.1	130	11	Good
W-1417	16-Jul-98	Step	5.9	150	13	Fair
W-1418	25-Sep-98	Drawdown	10.7	78	6.5	Excellent
W-1418	16-Dec-98	Step	10.5	490	41	Fair
W-1419	15-Jul-98	Step	6.1	47	3	Poor
W-1420	12-Aug-98	Drawdown	13.1	3,000	220	Poor
W-1421	14-Jul-98	Step	1.82	14	1.8	Poor
W-1421	17-Jul-98	Step	3.8	22	2.8	Poor
W-1422	18-Sep-98	Drawdown	12.0	170	33	Excellent
W-1422	18-Dec-98	Step	11.7	160	32	Good
W-1423	12-Nov-98	Drawdown	24.6	540	39	Fair
W-1424	1-Oct-98	Drawdown	6	48	6.9	Excellent
W-1425	1-Oct-98	Drawdown	1.4	15	2.4	Fair
W-1426	13-Nov-98	Drawdown	6.5	840	56	Good
W-1427	11-Jan-99	Drawdown	7.9	2,100	300	Good
W-1428	13-Jan-99	Drawdown	8.1	8,200	550	Good
W-1501	20-Nov-98	Drawdown	7.2	68	11	Good
W-1502	17-May-99	Drawdown	1.5	360	60	Good
W-1503	12-Feb-99	Drawdown	17.6	1,700	180	Good
W-1504	18-Feb-99	Drawdown	15.4	600	60	Fair
W-1505	29-Apr-99	Drawdown	11.2	280	35	Fair
W-1506	19-Apr-99	Drawdown	3.1	50	5.4	Good
W-1507	27-Apr-99	Drawdown	0.65	15	1.9	Fair
W-1508	28-Jun-01	Slug	NA	160	16	Good
W-1509	9-Apr-99	Drawdown	7.2	7,000	700	Good
W-1510	14-Apr-99	Drawdown	6.6	280	20	Fair
W-1512	21-Jun-01	Slug	NA	230	23	Good
W-1514	23-Jun-99	Longterm	5.8	440	90	Good
W-1515	18-Jan-00	Drawdown	1.5	26	1.5	Poor
W-1515	2-Feb-00	Longterm	1.1	75	4.1	Fair
W-1518	22-Mar-00	Step	6.0	440	19	Good
W-1520	21-Mar-00	Longterm	4.0	165	20	Poor
W-1522	20-Mar-00	Step	10.5	3,500	235	Good

Table B-1. Results of hydraulic tests^a.

Well	Date	Type of test ^b	Flow rate (Q) (gpm)	Transmissivity (T) (gpd/ft)	Hydraulic conductivity (K) ^c (gpd/sq ft)	Data quality ^d
W-1550	28-Dec-99	Drawdown	10.0	330	35	Fair
W-1601	25-Feb-00	Drawdown	3.0	35	3.6	Good
W-1602	3-Mar-00	Drawdown	8.3	3,100	310	Fair
W-1604	2-Apr-01	Drawdown	4.0	1,600	220	Fair
W-1609	14-Dec-05	Injection	0.30	1.90	0.10	Fair
W-1610	14-Jul-00	Injection	2.0	17	0.8	Good
W-1610	17-Jul-00	Injection	3.0	17	0.8	Excel
W-1610	7-Dec-05	Injection	1.5	17	0.80	Fair
W-1614	25-Aug-00	Drawdown	1.9	75	8.3	Good
W-1654	20-Apr-00	Drawdown	0.5	12	2.0	Good
W-1655	21-Apr-00	Drawdown	1.5	27	4.9	Good
W-1701	23-Jul-01	Drawdown	9.0	160	40	Good
W-1701	26-Sep-01	Longterm	15.0	60	15	Fair
W-1703	25-Oct-01	Drawdown	12.0	16,000	2,300	Fair
W-1801	3-May-02	Drawdown	10.0	6,600	660	Fair
W-1802	30-Sep-02	Drawdown	1.3	11	1.1	Fair
W-1805	22-Jan-03	Drawdown	11.1	13,000	800	Fair
W-1806	15-Apr-03	Drawdown	3.1	450	77	Good
W-1902	19-Mar-03	Step	11.0	1,100	29	Good
W-2202	2-Mar-06	Drawdown	0.95	65	6.5	Poor
W-2203	23-Feb-06	Drawdown	1.04	15	1.4	Fair
SIP-ETC-201	1-Apr-04	Drawdown	1.0	200	10	Fair
TW-11	24-Jan-85	Drawdown	0.3	200	20	Good
TW-11A	24-Jan-85	Drawdown	10.0	3,100	110	Fair
GSW-01	11-Dec-85	Slug	NA	72	0.2	Fair
GSW-01A	14-Jul-86	Drawdown	13.4	12,000	790	Good
GSW-02	17-Dec-85	Slug	NA	240	10	Good
GSW-03	23-Dec-85	Slug	NA	510	41	Good
GSW-04	19-Dec-85	Slug	NA	17	0.9	Good
GSW-05	12-Feb-86	Slug	NA	99	9	Excel
GSW-06	23-Jun-86	Drawdown	25.0	4,800	310	Good
GSW-06	16-Jun-87	Longterm	20.0	5,500	350	Good
GSW-07	3-Apr-86	Drawdown	4.3	230	23	Excel
GSW-08	19-Nov-86	Drawdown	2.0	230	38	Good
GSW-09	28-May-86	Drawdown	1.9	500	63	Poor
GSW-10	22-May-86	Drawdown	14.3	21,000	2,000	Good
GSW-11	2-Jun-86	Drawdown	4.7	390	45	Excel
GSW-12	7-Jun-86	Drawdown	0.8	51	11	Fair

Table B-1. Results of hydraulic tests^a.

Well	Date	Type of test ^b	Flow rate (Q) (gpm)	Transmissivity (T) (gpd/ft)	Hydraulic conductivity (K) ^c (gpd/sq ft)	Data quality ^d
GSW-13	4-Aug-86	Slug	NA	110	13	Excel
GSW-13	8-Aug-86	Slug	NA	62	7	Good
GSW-15	23-Feb-88	Drawdown	25.8	1,500	190	Good
GSW-208	8-May-86	Drawdown	1.9	440	80	Good
GSW-209	8-May-86	Drawdown	6.1	1,200	120	Good
GSW-215	4-Jun-86	Drawdown	1.9	220	40	Poor
GSW-216	16-Jan-92	Drawdown	10.5	3,500	440	Fair
GSW-266	20-Jun-86	Drawdown	2.1	470	72	Good
GSW-266	18-Nov-86	Drawdown	3.0	450	64	Good
GSW-266	18-Nov-86	Drawdown	4.7	410	59	Good
GSW-367	11-May-87	Drawdown	6.9	200	29	Fair
GSW-403-6	8-Dec-85	Slug	NA	4	0.2	Good
GSW-442	23-Nov-87	Drawdown	1.2	32	4.6	Good
GSW-443	30-Nov-87	Drawdown	10.3	260	8.7	Good
GSW-444	28-Jan-88	Slug	NA	9	0.86	Good
GSW-445	26-Jan-85	Drawdown	4.7	43	4.30	Fair
GEW-710	23-Sept-91	Step	36.0	4,800	220	Excel
GEW-816	15-Aug-92	Drawdown	39.0	12,000	1,100	Good
11H4	15-Jan-85	Drawdown	24.6	2,000	77	Good
11H4	19-Jan-85	Longterm	29.5	1,780	18	Good
11J4	10-Jun-88	Drawdown	17.0	1,000	15	Excel
11J4	14-Jun-85	Longterm	16.0	1,100	16	Good
13D1	9-Feb-85	Longterm	50.0	4,800	48	Excel

Notes and footnotes appear on the following page.

Table B-1. Results of hydraulic tests^a.

Notes:

gpd = Gallons per day.

gpm = Gallons per minute.

NA = Not applicable.

sq ft = Square feet.

- ^a The pumping test results were obtained by using the analytic techniques of Theis (1935), Cooper and Jacob (1946), Papadopulos and Cooper (1967), Hantush and Jacob (1955), Hantush (1960), or Boulton (1963). The particular method used depends on the character of the data obtained. The slug test results were obtained using the method of Cooper et al. (1967) (See references below).
- ^b "Drawdown" denotes 1-hr pumping tests; "Longterm" denotes 24- to 48-hr pumping tests; "Slug" denotes monitoring and recovery after an instantaneous change in ground water elevations; "Step" denotes a step-drawdown test, flow rate given is the maximum or final step. "Injection" denotes the introduction of treated ground water under gravity into a well.
- ^c K is calculated by dividing T by the thickness of permeable sediments intercepted by the sand pack of the well. This thickness is the sum of all sediments with moderate to high estimated conductivities determined from the geologic and geophysical logs of the well.
- ^d Hydraulic test quality criteria:
- Excel: High confidence that type curve match is unique. Data are smooth and flow rate well controlled.
- Good: Some confidence that curve match is unique. Data are not too "noisy." Well bore storage effects, if present, do not significantly interfere with the curve match. Boundary effects can be separated from properties of the pumped zone.
- Fair: Low confidence that curve match is unique. Data are "noisy." Multiple leakiness and other boundary effects tend to obscure the curve match.
- Poor: Unique curve match cannot be obtained due to multiple boundaries, well bore storage, uneven flow rate, or equipment problems. Usually, the test is repeated.

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Appendix C
Soil Vapor Extraction Test Results

Table C-1. Soil vapor extraction test results.

Well	Date	HSU	Duration test (hours)	Flow rate (scfm)	Vacuum, inches (Hg)	Max. conc. ^a (ppm _v)	Air permeability (cm ²)
W-543-001	22-Apr-03	2	6	19.3	3.7	296	3E-08
W-543-002A	30-Apr-03	2	6	10	5.1	138	8E-09
W-543-002B	1-May-03	2	6	14	5.1	145	2E-08
W-543-003	29-Apr-03	2	6	31	5.1	236	7E-08
W-543-004A	23-Apr-03	2	6	37	3.7	198	2E-08
W-543-004B	28-Apr-03	2	6	36.5	5.1	188	2E-08
W-HPA-001B	13-May-03	2	1.5	9.3	6.6	31	1E-08
W-HPA-002A	20-May-03	1B	2	0.8	6.6	4.3	1E-08
W-1552	6-Oct-03	3A/B	1.8	1	15	NM	9E-11
W-1650	9-Oct-03	3A/B	2.8	0.8	12	22.7 ^b	1E-10
W-1651	9-Oct-03	3A/B	3	0.9	12	31 ^b	1E-10
W-1652	7-Oct-03	3A/B	6	1.1	12	29 ^b	2E-10
W-1653	10-Oct-03	3A/B	2	0.8	12	17.7 ^b	3E-10
W-1654	10-Oct-03	3A/B	2.5	0.8	12	10 ^b	3E-11
W-1655	8-Oct-03	3A/B	1	1.5	12	NM	4E-10
W-1656	13-Oct-03	3A/B	0.5	NM	12	10 ^b	2E-10
W-1657	8-Oct-03	3A/B	2.8	1	12	20 ^b	3E-10
SIP-518-201	26-Jan-04	2	6	4.5	13	102	7E-10
SVB-518-204	22-Jan-04	2	6	0.9	25	1,944	2E-11
W-518-1913	21-Jan-04	2	6	0.5	26	106	2E-11
W-518-1914	23-Jan-04	1B	6	5.5	16	44	1E-09
W-518-1915	28-Jan-04	2	6	0.03	25	193	2E-12
W-1615	29-Jan-04	2	6	1.4	24	478	4E-11
W-ETC-2001A	16-Mar-04	1B	6	8.3	5	52.5	2E-08
W-ETC-2001B	19-Mar-04	2	6	0.7	5	145.3	1E-09
W-ETC-2002A	11-Mar-04	1B/2	6	6	5	22.6	3E-09
W-ETC-2002B	15-Mar-04	2	6	4	5.5	26	NC
W-ETC-2003	22-Mar-04	1B	6	17	4.5	77.4	8E-09
W-ETC-2004A	5-Mar-04	1B/2	6	12	8	82.8	3E-09
W-ETC-2004B	9-Mar-04	2	6	18	3.8	188	3E-09
SIP-ETC-201	4-Mar-04	2	6	8	7	185.5	7E-09
W-1904	2-Mar-04	2	6	23	4	63.3	2E-08
W-514-2007A	19-Apr-04	1B	96	14	7.5	17.6	NC
W-514-2007B	26-Apr-04	5	96	21	3.3	39.6	NC
W-217	3-May-04	5	96	20	3	63.2	NC
W-ETS-2008A	28-Sep-04	1B	6	50	7	23.7	NC
W-ETS-2008B	29-Sep-04	2	6	33	9.5	67.8	NC
W-ETS-2009	30-Nov-04	2	6	76	4.8	16.4	NC
W-ETS-2010A	7-Oct-04	1B	6	70	3	20.5	NC

Table C-1. Soil vapor extraction test results.

Well	Date	HSU	Duration test (hours)	Flow rate (scfm)	Vacuum, inches (Hg)	Max. conc. ^a (ppm _v)	Air permeability (cm ²)
W-ETS-2010B	11-Oct-04	2	6	63	4.5	39.8	NC
SIP-ETS-601	13-Oct-04	2	2.5	0.5	10	153.7	NC
W-653	16-Mar-05	3A	2	0	NA	9.6	NC
W-2011	18-Mar-05	3A	2	0	NA	1.5	NC
W-2101	6-Apr-05	3A	1.75	0	NA	8.1	NC
W-2102	25-Apr-05	3A	5	0.46	28	4.7	NC
W-2103	14-Apr-05	3A	1.25	0.35	28.2	NM	NC
W-2104A	9-Mar-05	1B	24	43	10	0.13	NC
W-2104B	14-Mar-05	2	24	43	10	0.16	NC
W-2110A	8-Nov-05	1B/2	3	37	6.4	5.2	NC
W-2110B	9-Nov-05	2	3	32	6.5	8.4	NC
W-2111A	3-Nov-05	1B	3	39	5.4	4.0	NC
W-2111B	4-Nov-05	2	3	28	3.0	4.1	NC
W-2112A	15-Nov-05	1B/2	3	44	2.9	0.75	NC
W-2112B	17-Nov-05	2	3	51	2.8	15	NC
W-2204	22-Feb-06	2	26.25	16.7	6.1	62.5	4.16E-09
W-2205	9-May-06	2/3A	71.75	18	6.5	25.2	NC
W-2206	28-Feb-06	2/3A	24	13.3	8.9	37.9	2.70E-09
W-2207A	20-Apr-06	2	23.75	20	6.1	87.8	1.07E-08
W-2208A	13-Apr-06	1B	24	23	2.44	394.8	2.52E-08

Notes:

cm² = Square centimeters.

Hg = Mercury.

HSU = Hydrostratigraphic unit.

Max. conc. = Maximum concentration.

NM = Not measured.

ppm_v = Parts per million by volume.

scfm = Standard cubic feet per minute.

NC = Not computed due to insufficient data for analysis.

NA = Not applicable.

^a Sample collected in Tedlar bag for TO-14 analysis.

^b Sample measured with organic vapor analyzer.

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Appendix D
2007 Ground Water Sampling Schedule

Table D-1. 2007 LLNL Livermore Site VOC ground water sampling schedule.

Well number	VOC sampling frequency	Next quarter sample date	Additional analytes (Q1-07)
W-001	O	2-07	
W-001A	A	1-07	
W-002	Q	1-07	
W-002A	E	3-08	
W-004	A	1-07	
W-005	O	3-07	
W-005A	E	4-08	
W-007	O	1-07	
W-008	O	1-07	WGMG
W-011	O	4-07	
W-012	S	1-07	
W-017	E	1-08	WGMG
W-017A	O	1-07	
W-101	A	1-07	
W-102	O	1-07	
W-103	O	1-07	
W-104	Q	1-07	
W-105	O	4-07	
W-106	E	4-08	
W-107	O	1-07	
W-108	O	3-07	
W-110	Q	1-07	
W-111	Q	1-07	
W-113	Q	1-07	
W-114	Q	1-07	
W-115	E	4-08	
W-116	Q	1-07	
W-117	O	1-07	
W-118	A	1-07	
W-119	Q	1-07	WGMG
W-120	S	1-07	
W-121	Q	1-07	WGMG
W-122	E	1-08	
W-123	E	1-08	
W-141	A	4-07	
W-142	Q	1-07	
W-143	E	2-08	
W-146	E	3-08	
W-147	E	3-08	
W-148	E	1-08	
W-151	Q	1-07	WGMG
W-201	Q	1-07	
W-202	E	1-08	
W-203	E	2-08	
W-204	A	3-07	WGMG
W-205	Q	1-07	

Table D-1. 2007 LLNL Livermore Site VOC ground water sampling schedule.

Well number	VOC sampling frequency	Next quarter sample date	Additional analytes (Q1-07)
W-206	Q	1-07	
W-207	Q	1-07	
W-210	Q	1-07	
W-212	O	1-07	
W-213	S	1-07	
W-214	Q	1-07	
W-218	A	1-07	
W-219	O	1-07	
W-220	A	2-07	
W-221	E	2-08	WGMG
W-222	Q	1-07	
W-223	O	2-07	
W-224	E	4-08	
W-225	E	2-08	
W-226	E	3-08	
W-251	Q	1-07	
W-252	Q	1-07	
W-253	O	2-07	
W-255	E	4-08	
W-256	E	4-08	
W-257	Q	1-07	
W-258	S	1-07	
W-259	Q	1-07	
W-260	A	3-07	
W-261	Q	1-07	
W-263	Q	1-07	
W-264	A	2-07	
W-265	O	3-07	
W-267	S	1-07	
W-268	A	3-07	
W-269	A	1-07	
W-270	E	4-08	
W-271	A	2-07	
W-272	A	3-07	
W-273	O	4-07	
W-275	A	2-07	
W-276	S	1-07	
W-277	E	1-08	
W-290	O	1-07	
W-291	O	1-07	
W-293	E	2-08	
W-294	E	3-08	
W-301	A	3-07	
W-302	O	3-07	
W-303	O	3-07	
W-304	S	1-07	

Table D-1. 2007 LLNL Livermore Site VOC ground water sampling schedule.

Well number	VOC sampling frequency	Next quarter sample date	Additional analytes (Q1-07)
W-306	E	1-08	
W-307	S	1-07	
W-308	A	1-07	
W-310	S	1-07	
W-311	A	1-07	
W-312	E	2-08	
W-313	A	3-07	
W-315	Q	1-07	
W-316	S	1-07	
W-317	A	3-07	
W-318	Q	1-07	
W-319	A	3-07	
W-320	A	3-07	
W-321	E	1-08	
W-322	Q	1-07	
W-323	Q	1-07	
W-324	E	2-08	
W-325	O	1-07	
W-353	A	3-07	
W-354	Q	1-07	
W-355	S	1-07	
W-356	S	1-07	
W-361	S	2-07	
W-362	E	2-08	
W-363	Q	1-07	WGMG
W-364	A	1-07	
W-365	E	3-08	
W-366	O	4-07	
W-369	A	1-07	
W-370	O	2-07	
W-371	Q	1-07	
W-372	O	1-07	
W-373	O	3-07	WGMG
W-375	A	1-07	
W-376	E	1-08	
W-377	E	2-08	
W-378	E	2-08	
W-379	A	1-07	
W-380	O	1-07	
W-401	E	2-08	
W-402	O	1-07	
W-403	O	2-07	
W-405	Q	1-07	
W-406	O	4-07	
W-407	Q	1-07	
W-409	A	4-07	

Table D-1. 2007 LLNL Livermore Site VOC ground water sampling schedule.

Well number	VOC sampling frequency	Next quarter sample date	Additional analytes (Q1-07)
W-410	Q	1-07	
W-411	A	4-07	
W-412	A	1-07	
W-416	E	2-08	
W-417	O	4-07	
W-418	E	4-08	
W-419	Q	1-07	
W-420	E	1-08	
W-421	Q	1-07	
W-422	S	1-07	
W-423	A	2-07	
W-424	Q	1-07	
W-446	A	1-07	
W-447	A	1-07	
W-448	A	3-07	
W-449	E	1-08	
W-450	A	1-07	
W-451	E	2-08	
W-452	E	2-08	
W-453	E	2-08	
W-454	E	3-08	
W-455	O	1-07	
W-458	O	4-07	
W-459	O	4-07	
W-461	Q	1-07	
W-462	O	4-07	
W-463	E	2-08	
W-464	S	1-07	
W-481	Q	1-07	
W-482	S	1-07	
W-483	O	3-07	
W-484	O	3-07	
W-485	E	2-08	
W-486	O	2-07	
W-487	O	2-07	
W-501	A	3-07	
W-502	E	3-08	
W-503	A	3-07	
W-504	O	4-07	
W-505	O	2-07	
W-506	S	1-07	
W-507	O	3-07	
W-509	S	1-07	
W-510	O	1-07	
W-511	O	2-07	
W-512	E	3-08	

Table D-1. 2007 LLNL Livermore Site VOC ground water sampling schedule.

Well number	VOC sampling frequency	Next quarter sample date	Additional analytes (Q1-07)
W-513	E	2-08	
W-514	O	4-07	
W-515	Q	1-07	
W-516	O	2-07	
W-517	Q	1-07	
W-519	O	1-07	
W-521	E	4-08	
W-551	E	2-08	
W-552	E	2-08	
W-553	E	4-08	
W-554	E	1-08	
W-555	E	2-08	
W-556	O	3-07	WGMG
W-557	E	4-08	
W-558	Q	1-07	
W-559	O	1-07	
W-560	E	1-08	
W-561	E	3-08	
W-562	E	3-08	
W-563	E	4-08	
W-564	Q	1-07	
W-565	A	4-07	
W-567	O	2-07	
W-568	A	1-07	
W-569	A	1-07	
W-570	O	1-07	
W-571	O	1-07	WGMG
W-592	O	4-07	
W-593	O	1-07	
W-594	O	2-07	
W-604	E	3-08	
W-606	A	3-07	
W-607	A	2-07	
W-608	E	2-08	
W-611	A	3-07	
W-612	O	4-07	
W-613	O	1-07	
W-615	A	1-07	
W-616	A	1-07	
W-617	E	4-08	
W-618	Q	1-07	
W-619	O	3-07	
W-622	Q	1-07	
W-651	Q	1-07	
W-652	O	2-07	
W-654	Q	1-07	

Table D-1. 2007 LLNL Livermore Site VOC ground water sampling schedule.

Well number	VOC sampling frequency	Next quarter sample date	Additional analytes (Q1-07)
W-702	E	2-08	
W-705	O	4-07	
W-706	A	4-07	
W-750	S	2-07	
W-901	A	1-07	
W-902	O	4-07	
W-905	O	3-07	
W-906	Q	1-07	WGMG
W-908	O	1-07	
W-909	Q	1-07	
W-911	A	1-07	
W-912	Q	1-07	
W-913	Q	1-07	
W-1002	O	1-07	
W-1003	O	4-07	
W-1008	O	1-07	
W-1010	E	1-08	
W-1011	E	4-08	
W-1012	A	1-07	WGMG
W-1013	O	4-07	
W-1014	O	4-07	
W-1101	O	2-07	
W-1105	E	3-08	
W-1106	A	3-07	
W-1107	S	2-07	
W-1110	A	1-07	
W-1112	A	2-07	
W-1113	E	4-08	
W-1115	O	4-07	
W-1117	Q	1-07	
W-1118	Q	1-07	
W-1201	S	1-07	
W-1202	Q	1-07	
W-1203	Q	1-07	
W-1204	S	1-07	
W-1205	Q	1-07	
W-1207	A	1-07	
W-1209	S	1-07	
W-1210	S	1-07	
W-1212	Q	1-07	
W-1214	Q	1-07	
W-1217	A	4-07	
W-1219	A	2-07	
W-1222	S	1-07	
W-1223	S	2-07	
W-1224	O	1-07	

Table D-1. 2007 LLNL Livermore Site VOC ground water sampling schedule.

Well number	VOC sampling frequency	Next quarter sample date	Additional analytes (Q1-07)
W-1225	A	4-07	
W-1226	A	2-07	
W-1227	A	1-07	
W-1250	Q	1-07	
W-1251	S	2-07	
W-1252	S	2-07	
W-1303	Q	1-07	WGMG
W-1304	Q	1-07	
W-1306	Q	1-07	WGMG
W-1308	Q	1-07	WGMG
W-1311	A	4-07	
W-1401	Q	1-07	
W-1402	S	1-07	
W-1405	S	1-07	
W-1406	Q	1-07	
W-1407	Q	1-07	
W-1408	S	1-07	
W-1411	O	3-07	
W-1412	Q	1-07	
W-1413	Q	1-07	
W-1414	Q	1-07	
W-1416	A	3-07	
W-1417	S	1-07	
W-1418	A	2-07	
W-1419	A	1-07	
W-1420	S	1-07	
W-1421	S	1-07	
W-1422	A	4-07	
W-1424	A	1-07	
W-1425	S	1-07	
W-1426	E	4-08	
W-1427	S	1-07	
W-1428	A	1-07	
W-1501	E	1-08	
W-1502	A	2-07	
W-1505	Q	1-07	
W-1506	A	4-07	
W-1507	Q	1-07	
W-1508	A	1-07	
W-1509	A	1-07	
W-1511	Q	1-07	
W-1512	A	3-07	
W-1513	E	2-08	
W-1514	E	3-08	
W-1515	E	3-08	
W-1516	A	3-07	

Table D-1. 2007 LLNL Livermore Site VOC ground water sampling schedule.

Well number	VOC sampling frequency	Next quarter sample date	Additional analytes (Q1-07)
W-1519	E	4-08	
W-1553	Q	1-07	
W-1613	O	1-07	
W-1614	E	2-08	
W-1701	E	2-08	
W-1703	E	3-08	
W-1704	A	1-07	
W-1802	S	2-07	
W-1803-1 ^a	Q	1-07	
W-1803-2 ^a	A	1-07	
W-1804-1 ^a	S	1-07	
W-1804-2 ^a	S	2-07	
W-1805	A	1-07	
W-1901-1 ^a	S	1-07	
W-1901-2 ^a	A	4-07	
W-1905-1 ^a	Q	1-07	
W-1905-2 ^a	S	2-07	
W-2103	S	2-07	
W-2113	Q	1-07	
W-2202	Q	1-07	
TW-11	E	2-08	
TW-11A	E	1-08	
TW-21	E	3-08	
11C1	E	2-08	
14A11	O	1-07	
14A3	O	1-07	
14B1	O	2-07	WGMG
14B4	O	3-07	
14C1	Q	1-07	
14C2	E	3-08	
14C3	Q	1-07	
14H1	Q	1-07	
18D1	O	3-07	
GEW-710	E	2-08	
GSW-006	O	4-07	
GSW-007	E	2-08	
GSW-008	E	1-08	
GSW-009	Q	1-07	
GSW-011	A	2-07	
GSW-013	O	1-07	
GSW-215	A	3-07	
GSW-216	O	2-07	
GSW-266	A	3-07	
GSW-326	O	2-07	
GSW-367	E	3-08	
GSW-442	Q	1-07	

Table D-1. 2007 LLNL Livermore Site VOC ground water sampling schedule.

Well number	VOC sampling frequency	Next quarter sample date	Additional analytes (Q1-07)
GSW-443	O	4-07	
GSW-444	Q	1-07	

Notes:

All analyses are by EPA Method 601 for purgeable halocarbons.

E = Even years.

O = Odd years.

A = Annual.

S = Semiannual.

Q = Quarterly.

Q1 = First Quarter.

WGMG = LLNL Water Guidance and Monitoring Group. Analyses are for the environmental surveillance monitoring programs carried out at DOE sites to complement restoration activities.

^a Wells completed with two discrete screened intervals which are hydraulically isolated from one another by a packer and are sampled individually.

Appendix E

Lake Hausmann
Annual Monitoring Program

Appendix E

Lake Haussmann

Annual Monitoring Program Summary

This appendix summarizes the LLNL Operations and Regulatory Affairs Division discharge data for Lake Haussmann, formerly known as the Drainage Retention Basin and renamed in 2006. Lake Haussmann is an artificial water body with an underlying liner to prevent infiltration. It was re-surveyed in 2000 and shown to have a capacity of about 37 acre-ft (12 million gallons). Lake Haussmann is located in the central portion of the Livermore Site (Fig. E-1) and receives storm water runoff and treated ground water. Discharge from Lake Haussmann flows north through a culvert into Arroyo Las Positas.

Samples from Lake Haussmann are collected during the first planned release of the rainy season and, at a minimum, in conjunction with one additional storm water monitoring event, as requested by the San Francisco Bay RWQCB. Samples are also collected for each dry season release event or, if the release is continuous, samples are collected each month. Release samples are collected at location CDBX (Fig. E-1) and are compared with samples collected at location WPDC where Arroyo Las Positas leaves LLNL property (Fig. E-1). Release samples are used to determine compliance with discharge limits established in the CERCLA Record of Decision (ROD) for the Lawrence Livermore National Laboratory, Livermore Site (DOE, 1992) and the Explanation of Significant Differences for Metals Discharge Limits at the Lawrence Livermore National Laboratory, Livermore Site (Berg et al., 1997). In 2003, the monitoring program was modified to eliminate sample collection within Lake Haussmann according to a letter submitted to the RWQCB (Jackson, 2002).

The analytical results for release samples are reported in the LLNL Livermore Site Quarterly Self-Monitoring Reports (Yow and Wong 2006a, b, c, and 2007) and will be reported in the 2006 LLNL Site Annual Environmental Report.

E-1. Lake Haussmann Discharge Monitoring

Releases from Lake Haussmann occurred continuously throughout the year except for a period when flow was stopped on October 6, 2006 for rotenone application to eliminate invasive nonnative species (fish) from the lake (Yow and Wong, 2007). Flow from the lake resumed November 27, 2006.

Release samples for the 2005–2006 wet season were collected on November 11, 2005 and January 18, 2006, respectively. Release samples for the 2006–2007 wet season were collected on November 27 and December 12, 2006, which also coincided with an NPDES storm water sampling event. Data for the December 2006 sampling event are not yet available from the analytical laboratories.

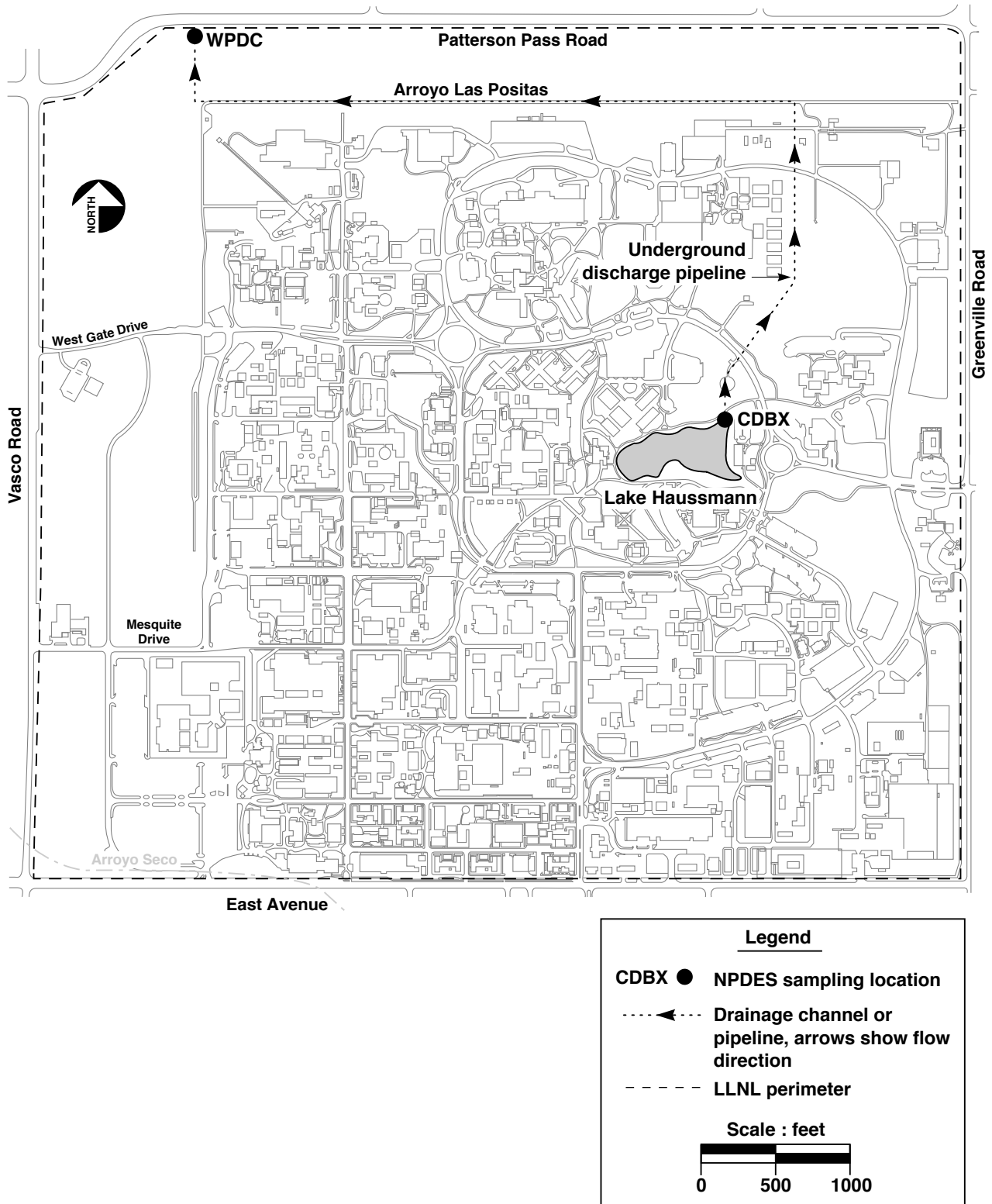
Samples from Lake Haussmann were within discharge limits for all parameters except pH. Samples collected at CDBX exceeded the pH 8.5 limit in all six reported wet and dry season monitoring events, at a maximum of 9.98. Since 1998, the pH has averaged 8.8 at CDBX and 8.5 at WPDC and is typically higher during the summer due to increased photosynthesis.

Corresponding samples collected at location WPDC exceeded the pH discharge limit in four of the six reported monitoring events. The maximum pH at WPDC was 8.94. Several metals were detected above detection limits at both CDBX and WPDC; however, all of the analytical results were below discharge limits. All acute aquatic survival bioassay tests resulted in satisfactory survival of the test species.

Lake Haussmann release samples were also analyzed for VOCs, herbicides, and polychlorinated biphenyl compounds. All analytical results were below detection limits.

E-2. References

- Berg, L., E.N. Folsom, M.D. Dresen, R.W. Bainer, A.L. Lamarre (Eds.) (1997), *Explanation of Significant Differences for Metals Discharge Limits at the Lawrence Livermore National Laboratory Livermore Site*, Lawrence Livermore National Laboratory, Livermore, Calif. (UCRL-AR-125927).
- Jackson, C.S. (2002), Division Leader, Operations and Regulatory Affairs Division, LLNL "Drainage Retention Basin Monitoring Plan," letter to Naomi Feger, San Francisco Bay Regional Water Quality Control Board, December 6, 2002.
- U.S. Department of Energy (DOE) (1992), *Record of Decision for the Lawrence Livermore National Laboratory, Livermore Site*, Lawrence Livermore National Laboratory, Livermore, Calif. (UCRL-AR-109105).
- Yow, J.L., and P.W. Wong (2006a), Letter Report: LLNL Livermore Site First Quarter Self-Monitoring Report, May 31, 2006.
- Yow, J.L., and P.W. Wong (2006b), Letter Report: LLNL Livermore Site Second Quarter Self-Monitoring Report, August 31, 2006.
- Yow, J.L., and P.W. Wong (2006c), Letter Report: LLNL Livermore Site Third Quarter Self-Monitoring Report, November 30, 2006.
- Yow, J.L., and P.W. Wong (2007), Letter Report: LLNL Livermore Site Fourth Quarter Self-Monitoring Report, February 28, 2007.



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Figure E-1. Location of Lake Haussmann showing discharge sampling locations.