Sparton Technology, Inc.
Former Coors Road Plant
Remedial Program

2006 Annual Report

S. S. PAPADOPULOS & ASSOCIATES, INC.
Environmental & Water-Resource Consultants

May 30, 2007

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Subject: Sparton Technology, Inc. Former Coors Road Plant Remedial Program 2006 Annual Report

Gentlemen:

On behalf of Sparton Technology, Inc. (Sparton), S. S. Papadopulos & Associates, Inc. (SSP&A) is pleased to submit the subject report. The report presents data collected at Sparton's former Coors Road Plant during the operation of the remedial systems in 2006, and evaluations of these data to assess the performance of the systems. This document was prepared by SSP&A with the assistance of Metric Corporation, Inc.

I certify under penalty of law that this document and all attachments were prepared under my direction and supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based upon my inquiry of either the person or persons who manage the system and/or the person or persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I further certify, to the best of my knowledge and belief, that this document is consistent with the applicable requirements of the Consent Decree entered among the New Mexico Environment Department, the U.S. Environmental Protection Agency, Sparton

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Technology, Inc., and others in connection with Civil Action No. CIV 97 0206 LH/JHG, United States District Court for the District of New Mexico. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If you have any questions concerning the report, please contact me.

Sincerely,

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Sparton Technology, Inc.
Former Coors Road Plant
Remedial Program

2006 Annual Report

Prepared for:

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Prepared by:

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May 30, 2007

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Executive Summary

The former Coors Road Plant (Site) of Sparton Technology, Inc. (Sparton) is located at 9621 Coors Boulevard NW, Albuquerque, New Mexico. The Site is at an elevation of about 5,050 feet above mean sea level (ft MSL); the land slopes towards the Rio Grande on the east and rises to elevations of 5,150-5,200 ft MSL within a short distance to the west of the Site. The upper 1,500 feet of the fill deposits underlying the Site consist primarily of sand and gravel with minor amounts of silt and clay. The water table beneath the Site is at an elevation of 4,975-4,985 ft MSL and slopes towards the northwest to an elevation of about 4,960 ft MSL within about one-half mile of the Site. At an elevation of about 4,800 ft MSL a 2- to 3-foot clay layer, referred to as the 4,800-foot clay unit, has been identified.

Past waste management activities at the Site had resulted in the contamination of the Site soils and of groundwater beneath and downgradient from the Site. The primary contaminants are volatile organic compounds (VOCs), specifically trichloroethylene (TCE), 1,1-Dichloroethylene (DCE), and 1,1,1-Trichloroethane (TCA), and chromium. Remedial investigations at the Site had indicated that groundwater contamination was limited to the aquifer above the 4,800-foot clay and current measures for groundwater remediation have been designed to address contamination within this depth interval.

Under the terms of a Consent Decree entered on March 3, 2000, Sparton agreed to implement a number of remedial measures. These remedial measures consisted of: (1) the installation and operation of an off-site containment system; (2) the installation and operation of a source containment system; and (3) the operation of an on-site, 400-cfm (cubic feet per minute) soil vapor extraction (SVE) system for an aggregate period of one year. The goals of these remedial measures are: (a) to control hydraulically the migration of the off-site plume; (b) to control hydraulically any potential source areas that may be continuing to contribute to groundwater contamination at the on-site area; (c) to reduce contaminant concentrations in vadose-zone soils in the on-site area and thereby reduce the likelihood that these soils remain a source of groundwater contamination; and (d) in the long-term, restore the groundwater to beneficial use.

The installation of the off-site containment system began in late 1998 and was completed in early May 1999. The system consisted of (1) a containment well near the leading edge of the plume, designed to pump at a rate of about 225 gallons per minute (gpm), (2) an off-site treatment system, (3) an infiltration gallery in the Arroyo de las Calabacillas, and (4) associated conveyance and monitoring components. The off-site containment well began operating on December 31, 1998; except for brief interruptions for maintenance activities or due to power outages, the well has operated continuously since that date; the year 2006 was the eighth full year of operation of this well. The source containment system was installed during 2001 and began operating on January 3, 2002. This system consisted of (1) a containment well immediately downgradient from the site, designed to pump at a rate of about 50 gpm, (2) an on-

site treatment system, (3) six[a] on-site infiltration ponds, and (4) associated conveyance and monitoring components. The year 2006 was the fifth year of operation of this well. The 400-cfm SVE system had operated for a total of about 372 days between April 10, 2000 and June 15, 2001 and thus met the length-of-operation requirements of the Consent Decree; monitoring conducted in the Fall of 2001 indicated that the system had also met its performance goals, and the system was dismantled in May 2002.

During 2006, considerable progress was made towards achieving the goals of the remedial measures:

- The off-site containment well continued to operate during the year at an average discharge rate of 213 gpm, sufficient for containing the plume.
- The pumped water was treated and returned to the aquifer through the infiltration gallery. The concentrations of constituents of concern in the treated water met all the requirements of the Groundwater Discharge Permit for the site. Chromium concentrations in the influent to the treatment system remained at levels that did not require treatment.
- The source containment well continued to operate during the year at an average rate of 46 gpm, sufficient for containing potential on-site source areas.
- Groundwater monitoring was conducted as specified in Attachment A to the Consent Decree. Water levels in all accessible wells and/or piezometers, and the Corrales Main Canal were measured quarterly. Samples were collected for water-quality analyses from monitoring wells at the frequency specified in the Consent Decree and analyzed for VOCs and total chromium.
- Samples were obtained from the influent and effluent of the treatment plants for the off-site and source containment systems, and the infiltration gallery and infiltration pond monitoring wells at the frequency specified in the Groundwater Discharge Permit. All samples were analyzed for VOCs, total chromium, iron, and manganese.
- The groundwater flow and transport model that was developed in 1999 to simulate the hydrogeologic system underlying the site was recalibrated and used to simulate TCE concentrations in the aquifer from start-up of the off-site containment well in December 1998 through November 2006 and to predict concentrations in November 2007.[b]

The off-site containment well continued to provide hydraulic control of the contaminant plume throughout the year. The source containment well that began operating in early 2002 quickly developed a capture zone that controls any potential on-site sources that may be contributing to groundwater contamination. Data from 2006 indicate that the well continued to

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[a] The performance of the six on-site infiltration ponds between 2002 and 2004 indicated that four ponds are more than adequate for handling the water pumped by the source containment well. With the approval of the regulatory agencies, Sparton backfilled two of the six ponds in 2005 to put the land to other beneficial use.

[b] This task was carried out in early 2007 as part of the preparation of this 2006 Annual Report.

maintain an adequate capture zone throughout 2006, although its average discharge rate was a little lower than in previous years.

The extent of groundwater contamination, as defined by the extent of the TCE plume, did not change significantly during 2006. Of 57 wells sampled both in November 2005 and 2006, the concentrations of TCE were lower than in November 2005 in 24 wells, higher in 8 wells, and remained the same in 25 wells (23 below detection limits). Well MW-60, at 7,500 micrograms per liter (μg/L) continued to be the most contaminated off-site well. The corresponding results for DCE were 15 wells with lower, 10 wells with higher, and 32 wells with the same (below detection limits) concentrations. The TCA plume ceased to exist during 2003, and this condition continued through 2006, that is, throughout the year there were no wells with TCA concentrations above the maximum allowable concentration in groundwater set by the New Mexico Water Quality Control Commission.

Changes in concentrations observed in monitoring wells since the implementation of the current remedial measures indicate that contaminant concentrations in the on-site area decreased significantly. Concentrations in most off-site wells have also decreased, or remained unchanged (below detection limits). The only wells where significant increases occurred are the off-site containment well CW-1, and on-site monitoring well MW-19. The persistence of the high concentrations that have been observed in the water pumped from CW-1 since the beginning of its operation, and the concentrations detected at MW-60 indicate the presence of high concentration areas upgradient from both CW-1 and MW-60. This conclusion is confirmed by the model calibration results.

The off-site and source containment wells operated at a combined average rate of 259 gpm during 2006. A total of about 136.3 million gallons of water were pumped from the wells. The total volume of water pumped since the beginning of the current remedial operations on December 1998 is about 1.051 billion gallons and represents 93 percent of the initial volume of contaminated groundwater (pore volume).

Approximately 550 kilograms (kg) (1,210 pounds [lbs]) of contaminants consisting of 513 kg (1,130 lbs) of TCE, 34 kg (76 lbs) of DCE, and 1.7 kg (3.7 lbs) of TCA were removed from the aquifer by the two containment wells during 2006. The total mass that was removed since the beginning of the of the current remedial operations is 4,490 kg (9,900 lbs) consisting of 4,230 kg (9,320 lbs) of TCE, 250 kg (550 lbs) of DCE, and 13 kg (29 lbs) of TCA. This represents about 61 percent of the total dissolved contaminant mass currently estimated to have been present in the aquifer prior to the testing and operation of the off-site containment well.

To address the continuing presence of contaminants in monitoring well MW-71R, which is completed in the Deep Flow Zone (DFZ) below the 4,800-foot clay, a decision was made in 2004 to install a DFZ monitoring/standby-extraction well near the off-site containment well CW-1. A Work Plan for the installation, testing, monitoring, and/or operation of this well was prepared in December 2004 and submitted to the United States Environmental Protection Agency and the New Mexico Environment Department. Upon approval of the Work Plan and

the obtaining of the necessary permits and easements, this DFZ monitoring/standby-extraction well was installed in February 2006. The first samples from this well, obtained during its testing in April 2006, indicated that the well did not contain any site-related contaminants. Based on these results the well was designated as monitoring well MW-79, and sampled again, on a semi-annual schedule, in May and November 2006; both of these samples did not contain any site-related contaminants.

The containment systems were shutdown several times during 2006 for routine maintenance activities, due to power and monitoring system failures, due to low levels in the chemical feed tanks, or due to the failure of other components of the systems. The downtime for these shutdowns ranged from 5 minutes to about 11.5 days.

Plans for next year include continuing the operation of the off-site and source containment systems and the collection of monitoring data as required by the Consent Decree and the permits controlling groundwater discharge and air emissions. Three monitoring wells that were dry during the last several years will be plugged and abandoned. The pump in the source containment well CW-2 will be replaced to restore its pumping rate to its design pumping rate of 50 gpm. Recalibration of the flow and transport model against data collected in 2007 and improvement of the model will continue in early 2008.

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List of Acronyms

3rdFZ	Third depth interval of the Lower Flow Zone
COA	City of Albuquerque
CMS	Corrective Measure Study
cfm	cubic feet per minute
cm^2/s	Centimeter square per second
DCE	1,1-Dichloroethylene
DFZ	Deep Flow Zone below the 4800 - foot clay
ft	foot or feet
ft MSL	feet above Mean Sea Level
ft^2	square feet
ft^3	cubic feet
ft/d	feet per day
ft/yr	feet per year
ft^2/d	feet squared per day
g/cm^3	grams per cubic centimeter
gpd	gallons per day
gpm	gallons per minute
IM	Interim Measure
kg	Kilogram
LLFZ	Lower Lower Flow Zone
lbs	Pounds
MCL	Maximum Contaminant Level
MSL	Mean Sea Level
Metric	Metric Corporation
mg/m^3	Milligrams per cubic meter
µg/L	Micrograms per liter
ND	Not Detected
NMED	New Mexico Environmental Department
NMEID	New Mexico Environmental Improvement Division
NMWQCC	New Mexico Water Quality Control Commission
ppmv	parts per million by volume
RFI	RCRA Facility Investigation
rpm	Revolutions per minute
Sparton	Sparton Technology, Inc.
SSP&A	S.S. Papadopulos & Associates, Inc.
SVE	Soil Vapor Extraction
TCA	1,1,1-Trichloroethane
TCE	Trichloroethylene
UFZ	Upper Flow Zone
ULFZ	Upper Lower Flow Zone
USEPA	United States Environmental Protection Agency
USF	Upper Santa Fe Group
USGS	United States Geological Survey
VOC	Volatile Organic Compound

REPORT

REPORT

Section 1
Introduction

The former Coors Road Plant of Sparton Technology, Inc. (Sparton) is located at 9621 Coors Boulevard NW (the west side of the boulevard), Albuquerque, New Mexico, north of Paseo del Norte and south of the Arroyo de las Calabacillas (see Figure 1.1). Investigations conducted between 1983 and 1987 at and around the plant revealed that past waste management activities had resulted in the contamination of on-site soils and groundwater and that contaminated groundwater had migrated beyond the boundaries of the facility to downgradient, off-site areas.

In 1988, the United States Environmental Protection Agency (USEPA) and Sparton negotiated an Administrative Order on Consent, which became effective on October 1, 1988. Under the provisions of this Order, Sparton implemented in December 1988 an Interim Measure (IM) that consisted of an on-site, eight-well groundwater recovery and treatment system. The initial average recovery rate of the system was about 1.5 gallons per minute (gpm); however, the recovery rate began declining within a few years due to a regional decline in water levels. As a result, the system was shut-down and permanently taken out of service on November 16, 1999.

In 1998 and 1999, during settlement negotiations associated with lawsuits brought by the USEPA, the State of New Mexico, the County of Bernalillo, and the City of Albuquerque (COA), Sparton agreed to implement a number of remedial measures and take certain actions, including: (1) the installation, testing, and continuous operation of an off-site extraction well designed to contain the contaminant plume; (2) the replacement of the on-site groundwater recovery system by a source containment well designed to address the release of contaminants from potential on-site source areas; (3) the operation of a 400 cubic feet per minute (cfm) capacity on-site soil vapor extraction (SVE) system for a total operating time of one year over a period of eighteen months; (4) the implementation of a groundwater monitoring plan; (5) the assessment of aquifer restoration; and (6) the implementation of a public involvement plan. Work Plans for the implementation of the measures and actions agreed upon by the parties were developed and included in a Consent Decree entered by the parties on March 3, 2000 (Consent Decree, 2000; S.S. Papadopulos & Associates, Inc. [SSP&A], 2000a; 2000b; 2000c; and Chandler, 2000).

The off-site containment well was installed and tested in late 1998. Based on the test results, a pumping rate of about 225 gpm was determined to be adequate for containing the off-site plume (SSP&A, 1998), and the well began operating at approximately this rate on December 31, 1998. An air stripper for treating the pumped water and an infiltration gallery for returning the treated water to the aquifer were constructed in the spring of 1999, and the well was connected to these facilities in late April 1999. In 2000, due to chromium concentrations that exceeded the permit requirements for the discharge of the treated water, a chromium reduction process was added to the treatment system and began operating on December 15, 2000; however,

chromium concentrations declined in 2001 and the process was discontinued on October 31, 2001. The year 2006 constitutes the eighth year of operation of the off-site containment system.

Throughout 1999 and 2000, Sparton applied for and obtained approvals for the different permits and work plans required for the installation of the source-containment system. The Construction Work Plan for the system was approved on February 20, 2001, and construction began soon after that date. The installation of the system was completed by the end of 2001, and the system began operating on January 3, 2002. Thus, the year 2006 constitutes the fifth year of operation of the source containment system.

SVE systems of different capacities were operated at the Sparton facility between April and October 1998, and between May and August 1999. The 400-cfm SVE system was installed in the spring of 2000 and operated for an aggregate of about 372 days between April 10, 2000 and June 15, 2001, meeting the one-year operation requirement of the Consent Decree. The performance of the system was evaluated by conducting two consecutive monthly sampling events of soil gas in September and October 2001, after a 3-month shut-off period. The results of these two sampling events, which were presented in the Final Report on the On-Site Soil Vapor Extraction System (Chandler and Metric Corporation, 2001) and on Table 4.7 of the 2001 Annual Report (SSP&A, 2002), indicated that TCE concentrations at all monitoring locations were considerably below the 10 parts per million by volume (ppmv) remediation goal of the Consent Decree. Based on these results, the operation of the SVE system was permanently discontinued by dismantling the system and plugging the vapor recovery well and vapor probes in May 2002.

The purpose of this 2006 Annual Report is to:

- provide a brief history of the former Sparton plant and affected areas downgradient from the plant,
- summarize remedial and other actions taken by the end of 2006,
- present the data collected during 2006 from operating and monitoring systems, and
- provide the interpretations of these data with respect to meeting remedial objectives.

This report was prepared on behalf of Sparton by SSP&A in cooperation with Metric. Background information on the site, the implementation of remedial actions, and initial site conditions as they existed prior to the implementation of the remedial actions agreed upon in the Consent Decree are discussed in Section 2; a brief summary of operations during 1999 through 2005 is included in this section. Issues related to the year-2006 operation of the off-site and source containment systems are discussed in Section 3. Data collected to evaluate system performance and to satisfy permit or other requirements are presented in Section 4. Section 5 presents the interpretations of the data and discusses the results with respect to the performance and the goals of the remedial systems. A description of the site's groundwater flow and transport model that was developed in 1999 (SSP&A, 2001a), modifications to the model based on data

collected during 2006, and predictions made using this model are presented in Section 6. Section 7 summarizes the report and discusses future plans. References cited in the report are listed in Section 8.

Section 2
Background

2.1 Description of Facility

The site of Sparton's former Coors Road plant is approximately a 12-acre property located in northwest Albuquerque, on Coors Boulevard NW. The property is about one-quarter mile south of the Arroyo de las Calabacillas, about three-quarters of a mile north of the intersection of Coors Boulevard and Paseo del Norte, and about one-half mile west of the Rio Grande (see Figure 1.1). The property sits on a terrace about 60 feet (ft) above the Rio Grande floodplain. An irrigation canal, the Corrales Main Canal, is within a few hundred feet from the southeast corner of the property. About one-quarter mile west of the property, the land rises approximately 150 ft forming a hilly area with residential properties.

The plant consisted of a 64,000-square-foot manufacturing and office building and several other small structures that were used for storage or as workshops (see Figure 2.1). Manufacturing of electronic components, including printed-circuit boards, began at the plant in 1961 and continued until 1994. Between 1994 and the end of 1999, Sparton operated a machine shop at the plant in support of manufacturing at the company's Rio Rancho plant and other locations. The property was leased to Melloy Dodge in October 1999. During 2000 and early 2001, the tenant made modifications and renovations to the property to convert it to an automobile dealership and began operating it as a dealership on April 23, 2001.

2.2 Waste Management History

The manufacturing processes at the plant generated two waste streams that were managed as hazardous wastes: a solvent waste stream and an aqueous metal-plating waste stream. Waste solvents were accumulated in an on-site concrete sump (Figure 2.1) and allowed to evaporate. In October 1980, Sparton discontinued using the sump and closed it by removing remaining wastes and filling it with sand. After that date, Sparton began to accumulate the waste solvents in drums and disposed of them off-site at a permitted facility.

The plating wastes were stored in a surface impoundment (Figure 2.1), and wastewater that accumulated in the impoundment was periodically removed by a vacuum truck for off-site disposal at a permitted facility. Closure of the former impoundment and sump area occurred in December 1986 under a New Mexico State-approved closure plan. The impoundment was backfilled, and an asphaltic concrete cap was placed over the entire area to divert rainfall and surface-water run on, and thus to minimize infiltration of water into the subsurface through this area.

2.3 Hydrogeologic Setting

The Sparton site lies in the northern part of the Albuquerque Basin. The Albuquerque Basin is one of the largest sedimentary basins of the Rio Grande rift, a chain of linked basins that extend south from central Colorado into northern Mexico. Fill deposits in the basin are as much

as 15,000 ft thick. The deposits at the site have been characterized by 104 borings advanced for installing monitoring, production, and temporary wells, and soil vapor probes, and by a 1,505-foot-deep boring (the Hunters Ridge Park I Boring) advanced by the U.S. Geological Survey (USGS) about 0.5 mile north of the facility on the north side of the Arroyo de las Calabacillas (Johnson and others, 1996).

The fill deposits in the upper 1,500 ft of the subsurface consist primarily of sand and gravel with minor amounts of silt and clay. The near-surface deposits consist of less than 200 ft of Quaternary (Holocene and Pleistocene) alluvium associated with terrace, arroyo fan, and channel and floodplain deposits. These deposits are saturated beneath the facility and to the east of the facility toward the Rio Grande, but are generally unsaturated to the west of the site. Two distinct geologic units have been mapped in the saturated portion of these deposits: Recent Rio Grande deposits, and a silt/clay unit (Figure 2.2). The Recent Rio Grande deposits occur to the east of the facility adjacent to the Rio Grande. These deposits consist primarily of pebble to cobble gravel and sand, and sand and pebbly sand. These deposits are Holocene-age and are up to 70-ft thick. Beneath the facility, and in an approximately 1,500-foot-wide band trending north from the facility, a silty/clay unit has been mapped between an elevation of about 4,965 ft above mean sea level (ft MSL) and 4,975 ft MSL. This unit, which is referred to as the 4970-foot silt/clay unit, represents Late-Pleistocene-age overbank deposits. The areal extent of the unit at and in the vicinity of the Sparton site is shown in Figure 2.3. Additional information on this unit is presented in Appendix A to both the 1999 and 2000 Annual Reports (SSP&A, 2001a; 2001b).) Holocene-age arroyo fan and terrace deposits, which are primarily sand and gravel, overlie this unit.

The Pliocene-age Upper Santa Fe Group (USF) deposits underlie the Quaternary alluvium. These USF deposits, to an elevation of 4,800 ft MSL, consist primarily of sand with lenses of sand and gravel and silt and clay. The lithologic descriptions of these deposits are variable, ranging from "sandy clay," to "very fine to medium sand," to "very coarse sand," to "small pebble gravel." Most of the borings into this unit were advanced using the mud-rotary drilling technique, and as a result, it has not been possible to map the details of the geologic structure. The sand and gravel unit is primarily classified as USF2 lithofacies assemblages 2 and 3 (Hawley, 1996). Locally, near the water table in some areas, the sands and gravels are classified as USF4 lithofacies assemblages 1 and 2. Lithofacies 2 represents basin-floor alluvial deposits that are primarily sand with lenses of pebble sand and silty clay. Lithofacies 3 represents basin-floor, overbank, and playa and lake deposits that are primarily interbedded sand and silty clay with lenses of pebbly sand.

At an elevation of approximately 4,800 ft MSL, a 2- to 3-foot thick clay layer is encountered. This clay, which is referred to as the 4800-foot clay unit (Figure 2.2), likely represents lake deposits. This clay unit was encountered in borings for seven wells (MW-67, MW-71, MW-71R, MW-79, CW-1, OB-1, and OB-2) installed during site investigations and remedial actions. The unit was also encountered in the USGS Hunter Park I Boring which is located about 0.5 mile north of the Sparton Site on the north side of the Arroyo de las Calabacillas. The nature of the depositional environment (i.e. lake deposits), and the fact that the

unit has been encountered in every deep well drilled in the vicinity of the site, as well as at the more distant USGS boring, indicate that the unit is areally extensive. The deposits of the Santa Fe Group immediately below the 4800-foot clay are similar to those above the clay.

The water table beneath the Sparton Site and between the Site and the Rio Grande lies within the Quaternary deposits; however, to the west and downgradient from the site the water table is within the USF deposits. A total of 90 wells were installed at the site to define hydrogeologic conditions and the extent and nature of groundwater contamination and to implement and monitor remedial actions; of these wells, 17 have been plugged and abandoned. The locations of the remaining 73 wells are shown in Figure 2.3.

The off-site containment well, CW-1, and two associated observation wells, OB-1 and OB-2, were drilled to the top of the 4800-foot clay unit and were screened across the entire saturated thickness of the aquifer above the clay unit. The source containment well, CW-2, was drilled to a depth of 130 ft and equipped with a 50-foot screen from the water table to total depth. The monitoring wells have short screened intervals (5 to 30 ft) and during past investigations, were classified according to their depth and screened interval. Wells screened across, or within 15 ft of, the water table were referred to as Upper Flow Zone (UFZ) wells. Wells screened 15-45 and 45-75 ft below the water table were referred to as Upper Lower Flow Zone (ULFZ) and Lower Lower Flow Zone (LLFZ) wells, respectively. Wells completed below the 4800-foot clay unit were referred to as Deep Flow Zone (DFZ) wells. At cluster well locations where an ULFZ or LLFZ well already existed, wells screened at a deeper interval were referred to as LLFZ or Third Flow Zone (3rdFZ) wells, regardless of the depth of their screened interval with respect to the water table.

The completion flow zone, location coordinates, and measuring point elevation of all existing wells are presented in Table 2.1; their screened intervals are summarized in Table 2.2. In Figure 2.4, the screened interval of each well is projected onto a schematic cross-section through the site to show its position relative to the flow zones defined above. (Monitoring wells screened in the DFZ [MW-67, MW-71R, and MW-79], wells screened across the entire aquifer above the 4800-foot clay [CW-1, OB-1 and OB-2], and infiltration gallery monitoring wells [MW-74, MW-75, and MW-76] are not included in this figure.) The screened intervals in three of the monitoring wells shown on Figure 2.4 are inconsistent with the completion flow zones listed on Table 2.1 which were defined at the time of well construction. These monitoring wells are: MW-32, which is listed in Table 2.1 as a LLFZ well but is shown on Figure 2.4 as a ULFZ well; and MW-49 and MW-70 which are listed on Table 2.1 as 3rdFZ wells but are shown on Figure 2.4 as LLFZ wells. In the evaluations of water-level and water-quality data for the flow zones, MW-32 is treated as a ULFZ well, and MW-49 and MW-70 are treated as LLFZ wells.

Data collected from these wells indicate that the thickness of the saturated deposits above the 4800-foot clay ranges from about 180 ft at the Site to about 160 ft west of the Site and averages about 170 ft. Outside the area underlain by the 4970-foot silt/clay unit, groundwater occurs under unconfined conditions; however, in the area where this unit is present, it provides confinement to the underlying saturated deposits. The water table in this area occurs within the

Late-Pleistocene-age arroyo fan and terrace deposits that overlie the 4970-foot silt/clay unit and is considerably higher than the potentiometric surface of the underlying confined portion of the aquifer.

Analyses of data from aquifer tests conducted at the Site (Harding Lawson Associates, 1992; SSP&A, 1998; 1999b) indicate that the hydraulic conductivity of the aquifer is in the range of 25 to 30 ft per day (ft/d), corresponding to a transmissivity of about 4,000 to 5,000 ft squared per day (ft^2/d). A transmissivity of about 4,000 ft^2/d, corresponding to a hydraulic conductivity of about 25 ft/d, is also indicated by the response of water levels to long-term pumping from the off-site containment well CW-1. Analyses of the water levels measured quarterly in observation wells OB-1 and OB-2, and in monitoring wells within 1,000 ft of the off-site containment well, indicate that the response of these wells to the long-term pumping from CW-1 is best explained with a transmissivity of 4,000 ft^2/d; that is, a transmissivity of 4,000 ft^2/d produces the smallest residual between calculated and measured water levels in these wells.

Water-level data indicate that the general direction of groundwater flow is to the northwest with gradients that generally range from 0.0025 to 0.006. The direction of groundwater flow beneath the Sparton Site, however, in the part of the aquifer underlain by the 4970-foot silt/clay unit, is to the west-southwest and the water table has a steeper gradient ranging from 0.010 to 0.016. Vertical flow is downward with an average gradient of about 0.002. Groundwater production from the deeper aquifers and a reduction in the extent of irrigated lands in the vicinity of the Site have resulted in a regional decline of water levels. Until a few years ago, this regional decline averaged about 0.65 foot per year (ft/yr); however, the rate of decline has slowed down and averaged about 0.35 ft/yr during the last several years (see well hydrographs presented in Figure 2.5).

2.4 Site Investigations and Past Remedial Actions

In 1983, several groundwater monitoring wells were installed around the impoundment and sump area to determine whether there had been a release of constituents of concern from the impoundment or the sump. Analytical results from groundwater samples taken from these wells indicated concentrations of several constituents above New Mexico State standards.

Since this initial finding in 1983, several investigations have been conducted to define the nature and extent of the contamination and to implement remedial measures; these investigations continued through 1999. The results of the investigations indicate that the primary constituents of concern found in on-site soils and in both on-site and off-site groundwater are volatile organic compounds (VOCs), primarily trichloroethene (TCE), 1,1,1-trichloroethane (TCA) and its abiotic transformation product 1,1-dichloroethene (DCE). Of these constituents, TCE has the highest concentrations and is the constituent that has been used to define the extent of groundwater contamination. DCE has been detected at low concentrations relative to TCE in groundwater, but it has the second largest plume extent. Groundwater contamination by TCA was primarily limited to the facility and its immediate vicinity. Various metals have also been detected in both soil and groundwater samples. Historically, chromium has the highest frequency of occurrence at elevated concentrations.

During the period 1983 to 1987, Sparton worked closely with the New Mexico Environmental Improvement Division (NMEID), the predecessor to the New Mexico Environment Department (NMED). Several investigations were conducted during this period (Harding and Lawson Associates, 1983; 1984; 1985). In 1987, when it became apparent that contaminants had migrated beyond plant boundaries, the USEPA commenced negotiations with Sparton to develop an Administrative Order on Consent. This Order was signed and became effective on October 1, 1988. Under the provisions of this Order, Sparton implemented an IM in December 1988. The IM consisted of groundwater recovery through eight on-site wells (PW-1, MW-18, and MW-23 through MW-28), and treatment of the recovered water in an on-site air stripper (Figure 2.1). The purpose of this IM was to remove contaminants from areas of high concentration in the UFZ. Due to the regional decline of water levels, the total discharge rate from the IM system dropped to less than 0.25 gpm by November 1999. As a result, the system was shut-down and taken permanently out of service on November 16, 1999. Groundwater production from this system, during its 11-year operation, is summarized on Table 2.3. A total of 4.4 million gallons of water were recovered during the 11-year operation period, as shown on this table.

From 1988 through 1990, horizontal and vertical delineation of the groundwater plume continued under the October 1, 1988 Order on Consent. On July 6, 1990, the first draft of the RCRA Facility Investigation (RFI) report was submitted to USEPA; the final RFI was issued on May 20, 1992 (Harding Lawson Associates, 1992) and approved by USEPA on July 1, 1992. A draft Corrective Measures Study (CMS) report was submitted to USEPA on November 6, 1992. The report was revised in response to USEPA comments, and a draft Final CMS was issued on May 13, 1996; the draft was approved, subject to some additional revisions, by USEPA on June 24, 1996. The Revised Final CMS was issued on March 14, 1997 (HDR Engineering, Inc., 1997). Nine additional monitoring wells (MW-65 through MW-73) were installed between 1996 and 1999 to further delineate the groundwater plume.

The investigations conducted at the site included several soil-gas surveys to determine the extent of groundwater contamination and to characterize vadose zone soil contamination and its potential impacts on groundwater quality. The results of soil-gas surveys conducted in 1984, 1985, 1987, and 1991 were reported in the RFI and the CMS. Additional soil-gas investigations to characterize vadose zone contamination were conducted between April 1996 and February 1997 (Black & Veatch, 1997). This work included the installation and sampling of a six-probe vertical vapor probe cluster in the source area, five vapor sampling probes at various radial distances from the former sump area, and vapor sampling of nine on-site and four off-site UFZ monitoring wells that are screened across the water table. The locations of the vapor probes (VP-1-6 and VR-1 through VR-5) and of the sampled on-site monitoring wells are shown in Figure 2.6; the locations of the sampled off-site monitoring wells MW-48, MW-57, and MW-61 are shown on Figure 2.3. The fourth off-site monitoring well, MW-37, which became dry and was plugged in 2002, was located near its replacement well MW-37R. The area where TCE concentrations in soil-gas exceeded 10 ppmv was determined from the results of this investigation (Figure 2.7).

Following this investigation, a SVE pilot test was conducted on February 27 and 28, 1997 (Black & Veatch, 1997). The test was conducted on vapor recovery well VR-1 using an AcuVac System operating at a flow of 65 cfm at a vacuum of 5 inches of water.

Based on the results of this pilot test, an AcuVac System was installed at the site in the spring of 1998 and operated at a flow rate of 50 cfm on vapor recovery well VR-1 from April 8, 1998 to October 20, 1998 (195 days). Influent and effluent concentrations measured during the operation of the system are shown in Figure 2.8. As shown in this figure, influent TCE concentrations dropped from about 18,000 milligrams per cubic meter (mg/m^3), or about 4,000 ppmv, during the first day of operation, to about 150 mg/m^3 (34 ppmv) in about 120 days. Trend lines determined by analysis of the data (see Figure 2.8) indicate that influent TCE concentration was probably as low as 75 mg/m^3 (17 ppmv) prior to the shut-down of the system after 195 days of operation. The mass of TCE removed during this operation of the SVE system was calculated to be about 145 kilograms (kg) or 320 pounds (lbs).

2.5 Implementation of Current Remedial Actions

Based on settlement negotiations that led to the March 3, 2000 Consent Decree, Sparton agreed to implement the following remedial measures: (a) installation and operation of an off-site containment system designed to contain the contaminant plume; (b) replacement of the on-site groundwater recovery system by a source containment system designed to address the release of contaminants from potential on-site source areas; and (c) operation of a robust SVE system for a total operating time of one year over a period of eighteen months.

Implementation of the off-site containment system, as originally planned, was completed in 1999. A chromium reduction process was added to the treatment component of the system in 2000. Chromium treatment ceased in 2001 because the chromium concentration in the influent dropped below the New Mexico groundwater standard. The system currently consists of:

- a containment well (CW-1) installed near the leading edge of the TCE plume;
- an off-site treatment system for the water pumped by CW-1, consisting of an air stripper housed in a building;
- an infiltration gallery installed in the Arroyo de las Calabacillas for returning treated water to the aquifer;
- a pipeline for transporting the treated water from the treatment building to the gallery;
- a piezometer, PZG-1, with an horizontal screen placed near the bottom of the gallery, for monitoring the water level in the gallery; and
- three monitoring wells (MW-74, MW-75, and MW-76) for monitoring potential water-quality impacts of the gallery.

The locations of these components of the off-site containment system are shown in Figure 2.9.

The containment well was installed in August 1998, and aquifer tests were conducted on the well and evaluated in December (SSP&A, 1998). The well began operating at a design rate of 225 gpm on December 31, 1998. During the testing of the well and during its continuous operation between December 31, 1998 and April 14, 1999, the groundwater pumped from the well was discharged into a sanitary sewer without treatment. Installation of the air stripper, the infiltration gallery, and other components of the system (except the chromium reduction process) was completed in early April, 1999. The containment well was shut-down on April 14, 1999 to install a permanent pump and to connect the well to the air stripper. Between April 14 and May 6, 1999, the well operated intermittently to test the air stripper and other system components. The tests were completed on May 6, 1999, and the well was placed into continuous operation. Due to increases in chromium concentrations in the influent to, and hence in the effluent from, the air stripper, a chromium reduction process was added to the treatment system on December 15, 2000. Chromium concentrations, however, declined during 2001 and the chromium reduction process was removed on November 1, 2001. The off-site containment system is now operating with all other system components functioning.

All permits and approvals required for the implementation of the source containment system were obtained between May 1999 and February 2001. The installation of the system began soon after the approval of the Construction Work Plan for the system in February 2001, and completed in December 2001. The system was tested in December 2001 and placed into operation on January 3, 2002. The system consists of:

- a source containment well (CW-2) installed immediately downgradient of the Site;
- an on-site treatment system for the water pumped by CW-2, consisting of an air stripper housed in a building;
- six on-site infiltration ponds for returning the treated water to the aquifer;
- pipelines for transporting the pumped water to the air stripper and the treated water to the ponds; and
- three monitoring wells (MW-17, MW-77, and MW-78) for monitoring the potential water-quality impacts of the ponds.

The layout of the system is shown in Figure 2.10. The chromium concentrations in the influent to, and hence in the effluent from, the air stripper meets the New Mexico water-quality standard for groundwater and, therefore, treatment for chromium is not necessary. Based on the first three years of operation of the system, Sparton concluded that four infiltration ponds were sufficient for returning to the aquifer the water treated by this system. Therefore, in April 2005 Sparton requested USEPA and NMED approval to backfill two of the six ponds (Ponds 5 and 6 in Figure .10), and upon approval of this request in June 2005, the two ponds were backfilled between August and December 2005.

An AcuVac SVE system was installed on vapor recovery well VR-1 (see Figure 2.6) in the spring of 1998 and operated between April 8 and October 20, 1998. Additional SVE operations at this location with the AcuVac system at 50 cfm and with a 200-cfm Roots blower

occurred in 1999 between May 12 and June 23 and between June 28 and August 25, respectively. An additional 200-cfm Roots blower was installed in 2000, and the SVE system was operated at 400 cfm between April 10, 2000 and June 15, 2001. The total operating time during this period, 371 days and 13 hours, and the results of the performance monitoring conducted after the shut-down of the system met the requirements of the Consent Decree for the termination of the SVE operations at the site. The system was, therefore, dismantled, and the recovery well and vapor probes associated with the system were plugged in May 2002.

2.6 Initial Site Conditions

Initial site conditions, as referred to in this report, represent hydrogeologic and soil-gas conditions as they existed prior to the implementation of the current remedial measures (the installation and operation of the off-site and source containment systems, and the 1999-2001 operation of SVE systems).

2.6.1 Hydrogeologic Conditions

2.6.1.1 Groundwater Levels

The elevation of water levels in monitoring wells, based on measurements made in November 1998, is presented on Table 2.4. These data were used to prepare maps showing the configuration of the water levels at the site prior to the implementation of the current remedial measures.

Water-level data from UFZ and ULFZ well pairs indicate that UFZ wells screened above or within the 4970-foot silt/clay unit (most of the UFZ wells on the Sparton Site) have a water level that is considerably higher than that in the adjacent ULFZ wells that are screened below this unit. These water-level differences range from less than one foot near the western and southwestern limit of the unit to more than 10 ft north and northeast of the Sparton site. Outside the area underlain by the 4970-foot silt/clay unit, however, the water-level difference between UFZ and ULFZ well pairs is 0.2 foot or less. This relationship between UFZ and ULFZ water levels is illustrated in the schematic cross-section shown in Figure 2.4.

In early interpretations of water-level data, including those presented in the 1999 and 2000 Annual Reports (SSP&A, 2001a; 2001b), separate water-level maps were prepared using data from UFZ, ULFZ, and LLFZ wells without taking into consideration the above-discussed relationship between the water levels in UFZ and ULFZ wells. Since the 2001 Annual Report (SSP&A, 2002), however, this relationship has been taken into consideration, and water level conditions at the site and its vicinity are presented in three maps depicting: (1) the water table above the 4970-foot silt/clay unit underlying the Sparton site and at the area north of the site, based on water-level data from UFZ wells screened above or within the silt/clay unit (referred to as the "on-site water table"); (2) the combined UFZ/ULFZ water levels based on data from UFZ and ULFZ wells outside the area underlain by the silt/clay unit (using the average water level at UFZ/ULFZ well pair locations) and ULFZ wells screened below this unit; and (3) the LLFZ water levels based on data from LLFZ wells.

The elevation of the on-site water table in November 1998 is shown in Figure 2.11. The corresponding water-level elevations in the UFZ/ULFZ and LLFZ are shown in Figures 2.12 and 2.13, respectively. These water-level maps indicate that in the off-site areas downgradient from the site, the direction of groundwater flow is generally to the northwest with a gradient of approximately 0.0025. On-site, the direction of flow is also northwesterly in both the UFZ/ULFZ and the LLFZ; however, the gradients are steeper, approximately 0.005 in the UFZ/ULFZ and 0.006 in the LLFZ. The on-site water table is affected by the on-site groundwater recovery system, which was operating during the November 1998 water-level measurements, and the presence of the 4970-foot silt/clay unit; the direction of flow changes from westerly north of the site to southwesterly on the site, with gradients that range from 0.01 to 0.016.

2.6.1.2 Groundwater Quality

The concentrations of TCE, DCE, and TCA in groundwater samples obtained from monitoring wells during the Fourth Quarter 1998 sampling event are summarized on Table 2.5. Also included on this table are data obtained on September 1, 1998, from the off-site containment well, CW-1, and the nearby observation wells, OB-1 and OB-2, and from temporary wells, TW-1 and TW-2, drilled in early 1998 at the current location of MW-73 and sampled on February 18 and 19, 1998, respectively. For each of the compounds reported on Table 2.5, concentrations that exceed the more stringent of its Maximum Contaminant Level (MCL) for drinking water or its maximum allowable concentration in groundwater set by the New Mexico Water Quality Control Commission (NMWQCC) are highlighted.

These concentration data were used to prepare maps showing the horizontal extent of the TCE, DCE and TCA plumes as they existed in November 1998, prior to the beginning of pumping from the off-site containment well. The procedures presented in the Work Plan for the Off-Site Containment System were used in preparing these maps (SSP&A, 2000a). The horizontal extent of the TCE plume (in November 1998) is shown in Figure 2.14 and the extent of the DCE and TCA plumes is shown in Figures 2.15 and 2.16, respectively. The extent of these plumes forms a basis for evaluating the effectiveness of the remedial actions that have been implemented at the site.

2.6.1.3 Pore Volume of Plume

TCE is the predominant contaminant at the Sparton site and has the largest plume. Calculation of the initial volume of water contaminated above MCLs, referred to as the pore volume of the plume, was, therefore, based on the horizontal and vertical extent of the TCE plume.

In preparing the plume maps presented in the previous section (Figures 2.14 through 2.16), the completion zone of monitoring wells was not considered; that is, data from an UFZ well at one location was combined with data from an ULFZ or LLFZ well at another location. At well cluster locations, the well with the highest concentration was used, regardless of its completion zone. As such, the horizontal extent of the TCE plume shown in Figure 2.14

represents the envelope of the extent of contamination at different depths, rather than the extent of the plume at a specific depth within the aquifer.

To estimate the initial pore volume of the plume, three separate maps depicting the horizontal extent of the TCE plume were prepared using water-quality data from UFZ, ULFZ, and LLFZ monitoring wells. The concentrations measured in the fully-penetrating containment well CW-1 and observation wells OB-1 and OB-2 were assumed to represent average concentrations present in the entire aquifer above the 4800-foot clay, and these data were used in preparing all three maps. An estimate of the horizontal extent of TCE contamination at the top of the 4800-foot clay was also made by preparing a fourth plume map using the data from the containment well and the two observation wells, and data from two temporary wells that obtained samples from about 30-35 ft above the top of the clay during the construction of DFZ wells MW-67 (July 1996) and MW-71 (June 1998). (These four TCE plume maps were presented in Appendix B to both the 1999 and the 2000 Annual Reports [SSP&A, 2001a; 2001b].)

The extent of the plume based on UFZ wells was assumed to represent conditions at the water table; based on the elevation of the screened intervals in ULFZ and LLFZ wells (see Figure 2.4), the extent of the plume estimated from ULFZ wells was assumed to represent conditions at an elevation of 4,940 ft MSL, and that estimated from LLFZ wells conditions at an elevation of 4,900 ft MSL. The extent of the plume at the top of the clay was assumed to represent conditions at an elevation of 4,800 ft MSL. The area of the TCE plumes at each of these four horizons was calculated.[1] Using these areas, the thickness of the interval between horizons, and a porosity of 0.3, the pore volume was estimated to be approximately 150 million cubic ft (ft^3), or 1.13 billion gallons, or 3,450 acre-ft.

2.6.1.4 Dissolved Contaminant Mass

As discussed in both the 1999 and 2000 Annual Reports (SSP&A, 2001a; 2001b), calculations of the initial dissolved contaminant mass based on a plume-map approach, such as the one used above to estimate the initial pore volume (Section 2.6.1.3), significantly underestimate the dissolved contaminant mass present in the aquifer underlying the site. The calibration of the numerical transport model that was developed for the site and its vicinity (see Section 6.2.3) was, therefore, used to provide an estimate of the initial contaminant mass. During the calibration process of this model, the initial TCE concentration distribution within each model layer is adjusted, in a manner consistent with the initial concentrations observed in monitoring wells, until the computed concentrations of TCE in the water pumped from each containment well, and hence the computed TCE mass removal rates, closely match the observed concentrations and mass removal rates. Based on the calibration of the model against 1999 through 2006 water-quality data, the initial dissolved TCE mass is currently estimated to be (see Table 6.1) about 6,910 kg (15,230 lbs). Using this estimate, and ratios of the removed TCE mass to the removed DCE and TCA mass, the initial masses of dissolved DCE and TCA are estimated

[1] The features of the commercially available mapping program Surfer 7.0 (copyright © 1999, Golden Software, Inc.) were used in generating the plume maps and in calculating plume areas.

to be approximately 410 kg (900 lbs) and 21 kg (46 lbs), respectively. Thus, the total initial mass of dissolved contaminants is currently estimated to be about 7,340 kg (16,180 lbs).

2.6.2 Soil Gas Conditions

A supplemental vadose zone characterization was conducted between March 15 and May 5, 1999, which included installation and sampling of eight additional vapor probes, VP-7 through VP-14 (Figure 2.6) and resampling of 15 vapor-monitoring points that had exhibited soil-gas concentrations greater than 10 ppmv during the initial characterization. The results of the supplemental investigation are presented in Figure 2.17, with the approximate 10 ppmv TCE plume limit delineated. The extent of the TCE plume presented in this figure represents the initial conditions prior to the resumption of soil vapor extraction remedial actions in 1999.

2.7 Summary of the 1999 through 2005 Operations

During 1999 through 2005, significant progress was made in implementing and operating the remedial measures Sparton agreed to implement under the terms of the Consent Decree entered on March 3, 2000. These remedial measures resulted in the containment of the plume at the site, the removal of a significant amount of mass from the plume of groundwater contamination, and a significant reduction in soil-gas concentrations in the on-site source areas.

The remedial measures undertaken in 1999 through 2005 included the following:

- Between December 31, 1998 and April 14, 1999, and from May 6, 1999, through December 31, 2005, the off-site containment well was operated at a rate sufficient to contain the plume. The air stripper for treating the pumped water and the infiltration gallery for returning the treated water to the aquifer were constructed in the spring of 1999. These systems were connected to the containment well and tested between April 14 and May 6, 1999. A chromium reduction process was added to the off-site treatment system on December 15, 2000, to control chromium concentrations in the air stripper effluent and thus meet discharge permit requirements for the infiltration gallery; the process was discontinued on November 1, 2001, after chromium concentrations in the influent decreased to levels that no longer required treatment.
- A 50-cfm AcuVac SVE system was operated at vapor recovery well VR-1 from May 12 through June 23, 1999, and a 200-cfm Root blower system was operated at this well from June 28 to August 25, 1999. A second 200-cfm Root blower was added to the system in the Spring of 2000, and the 400-cfm SVE system operated for a total of 372 days between April 10, 2000 and June 15, 2001 meeting the length-of-operation requirement of the Consent Decree. The results of the performance monitoring that was conducted in September and October 2001 indicated that the system had met the termination criteria specified in the Consent Decree, and the system was dismantled in May 2002.
- The source containment system, consisting of a containment well immediately downgradient from the site, an on-site treatment system, six on-site infiltration ponds, and associated conveyance and monitoring components, was installed and tested during 2001. Operation of the system began on January 3, 2002, and the system continued to

operate through December 31, 2005, at a rate sufficient for containing any potential sources that may remain at the site.

- Groundwater monitoring was conducted as specified in Attachment A to the Consent Decree. Water levels in accessible monitoring wells, the containment well, observation wells, piezometers, and the Corrales Main Canal were measured quarterly. Samples were collected for water-quality analyses from monitoring wells and from the influent and effluent of the air stripper at the frequency specified in the Consent Order. Water samples were analyzed for TCE, DCE, TCA, and other constituents, as required by the Consent Decree and the Groundwater Discharge Permit.
- A groundwater flow and transport model of the hydrogeologic system underlying the site was developed in 2000. The model was calibrated against data available at the end of 1999, and again against data available at the end of each subsequent year, and used to simulate TCE concentrations in the aquifer from the start-up of the containment well in December 1998 through November 2005 and to predict TCE concentrations in November 2006. Plans were made to continue the calibration and improvement of the model during 2006.

A total of about 810 million gallons of water, corresponding to an average rate of about 220 gpm, were pumped from the off-site containment well between the start of its operation and the end of 2005. Evaluation of quarterly water-level data indicated that containment of the contaminant plume was maintained throughout each year.

Since the beginning of its operation on January 3, 2002, the source containment well pumped a total of about 104 million gallons of water, corresponding to an average rate of 49.5 gpm. Evaluation of quarterly water-level data indicated that the well developed a capture zone that prevents the off-site migration of contaminants from the site

The total volume of water pumped by both the off-site and source containment wells between the start of the off-site containment well operation and the end of 2005 was about 914 million gallons, and represents about 81 percent of the initial volume of contaminated groundwater (pore volume).

The total mass of contaminants that was removed by the off-site containment well between the start of its operation and the end of 2005 was about 3,760 kg (8,290 lbs) and consisted of 3,560 kg (7,850 lbs) of TCE, 190 kg (420 lbs) of DCE, and 7.9 kg (17 lbs.) of TCA. An additional 180 kg (400 lbs) of contaminants consisting of about 155 kg (340 lbs) of TCE, 22 kg (49 lbs) of DCE, and 3.3 kg (7.2 lbs.) of TCA were removed from the aquifer by the source containment well. Thus, the total mass of contaminants removed from the aquifer by both wells between the start of the off-site containment well operation on December 1998 and the end of 2005 was about 3,940 kg (8,690 lbs) consisting of 3,710 kg (8,180 lbs) of TCE, 215 kg (475 lbs) of DCE, and 11 kg (24 lbs) of TCA. This removed mass represents about 54 percent of the contaminant mass (54 percent of the TCE, 53 percent of the DCE, and 52 percent of the TCA mass currently estimated to have been present in the aquifer prior to the operation of the off-site containment well.

The operation of the soil vapor extraction systems at vapor recovery well VR-1 in 1999 and 2000 had a measurable impact on soil-gas concentrations at the site. The 1999 SVE operations had reduced TCE concentrations in soil gas below 10 ppmv at all but one of the monitored locations. Soil-gas was not monitored during the 2000 and 2001 operation of the 400-cfm system. The system was shut-down on June 15, 2001; and performance monitoring was conducted near the end of 2001, three months after the shut-down. The results of this monitoring indicated that soil gas concentrations at all monitoring locations were considerably below the 10 ppmv termination criterion for the system, and the system was dismantled in May 2002.

The remedial systems were operated with only minor difficulties during 1999 through 2005. In 1999, the metering pump adding anti-scaling chemicals to the influent to the off-site air-stripper was not operating correctly. This problem was solved in December 1999 by replacing the pump. Also, chromium concentrations in the influent to, and hence in the effluent from, the air stripper increased from 20 μg/L at system start-up to 50 μg/L by May 1999, and fluctuated near this level, which is the discharge permit limit for the infiltration gallery, throughout the remainder of 1999 and during 2000. To solve this problem, a chromium reduction process was added to the treatment system on December 15, 2000; the process was discontinued on November 1, 2001, after chromium concentrations declined to levels that no longer required treatment.

Another problem that developed during these years was the continuing presence of contaminants in the DFZ monitoring well MW-71. During 2001, an investigation was conducted on the well and the well was plugged. Based on the results of the investigation, a replacement well, MW-71R located about 30 ft south of the original well, was installed in February 2002. Samples collected from the replacement well since its installation indicated the continuing presence of contaminants in the Deep Flow Zone (TCE concentrations of 130 to 210 μg/L). Based on these results, Sparton proposed to pump the well and, after treatment, re-inject the pumped water in the unsaturated zone at allocation south of the well. A Work Plan for this proposed MW-71R pump-and-treat system was prepared in late 2003 and submitted to USEPA/NMED in January 2004 (SSP&A and Metric, 2004a). USEPA/NMED comments on this Work Plan (August 10, 2004[2]) led Sparton to invoke the dispute resolution mechanism allowed under the Consent Decree (September 13, 2004[3]). To resolve the dispute a conference call was held on October 13, 2004, between technical representatives of USEPA/NMED and Sparton. During this conference call the parties agreed to abandon the plan for a pump-and-treat system at MW-71R, and instead install a DFZ monitoring/stand-by extraction well near CW-1, with the understanding that the decision to use this well as a monitoring or extraction well was to

[2] Technical Review – Sparton Technology Inc. Former Coors Plant Remedial Program, Work Plan for the Proposed MW-71R Pump-and-Treat System, Sparton Technology, Inc. Albuquerque, New Mexico, EPA ID No. NMD083212332, transmitted by letter dated August 10, 2004, from Charles A. Barnes of USEPA to Tony Hurst of Hurst Engineering Services, Project Coordinator for Sparton.

[3] Notice of Dispute, Sparton Technology, Inc. Consent Decree, Civil Action No. CIV 97 0206 CH/JHG, EPA ID No. NMD083212332, September 13, 2004, letter to the Plaintiffs from James B. Harris of Thompson & Knight, counsel to Sparton.

be based on whether the well is clean or contaminated. The agreement was documented in the minutes[4] of the conference call and upon approval of the minutes[5] a Work Plan (SSP&A and Metric, 2004b) for the installation, testing, monitoring, and/or operation of this well was submitted to USEPA/NMED on December 6, 2004. This Work Plan was approved by USEPA/NMED on January 6, 2005, and Sparton proceeded with obtaining an easement agreement from the City of Albuquerque to provide access through a City owned park for moving a drilling rig to the proposed well location. This easement agreement was obtained by Sparton in October 2005. In November 2005, Sparton submitted to USEPA/NMED a revised schedule for the Work Plan, and in December 2005 notified the City of Albuquerque that construction of the monitoring/stand-by extraction well would begin in January 2006.

Six water table (UFZ) monitoring wells that became dry due to declining water levels were plugged during 2002 and 2003; three of these wells were replaced by wells with longer screens spanning both the UFZ and ULFZ. Several other water table monitoring wells became dry during 2004 and 2005 and several others were dry during one or more monitoring/sampling events during these two years. Three of the wells that were continuously dry, were recommended for plugging and abandoning in the 2005 Annual Report. Other minor problems during the past years of operation included the occasional shutdown of the containment systems due to power failures, failures of the monitoring or paging systems, and failures of the discharge pumps or air-stripper blower motors. Appropriate measures were taken to address these problems.

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[4] Memorandum dated October 20, 2004, to Charles A. Barnes (USEPA), and Baird Swanson and Carolyn Cooper (NMED) from Gary L. Richardson (Metric) and Stavros S. Papadopulos (SSP&A) on the subject of Sparton Technology, Inc., Former Coors Road Plant Remedial Program – Minutes of the October 13, 2004 Conference Call.

[5] E-mail dated October 21, 2004, from Charles A. Barnes of USEPA to Stavros Papadopulos of SSP&A on the subject of "Re: Minutes of the October 13, 2004 Conference Call."

Section 3
System Operations - 2006

3.1 Monitoring Well System

3.1.1 Upper Flow Zone

The continuing water-level declines in the Albuquerque area continued to affect shallow monitoring wells (UFZ wells) at the Site. Monitoring wells PW-1, MW-35, and MW-36, which had been dry for the last several years, continued to be dry during 2006. Wells PW-1 and MW-35 were proposed for plugging and abandoning in the 2004 and the 2005 Annual Reports (SSP&A, 2005; 2006), and well MW-36 in the 2005 Annual Report. Plugging and abandonment of these three wells is awaiting agency approval of the 2004 and 2005 Annual Reports. Wells MW-13 and MW-33 were dry during the first three quarters of 2006, and well MW-57 was dry during the 2nd and 3rd quarters. In addition, wells MW-9, MW-13, MW-33, and MW-57 did not have sufficient water for sampling in November 2006.

3.1.2 Deep Flow Zone

Construction of the DFZ monitoring/standby-extraction well, proposed for installation to address the continuous presence of contaminants in DFZ well MW-71R (SSP&A and Metric, 2004b), began in January 2006 and the well was completed on February 24, 2006. The well, initially referred to as CW-3, is located about 25 ft north of OB-1 (shown as MW-79 in Figure 2.3). A step-drawdown test was conducted on the well on April 3, 2006 followed by a 24-hour constant-rate pumping test on April 4-5, 2006. Three sets of samples of groundwater were obtained during the constant-rate test. The first set of samples was obtained on the 18th hour of the test, the second set on the 21st hour, and the third set just prior to the end of the test. One sample from each set was analyzed for volatile organic compounds, and another for chromium (both unfiltered and filtered samples). The results of the analyses of these samples indicated that the groundwater from the well did not contain any compounds related to the Sparton site. Based on these results, and in accordance with the approved Work Plan (SSP&A and Metric, 2004b), the new DFZ well was converted to a monitoring well (designated as MW-79) to be sampled on a semi-annual frequency. A permanent sampling pump was installed in the well on May 5, 2006.

A letter-report[6] on the details of the installation, testing, and sampling of the well, data collected during these processes, and associated documents were submitted to USEPA/NMED in in June 2006. The results of the analysis of the data collected during the pump-testing of the well will be completed and will be presented in a separate letter-report during 2007.

[6] Letter dated June 2, 2006 to USEPA and NMED representatives from Stavros S. Papadopulos of SSP&A and Gary L. Richardson of Metric with subject "Sparton Technology, Inc. Former Coors Road Plant Remedial Program - Transmittal of Data from the Installation, Testing, and Sampling of a new DFZ Well."

3.2 Containment Systems

3.2.1 Off-Site Containment System

The Off-Site Containment System operated for about 8570 hours, or 97.8 percent of the 8,760 hours available during 2006. The system was down for about 190 hours due to thirteen interruptions ranging in duration from 0.08 hours to about 120 hours. A summary of the downtime for the year is presented in Table 3.1 (a). These downtimes consisted of six shutdowns for routine maintenance activities, five shutdowns for system repairs, one shutdown due to a power failure, and one shutdown due to the occurrence of "low level" in the chemical feed tank. Additionally, the pumping rate was reduced to 150 gpm from March 15th to April 11th to accommodate well testing activities at MW-79.

3.2.2 Source Containment System

The Source Containment System operated for about 8399 hours, or 95.9 percent of the 8,760 hours available during 2006. The system was down for about 361 hours due to eight interruptions ranging in duration from 0.17 hours to about 277 hours. A summary of the downtime for the year is presented on Table 3.1 (b). These downtimes consisted of three shutdowns for routine maintenance activities, two shutdowns due power failure, two shutdowns due to a clogged water meter screen, and one shutdown due to problems with the float switch assembly in the air stripper. The shutdown due to the malfunction of the float switch assembly in the air stripper was of long duration because this is a custom built item and had to be ordered. To prevent the reoccurrence of long shutdowns due to float switch failure, two assembly sets were procured, one as a replacement for the source containment system, and the second as a spare that will work in either system.

The rapid infiltration ponds performed well during 2006. Ponds 2 and 3 were used between the beginning of the year and June 2, 2006, and then again between December 1, 2006, and the end of the year. Ponds 1 and 4 were used from June 2, 2006 until December 1, 2006. The amount of water evaporating from the ponds has been estimated to be about 1 percent of the discharged water, that is, about 0.5 gpm.

3.3 Problems and Responses

Besides the downtimes listed on Table 3.1 and discussed in the previous section, two other problems were experienced during the 2006 operation of the containment systems. Both of these problems were associated with the source containment system. First, the pumping rate of well CW-2 gradually declined to about 44 gpm near the end of the year. Although this did not have any significant effect on the capture zone of the well, the pump will be replaced in 2007. Second, the discharge pump to the infiltration ponds began experiencing difficulties when discharging to Ponds 1 and 4. This was attributed to the clogging of the flow meters on the discharge lines to these two ponds. Discharge of the treatment plant effluent was switched to Ponds 2 and 3 on December 1, 2006, and the flow meters will be serviced during 2007.

Section 4
Monitoring Results - 2006

The following data were collected in 2006 to evaluate the performance of the operating remedial systems and to meet the requirements of the Consent Decree and of the permits for the site:

- water-level and water-quality data from monitoring wells,
- data on containment well flow rates, and
- data on the quality of the influent to and effluent from the water-treatment systems.

4.1 Monitoring Wells

4.1.1 Water Levels

The depth to water was measured quarterly during 2006 in all accessible monitoring wells, the off-site and source containment wells, the two observation wells, the piezometer installed in the infiltration gallery, and the Corrales Main Canal near the southeast corner of the Sparton property. The quarterly elevations of the water levels, calculated from these data, are summarized on Table 4.1.

4.1.2 Water Quality

Monitoring wells within and in the vicinity of the plume were sampled at the frequency specified in the Groundwater Monitoring Program Plan (Attachment A to Consent Order). The samples were analyzed for VOCs (primarily for determination of TCE, DCE, and TCA concentrations), and for total chromium (unfiltered, and occasionally filtered, samples). The results of the analysis of the samples collected from these monitoring wells during all sampling events conducted in 2006, and for all of the analyzed constituents, are presented in Appendix A-1. Data on TCE, DCE, and TCA concentrations, in samples collected during the Fourth Quarter of 2006 (November 2006), are summarized on Table 4.2. Samples were also obtained quarterly from the infiltration gallery monitoring wells (MW-74, MW-75, and MW-76) and from the infiltration pond monitoring wells (MW17, MW-77, and MW-78); these samples were analyzed for VOCs (primarily TCE, DCE, and TCA), total chromium, iron, and manganese, as specified in the Groundwater Discharge Permit for the infiltration gallery and the infiltration ponds. The results of the analysis of these samples are presented in Appendix A-2; data on TCE, DCE and TCA concentrations in the Fourth Quarter of 2006 (November 2006) samples from these wells are also included on Table 4.2. For each of the compounds reported on Table 4.2 and in Appendix A, concentrations that exceed the more stringent of its MCL for drinking water or its maximum allowable concentration in groundwater set by NMWQCC are highlighted.

4.2 Containment Systems

4.2.1 Flow Rates

The volumes of groundwater pumped by the off-site and source containment wells during 2006 and the corresponding flow rates are summarized on Table 4.3. As shown on Table 4.3 (a), a total of about 136.3 million gallons of water, corresponding to a combined flow rate of 259 gpm were pumped by the two containment wells. The volume and average flow rate of each well are discussed further below.

4.2.1.1 Off-Site Containment Well

The volume of the water pumped by the off-site containment well during 2006 was monitored with a totalizer meter that was read at irregular frequencies. The intervals between meter readings ranged from less than a day to about seventeen days, and averaged about six days. During each reading of the meter, the instantaneous flow rate of the well was calculated by timing the volume pumped over a specific time interval. The totalizer data collected from these flow meter readings and the calculated instantaneous discharge rate during each reading of the meter are presented in Appendix B-1. Also included in this appendix are the average discharge rate between readings and the total volume pumped between the start of continuous pumping on December 31, 1998, and the time of the measurement, calculated from the totalizer meter readings.

The average monthly discharge rate and the total volume of water pumped from the off-site containment well during each month of 2006, as calculated from the totalizer data, are summarized on Table 4.3 (b). As indicated on this table, approximately 112.2 million gallons of water, corresponding to an average rate of 213 gpm, were pumped in 2006.

4.2.1.2 Source Containment Well

The volume of the water pumped by the source containment well during 2006 was also monitored with a totalizer meter that was also read at irregular frequencies. The intervals between meter readings ranged from one day to about twenty seven days, and averaged about eight days. During each reading of the meter, the instantaneous flow rate of the well was calculated by timing the volume pumped over a specific time interval. The totalizer data collected from these flow meter readings and the calculated instantaneous discharge rate during each reading of the meter are presented in Appendix B-2. Also included in this appendix are the average discharge rate between readings and the total volume pumped between the start of continuous pumping on January 3, 2002, and the time of the measurement, calculated from the totalizer meter readings.

The average monthly discharge rate and the total volume of water pumped from the source containment well during each month of 2006, as calculated from the totalizer data, are summarized on Table 4.3 (c). As indicated on this table, approximately 24.1 million gallons of water, corresponding to an average rate of 46 gpm, were pumped in 2006.

4.2.2 Influent and Effluent Quality

4.2.2.1 Off-Site Containment System

During 2006, the influent[7] to and effluent from the treatment plant for the off-site containment system was sampled monthly. These monthly samples were analyzed for VOCs (primarily TCE, DCE, and TCA), total chromium, iron, and manganese. The results of these influent and effluent sample analyses are presented in Appendix C-1. Concentrations of TCE, DCE, TCA, and total chromium in samples collected during 2006 are summarized on Table 4.4 (a). For each of the compounds shown on Table 4.4 (a), concentrations that exceed the more stringent of its MCL for drinking water or its maximum allowable concentrations in groundwater set by NMWQCC are highlighted. Data on TCE, DCE, and TCA concentrations for the November sample of influent are also included in Table 4.2, as the Fourth Quarter concentrations in CW-1, and were used in the preparation of the plume maps discussed in the next section.

4.2.2.2 Source Containment System

During 2006, the influent to and effluent from the treatment plant for the source containment system was sampled monthly. These monthly samples were analyzed for VOCs (primarily TCE, DCE, and TCA), total chromium, iron, and manganese. The results of these influent and effluent sample analyses are presented in Appendix C-2. Concentrations of TCE, DCE, TCA, and total chromium in samples collected during 2006 are summarized on Table 4.4 (b). For each of the compounds shown on Table 4.4 (b), concentrations that exceed the more stringent of its MCL for drinking water or its maximum allowable concentrations in groundwater set by NMWQCC are highlighted. Data on TCE, DCE, and TCA concentrations for the November sample of influent are also included in Table 4.2, as the Fourth Quarter concentrations in CW-2, and were used in the preparation of the plume maps discussed in the next section.

[7] The "discharge from the containment wells" is the "influent" to the treatment systems; therefore, the two terms are used interchangeably in this report.

Section 5
Evaluation of Operations - 2006

The goal of the off-site containment system is to control hydraulically the migration of the plume in the off-site area and, in the long-term, restore the groundwater to beneficial use. The goal of the source containment system is to control hydraulically, within a short distance from the site, any potential source areas that may be continuing to contribute to groundwater contamination at the on-site area. This section presents the results of evaluations based on data collected during 2006 of the performance of the off-site and source containment systems with respect to their above-stated goals.

5.1 Hydraulic Containment

The quarterly water-level elevation data presented in Table 4.1 were used to evaluate the performance of both the off-site and source containment wells with respect to providing hydraulic containment for the plume and potential on-site source areas. Maps of the elevation of the on-site water table and of the water levels in the UFZ/ULFZ and the LLFZ during each of the four rounds of water-level measurements during 2006 are shown in Figures 5.1 through 5.12. Also shown in these figures are: (1) the limit of the capture zones of the containment wells in the UFZ/ULFZ or the LLFZ, as determined from the configuration of the water levels; and (2) the extent of the TCE plume based on previous year's (November 2005) water-quality data from monitoring wells. (The November 2005 extent of the TCE plume is used as representative of the area that should have been contained during 2006.)

As shown in Figures 5.1, 5.4, 5.7, and 5.10, the pumping from the source containment well CW-2 has a small effect on the on-site water table contours. Well CW-2 is screened between an elevation of 4968.5 and 4918.5 ft MSL. The sand-pack extends about ten ft above the top of the screen, to an elevation of about 4978.5 ft MSL. The top of the 4970-foot silt/clay at this location is also at an elevation of about 4968.5 ft MSL. Most of the water pumped from the well, therefore, comes from the ULFZ and LLFZ underlying the 4970-foot silt/clay unit. The pumping water level in CW-2 is about 4957 ft MSL, more than 10 ft below the top of the silt/clay unit; thus, the direct contribution of water from the aquifer above the silt/clay unit into the well is by leakage through the sand pack, and is controlled by the elevation of the top of the silt/clay unit at the well location. In preparing the water-table maps for the on-site area, the elevation of the water table at the location of CW-2 was, therefore, assumed to be near the top of the 4970-foot silt/clay, that is, at an elevation of 4968.5 ft MSL. A similar condition exists at the location of infiltration pond monitoring wells MW-77 and MW-78. These two monitoring wells are equipped with 30-foot screens that span across the silt/clay unit, and thus allow water to flow from the on-site water table into the underlying ULFZ. The effects of this downward flow were also considered in preparing the water table maps. Finally, note that well MW-63 had an unusually high water level in November 2006 (see Figure 5.10); this was attributed to continuous lawn irrigation at an apartment complex near this well, and the area was treated as a local recharge point in preparing the November water-level map (Figure 5.10).

The quarterly on-site water table maps (Figures 5.1, 5.4, 5.7, and 5.10) also indicate that the treated groundwater infiltrating from the infiltration ponds has created a water-table mound in the pond area. Comparison of the 2006 water table elevations with those that prevailed prior to the operation of CW-2 and of the infiltration ponds indicates that water levels in monitoring wells close to the ponds have risen by one foot or more (see hydrographs of wells MW-17 and MW-22 in Figure 2.5); the highest rise of the water table, from about 7 to more than 8.5 ft, occurred in the vicinity of wells MW-21 and MW-27. The water levels in monitoring wells along or near the southern limit of the silt/clay unit (MW-07, MW-09, MW-12, MW-13, MW-23, MW-26, and MW-33), however, continued to decline due to the off-setting effects of regional declining trends (see hydrograph of well MW-12 in Figure 2.5). These changes in water levels have resulted in steeper gradients, and hence, faster flow rates, both horizontally and vertically. These faster flow rates and the flushing effects of the infiltrating water expedite the migration of contaminants remaining above the 4970-foot silt/clay unit into the capture zones of the source and off-site containment wells.

The quarterly water levels and the capture zones of the containment wells within the UFZ/ULFZ are shown in Figures 5.2, 5.5, 5.8, and 5.11; those within the LLFZ are shown in Figures 5.3, 5.6, 5.9, and 5.12. These figures indicate, that the capture zone of the off-site containment well, CW-1, contained the off-site groundwater contamination, as defined by the extent of the November 2005 TCE plume, throughout the year. The figures also indicate that the source containment well CW-2 has developed a capture zone that controls any potential on-site source areas that may still be contributing to groundwater contamination. The capture zone of the well in both the UFZ/ULFZ and the LLFZ is wider than predicted during its design (SSP&A, 2000c). Hydraulic containment of the plume and of potential source areas was, therefore, maintained throughout 2006.

5.2 Groundwater Quality

Plots showing temporal changes in the concentrations of TCE, DCE, and TCA were prepared for a number of on-site and off-site wells to evaluate long-term water-quality changes at the Sparton site. Plots for on-site wells are shown in Figure 5.13 and plots for off-site wells in Figure 5.14. The concentrations in the on-site wells (Figure 5.13) indicate a general decreasing trend. In fact, the data from wells MW-9 and MW-16, which have the longest record, suggest that this decreasing trend may have started before 1983. A significant decrease in concentrations occurred in well MW-16 during 1999 through 2001. This well is located near the area where the SVE system was operating during those years, and it is apparent that the SVE operations affected the concentrations in the well. The TCE concentrations in the well have been below 10 μg/L during the last several years; the November 2006 concentration was 3.8 μg/L. Since the termination of the SVE operations in 2001, relatively low concentrations have been observed not only in this well but also in other onsite wells completed above the 4970-foot silt/clay unit. This indicates that the SVE system was very effective in cleaning up the unsaturated zone beneath the former Sparton plant area.

A plot for well MW-72 is also included in Figure 5.13. Well MW-72 (see Figure 2.3 for well location) was installed in late February 1999 (SSP&A, 1999a) to provide a means for

assessing whether source areas exist outside the then-predicted capture zone of the source containment well. The first sampling of the well in March 1999 indicated a TCE concentration of 1,800 μg/L and, under the terms of the Consent Decree (see Attachment F to the Consent Decree [SSP&A, 2000c]), the well was scheduled for semi-annual sampling for a period of five years (starting in May 1999). The 5-year semi-annual sampling period was completed in 2003 and, as required by the Consent Decree, an evaluation of the data collected during these five years was made and presented in the 2003 Annual Report (SSP&A, 2004). Based on the declining trend of the concentrations observed during several years prior to the evaluation and on the relative position of the well with respect to the capture zone of the source containment well, the evaluation concluded that there are no source areas outside the capture zone of CW-2, and recommended that sampling frequency of the well be reduced to annually. This change in the sampling frequency became effective in 2005. In November 2005, the TCE concentration in this well rose to 720 μg/L from 170 μg/L during the previous year; however, by November 2006, the concentration declined again to 160 μg/L. These data confirm the earlier conclusion that there are no significant on-site source areas outside the capture zone of the source containment well CW-2.

Of the six off-site wells shown in Figure 5.14, the November 2006 concentrations in well MW-60 continued to be the highest observed in an off-site well, as it has been the case during the last several years. The concentrations of TCE in this well increased from low μg/L levels in 1993 to a high of 11,000 μg/L in November 1999 and then declined to 2,900 μg/L in November 2000. Then, they began increasing again reaching a second peak of 18,000 μg/L in November 2004 and then declining to 7,700 μg/L in November 2005. In November 2006, TCE, DCE, and TCA concentrations in this well (7,500, 475, and 29 μg/L, respectively) were at about the same levels as in November 2005 (7,800, 455, and 27 μg/L, respectively). In general, the flow patterns that resulted from the operation of the containment systems have caused contaminant concentrations to decline in some off-site wells (see for example wells MW-55 and MW-61 in Figure 5.14), or remain relatively stable in some others (see for example wells MW-48, MW-56, and MW-58 in Figure 5.14).

Prior to the start of remedial pumping from the off-site containment well CW-1, there were two monitoring wells completed in the DFZ, well MW-67 of the MW-48/55/56/67 cluster, and well MW-71 located near the MW-60/61 cluster. Well MW-67 had been clean since its installation in July 1996, and continued to be free of any contaminants in 2006. The other DFZ well, well MW-71, had been problematic since its installation in June 1998, and its recompletion in October 1998 (see 1999 Annual Report [SSP&A, 2001a] for a detailed discussion of the history of this well). A purge test and the deviation survey were conducted on the well in July and September 2001 to investigate its behavior. Based on the results of these tests (SSP&A and Metric, 2002), the well was plugged in October 2001 and a replacement well, MW-71R, was installed about 30 ft south of the original well (see Figure 2.3 for location); this well is equipped with a 5-foot screen installed 20 ft below the screen of the original well (see Table 2.2 for elevation of screened interval).

The first sample from MW71R, obtained in February 2002, had a TCE concentration of 130 μg/L. The TCE concentration in the well then gradually increased to 210 μg/L by August 2003. Quarterly samples collected since then indicate that while contaminant concentrations are declining (92 μg/L of TCE in November 2006), the well remains contaminated. In early 2004, a proposal for action was made by Sparton (SSP&A and Metric, 2004a) to address the continuing presence of contaminants in this well. Several discussions on this proposal and other potential actions ensued between technical representatives of USEPA, NMED, and Sparton. In October 2004, the parties agreed to install a DFZ monitoring/stand-by extraction well near the off-site containment well CW-1 with the decision on whether the well will be a monitoring or an extraction well to be based on the results of the initial sampling of the well. Following the preparation (SSP&A and Metric 2004b) and approval[8] of a Work Plan, and the obtaining of the necessary permits, this third DFZ well was installed in February 2006. The first samples from this well, obtained during its testing in April 2006, indicated that the well did not contain any site-related contaminants. Details on the installation, testing and sampling of the well were included in a letter-report[9] presented to USEPA/NMED in June 2006. Based on these results the well was designated as monitoring well MW-79, and sampled again, on a semi-annual schedule, in May and November 2006; both of these samples did not contain any site-related contaminants[10].

The Fourth Quarter (November) 2006 water-quality data presented in Table 4.2 were used to prepare concentration distribution maps showing conditions near the end of 2006. The horizontal extent of the TCE and DCE plumes and the concentration distribution within these plumes in November 2006, as determined from the monitoring well data, are shown on Figures 5.15 and 5.16, respectively; the concentrations of TCA are shown on Figure 5.17. (At well cluster locations only the well with the highest concentration is shown in these figures.) Also shown on Figure 5.15 are the approximate areas of origin[11] of the water pumped by the off-site containment well during the last seven years and from the source containment well during the last four years.

The extent of the TCE and DCE plumes in November 2006 (Figures 5.15 and 5.16) is similar to that in November 2005. Of 57 wells that were sampled both in November 2006 and 2005, the TCE concentrations were lower than in November 2005 in 24 wells, higher in 8 wells,

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[8] E-mail dated January 6, 2005 from Charles A. Barnes of USEPA to Tony Hurst of Hurst Engineering Services, Project Coordinator for Sparton, on the subject of "Approval of Work Plan submitted December 6, 2004," with cc to John Kieling, Carolyn Cooper, and Baird Swanson of NMED.

[9] Letter dated June 2, 2006 to USEPA and NMED representatives from Stavros S. Papadopulos of SSP&A and Gary L. Richardson of Metric with subject "Sparton Technology, Inc. Former Coors Road Plant Remedial Program - Transmittal of Data from the Installation, Testing, and Sampling of a new DFZ Well."

[10] The samples obtained during the April 2006 testing of the well and the May sample contained toluene at very low concentrations (1.6 to 5.8 μg/L). The toluene was attributed to the drilling operations, and was not present in the November 2006 sample.

[11] Area of origin refers to the areal extent of the volume of the aquifer within which the water pumped during a particular year was stored prior to the start of pumping from that particular well, that is, in late December 1998 for extraction well CW-1 and in early January 2002 for extraction well CW-2.

and remained the same in 25 wells (23 below the detection limit of 1 μg/L). The corresponding numbers for DCE were 15 wells with lower, 10 wells with higher, and 32 wells with the same (below the detection limit of 1 μg/L) concentrations. The greatest decrease was in well MW-72 where the concentration of TCE decreased from 720 μg/L in 2005 to 160 μg/L in 2006, and that of DCE from 67 μg/L to 19 μg/L. The highest increase was in well CW-1 where the concentration of TCE increased from 1200 to 1300 μg/L, and in well MW-60 where the concentration of DCE increased from 455 to 475 μg/L. In approximately half of the wells where the concentrations of TCE and/or DCE increased, the increase was less than 10 μg/L. The concentrations of TCA presented in Figure 5.17 indicate that a TCA plume (defined as the area with concentrations exceeding the more stringent of the federal or state allowable limits in groundwater) continued not to exist in November 2006, as it has been the case since November 2003. None of the monitoring wells had a TCA concentration above the 60 μg/L maximum allowable concentration in groundwater set by the NMWQCC. The highest TCA concentration in November 2006 was 29 μg/L and occurred in well MW-60.

Note that the leading edge of the DCE plume (Figure 5.16) extends towards the southeast to monitoring well MW-65. Until late 2001, DCE concentrations in this well had been below detection limits; DCE above the detection limit of 1 μg/L first occurred in November 2001 (2.6 μg/L), and its concentration rose above the MCL of 5 μg/L in February 2002 (5.4 μg/L). The DCE concentrations in the well continued to increase, reaching 73 μg/L in November 2005; the November 2006 DCE concentration in the well was slightly lower, 65 μg/L. A similar situation also exists with the TCE and TCA concentration histories in MW-65. Prior to the start of remedial pumping, TCE was the only compound that was detected in this well above the detection limit of 1 μg/L. Its concentration in November 1998, a few months before the start of pumping from the off-site containment well CW-1, was 13 μg/L. After the start of pumping from CW-1 on December 31, 1998, TCE concentrations in the well rapidly decreased and were below the detection limit by August 1999. The concentrations of TCE in the well remained below the detection limit until November 2001 when it was again detected and began rising reaching 19 μg/L in November 2005; the November 2006 concentration of TCE in the well was 15 μg/L. The first detection of TCA in well MW-65, at the detection limit of 1 μg/L, occurred in February 2002 and its concentration rose to 28 μg/L in November 2005; in November 2006 the TCA concentration in the well was 26 μg/L. Given the direction of groundwater flow (see Figures 5.1 through 5.12), and the lack of any significant historical concentrations of DCE or TCA in wells MW-53, MW-58, MW-55, MW-47, and MW-37R (or its predecessor MW-37), the contaminants detected in MW-65 during the last several years may represent a separate source south of the Sparton Site. Such a possibility is also supported by the presence of DCE (and TCA) in well MW-62 which is located south of the main DCE plume.

Changes that occurred between November 1998 (prior to the implementation of the current remedial activities) and November 2006 in the TCE, DCE, and TCA concentrations at wells that were used for plume definition and sampled during both sampling events are shown in Figures 5.18, 5.19, and 5.20. Also shown on these figures is the extent of the plumes in November 1998 and November 2006. (Changes in monitoring wells MW-72, MW-73 and

MW-77, and containment well CW-2, which were installed after November 1998 are also included in these figures; the changes in these wells are between their first sampling after installation and November 2006.) Among the 35 wells that were used to prepare these figures, TCE concentrations decreased in 22 wells, increased in 8 wells, and remained unchanged (below detection limit) in 5 wells. The corresponding number of wells where concentrations decreased, increased, or remained unchanged are 19, 7, and 9 for DCE, and 18, 4, and 13 for TCA.

The largest decreases in contaminant concentrations occurred in on-site wells MW-23, MW-25, and MW-26. Concentrations of TCE in these wells decreased by 6,189, 5,568, and 6,480 μg/L, respectively, from levels that were in the 5,500-6,500 μg/L range in 1998 to levels of 32 μg/L and less; DCE concentrations decreased by 399, 71, and 590 μg/L, to very low μg/L levels or to "not detected" (ND); and TCA concentrations decreased from levels that were at the 550-720 μg/L levels to ND. The largest increases in TCE concentrations occurred in the off-site containment well CW-1 (1,160 μg/L), and on-site ULFZ well MW-19 (576 μg/L). The TCE concentration in CW-1 increased from 140 μg/L in September 1998 to 1,000 μg/L levels soon after the start of its operation and stayed at levels around 1,200 μg/L since then; it was 1,300 μg/L in November 2006. In well MW-19, the TCE concentration was 4.2 μg/L in 1998 and 580 μg/L in November 2006. When first sampled in 1991, well MW-19 had a TCE concentration of 680 μg/L and a DCE concentration of 57 μg/L; the concentration of both TCE and DCE began declining after that reaching 4.2 μg/L for TCE and ND for DCE by November 1998 (TCA concentrations during this period had been ND or at low μg/L levels). Contaminant concentrations in the well remained at these low levels until November 2001 and then began rising reaching concentrations of 815 μg/L for TCE, 81 μg/L for DCE, and 8 μg/L for TCA by November 2005. The November 2006 concentrations in the well were 72 μg/L for DCE and 5.3 μg/L for TCA. (see Table 4.2). These higher contaminant concentrations in well MW-19 are attributed to the presence of residual contaminants within the 4970-foot silt/clay unit and the higher leakage rates through this unit that were induced by the operation of the source containment well and the associated on-site infiltration ponds.

The persistence of the high concentrations that have been observed in the water pumped from containment well CW-1 since the beginning of its operation, and the concentrations detected at well MW-60 indicate the presence of high concentration areas upgradient from both the off-site containment well and MW-60. This conclusion is confirmed by the model calibration results discussed in Section 6.

5.3 Containment Systems

5.3.1 Flow Rates

A total of about 136.3 million gallons of water, corresponding to an average pumping rate of about 259 gpm, were pumped during 2006 from the off-site and source containment wells [see Table 4.3 (a)]. The total volume pumped from both wells since the beginning of remedial pumping in December 1998 is about 1.051 billion gallons (Figure 5.22), and represents

approximately 93 percent of the initial plume pore volume reported in Subsection 2.6.1.3 of this report. The volume pumped from each well and the average flow rates are discussed below.

5.3.1.1 Off-Site Containment Well

The volume of water pumped from the off-site containment well during each month of 2006 is shown on Table 4.3 (b); a plot of the monthly production is presented in Figure 5.21. Based on the total volume of water pumped during the year (approximately 112.2 million gallons), the average discharge rate for the year was 213 gpm. Due to several downtimes (see Table 3.1), the well was operated 97.8 percent of the time available during the year, thus the average discharge rate of the well during its operating hours was about 218 gpm. It should also be noted that the discharge rate of this well was deliberately reduced to 150 gpm between March 15 and April 11 2006 to allow the treatment of the water pumped during the development and testing of the new DFZ well, MW-79, at the off-site treatment system.

Since the beginning of its operation in December 1998, the off-site containment well pumped a total of about 923 million gallons of water from the aquifer. (This total includes about 2 million gallons pumped during the testing and the first day of operation of the well in December 1998.) This represents approximately 82 percent of the initial plume pore volume reported in Subsection 2.6.1.3 of this report. A cumulative plot of the volume of water pumped from the off-site containment well is presented in Figure 5.22.

5.3.1.2 Source Containment Well

The volume of water pumped from the source containment well during each month of 2006 is shown on Table 4.3 (c); a plot of the monthly production is presented in Figure 5.21. Based on the total volume of water pumped during the year (approximately 24.1 million gallons), the average discharge rate for the year was 46 gpm. The well was operated 95.9 percent of the time available during the year, thus the average discharge rate of the well during its operating hours was about 48 gpm, .The discharge rate of the well declined during the latter half of the year reaching a monthly average of 44 gpm in November and December. The pump will be replaced in 2007 to restore the discharge rate to the design value of 50 gpm.

Since the beginning of its operation in January 3, 2002, the source containment well pumped a total of about 128 million gallons of water from the aquifer. This represents approximately 11 percent of the initial plume pore volume reported in Subsection 2.6.1.3 of this report. A cumulative plot of the volume of water pumped from the off-site containment well is presented in Figure 5.22.

5.3.2 Influent and Effluent Quality

5.3.2.1 Off-Site Containment System

The concentrations of TCE, DCE, TCA, and total chromium in the influent to and effluent from the off-site air stripper during 2006, as determined from samples collected at the beginning of each month, are presented on Table 4.4 (a). Plots of the TCE, DCE, and total chromium concentrations in the influent are presented in Figure 5.23.

The concentrations of TCE in the influent during 2006 ranged from 990 μg/L detected in the October sample to 1,500 μg/L at the end of the year (January 4, 2007 sample); the average concentration for the year was about 1,190 μg/L. The lowest (63 μg/L) and highest (100 μg/L) concentrations of DCE were also detected in the same samples (October and January 2007); the average concentration for the year was 77 μg/L. Concentrations of TCA in the influent fluctuated within a relatively narrow range (3.2 to 4.5 μg/L) and averaged about 4 μg/L. Throughout the year, total chromium concentrations in the influent were below the 50 μg/L maximum allowable concentration in groundwater set by NMWQCC and averaged about 26 μg/L.

The concentrations of TCE, DCE, and TCA in the air stripper effluent were below the detection limit of 1 μg/L throughout 2006. Total chromium concentrations in the effluent were essentially the same as those in the influent.

5.3.2.2 Source Containment System

The 2006 concentrations of TCE, DCE, TCA, and total chromium in the influent to and effluent from air stripper for the source containment system, as also determined from samples collected at the beginning of each month, are presented on Table 4.4 (b). Plots of the TCE, DCE, and total chromium concentrations in the influent are presented in Figure 5.23.

The concentrations of TCE in the influent during 2006 ranged from 140 μg/L to 190 μg/L, and averaged about 150 μg/L. The concentrations of DCE and TCA fluctuated within a relatively narrow range during the year and averaged about 19 μg/L and 1.2 μg/L, respectively. Throughout the year, the total chromium concentrations in the influent were below the 50 μg/L maximum allowable concentration in groundwater set by NMWQCC and averaged 30 μg/L.

The concentrations of TCE, DCE, and TCA in the air stripper effluent were below detection limits throughout the year, and chromium concentrations were at about the same level as those in the influent. Note that the reported chromium concentrations in the May sample of both the influent and effluent (see Table 4.4) are suspect as they are not consistent with other monthly data.

5.3.3 Origin of the Pumped Water

The groundwater pumped from the off-site and the source containment wells is water that was originally (prior to the start of pumping) in storage around each well. The areal extent of the volume of the aquifer within which the water pumped during a particular year was originally stored is referred to as the "area of origin" of the water pumped during that year. The approximate areas of origin of the water pumped from the off-site containment well during each of the last eight years and from the source containment well during each of the last five years are shown in Figure 5.15. Particle tracking analysis (see Section 6.1.4) with the calibrated model of the site was used to determine these areas of origin. The area of origin of the water pumped by each well during the first year of its operation (1999 for the off-site and 2002 for the source containment well) is a slightly elliptical area around each well, with the well off-centered on the

down-gradient side of the elliptical area. The areas of origin corresponding to subsequent years of operation form elliptical rings around the first year's area of origin. (The elliptical shape and the off-centered location with respect to the containment wells are due to the effects of the regional gradient.)

5.3.3.1 Off-Site Containment Well

Approximately 923 million gallons of groundwater have been removed from the aquifer during the eight-year operation of the off-site containment well. The well is screened across the entire thickness of the aquifer above the 4,800-foot clay. Using an average thickness of 160 ft for the aquifer, a porosity of 0.3, and assuming that the flow is primarily horizontal, the areal extent of the original storage volume for this water is estimated to be 2.57 million square ft (ft^2). This is consistent with the extent of the model calculated areas of origin for this well shown in Figure 5.15 (about 2.76 million ft^2). Note that the above estimate assumes horizontal flow, whereas the model takes into consideration the fact that the water table is declining and that, therefore, the source of some of the pumped water is vertical drainage from the water table rather than purely horizontal flow. The storage volume from which the pumped water is derived has a smaller area near the water table than in the deeper horizons of the aquifer. The area shown in Figure 5.15 represents the horizon where the area is the largest.

5.3.3.2 Source Containment Well

Approximately 128 million gallons of groundwater have been removed from the aquifer during the four-year operation of the source containment well. About 40 ft of the screen of this well is open to the aquifer below the 4970-foot silt/clay. Assuming that groundwater flow toward the well is primarily within this 40-foot screened interval, and a porosity of 0.3, the areal extent of the original storage volume of the water pumped from the well is estimated to be 1.43 million ft^2. The extent of the model calculated areas of origin for this well shown in Figure 5.15 is about 0.94 million ft^2. The difference in the estimated and model based areas indicates that about one third of the water pumped by this well is vertical leakage that originates from the aquifer above the 4970-foot silt/clay, and from deeper horizons of the aquifer below the screened interval of the well.

5.3.4 Contaminant Mass Removal

A total of about 550 kg (1,210 lbs) of contaminants, consisting of 513 kg (1,130 lbs) of TCE, 34 kg (76 lbs) of DCE, and 1.7 kg (3.7 lbs) of TCA, were removed by the two containment wells during 2006 [see Table 5.1 (a)]. The total mass removed by the containment wells since the beginning of operations in December 1998 is about 4,490 kg (9,900 lbs), consisting of about 4,230 kg (9,320 lbs) of TCE, 249 kg (550 lbs) of DCE, and 13 kg (29 lbs) of TCA. This represents about 61.2 percent of the total dissolved contaminant mass currently estimated to have been present in the aquifer prior to the testing and operation of the off-site containment system (see Section 2.6.1.4). The mass removal rates by each well are discussed below.

5.3.4.1 Off-Site Containment Well

The monthly mass removal rates of TCE, DCE, and TCA by the off-site containment well during the 2006 were estimated using the monthly discharge volumes presented on Table 4.3 (b)

and the concentration of these compounds shown on Table 4.4 (a). These monthly removal rates are summarized on Table 5.1 (b) and plotted in Figure 5.24. As shown on Table 5.1 (b), about 533 kg (1,174 lbs) of contaminants, consisting of about 499 kg (1,099 lbs) of TCE, 33 kg (72 lbs) of DCE, and 1.6 kg (3.5 lbs) of TCA were removed by the off-site containment well during 2006.

A plot showing the cumulative mass removal by the off-site containment well, including 1.3 kg (3 lbs) removed during the December 1998 testing and operation of the well, is presented in Figure 5.25. By the end of 2006 the off-site containment well had removed a total of approximately 4,290 kg (9,460 lbs) of contaminants, consisting of approximately 4,060 kg (8,940 lbs) of TCE, 225 kg (500 lbs) of DCE, and 9.4 kg (21 lbs) of TCA. This represents about 58.5 percent of the total dissolved contaminant mass currently estimated to have been present in the aquifer prior to the testing and operation of the off-site containment system (see Section 2.6.1.4).

5.3.4.2 Source Containment Well

The monthly mass removal rates of TCE, DCE, and TCA by the source containment well during the 2006 were estimated using the monthly discharge volumes presented on Table 4.3 (c) and the concentration of these compounds shown on Table 4.4 (b). These monthly removal rates are summarized on Table 5.1 (c) and plotted in Figure 5.24. As shown on Table 5.1 (c), about 16 kg (34 lbs) of contaminants, consisting of about 14 kg (30 lbs) of TCE, 1.7 kg (3.9 lbs) of DCE, and 0.1 kg (0.2 lbs) of TCA were removed by the source containment well during 2006.

A plot showing the cumulative mass removal by the source containment well since the beginning of its operation on January 3, 2002 is presented in Figure 5.25. The total mass of contaminants removed by the well by the end of 2006 was abou 200 kg (440 lbs), consisting of 170 kg (375 lbs) of TCE, 24 kg (53 lbs) of DCE, and 3.4 kg (7.5 lbs) of DCA. This represents about 2.7 percent of the total dissolved contaminant mass currently estimated to have been present in the aquifer prior to the testing and operation of the off-site containment system (see Section 2.6.1.4).

5.4 Site Permits

5.4.1 Off-Site Containment System

The infiltration gallery associated with the off-site containment system is operated under State of New Mexico Groundwater Discharge Permit DP-1184. This permit requires monthly sampling of the treatment system effluent, and the quarterly sampling of the infiltration gallery monitoring wells MW-74, MW-75 and MW-76. The samples are analyzed for TCE, DCE, TCA, chromium, iron, and manganese. The concentrations of these constituents must not exceed the maximum allowable concentrations for groundwater set by NMWQCC, and the results of the analyses must be reported quarterly.

As required by the Groundwater Discharge Permit, all sample analysis results during 2006 were reported quarterly to the NMED Groundwater Bureau. The sampling results met the permit requirements throughout the year.

No violation notices were received during 2006 for activities associated with the operation of the off-site containment system

5.4.2 Source Containment System

The rapid infiltration ponds associated with the source containment system are also operated under State of New Mexico Groundwater Discharge Permit DP-1184, and are subject to the above-stated requirements of this permit. The monitoring wells for this system are MW-17, MW-77 and MW-78. The data collected from the system met the requirements of the Groundwater Discharge Permit throughout 2006.

The air stripper associated with the source containment system is operated under Albuquerque/Bernalillo County Authority-to-Construct Permit No. 1203. This permit specifies emission limits for total VOCs, TCE, DCE, and TCA. Emissions from the air stripper are calculated annually by using influent water-quality concentrations and the air stripper blower capacity. The calculated emissions are reported to the Albuquerque Air Quality Division by March 15 every year as required by the permit.

The requirements of Permit No. 1203 were met throughout 2006. No violation notices were received during 2006 for activities associated with operation of the source containment system.

5.5 Contacts

In May 2006, Baird Swanson (NMED Groundwater Bureau) visited the site during the sampling of DFZ well MW-71R and obtained split samples from this well.

Under the terms of the Consent Decree,[12] Sparton is required to prepare an annual Fact Sheet summarizing the status of the remedial actions, and after approval by USEPA/NMED, distribute this Fact Sheet to property owners located above the plume and adjacent to the off-site treatment plant water discharge pipeline. Annual Fact Sheets reporting on remedial activities during 1999, 2000, and 2001 were prepared by Sparton, approved by the regulatory agencies, and distributed to the property owners. During the last three years, however, such Fact Sheets were not distributed to the property owners. Sparton prepared Draft Fact Sheets for 2002, for 2002 and 2003 combined, and for 2002 through 2004 combined, but could not distribute these Fact Sheets because approval had not been issued by USEPA/NMED. The last Draft Fact Sheet, for the years 2002 through 2004, was submitted to the agencies for approval on August 2005, but approval had not been obtained as of the end of 2006.

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[12] Attachment B to the Consent Decree in Albuquerque v. Sparton Technology, Inc., No. CV 07 0206 (D.N.M.), Public Involvement Plan for Corrective Measure Activities.

Section 6
Groundwater Flow and Transport Model

This section describes a numerical groundwater and contaminant transport model of the aquifer system underlying the Sparton site and its vicinity. This model was developed following the general outline described in Task 3 of the "Work Plan for the Assessment of Aquifer Restoration" (SSP&A,2000b), which is incorporated as Attachment D in the Consent Order. The development of the model is described in the 1999 Annual Report (SSP&A, 2001a) and in the 2003 Annual Report (SSP&A, 2004).

The groundwater flow model is based on MODFLOW-2000 (Harbaugh and others, 2000). This flow model has been calibrated to the average annual water levels observed since the start of the operation of the off-site containment well (1999-2006). The flow model is coupled with the solute transport simulation code MT3D99 (Zheng and SSP&A, 1999) for the simulation of constituents of concern underlying the site. The model has been used to simulate TCE concentrations in the aquifer from start-up of the off-site containment well in December 1998 through December 2007.

6.1 Groundwater Flow Model

6.1.1 Structure of Model

The model area and model grid are presented in Figure 6.1. The overall model dimensions are 12,800 ft by 7,300 ft. The model consists of 88 rows and 133 columns. The central part of the model covers a finely gridded area of 4,100 ft by 2,600 ft which includes the Site and the off-site plume; the grid spacing in this area is uniform at 50 ft. Outward from this central area, the grid spacing is gradually increased to 200 ft towards the limits of model domain. The model grid is aligned with principal axes corresponding to the approximate groundwater flow direction and plume orientation (45° clockwise rotation).

The model consists of 13 layers. The vertical discretization used in the model is shown in Figure 6.2. Layers 1 through 11 correspond to the surficial aquifer. Layer 1 is 15 ft thick, layer 2 is 5 ft thick, layers 3 through 7 are 10 ft thick, layers 8 and 9 are 20 ft thick, and layers 10 and 11 are 40 ft thick. Layer 12 is a 4-foot-thick unit that represents the 4800-foot clay unit. Layer 13 represents the upper 100 ft of the aquifer underlying the 4800-foot clay unit. The vertical discretization was selected to minimize vertical numerical dispersion.

6.1.1.1 Boundary Conditions

The northeast and southwest model boundaries are specified as no-flow boundaries. The rationale for no-flow boundaries on the northeast and southwest boundaries is that these boundaries are oriented approximately parallel to the direction of groundwater flow. The boundary on the southeast is the Rio Grande. The northwest model domain boundary is a constant head boundary (Figure 6.1). The procedure used to estimate heads on the constant head

boundaries is described in the 2001 Annual Report (SSP&A, 2002). This procedure captures the regional water decline that has been observed at the Site over the past decade (Figure 6.3). Regional water levels, based on the water-level data shown on Figure 6.3, have declined at an average rate of 0.6 ft per year for the past 13 years. The method incorporates the following assumptions:

- the water levels from the ULFZ and LLFZ wells are best represented by a planar surface,
- the water levels vary linearly with depth,
- the coefficients of the plane of best-fit vary linearly over time, and
- the head drop across the 4800-foot silt/clay unit is about 6 ft.

6.1.1.2 Hydraulic Properties

Four different geologic zones are specified within the model domain:

- Holocene channel and flood plain deposits, also referred to as Recent Rio Grande deposits;
- the 4970-foot silt/clay unit;
- sands of the Upper Santa Fe Group, Late-Pleistocene channel and flood plain deposits, and Late-Pleistocene and Holocene arroyo fan and terrace deposits, collectively referred to as the sand unit; and
- the 4800-foot clay unit.

The sand unit is primarily classified as USF2 facies assemblages 2 and 3 (Hawley, 1996). Locally, near the water table, in some areas, the sands and gravels are classified as USF4 facies assemblages 1 and 2. In areas where the 4970-foot silt/clay unit is present, the sands and gravels overlying this unit are Late-Pleistocene arroyo fan and terrace deposits. The 4970-foot silt/clay unit represents Late-Pleistocene overbank deposits. The 4800-foot clay unit is included in the USF2.

The specific storage of all model units was specified at 2×10^{-6} ft^{-1} consistent with the value specified in the USGS model of the Albuquerque Basin (Kernodle, 1998). The specific yield of the sand unit and the Recent Rio Grande deposits was specified as 0.20.

The spatial extent of the recent Rio Grande deposits and the 4970-foot silt/clay unit are shown in Figure 6.1. The following table summarizes the estimates of hydraulic properties:

Hydrogeologic Zone	Hydraulic Conductivity, ft/d		Specific Yield	Specific Storage, ft^{-1}	Model Layers in which zone is present
	Horizontal	Vertical			
Sand unit above 4970-silt/clay unit	39	0.2	0.2	2×10^{-6}	1,2
Sand unit above 4970-silt/clay unit near southeastern extent	20	0.2	0.2	2×10^{-6}	1,2
4970-foot silt/clay unit	16	0.00006		2×10^{-6}	3
Recent Rio Grande deposits	91	0.008	0.2	2×10^{-6}	1-6
Sand unit	25	0.1	0.2	2×10^{-6}	3-11, 13
4800-foot clay unit	0.017	0.00002		2×10^{-6}	12

6.1.1.3 Sources and Sinks

The groundwater sinks in the model domain are the off-site containment well CW-1, the source containment well CW-2, and eight on-site shallow wells (PW-1, MW-18, and MW-23 through MW-28) that are, or were, used for remedial extraction. The off-site containment well has been in operation since December 31, 1998 with a brief shut down in April 1999. The average annual pumping rate has varied between 213 gpm and 225 gpm. The average pump rate in 2006 was 213 gpm. The pumping at CW-1 is distributed across model layers 4 through 11 and is apportioned based on layer transmissivities. The discharge from well CW-1 to the infiltration gallery is simulated using wells injecting into layer 2. The discharge is distributed across the area of the gallery.

The source containment well, CW-2, began operation in January 2002. The well has operated at an average annual pumping rate of between 46 gpm and 52 gpm. The average pump rate in 2006 was 46 gpm. Ninety-nine percent of the treated water from this well is assumed to infiltrate back to the aquifer from the six on-site infiltration ponds based on consumptive use calculations. Only two ponds are used for infiltration at any given time; during 2002 the treated discharge from the well was rotated among the ponds, but since then discharge was only to ponds 1,2,3, and 4 (see Figure 2.10 for pond locations). The other two infiltration ponds were backfilled during 2005.

The shallow extraction wells were operated from December 1988 to November 1999. Total extraction rates from the wells declined with time. The average pump rate was 0.26 gpm in 1999. Since discharge from the shallow extraction wells was to the city sewer, infiltration of this water was not simulated in the model. Infiltration of precipitation is considered to be negligible due to high evapotranspiration and low precipitation.

Recharge within the modeled area was assumed to occur from the Arroyo de las Calabacillas, the Corrales Main Canal, irrigated fields and the Rio Grande. The recharge rate for the arroyo and the canal was estimated in the model calibration process described below. The calibrated recharge rate from the arroyo and the canal was 19 ft/yr. Recharge from the irrigated fields east of the Corrales Main Canal was simulated at a rate of 1.1 ft/yr. Recharge was applied to the highest layer active within the model. The resulting total recharge rates within the

modeled area were 141 gpm from the arroyo, 8 gpm from the canal, and 24 gpm from irrigated fields.

Infiltration from the Rio Grande was simulated with the MODFLOW river package. The water level in the Rio Grande was estimated from the USGS 7.5 minute topographic map for the Los Griegos, New Mexico quadrangle. The ratio of the vertical hydraulic conductivity of the sediments beneath the river to the thickness of these sediments was a parameter in the model calibration process. The calibrated ratio of the vertical hydraulic conductivity to the thickness was 0.1 per day. The model calculated infiltration rates from the Rio Grande range from about 423 gpm in 1998 to 462 gpm in 2006.

6.1.2 Model Calibration

The groundwater flow model initially calibrated as described in the 1999 Annual Report (SSP&A, 2001a) was recalibrated during the preparation of the 2003 Annual Report (SSP&A, 2004), to obtain better estimates of the hydraulic properties of the 4970-foot silt/clay unit, the sand unit above the 4970-foot silt clay unit, and the recent Rio Grande deposits. The annual averages of the water levels measured in each monitoring well between 1999 and 2003 were used as calibration targets, and the model was recalibrated by making transient simulations of the period between December 1998 and December 2003 and adjusting the above-listed hydraulic parameters to minimize the water-level residuals, that is, the difference between measured and calculated average water levels. The results of this recalibration were presented in the 2003 Annual Report.

A new recalibration of the groundwater flow model was not conducted this year. The average water levels for 2006 were added to the set of calibration targets and a transient simulation between December 1998 and December 2006 was conducted. The results of this simulation indicated that the model, as calibrated for the 2003 Annual Report, was able to match satisfactorily the 2006 water levels, and that, therefore, further recalibration was not necessary this year. The transient simulation between December 1998 and December 2006 and its results are discussed in the next section.

6.1.3 Transient Simulation – December 1998 to December 2006

The groundwater model was used to simulate groundwater levels in the aquifer system underlying the former Sparton site and its vicinity from December 1998, just prior to the startup of containment well CW-1, until December 2006. With the exception of the month-long stress period for December 1998, annual stress periods were used in the transient simulation. The 2006 pumping rates specified for the containment wells CW-1 and CW-2 were those specified on Table 4.3; the pumping rates for earlier years were those listed in Table 4.3 of the earlier Annual Reports (SSP&A, 2001a; 2001b; 2002; 2003; 2004, 2005). The calculated water levels at the end of this simulation, representing December 2006, for the water table (UFZ), ULFZ, and LLFZ are shown in Figures 6.4, 6.5, and 6.6, respectively.

The annual averages of the water levels measured between 1999 and 2006 at each of the monitoring wells at the former Sparton site and its vicinity were compared to model-simulated

water levels. Measured water levels were compared to calculated water levels in the model layer corresponding to the location of the screened interval of the monitoring well. When the screened interval of a monitoring well spanned more than one model layer, the measured water levels were compared to the average of the calculated water levels in the layers penetrated by the well.

The correspondence between measured and model-calculated water levels was evaluated using both qualitative and quantitative measures. Scatter plots of observed versus calculated water levels were used to provide a visual comparison of the fit of model to the measured water level data. For a calibrated model, the points on the scatter plot should be randomly and closely distributed about the straight line that represents an exact match between the calculated and observed groundwater levels. The scatter plot shown in Figure 6.7 is a plot of measured versus calculated average water levels for all of the water level data collected between 1999 and 2006. This scatter plot visually illustrates the excellent comparison between model calculated water levels and observed water levels.

The quantitative evaluation of the model simulation consisted of examining the residuals between the 500 average annual water levels measured in the monitoring wells at the former Sparton site and its vicinity and the corresponding calculated water levels for these monitoring wells. The residual is defined as the observed water level minus the calculated water level. To quantify model error, three statistics were calculated for the residuals: the mean of the residuals, the mean of the absolute value of the residuals, and the sum of squared residuals. The mean of the residuals is 0.21 ft, the mean of the absolute value of the residuals is 0.79 ft, and the sum of squared residuals is 617 ft^2. The minimum residual is -3.0 ft and the maximum residual is 4.5 ft. The absolute mean residual of 0.79 ft is considered acceptable since the observed water-level measurements applied as calibration targets have a total range of 27 ft, and seasonal fluctuations of water levels are on the order of several ft. The residuals at each monitoring well for each monitoring period and the calibration statistics are presented in Appendix D.

6.1.4 Capture Zone Analysis

The capture zones of containment wells CW-1 and CW-2 in 2006 were calculated using particle tracking. The particle tracking was applied to the calculated 2006 water levels, assuming that these water levels represented a steady-state condition. The particle tracking was carried out using the PATH3D computer code (Zheng, 1991). The calculated 2006 water levels and capture zones are based on the average annual pump rates at CW-1 and CW-2. In 2006 the average rate at CW-1 was about five percent less than in previous years due to curtailment of pumping during testing of MW-79 in March and April and a five day shut down in late October for repairs. The actual area of capture that was achieved by pumping during most of the year is larger than calculated by this analysis as monthly average pumping rates in most months were about five percent greater than the average annual rate.

The calculated capture zones of containment wells CW-1 and CW-2 in the water table (UFZ), the ULFZ, and the LLFZ are presented in Figures 6.4, 6.5, and 6.6, respectively. Also shown in these figures is the extent of the TCE plume in November 2005. Note that, since well CW-2 is not screened across the aquifer above the 4,970-foot silt/clay unit, the capture zone of

this well shown in Figure 6.4 represents water that flows eastward, over the edge of the 4,970-foot silt/clay, and then westward under the silt/clay unit to be eventually captured by CW-2. It should also be noted that Figure 6.6 represents the water levels in the middle of model layer 8 which corresponds to an elevation of 4,910 ft MSL (see Figure 6.2). This is an elevation 8.5 ft below the bottom of the screen in well CW-2; thus, the capture zone of this well shown in Figure 6.6 represents the area through which water moves upward and is captured by CW-2. Particle tracking analysis was also used to determine the aquifer area where the water extracted at CW-1 in each year from 1999 to 2006 was located at the start of extraction in 1998 and where the water extracted at CW-2 in each year from 2002 to 2006 was located at the start of extraction in January 2002. These areas form a set of elliptical rings about the production wells as shown on Figure 5.15, with the outer ring in the vicinity of CW-1 representing the area where water extracted in 2006 resided within the aquifer in 1998, the year extraction began at the site.

The travel time from the center of the Sparton property (a point near monitoring well MW-26) to the source containment well CW-2, and the travel time from a point downgradient from and outside the capture zone of CW-2 to the off-site containment well CW-1 were estimated. These travel times were calculated as 1.5 and 15 years, respectively. This calculation assumed that both the off-site and the source containment wells are operating continuously at their current pumping rates and that 2006 water level conditions exist throughout the 15-year period.

6.2 Solute Transport Model

A solute transport model is linked to the groundwater flow model to simulate the concentration of constituents of concern at the site. The three-dimensional contaminant transport simulation code MT3D99 (Zheng and SSP&A, 1999) was applied for this study. The model was used to simulate TCE concentrations in the aquifer from December 1998 through December 2007.

Model input parameters were specified based on available data and the TCE concentrations in the model domain at the start of the simulation period were estimated from November 1998 measured concentration data. The model was calibrated in previous years by adjusting the initial TCE concentration distribution in the aquifer in a manner consistent with available data until a reasonable match was obtained between the calculated and measured TCE concentrations, and the calculated and measured TCE mass removal at both containment wells, CW-1 and CW2, throughout their respective period of operation. The model was not recalibrated this year; the initial TCE concentrations were the calibrated values described in the 2005 Annual Report (SSP&A, 2006). The model was used to predict TCE concentrations in the aquifer between January 2007 and December 2007. No attempt was made to simulate DCE and TCA. Generally, DCE is detected at monitoring wells where TCE is detected, but DCE concentrations are much lower than TCE concentrations. During 2005, DCE was about 7 percent of the total mass of chlorinated volatile organic compounds extracted by CW-1 and 13 percent of that extracted by CW-2.

The other constituent of concern, TCA, had been detected at concentrations greater than the 60 µg/L maximum allowable concentration in groundwater set by the NMWQCC, primarily in monitoring wells at the facility; TCA has been detected historically at levels above 60 µg/L in only one off-site well, MW-46. During the last four years, including the sampling round conducted in November 2006, none of the monitoring wells had TCA concentrations that exceeded 60 µg/L. The limited distribution of TCA and the reduction in its concentrations are the result of the abiotic transformation of TCA to acetic acid and DCE; a transformation that occurs relatively rapidly when TCA is dissolved in water. Only about 20 percent of TCA degrades to DCE, the rest degrades to acetic acid (Vogel and McCarty, 1987). The current concentrations of TCA and DCE in monitoring wells at the facility indicate that it is not likely that DCE concentrations will increase significantly in the future as the result of TCA degradation.

6.2.1 Transport Parameters

A number of aquifer and chemical properties are required as input parameters for the contaminant transport simulation. The required aquifer properties are porosity, bulk density, and dispersivity. The required chemical property is the retardation coefficient which is a function of the fraction organic carbon, the organic-carbon partition coefficient for the organic compound being simulated, and the effective diffusion coefficient. The following table summarizes the transport parameters:

Transport Parameter	Geologic Unit	Value
Effective porosity	All	0.3
Longitudinal dispersivity	All	25 ft
Transverse horizontal dispersivity	All	0.25 ft
Transverse vertical dispersivity	All	0.025 ft
Retardation Coefficient	All except 4,970-foot silt/clay	1
	4,970-foot silt clay	4.3

The rationale for choosing these transport parameters is described in the 2000 Annual Report (SSP&A, 2001b) with the exception of the retardation coefficient for the 4,970-foot silt/clay unit.

The retardation coefficient for TCE was specified as unity in all geologic units, except for the 4970-foot silt/clay unit, because the total organic carbon content of the sandy units is very small. The retardation coefficient for this unit was estimated during model calibration. The retardation coefficient specified for the 4970-foot silt/clay unit most likely represents a number of physical/chemical processes including desorption and diffusion from lower to more permeable zones within the unit.

6.2.2 Initial Concentration Distribution

The initial TCE distribution was generated based on the November 1998 measured concentration data. An interpolated concentration distribution was created for each flow zone

and the base of the contaminated zone using linear kriging of the log values of concentration. The zones for which concentration distributions were generated are the following:

- the upper flow zone (UFZ), corresponding to concentrations at the water table;
- the upper lower flow zone (ULFZ), corresponding to concentrations at an elevation of 4,940 ft MSL;
- the lower flow zone (LLFZ), corresponding to an elevation of 4920 ft MSL at the facility and an elevation of 4,900 ft MSL west of the facility; and
- the base of the contaminated zone, corresponding to top of 4800-foot clay west of facility and an elevation of 4,910 ft MSL at the facility.

The concentration distributions generated for these four zones were used as the basis for specifying initial concentrations at each node in the model domain. The concentrations generated for a given flow zone were assumed to represent concentrations on an approximately horizontal surface. These surfaces generally did not coincide with the node centers of the model grid and, therefore, the initial concentration at a given node was calculated by vertical linear interpolation of the log values of concentration corresponding to the overlying and underlying surfaces.

The concentration distribution for the UFZ was assumed to represent concentration at the water table as estimated based on November 1998 water levels at wells screened within the UFZ. The concentration distribution for the ULFZ was assumed to represent concentrations on a horizontal surface at an elevation of 4,940 ft MSL. The concentration distribution for the LLFZ was assumed to represent concentrations on a horizontal surface at an elevation of 4,920 ft MSL at the facility and at an elevation of 4,900 ft MSL west of the facility. The concentration distribution for the bottom zone was assumed to represent concentrations on a horizontal surface at an elevation of 4,910 ft MSL at the facility and at an elevation of 4,800 ft MSL west of the facility. The 4,910 ft MSL elevation at the facility is based on no detections of TCE in monitoring wells MW-38, MW-39, MW-40, and MW-70. A processor was developed to generate one horizontal concentration distribution for each model layer, representing the initial contaminant distribution for the transport model.

6.2.3 Model Calibration

Calibration of the transport model has consisted of adjustment of the initial contaminant (TCE) concentration distribution, prior to startup of off-site containment well CW-1, to achieve a reasonable match between calculated and observed TCE concentrations and mass removal at containment wells CW-1 and CW-2. The transport model was initially calibrated in 2000 when the model was developed (1999 Annual Report, SSP&A, 2001a), and was recalibrated annually to incorporate new concentration data (SSP&A, 2001b; 2002; 2003; 2004; 2005). The transport model was not recalibrated this year. The parameter estimation program PEST (Doherty, 2002) was used in these calibration and recalibration processes. PEST was used to estimate TCE concentrations at a number of control points along the center line of the plume; these estimates were then used along with the monitoring well data for estimating the concentration distributions

in each flow zone. A better representation of the TCE distribution prior to startup of the containment systems has been obtained with each model calibration effort.

The calibration process has resulted in good agreement between observed and calculated TCE mass removal from containment wells CW-1 and CW-2, and between observed and calculated concentrations at CW-1 and CW-2 (Figure 6.8). The observed and calculated TCE mass removal and TCE concentrations at CW-1 and CW-2 near the end of each year of system operation are tabulated below:

Date	Cumulative TCE mass removed (kg)		Concentration at CW-1 (μg/L)		Concentration at CW-2 (μg/L)	
	Measured	Calculated	Measured	Calculated	Measured	Calculated
12/31/1998	1.3	0.1	190	252		
1/3/2000	359	407	860	1,028		
1/2/2001	822	855	1,200	1,054		
1/3/2002	1,340	1,337	1,100	1,188	1,100	964
1/3/2003	1,944	1,954	1,300	1,288	450	563
1/6/2004	2,560	2,579	1,200	1,298	380	345
1/4/2005	3,156	3,159	1,300	1,249	220	231
1/4/2006	3,714	3,706	1,300	1,131	160	167
1/4/2007	4,225	4,186	1,500	1,040	150	126

Overall, the correspondence between observed and calculated cumulative mass removal and concentrations is excellent. The calculated concentrations at both CW-1 and CW-2 at the end of 2006, though, underestimated measured concentrations. It should be noted that comparisons with discrete measurements can be misleading as there is variability in reported concentrations from month to month. When comparisons are made with average concentrations during 2006, the correspondence between observed and calculated concentrations is much better. The average calculated concentration at CW-1 during 2006 was 1086 ug/L, slightly less than the average measured concentration of 1166 ug/L based on monthly samples. The average calculated concentration at CW-2 during 2006 was 147 ug/L which was slightly less than the average measured concentration of 153 ug/L

The initial mass and the maximum TCE concentrations within each model layer, under the recalibrated initial concentration distribution specified in the model, are summarized on Table 6.1. The estimated initial mass of TCE is 6,908 kg (15,230 lbs). The estimate of the mass of TCE in the aquifer prior to startup of the containment wells has changed from 2,180 kg (4,800 lbs) in the initial model calibration, to 3,100 kg (6,840 lbs) after the first recalibration, to 3,300 kg (7,280 lbs) after the second recalibration, to 4,650 kg (12,250 lbs) after the third recalibration, to 7,342 kg (16,152 lbs) after the fourth recalibration to 6,638 kg (14,634 lbs) after the fifth recalibration, and 6,908 kg (15,230 lbs) after the sixth recalibration described in the 2005 Annual Report (SSP&A, 2006).

A comparison of calculated to observed concentrations of TCE at all monitoring wells for all samples analyzed between November 1998 and November 2006 is presented in Figure 6.9. Also presented in Figure 6.9 is a comparison of calculated to observed concentrations of TCE for only those samples analyzed in November 2006 on which the individual data points are labeled with the well number. The general agreement between observed and computed concentrations is reasonable given the uncertainty of the initial contaminant distribution.

6.2.4 Predictions of TCE Concentrations in 2007

The groundwater transport model was applied to predict TCE concentrations through December 2007 after 109 months of pumping at well CW-1, and after 72 months of pumping at CW-2. In this predictive simulation, the 2007 pumping rates for the off-site containment well CW-1 and the source containment well CW-2 were assumed to be their design pumping rates of 225 gpm and 50 gpm, respectively. The TCE concentrations calculated for December 2006 are specified as the initial conditions for the predictive groundwater transport model.

The predicted TCE concentrations in November 2007 are presented in Figure 6.10. The concentration distribution is based on the maximum TCE concentration simulated within any given layer. A mass removal of 436 kg (961 lbs) of TCE by containment well CW-1 and 10.5 kg (23 lbs) from containment well CW-2 is predicted for the period of January 2007 to December 2007. The calculated TCE concentration in December 2007 is 928 μg/L at well CW-1 and 98 μg/L at CW-2.

The calibrated TCE concentration in November 1998 prior to start of groundwater extraction, the calculated TCE concentrations in November 2001, November 2003, November 2005, and the predicted TCE concentrations for November 2007 are presented in Figure 6.11.

6.3 Future Simulations

The accuracy of this modeling effort will be evaluated again during the next 12 months based on the concentrations measured at the containment well and the monitoring wells. As new data are collected, the initial conditions and parameters in the model will be adjusted as necessary to improve the model.

Section 7
Conclusions and Future Plans

7.1 Summary and Conclusions

Sparton's former Coors Road Plant is located at 9621 Coors Boulevard NW, Albuquerque, New Mexico. The Site is at an elevation of about 5,050 ft MSL; the land slopes towards the Rio Grande on the east and rises to elevations of 5,150-5,200 ft MSL within a short distance to the west of the Site. The upper 1,500 ft of the fill deposits underlying the Site consist primarily of sand and gravel with minor amounts of silt and clay. The water table beneath the Site is at an elevation of 4,975-4,985 ft MSL and slopes towards the northwest to an elevation of about 4,960 ft MSL within about one-half mile of the Site. At an elevation of about 4,800 ft MSL a 2- to 3-foot clay layer, referred to as the 4,800-foot clay unit, has been identified.

Past waste management activities at the Site had resulted in the contamination of the Site soils and of groundwater beneath and downgradient from the Site. The primary contaminants are VOCs, specifically TCE, DCE, and TCA, and chromium. Remedial investigations at the Site had indicated that groundwater contamination was limited to the aquifer above the 4,800-foot clay and current measures for groundwater remediation have been designed to address contamination within this depth interval.

Under the terms of a Consent Decree entered on March 3, 2000, Sparton agreed to implement a number of remedial measures. These remedial measures consisted of: (1) the installation and operation of an off-site containment system; (2) the installation and operation of a source containment system; and (3) the operation of an on-site, 400-cfm SVE system for an aggregate period of one year. The goals of these remedial measures are: (a) to control hydraulically the migration of the off-site plume; (b) to control hydraulically any potential source areas that may be continuing to contribute to groundwater contamination at the on-site area; (c) to reduce contaminant concentrations in vadose-zone soils in the on-site area and thereby reduce the likelihood that these soils remain a source of groundwater contamination; and (d) in the long-term, restore the groundwater to beneficial use.

The installation of the off-site containment system began in late 1998 and was completed in early May 1999. The system consisted of (1) a containment well near the leading edge of the plume, designed to pump at a rate of about 225 gpm, (2) an off-site treatment system, (3) an infiltration gallery in the Arroyo de las Calabacillas, and (4) associated conveyance and monitoring components. The off-site containment well began operating on December 31, 1998; except for brief interruptions for maintenance activities or due to power outages, the well has operated continuously since that date; the year 2006 was the eighth full year of operation of this well. The source containment system was installed during 2001 and began operating on January 3, 2002. This system consisted of (1) a containment well immediately downgradient from the

site, designed to pump at a rate of about 50 gpm, (2) an on-site treatment system, (3) six[13] on-site infiltration ponds, and (4) associated conveyance and monitoring components. The year 2006 was the fifth year of operation of this well. The 400-cfm SVE system had operated for a total of about 372 days between April 10, 2000 and June 15, 2001 and thus met the length-of-operation requirements of the Consent Decree; monitoring conducted in the Fall of 2001 indicated that the system had also met its performance goals, and the system was dismantled in May 2002.

During 2006, considerable progress was made towards achieving the goals of the remedial measures:

- The off-site containment well continued to operate during the year at an average discharge rate of 213 gpm, sufficient for containing the plume.
- The pumped water was treated and returned to the aquifer through the infiltration gallery. The concentrations of constituents of concern in the treated water met all the requirements of the Groundwater Discharge Permit for the site. Chromium concentrations in the influent to the treatment system remained at levels that did not require treatment.
- The source containment well continued to operate during the year at an average rate of 46 gpm, sufficient for containing potential on-site source areas.
- Groundwater monitoring was conducted as specified in Attachment A to the Consent Decree. Water levels in all accessible wells and/or piezometers, and the Corrales Main Canal were measured quarterly. Samples were collected for water-quality analyses from monitoring wells at the frequency specified in the Consent Decree and analyzed for VOCs and total chromium.
- Samples were obtained from the influent and effluent of the treatment plants for the off-site and source containment systems, and the infiltration gallery and infiltration pond monitoring wells at the frequency specified in the Groundwater Discharge Permit. All samples were analyzed for VOCs, total chromium, iron, and manganese.
- The groundwater flow and transport model that was developed in 1999 to simulate the hydrogeologic system underlying the site was recalibrated and used to simulate TCE concentrations in the aquifer from start-up of the off-site containment well in December 1998 through November 2006 and to predict concentrations in November 2007.[14]

The off-site containment well continued to provide hydraulic control of the contaminant plume throughout the year. The source containment well that began operating in early 2002 quickly developed a capture zone that controls any potential on-site sources that may be contributing to groundwater contamination. Data from 2006 indicate that the well continued to

[13] The performance of the six on-site infiltration ponds between 2002 and 2004 indicated that four ponds are more than adequate for handling the water pumped by the source containment well. With the approval of the regulatory agencies, Sparton backfilled two of the six ponds in 2005 to put the land to other beneficial use.

[14] This task was carried out in early 2007 as part of the preparation of this 2006 Annual Report.

maintain an adequate capture zone throughout 2006, although its average discharge rate was a little smaller than in previous years.

The extent of groundwater contamination, as defined by the extent of the TCE plume, did not change significantly during 2006. Of 57 wells sampled both in November 2006 and 2005, the concentrations of TCE were lower than in November 2005 in 24 wells, higher in 8 wells, and remained the same in 25 wells (23 below detection limits). The corresponding numbers for DCE were 15 wells with lower, 10 wells with higher, and 32 wells with the same (below detection limits) concentrations. Well MW-60, at 7,500 micrograms per liter (μg/L) continued to be the most contaminated off-site well. The TCA plume ceased to exist during 2003, and this condition continued through 2006, that is, throughout the year there were no wells with TCA concentrations above the maximum allowable concentration in groundwater set by NMWQCC.

Changes in concentrations observed in monitoring wells since the implementation of the current remedial measures indicate that contaminant concentrations in the on-site area decreased significantly. Concentrations in most off-site wells have also decreased, or remained unchanged (below detection limits). The only wells were significant increases occurred are the off-site containment well CW-1, and on-site monitoring well MW-19. The persistence of the high concentrations that have been observed in the water pumped from CW-1 since the beginning of its operation, and the concentrations detected at MW-60 indicate the presence of high concentration areas upgradient from both CW-1 and MW-60. This conclusion is confirmed by the model calibration results.

The off-site and source containment wells operated at a combined average rate of 259 gpm during 2006. A total of about 136.3 million gallons of water were pumped from the wells. The total volume of water pumped since the beginning of the current remedial operations on December 1998 is about 1.051 billion gallons and represents 93 percent of the initial volume of contaminated groundwater (pore volume).

Approximately 550 kg (1,210 lbs) of contaminants consisting of 513 kg (1,130 lbs) of TCE, 34 kg (76 lbs) of DCE, and 1.7 kg (3.7 lbs) of TCA were removed from the aquifer by the two containment wells during 2006. The total mass that was removed since the beginning of the of the current remedial operations is 4,490 kg (9,900 lbs) consisting of 4,230 kg (9,320 lbs) of TCE, 250 kg (550 lbs) of DCE, and 13 kg (29 lbs) of TCA. This represents about 61 percent of the total dissolved contaminant mass currently estimated to have been present in the aquifer prior to the testing and operation of the off-site containment well.

To address the continuing presence of contaminants in monitoring well MW-71R, which is completed in the Deep Flow Zone (DFZ) below the 4,800-foot clay, a decision was made in 2004 to install a DFZ monitoring/standby-extraction well near the off-site containment well CW-1. A Work Plan for the installation, testing, monitoring, and/or operation of this well was prepared in December 2004 and submitted to USEPA and NMED. Upon approval of the Work Plan and the obtaining of the necessary permits and easements, this DFZ monitoring/standby-extraction well was installed in February 2006. The first samples from this well, obtained during

its testing in April 2006, indicated that the well did not contain any site-related contaminants. Based on these results the well was designated as monitoring well MW-79, and sampled again, on a semi-annual schedule, in May and November 2006; both of these samples did not contain any site-related contaminants.

The containment systems were shutdown several times during 2006 for routine maintenance activities, due to power and monitoring system failures, due to low levels in the chemical feed tanks, or due to the failure of other components of the systems. The downtime for these shutdowns ranged from 5 minutes to about 11.5 days.

7.2 Future Plans

Both the off-site and source containment systems will continue to operate during 2007. The pump of the source containment well will be replaced to restore its pumping rate to the design value of 50 gpm. Data collection will continue in accordance with the Groundwater Monitoring Program Plan and site permits, and as necessary for the evaluation of the performance of the remedial systems. As additional data are being collected, calibration and improvement of the flow and transport model developed to assess aquifer restoration will continue.

Monitoring wells PW-1, MW-35, and MW-36 have been dry during the last several years and have been proposed for abandonment in past Annual Reports. These wells are scheduled for plugging and abandonment during 2007. Well PW-1 is next to MW-9, and data from MW-34 and MW-44 provide adequate data in the area of MW-35 and MW-36; therefore, replacement wells for these three wells are not planned. Monitoring wells MW-13, MW-33 and MW-57 were also dry during several quarters in 2006; these three wells and well MW-9 were dry or did not have sufficient water for sampling in November 2006. Conditions in these wells will continue to be monitored during 2007 to assess whether they should be abandoned and replaced.

Analysis of the pumping test data from the new DFZ well MW-79 will be completed in 2007 and a letter-report presenting the results will be submitted to USEPA and NMED. Upon approval of the combined Draft Fact Sheet for 2002 through 2004 by USEPA and NMED, the Fact Sheet will be distributed to the property owners located above the plume and adjacent to the off-site treatment plant water discharge pipeline.

Regulatory agencies will continue to be kept informed of any significant milestones or changes in remedial system operations. The goal of the systems will continue to be the return of the contaminated groundwater to beneficial use.

Section 8
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FIGURES

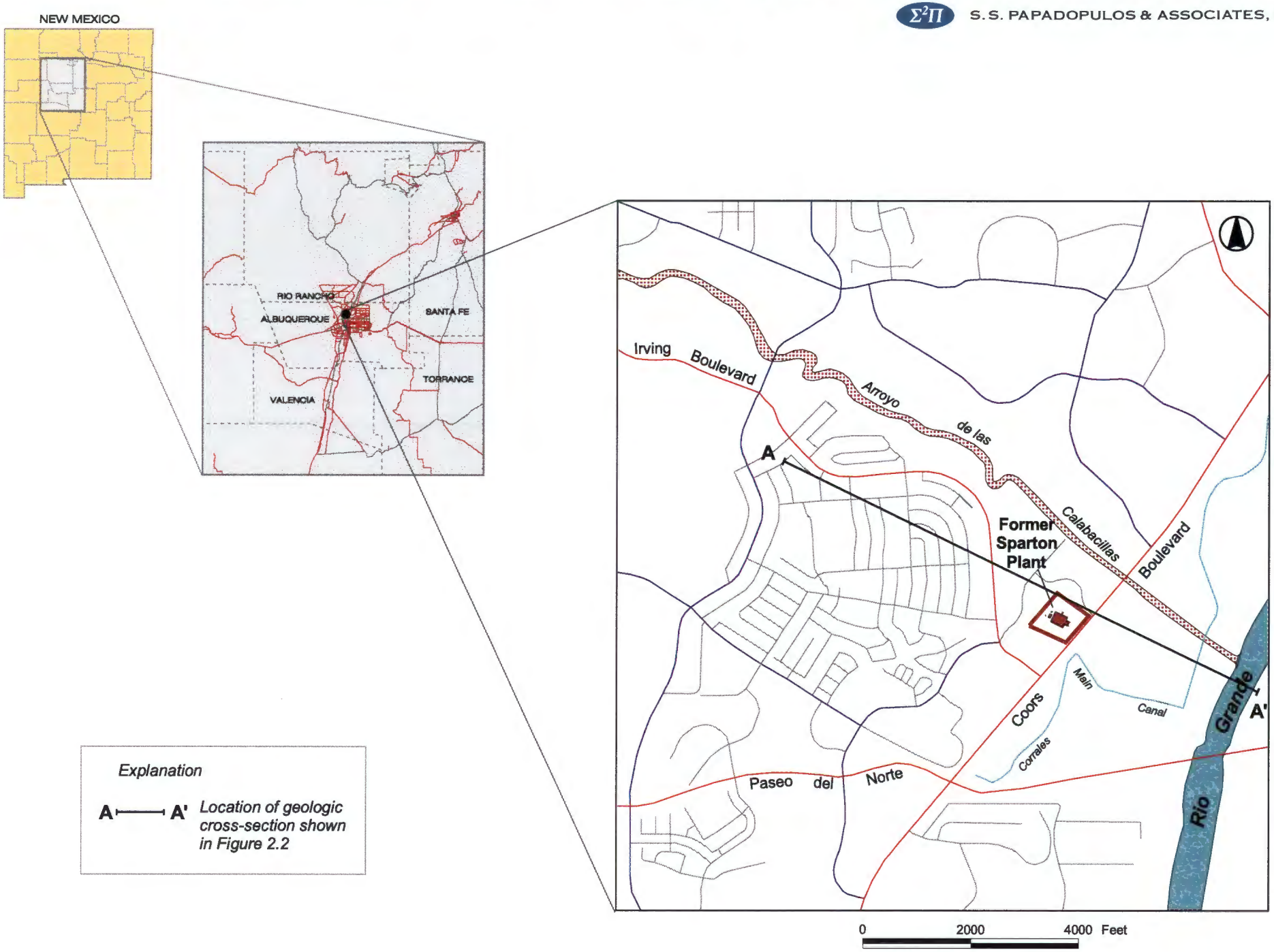


Figure 1.1 Location of the Former Sparton Coors Road Plant

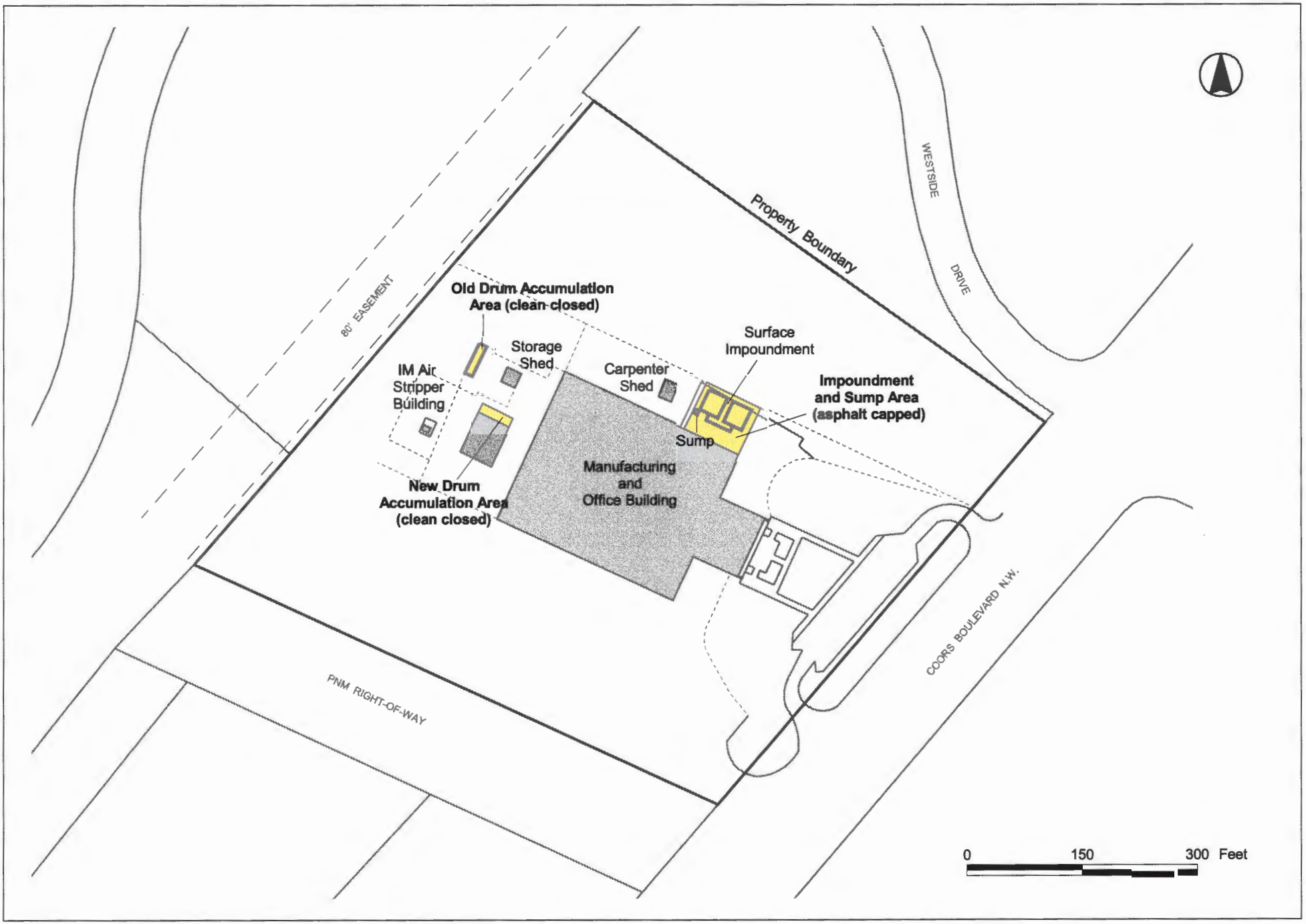
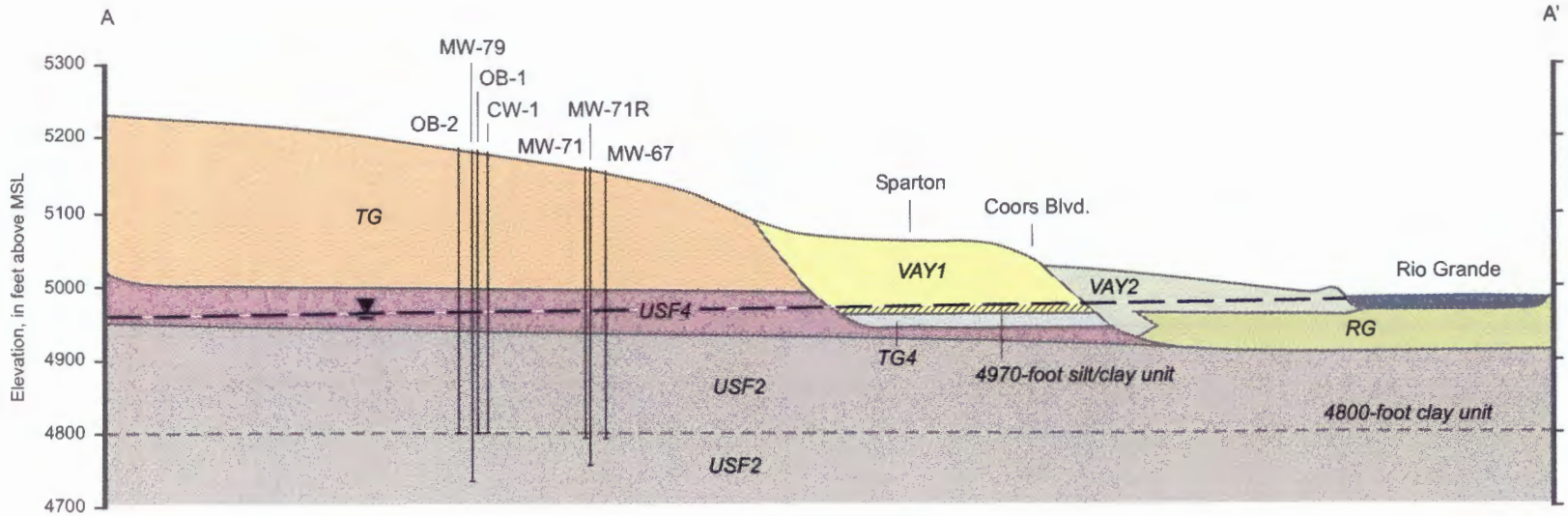


Figure 2.1 The Former Sparton Coors Road Plant



Vertical Exaggeration 5x

Note: See Figure 1.1 for location of cross section

Explanation

RG	Holocene channel and flood plain deposits
VAY2	Holocene arroyo fan and terrace deposits
VAY1	Late Pleistocene arroyo fan and terrace deposits
TG4	Late Pleistocene channel and flood plain deposits, upper portion is the 4970-foot silt/clay unit
TG	Middle Pleistocene undifferentiated deposits
USF4	Pliocene Upper Santa Fe Group Western Basin fluvial facies
USF2	Pliocene Upper Santa Fe Group Rio Grande facies

Figure 2.2 Geologic Cross Section Showing Shallow Deposits

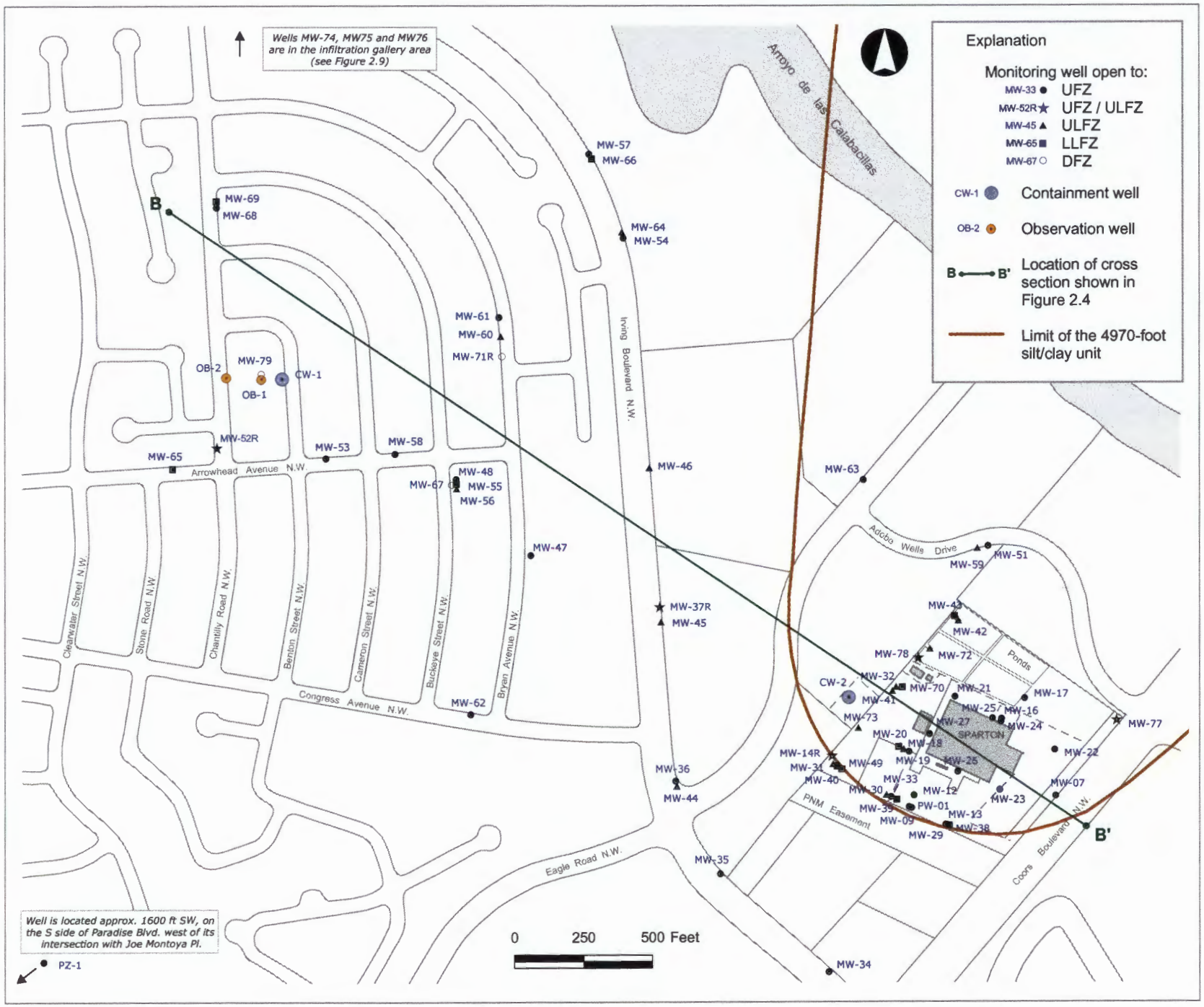


Figure 2.3 Location of Wells

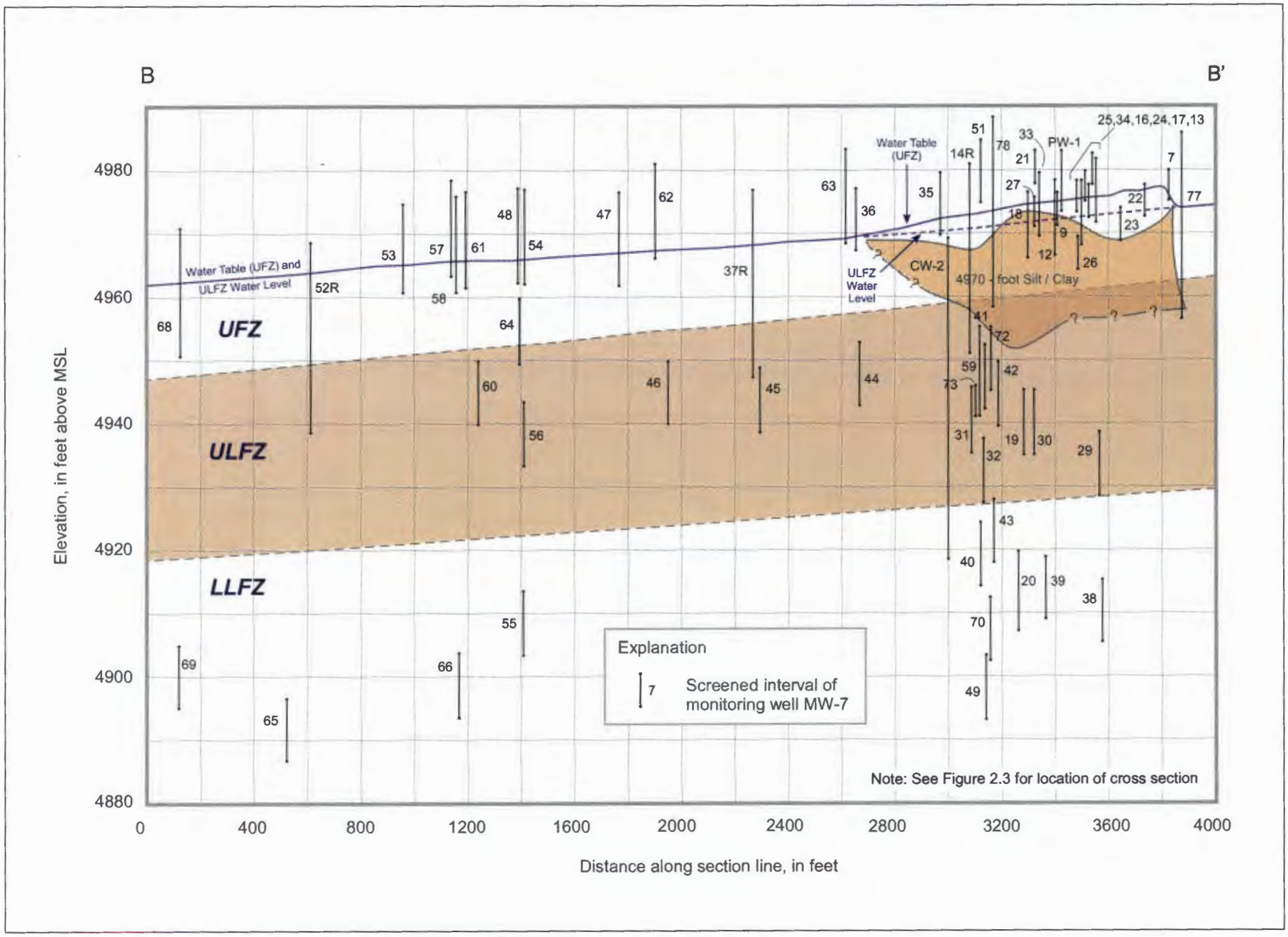


Figure 2.4 Schematic Cross-Section Showing Screened Interval of Monitoring Wells and Relation to Flow Zones

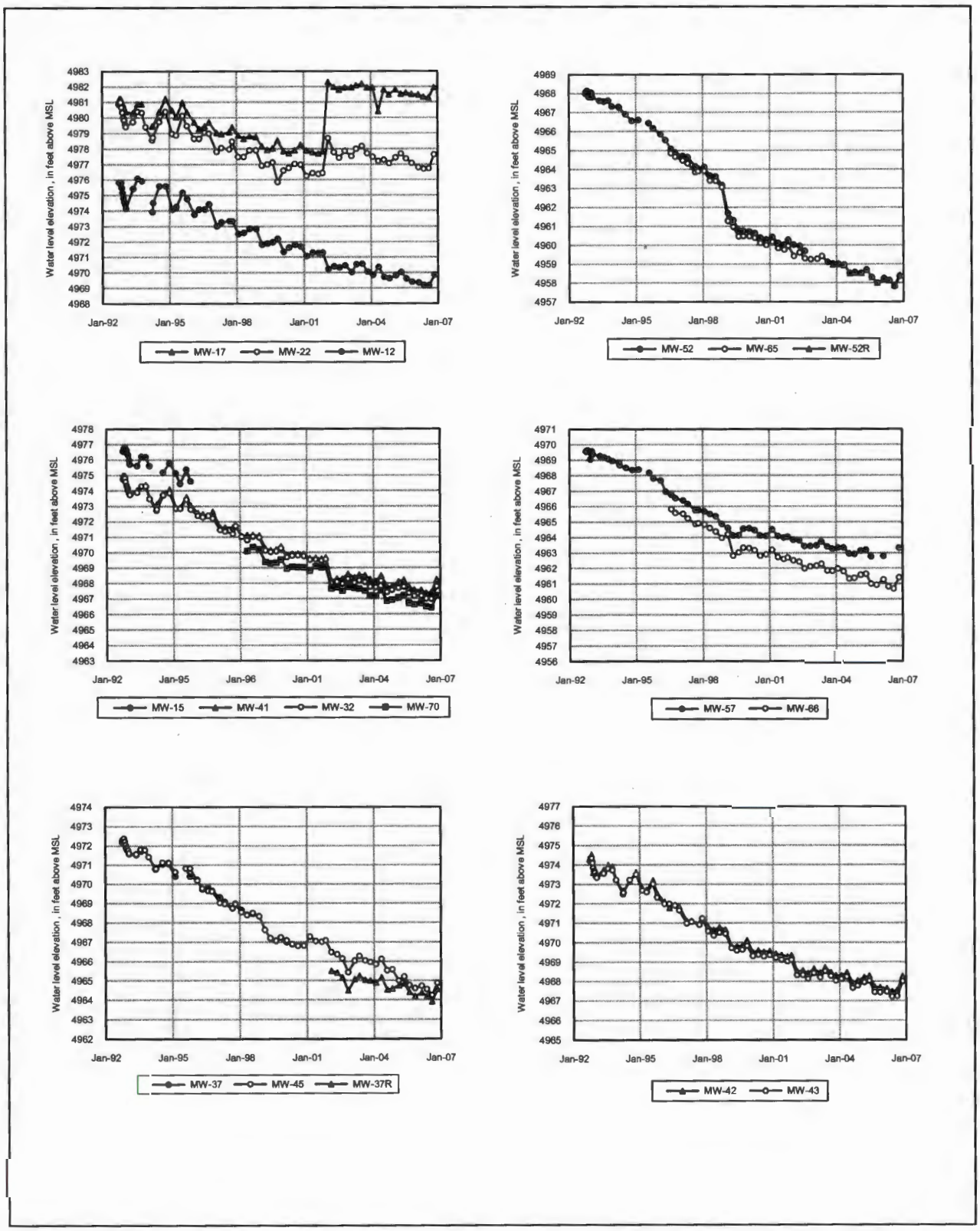


Figure 2.5 Monitoring Well Hydrographs

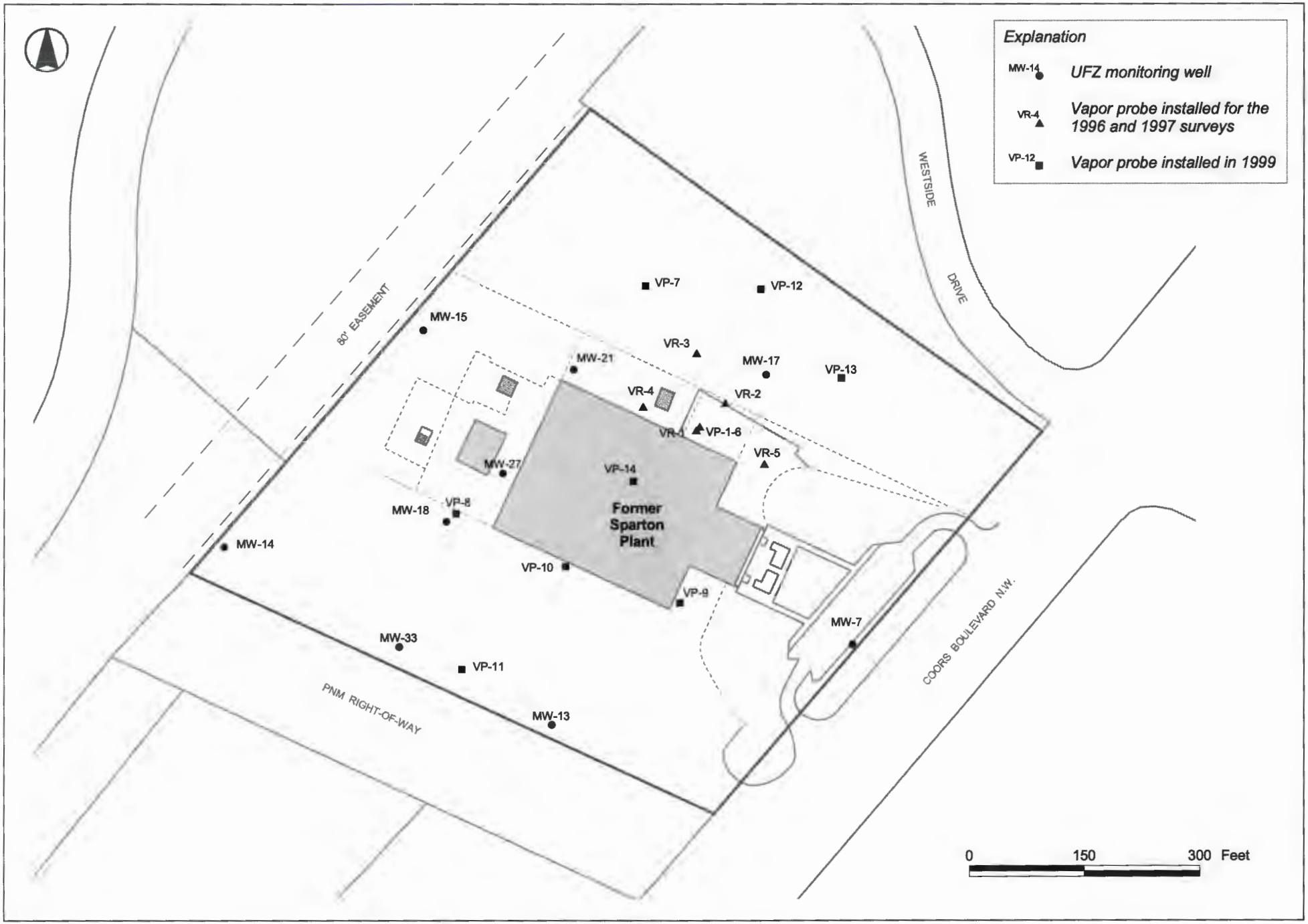


Figure 2.6 Location of Vapor Probes and On-Site Monitoring Wells Used in Vadose Zone Characterizations

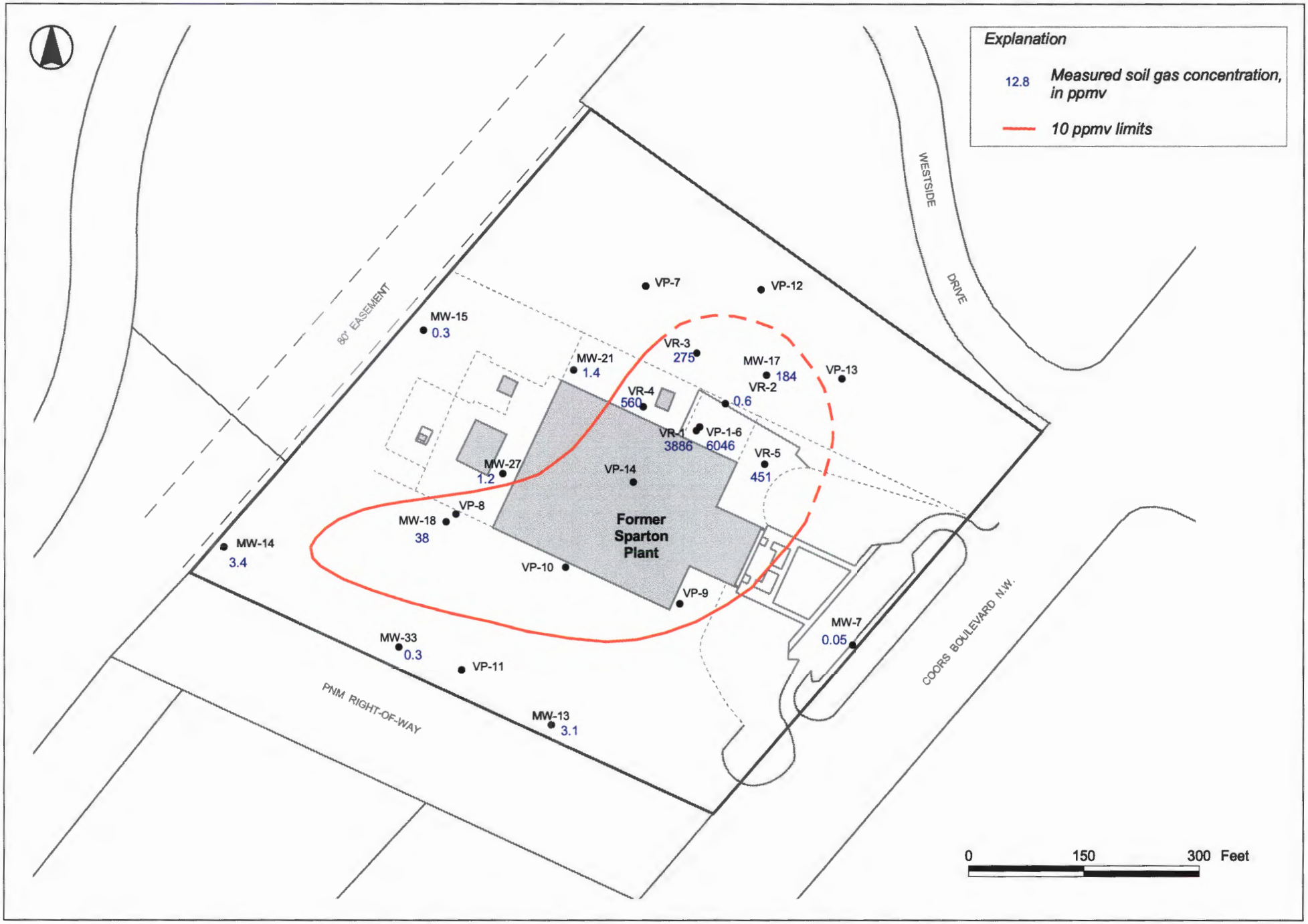


Figure 2.7 TCE Concentrations in Soil Gas - April 1996 - February 1997 Survey

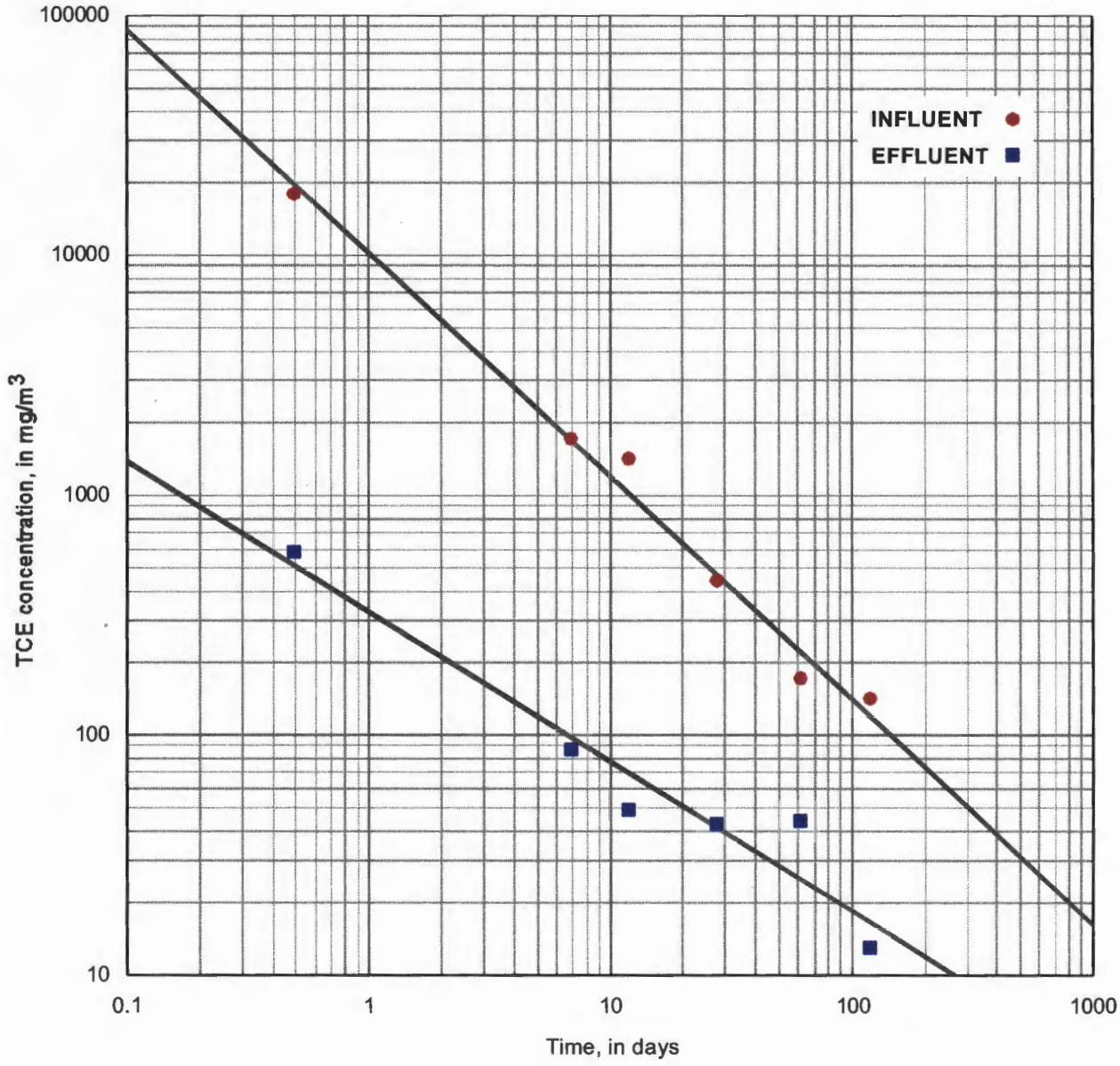


Figure 2.8 Influent and Effluent Concentrations - SVE Operation
April 8 - October 20, 1998

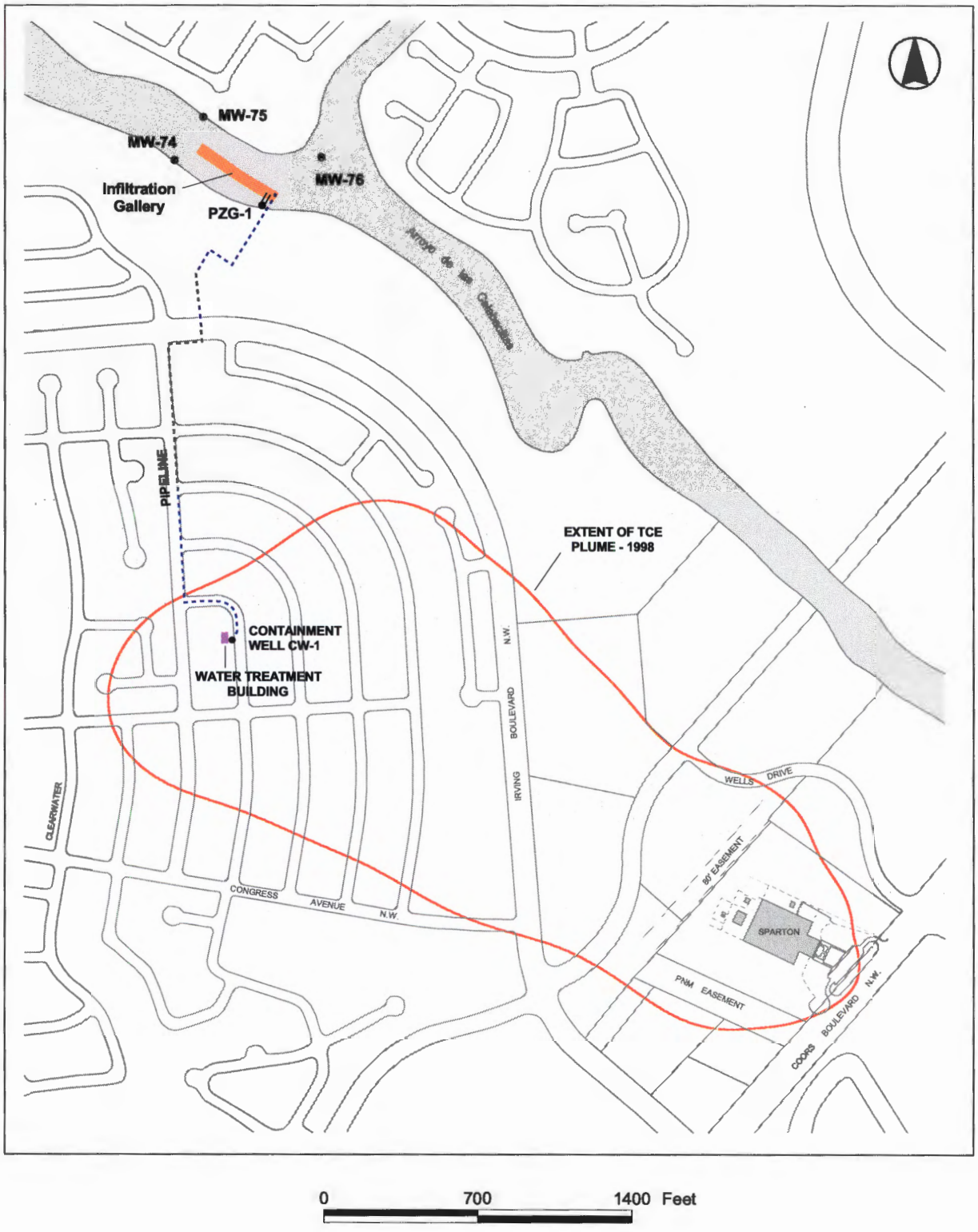


Figure 2.9 Layout of the Off-Site Containment System Components

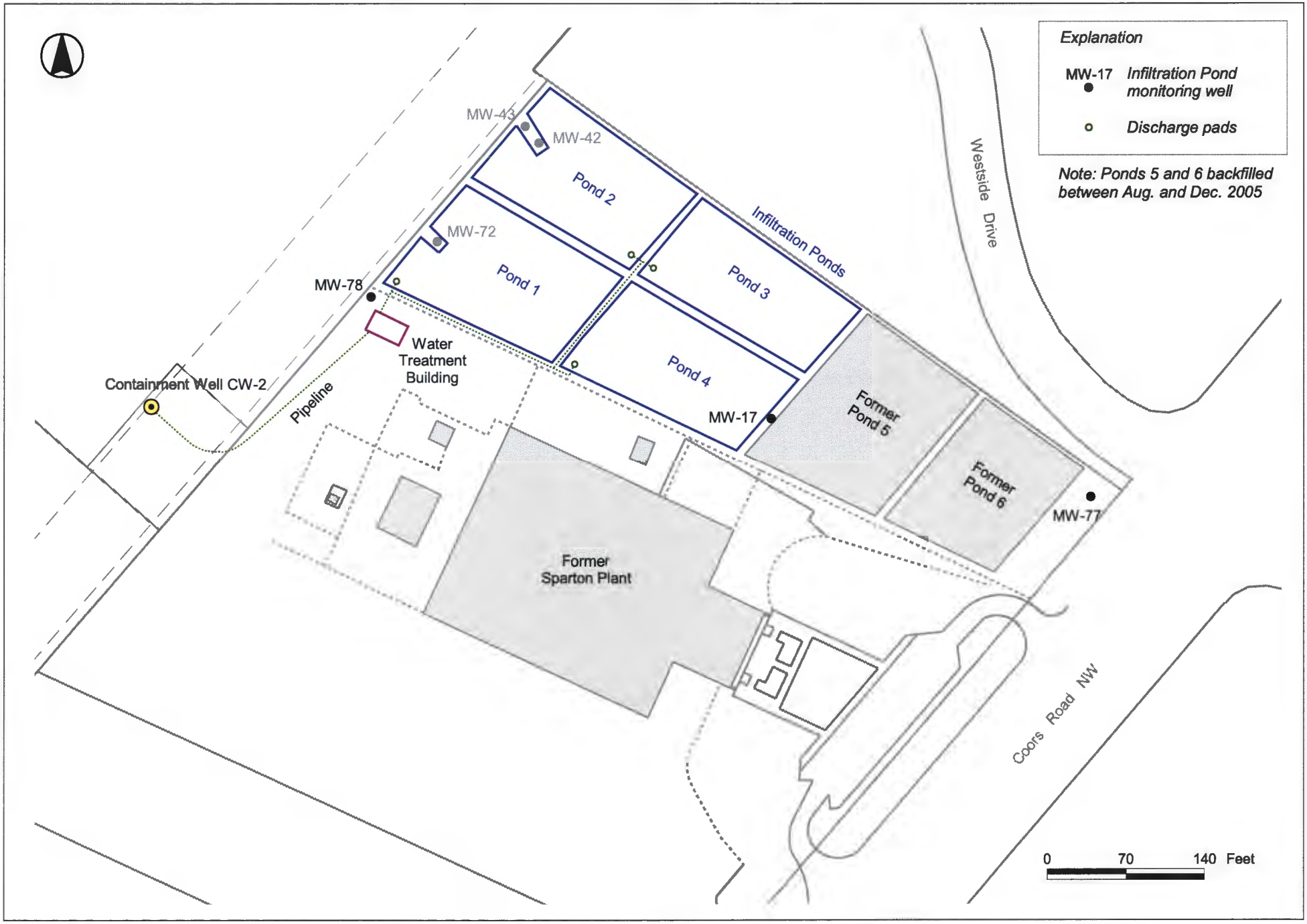


Figure 2.10 Layout of the Source Containment System Components

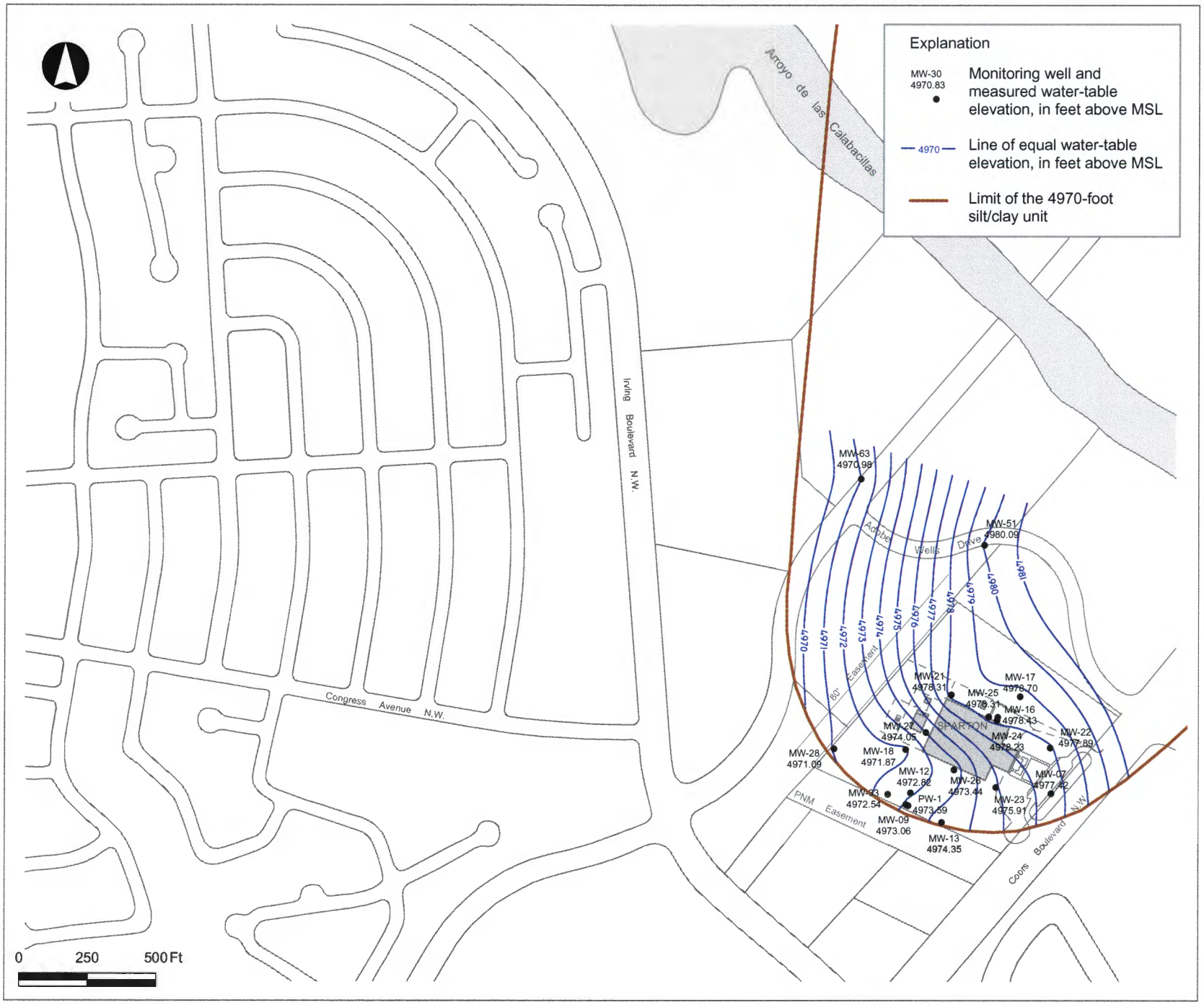


Figure 2.11 Elevation of the On-Site Water Table - November 1998

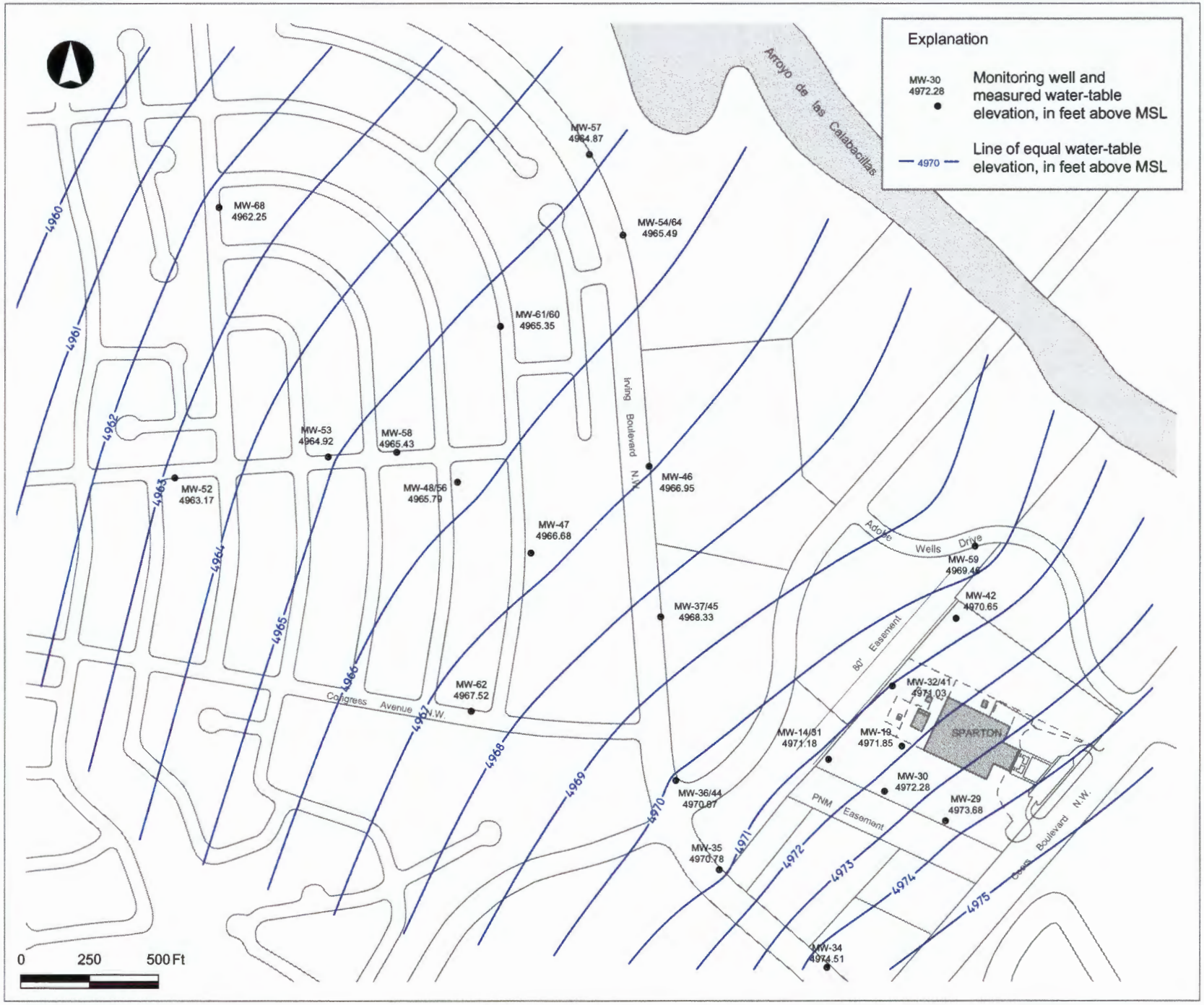


Figure 2.12 Elevation of the Water Levels in the UFZ/ULFZ - November 1998

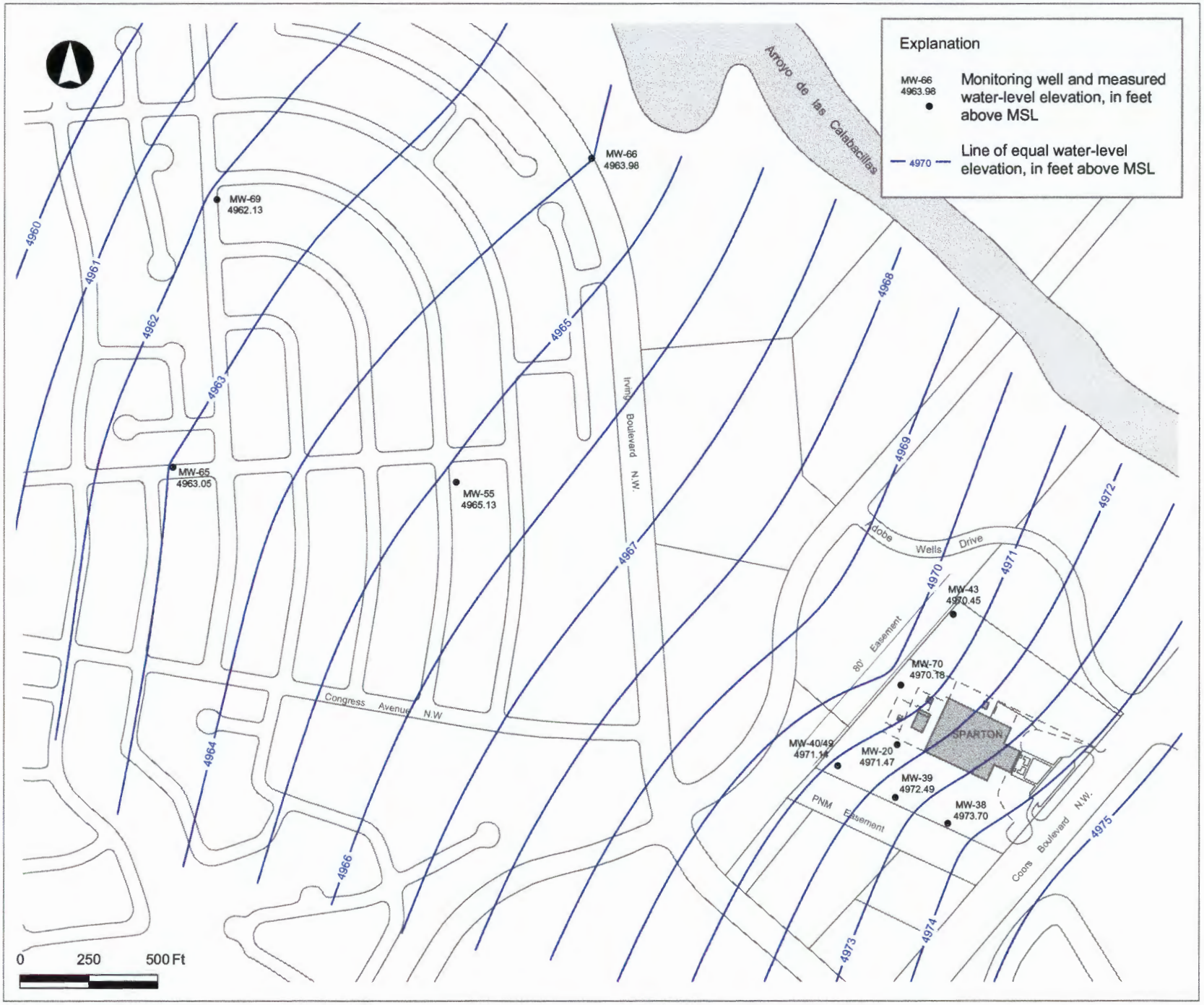


Figure 2.13 Elevation of the Water Levels in the LLFZ - November 1998

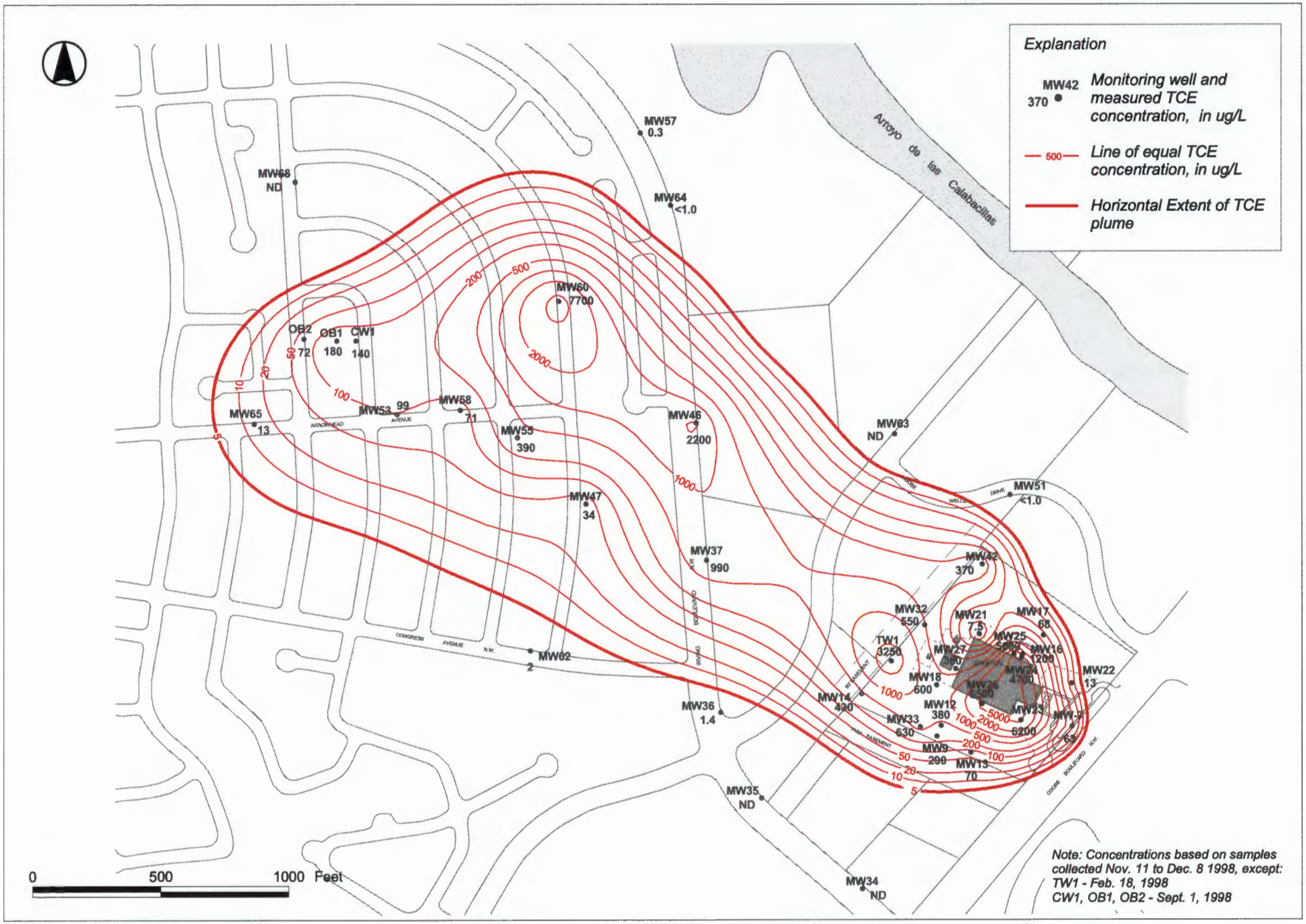


Figure 2.14 Horizontal Extent of TCE Plume - November 1998

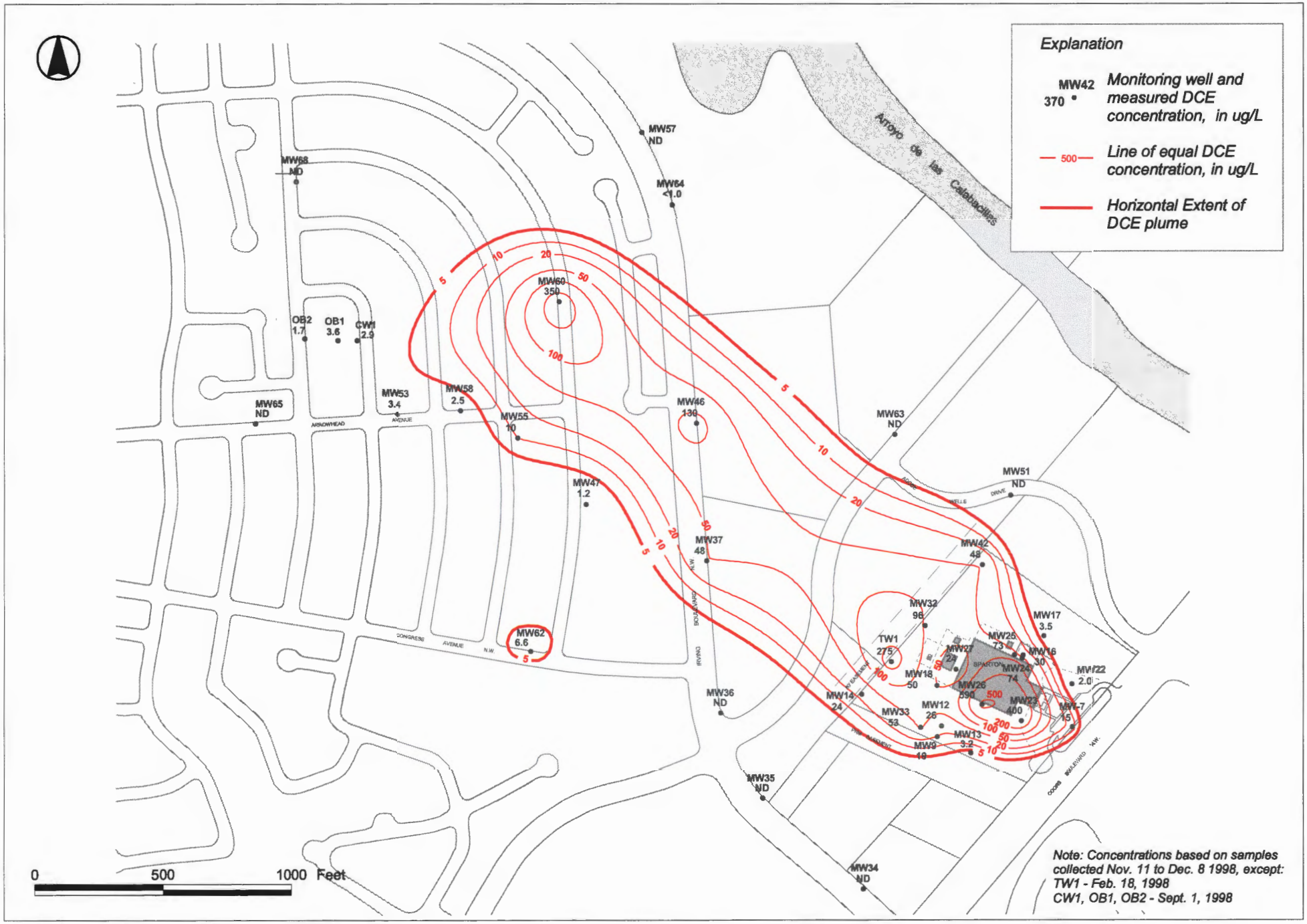


Figure 2.15 Horizontal Extent of DCE Plume - November 1998

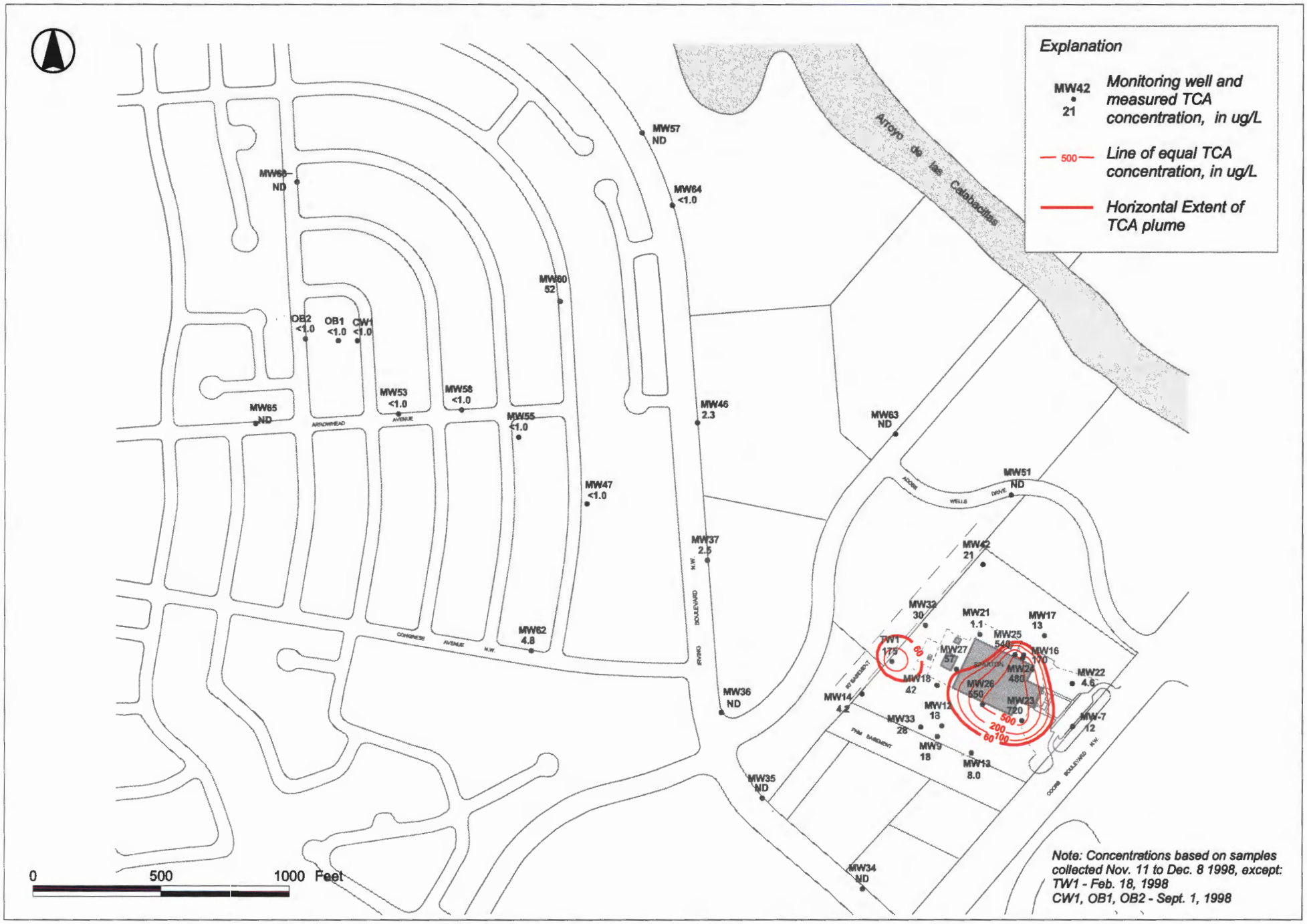


Figure 2.16 Horizontal Extent of TCA Plume - November 1998

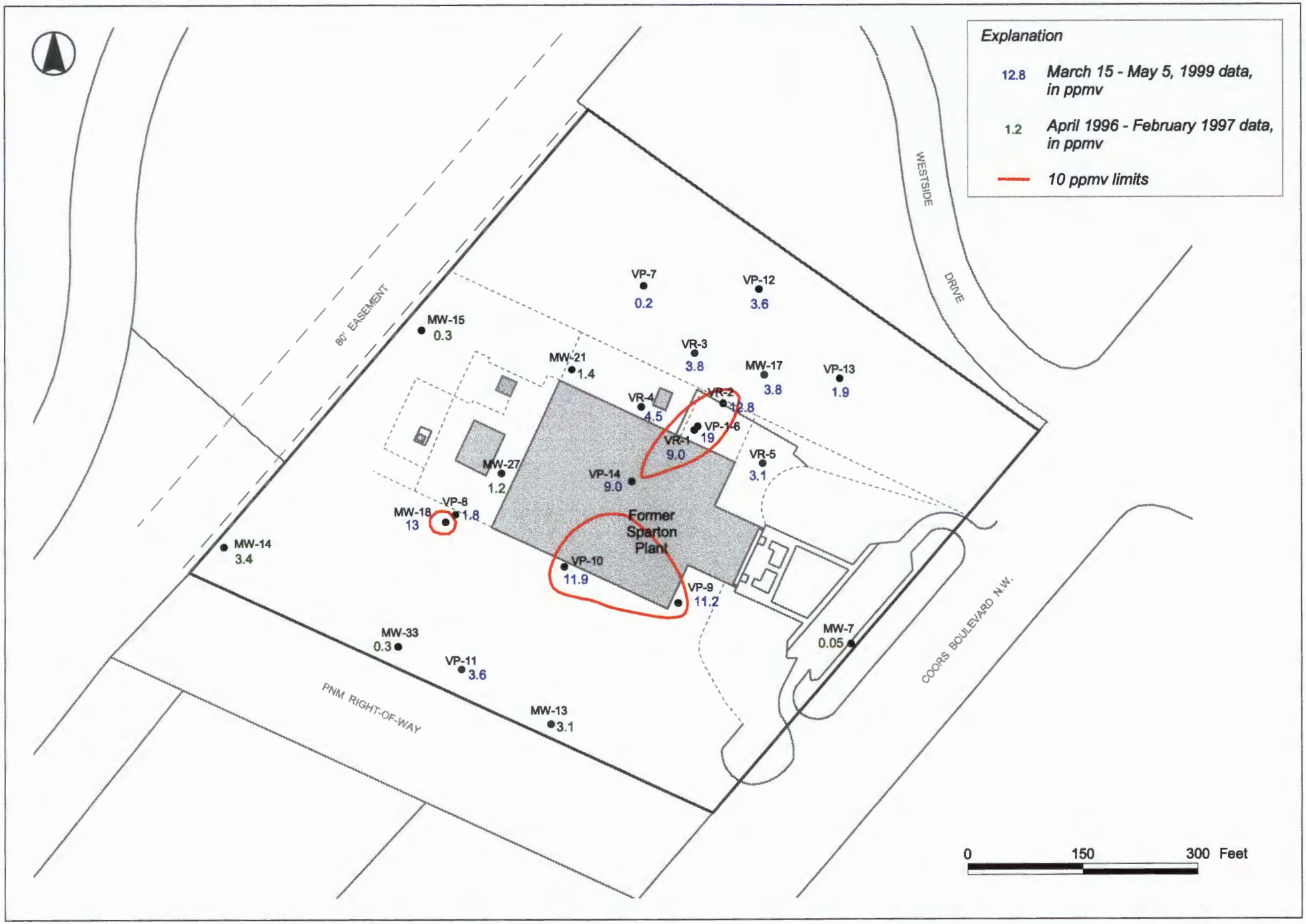


Figure 2.17 TCE Soil Gas Concentrations Prior to the 1999 Resumption of SVE System Operations

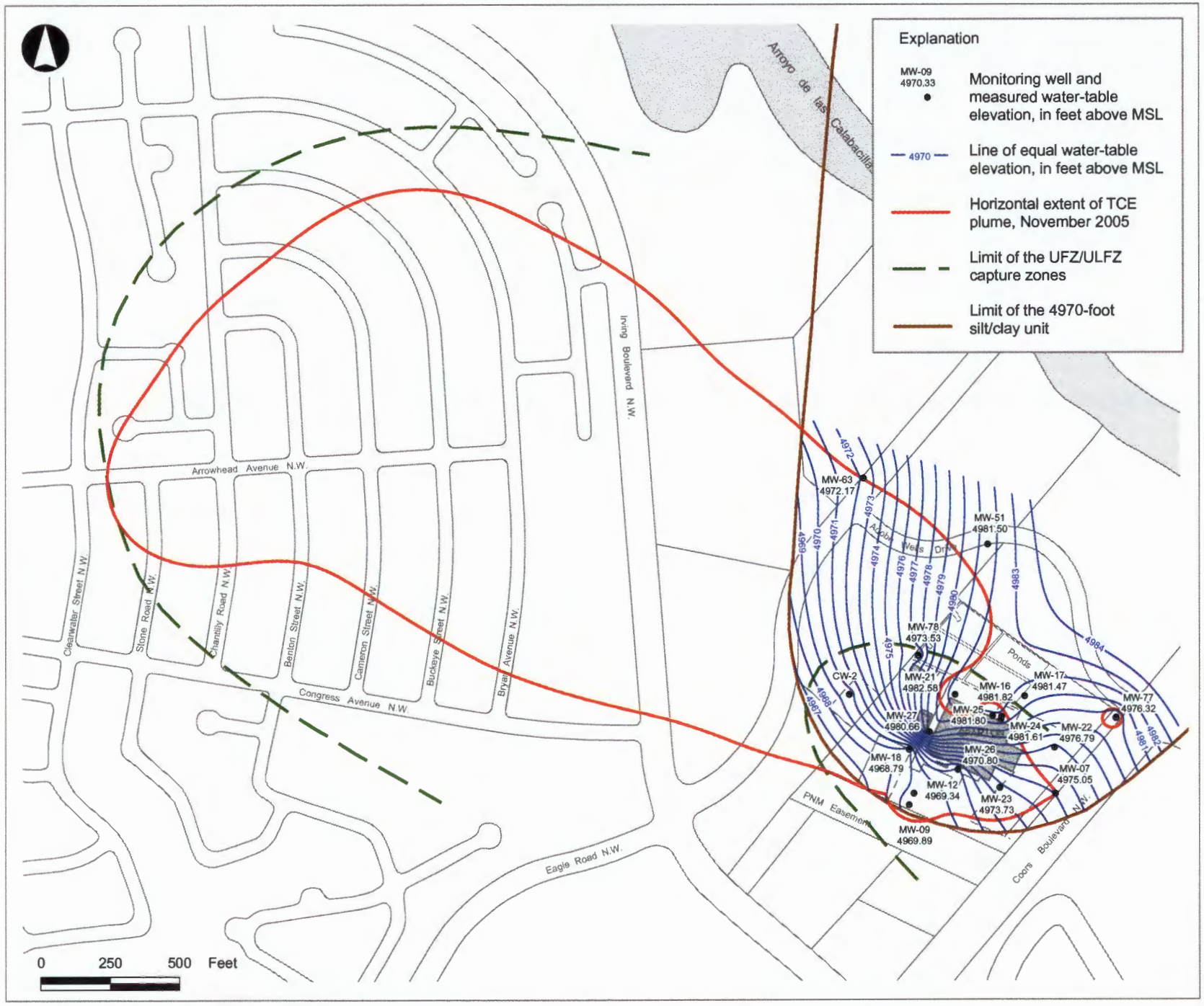


Figure 5.1 Elevation of the On-Site Water Table - February 22, 2006

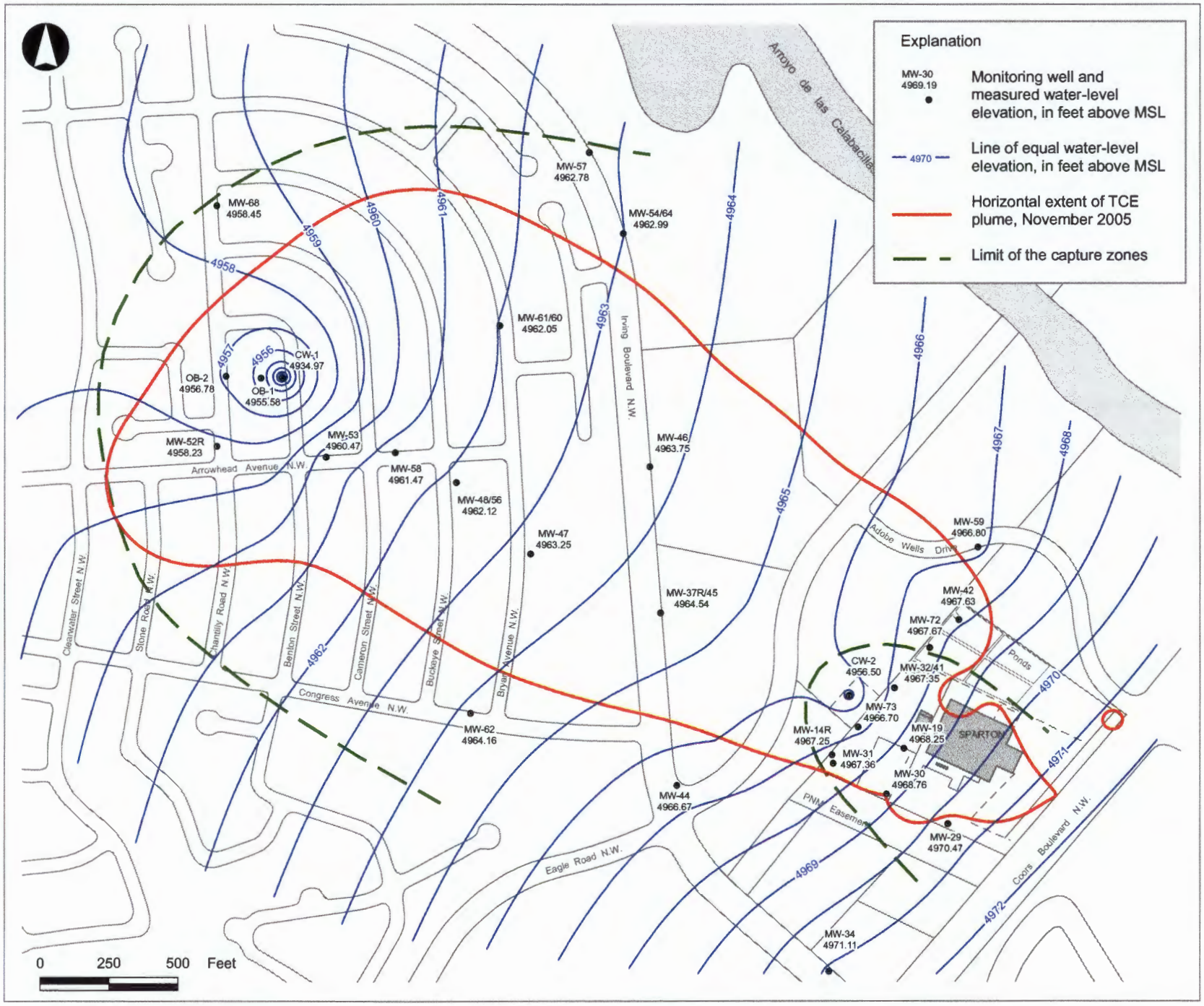


Figure 5.2 Elevation of Water Levels and Limits of Containment Well Capture Zones in the UFZ/ULFZ - February 22, 2006

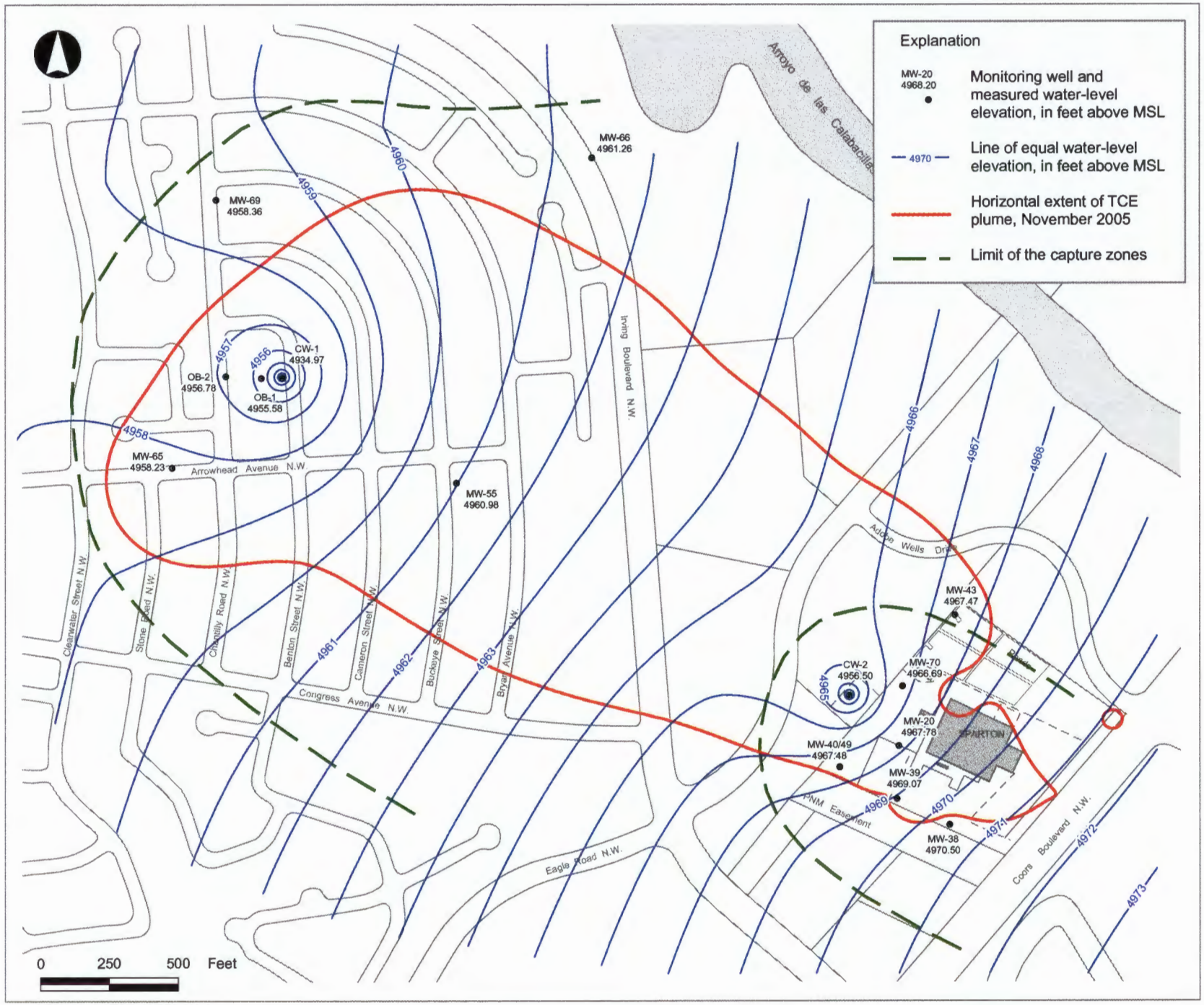


Figure 5.3 Elevation of Water Levels and Limits of Containment Well Capture Zones in the LLFZ - February 22, 2006

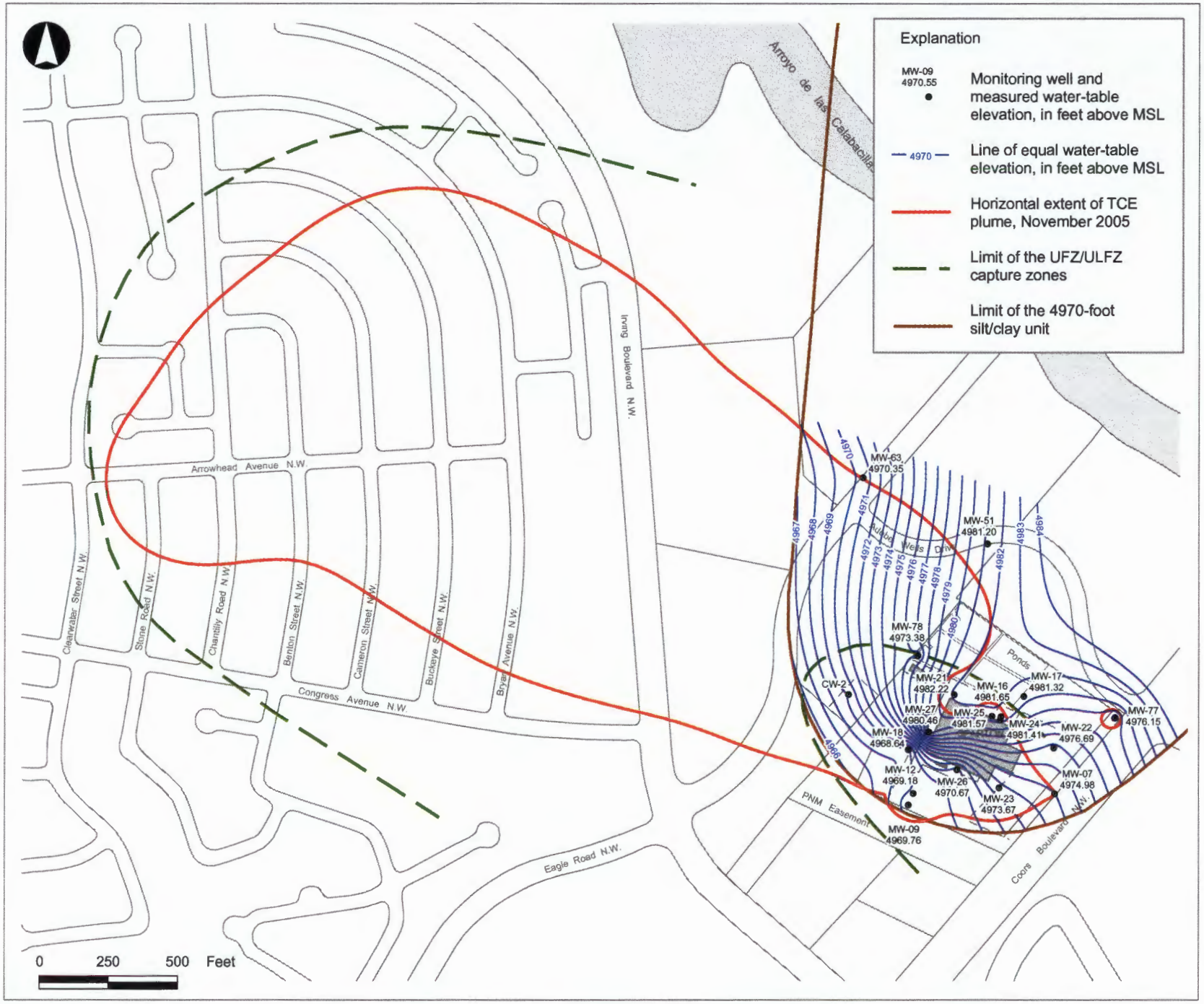


Figure 5.4 Elevation of the On-Site Water Table - May 17, 2006

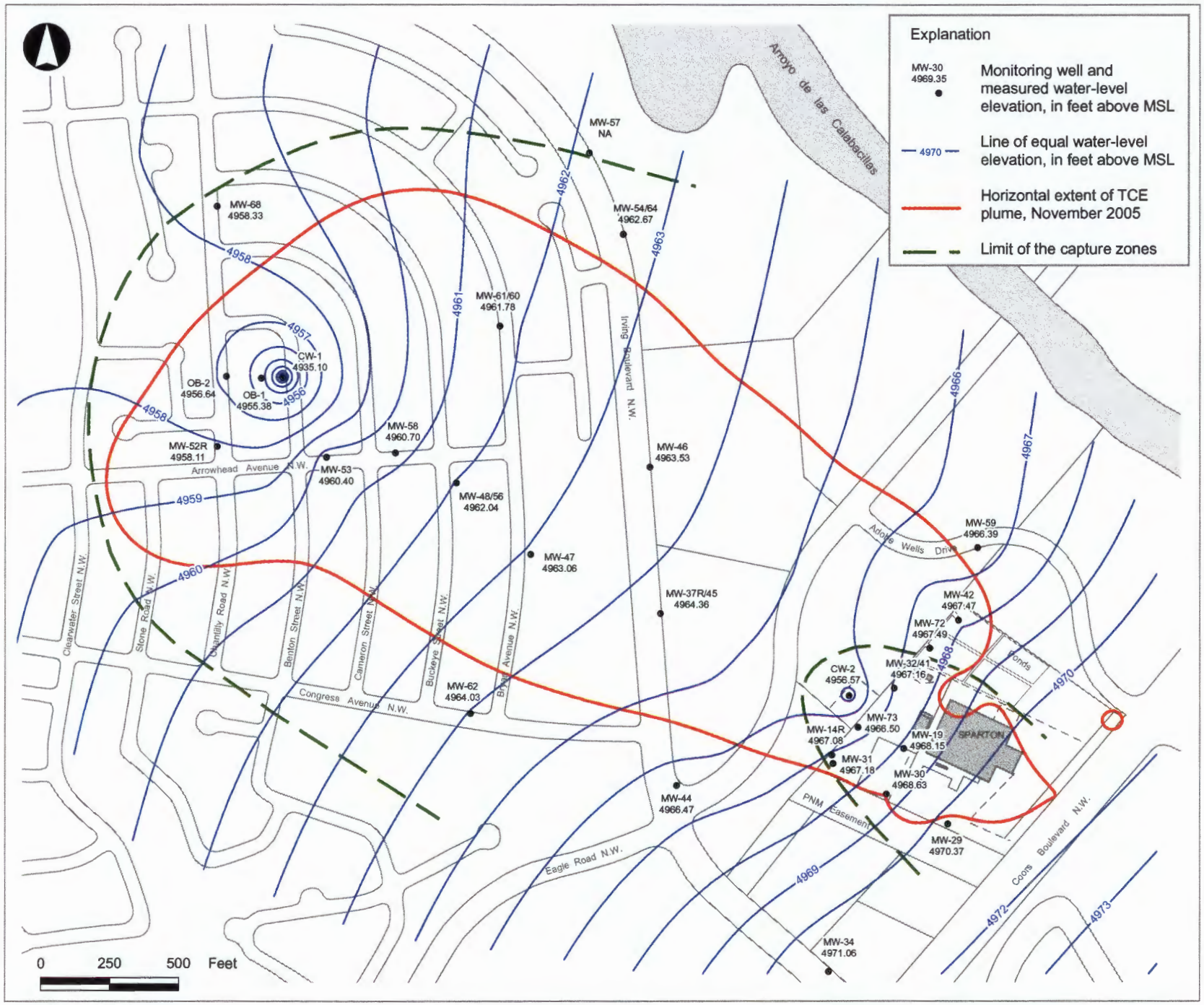


Figure 5.5 Elevation of Water Levels and Limits of Containment Well Capture Zones in the UFZ/ULFZ - May 17, 2006

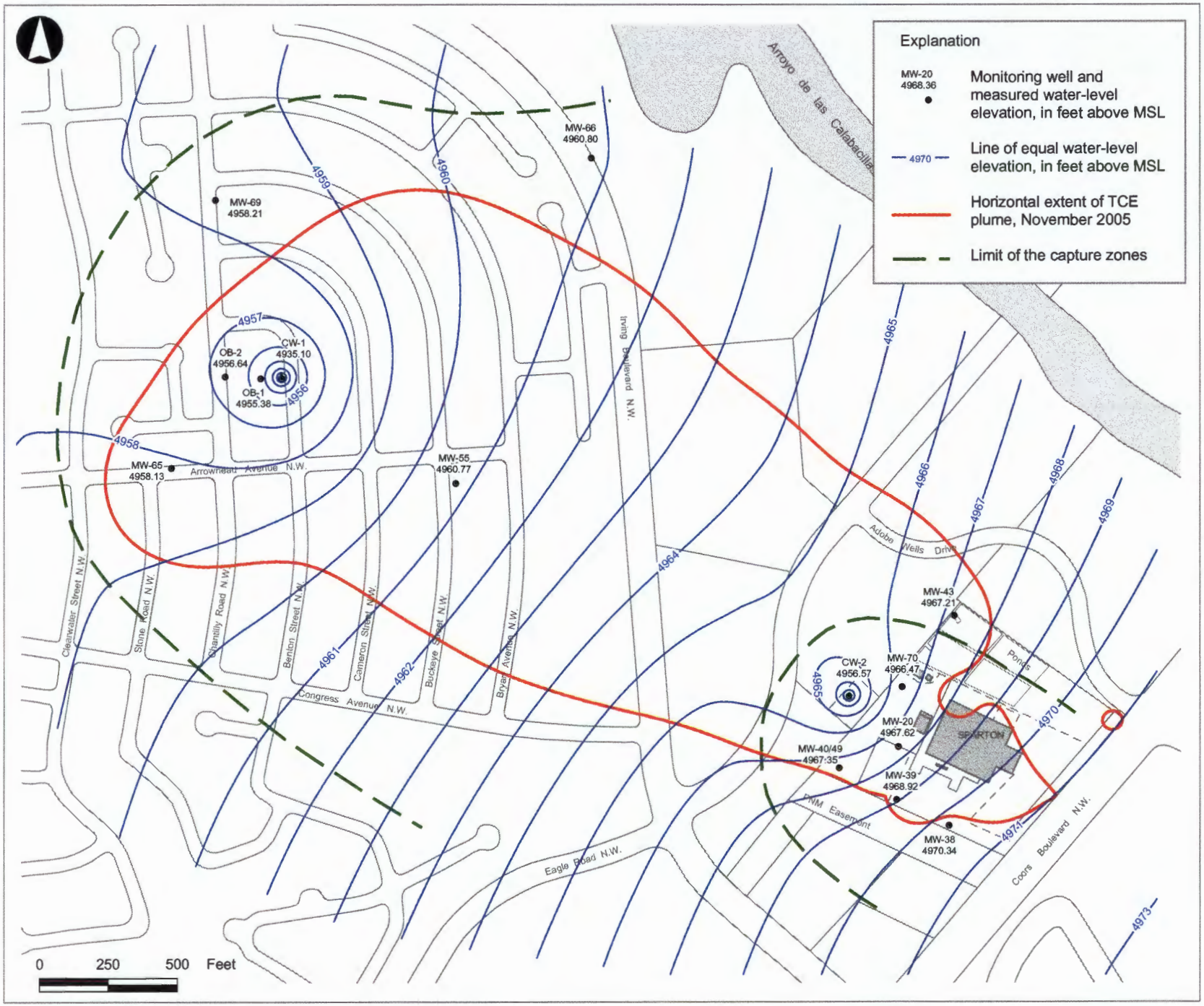


Figure 5.6 Elevation of Water Levels and Limits of Containment Well Capture Zones in the LLFZ - May 17, 2006

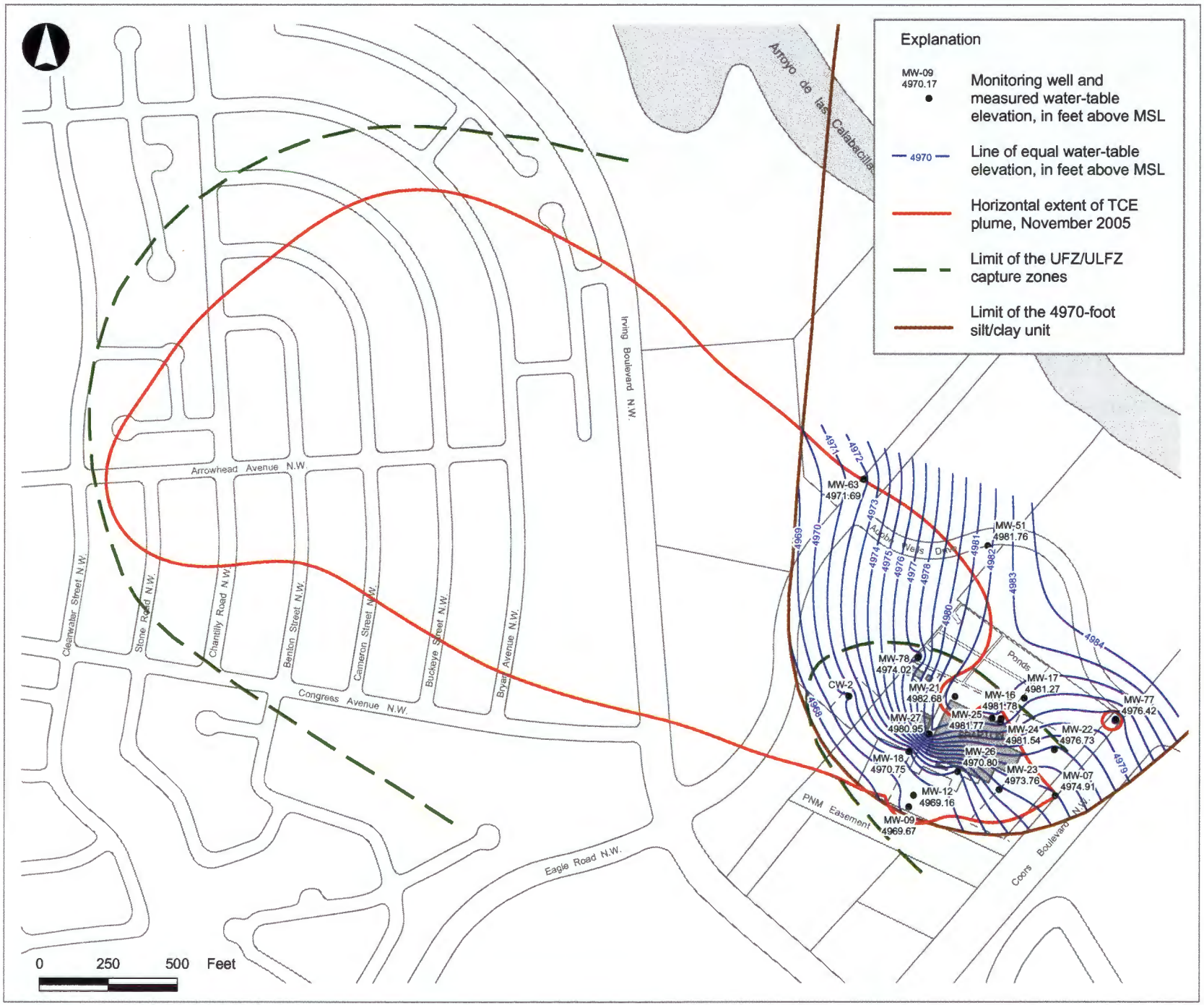


Figure 5.7 Elevation of the On-Site Water Table - August 9, 2006

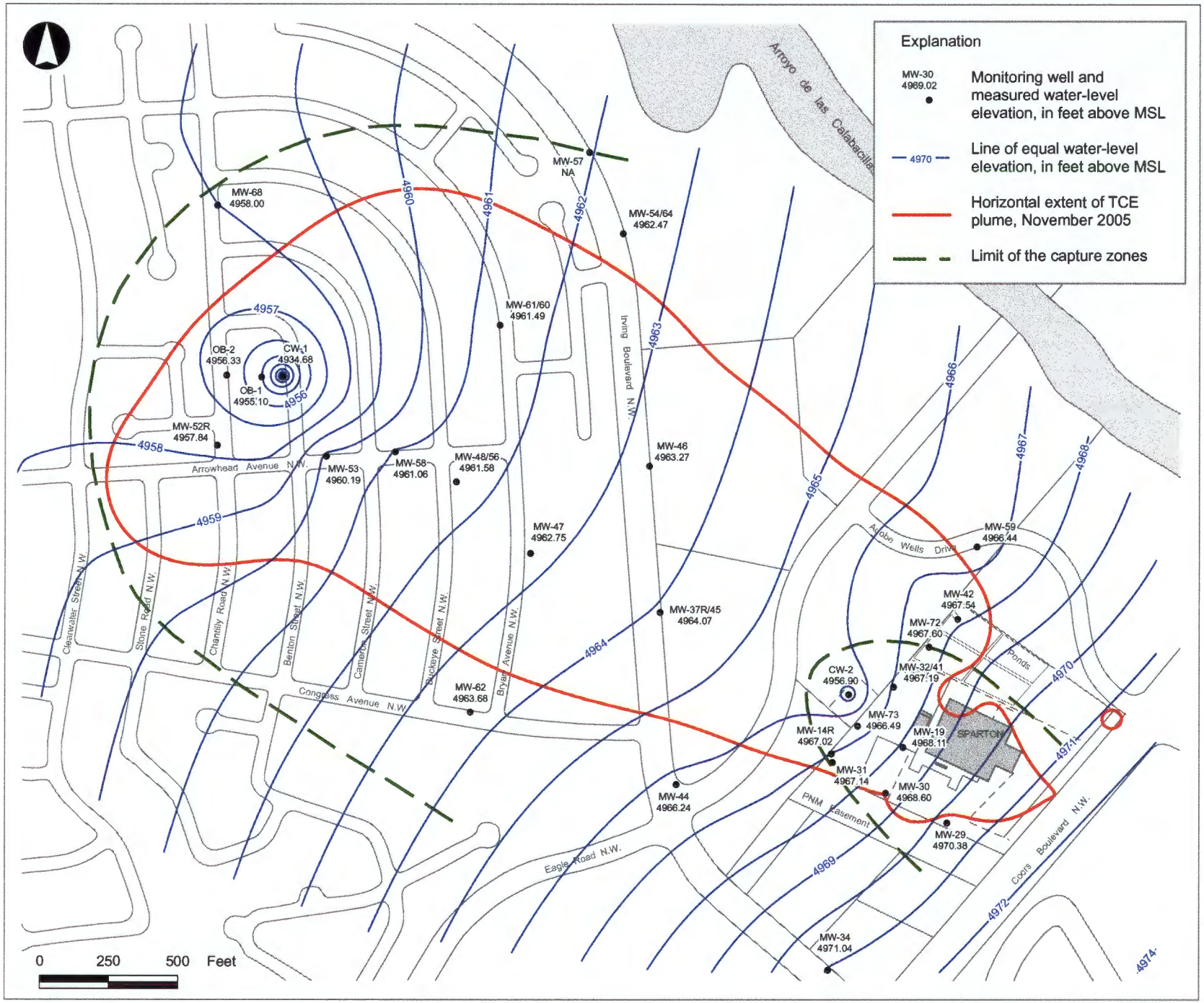


Figure 5.8 Elevation of Water Levels and Limits of Containment Well Capture Zones in the UFZ/ULFZ - August 9, 2006

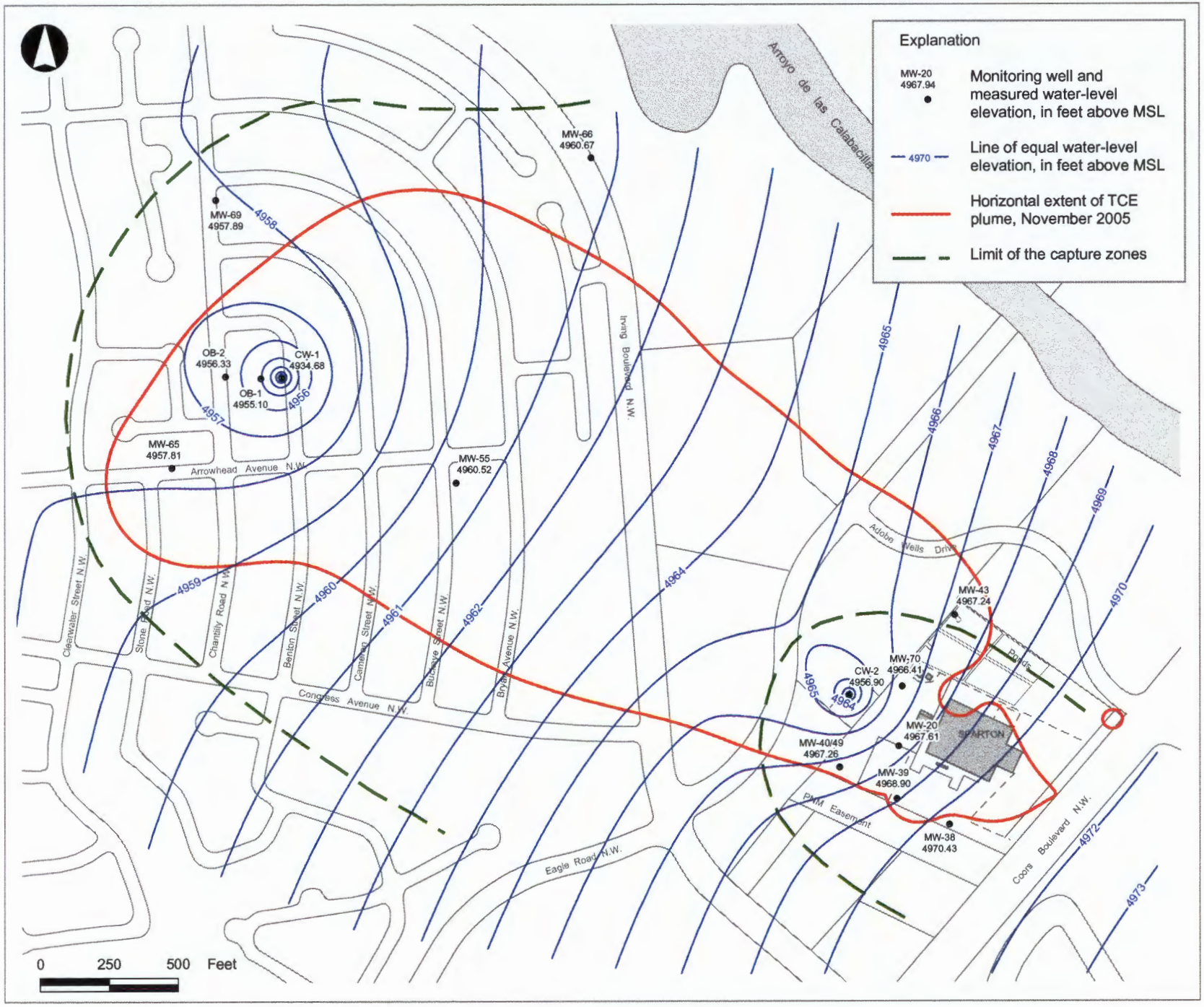


Figure 5.9 Elevation of Water Levels and Limits of Containment Well Capture Zones in the LLFZ - August 9, 2006

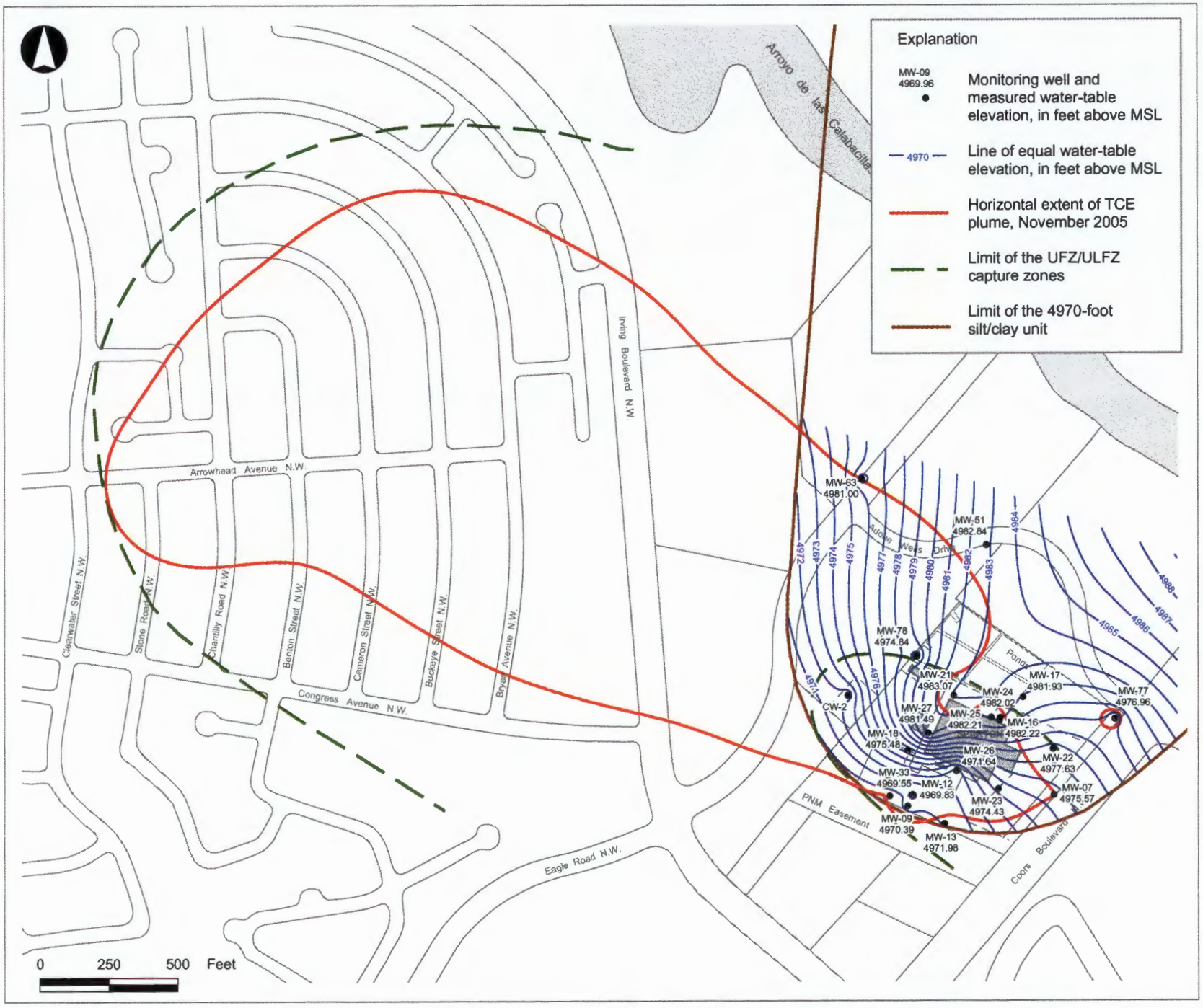


Figure 5.10 Elevation of the On-Site Water Table - November 6, 2006

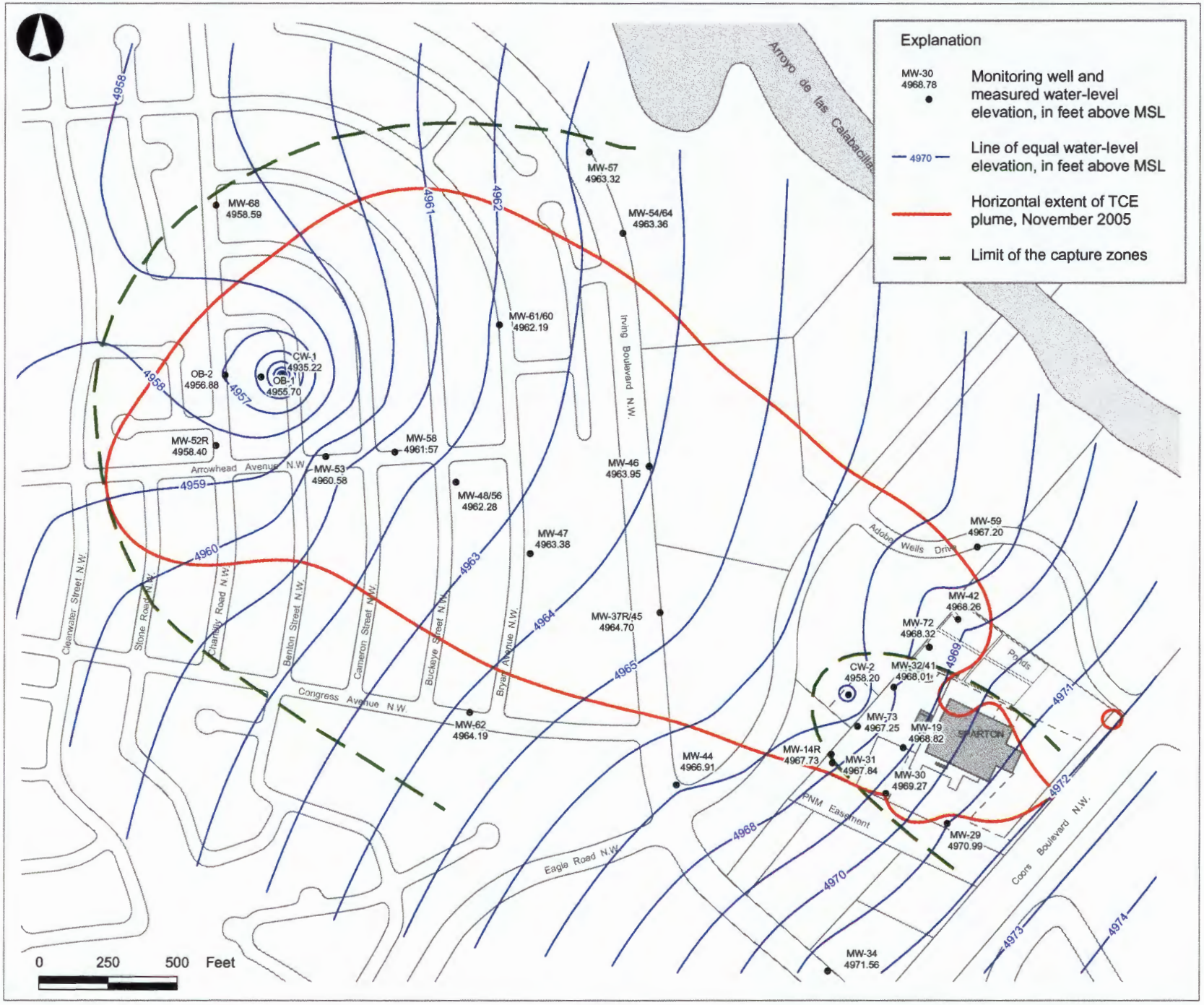


Figure 5.11 Elevation of Water Levels and Limits of Containment Well Capture Zones in the UFZ/ULFZ - November 6, 2006

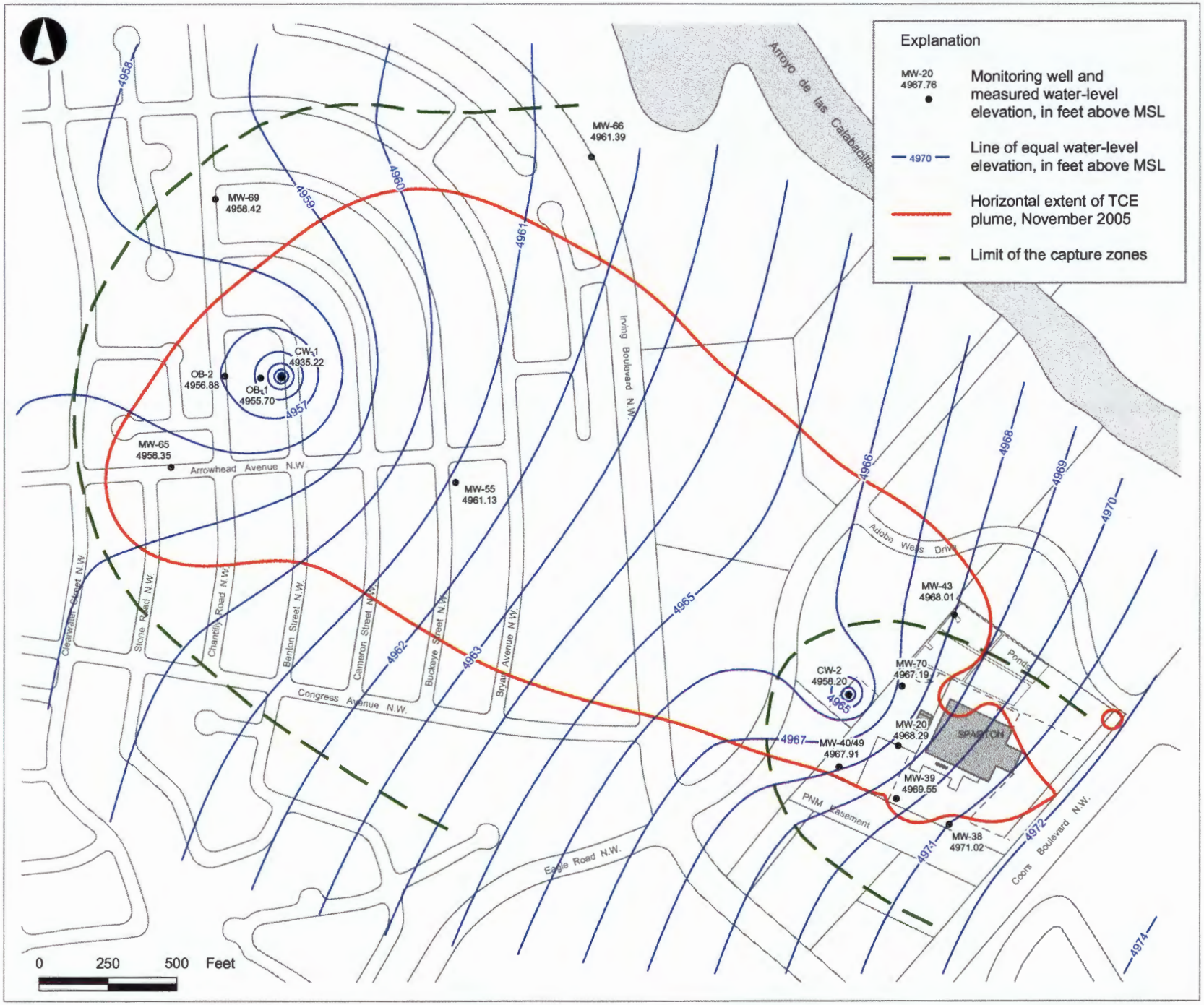


Figure 5.12 Elevation of Water Levels and Limits of Containment Well Capture Zones in the LLFZ - November 6, 2006

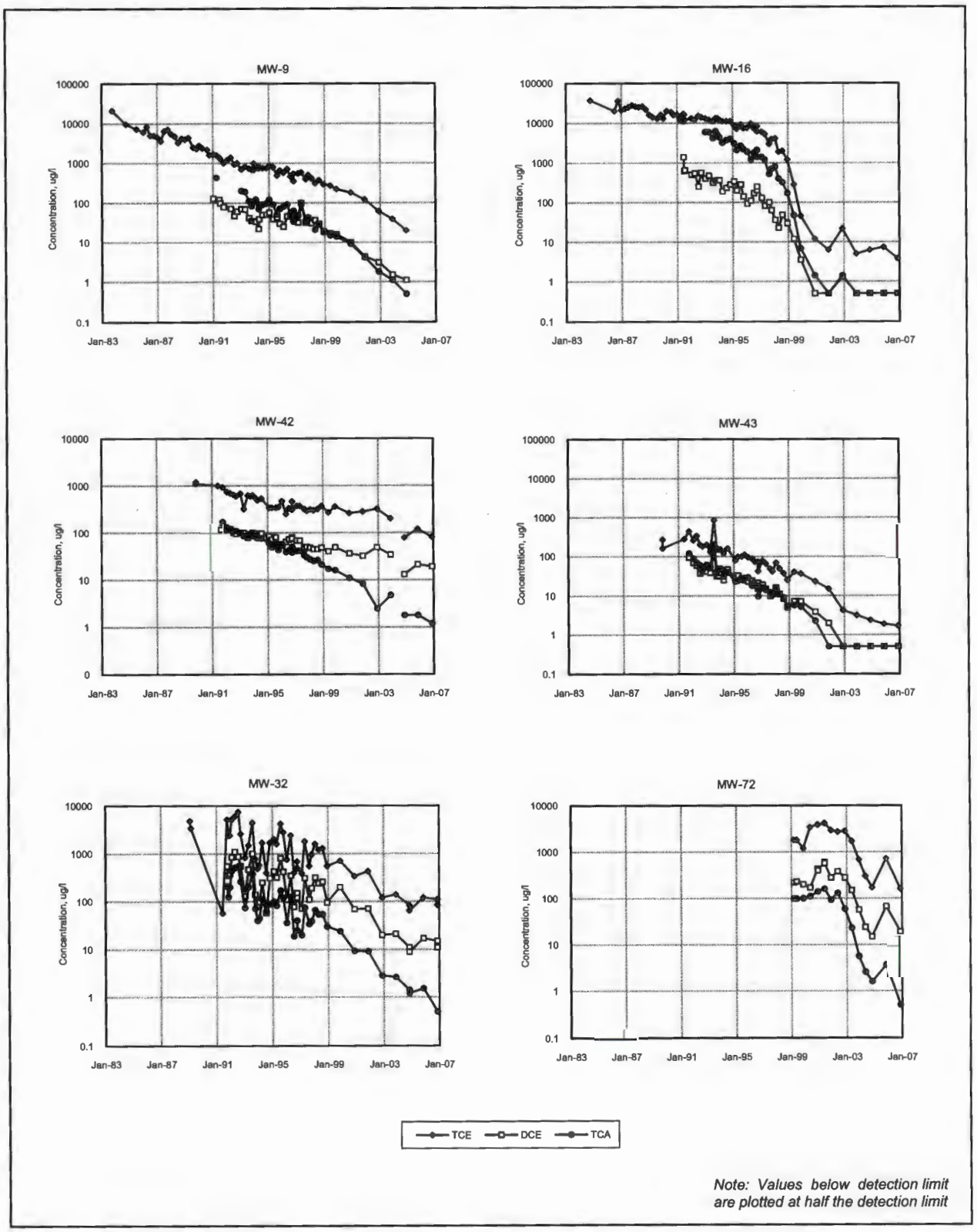
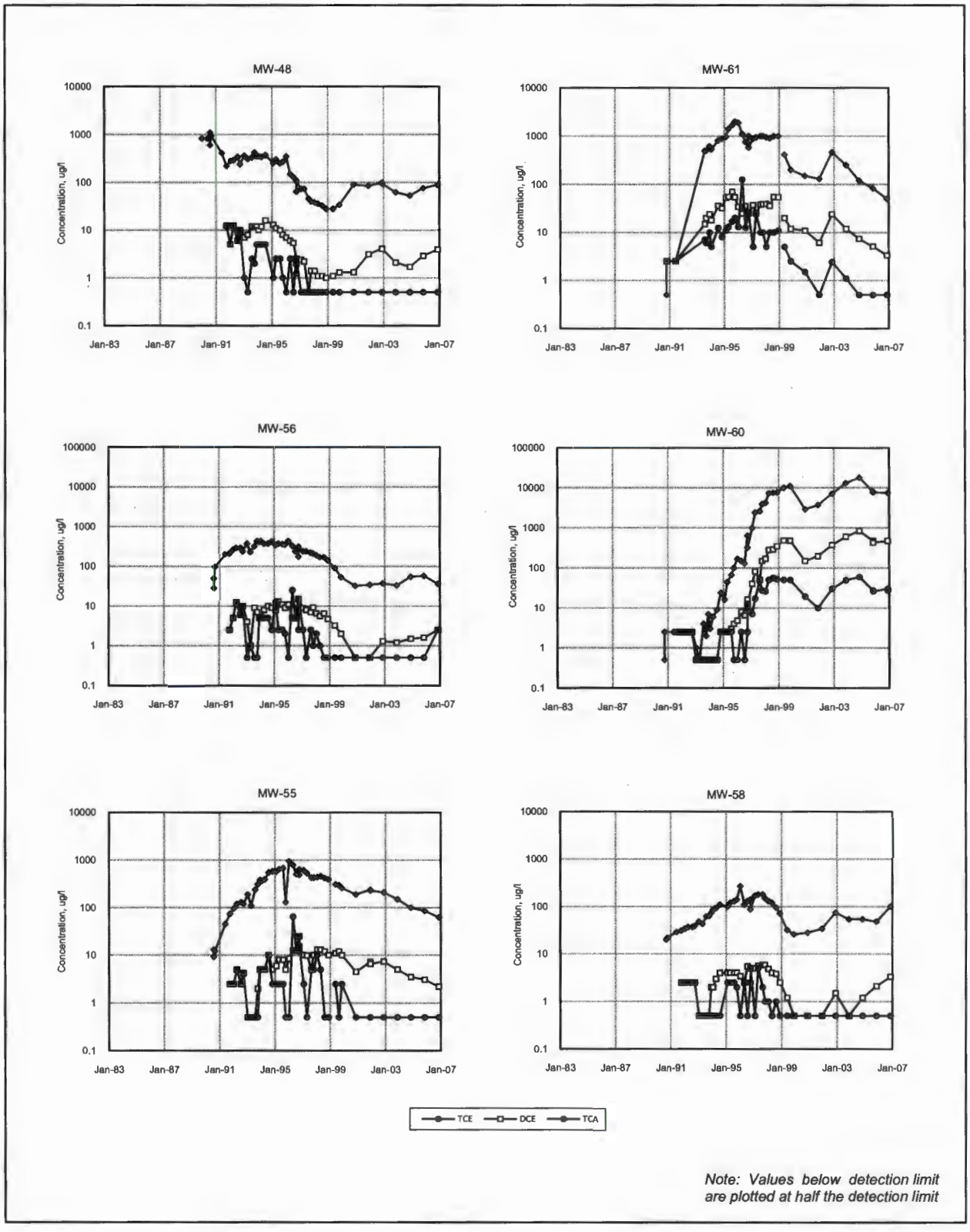


Figure 5.13 Contaminant Concentration Trends in On-Site Monitoring Wells



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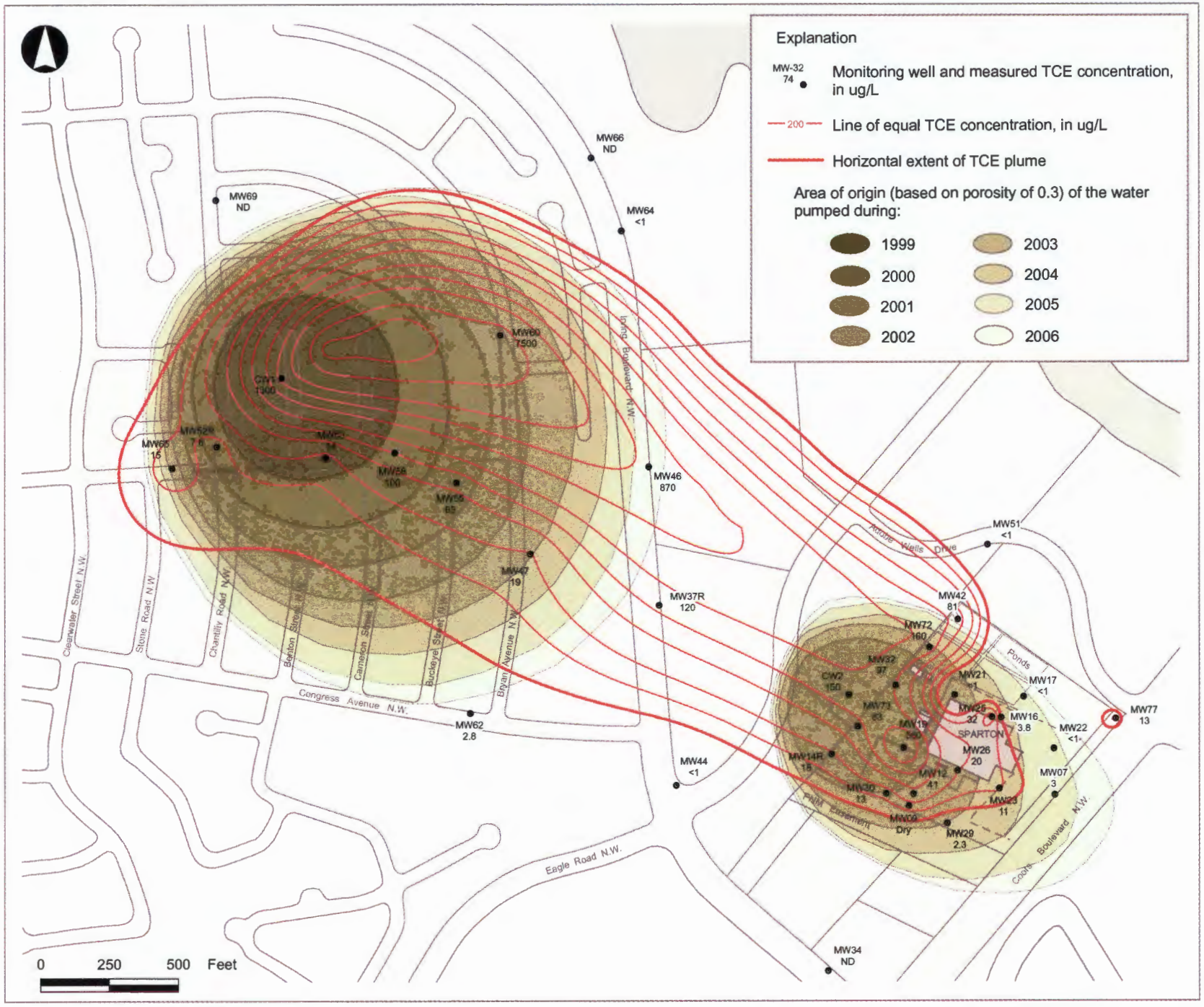


Figure 5.15 Horizontal Extent of TCE Plume - November 2006

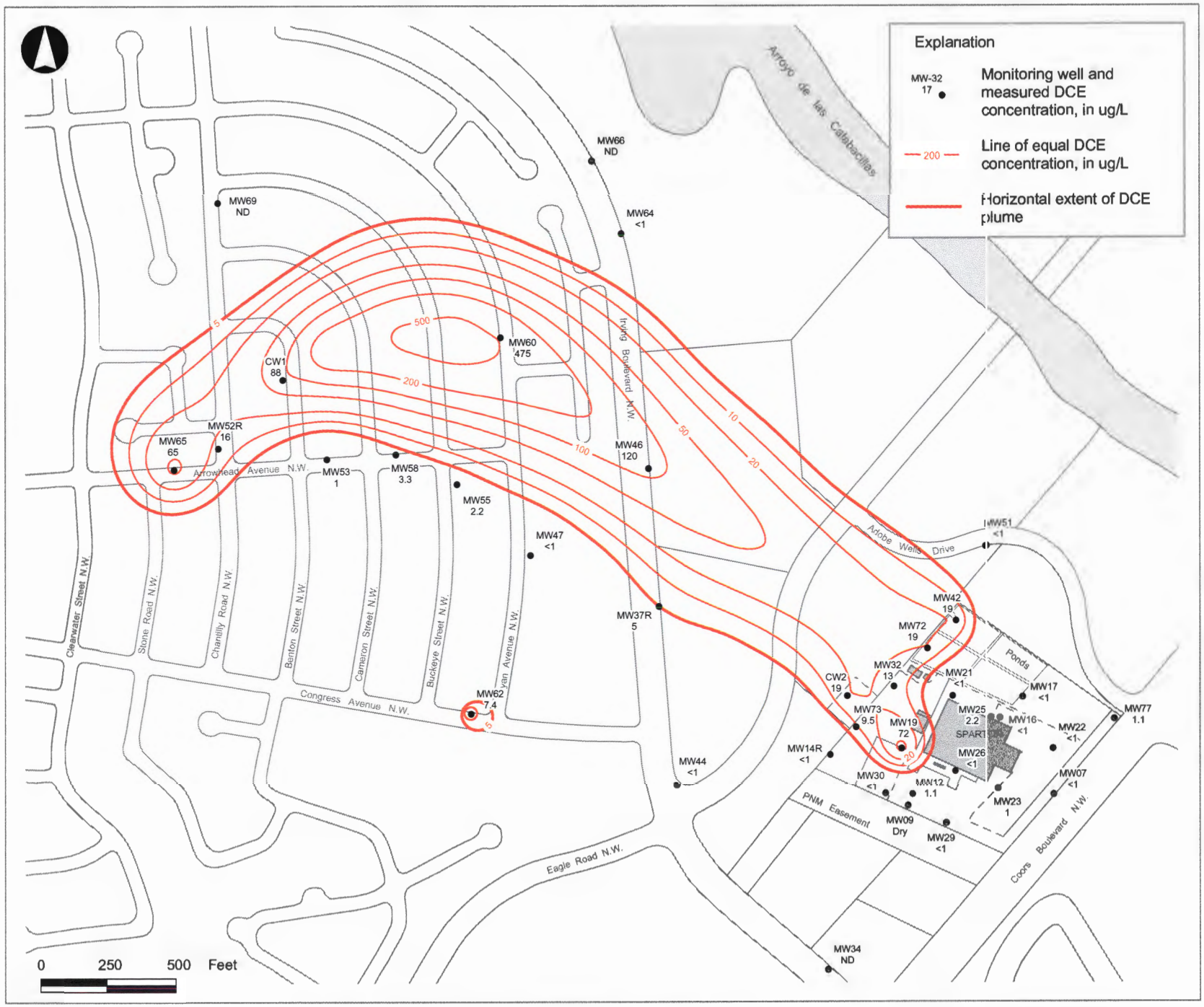


Figure 5.16 Horizontal Extent of DCE Plume - November 2006

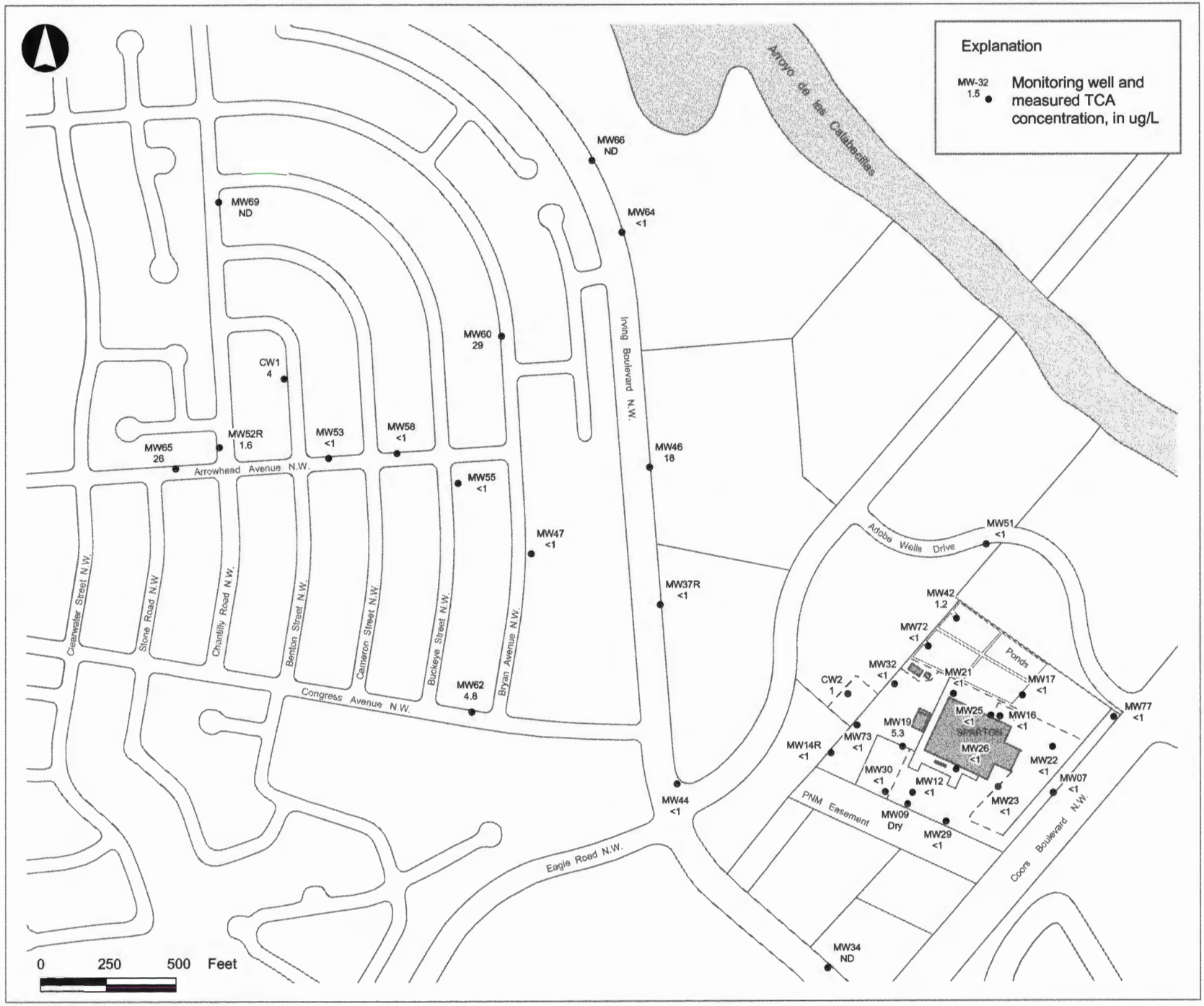


Figure 5.17 Maximum Concentrations of TCA in Wells - November 2006

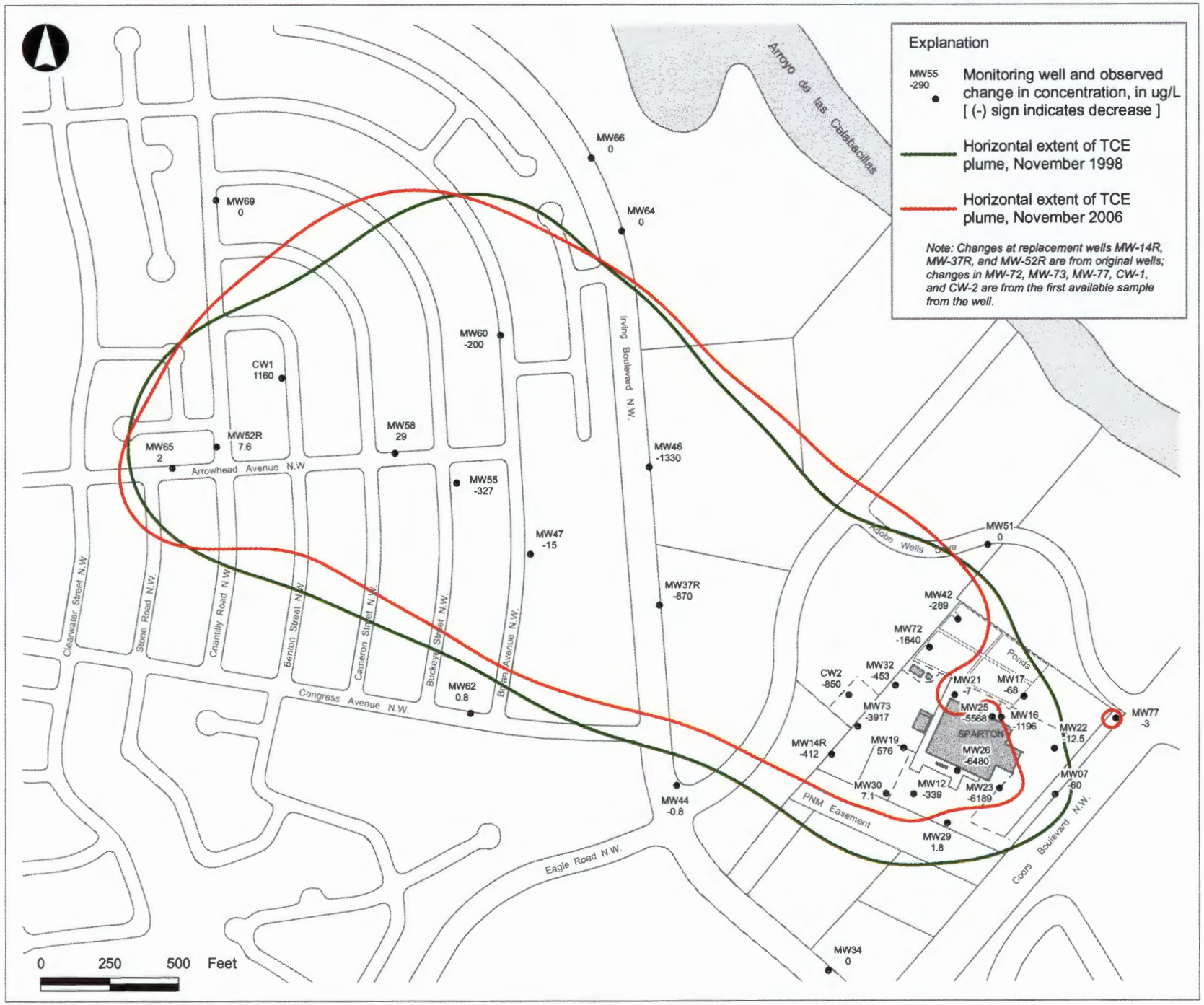


Figure 5.18 Changes in TCE Concentrations at Wells Used for Plume Definition - November 1998 to November 2006

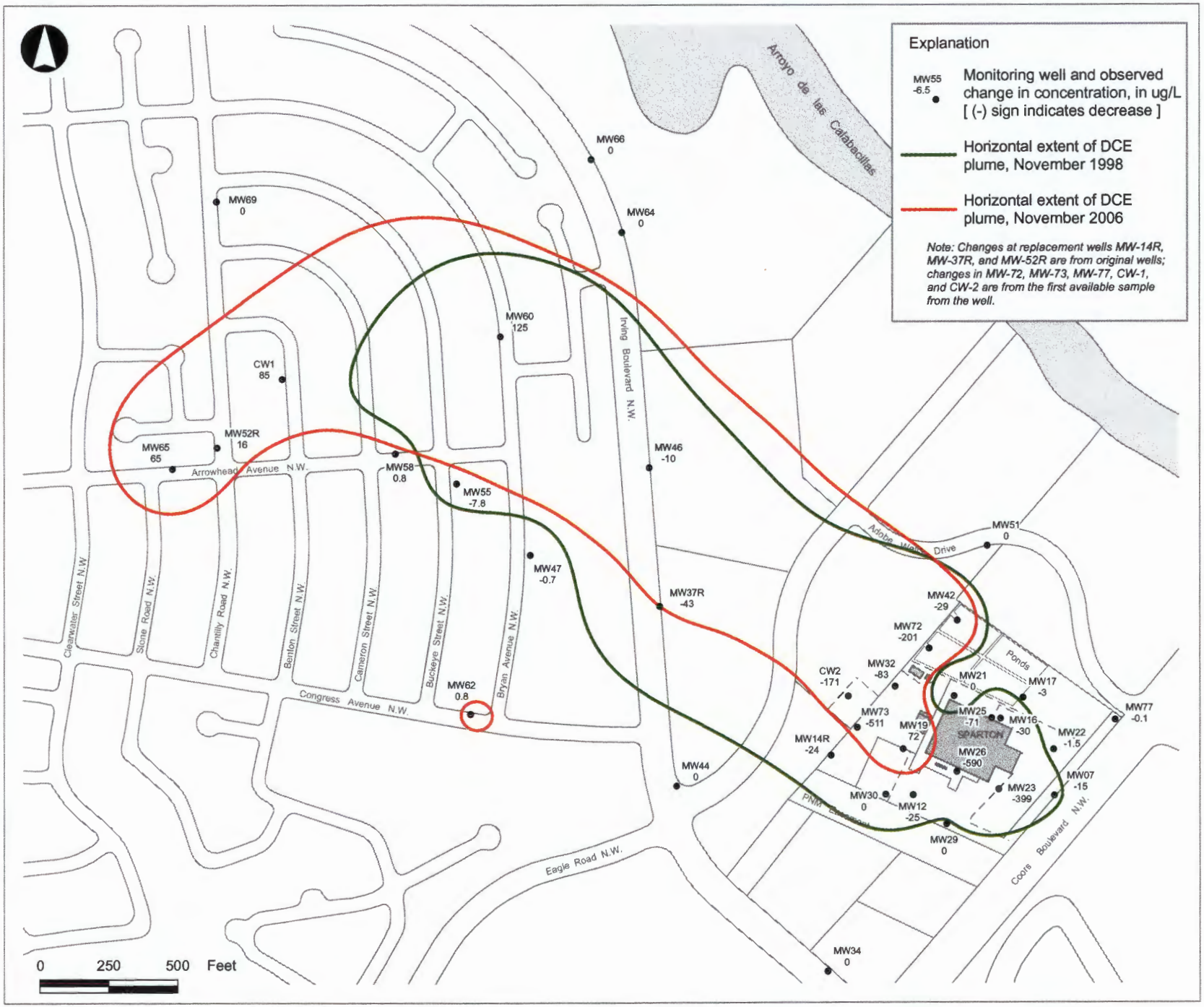


Figure 5.19 Changes in DCE Concentrations at Wells Used for Plume Definition - November 1998 to November 2006

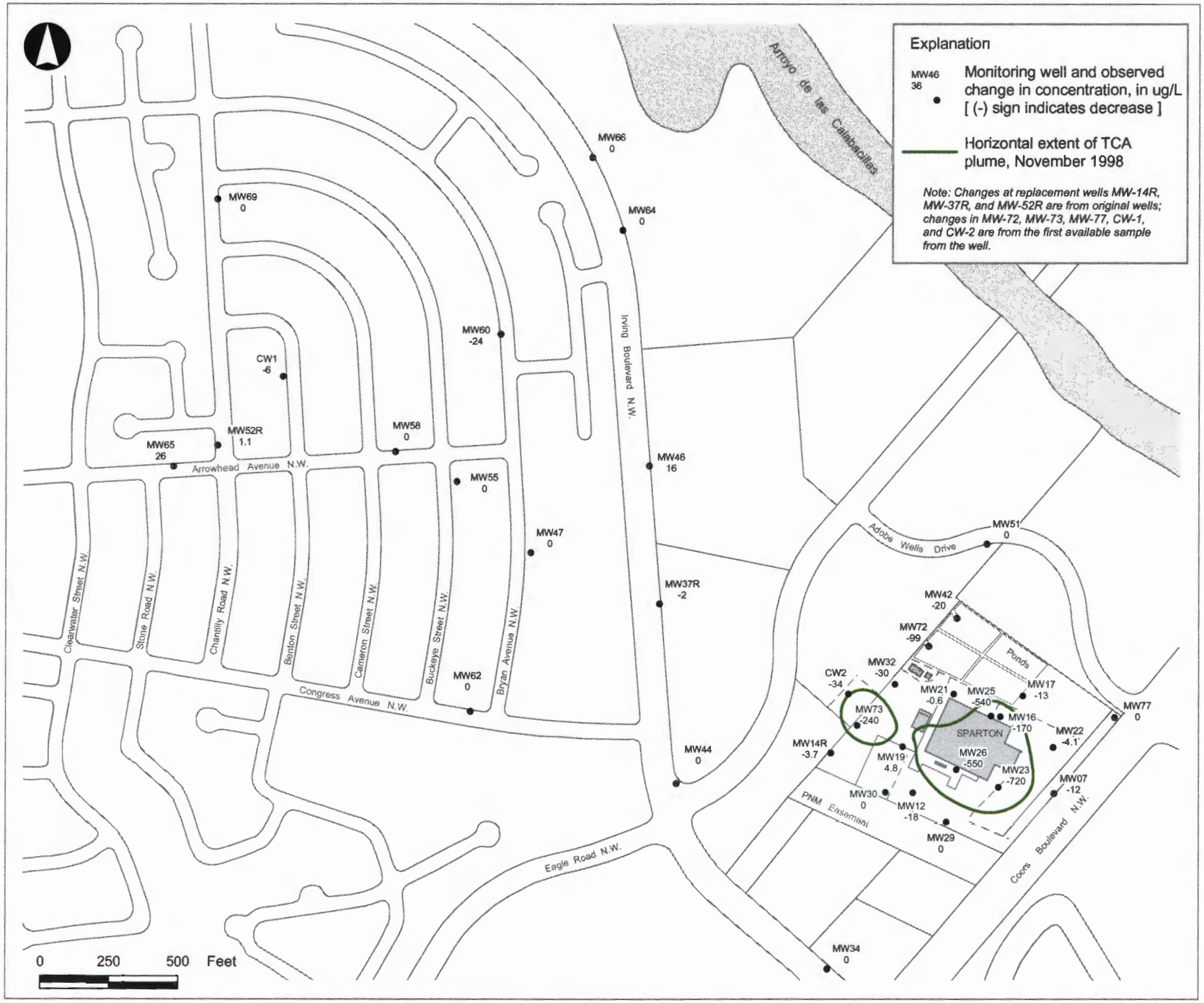


Figure 5.20 Changes in TCA Concentrations at Wells Used for Plume Definition - November 1998 to November 2006

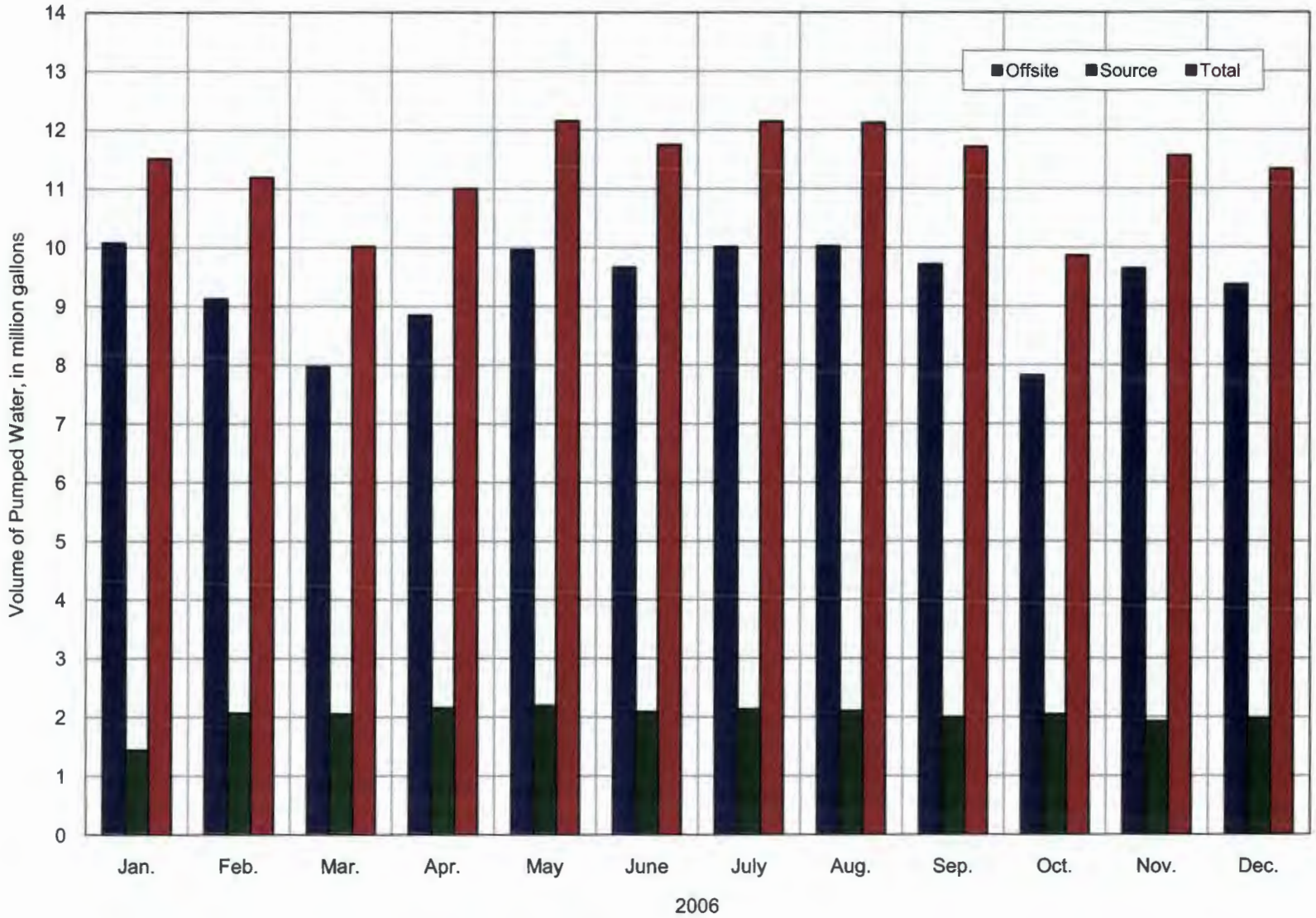


Figure 5.21 Monthly Volume of Water Pumped by the Off-Site and Source Containment Wells - 2006

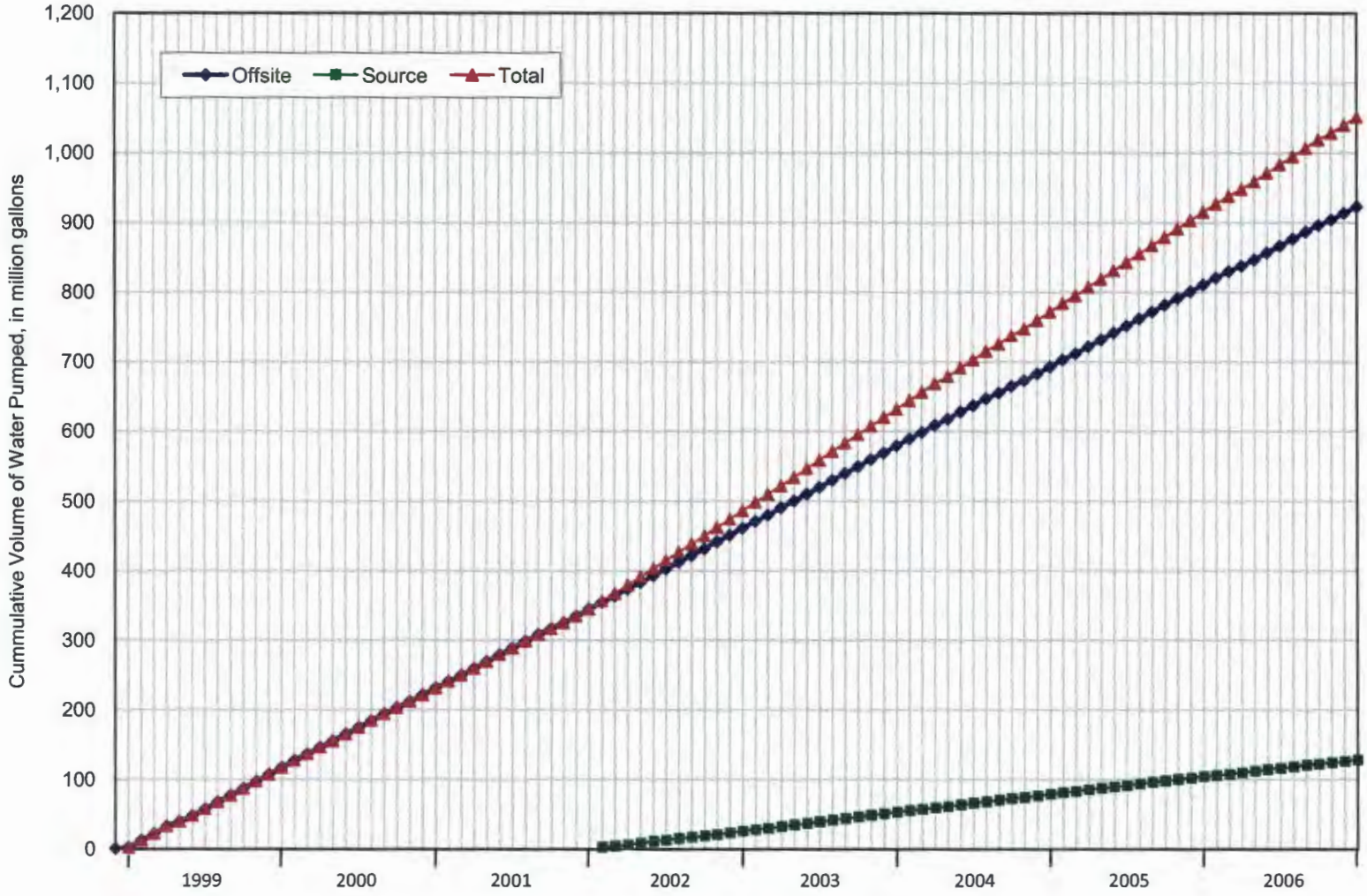


Figure 5.22 Cumulative Volume of Water Pumped by the Off-Site and Source Containment Wells

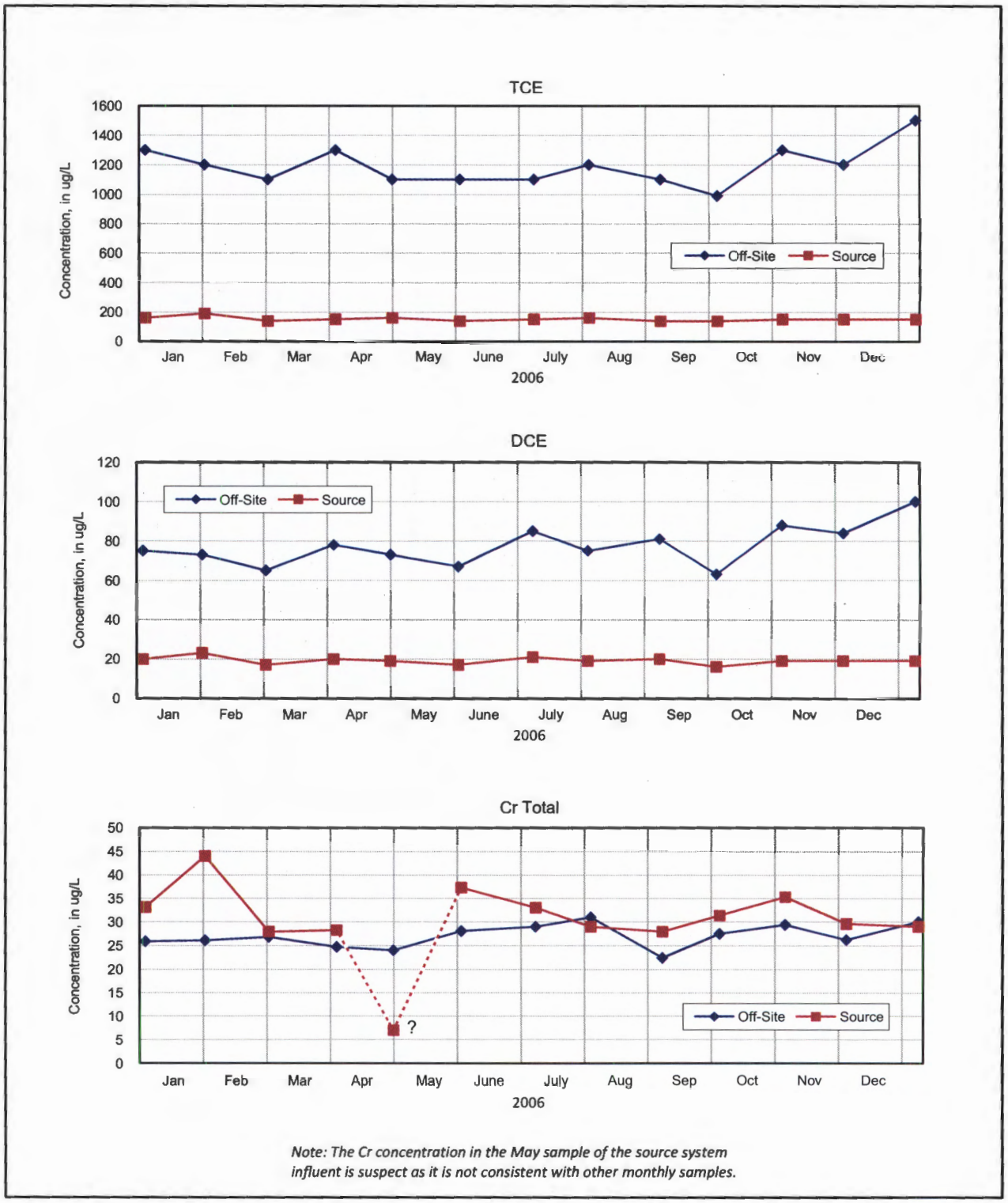
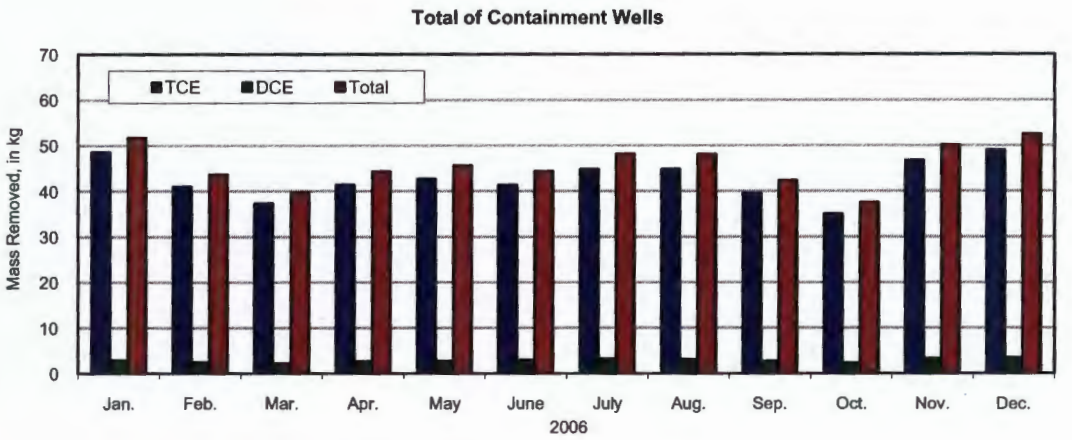
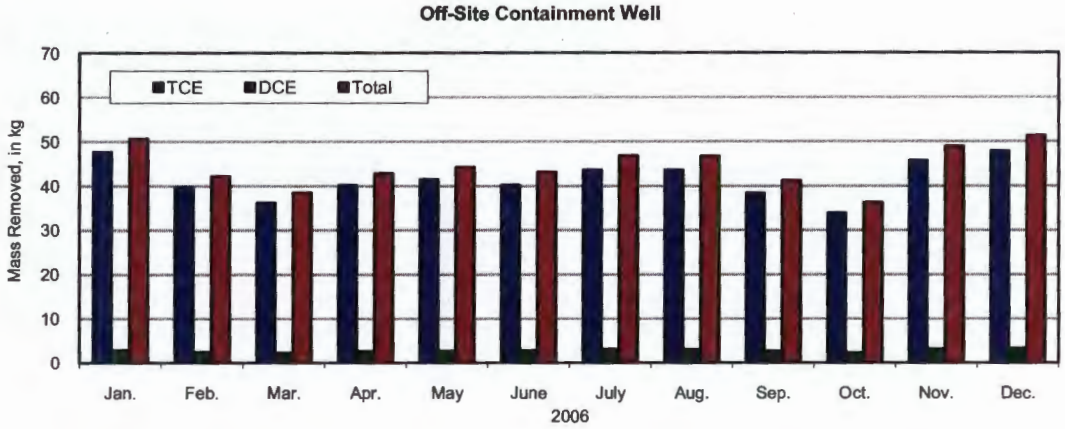


Figure 5.23 Source and Off-Site Containment Systems - TCE, DCE, and Total Chromium Concentrations in the Influent - 2006





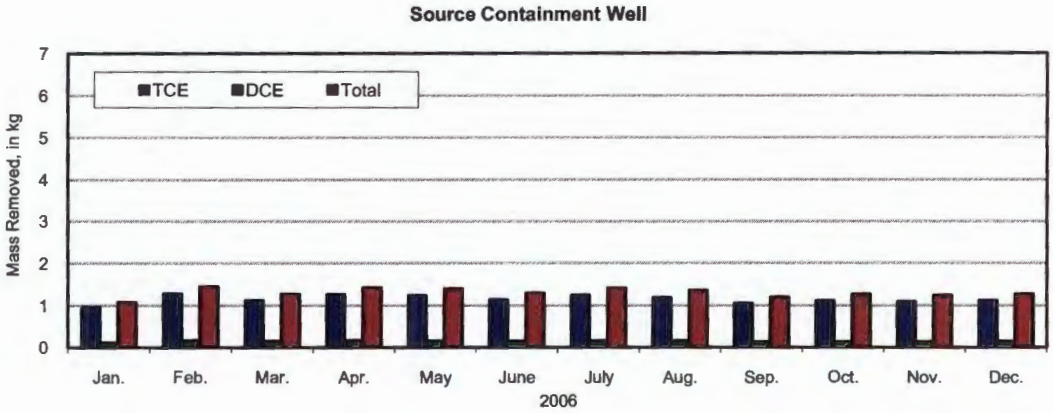


Figure 5.24 Monthly Contaminant Mass Removal by the Containment Wells - 2006

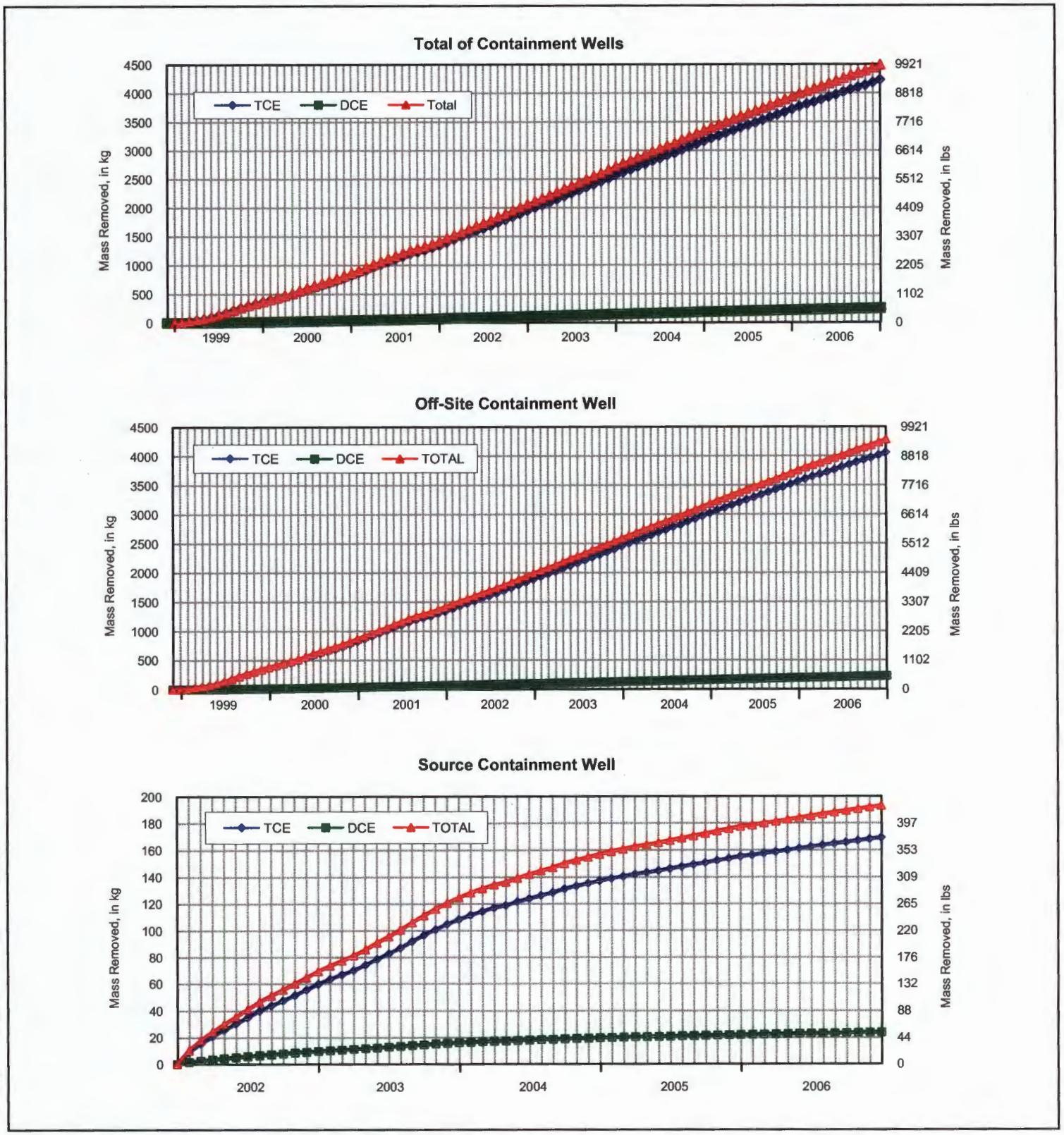


Figure 5.25 Cumulative Containment Mass Removal by the Source and Off-Site Containment Wells

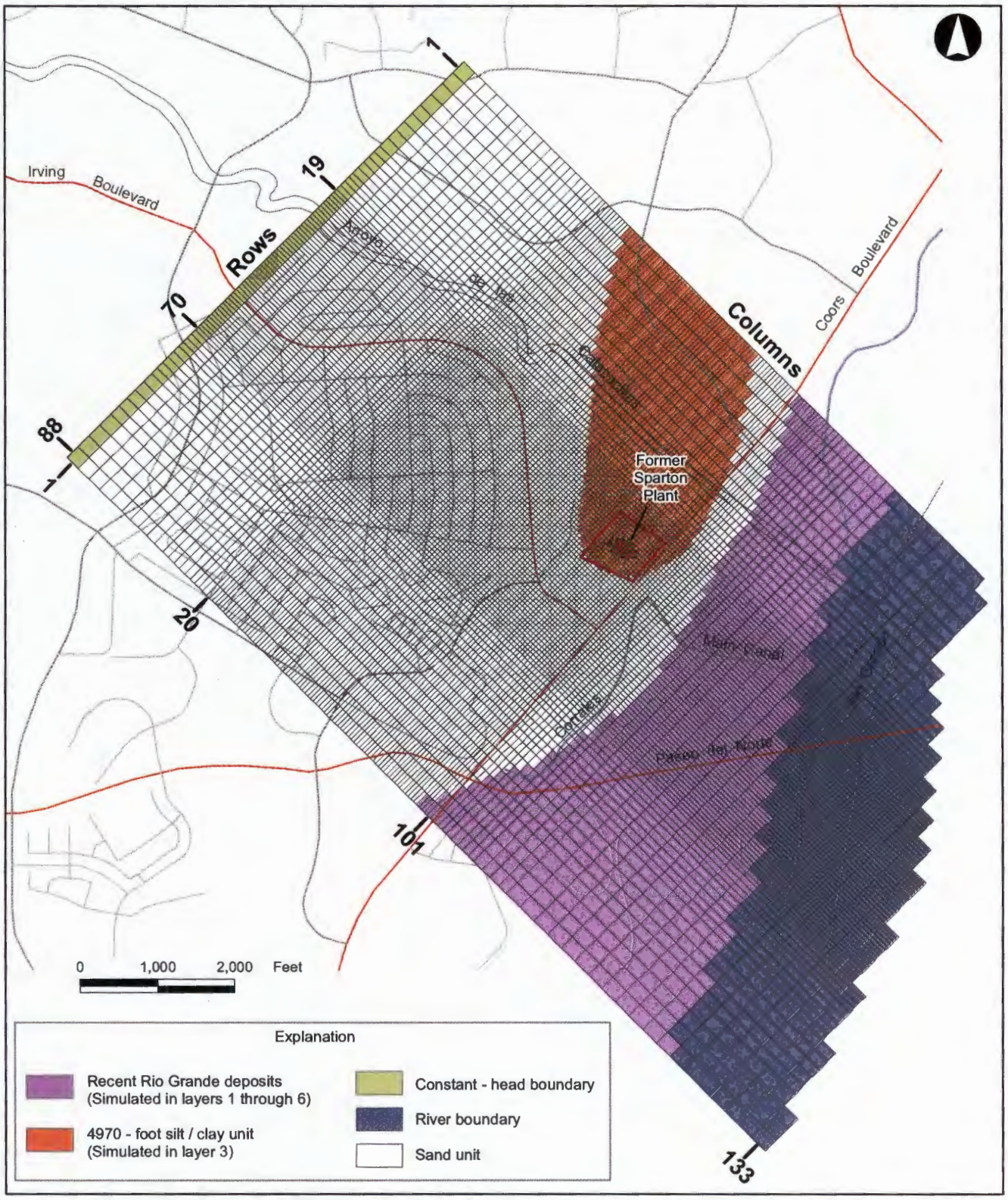


Figure 6.1 Model Grid, Hydraulic Property Zones and Boundary Conditions

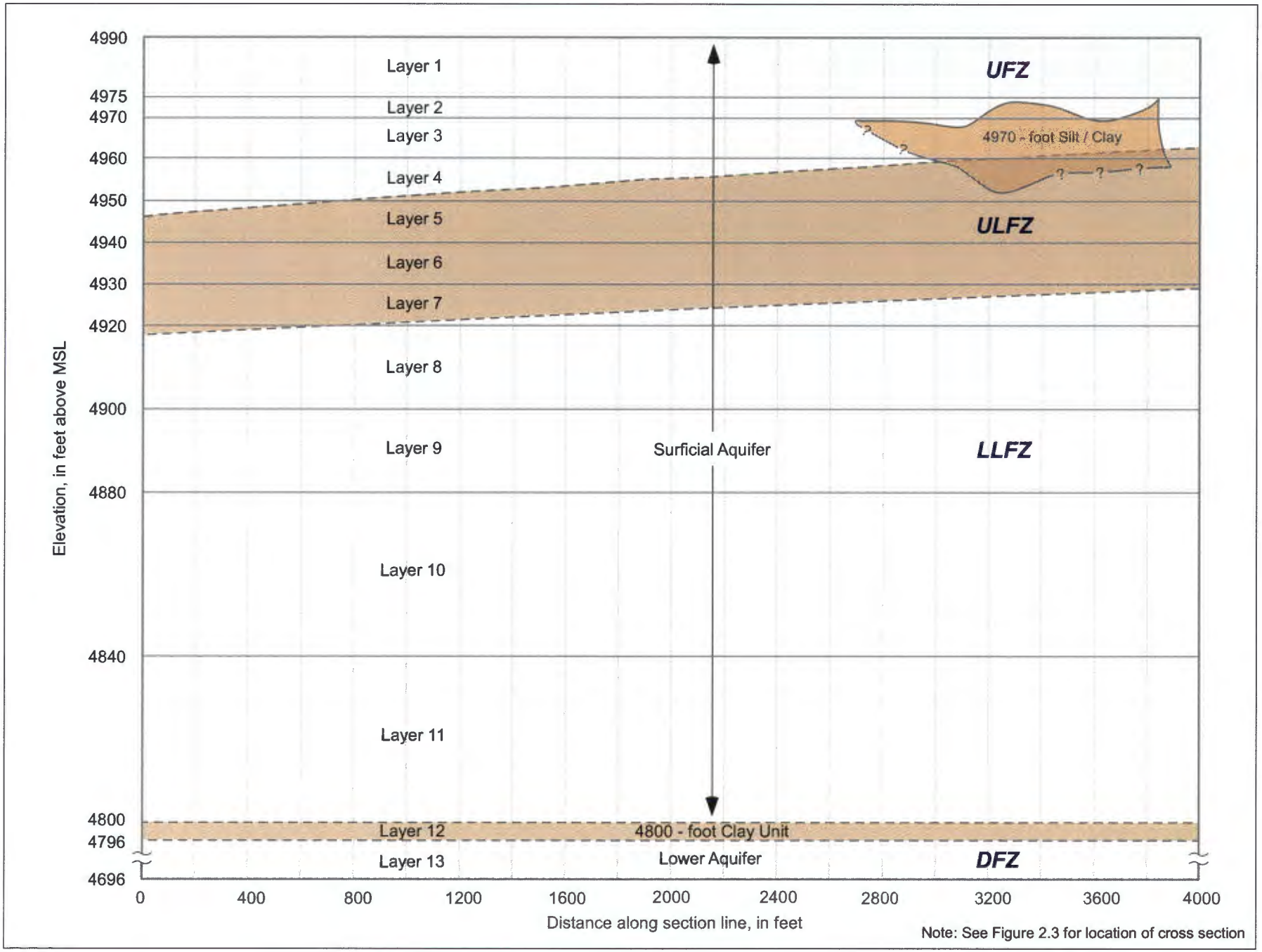
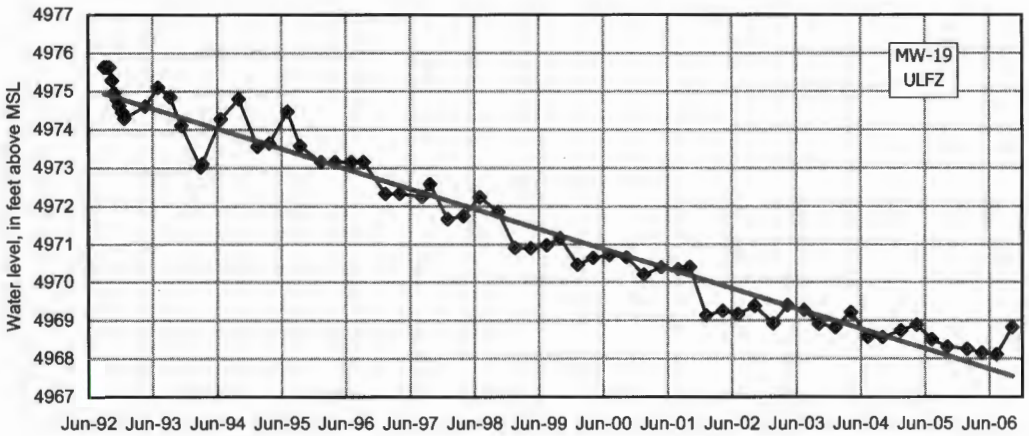
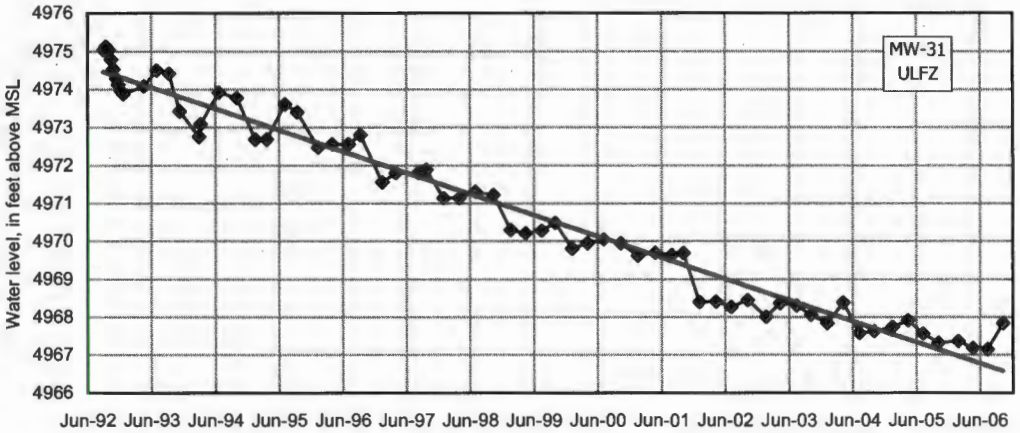


Figure 6.2 Model Layers





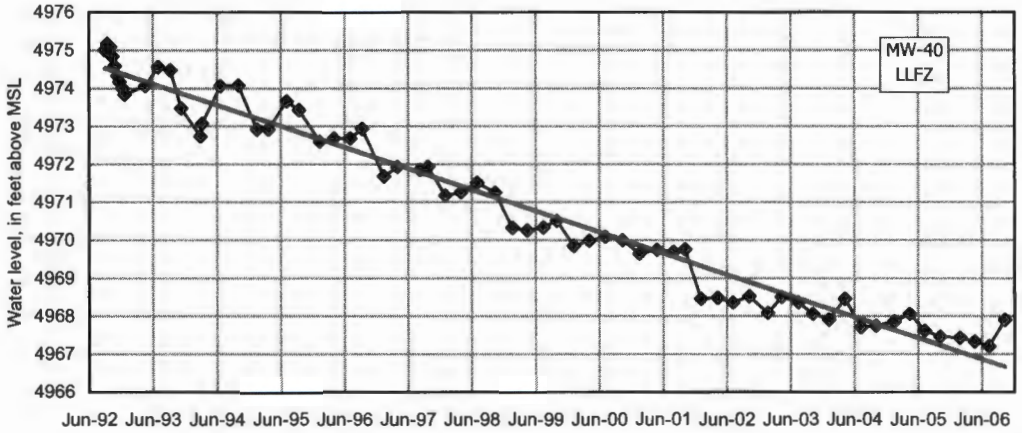
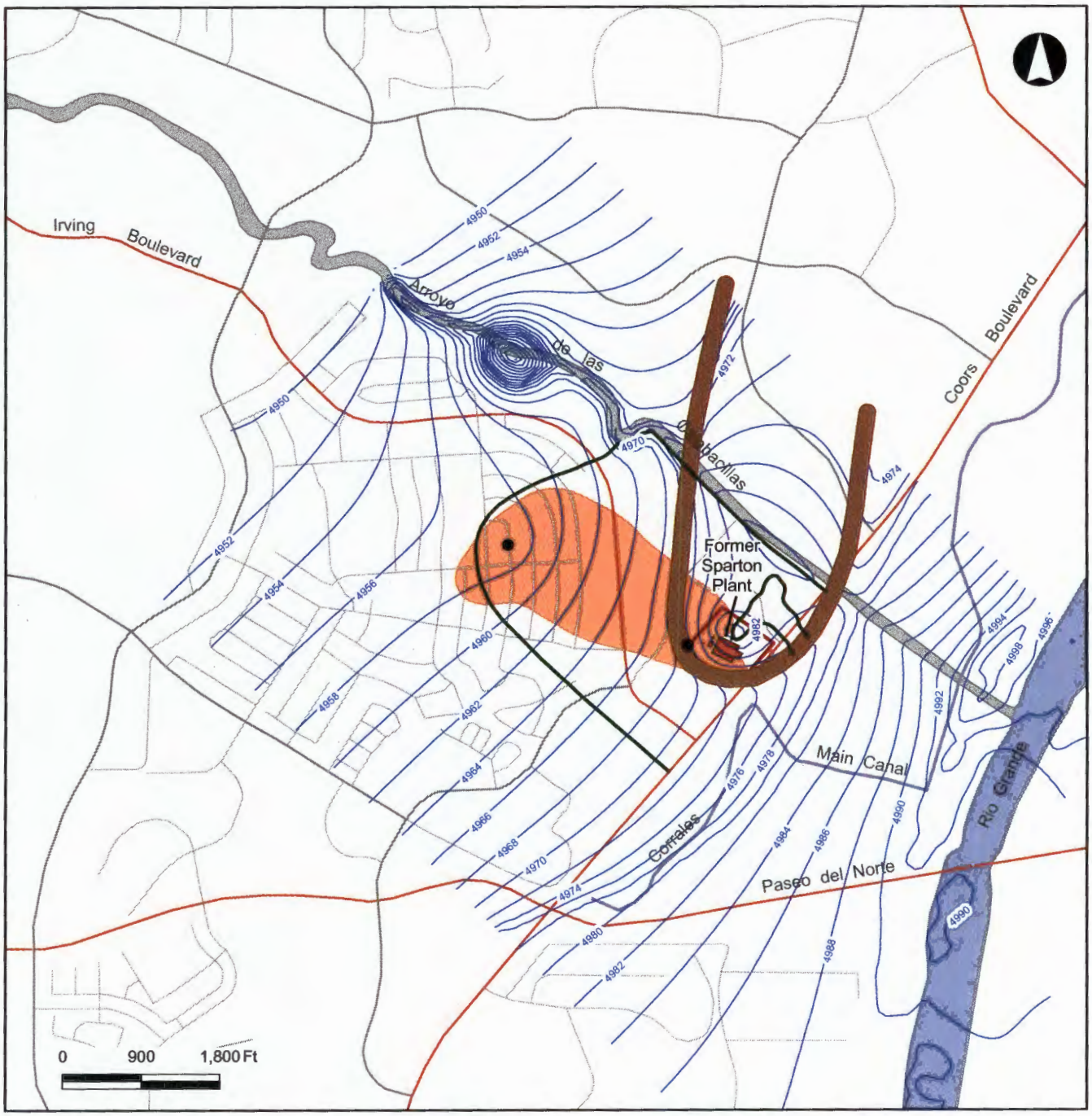


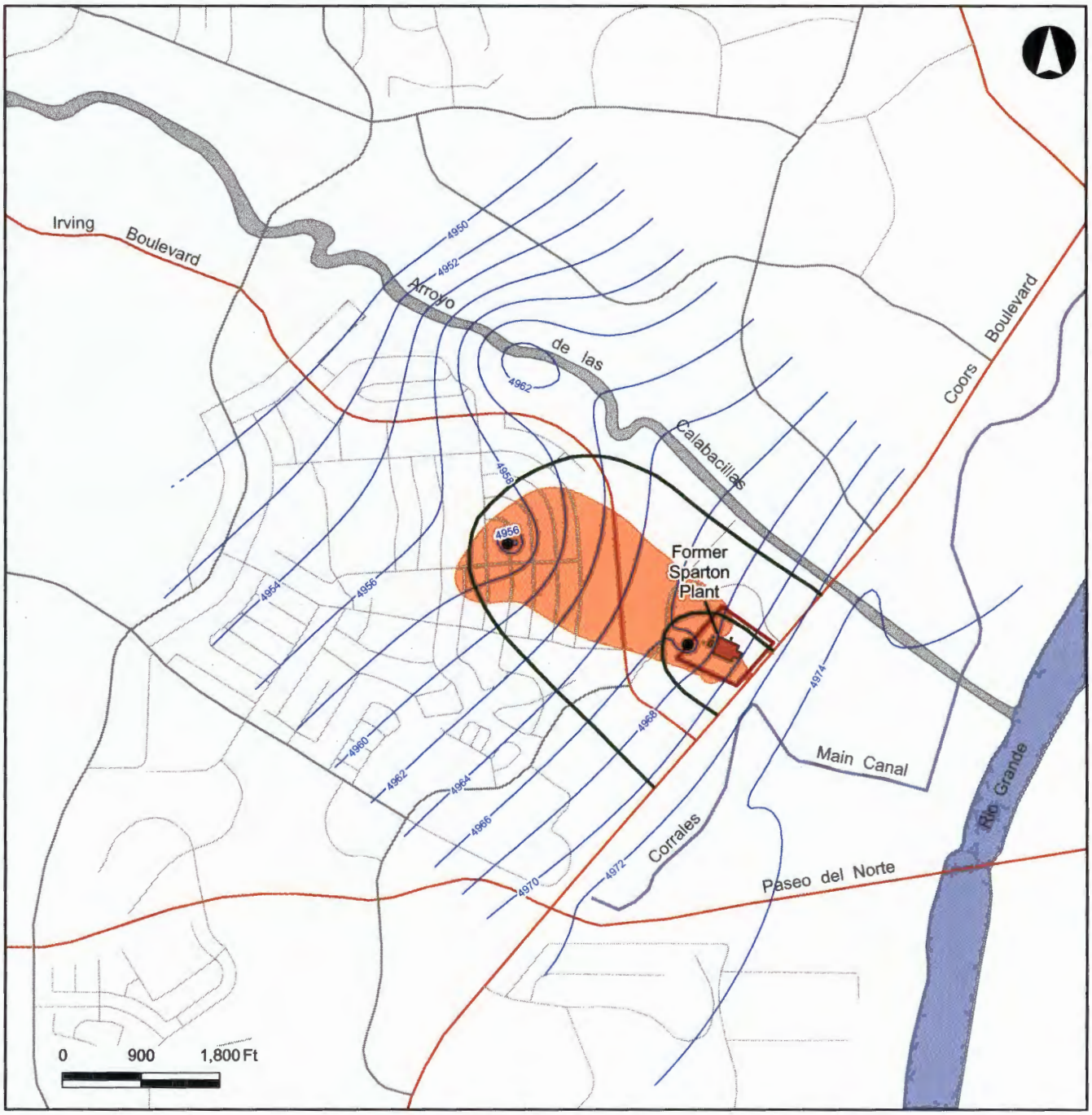
Figure 6.3 Regional Water Level Trends



Explanation

- Containment Well
- —4968— Line of equal water-level elevation, in feet above MSL
- Limit of the capture zones
- Approximate extent of 4970-foot silt/clay unit
- Horizontal extent of TCE plume, November 2005

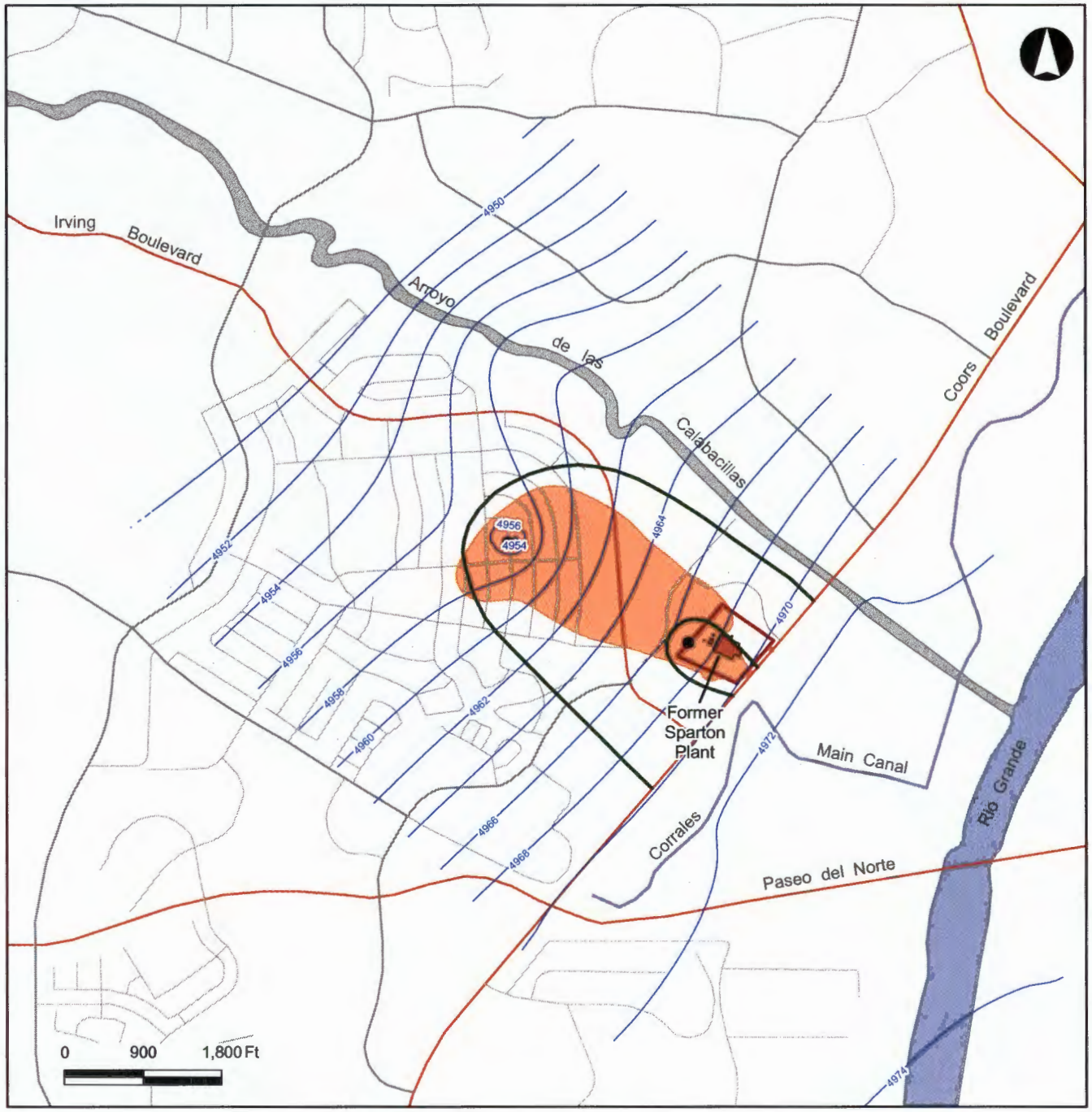
Figure 6.4 Calculated Water Table (UFZ) and Comparison of the Calculated Capture Zone to the TCE Plume Extent



Explanation

- Containment Well
- —4968— Line of equal water-level elevation, in feet above MSL
- Limit of the capture zones
- Horizontal extent of TCE plume, November 2005

Figure 6.5 Calculated Water Levels in the ULFZ and Comparison of the Calculated Capture Zone to the TCE Plume Extent



Explanation

- Containment Well
- —4968— Line of equal water-level elevation, in feet above MSL
- Limit of the capture zones
- Horizontal extent of TCE plume, November 2005

Figure 6.6 Calculated Water Levels in the LLFZ and Comparison of the Calculated Capture Zone to the TCE Plume Extent

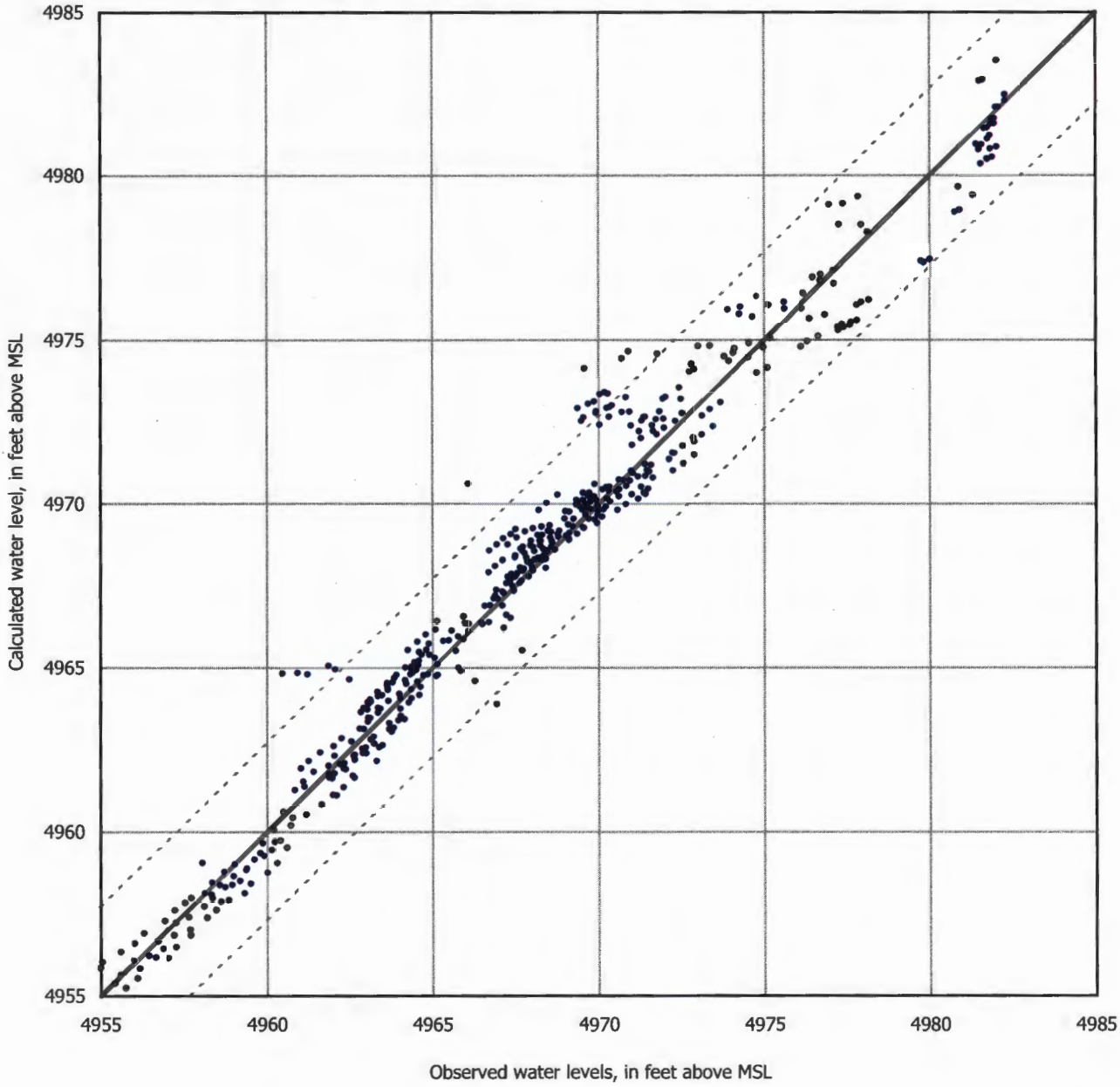


Figure 6.7 Comparison of Calculated to Observed Water Levels - November 1998 to November 2006

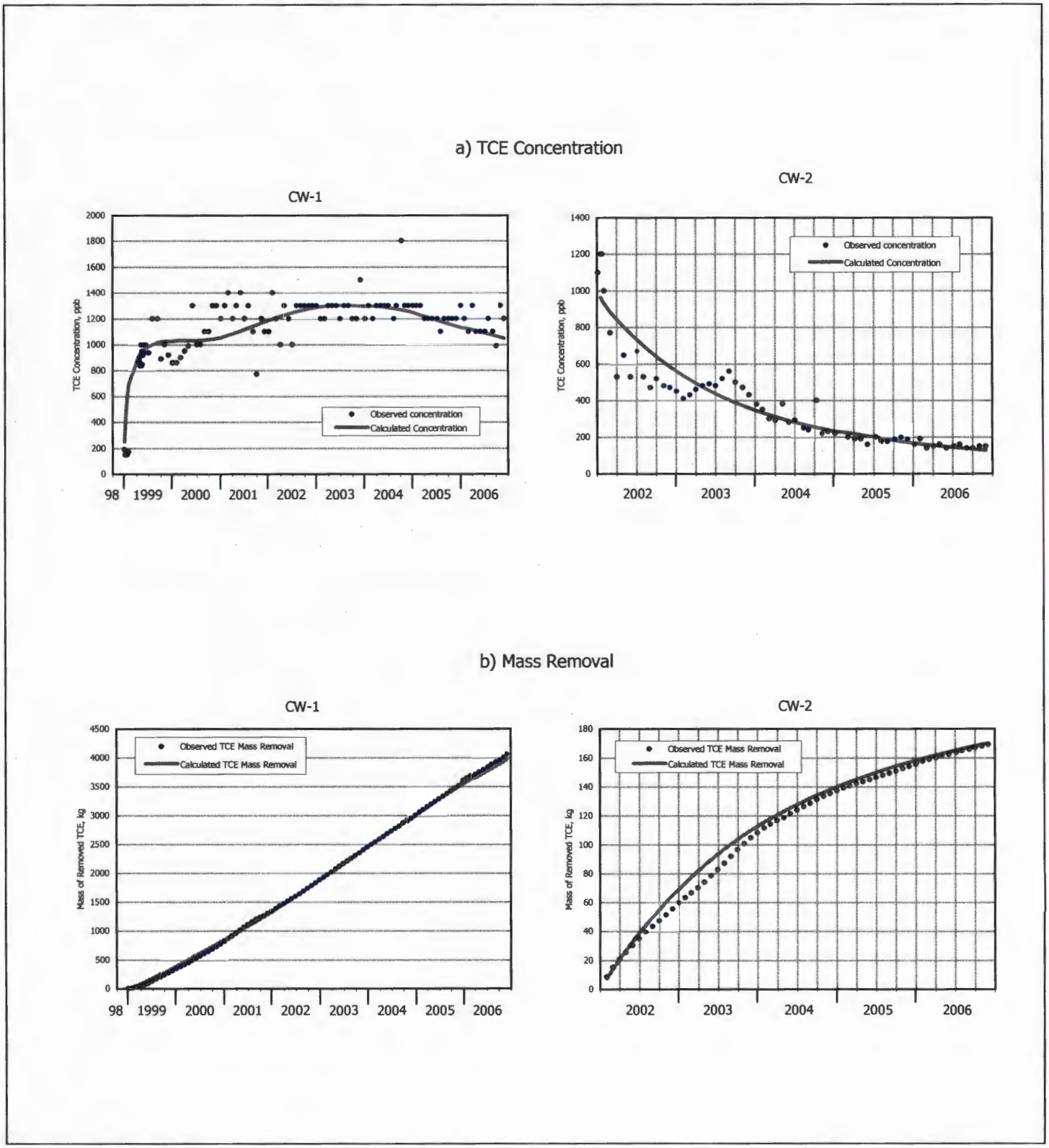
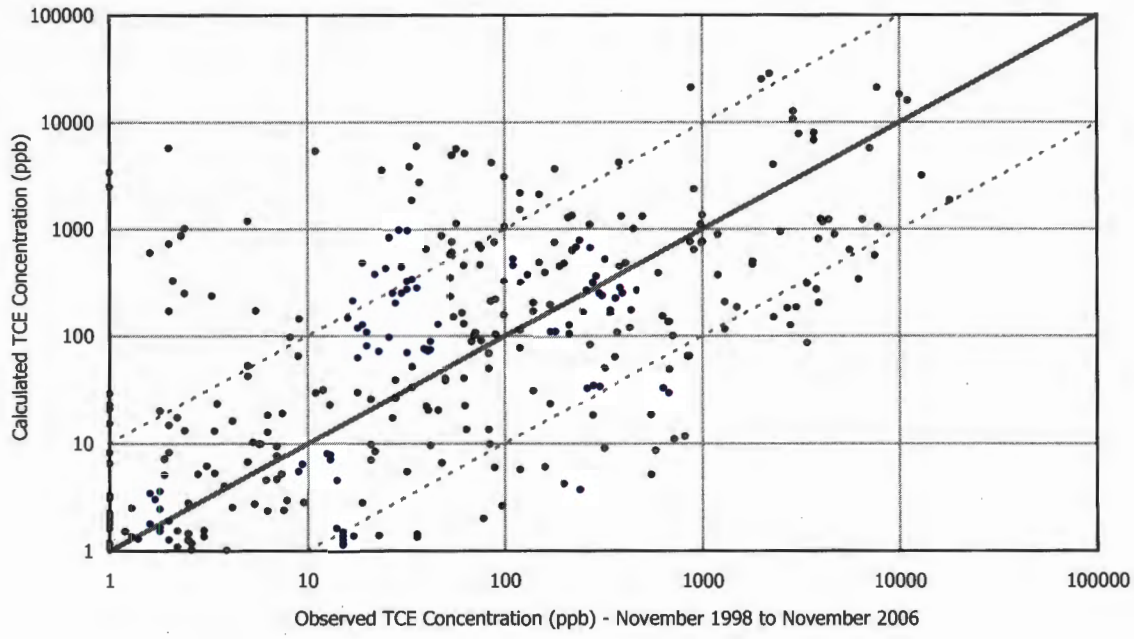


Figure 6.8 Comparison of Calculated to Observed TCE Concentrations and Mass Removal



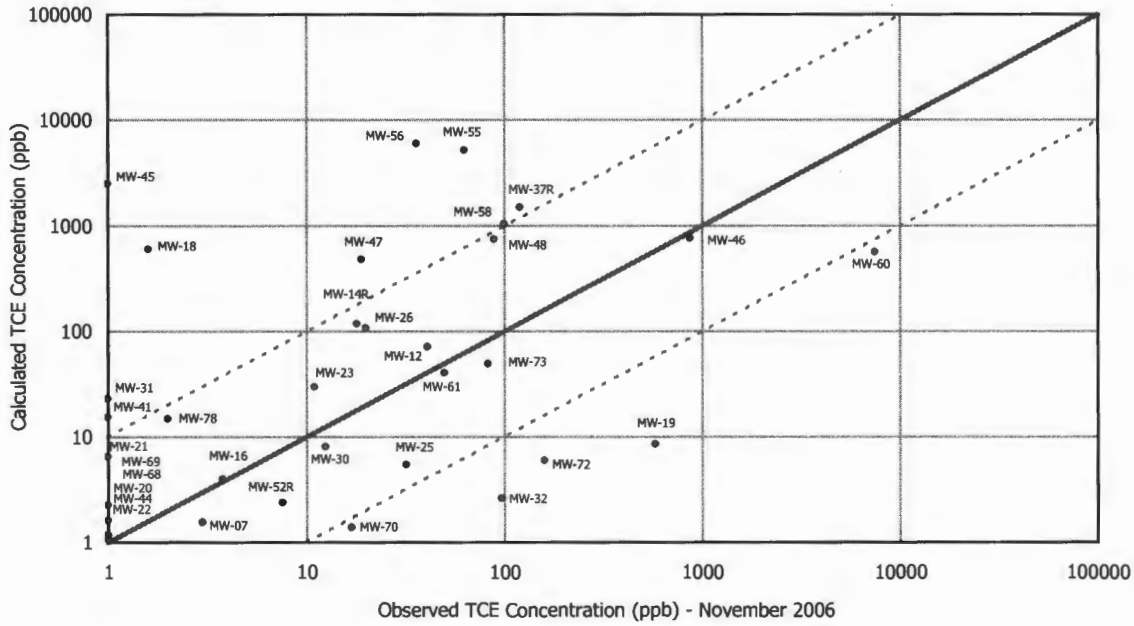


Figure 6.9 Comparisons of Calculated to Observed TCE Concentrations

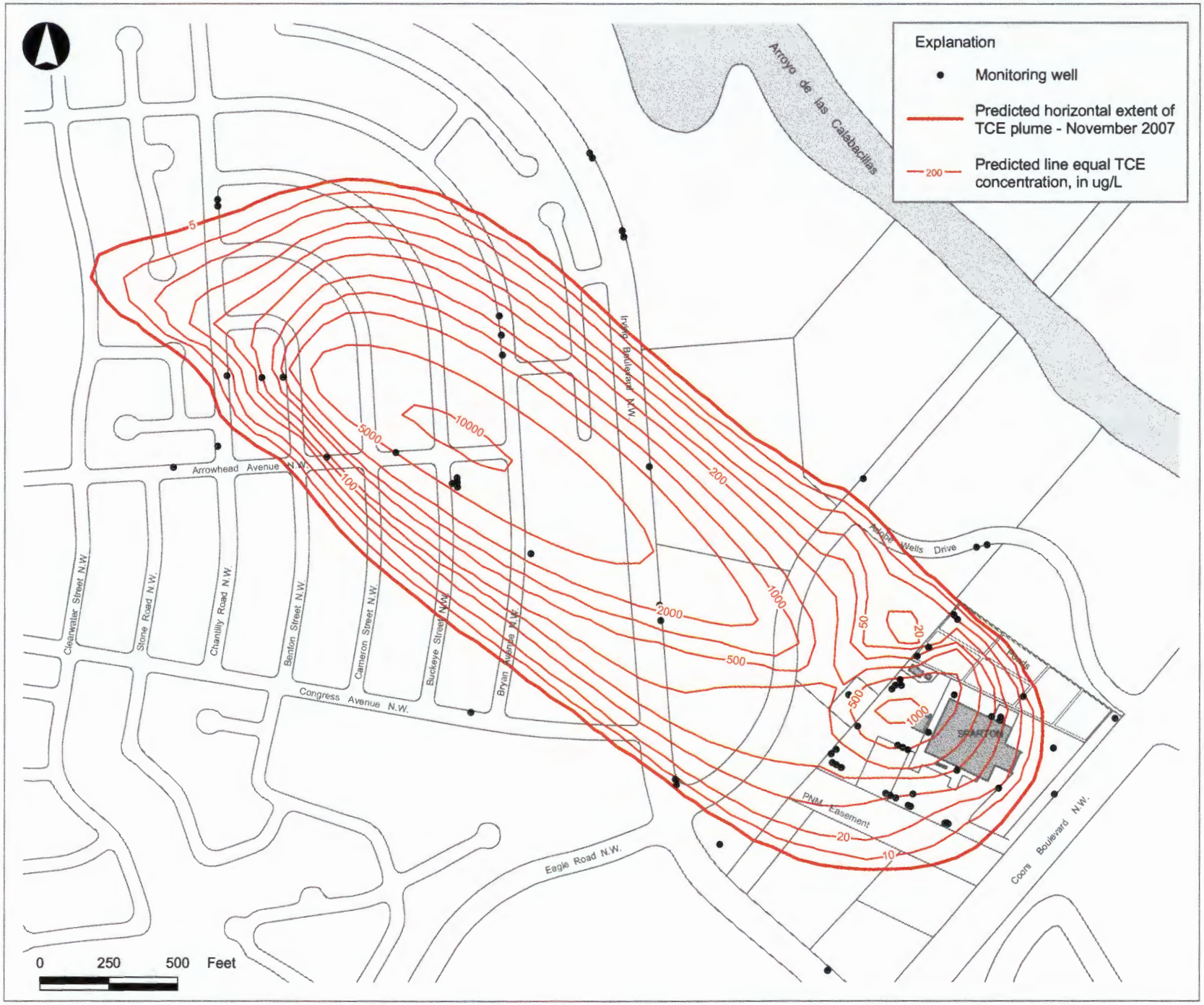


Figure 6.10 Predicted Extent of TCE Plume - November 2007

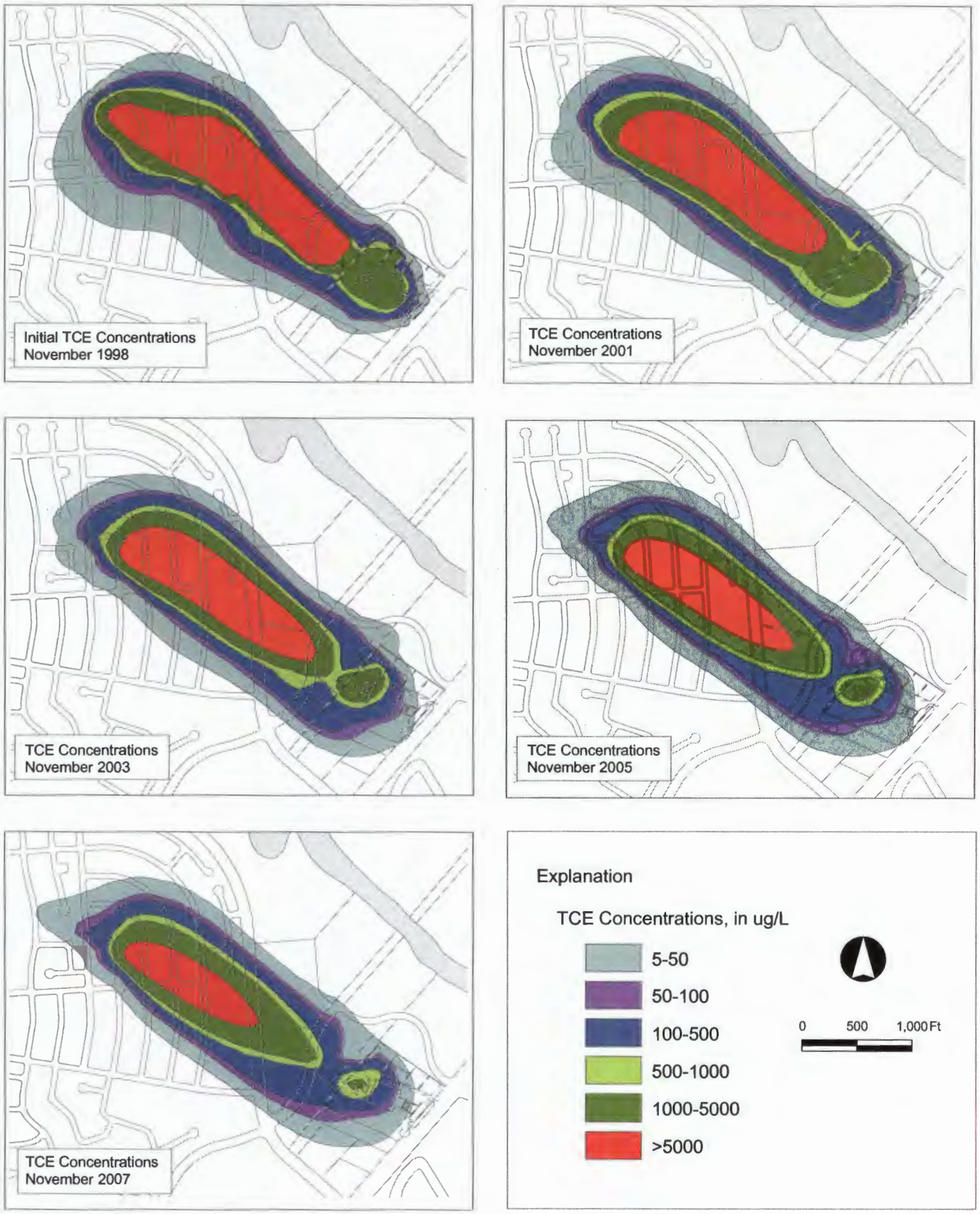


Figure 6.11 Model Calculated TCE Concentrations

TABLES

Table 2.1

Completion Flow Zone, Location Coordinates, and Measuring Point Elevation of Wells

Well ID	Flow Zone[a]	Easting[b]	Northing[b]	Elevation[c]
CW-1	UFZ&LFZ	374740.43	1525601.48	5168.02
CW-2	UFZ-LLFZ	376788.70	1524459.40	5045.61
OB-1	UFZ&LFZ	374665.16	1525599.52	5169.10
OB-2	UFZ&LFZ	374537.98	1525606.65	5165.22
PW-1	UFZ	377014.89	1524058.48	5042.30
PZ-1	UFZ	372283.60	1523143.31	5141.79
MW-7	UFZ	377535.41	1524101.14	5043.48
MW-9	UFZ	377005.75	1524062.25	5042.46
MW-12	UFZ	377023.27	1524102.56	5042.41
MW-13	UFZ	377137.23	1523998.34	5041.98
MW-14R	UFZ/ULFZ	376727.10	1524246.40	5040.92
MW-16	UFZ	377340.57	1524378.38	5047.50
MW-17	UFZ	377423.18	1524452.68	5049.28
MW-18	UFZ	377005.22	1524260.58	5043.38
MW-19	ULFZ	376986.52	1524269.27	5043.30
MW-20	LLFZ	376967.98	1524277.98	5043.20
MW-21	UFZ	377171.22	1524458.71	5045.78
MW-22	UFZ	377531.77	1524267.24	5044.73
MW-23	UFZ	377333.63	1524123.03	5045.74
MW-24	UFZ	377338.05	1524367.39	5048.70
MW-25	UFZ	377307.91	1524380.40	5046.17
MW-26	UFZ	377180.89	1524187.40	5045.37
MW-27	UFZ	377078.91	1524323.46	5046.04
MW-29	ULFZ	377144.48	1523998.74	5041.88
MW-30	ULFZ	376924.12	1524105.15	5042.12
MW-31	ULFZ	376731.49	1524215.04	5041.38
MW-32	LLFZ	376958.37	1524494.18	5045.29
MW-33	UFZ	376940.80	1524097.74	5042.20
MW-34	UFZ	376715.25	1523469.17	5034.33[d]
MW-35	UFZ	376322.45	1523922.39	5042.33[d]
MW-36	UFZ	376161.85	1524154.66	5059.34[d]
MW-37R	UFZ/ULFZ	376104.50	1524782.90	5093.15[d]
MW-38	LLFZ	377150.52	1523995.17	5041.70
MW-39	LLFZ	376961.13	1524088.17	5042.30
MW-40	LLFZ	376745.33	1524207.40	5041.44
MW-41	ULFZ	376945.67	1524479.28	5044.56
MW-42	ULFZ	377183.28	1524730.69	5057.33
MW-43	LLFZ	377169.66	1524747.27	5057.74

Well ID	Flow Zone[a]	Easting[b]	Northing[b]	Elevation[c]
MW-44	ULFZ	376166.14	1524136.09	5058.63[d]
MW-45	ULFZ	376108.80	1524726.75	5089.50[d]
MW-46	ULFZ	376067.09	1525279.84	5118.86[d]
MW-47	UFZ	375638.14	1524967.74	5121.16
MW-48	UFZ	375369.75	1525239.86	5143.44
MW-49	3rd FZ	376763.40	1524197.32	5041.44
MW-51	UFZ	377291.45	1525000.02	5060.34
MW-52R	UFZ/ULFZ	374504.50	1525353.60	5156.37
MW-53	UFZ	374899.50	1525314.41	5148.62
MW-54	UFZ	375974.55	1526106.27	5097.69[d]
MW-55	LLFZ	375370.70	1525224.15	5143.45
MW-56	ULFZ	375371.31	1525207.68	5141.45
MW-57	UFZ	375849.02	1526406.98	5103.62[d]
MW-58	UFZ	375148.43	1525330.73	5146.40
MW-59	ULFZ	377253.38	1524991.51	5060.65
MW-60	ULFZ	375530.19	1525753.61	5134.40
MW-61	UFZ	375523.16	1525821.65	5134.74
MW-62	UFZ	375421.24	1524395.94	5073.69
MW-63	UFZ	376840.50	1525236.52	5063.10
MW-64	ULFZ	375968.81	1526127.81	5097.84
MW-65	LLFZ	374343.87	1525277.92	5156.45
MW-66	LLFZ	375859.24	1526389.09	5103.19[d]
MW-67	DFZ	375352.47	1525220.38	5142.21
MW-68	UFZ	374503.81	1526216.71	5168.54
MW-69	LLFZ	374502.80	1526239.55	5167.79
MW-70	3rd FZ	376981.33	1524492.75	5046.74
MW-71R	DFZ	375534.49	1525681.93	5134.12
MW-72	ULFZ	377079.68	1524630.73	5056.25
MW-73	ULFZ	376821.45	1524346.08	5051.08
MW-74	UFZ/ULFZ	374484.30	1527810.76	5094.80
MW-75	UFZ/ULFZ	374613.33	1528009.97	5113.74
MW-76	UFZ/ULFZ	375150.41	1527826.10	5108.32
MW-77	UFZ/ULFZ	377754.90	1524374.20	5045.64
MW-78	UFZ/ULFZ	377038.50	1524599.30	5052.91
MW-79	DFZ	374662.64	1525626.72	5168.50
PZG-1	Infilt. Gall.	374871.44	1527608.15	5090.90
Canal				4996.07

[a] UFZ denotes the Upper Flow Zone; ULFZ, LLFZ, and 3rdFZ denote the upper, lower, and deeper intervals of the Lower Flow Zone (LFZ); DFZ denotes a deeper flow zone separated from the Lower Flow Zone by a continuous clay layer that causes significant head differences between LFZ and DFZ.

[b] New Mexico "Modified State Plane" coordinates, in feet.

[c] In feet above mean sea level (MSL).

[d] Elevation effective February 1, 2005.

Table 2.2

Well Screen Data

Well ID	Flow Zone	Elevation (ft above MSL)			Depth below Ground (ft)		Screen Length (ft)
		Ground Surface	Top of Screen	Bottom of Screen	Top of Screen	Bottom of Screen	
CW-1	UFZ&LFZ	5166.4	4957.5	4797.5	208.9	368.9	160.0
CW-2	UFZ-LLFZ	5048.5	4968.5	4918.5	80.0	130.0	50.0
OB-1	UFZ&LFZ	5166.2	4960.3	4789.8	205.9	376.4	170.5
OB-2	UFZ&LFZ	5164.8	4960.3	4789.7	204.5	375.1	170.6
PW-1	UFZ	5042.2	4982.9	4972.9	59.3	69.3	10.0
PZ-1	UFZ	5141.3	4961.5	4951.3	179.8	190.0	10.2
MW-7	UFZ	5043.0	4979.7	4974.7	63.3	68.3	5.0
MW-9	UFZ	5042.4	4975.8	4970.8	66.6	71.6	5.0
MW-12	UFZ	5042.3	4978.2	4966.2	64.1	76.1	12.0
MW-13	UFZ	5041.9	4981.5	4971.6	60.4	70.3	9.9
MW-14R	UFZ/ULFZ	5040.8	4980.5	4950.5	60.3	90.3	30.0
MW-16	UFZ	5046.2	4979.7	4974.7	66.5	71.5	5.0
MW-17	UFZ	5047.5	4982.3	4977.3	65.2	70.2	5.0
MW-18	UFZ	5042.9	4976.0	4966.0	66.9	76.9	10.0
MW-19	ULFZ	5042.9	4944.8	4934.8	98.1	108.1	10.0
MW-20	LLFZ	5042.8	4919.2	4906.8	123.6	136.0	12.4
MW-21	UFZ	5045.7	4982.8	4977.8	62.9	67.9	5.0
MW-22	UFZ	5044.6	4977.2	4972.2	67.4	72.4	5.0
MW-23	UFZ	5045.6	4973.8	4968.8	71.8	76.8	5.0
MW-24	UFZ	5046.2	4977.5	4972.5	68.7	73.7	5.0
MW-25	UFZ	5046.1	4977.9	4972.9	68.2	73.2	5.0
MW-26	UFZ	5045.4	4969.1	4964.1	76.3	81.3	5.0
MW-27	UFZ	5045.8	4975.4	4970.4	70.4	75.4	5.0
MW-29	ULFZ	5041.9	4938.3	4928.3	103.6	113.6	10.0
MW-30	ULFZ	5041.7	4944.8	4934.8	96.9	106.9	10.0
MW-31	ULFZ	5040.9	4945.2	4935.2	95.7	105.7	10.0
MW-32	LLFZ	5044.8	4937.3	4927.3	107.5	117.5	10.0
MW-33	UFZ	5042.1	4980.1	4969.1	62.0	73.0	11.0
MW-34	UFZ	5034.4	4978.0	4968.0	56.4	66.4	10.0
MW-35	UFZ	5042.1	4979.3	4969.3	62.8	72.8	10.0
MW-36	UFZ	5059.5	4976.9	4966.9	82.6	92.6	10.0
MW-37R	UFZ/ULFZ	5093.0	4976.6	4946.6	116.4	146.4	30.0
MW-38	LLFZ	5041.6	4915.0	4905.0	126.6	136.6	10.0
MW-39	LLFZ	5042.2	4918.7	4908.7	123.5	133.5	10.0
MW-40	LLFZ	5040.0	4923.9	4913.9	116.1	126.1	10.0

Table 2.2

Well Screen Data

Well ID	Flow Zone	Elevation (ft above MSL)			Depth below Ground (ft)		Screen Length (ft)
		Ground Surface	Top of Screen	Bottom of Screen	Top of Screen	Bottom of Screen	
MW-41	ULFZ	5044.1	4952.1	4942.1	92.0	102.0	10.0
MW-42	ULFZ	5054.8	4949.3	4939.3	105.5	115.5	10.0
MW-43	LLFZ	5055.2	4927.7	4917.7	127.5	137.5	10.0
MW-44	ULFZ	5058.8	4952.4	4942.4	106.4	116.4	10.0
MW-45	ULFZ	5090.1	4948.5	4938.5	141.6	151.6	10.0
MW-46	ULFZ	5118.5	4949.4	4939.4	169.1	179.1	10.0
MW-47	UFZ	5120.7	4976.4	4961.4	144.3	159.3	15.0
MW-48	UFZ	5143.0	4976.9	4961.9	166.1	181.1	15.0
MW-49	3rd FZ	5041.0	4903.2	4893.2	137.8	147.8	10.0
MW-51	UFZ	5059.9	4984.5	4974.5	75.4	85.4	10.0
MW-52R	UFZ/ULFZ	5156.2	4968.5	4938.5	187.0	217.0	30.0
MW-53	UFZ	5148.6	4974.4	4960.4	174.2	188.2	14.0
MW-54	UFZ	5097.2	4976.8	4961.8	120.4	135.4	15.0
MW-55	LLFZ	5143.1	4913.1	4903.1	230.0	240.0	10.0
MW-56	ULFZ	5141.0	4942.9	4932.9	198.1	208.1	10.0
MW-57	UFZ	5103.1	4978.0	4963.0	125.1	140.1	15.0
MW-58	UFZ	5146.4	4975.4	4960.4	171.0	186.0	15.0
MW-59	ULFZ	5060.2	4954.9	4944.4	105.3	115.8	10.5
MW-60	ULFZ	5134.4	4949.5	4939.5	184.9	194.9	10.0
MW-61	UFZ	5134.8	4976.2	4961.2	158.6	173.6	15.0
MW-62	UFZ	5073.7	4980.8	4965.8	92.9	107.9	15.0
MW-63	UFZ	5063.1	4983.1	4968.1	80.0	95.0	15.0
MW-64	ULFZ	5097.4	4959.3	4949.1	138.1	148.3	10.2
MW-65	LLFZ	5156.5	4896.4	4886.4	260.1	270.1	10.0
MW-66	LLFZ	5102.6	4903.3	4893.3	199.3	209.3	10.0
MW-67	DFZ	5142.2	4798.1	4788.1	344.1	354.1	10.0
MW-68	UFZ	5168.5	4970.5	4950.5	198.0	218.0	20.0
MW-69	LLFZ	5167.8	4904.7	4894.7	263.1	273.1	10.0
MW-70	3rd FZ	5046.3	4912.1	4902.1	134.2	144.2	10.0
MW-71R	DFZ	5134.2	4761.5	4756.5	372.7	377.7	5.0
MW-72	ULFZ	5053.7	4955.0	4945.0	98.7	108.7	10.0
MW-73	ULFZ	5050.6	4945.5	4940.5	105.1	110.1	5.0
MW-74	UFZ/ULFZ	5092.4	4969.2	4939.2	123.2	153.2	30.0
MW-75	UFZ/ULFZ	5111.6	4971.2	4941.2	140.4	170.4	30.0
MW-76	UFZ/ULFZ	5105.5	4972.4	4942.4	133.1	163.1	30.0
MW-77	UFZ/ULFZ	5045.5	4985.9	4955.9	59.6	89.6	30.0
MW-78	UFZ/ULFZ	5050.5	4988.1	4958.1	62.4	92.4	30.0
MW-79	DFZ	5166.7	4767.7	4752.7	399.0	414.0	15.0
			4747.7	4732.7	419.0	434.0	15.0

Table 2.3

Production History of the Former On-Site Groundwater Recovery System

Year	Volume of Recovered Water, in gal	Average Discharge Rate, in gpm
1988[a]	25,689	1.05
1989	737,142	1.40
1990	659,469	1.25
1991	556,300	1.06
1992	440,424	0.84
1993	379,519	0.72
1994	370,954	0.71
1995	399,716	0.76
1996	306,688	0.58
1997	170,900	0.33
1998	232,347	0.44
1999[b]	137,403	0.26
Total Recovered Volume, in gal	**4,416,550**	
Average Discharge Rate, in gpm		**0.77**

[a] System began operating on December 15, 1988.

[b] System was terminated on November 16, 1999.

Table 2.5

Water-Quality Data - Fourth Quarter 1998[a]

Well ID	Sampling Date	Concentration, in µg/L TCE	DCE	TCA
CW-1	09/01/98	140	2.9	<20
OB-1	09/01/98	180	3.6	<20
OB-2	09/01/98	72	1.7	<20
PW-1	12/04/98	48	1	2.2
MW-7	12/01/98	63	15	12
MW-9	12/03/98	290	19	18
MW-12	12/07/98	380	26	18
MW-13	12/01/98	70	3.2	8
MW-14	12/01/98	430	24	4.2
MW-16	12/08/98	1200	30	170
MW-17	12/01/98	68	3.5	13
MW-18	12/02/98	600	50	42
MW-19	11/23/98	4.2	<1.0	<1.0
MW-20	11/23/98	<1.0	<1.0	<1.0
MW-21	12/02/98	7.5	<1.0	1.1
MW-22	11/19/98	13	2	4.6
MW-23	12/03/98	6200	400	720
MW-24	12/08/98	4700	74	480
MW-25	12/08/98	5600	73	540
MW-26	12/03/98	6500	590	550
MW-27	12/02/98	880	24	90
MW-29	11/19/98	<1.0	<1.0	<1.0
MW-30	11/23/98	5.4	<1.0	<1.0
MW-31	11/23/98	<1.0	<1.0	<1.0
MW-32	11/30/98	550	96	30
MW-33	12/02/98	630	53	28
MW-34	11/18/98	<1.0	<1.0	<1.0
MW-35	12/08/98	<1.0	<1.0	<1.0
MW-36	12/07/98	1.4	<1.0	<1.0
MW-37	12/03/98	990	48	<5
MW-38	11/19/98	<1.0	<1.0	<1.0
MW-39	11/23/98	<1.0	<1.0	<1.0
MW-40	11/30/98	<1.0	<1.0	<1.0

Well ID	Sampling Date	Concentration, in µg/L TCE	DCE	TCA
MW-41	11/19/98	170	26	<15
MW-42	11/19/98	370	48	21
MW-43	11/19/98	25	5.1	5.4
MW-44	11/18/98	1.3	<1.0	<1.0
MW-45	11/18/98	40	1.7	<1.0
MW-46	11/19/98	2200	130	2.3
MW-47	11/17/98	34	1.2	<1.0
MW-48	11/17/98	28	1	<1.0
MW-49	11/23/98	<1.0	<1.0	<1.0
MW-51	11/18/98	<1.0	<1.0	<1.0
MW-52	11/30/98	<1.0	<1.0	<1.0
MW-53	11/16/98	99	3.4	<1.0
MW-55	11/16/98	390	10	<1.0
MW-56	11/16/98	140	4.7	<1.0
MW-57	12/08/98	<1.0	<1.0	<1.0
MW-58	11/16/98	71	2.5	<1.0
MW-59	11/18/98	<1.0	<1.0	<1.0
MW-60	11/17/98	7700	350	52
MW-61	12/07/98	1000	54	11
MW-62	12/07/98	2	6.6	4.8
MW-63	12/02/98	<1.0	<1.0	<1.0
MW-64	11/17/98	<1.0	<1.0	<1.0
MW-65	11/16/98	13	<1.0	<1.0
MW-66	11/17/98	<1.0	<1.0	<1.0
MW-67	11/17/98	<1.0	<1.0	<1.0
MW-68	11/12/98	<1.0	<1.0	<1.0
MW-69	11/12/98	<1.0	<1.0	<1.0
MW-70	11/23/98	<1.0	<1.0	<1.0
MW-71	11/17/98	56	1.6	<1.0
TW-1	02/18/98	3100	280	180
TW-1 Dup.		3400	270	170
TW-2	02/19/98	18	<1.0	<1.0
TW-2 Dup.		16	<1.0	<1.0

[a] Includes 2/18/98 data from temporary well TW-1/2 which was drilled at the current location of well MW-73, and 9/1/98 data from the containment well CW-1.

Notes: Shaded cells indicate concentrations that exceed MCLs based on the more stringent of the drinking water standards or the maximum allowable concentrations in groundwater set by the NMWQCC (5 µg/L for TCE and DCE, and 60 µg/L for TCA).

Table 3.1

Downtime in the Operation of the Containment Systems - 2006

(a) Off-Site Containment System

Date of Downtime		Duration	Cause
From	To	(hours)	
3-Mar	3-Mar	0.48	Routine Maintenance
12-Mar	12-Mar	3.27	False Failure Signal
13-Mar	13-Mar	0.12	Routine Maintenance
15-Mar	11-Apr	----	Pump Rate Reduced to 150 gpm
28-Mar	28-Mar	1.08	Routine Maintenance
29-Mar	29-Mar	0.18	Leak Repair
4-May	4-May	4.62	Leak Repair
30-Sep	30-Sep	0.35	Low Level in Chemical Feed Tank
22-Oct	24-Oct	44.85	System Vibrations
27-Oct	1-Nov	120.02	Install Vacuum Relief Valve
9-Nov	9-Nov	4.30	Routine Maintenance
20-Nov	20-Nov	1.87	Routine Maintenance
14-Dec	14-Dec	0.08	Routine Maintenance
30-Dec	30-Dec	8.60	Power Failure
Total Downtime		**189.82**	

(b) Source Containment System

Date of Downtime		Duration	Cause
From	To	(hours)	
13-Jan	25-Jan	276.80	Float Switch Failure
31-Jan	31-Jan	3.15	Power Failure
3-Mar	6-Mar	64.58	Clogged Water Meter Screen
6-Mar	6-Mar	0.40	Routine Maintenance
15-Mar	15-Mar	0.17	Routine Maintenance
22-Mar	22-Mar	0.72	Routine Maintenance
30-Jun	30-Jun	3.03	Power Failure
14-Nov	14-Nov	11.70	Clogged Water Meter Screen
Total Downtime		**360.55**	

Table 4.1

Quarterly Water-Level Elevations - 2006

Well ID	Flow Zone	Elevation (feet above MSL)			
		Feb. 22	May 17	Aug. 9	Nov. 6
CW-1	UFZ&LFZ	4934.97	4935.10	4934.68	4935.22
CW-2	UFZ&LFZ	4956.50	4956.57	4956.90	4958.20
OB-1	UFZ&LFZ	4955.58	4955.38	4955.10	4955.70
OB-2	UFZ&LFZ	4956.78	4956.64	4956.33	4956.88
PZ-1	UFZ	4953.49	4953.31	4952.71	4953.32
MW-7	UFZ O/S	4975.05	4974.98	4974.91	4975.57
MW-9	UFZ O/S	4969.89	4969.76	4969.67	4970.39
MW-12	UFZ O/S	4969.34	4969.18	4969.16	4969.83
MW-13	UFZ O/S	Dry	Dry	Dry	4971.98
MW-14-R	UFZ/ULFZ	4967.25	4967.08	4967.02	4967.73
MW-16	UFZ O/S	4981.82	4981.65	4981.78	4982.22
MW-17	UFZ O/S	4981.47	4981.32	4981.27	4981.93
MW-18	UFZ O/S	4968.79	4968.64	4970.75	4975.48
MW-19	ULFZ	4968.25	4968.15	4968.11	4968.82
MW-20	LLFZ	4967.78	4967.62	4967.61	4968.29
MW-21	UFZ O/S	4982.58	4982.22	4982.68	4983.07
MW-22	UFZ O/S	4976.79	4976.69	4976.73	4977.63
MW-23	UFZ O/S	4973.73	4973.67	4973.76	4974.43
MW-24	UFZ O/S	4981.61	4981.41	4981.54	4982.02
MW-25	UFZ O/S	4981.80	4981.57	4981.77	4982.21
MW-26	UFZ O/S	4970.80	4970.67	4970.80	4971.64
MW-27	UFZ O/S	4980.66	4980.46	4980.95	4981.49
MW-29	ULFZ	4970.47	4970.37	4970.38	4970.99
MW-30	ULFZ	4968.76	4968.63	4968.60	4969.27
MW-31	ULFZ	4967.36	4967.18	4967.14	4967.84
MW-32	ULFZ	4967.16	4966.98	4966.97	4967.78
MW-33	UFZ O/S	Dry	Dry	Dry	4969.55
MW-34	UFZ	4971.11	4971.06	4971.04	4971.56
MW-37-R	UFZ/ULFZ	4964.37	4964.18	4963.91	4964.54
MW-38	LLFZ	4970.50	4970.34	4970.43	4971.02
MW-39	LLFZ	4969.07	4968.92	4968.90	4969.55
MW-40	LLFZ	4967.43	4967.33	4967.20	4967.90
MW-41	ULFZ	4967.54	4967.34	4967.40	4968.24
MW-42	ULFZ	4967.63	4967.47	4967.54	4968.26
MW-43	LLFZ	4967.47	4967.21	4967.24	4968.01
MW-44	ULFZ	4966.67	4966.47	4966.24	4966.91

Note: Wells PW-1, MW-35 and MW-36 are not listed because they were dry all year.

Well ID	Flow Zone	Elevation (feet above MSL)			
		Feb. 22	May 17	Aug. 9	Nov. 6
MW-45	ULFZ	4964.71	4964.54	4964.23	4964.86
MW-46	ULFZ	4963.75	4963.53	4963.27	4963.95
MW-47	UFZ	4963.25	4963.06	4962.75	4963.38
MW-48	UFZ	4962.14	4962.01	4961.72	4962.26
MW-49	LLFZ	4967.52	4967.36	4967.32	4967.91
MW-51	UFZ O/S	4981.50	4981.20	4981.76	4982.84
MW-52R	UFZ/ULFZ	4958.23	4958.11	4957.84	4958.40
MW-53	UFZ	4960.47	4960.40	4960.19	4960.58
MW-54	UFZ	4963.02	4962.62	4962.60	4963.42
MW-55	LLFZ	4960.98	4960.77	4960.52	4961.13
MW-56	ULFZ	4962.10	4962.06	4961.43	4962.29
MW-57	UFZ	4962.78	Dry	Dry	4963.32
MW-58	UFZ	4961.47	4960.70	4961.06	4961.57
MW-59	ULFZ	4966.80	4966.39	4966.44	4967.20
MW-60	ULFZ	4962.05	4961.79	4961.49	4962.17
MW-61	UFZ	4962.04	4961.76	4961.49	4962.20
MW-62	UFZ	4964.16	4964.03	4963.68	4964.19
MW-63	UFZ O/S	4972.17	4970.35	4971.69	4981.00
MW-64	ULFZ	4962.96	4962.71	4962.33	4963.30
MW-65	LLFZ	4958.23	4958.13	4957.81	4958.35
MW-66	LLFZ	4961.26	4960.80	4960.67	4961.39
MW-67	DFZ	4955.46	4954.83	4954.51	4955.23
MW-68	UFZ	4958.45	4958.33	4958.00	4958.59
MW-69	LLFZ	4958.36	4958.21	4957.89	4958.42
MW-70	LLFZ	4966.69	4966.47	4966.41	4967.19
MW-71R	DFZ	4955.41	4954.85	4954.54	4955.33
MW-72	ULFZ	4967.67	4967.49	4967.60	4968.32
MW-73	ULFZ	4966.70	4966.50	4966.49	4967.25
MW-74	UFZ/ULFZ	4960.95	4960.01	4960.27	4960.66
MW-75	UFZ/ULFZ	4965.19	4964.46	4964.49	4964.75
MW-76	UFZ/ULFZ	4966.71	4965.65	4966.08	4965.45
MW-77	UFZ/ULFZ	4976.32	4976.15	4976.42	4976.96
MW-78	UFZ/ULFZ	4973.53	4973.38	4974.02	4974.84
MW-79[a]	DFZ	----	4952.79	4952.32	4953.83
PZG-1	Infilt. Gall.	Dry	Dry	Dry	Dry
Canal[b]		Dry	Dry	Dry	Dry

[a] Well completed on February 24, 2006

[b] Measured near the SE corner of Sparton property.

Table 4.2

Water-Quality Data - Fourth Quarter 2006

Well ID	Sampling Date	Concentration (µg/L)		
		TCE	DCE	TCA
CW1	11/02/06	1300	88	4.0
CW2	11/02/06	150	19	1.0
MW-7	11/07/06	3.0	<1.0	<1.0
MW-9[a]	11/07/06	----	----	----
MW-12	11/07/06	41	1.1	<1.0
MW-13[a]	11/07/06	----	----	----
MW-14R	11/07/06	18	<1.0	<1.0
MW-16	11/09/06	3.8	<1.0	<1.0
MW-17	11/09/06	<1.0	<1.0	<1.0
MW-18	11/09/06	1.6	<1.0	<1.0
MW-19	11/07/06	580	72	5.3
MW-20	11/07/06	<1.0	<1.0	<1.0
MW-21	11/07/06	<1.0	<1.0	<1.0
MW-22	11/09/06	<1.0	<1.0	<1.0
MW-23	11/07/06	11	1.0	<1.0
MW-25	11/07/06	32	2.2	<1.0
MW-26	11/09/06	20	<1.0	<1.0
MW-29	11/17/06	2.3	<1.0	<1.0
MW-30[b]	11/09/06	13	<1.0	<1.0
MW-31	11/09/06	<1.0	<1.0	<1.0
MW-32[b]	11/11/06	97	13	<1.0
MW-33[a]	11/07/06	----	----	----
MW-34	11/09/06	<1.0	<1.0	<1.0
MW-37R	11/10/06	120	5.0	<1.0
MW-38	11/17/06	<1.0	<1.0	<1.0
MW-39	11/18/06	<1.0	<1.0	<1.0
MW-40	11/20/06	<1.0	<1.0	<1.0
MW-41	11/20/06	<1.0	<1.0	<1.0
MW-42	11/21/06	81	19	1.2
MW-43	11/21/06	1.7	<1.0	<1.0
MW-44	11/16/06	<1.0	<1.0	<1.0
MW-45	11/14/06	<1.0	<1.0	<1.0

Well ID	Sampling Date	Concentration (µg/L)		
		TCE	DCE	TCA
MW-46	11/16/06	870	120	18
MW-47	11/17/06	19	<1.0	<1.0
MW-48	11/13/06	89	3.9	<1.0
MW-49	11/21/06	<1.0	<1.0	<1.0
MW-51	11/20/06	<1.0	<1.0	<1.0
MW-52R	11/13/06	7.6	16	1.6
MW-53	11/13/06	14	1.0	<1.0
MW-55	11/10/06	63	2.2	<1.0
MW-56	11/11/06	36	<5.0	<5.0
MW-57[a]	11/07/06	----	----	----
MW-58	11/13/06	100	3.3	<1.0
MW-59	11/20/06	<1.0	<1.0	<1.0
MW-60[b]	11/27/06	7500	475	29
MW-61	11/16/06	50	3.3	<1.0
MW-62	11/13/06	2.8	7.4	4.8
MW-64	11/20/06	<1.0	<1.0	<1.0
MW-65	11/13/06	15	65	26
MW-66	11/17/06	<1.0	<1.0	<1.0
MW-67	11/14/06	<1.0	<1.0	<1.0
MW-68	11/10/06	<1.0	<1.0	<1.0
MW-69	11/20/06	<1.0	<1.0	<1.0
MW-70	11/17/06	17	1.1	<1.0
MW-71R	11/21/06	92	3.0	<1.0
MW-72	11/17/06	160	19	<1.0
MW-73	11/17/06	83	9.5	<1.0
MW-74	11/21/06	<1.0	<1.0	<1.0
MW-75	11/21/06	<1.0	<1.0	<1.0
MW-76	11/21/06	<1.0	<1.0	<1.0
MW-77	11/21/06	13	1.1	<1.0
MW-78	11/21/06	<2.0	<1.0	<1.0
MW-79	11/20/06	<1.0	<1.0	<1.0

[a] Well not sampled due to insufficient water.

[b] Results for well are the average of duplicate samples.

Notes: Shaded cells indicate concentrations that exceed MCLs based on the more stringent of the drinking water standards or the maximum allowable concentrations in groundwater set by the NMWQCC (5 mg/L for TCE and DCE, and 60 mg/L for TCA).

Table 4.3
Flow Rates - 2006

(a) Containment Well Summary

2006	**Total Volume of Water Pumped from both Wells (gal)**	136,346,352
	Total Average Discharge Rate from both Wells (gpm)	259

(b) Off-Site Containment Well

Month	**Volume of Water Pumped (gal)**		**Average Discharge Rate (gpm)**	
	Monthly	**Annual**	**Monthly**	**Annual**
Jan.	10,077,562		226	
Feb.	9,124,113		226	
Mar.	7,968,417		179	
Apr.	8,847,322		205	
May	9,957,209		223	
June	9,661,938		224	
July	10,011,301		224	
Aug.	10,019,330		224	
Sep.	9,711,246		225	
Oct.	7,822,399		175	
Nov.	9,643,285		223	
Dec.	9,368,968	**112,213,088**	210	**213**

(c) Source Containment Well

Month	**Volume of Water Pumped (gal)**		**Average Discharge Rate (gpm)**	
	Monthly	**Annual**	**Monthly**	**Annual**
Jan.	1,434,404		32	
Feb.	2,064,261		51	
Mar.	2,048,115		46	
Apr.	2,152,728		50	
May	2,194,144		49	
June	2,085,076		48	
July	2,130,118		48	
Aug.	2,101,318		47	
Sep.	1,996,462		46	
Oct.	2,040,676		46	
Nov.	1,919,644		44	
Dec.	1,966,318	**24,133,264**	44	**46**

Table 4.4
Influent and Effluent Quality - 2006[a]

(a) Off-Site Containment System

Sampling Date	Concentration (µg/L)							
	Influent				Effluent			
	TCE	DCE	TCA	Cr Total	TCE	DCE	TCA	Cr Total
01/04/06	1300	75	3.9	26	<1.0	<1.0	<1.0	30
2/1/2006	1200	73	4.5	26	<1.0	<1.0	<1.0	28
03/03/06	1100	65	3.3	27	<1.0	<1.0	<1.0	24
04/04/06	1300	78	3.9	25	<1.0	<1.0	<1.0	13
05/01/06	1100	73	3.7	24	<1.0	<1.0	<1.0	27
06/02/06	1100	67	3.4	28	<1.0	<1.0	<1.0	25
07/07/06	1100	85	3.8	29	<1.0	<1.0	<1.0	30
08/02/06	1200	75	3.8	31	<1.0	<1.0	<1.0	24
09/05/06	1100	81	3.3	22	<1.0	<1.0	<1.0	24
10/02/06	990	63	3.2	28	<1.0	<1.0	<1.0	26
11/02/06	1300	88	4.0	29	<1.0	<1.0	<1.0	28
12/01/06	1200	84	3.9	26	<1.0	<1.0	<1.0	24
01/04/07	1500	100	4.5	30	<1.0	<1.0	<1.0	30

(b) Source Containment System

Sampling Date	Concentration (µg/L)							
	Influent				Effluent			
	TCE	DCE	TCA	Cr Total	TCE	DCE	TCA	Cr Total
01/04/06	160	20	1.5	33	<1.0	<1.0	<1.0	33
2/1/2006	190	23	1.7	44	<1.0	<1.0	<1.0	33
03/03/06	140	17	1.3	28	<1.0	<1.0	<1.0	33
04/04/06	150	20	1.3	28	<1.0	<1.0	<1.0	26
05/01/06	160	19	1.2	7[b]	<1.0	<1.0	<1.0	6[b]
06/02/06	140	17	1.1	37	<1.0	<1.0	<1.0	32
07/07/06	150	21	<1.0	33	<1.0	<1.0	<1.0	33
08/02/06	160	19	1.2	29	<1.0	<1.0	<1.0	30
09/05/06	140	20	<1.0	28	<1.0	<1.0	<1.0	28
10/02/06	140	16	<1.0	31	<1.0	<1.0	<1.0	29
11/02/06	150	19	1.0	35	<1.0	<1.0	<1.0	32
12/01/06	150	19	1.1	30	<1.0	<1.0	<1.0	29
01/04/07	150	19	<1.0	29	<1.0	<1.0	<1.0	32

[a] Data from 01/04/07 has been included to show conditions at the end of the year.

[b] These data appear to be reported incorrectly as they are not consistent with other monthly data on chromium concentrations.

Note: Shaded cells indicate concentrations that exceed MCLs based on the more stringent of the drinking water standards or the maximum allowable concentrations in groundwater set by the NMWQCC (5 ug/L for TCE and DCE, 60 ug/L for TCA and 50 ug/L for total chromium).

Table 5.1
Contaminant Mass Removal - 2006

(a) Containment Well Summary

		(kg)	(lbs)
2006	Total Mass of Removed TCE	513	1129
	Total Mass of Removed DCE	34.3	75.6
	Total Mass of Removed TCA	1.7	3.7
	Total Mass Removed	**549**	**1208**

(b) Off-Site Containment Well

Month	Mass of Removed TCE		Mass of Removed DCE		Mass of Removed TCA		Total Mass Removed	
	(kg)	(lbs)	(kg)	(lbs)	(kg)	(lbs)	(kg)	(lbs)
Jan.	48	106	2.8	6.2	0.15	0.33	51	113
Feb.	40	88	2.4	5.3	0.13	0.29	43	93
Mar.	36	79	2.2	4.9	0.11	0.24	38	84
Apr.	40	88	2.5	5.5	0.13	0.29	43	94
May	41	90	2.6	5.7	0.13	0.29	44	96
June	40	88	2.8	6.2	0.13	0.29	43	94
July	44	97	3.0	6.6	0.14	0.31	47	104
Aug.	44	97	3.0	6.6	0.13	0.29	47	104
Sep.	38	84	2.6	5.7	0.12	0.26	41	90
Oct.	34	75	2.2	4.9	0.11	0.24	36	80
Nov.	46	101	3.1	6.8	0.14	0.31	49	108
Dec.	48	106	3.3	7.3	0.15	0.33	51	114
Total	**499**	**1099**	**32.5**	**71.7**	**1.57**	**3.47**	**533**	**1174**

(c) Source Containment Well

Month	Mass of Removed TCE		Mass of Removed DCE		Mass of Removed TCA		Total Mass Removed	
	(kg)	(lbs)	(kg)	(lbs)	(kg)	(lbs)	(kg)	(lbs)
Jan.	1.0	2.2	0.12	0.26	0.009	0.020	1.1	2.5
Feb.	1.3	2.9	0.16	0.35	0.012	0.026	1.5	3.3
Mar.	1.1	2.4	0.14	0.31	0.010	0.022	1.3	2.7
Apr.	1.3	2.9	0.16	0.35	0.010	0.022	1.5	3.3
May	1.2	2.6	0.15	0.33	0.010	0.022	1.4	3.0
June	1.1	2.4	0.15	0.33	0.006	0.013	1.3	2.7
July	1.2	2.6	0.16	0.35	0.007	0.015	1.4	3.0
Aug.	1.2	2.6	0.16	0.35	0.007	0.015	1.4	3.0
Sep.	1.1	2.4	0.14	0.31	0.004	0.009	1.2	2.7
Oct.	1.1	2.4	0.14	0.31	0.006	0.013	1.2	2.7
Nov.	1.1	2.4	0.14	0.31	0.008	0.018	1.2	2.7
Dec.	1.1	2.4	0.14	0.31	0.006	0.013	1.2	2.7
Total	**13.8**	**30.2**	**1.76**	**3.87**	**0.095**	**0.208**	**15.7**	**34.3**

Table 6.1

Initial Mass and Maximum Concentration of TCE in Model Layers

Model Layer	Approximate Mass (kg)	Approximate Mass (lbs)	Maximum Concentration (µg/L)
1	0.2	0.5	5607.8
2	9.0	19.9	5083.7
3	190.3	419.5	4002.5
4	463.8	1022.4	12004.7
5	1846.5	4070.8	35629.9
6	1859.4	4099.4	35766.9
7	1803.6	3976.2	35818.8
8	372.7	821.7	4058.0
9	179.1	394.9	1982.8
10	138.0	304.2	1002.0
11	45.4	100.2	408.7
Total Mass	**6,908**	**15,230**	

APPENDIX A

APPENDIX A

Appendix A

2006 Groundwater Quality Data

A-1: Groundwater Monitoring Program Wells

A-2: Infiltration Gallery and Pond Monitoring Wells

A-1: Groundwater Monitoring Program Wells

Appendix A-1

Groundwater Monitoring Program Wells
2006 Analytical Results[a]

	Sample Date	TCE ug/L	1,1-DCE ug/L	1,1,1-TCA ug/L	Cr Total (mg/L)		Other
					Unfiltered	Filtered	
MW-7	11/07/06	3	<1.0	<1.0	0.0242	0.0172	
MW-9	11/07/06	NA	NA	NA	NA	NA	
MW-12	11/07/06	41	1.1	<1.0	0.00893	0.0059	
MW-13	11/07/06	NA	NA	NA	NA	NA	
MW-14R	11/07/06	18	<1.0	<1.0	0.117	0.121	
MW-16	11/09/06	3.8	<1.0	<1.0	0.246	0.112	
MW-17	11/09/06	<1.0	<1.0	<1.0	0.0411	0.0304	Iron Diss:0.0423,Mg Diss:0.0132, Iron:2.33, Mg:0.0969
MW-18	11/09/06	1.6	<1.0	<1.0	0.0328	0.0293	
MW-19	11/07/06	580	72	5.3	0.0261	NA	
MW-20	11/07/06	<1.0	<1.0	<1.0	0.0029	NA	
MW-21	11/07/06	<1.0	<1.0	<1.0	0.0563	0.0315	
MW-22	11/09/06	<1.0	<1.0	<1.0	0.0359	NA	
MW-23	11/07/06	11	1	<1.0	0.276	0.0898	
MW-25	11/07/06	32	2.2	<1.0	0.24	0.0643	cis-1,2-DCE: 2.0,
MW-26	11/09/06	20	<1.0	<1.0	0.278	0.129	
MW-29	11/17/06	2.3	<1.0	<1.0	0.0048	NA	
MW-30	11/09/06	13	<1.0	<1.0	0.0175	NA	
	11/09/06	12	<1.0	<1.0	0.0158	NA	
MW-31	11/09/06	<1.0	<1.0	<1.0	0.00296	NA	
MW-32	11/11/06	110	15	<1.0	0.00486	NA	PCE: 1.2
	11/11/06	84	11	<1.0	0.0034	NA	
MW-33	11/07/06	NA	NA	NA	NA	NA	
MW-34	11/09/06	<1.0	<1.0	<1.0	0.0545	0.0125	
MW-35	11/07/06	NA	NA	NA	NA	NA	
MW-36	11/07/06	NA	NA	NA	NA	NA	
MW-37R	11/10/06	120	5	<1.0	0.0823	NA	
MW-38	11/17/06	<1.0	<1.0	<1.0	0.00706	NA	
MW-39	11/18/06	<1.0	<1.0	<1.0	0.0132	NA	
MW-40	11/20/06	<1.0	<1.0	<1.0	0.00516	NA	
MW-41	11/20/06	<1.0	<1.0	<1.0	0.0311	NA	
MW-42	11/21/06	81	19	1.2	0.0343	NA	PCE: 1.0

Appendix A-1

Groundwater Monitoring Program Wells
2006 Analytical Results[a]

	Sample Date	TCE ug/L	1,1-DCE ug/L	1,1,1-TCA ug/L	Cr Total (mg/L)		Other
					Unfiltered	Filtered	
MW-43	11/21/06	1.7	<1.0	<1.0	0.00347	NA	
MW-44	11/16/06	<1.0	<1.0	<1.0	0.00347		
MW-45	11/14/06	<1.0	<1.0	<1.0	0.0219	NA	
MW-46	11/16/06	870	120	18	0.0606	NA	112-TCTFA:<25, 11DCA:<5.0, Chlor:<5.0, 112-TCA:<5.0, PCE:8.4
MW-47	11/17/06	19	<1.0	<1.0	0.0208	0.0202	
MW-48	11/13/06	89	3.9	<1.0	0.659	0.0336	
MW-49	11/21/06	<1.0	<1.0	<1.0	0.00406	NA	
MW-51	11/20/06	<1.0	<1.0	<1.0	0.0246	NA	
MW-52R	02/28/06	6.4	14	1.3	0.0147	NA	
	02/28/06	5.9	12	1.3	0.014	NA	
	05/23/06	7.3	14	1.5	0.018	NA	
	08/10/06	6.5	15	<1.0	0.018	NA	
	08/10/06	6.6	16	<1.0	0.019	NA	
	11/13/06	7.6	16	1.6	0.0162	NA	
MW-53	11/13/06	14	1	<1.0	0.031	0.0287	
MW-55	11/10/06	63	2.2	<1.0	0.031	NA	
MW-56	11/11/06	36	<5.0	<5.0	0.0438	NA	
MW-57	11/07/06	NA	NA	NA	NA	NA	
MW-58	11/13/06	100	3.3	<1.0	0.591	0.0587	
MW-59	11/20/06	<1.0	<1.0	<1.0	0.0302	NA	
MW-60	11/27/06	7500	470	30		0.0092	cis1,2-DCE:6.7, 1,1,2-TCTFA:68,1,1-DCA:3.0, Chlor:7.3, 1,1,2-TCA:6.9, PCE:94
	11/27/06	7500	480	27		0.00758	cis1,2-DCE:6.4, 1,1,2-TCTFA:63,1,1-DCA:2.8, Chlor:6.8, 1,1,2-TCA:6.4, PCE:86
MW-61	11/16/06	50	3.3	<1.0	0.0142	0.00998	
MW-62	02/28/06	2	5.2	3.6	0.0039	0.0024	
	05/23/06	2.2	5.6	3.9	0.0348	0.0047	
	08/10/06	2.5	7	<1.0	0.021	0.004	
	11/13/06	2.8	7.4	4.8	0.00598	0.00621	
MW-64	11/20/06	<1.0	<1.0	<1.0	0.00483	NA	
MW-65	02/28/06	16	64	29	<0.00100	NA	
	05/24/06	16	63	29	<0.00100	NA	
	08/25/06	17	85	30	0.0051	NA	

Appendix A-1

Groundwater Monitoring Program Wells
2006 Analytical Results[a]

	Sample Date	TCE ug/L	1,1-DCE ug/L	1,1,1-TCA ug/L	Cr Total (mg/L) Unfiltered	Cr Total (mg/L) Filtered	Other
	11/13/06	15	65	26	0.00151	NA	
MW-66	02/23/06	<1.0	<1.0	<1.0	<0.00100	NA	
	05/24/06	<1.0	<1.0	<1.0	0.004	NA	
	08/11/06	<1.0	<1.0	<1.0	0.002	NA	
	11/17/06	<1.0	<1.0	<1.0	0.00412	NA	
MW-67	05/24/06	<1.0	<1.0	<1.0	<0.00100	NA	
	05/24/06	<1.0	<1.0	<1.0	0.0032	NA	
	11/14/06	<1.0	<1.0	<1.0	0.00259	NA	
MW-68	02/23/06	<1.0	<1.0	<1.0	0.00160	NA	
	05/23/06	<1.0	<1.0	<1.0	<0.00100	NA	
	08/10/06	<1.0	<1.0	<1.0	0.00200	NA	
	11/10/06	<1.0	<1.0	<1.0	0.00206	NA	
MW-69	02/23/06	<1.0	<1.0	<1.0	<0.00100	NA	
	05/23/06	<1.0	<1.0	<1.0	<0.00100	NA	
	08/10/06	<1.0	<1.0	<1.0	<0.00100	NA	
	11/20/06	<1.0	<1.0	<1.0	0.00352	NA	
MW-70	11/17/06	17	1.1	<1.0	0.00447	NA	
MW-71R	02/23/06	90	3	<1.0	<0.00100	NA	
	05/23/06	99	3	<1.0	0.002	NA	
	08/10/06	82	2.9	<1.0	<0.00100	NA	
	11/21/06	92	3	<1.0	0.00199	NA	
MW-72	11/17/06	160	19	<1.0	0.0337	NA	PCE: 1.4
MW-73	11/17/06	83	9.5	<1.0	0.0479	NA	
MW-79	05/23/06	<1.0	<1.0	<1.0	<0.00100	NA	Toluene: 5.8
	11/20/06	<1.0	<1.0	<1.0	0.00218	NA	

[a]VOCs by EPA Method 8260

Notes: NA = Not analyzed

Shaded cells indicate concentrations that exceed MCLs based on the more stringent of the drinking water standards or the maximum allowable concentrations in groundwater set by the NMWQCC (5 ug/L for TCE and DCE, 60 ug/L for TCA, and 50 ug/L for total chromium).

A-2: Infiltration Gallery and Pond Monitoring Wells

Appendix A-2

Infiltration Gallery and Pond Monitoring Wells

2006 Analytical Results[a]

Well	Sample Date	TCE (ug/l)	1,1DCE (ug/l)	1,1,1TCA (ug/l)	Cr (total) (mg/l)	Fe (total) (mg/l)	Mn (total) (mg/l)	Cr (diss) (mg/l)	Fe (diss) (mg/l)	Mn (diss) (mg/l)
MW-17	02/28/06	<1.0	<1.0	<1.0	0.0373	2.48	0.0736	0.0298	0.0150	<0.0100
	05/24/06	1.4	<1.0	<1.0	0.0410	5.05	0.143	0.0377	0.0358	0.0123
	08/10/06	1.4	<1.0	<1.0	0.0400	4.13	0.129	0.0270	0.0222	<0.0100
	11/09/06	<1.0	<1.0	<1.0	0.0411	2.33	0.0969	0.0304	0.0423	0.0132
MW-74	02/28/06	<1.0	<1.0	<1.0	0.0228	0.0354	<0.0100			
	05/24/06	<1.0	<1.0	<1.0	0.0252	0.0241	<0.0100			
	08/11/06	<1.0	<1.0	<1.0	0.0190	0.0290	0.0103			
	11/21/06	<1.0	<1.0	<1.0	0.0234	0.0227	<0.0100			
MW-75	02/28/06	<1.0	<1.0	<1.0	0.0223	<0.0100	<0.0100			
	05/24/06	<1.0	<1.0	<1.0	0.0254	0.0115	<0.0100			
	08/11/06	<1.0	<1.0	<1.0	0.0220	0.0151	<0.0100			
	11/21/06	<1.0	<1.0	<1.0	0.0224	<0.0100	<0.0100			
MW-76	02/28/06	<1.0	<1.0	<1.0	0.0224	0.0212	<0.0100			
	05/24/06	<1.0	<1.0	<1.0	0.0269	0.0174	<0.0100			
	08/11/06	<1.0	<1.0	<1.0	0.0200	<0.0100	<0.0100			
	11/21/06	<1.0	<1.0	<1.0	0.0296	<0.0100	<0.0100			
MW-77	02/28/06	12	1.1	<1.0	<0.00100	0.132	6.54	<0.00100	0.0301	0.486
	05/24/06	15	1.3	<1.0	0.00290	0.251	8.00	0.0013	0.0407	0.579
	08/10/06	11	<1.0	<1.0	<0.00100	0.120	4.06	<0.00100	0.0230	0.429
	11/21/06	13	1.1	<1.0	0.00549	0.245	6.76	0.0035	0.0430	0.573
MW-78	02/28/06	1.1	<1.0	<1.0	0.0320	0.149	0.0169	0.0309	0.0157	<0.0100
	05/24/06	1.5	<1.0	<1.0	0.0319	0.371	0.0311	0.0316	0.0991	<0.0100
	08/10/06	<1.0	<1.0	<1.0	0.0260	0.231	0.0230	0.0250	0.0339	<0.0100
	11/21/06	<2.0	<1.0	<1.0	0.0327	0.0622	0.0102	0.0314	0.0408	<0.0100

[a]VOCs by EPA Method 8260

Note: Shaded cells indicate concentrations that exceed MCLs based on the more stringent of the drinking water standards or the maximum allowable concentrations in groundwater set by the NMWQCC (5 ug/L for TCE and DCE, 60 ug/L for TCA, and 50 ug/L for total chromium).

APPENDIX B

APPENDIX B

Appendix B

2006 Containment Well Flow Rate Data

B-1: Off-Site Containment Well

B-2: Source Containment Well

B-1: Off-Site Containment Well

Appendix B-1
Off-Site Containment Well
2006 Flow Rate Data

Date	Time	Instantaneous Discharge (gpm)	Totalizer Reading (gallons)	Average Discharge (gpm)	Total Volume (gallons)*
12/29/05	12:26	226	772,702,200		808,384,700
				226	
01/03/06	11:45	---	774,318,400		810,000,900
				226	
01/04/06	16:00	---	774,700,900		810,383,400
				226	
01/13/06	10:50	---	777,555,600		813,238,100
				226	
01/19/06	12:10	---	779,524,500		815,207,000
				226	
01/23/06	14:03	---	780,850,500		816,533,000
				226	
01/27/06	7:30	---	782,063,300		817,745,800
				226	
02/01/06	13:40	---	783,771,800		819,454,300
				226	
02/09/06	11:30	---	786,344,400		822,026,900
				226	
02/16/06	7:44	227	788,569,700		824,252,200
				226	
02/28/06	14:30	---	792,563,500		828,246,000
				225	
03/01/06	7:30	---	792,792,800		828,475,300
				223	
03/03/06	11:30	---	793,489,200		829,171,700
				225	
03/12/06	6:30	---	796,342,700		832,025,200
				215	
03/15/06	8:00	227	797,288,800		832,971,300
				155	
03/16/06	20:05	---	797,623,400		833,305,900
				154	
03/24/06	12:30	157	799,326,900		835,009,400
				154	
03/28/06	9:56	155	800,191,200		835,873,700
				149	
04/04/06	11:50	---	801,711,000		837,393,500
				151	
04/11/06	16:50	---	803,275,600		838,958,100
				223	
04/12/06	17:10	---	803,601,600		839,284,100
				225	
04/17/06	13:20	224	805,171,700		840,854,200
				225	
04/27/06	13:20	---	808,410,700		844,093,200
				225	
05/01/06	12:34	---	809,695,700		845,378,200
				214	

Appendix B-1
Off-Site Containment Well
2006 Flow Rate Data

Date	Time	Instantaneous Discharge (gpm)	Totalizer Reading (gallons)	Average Discharge (gpm)	Total Volume (gallons)*
05/04/06	16:40	---	810,671,900		846,354,400
				223	
05/13/06	21:31	225	813,632,300		849,314,800
				224	
05/16/06	11:05	---	814,461,500		850,144,000
				224	
05/23/06	8:30	---	816,688,000		852,370,500
				225	
05/26/06	10:20	---	817,682,900		852,370,500
				224	
06/02/06	10:50	---	819,951,300		855,633,800
				224	
06/09/06	11:35	---	822,223,800		857,906,300
				224	
06/15/06	8:55	---	824,125,200		859,807,700
				223	
06/27/06	17:55	---	828,096,000		863,778,500
				224	
06/30/06	12:30	---	828,992,000		864,674,500
				224	
07/05/06	6:38	125	830,526,700		866,209,200
				228	
07/07/06	7:50	---	831,199,900		866,882,400
				223	
07/14/06	15:45	---	833,554,700		869,237,200
				224	
07/28/06	16:15	---	838,082,300		873,764,800
				225	
08/01/06	14:00	---	839,345,500		875,028,000
				224	
08/18/06	17:30	223	844,883,900		880,566,400
				225	
08/21/06	8:10	---	845,728,400		881,410,900
				225	
08/31/06	16:40	---	849,078,200		884,760,700
				225	
09/05/06	19:25	---	850,732,200		886,414,700
				225	
09/14/06	13:00	---	853,556,700		889,239,200
				225	
09/21/06	15:00	---	855,848,300		891,530,800
				224	
09/30/06	18:32	---	858,801,600		894,484,100
				226	
10/02/06	12:45	---	859,373,300		895,055,800
				225	
10/06/06	16:20	---	860,718,800		896,401,300
				225	

Appendix B-1
Off-Site Containment Well
2006 Flow Rate Data

Date	Time	Instantaneous Discharge (gpm)	Totalizer Reading (gallons)	Average Discharge (gpm)	Total Volume (gallons)[a]
10/19/06	16:45	---	864,943,400		900,625,900
				136	
10/24/06	10:10	---	865,871,800		901,554,300
				225	
10/27/06	13:03	---	866,882,900		902,565,400
				2	
11/01/06	13:45	---	866,899,100		902,581,600
				225	
11/02/06	12:30	---	867,205,800		902,888,300
				219	
11/09/06	6:22	---	869,333,600		905,016,100
				225	
11/10/06	11:50	---	869,731,400		905,413,900
				270	
11/15/06	12:40	---	871,687,500		907,370,000
				179	
11/20/06	15:40	---	873,005,400		908,687,900
				225	
11/28/06	11:23	---	875,534,800		911,217,300
				225	
12/01/06	12:45	---	876,525,400		912,207,900
				225	
12/04/06	13:18	---	877,503,300		913,185,800
				225	
12/14/06	10:15	---	880,700,600		916,383,100
				225	
12/23/06	12:50	---	883,654,600		919,337,100
				214	
12/30/06	10:21	---	885,775,688		921,458,188
				144	
01/04/07	12:30	---	886,831,800		922,514,300

[a]Total pumpage since 12/31/98

B-2: Source Containment Well

Appendix B-2

Source Containment Well
2006 Flow Rate Data

Date	Time	Instantaneous Discharge (gpm)	Totalizer Reading (gallons)	Average Discharge (gpm)	Total Volume (gallons)
12/29/05	12:00	---	104,167,105		104,167,105
				52	
01/03/06	11:35	---	104,537,440		104,537,440
				52	
01/04/06	15:30	---	104,624,570		104,624,570
				51	
01/13/06	10:00	---	105,273,440		105,273,440
				16	
01/14/06	21:53	---	105,308,236		105,308,236
				0	
01/25/06	10:10	---	105,309,880		105,309,880
				50	
01/31/06	15:49	---	105,762,100		105,762,100
				52	
02/01/06	14:00	---	105,830,700		105,830,700
				51	
02/09/06	11:07	---	106,414,600		106,414,600
				51	
02/16/06	10:03	51.0	106,928,230		106,928,230
				51	
02/22/06	8:25	51.1	107,364,700		107,364,700
				51	
03/01/06	8:00	---	107,876,100		107,876,100
				51	
03/03/06	11:25	---	108,032,700		108,032,700
				3	
03/06/06	8:13	---	108,045,439		108,045,439
				50	
03/15/06	10:09	---	108,698,598		108,698,598
				50	
03/24/06	12:40	---	109,359,670		109,359,670
				50	
04/04/06	10:35	---	110,146,690		110,146,690
				50	
05/01/06	11:40	---	112,087,190		112,087,190
				49	
05/08/06	13:09	49.0	112,589,300		112,589,300
				49	
05/16/06	10:23	----	113,148,270		113,148,270
				49	
05/23/06	8:14	---	113,636,211		113,636,211
				49	
05/26/06	10:07	---	113,853,450		113,853,450
				49	

Appendix B-2

Source Containment Well
2006 Flow Rate Data

Date	Time	Instantaneous Discharge (gpm)	Totalizer Reading (gallons)	Average Discharge (gpm)	Total Volume (gallons)
06/02/06	9:56	---	114,345,440		114,345,440
				49	
06/09/06	11:06	---	114,839,760		114,839,760
				48	
06/15/06	9:15	---	115,253,370		115,253,370
				48	
06/27/06	17:30	---	116,112,320		116,112,320
				46	
06/30/06	12:00	---	116,296,180		116,296,180
				48	
07/05/06	7:00	49.0	116,626,840		116,626,840
				48	
07/07/06	8:30	---	116,769,140		116,769,140
				48	
07/14/06	15:20	----	117,271,720		117,271,720
				48	
07/18/06	8:02	---	117,525,680		117,525,680
				48	
08/01/06	13:23	---	118,499,850		118,499,850
				47	
08/21/06	8:30	---	119,844,920		119,844,920
				47	
08/29/06	11:45	46.0	120,393,170		120,393,170
				47	
08/31/06	16:20	---	120,540,240		120,540,240
				46	
09/05/06	18:50	---	120,881,710		120,881,710
				46	
09/14/06	13:20	---	121,467,550		121,467,550
				46	
09/28/06	14:00	---	122,399,310		122,399,310
				46	
10/02/06	12:25	---	122,659,780		122,659,780
				46	
10/27/06	12:42	45.5	124,305,490		124,305,490
				46	
11/01/06	8:56	---	124,624,476		124,624,476
				45	
11/02/06	12:00	---	124,697,600		124,697,600
				45	
11/06/06	13:06	---	124,961,440		124,961,440
				45	
11/10/06	11:34	---	125,217,070		125,217,070
				44	
12/01/06	11:15	45.5	126,549,900		126,549,900

Appendix B-2

Source Containment Well
2006 Flow Rate Data

Date	Time	Instantaneous Discharge (gpm)	Totalizer Reading (gallons)	Average Discharge (gpm)	Total Volume (gallons)
				45	
12/14/06	9:57	---	127,383,550		127,383,550
				44	
12/23/06	13:30	---	127,968,500		127,968,500
				44	
01/04/07	11:48	---	128,726,310		128,726,310

APPENDIX C

APPENDIX C

Appendix C

2006 Influent / Effluent Quality Data

C-1: Off-Site Treatment System

C-2: Source Treatment System

C-1: Off-Site Treatment System

Appendix C-1

Off-Site Treatment System
2006 Analytical Results[a]

Sample Date	Influent						Effluent					
	TCE (ug/l)	1,1DCE (ug/l)	1,1,1TCA (ug/l)	Cr (total) (mg/l)	Fe (total) (mg/l)	Mn (total) (mg/l)	TCE (ug/l)	1,1DCE (ug/l)	1,1,1TCA (ug/l)	Cr (total) (mg/l)	Fe (total) (mg/l)	Mn (total) (mg/l)
01/04/06	1300	75	3.9	0.026	<0.0100	<0.00500	<1.0	<1.0	<1.0	0.030	0.716	<0.00500
2/1/2006	1200	73	4.0	0.026	0.013	<0.00500	<1.0	<1.0	<1.0	0.028	0.137	<0.00500
03/03/06	1100	65	3.3	0.027	0.021	<0.0100	<1.0	<1.0	<1.0	0.024	0.024	<0.0100
04/04/06	1300	78	3.9	0.025	<0.0100	<0.0100	<1.0	<1.0	<1.0	0.013	0.067	<0.0100
05/01/06	1100	73	3.7	0.024	0.022	<0.0100	<1.0	<1.0	<1.0	0.027	0.046	<0.0100
06/02/06	1100	67	3.4	0.028	0.013	<0.0100	<1.0	<1.0	<1.0	0.025	<0.0100	<0.0100
07/07/06	1100	85	3.8	0.029	<0.0100	<0.0100	<1.0	<1.0	<1.0	0.030	0.427	<0.0100
08/02/06	1200	75	3.8	0.031	0.067	<0.0100	<1.0	<1.0	<1.0	0.024	0.083	<0.0100
09/05/06	1100	81	3.3	0.022	<0.0100	<0.0100	<1.0	<1.0	<1.0	0.024	0.034	<0.0100
10/02/06	990	63	3.2	0.028	0.014	<0.0100	<1.0	<1.0	<1.0	0.026	0.104	<0.0100
11/02/06	1300	88	4.0	0.029	0.031	<0.0100	<1.0	<1.0	<1.0	0.028	0.024	<0.0100
12/01/06	1200	84	3.9	0.026	0.055	<0.0100	<1.0	<1.0	<1.0	0.024	0.258	<0.0100
01/04/07	1500	100	4.5	0.030	0.012	<0.0100	<1.0	<1.0	<1.0	0.030	0.012	<0.0100

[a] Data from 01/04/07 has been included to show conditions at the end of the year.

Note: Shaded cells indicate concentrations that exceed MCLs based on the more stringent of the drinking water standards or the maximum allowable concentrations in groundwater set by the NMWQCC (5 ug/L for TCE and DCE, 60 ug/L for TCA, and 50 ug/L for total chromium).

C-2: Source Treatment System

Appendix C-2

Source Treatment System
2006 Analytical Results[a]

Sample Date	Influent						Effluent					
	TCE (ug/l)	1,1DCE (ug/l)	1,1,1TCA (ug/l)	Cr (total) (mg/l)	Fe (total) (mg/l)	Mn (total) (mg/l)	TCE (ug/l)	1,1-DCE (ug/l)	1,1,1-TCA (ug/l)	Cr (total) (mg/l)	Fe (total) (mg/l)	Mn (total) (mg/l)
01/04/06	160	20	1.5	0.033	<0.0100	0.094	<1.0	<1.0	<1.0	0.033	0.032	0.108
02/01/06	190	23	1.7	0.044	0.022	0.339	<1.0	<1.0	<1.0	0.033	<0.0100	0.070
03/03/06	140	17	1.3	0.028	0.034	1.030	<1.0	<1.0	<1.0	0.033	0.025	0.049
04/04/06	150	20	1.3	0.028	0.027	0.895	<1.0	<1.0	<1.0	0.026	<0.0100	0.100
05/01/06	160	19	1.2	0.007	0.029	1.350	<1.0	<1.0	<1.0	0.006	<0.0100	0.051
06/02/06	140	17	1.1	0.037	<0.0100	0.326	<1.0	<1.0	<1.0	0.032	0.012	0.051
07/07/06	150	21	<1.0	0.033	0.012	0.234	<1.0	<1.0	<1.0	0.033	<0.0100	0.043
08/02/06	160	19	1.2	0.029	<0.0100	0.751	<1.0	<1.0	<1.0	0.030	<0.0100	0.050
09/05/06	140	20	<1.0	0.028	0.105	2.360	<1.0	<1.0	<1.0	0.028	0.024	0.051
10/02/06	140	16	<1.0	0.031	0.018	0.805	<1.0	<1.0	<1.0	0.029	0.019	<0.0100
11/02/06	150	19	1.0	0.035	0.023	0.704	<1.0	<1.0	<1.0	0.032	<0.0100	0.042
12/01/06	150	19	1.1	0.030	0.016	0.490	<1.0	<1.0	<1.0	0.029	<0.0100	0.054
01/04/07	150	19	<1.0	0.029	0.018	1.080	<1.0	<1.0	<1.0	0.032	0.015	0.044

[a] Data from 01/04/07 has been included to show conditions at the end of the year.

Note: Shaded cells indicate concentrations that exceed MCLs based on the more stringent of the drinking water standards or the maximum allowable concentrations in groundwater set by the NMWQCC (5 ug/L for TCE and DCE, 60 ug/L for TCA, and 50 ug/L for total chromium).

APPENDIX D

Appendix D

Water Level Residuals – December 1998 to December 2006 Simulation

Appendix D

Water Level Residuals
December 1998 to December 2006 Simulation

Monitoring Well	Year	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-07	1999	4976.63	4975.11	1.52
MW-09	1999	4972.31	4972.53	-0.22
MW-12	1999	4971.96	4972.59	-0.64
MW-13	1999	4973.69	4973.09	0.60
MW-16	1999	4977.80	4975.59	2.21
MW-17	1999	4978.16	4976.21	1.95
MW-19	1999	4970.99	4971.01	-0.02
MW-20	1999	4970.62	4970.44	0.18
MW-29	1999	4972.87	4972.02	0.86
MW-30	1999	4971.40	4971.21	0.19
MW-31	1999	4970.32	4970.40	-0.08
MW-32	1999	4971.37	4970.34	1.03
MW-33	1999	4971.65	4972.21	-0.57
MW-34	1999	4973.46	4972.35	1.10
MW-35	1999	4970.62	4970.23	0.39
MW-36	1999	4969.03	4969.03	0.00
MW-37	1999	4967.27	4967.77	-0.51
MW-38	1999	4972.90	4971.49	1.41
MW-39	1999	4971.63	4970.80	0.84
MW-40	1999	4970.35	4970.07	0.28
MW-41	1999	4970.23	4970.51	-0.28
MW-42	1999	4969.89	4970.61	-0.72
MW-43	1999	4969.69	4970.25	-0.56
MW-44	1999	4969.10	4968.94	0.16
MW-45	1999	4967.28	4967.60	-0.32
MW-46	1999	4965.93	4966.56	-0.63
MW-47	1999	4965.49	4965.84	-0.35
MW-48	1999	4964.63	4964.41	0.21
MW-49	1999	4970.15	4969.82	0.33
MW-51	1999	4979.98	4977.45	2.54
MW-52	1999	4961.13	4961.38	-0.25
MW-53	1999	4963.38	4962.58	0.80
MW-54	1999	4964.80	4965.55	-0.75
MW-55	1999	4963.34	4963.78	-0.44
MW-56	1999	4964.59	4964.17	0.42
MW-57	1999	4964.36	4965.04	-0.68
MW-58	1999	4964.15	4963.44	0.71
MW-59	1999	4968.77	4970.28	-1.52
MW-60	1999	4964.27	4963.94	0.33
MW-61	1999	4964.35	4964.07	0.28
MW-62	1999	4966.51	4966.34	0.17
MW-64	1999	4964.90	4965.40	-0.50

Appendix D

Water Level Residuals
December 1998 to December 2006 Simulation

Monitoring Well	Year	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-65	1999	4960.79	4960.43	0.36
MW-66	1999	4963.34	4963.63	-0.29
MW-67	1999	4957.74	4957.99	-0.25
MW-68	1999	4960.73	4960.19	0.53
MW-69	1999	4960.62	4959.51	1.10
MW-70	1999	4969.37	4970.06	-0.69
MW-71	1999	4957.73	4956.85	0.88
MW-72	1999	4966.08	4970.61	-4.53
MW-73	1999	4970.12	4970.44	-0.32
OB-1	1999	4958.08	4959.05	-0.98
OB-2	1999	4959.81	4959.36	0.45
MW-07	2000	4976.30	4974.95	1.35
MW-09	2000	4971.97	4972.31	-0.34
MW-12	2000	4971.61	4972.39	-0.78
MW-13	2000	4973.37	4972.88	0.48
MW-16	2000	4977.63	4975.53	2.09
MW-17	2000	4977.93	4976.14	1.79
MW-18	2000	4970.71	4972.79	-2.09
MW-19	2000	4970.62	4970.74	-0.12
MW-20	2000	4970.26	4970.16	0.10
MW-22	2000	4976.84	4975.76	1.08
MW-23	2000	4975.11	4974.15	0.96
MW-24	2000	4977.35	4975.47	1.88
MW-25	2000	4977.40	4975.38	2.02
MW-26	2000	4972.51	4972.76	-0.25
MW-27	2000	4972.89	4974.11	-1.22
MW-29	2000	4972.54	4971.77	0.77
MW-30	2000	4971.04	4970.94	0.09
MW-31	2000	4969.94	4970.11	-0.17
MW-32	2000	4969.76	4970.05	-0.30
MW-33	2000	4971.28	4971.99	-0.71
MW-34	2000	4973.12	4972.11	1.01
MW-35	2000	4970.22	4969.91	0.31
MW-36	2000	4968.58	4968.69	-0.11
MW-37	2000	4966.92	4967.37	-0.45
MW-38	2000	4972.56	4971.23	1.33
MW-39	2000	4971.28	4970.52	0.76
MW-40	2000	4969.98	4969.77	0.21
MW-41	2000	4969.86	4970.23	-0.37
MW-42	2000	4969.54	4970.34	-0.80
MW-43	2000	4969.33	4969.98	-0.65
MW-44	2000	4968.69	4968.59	0.10

Appendix D

Water Level Residuals
December 1998 to December 2006 Simulation

Monitoring Well	Year	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-45	2000	4966.89	4967.20	-0.31
MW-46	2000	4965.57	4966.13	-0.56
MW-47	2000	4965.06	4965.31	-0.25
MW-48	2000	4964.02	4963.75	0.27
MW-49	2000	4969.88	4969.52	0.36
MW-51	2000	4979.72	4977.40	2.32
MW-52	2000	4960.51	4960.61	-0.10
MW-53	2000	4962.63	4961.65	0.98
MW-54	2000	4964.58	4965.22	-0.64
MW-55	2000	4962.91	4963.15	-0.23
MW-56	2000	4964.03	4963.53	0.49
MW-57	2000	4964.32	4964.80	-0.48
MW-58	2000	4963.48	4962.64	0.84
MW-59	2000	4968.44	4970.02	-1.58
MW-60	2000	4963.96	4963.40	0.55
MW-61	2000	4964.04	4963.52	0.51
MW-62	2000	4965.93	4965.87	0.06
MW-63	2000	4970.19	4973.40	-3.21
MW-64	2000	4964.56	4965.08	-0.52
MW-65	2000	4960.25	4959.69	0.55
MW-66	2000	4963.04	4963.36	-0.32
MW-67	2000	4957.25	4957.61	-0.36
MW-68	2000	4960.41	4959.74	0.68
MW-69	2000	4960.32	4959.05	1.27
MW-70	2000	4969.01	4969.77	-0.76
MW-71	2000	4957.29	4956.49	0.80
MW-72	2000	4969.73	4970.34	-0.62
MW-73	2000	4969.77	4970.15	-0.39
MW-74	2000	4963.03	4963.94	-0.91
MW-75	2000	4966.94	4963.89	3.05
MW-76	2000	4967.70	4965.53	2.18
OB-1	2000	4957.55	4957.83	-0.28
OB-2	2000	4958.97	4958.39	0.57
MW-07	2001	4976.11	4974.80	1.31
MW-09	2001	4971.75	4972.12	-0.36
MW-12	2001	4971.23	4972.21	-0.98
MW-13	2001	4973.13	4972.69	0.44
MW-16	2001	4977.59	4975.46	2.13
MW-17	2001	4977.80	4976.06	1.73
MW-18	2001	4970.32	4972.65	-2.33
MW-19	2001	4970.33	4970.52	-0.19
MW-20	2001	4969.98	4969.93	0.05

Appendix D

Water Level Residuals
December 1998 to December 2006 Simulation

Monitoring Well	Year	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-22	2001	4976.37	4975.64	0.72
MW-23	2001	4974.78	4974.00	0.78
MW-24	2001	4977.22	4975.38	1.84
MW-25	2001	4977.24	4975.30	1.94
MW-26	2001	4971.73	4972.57	-0.84
MW-27	2001	4972.75	4974.03	-1.28
MW-29	2001	4972.23	4971.56	0.67
MW-30	2001	4970.76	4970.72	0.04
MW-31	2001	4969.66	4969.87	-0.21
MW-32	2001	4969.51	4969.82	-0.31
MW-33	2001	4971.01	4971.80	-0.79
MW-34	2001	4972.90	4971.89	1.01
MW-35	2001	4969.98	4969.66	0.32
MW-36	2001	4968.35	4968.41	-0.06
MW-38	2001	4972.25	4971.02	1.23
MW-39	2001	4971.01	4970.29	0.71
MW-40	2001	4969.71	4969.53	0.18
MW-41	2001	4969.62	4970.00	-0.38
MW-42	2001	4969.34	4970.12	-0.79
MW-43	2001	4969.12	4969.76	-0.63
MW-44	2001	4968.41	4968.32	0.09
MW-45	2001	4967.10	4966.90	0.21
MW-46	2001	4965.32	4965.82	-0.50
MW-47	2001	4964.50	4964.94	-0.44
MW-48	2001	4963.68	4963.32	0.36
MW-49	2001	4969.54	4969.28	0.26
MW-51	2001	4979.80	4977.36	2.44
MW-52	2001	4960.21	4960.06	0.15
MW-53	2001	4962.10	4961.12	0.98
MW-54	2001	4964.35	4964.97	-0.62
MW-55	2001	4962.55	4962.76	-0.21
MW-56	2001	4963.69	4963.14	0.55
MW-57	2001	4964.16	4964.62	-0.45
MW-58	2001	4963.30	4962.15	1.15
MW-59	2001	4968.21	4969.81	-1.60
MW-60	2001	4963.76	4963.06	0.70
MW-61	2001	4963.82	4963.17	0.65
MW-62	2001	4965.70	4965.52	0.18
MW-63	2001	4970.04	4973.34	-3.30
MW-64	2001	4964.38	4964.84	-0.46
MW-65	2001	4959.93	4959.27	0.66
MW-66	2001	4962.80	4963.15	-0.35

Appendix D

Water Level Residuals
December 1998 to December 2006 Simulation

Monitoring Well	Year	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-67	2001	4956.95	4957.28	-0.34
MW-68	2001	4960.16	4959.44	0.71
MW-69	2001	4960.03	4958.75	1.27
MW-70	2001	4968.98	4969.54	-0.56
MW-71	2001	4957.05	4956.16	0.90
MW-72	2001	4969.53	4970.12	-0.59
MW-73	2001	4969.44	4969.92	-0.48
MW-74	2001	4962.49	4964.64	-2.16
MW-75	2001	4966.28	4964.59	1.68
MW-76	2001	4967.15	4966.22	0.92
OB-1	2001	4957.28	4957.23	0.04
OB-2	2001	4958.64	4957.88	0.76
MW-07	2002	4976.12	4975.95	0.17
MW-09	2002	4970.94	4972.80	-1.86
MW-12	2002	4970.34	4972.95	-2.61
MW-13	2002	4972.48	4973.20	-0.71
MW-14R	2002	4968.29	4969.31	-1.02
MW-16	2002	4981.75	4981.12	0.62
MW-17	2002	4981.99	4982.11	-0.12
MW-18	2002	4970.71	4974.43	-3.72
MW-19	2002	4969.23	4969.30	-0.07
MW-20	2002	4968.78	4969.07	-0.30
MW-22	2002	4977.93	4978.50	-0.57
MW-23	2002	4974.63	4975.72	-1.09
MW-24	2002	4981.48	4980.79	0.69
MW-25	2002	4981.57	4980.95	0.62
MW-26	2002	4971.40	4972.65	-1.25
MW-27	2002	4978.12	4978.28	-0.16
MW-29	2002	4971.53	4970.98	0.54
MW-30	2002	4969.78	4969.83	-0.05
MW-31	2002	4968.38	4968.57	-0.19
MW-32	2002	4968.08	4968.30	-0.22
MW-33	2002	4970.04	4972.40	-2.37
MW-34	2002	4972.28	4971.55	0.73
MW-36	2002	4967.55	4967.88	-0.33
MW-37R	2002	4965.13	4966.41	-1.28
MW-38	2002	4971.49	4970.46	1.03
MW-39	2002	4970.11	4969.60	0.51
MW-40	2002	4968.46	4968.54	-0.08
MW-41	2002	4968.32	4968.29	0.03
MW-42	2002	4968.54	4969.34	-0.80
MW-43	2002	4968.30	4969.05	-0.74

Appendix D

Water Level Residuals
December 1998 to December 2006 Simulation

Monitoring Well	Year	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-44	2002	4967.40	4967.75	-0.35
MW-45	2002	4966.10	4966.34	-0.25
MW-46	2002	4964.66	4965.41	-0.75
MW-47	2002	4964.20	4964.51	-0.32
MW-48	2002	4963.21	4962.90	0.31
MW-49	2002	4968.46	4968.58	-0.11
MW-51	2002	4980.87	4979.65	1.22
MW-52	2002	4959.88	4959.65	0.23
MW-53	2002	4961.53	4960.28	1.24
MW-54	2002	4963.83	4964.69	-0.85
MW-55	2002	4962.04	4962.32	-0.28
MW-56	2002	4963.22	4962.70	0.51
MW-57	2002	4963.63	4964.38	-0.75
MW-58	2002	4962.58	4961.72	0.87
MW-59	2002	4967.50	4969.23	-1.73
MW-60	2002	4963.23	4962.69	0.54
MW-61	2002	4963.13	4962.82	0.31
MW-62	2002	4965.14	4965.11	0.03
MW-63	2002	4969.59	4974.13	-4.54
MW-64	2002	4963.79	4964.55	-0.77
MW-65	2002	4959.39	4958.84	0.55
MW-66	2002	4962.25	4962.85	-0.60
MW-67	2002	4956.32	4956.91	-0.60
MW-68	2002	4959.64	4959.15	0.48
MW-69	2002	4959.52	4958.42	1.10
MW-70	2002	4967.66	4968.63	-0.98
MW-71R	2002	4956.19	4955.85	0.34
MW-72	2002	4968.58	4969.14	-0.56
MW-73	2002	4967.68	4967.66	0.02
MW-74	2002	4962.07	4964.96	-2.89
MW-75	2002	4965.84	4964.90	0.94
MW-76	2002	4967.35	4966.52	0.83
MW-77	2002	4977.10	4976.71	0.39
MW-78	2002	4972.81	4974.25	-1.44
OB-1	2002	4956.73	4956.66	0.07
OB-2	2002	4957.66	4957.39	0.27
MW-07	2003	4976.17	4976.42	-0.25
MW-09	2003	4970.83	4973.25	-2.42
MW-12	2003	4970.29	4973.36	-3.07
MW-13	2003	4972.43	4973.54	-1.11
MW-14R	2003	4968.03	4969.25	-1.22
MW-16	2003	4982.27	4982.48	-0.21

Appendix D

Water Level Residuals
December 1998 to December 2006 Simulation

Monitoring Well	Year	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-17	2003	4982.03	4983.52	-1.50
MW-18	2003	4975.19	4975.05	0.14
MW-19	2003	4969.13	4969.11	0.02
MW-20	2003	4968.59	4968.87	-0.28
MW-21	2003	4983.39	4983.79	-0.40
MW-22	2003	4977.85	4979.36	-1.51
MW-23	2003	4974.76	4976.32	-1.57
MW-24	2003	4982.09	4982.10	-0.02
MW-25	2003	4982.28	4982.30	-0.02
MW-26	2003	4971.84	4972.81	-0.97
MW-27	2003	4981.30	4979.40	1.90
MW-29	2003	4971.41	4970.85	0.56
MW-30	2003	4969.61	4969.67	-0.06
MW-31	2003	4968.19	4968.35	-0.16
MW-32	2003	4968.01	4968.05	-0.04
MW-33	2003	4969.94	4972.83	-2.89
MW-34	2003	4972.13	4971.36	0.77
MW-36	2003	4967.33	4967.60	-0.27
MW-37R	2003	4965.09	4966.17	-1.08
MW-38	2003	4971.42	4970.30	1.12
MW-39	2003	4969.96	4969.41	0.55
MW-40	2003	4968.26	4968.31	-0.06
MW-41	2003	4968.41	4968.04	0.37
MW-42	2003	4968.48	4969.17	-0.69
MW-43	2003	4968.27	4968.87	-0.60
MW-44	2003	4967.41	4967.50	-0.09
MW-45	2003	4966.08	4966.11	-0.03
MW-46	2003	4964.45	4965.17	-0.72
MW-47	2003	4963.98	4964.20	-0.22
MW-48	2003	4962.97	4962.57	0.40
MW-49	2003	4968.30	4968.37	-0.06
MW-51	2003	4981.89	4980.57	1.32
MW-52R	2003	4959.05	4959.01	0.03
MW-53	2003	4961.30	4959.92	1.38
MW-54	2003	4963.62	4964.46	-0.84
MW-55	2003	4961.86	4962.01	-0.15
MW-56	2003	4962.99	4962.39	0.60
MW-57	2003	4963.46	4964.16	-0.70
MW-58	2003	4962.30	4961.37	0.94
MW-59	2003	4967.36	4969.07	-1.71
MW-60	2003	4962.89	4962.41	0.48
MW-61	2003	4962.87	4962.53	0.34

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Water Level Residuals
December 1998 to December 2006 Simulation

Monitoring Well	Year	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-62	2003	4964.84	4964.80	0.04
MW-63	2003	4971.78	4974.57	-2.79
MW-64	2003	4963.64	4964.33	-0.69
MW-65	2003	4959.20	4958.51	0.69
MW-66	2003	4962.01	4962.62	-0.61
MW-67	2003	4956.05	4956.61	-0.56
MW-68	2003	4959.41	4958.88	0.53
MW-69	2003	4959.34	4958.14	1.20
MW-70	2003	4967.50	4968.42	-0.92
MW-71R	2003	4956.12	4955.54	0.58
MW-72	2003	4968.55	4968.97	-0.42
MW-73	2003	4967.45	4967.35	0.10
MW-74	2003	4961.86	4965.06	-3.21
MW-75	2003	4965.78	4965.01	0.77
MW-76	2003	4967.22	4966.62	0.60
MW-77	2003	4977.09	4977.11	-0.02
MW-78	2003	4974.98	4974.77	0.21
OB-1	2003	4956.46	4956.24	0.22
OB-2	2003	4957.71	4957.02	0.69
MW-07	2004	4975.59	4975.96	-0.37
MW-09	2004	4970.40	4973.00	-2.60
MW-12	2004	4969.88	4973.12	-3.25
MW-13	2004	4972.02	4973.25	-1.23
MW-14R	2004	4967.79	4969.16	-1.37
MW-16	2004	4981.74	4980.50	1.24
MW-17	2004	4981.40	4980.96	0.44
MW-18	2004	4973.36	4974.82	-1.46
MW-19	2004	4968.79	4968.99	-0.20
MW-20	2004	4968.25	4968.73	-0.49
MW-21	2004	4982.66	4982.48	0.17
MW-22	2004	4977.25	4978.51	-1.26
MW-23	2004	4974.24	4975.81	-1.57
MW-24	2004	4981.55	4980.36	1.18
MW-25	2004	4981.73	4980.51	1.21
MW-26	2004	4971.36	4972.64	-1.28
MW-27	2004	4980.76	4978.89	1.87
MW-29	2004	4970.95	4970.70	0.24
MW-30	2004	4969.25	4969.53	-0.28
MW-31	2004	4967.86	4968.24	-0.38
MW-32	2004	4967.71	4967.95	-0.24
MW-33	2004	4969.55	4972.64	-3.08
MW-34	2004	4971.59	4971.19	0.40

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Water Level Residuals
December 1998 to December 2006 Simulation

Monitoring Well	Year	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-36	2004	4967.43	4967.42	0.01
MW-37R	2004	4964.78	4966.01	-1.23
MW-38	2004	4971.20	4970.15	1.05
MW-39	2004	4969.56	4969.26	0.30
MW-40	2004	4967.96	4968.18	-0.22
MW-41	2004	4968.03	4967.96	0.07
MW-42	2004	4968.17	4969.05	-0.88
MW-43	2004	4967.95	4968.74	-0.79
MW-44	2004	4967.11	4967.33	-0.22
MW-45	2004	4965.77	4965.95	-0.19
MW-46	2004	4964.17	4965.01	-0.85
MW-47	2004	4963.66	4963.99	-0.34
MW-48	2004	4962.64	4962.35	0.29
MW-49	2004	4967.97	4968.22	-0.25
MW-51	2004	4981.82	4981.22	0.59
MW-52R	2004	4958.73	4958.78	-0.06
MW-53	2004	4961.00	4959.69	1.31
MW-54	2004	4963.33	4964.26	-0.94
MW-55	2004	4961.41	4961.83	-0.42
MW-56	2004	4962.64	4962.19	0.45
MW-57	2004	4963.13	4963.96	-0.84
MW-58	2004	4961.99	4961.14	0.85
MW-59	2004	4967.13	4968.94	-1.81
MW-60	2004	4962.64	4962.21	0.43
MW-61	2004	4962.61	4962.32	0.29
MW-62	2004	4964.54	4964.58	-0.04
MW-63	2004	4973.01	4974.81	-1.80
MW-64	2004	4963.34	4964.14	-0.80
MW-65	2004	4958.76	4958.32	0.43
MW-66	2004	4961.60	4962.42	-0.82
MW-67	2004	4955.63	4956.34	-0.71
MW-68	2004	4959.01	4958.65	0.35
MW-69	2004	4958.86	4957.93	0.93
MW-70	2004	4967.11	4968.29	-1.17
MW-71R	2004	4955.77	4955.24	0.53
MW-72	2004	4968.23	4968.87	-0.64
MW-73	2004	4967.15	4967.28	-0.13
MW-74	2004	4961.23	4964.80	-3.57
MW-75	2004	4965.11	4964.74	0.36
MW-76	2004	4966.48	4966.38	0.10
MW-77	2004	4976.69	4976.81	-0.12
MW-78	2004	4974.55	4974.90	-0.35

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Water Level Residuals
December 1998 to December 2006 Simulation

Monitoring Well	Year	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
OB-1	2004	4956.03	4956.10	-0.07
OB-2	2004	4957.22	4956.84	0.38
MW-07	2005	4975.59	4976.16	-0.57
MW-09	2005	4970.25	4972.92	-2.67
MW-12	2005	4969.70	4973.05	-3.35
MW-13	2005	4971.94	4973.21	-1.27
MW-14R	2005	4967.54	4968.97	-1.43
MW-16	2005	4981.95	4981.76	0.19
MW-17	2005	4981.60	4982.93	-1.33
MW-18	2005	4974.11	4974.73	-0.62
MW-19	2005	4968.61	4968.82	-0.21
MW-20	2005	4968.07	4968.55	-0.49
MW-21	2005	4982.73	4982.54	0.18
MW-22	2005	4977.39	4979.14	-1.76
MW-23	2005	4974.27	4976.02	-1.75
MW-24	2005	4981.74	4981.47	0.27
MW-25	2005	4981.94	4981.59	0.35
MW-26	2005	4971.30	4972.53	-1.24
MW-27	2005	4980.91	4978.95	1.95
MW-29	2005	4970.84	4970.55	0.29
MW-30	2005	4969.09	4969.37	-0.28
MW-31	2005	4967.64	4968.06	-0.42
MW-32	2005	4967.49	4967.77	-0.28
MW-33	2005	4969.49	4972.52	-3.04
MW-34	2005	4971.46	4971.03	0.43
MW-37R	2005	4964.54	4965.80	-1.26
MW-38	2005	4970.83	4969.98	0.84
MW-39	2005	4969.36	4969.09	0.27
MW-40	2005	4967.75	4967.99	-0.25
MW-41	2005	4967.90	4967.78	0.12
MW-42	2005	4967.97	4968.87	-0.90
MW-43	2005	4967.72	4968.55	-0.84
MW-44	2005	4966.85	4967.12	-0.28
MW-45	2005	4964.88	4965.73	-0.85
MW-46	2005	4963.90	4964.78	-0.89
MW-47	2005	4963.42	4963.75	-0.34
MW-48	2005	4962.33	4962.09	0.25
MW-49	2005	4967.75	4968.03	-0.28
MW-51	2005	4982.02	4980.88	1.14
MW-52R	2005	4958.37	4958.46	-0.09
MW-53	2005	4960.65	4959.41	1.24
MW-54	2005	4963.11	4964.03	-0.92

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Water Level Residuals
December 1998 to December 2006 Simulation

Monitoring Well	Year	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-55	2005	4961.10	4961.53	-0.43
MW-56	2005	4962.37	4961.91	0.46
MW-57	2005	4963.03	4963.73	-0.71
MW-58	2005	4961.66	4960.85	0.81
MW-59	2005	4966.94	4968.76	-1.82
MW-60	2005	4962.31	4961.94	0.38
MW-61	2005	4962.21	4962.06	0.14
MW-62	2005	4964.35	4964.34	0.01
MW-63	2005	4974.07	4974.61	-0.53
MW-64	2005	4963.07	4963.90	-0.84
MW-65	2005	4958.37	4957.99	0.39
MW-66	2005	4961.26	4962.16	-0.90
MW-67	2005	4955.07	4956.02	-0.96
MW-68	2005	4958.60	4958.38	0.22
MW-69	2005	4958.49	4957.62	0.87
MW-70	2005	4966.89	4968.10	-1.22
MW-71R	2005	4955.34	4954.92	0.42
MW-72	2005	4968.03	4968.68	-0.65
MW-73	2005	4966.97	4967.11	-0.14
MW-74	2005	4960.94	4964.84	-3.90
MW-75	2005	4965.15	4964.78	0.37
MW-76	2005	4966.70	4966.40	0.30
MW-77	2005	4976.71	4976.99	-0.28
MW-78	2005	4974.52	4974.46	0.06
OB-1	2005	4955.62	4955.64	-0.02
OB-2	2005	4956.87	4956.45	0.42
MW-07	2006	4975.13	4976.07	-0.94
MW-09	2006	4969.93	4972.77	-2.85
MW-12	2006	4969.38	4972.92	-3.54
MW-14R	2006	4967.27	4968.76	-1.49
MW-16	2006	4981.87	4981.74	0.13
MW-17	2006	4981.50	4982.89	-1.39
MW-18	2006	4970.92	4974.65	-3.74
MW-19	2006	4968.33	4968.63	-0.30
MW-20	2006	4967.83	4968.36	-0.54
MW-21	2006	4982.64	4982.13	0.51
MW-22	2006	4976.96	4979.12	-2.16
MW-23	2006	4973.90	4975.94	-2.05
MW-24	2006	4981.65	4981.45	0.19
MW-25	2006	4981.84	4981.58	0.26
MW-26	2006	4970.98	4972.38	-1.41
MW-27	2006	4980.89	4978.95	1.94

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Water Level Residuals
December 1998 to December 2006 Simulation

Monitoring Well	Year	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-29	2006	4970.55	4970.37	0.18
MW-30	2006	4968.82	4969.18	-0.36
MW-31	2006	4967.38	4967.86	-0.48
MW-32	2006	4967.22	4967.58	-0.36
MW-34	2006	4971.19	4970.83	0.36
MW-37R	2006	4964.25	4965.55	-1.30
MW-38	2006	4970.57	4969.80	0.77
MW-39	2006	4969.11	4968.90	0.21
MW-40	2006	4967.47	4967.79	-0.33
MW-41	2006	4967.63	4967.59	0.04
MW-42	2006	4967.73	4968.69	-0.96
MW-43	2006	4967.48	4968.37	-0.88
MW-44	2006	4966.57	4966.89	-0.32
MW-45	2006	4964.59	4965.49	-0.91
MW-46	2006	4963.63	4964.54	-0.91
MW-47	2006	4963.11	4963.47	-0.36
MW-48	2006	4962.03	4961.78	0.25
MW-49	2006	4967.53	4967.83	-0.31
MW-51	2006	4981.83	4980.82	1.01
MW-52R	2006	4958.15	4958.14	0.01
MW-53	2006	4960.41	4959.28	1.13
MW-54	2006	4962.92	4963.78	-0.86
MW-55	2006	4960.85	4961.28	-0.43
MW-56	2006	4961.97	4961.64	0.33
MW-57	2006	4963.05	4963.48	-0.43
MW-58	2006	4961.20	4960.53	0.67
MW-59	2006	4966.71	4968.57	-1.87
MW-60	2006	4961.88	4961.67	0.21
MW-61	2006	4961.87	4961.77	0.10
MW-62	2006	4964.02	4964.07	-0.05
MW-63	2006	4973.80	4974.50	-0.70
MW-64	2006	4962.83	4963.65	-0.83
MW-65	2006	4958.13	4957.73	0.40
MW-66	2006	4961.03	4961.94	-0.91
MW-67	2006	4955.01	4955.85	-0.84
MW-68	2006	4958.34	4958.09	0.25
MW-69	2006	4958.22	4957.38	0.84
MW-70	2006	4966.69	4967.91	-1.22
MW-71R	2006	4955.03	4954.74	0.29
MW-72	2006	4967.77	4968.50	-0.73
MW-73	2006	4966.74	4966.91	-0.18
MW-74	2006	4960.47	4964.83	-4.36

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Water Level Residuals
December 1998 to December 2006 Simulation

Monitoring Well	Year	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-75	2006	4964.72	4964.77	-0.05
MW-76	2006	4965.97	4966.36	-0.38
MW-77	2006	4976.46	4976.90	-0.44
MW-78	2006	4973.94	4974.35	-0.41
OB-1	2006	4955.44	4955.38	0.06
OB-2	2006	4956.66	4956.19	0.47

Number of active observation points =	500	
Number of inactive observation points =	10	
Mean of residuals =	0.21	ft
Standard Deviation of residuals =	1.09	ft
Sum of squared residuals =	617	ft^2
Mean of absolute residuals =	0.79	ft
Minimum residual =	-3.05	ft
Maximum residual =	4.54	ft
Range in observed heads =	28.38	ft