Sparton Technology, Inc.
Former Coors Road Plant
Remedial Program

2007 Annual Report

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

May 29, 2008

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S.S. PAPADOPULOS & ASSOCIATES, INC.
ENVIRONMENTAL & WATER-RESOURCE CONSULTANTS

May 29, 2008

United States Environmental Protection Agency
Region VI – Technical Section (6PD-O)
Compliance Assurance & Enforcement Division
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Subject: Sparton Technology, Inc. Former Coors Road Plant Remedial Program
2007 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 2007, 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

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the New Mexico Environment Department, the U.S. Environmental Protection Agency, Sparton 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,

S. S. PAPADOPULOS & ASSOCIATES, INC.

Stavros S. Papadopulos, PhD, PE
Founder & Senior Principal

cc: Secretary, Sparton Technology, Inc., c/o Ms. Susan Widener
Ms. Terri Donahue, Controller, Sparton Technology, Inc.
Ms. Susan Widener (3 copies)
Mr. James B. Harris
Mr. Tony Hurst (2 copies)
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Mr. Michael Wetzel (electronic copy)

Sparton Technology, Inc.
Former Coors Road Plant
Remedial Program

2007 Annual Report

Prepared for:

Sparton Technology, Inc.
Rio Rancho, New Mexico

Prepared by:

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

In Association with:
Metric Corporation, Albuquerque, New Mexico

May 29, 2008

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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 2007 was the ninth 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 2007 was the sixth 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 2007, 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 223 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 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 the Groundwater Monitoring Program Plan (Monitoring Plan [Attachment A to the Consent Decree]) and the State of New Mexico Groundwater Discharge Permit DP-1184 (Discharge Permit). 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 above plan and permit 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 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 2007 and to predict concentrations in November 2008.[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

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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 2008 as part of the preparation of this 2007 Annual Report.

quickly developed a capture zone that controls any potential on-site sources that may be contributing to groundwater contamination. To restore the well discharge rate, which had declined in 2006, the well pump was replaced in May 2007 and the pipeline connecting the well to the air-stripper building was cleaned in June 2007. Except for a few days during the pump replacement, the well continued to maintain an adequate capture zone throughout 2007.

The extent of groundwater contamination, as defined by the extent of the TCE plume, did not change significantly during 2007. Of 56 wells sampled both in November 2006 and 2007, the 2007 concentrations of TCE were lower than in 2006 in 24 wells, higher in 9 wells, and remained the same in 23 wells (21 below detection limits). Well MW-60, at 5,700 micrograms per liter (µg/L) continued to be the most contaminated off-site well. The corresponding results for DCE were 17 wells with lower, 4 wells with higher, and 35 wells with the same (33 below detection limits) concentrations. The TCA plume ceased to exist during 2003, and this condition continued through 2007, 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 of contaminants in the water pumped from CW-1 since the beginning of its operation, and the concentrations detected at MW-60 indicate that there are still areas of high concentration upgradient from both CW-1 and MW-60. This conclusion is confirmed by the model calibration results.

Evaluation of the dissolved oxygen and oxidation/reduction potential data collected from monitoring wells annually since 1998 indicates that groundwater conditions at the site are not suitable for the degradation of TCE, or of other chlorinated solvents found at the site, through reductive dechlorination, and that further collection of these data is unlikely to provide useful information with respect to site remediation. The off-site and source containment wells operated at a combined average rate of 269 gpm during 2007. A total of about 141.1 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 1.192 billion gallons and represents 105 percent of the initial volume of contaminated groundwater (pore volume).

Approximately 500 kilograms (kg) (1,110 pounds [lbs]) of contaminants consisting of 470 kg (1,030 lbs) of TCE, 33 kg (73 lbs) of DCE, and 1.1 kg (2.4 lbs) of TCA were removed from the aquifer by the two containment wells during 2007. The total mass that was removed since the beginning of the of the current remedial operations is 4,990 kg (11,000 lbs) consisting of 4,695 kg (10,350 lbs) of TCE, 280 kg (620 lbs) of DCE, and 14 kg (31 lbs) of TCA. This represents about 68 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.

Deep Flow Zone (DFZ) monitoring well MW-79, which was installed in 2006 to address the continuing presence of contaminants in DFZ monitoring well MW-71R, continued to be free of any site-related contaminants throughout 2007. Well MW-71R, however, continued to be contaminated; TCE concentrations in the well were about 70 µg/L during the 2007 quarterly sampling events.

The containment systems were shut down several times during 2007 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 15 minutes to about 5 days and 7 hours.

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 plans and permits controlling system operation, groundwater discharge, and air emissions. One monitoring well that was dry during the last several years will be plugged and abandoned. A Fact Sheet covering the period of 2002 through 2007 will be prepared and, upon approval by the agencies, will be distributed to the property owners located above the plume and adjacent to the off-site treatment plant water discharge pipeline. Recalibration of the flow and transport model against data collected in 2008 and improvement of the model will continue in early 2009.

Table of Contents

Page

Figures

Tables

Appendices

List of Figures

List of Figures
(Continued)

List of Figures
(Continued)

List of Tables

List of Appendices

List of Acronyms

µg/L	Micrograms per liter
3rdFZ	Third depth interval of the Lower Flow Zone
cfm	cubic feet per minute
Cis-12DCE	cis-1,2-Dichloroethene
cm^2/s	Centimeter squared per second
CMS	Corrective Measure Study
COA	City of Albuquerque
Cr	Chromium
DCE	1,1-Dichloroethylene
DFZ	Deep Flow Zone below the 4800 — foot clay
DO	Dissolved Oxygen
ft	foot or feet
ft MSL	feet above Mean Sea Level
ft/d	feet per day
ft/yr	feet per year
ft^2	square feet
ft^2/d	feet squared per day
ft^3	cubic feet
g/cm^3	grams per cubic centimeter
gpd	gallons per day
gpm	gallons per minute
IM	Interim Measure
kg	Kilogram
lbs	Pounds
LLFZ	Lower Lower Flow Zone
MCL	Maximum Contaminant Level
Metric	Metric Corporation
mg/L	Milligrams per liter
mg/m^3	Milligrams per cubic meter
MSL	Mean Sea Level
mV	Millivolt
ND	Not Detected
NMED	New Mexico Environmental Department
NMEID	New Mexico Environmental Improvement Division
NMWQCC	New Mexico Water Quality Control Commission
ORP	Oxidation/Reduction Potential
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
VC	Vinyl Chloride
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 2007 constitutes the ninth 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 2007 constitutes the sixth 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 2007 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 2007,
- present the data collected during 2007 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 2006 is included in this section. Issues related to the year-2007 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 2007, 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 assemblages 1 and 2 represent basin-floor alluvial deposits; assemblage 1 is primarily sand and gravel with lenses of silty clay, and assemblage 2 is primarily sand with lenses of pebbly sand and silty clay. Lithofacies assemblage 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 89 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, 19 have been plugged and abandoned. The locations of the remaining 70 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, subsequent 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 0.28 ft/yr during the last four 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.

A discussion of water levels in the DFZ had not been included in past Annual Reports because data from only two monitoring wells (MW-67 and MW-71 or MW-71R) were available from this zone; these data indicated steep downward gradients across the 4,800-foot clay (water-level differences of about 6 feet between the LLFZ and the DFZ) but provided little information on the direction of groundwater flow in this zone. The installation of the third DFZ monitoring well (MW-79) in 2006, and the water-level data collected from the three DFZ wells since then indicate that the average direction of groundwater flow in the DFZ is to the west-northwest (W 18° N) with an average gradient of about 0.0023. This direction of flow and gradient are similar to those observed in the flow zones above the 4,800-foot clay.

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

[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.

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 2007 water-quality data, the initial dissolved TCE mass is currently estimated to be (see Table 6.1) about 6,880 kg (15,170 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 to be approximately 415 kg (915 lbs) and 21 kg (46 lbs), respectively. Thus, the total initial mass of dissolved contaminants is currently estimated to be about 7,315 kg (16,130 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 2006 Operations

During 1999 through 2006, 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 2006 included the following:

- Between December 31, 1998 and April 14, 1999, and from May 6, 1999 through December 31, 2006, 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, 2006 at a rate sufficient for containing any potential sources that may remain at the site. Two of the six infiltration ponds were backfilled in 2005 when an evaluation of the pond performance indicated that four ponds were sufficient for infiltrating the treated water.
- Groundwater monitoring was conducted as specified in the Groundwater Monitoring Program Plan, hereafter "Monitoring Plan," (Consent Decree, 2000, Attachment A) and in the State of New Mexico Groundwater Discharge Permit DP-1184 that controls the discharge of the treated water through the infiltration gallery and ponds, hereafter "Discharge Permit." Water levels in monitoring wells, containment wells, 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 Monitoring Plan and the Discharge Permit, and analyzed for TCE, DCE, TCA, and other constituents, as required by these documents.
- 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 2006 and to predict TCE concentrations in November 2007. Plans were made to continue the calibration and improvement of the model during 2007.

A total of about 923 million gallons of water, corresponding to an average rate of about 219 gpm, were pumped from the off-site containment well between the start of its operation and the end of 2006. Evaluation of quarterly water-level data indicated that containment of the contaminant plume was maintained throughout each year.

Between the start of its operation on January 3, 2002 and the end of 2006, the source containment well pumped a total of about 128 million gallons of water, corresponding to an average rate of 49 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 2006 was about 1.051 billion gallons, and represents about 93 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 2006 was about 4,290 kg (9,460 lbs) and consisted of 4,060 kg (8,950 lbs) of TCE, 225 kg (500 lbs) of DCE, and 9.4 kg (21 lbs.) of TCA. An additional 200 kg (440 lbs) of contaminants consisting of about 170 kg (375 lbs) of TCE, 24 kg (53 lbs) of DCE, and 3.4 kg (7.5 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 2006 was about 4,490 kg (9,900 lbs) consisting of 4,230 kg (9,320 lbs) of TCE, 249 kg (550 lbs) of DCE, and 13 kg (29 lbs) of TCA. This removed mass represented about 61.4 percent of the contaminant mass (61.5 percent of the TCE, 60.3 percent of the DCE, and 61.9 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 2006. 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. In 2006, the discharge rate of the source containment well began declining during the latter half of the year; it was thought that this was due to the inefficiency of its pump and plans were made to change the pump in 2007.

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 between its installation and the end of 2003

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 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 for the installation, testing, monitoring, and/or operation of this DFZ well, hereafter "the DFZ Well Work Plan," (SSP&A and Metric, 2004b) was submitted to USEPA/NMED on December 6, 2004. The DFZ Well 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 DFZ Well 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. The well was installed in February 2006, and the first samples from the well were obtained during its testing in April 2006. The analyses of these samples 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[6] presented to USEPA/NMED in June 2006. Based on the sampling results the well was designated as monitoring well MW-79, and added to the Monitoring Plan under a semi-annual sampling schedule..

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[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.

[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."

[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."

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. Three other water table monitoring wells became dry during 2004 through 2006 and several others were dry during one or more monitoring/sampling events during these three years. In 2006, the three wells that were continuously dry during this three-year period were scheduled for plugging and abandonment in 2007. 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.

Section 3
System Operations - 2007

3.1 Monitoring Well System

During 2007, water levels were measured in and samples were collected from all monitoring wells that were not dry and had sufficient water during the measurement or sampling event. Water levels were measured quarterly and samples were collected from each well at the frequency specified either in the Monitoring Plan, or the Discharge Permit.

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, were plugged and abandoned in 2007. Water levels could not be measured in well MW-33 during the first quarter, in wells MW-13 and MW-33 during the third quarter, and in wells MW-33 and MW-57 in the fourth quarter, because the wells were dry during these measurement events. In addition, wells MW-9, MW-13, MW-33, MW-48, MW53, MW-57, and MW-58 did not have sufficient water for sampling in November 2007; well MW-57, which is sampled quarterly, could not be also sampled in August 2007 because it did not again have sufficient water for sampling.

3.1.2 Deeper Flow Zones

There were no problems associated with the measurement of the water levels or with the sampling of monitoring wells completed in the ULFZ, LLFZ, or the DFZ.

3.2 Containment Systems

3.2.1 Off-Site Containment System

The Off-Site Containment System operated for about 8,712 hours, or 99.5 percent of the 8,760 hours available during 2007. The system was down for about 48 hours due to fourteen interruptions ranging in duration from 0.25 hours to about 12.60 hours. A summary of the downtime for the year is presented in Table 3.1 (a). These downtimes consisted of two shutdowns for routine maintenance activities, six shutdowns for system repairs, two shutdowns due to power failure, one shutdown due to the occurrence of "low level" in the chemical feed tank, two shutdowns due to gallery radio transmitter failure, and one shutdown for a high air stripper sump.

3.2.2 Source Containment System

The Source Containment System operated for about 8,538 hours, or 97.5 percent of the 8,760 hours available during 2007. The system was down for about 222 hours due to twelve interruptions ranging in duration from 0.50 hours to about 127.4 hours. A summary of the downtime for the year is presented on Table 3.1 (b). These downtimes consisted of two

shutdowns for routine maintenance activities, four shutdowns due power failure, and six shutdowns for system repairs, including the replacement of the well pump.

The rapid infiltration ponds performed well during 2007. Ponds 1 and 4 were used between the beginning of the year and October 5, 2007, and Ponds 1 and 4 were used from October 5, 2007 until the end of the year. 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

As the downtimes listed on Table 3.1 indicate the longest shutdown of a containment system during 2007 was the one that occurred between May 11 andd 16 for the replacement of the well pump on the source containment well CW-2. The pumping rate of well CW-2 had gradually declined to about 44 gpm near the end of 2006, and remained at about this rate during the first half of 2007. This decline in the pumping rate was attributed to the wear of the well pump and, therefore, the pump was replaced in May 2007. As suspected, the old pump was found to be worn, however, the new replacement pump did not improve the pumping rate of the well. Further testing indicated that the rate decline was actually due to the clogging, with iron and manganese deposits, of the pipeline between the well and the air-stripper building. The pipeline was cleaned with acid in June, and the pumping rate was restored to the full capacity of 50 gpm.

Section 4
Monitoring Results - 2007

The following data were collected in 2007 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 2007 in all monitoring wells that were not dry during the measurement event, 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 Monitoring Plan and the Discharge Permit. 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 2007, 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 (November 2007), are summarized on Table 4.2. Quarterly samples 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) were analyzed for VOCs (primarily TCE, DCE, and TCA), total chromium, iron, and manganese, as specified in the Discharge Permit. 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 (November 2007) 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.

In addition to the VOCs and the other constituents listed above and reported in this and in all past Annual Reports, fourth quarter (November) samples from the monitoring wells listed in the Monitoring Plan have been analyzed since 1998 for Dissolved Oxygen (DO) and Oxydation/Reduction Potential (ORP) to determine whether subsurface geochemical conditions

vary across a site, and whether those conditions may impact contaminant chemistry through naturally occurring redox reactions or biologically mediated degradation. The results of these analyses are presented in Appendix B.

4.2 Containment Systems

4.2.1 Flow Rates

The volumes of groundwater pumped by the off-site and source containment wells during 2007 and the corresponding flow rates are summarized on Table 4.3. As shown on this table, a total of about 141.1 million gallons of water, corresponding to a combined flow rate of 268 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 2007 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 fifteen 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 C-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 2007, as calculated from the totalizer data, are summarized on Table 4.3. As indicated on this table, approximately 117.1 million gallons of water, corresponding to an average rate of 223 gpm, were pumped in 2007.

4.2.1.2 Source Containment Well

The volume of the water pumped by the source containment well during 2007 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 nineteen 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 C-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 2007, as calculated from the totalizer data, are

summarized on Table 4.3. As indicated on this table, approximately 24.0 million gallons of water, corresponding to an average rate of 46 gpm, were pumped in 2007.

4.2.2 Influent and Effluent Quality

4.2.2.1 Off-Site Containment System

During 2007, 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 D-1. Concentrations of TCE, DCE, TCA, and total chromium in samples collected during 2007 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 2007, 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 D-2. Concentrations of TCE, DCE, TCA, and total chromium in samples collected during 2007 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 - 2007

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 2007 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 2007 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 2006) water-quality data from monitoring wells. (The November 2006 extent of the TCE plume is used as representative of the area that should have been contained during 2007.) Note, however, that the water-level maps for the second-quarter measurements made on May 15 (Figures 5.4, 5.5, and 5.6) do not show a capture zone for the source containment well CW-2. As discussed in Section 3.3, this well was shut down between May 11 and 16 to replace its pump and, therefore, the measurements made on May 15 do not reflect its capture zone.

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. Note also that well MW-63 had an unusually

high water level in November 2007 (see Figure 5.10). The hydrograph of this well indicates that since 2003 the water level at this location has been fluctuating between a low in August and a high in November and has a generally rising trend. These fluctuations and rising trend are attributed to seasonal lawn irrigation at a new apartment complex near this well.

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 vicinity of the ponds. Comparisons of the water-level data collected since the start of the operation of CW-2 and of the infiltration ponds on January 3, 2002 with those that prevailed prior to the start of CW-2 and pond operation indicate that, except for monitoring wells located near or along the southern limit of the 4,700-foot silt/clay, water levels in the wells completed above the 4970-foot silty/clay unit rose (see for example the hydrographs of wells MW-17 and MW-22 shown in Figure 2.5) in response to the infiltrating water. The rise of the water table ranged from less than one foot in well MW-63 to more than 8.5 ft in well MW-27, and caused well MW-21 which was dry since 2000 to have water again. After this initial rise, which occurred within less than a year and a half after the start of the CW-2 operation, the water levels in these wells started declining under the regional trends albeit at a smaller rate than unaffected wells. Exceptions were wells MW-63 and MW-51 north of the site which continued to rise (MW-63) or remained fairly stable (MW-51) under the influence of the seasonal lawn irrigation mentioned earlier. Six wells along or near the southern limit of the silt/clay unit (MW-07, MW-09, MW-12, MW-13, MW-23, and MW-33) were not significantly affected by the infiltrating water. The water level in these wells continued to decline after the start of the infiltration due to the off-setting effects of the regional declining trends (see for example the 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 zone of the off-site containment well 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. Except for the second quarter (Figures 5.5 and 5.6) these figures also show the capture zone of the source containment well. As shown in these figures, 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 2006 TCE plume, throughout the year. Hydraulic containment of the plume was, therefore, maintained throughout 2007. The figures also indicate that the source containment well CW-2 has developed a capture zone that, except for a few days in May,[8] contained during 2007 any potential on-site source areas that may still be contributing to groundwater contamination.

[8] The hydraulic conductivity of the sands below the 4,700-foot silt/clay unit is 25 ft/d and the non-pumping hydraulic gradient is about 0.005; assuming a porosity of 0.3, contaminants in the front end of CW-2's capture zone could have moved about 2 ft into the capture zone of CW-1 during the 5-day shut down of CW-2; however, it is more likely that they were captured by CW-2 when a larger capture zone developed after the pumping rate of the well was restored.

5.2 Groundwater Quality

5.2.1 Monitoring Well VOC Data

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 2007 concentration was 5.1 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; in fact, only four out of the ten such wells that were sampled in 2007 had TCE concentrations above 5 µg/L, with the highest concentration, 26 µg/L, detected in well MW-12. 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. During the first annual sampling in November 2005, the TCE concentration in this well rose to 720 µg/L from 170 µg/L during the previous year; however, since then the concentration began declining again reaching 160 µg/L in November 2006 and 120 µg/L in November 2007. 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 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; since then TCE concentrations in the well have declined to 5,700 µg/L in November 2007. The DCE and TCA concentrations in this well also declined from 830 µg/L and 59 µg/L in November 2004 to 410 µg/L and 21 µg/L, respectively, in November 2007. 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), remain relatively stable (see for example wells MW-48 and MW-56 in Figure 5.14), or increase in some others (see for example 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 2007. 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 MW-71R, obtained in February 2002, had a TCE concentration of 130 µg/L, and the well remained contaminated throughout 2002 and 2003. 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.[9] The well was installed in February 2006, and tested and sampled,in April 2006. Details on the installation, testing and sampling of the well were included in a letter-report[10] presented to USEPA/NMED in June 2006. Analysis of the aquifer test data was completed in 2007, and the results are presented in Appendix E. The first samples from the well, obtained during its testing in April 2006 and

[9] A more detailed discussion of the steps that led to the installation of this well is presented in Section 2.7

[10] 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."

again in May 2006, indicated that the well did not contain any site-related contaminants.[11] Based on these results the well was designated as monitoring well MW-79, and added to the Monitoring Plan under a semi-annual sampling schedule. Samples collected from the well since then continued to be free of any site-related contaminants. Well MW-71R, however, continued to be contaminated although the concentrations of contaminants declined since 2003; the November 2007 TCE concentration in the well was 74 μg/L.

The Fourth Quarter (November) 2007 water-quality data presented in Table 4.2 were used to prepare concentration distribution maps showing conditions near the end of 2007. The horizontal extent of the TCE and DCE plumes and the concentration distribution within these plumes in November 2007, 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[12] of the water pumped by the off-site containment well during the last nine years and from the source containment well during the last six years. Note that wells MW-53 and MW-58 were dry during the November 2007 sampling event (see Table 4.2). Lack of concentration data from at least one of these two wells causes difficulties in the preparation of the plume maps because of the large data gap between well MW-55 and the leading edge of the plume; therefore, in preparing the TCE and DCE plume maps presented in Figures 5.15 and 5.16, the November 2007 concentrations at the location of these wells were assumed to be the same as those measured in November 2006.

The extent of the TCE and DCE plumes in November 2007 (Figures 5.15 and 5.16) is similar to that in November 2006. Of 56 wells that were sampled both in November 2007 and 2006, the TCE concentrations were lower than in November 2006 in 24 wells, higher in 9 wells, and remained the same in 23 wells (21 below the detection limit of 1 μg/L). The corresponding numbers for DCE were 17 wells with lower, 4 wells with higher, and 35 wells with the same (33 below the detection limit of 1 μg/L) concentrations. The largest decrease was in well MW-60 where the concentration of TCE decreased by 1,800 μg/L, from 7,500 μg/L in 2006 to 5,700 μg/L in 2007, and that of DCE by 65 μg/L, from 475 μg/L to 410 μg/L. Other monitoring wells with relatively large decreases were MW-19 where TCE and DCE concentrations decreased by 210 μg/L and 16 μg/L, respectively, and MW-46 with decreases of 250 μg/L and 20 μg/L in the TCE and DCE concentrations. In wells where the concentrations increased, the increases were very small. Out of the nine wells where the TCE concentration increased, the increase was less than 5 μg/L in six, and the highest increase was 16 μg/L in well MW-56 where the concentration of TCE increased from 36 to 52 μg/L. In all four of the wells where the DCE concentration increased, the increase was 2 μg/L or less. The concentrations of TCA presented in Figure 5.17

[11] 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 any subsequent samples from the well.

[12] Area of origin refers to the areal extent of the volume of the aquifer within which the water pumped during a particular period 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.

indicate that a TCA plume (defined as the area with concentrations exceeding the more stringent of the federal or state allowable limits in groundwater) does not exist anymore, 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. In fact, the TCA concentration in November 2007 was below the detection limit of 1 µg/L in all but three wells, MW-46, MW-60, and MW-65; the highest concentration, 21.3 µg/L, 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 DCE concentration in the well then began decreasing to 65 µg/L in November 2006 and 48 µg/L in November 2007. 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 TCE concentration then began decreasing to 15 µg/L in November 2006 and 11 µg/L in November 2007. 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; then, it also began decreasing to 26 µg/L in November 2006 and 15 µg/L in November 2007. 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, or spill, south of the Sparton Site. Such a possibility is also supported by the presence of DCE (and past detections of 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 2007 in the TCE, DCE, and TCA concentrations at wells that were sampled during both sampling events are summarized on Table 5.1. Also included on this table are wells MW-72 and MW-73 which were installed in early 1999 and wells MW-77 and CW-2 which were installed in late 2001; the listed changes in these wells are between November 2007 and the first available sample from these wells. Of the 52 wells listed on Table 5.1, the TCE concentrations decreased in 30, increased in 10 and remained unchanged in 12 (below detection limits during both sampling events). The corresponding number of wells where concentrations decreased, increased, or remained unchanged are 24, 9, and 19 for DCE, and 23, 2, and 27 for TCA. The distribution of the concentration changes, based on the changes

in 34 wells that were used for plume definition, 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 2007. Among these 34 wells, TCE concentrations decreased in 23 wells, increased in 7 wells, and remained unchanged in 4 wells; the corresponding number of these wells where concentrations decreased, increased, or remained unchanged are 18, 7, and 9 for DCE, and 19, 2, 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 6,192, 5,580, and 6,486 µg/L, respectively, from levels that were in the 5,500-6,500 µg/L range in 1998 to levels of 20 µg/L and less in 2007; DCE concentrations in these three wells decreased by 400, 73, and 590 µg/L, 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 (860 µg/L), and on-site ULFZ well MW-19 (366 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 generally at levels between 1,000 and 1,400 µg/L throughout its years of operation; the TCE concentration in the well was 1,000 µg/L in November 2007. In well MW-19, the TCE concentration was 4.2 µg/L in 1998 and 370 µg/L in November 2007. 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 2007 concentrations in the well were 56 µg/L for DCE and ND for TCA. (see Table 4.2). The increase in contaminant concentrations that occurred in well MW-19 between 2002 and 2005 is attributed to residual contaminants within the 4970-foot silt/clay unit that were mobilized by the higher leakage rates induced through this unit by the operation of the source containment well and the associated on-site infiltration ponds; the subsequent decreases in concentration indicate that these residual contaminants are being depleted.

The persistence of the high concentrations of contaminants 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 that there are still areas of high concentration upgradient from both the off-site containment well and MW-60. This conclusion is confirmed by the model calibration results discussed in Section 6.

5.2.2 Monitoring Well DO and ORP Data

From 1998 through 2007, over 500 pairs of measurements of DO and ORP were collected during annual sampling events at the Sparton site. These field parameters can be evaluated to determine whether subsurface geochemical conditions vary across a site, and

whether those conditions may impact contaminant chemistry through naturally occurring redox reactions or biologically mediated degradation.

If appropriate bacterial populations are present in the subsurface, TCE may degrade via sequential reductive dechlorination reactions under anerobic conditions (Wiedemeier, et al. 1999). Anaerobic conditions suitable for reductive dechlorination are indicated by low concentrations of DO [less than 0.5 milligrams per liter (mg/L)] and negative values of ORP [less than 0 millivolts (mV)] indicative of iron-reducing, sulfate-reducing, or methanogenic conditions. Evidence for such degradation reactions include the presence of the daughter products cis-1,2-dichloroethene (cis-12DCE) and vinyl chloride (VC) as well as the appropriate redox conditions.

A plot of the DO and ORP data that have been collected to date for the Sparton site is presented in Figure 5.21. As indicated in this figure, most of the DO concentrations (about 85 percent) exceed 0.5 mg/L. Similarly, 98 percent of the ORP values are positive. Collectively, these data indicate that aerobic conditions dominate across the site for the period of record. The correlation between ORP and DO values is not strong. Overall, these data indicate that groundwater conditions are not likely to support degradation of TCE through reductive dechlorination.

The VOC data collected over the same time period are consistent with this interpretation. Between 1998 and 2007, cis-12DCE was detected 11 times at only 4 locations, generally at concentrations less than 5 µg/L, and there were no detections of VC. The majority of cis-12DCE detections occurred in wells MW-25 and MW-60, two wells that are not near each other. It is possible that some locally reducing conditions are present in micro-environments upgradient or near these monitoring wells. It is also possible that the cis-12DCE detected was present as a contaminant in the source area. It is clear, however, that for the site as a whole, redox conditions are not suitable for TCE degradation.

Dissolved chromium is another contaminant of concern at this site. Under aerobic conditions, chromium is soluble primarily in the +6 oxidation state. Data collected during the 1998-2007 period indicate that when both total chromium and hexavalent chromium were measured, the two values were identical or very similar. This observation is consistent with generally oxidizing groundwater conditions, as described above.

Based on this evaluation of the DO and ORP data collected from monitoring wells at the Sparton site since 1998, it is concluded that:

- Groundwater conditions at the site are generally aerobic;
- Under these conditions, degradation of TCE or other chlorinated solvents via reductive dechlorination is unlikely;
- Other geochemical indicators, including the absence of significant cis-12DCE and the predominance of hexavalent chromium, are consistent with the DO and ORP data; and

- Further monitoring of these wells for ORP and DO is unlikely to provide useful information with respect to site remediation.

5.3 Containment Systems

5.3.1 Flow Rates

A total of about 141.1 million gallons of water, corresponding to an average pumping rate of about 268 gpm, were pumped during 2007 from the off-site and source containment wells [see Table 4.3. The volume of water pumped during each year of the operation of the containment wells is summarized on Table 5.2. As shown on this table, the total volume pumped from both wells since the beginning of remedial pumping in December 1998 is about 1.192 billion gallons, and represents approximately 105 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 2007 is shown on Table 4.3; a plot of the monthly production is presented in Figure 5.22. Based on the total volume of water pumped during the year (approximately 117.1 million gallons), the average discharge rate for the year was 223 gpm. Due to a few downtimes (see Table 3.1), the well was operated 99.5 percent of the time available during the year, thus the average discharge rate of the well during its operating hours was about 224 gpm.

The volume of water pumped during each year of the operation of the well is summarized on Table 5.2. As shown on this table, the off-site containment well pumped a total of about 1.040 billion gallons of water from the aquifer since the beginning of its operation in December 1998, This represents approximately 92 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 5.23.

5.3.1.2 Source Containment Well

The volume of water pumped from the source containment well during each month of 2007 is shown on Table 4.3; a plot of the monthly production is presented in Figure 5.22. Based on the total volume of water pumped during the year (approximately 24.0 million gallons), the average discharge rate for the year was 46 gpm. The well was operated 97.5 percent of the time available during the year, thus the average discharge rate of the well during its operating hours was about 47 gpm, .The discharge rate of the well declined during the latter half of 2006 to a monthly average of 44 gpm and continued at about this rate during the first four months of 2007. To restore the discharge rate of the well to 50 gpm, its pump was replaced over the period of May 11-16, 2007; however, further testing, conducted when the new pump failed to restore the discharge rate, indicated that the rate reduction was actually due to the clogging with iron and

manganese deposits of the pipeline between the well and the air-stripper building. The pipeline was cleaned with acid in June and the well was restored to full capacity.

The volume of water pumped during each year of the operation of the well is summarized on Table 5.2. As shown on this table, the source containment well pumped a total of about 152 million gallons of water from the aquifer since the beginning of its operation in January 3, 2002. This represents approximately 13 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 source containment well is presented in Figure 5.23. Also shown in Figure 5.23 is a cumulative plot of the volume of water pumped by both containment wells.

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 2007, 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 5.24.

The concentrations of TCE in the influent during 2007 ranged from 1,500 μg/L detected in the January sample to 950 μg/L in the June sample; the average concentration for the year was about 1,050 μg/L. The highest (100 μg/L) and the lowest (65 μg/L) concentrations of DCE were detected in the January and August samples, respectively; the average concentration for the year was 72 μg/L. Concentrations of TCA in the influent fluctuated within a relatively narrow range (4.5 μg/L to below the detection limit of 1 μg/L) and averaged about 3 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 21 μg/L.

The concentrations of TCE, DCE, and TCA in the air stripper effluent were below the detection limit of 1 μg/L throughout 2007. Total chromium concentrations in the effluent were essentially the same as those in the influent.

5.3.2.2 Source Containment System

The 2007 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 5.24.

The concentrations of TCE in the influent during 2007 ranged from 100 μg/L to 160 μg/L, and averaged about 130 μg/L. The concentrations of DCE fluctuated within a relatively narrow range during the year and averaged about 16 μg/L. The concentrations of TCA in the influent were below the detection limit of 1 μg/L throughout the year. 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.

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 period was originally stored is referred to as the "area of origin" of the water pumped during that period. The approximate areas of origin of the water pumped from the off-site containment well during the last nine years and from the source containment well during the last six 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. Note that the areas of origin of the water pumped by each well during the first few years of its operation (1999-2001 for the off-site and 2002-2004 for the source containment well) are slightly elliptical areas 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 area of origin. The elliptical shape and the off-centered location with respect to the containment wells are controlled by the capture zone of each well which in turn is a function of the regional gradient and of the pumping rate of each well. For a given gradient, a smaller pumping rate results in a narrower capture zone and, hence, more elliptical areas of origin.

5.3.3.1 Off-Site Containment Well

Approximately 1.040 billion gallons of groundwater have been removed from the aquifer during the nine-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 2.90 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 3.23 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 152 million gallons of groundwater have been removed from the aquifer during the six-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 1.69 million ft^2. The extent of the model calculated areas of origin for this well shown in Figure 5.15 is about 1.13 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 502 kg (1,110 lbs) of contaminants, consisting of 468 kg (1,032 lbs) of TCE, 33 kg (73 lbs) of DCE, and 1.1 kg (2.4 lbs) of TCA, were removed by the two containment wells during 2007 [see Table 5.3 (a)]. The total mass of contaminants removed by the two containment wells during each year of their operation is summarized on Table 5.4 (a). As shown on this table, the total mass removed by the containment wells since the beginning of the current remedial operations in December 1998 is about 4,990 kg (11,000 lbs), consisting of about 4,695 kg (10,350 lbs) of TCE, 282 kg (622 lbs) of DCE, and 14 kg (31 lbs) of TCA. This represents about 68.2 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 2007 were estimated using the monthly discharge volumes presented on Table 4.3 and the concentration of these compounds shown on Table 4.4 (a). These monthly removal rates are summarized on Table 5.3 (b) and plotted in Figure 5.25. As shown on Table 5.3 (b), about 490 kg (1,078 lbs) of contaminants, consisting of about 456 kg (1,006 lbs) of TCE, 32 kg (70 lbs) of DCE, and 1.0 kg (2.3 lbs) of TCA were removed by the off-site containment well during 2007.

The mass of contaminants removed by this well during each year of its operation is summarized on Table 5.4 (b), and a plot showing the cumulative mass removal by the off-site containment well is presented in Figure 5.26. As shown on this table and figure, by the end of 2007 the off-site containment well had removed a total of approximately 4,780 kg (10,540 lbs) of contaminants, consisting of approximately 4,515 kg (9,950 lbs) of TCE, 257 kg (567 lbs) of DCE, and 10.5 kg (23.1 lbs) of TCA. This represents about 65.3 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 2007 were estimated using the monthly discharge volumes presented on Table 4.3 and the concentration of these compounds shown on Table 4.4 (b). These monthly removal rates are summarized on Table 5.3 (c) and plotted in Figure 5.25. As shown on Table 5.3 (c), about 13 kg (29 lbs) of contaminants, consisting of about 11.5 kg (25.3 lbs) of TCE, 1.4 kg (3.2 lbs) of DCE, and 0.04 kg (0.1 lbs) of TCA were removed by the source containment well during 2007.

The mass of contaminants removed by this well during each year of its operation is summarized on Table 5.4 (c), and 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 5.26. A cumulative plot of the mass removed by both containment wells is also shown in Figure 5.26. As shown on Table 5.4 (c) and Figure 5.26, the total mass of contaminants removed by the well by the end of 2007 was about 209 kg (462 lbs), consisting of 181 kg (398 lbs) of TCE, 25 kg (56 lbs) of DCE, and 3.4 kg (7.6 lbs) of DCA. This represents about 2.9 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 the Discharge Permit (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. Until 2006, this permit required the results of the analyses to be reported quarterly; however, the permit was renewed on December 29, 2006 and under the terms of the renewed permit reporting requirements have been reduced to annually.

As required by the renewed Discharge Permit, the analysis results of all samples collected during 2007 were reported to the NMED Groundwater Bureau on January 30, 2008. The sampling results met the permit requirements throughout the year.

No violation notices were received during 2007 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 2007.

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 2007. No violation notices were received during 2007 for activities associated with operation of the source containment system.

5.5 Contacts

In November 2007, 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,[13] 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 six 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 2007.

[13] 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 flow 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 Decree. 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). 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 models have been used to simulate groundwater levels and TCE concentrations in the aquifer from start-up of the off-site containment well in December 1998 through December 2008.

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. In analyzing aquifer test data from MW-79 using a numerical model, as described in Appendix E, the geologic materials below the 4800-foot clay unit were represented by four layers, rather than one layer. In the model update that will be completed next year, a similar layer structure will be incorporated in the regional model. Incorporating this new structure will not significantly change simulated groundwater flow conditions and TCE transport in the model layers above the 4800-foot clay unit.

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-level 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, declined at an average rate of 0.6 ft per year between 1992 and 1999 and in recent years have been declining at an average rate of 0.28 feet. 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	0.0078	0.00058		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 pumping rate in 2007 was 223 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 pumping rate in 2007 was 46 gpm. Ninety-nine percent of the treated water from this well is assumed to infiltrate back to the aquifer from the 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 six original ponds, but starting with 2003 the discharge was rotated only among ponds 1 through 4 (see Figure 2.10 for pond locations), and ponds 5 and 6 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 465 gpm in 2007.

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 SSP&A, 2004).

A new recalibration of the groundwater flow model was not conducted this year. The average water levels for 2007 were added to the set of calibration targets and a transient simulation between December 1998 and December 2007 was conducted. The results of this simulation indicated that the model, as calibrated for the 2003 Annual Report, was able to match satisfactorily the 2007 water levels, and that, therefore, further recalibration was not necessary this year. The transient simulation between December 1998 and December 2007 and its results are discussed in the next section.

6.1.3 Transient Simulation – December 1998 to December 2007

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 2007. With the exception of the month-long stress period for December 1998, annual stress periods were used in the transient simulation. The average annual pumping rates specified for the containment wells CW-1 and CW-2 were those specified on Table 5.2. The calculated water levels at the end of this simulation, representing December 2007, 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 2007 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 the average water level in each monitoring well during each year of the simulation, based on water-level measurements made between 1999 and 2007, against the calculated average water level in each well.[14] 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 561 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 684 ft^2. The minimum residual is -3.05 ft and the maximum residual is 4.54 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 about 28.5 ft, and seasonal fluctuations of water levels are on the order of several feet. The residuals at each monitoring well for each monitoring period and the calibration statistics are presented in Appendix F.

6.1.4 Capture Zone Analysis

The capture zones of containment wells CW-1 and CW-2 in 2007 were calculated using particle tracking. The particle tracking was applied to the calculated average 2007 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 average 2007 water levels and capture zones are based on the average annual pump rates at CW-1 and CW-2.

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 2007. 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

[14] The calculated July water level during each year was used as the average calculated water level.

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 between 1999 to 2007 was located at the start of extraction in 1998 and where the water extracted at CW-2 between 2002 to 2007 was located at the start of extraction in January 2002. The areas for different extraction periods 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 2007 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 2007 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 2008.

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 used to predict TCE concentrations in the aquifer between January 2008 and December 2008. 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 2007, DCE was about 6 percent of the total mass of chlorinated volatile organic compounds extracted by CW-1 and 11 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; prior to 2003 TCA had been detected at levels above 60 μg/L in only one off-site well, MW-46. The concentrations of TCA have been below 60 μg/L since 2003; the maximum TCA concentration reported this year was 21 μg/L at MW-60. 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 and Model Calibration

The model has been re-calibrated each year, except in 2006, 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 calibration procedure has varied through time. For this report, the initial concentration distribution was interpolated based on the November 1998 measured concentration data and a number of the pilot points along the center line of the plume using three-dimensional kriging. The parameter estimation program PEST (Doherty, 2002) was used to estimate TCE concentrations at the pilot points. Calibration procedures used in previous years are described in the 2006 Annual Report (SSP&A, 2007). 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 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 6,881 kg (15,171 lbs). The estimate of initial mass has varied with each recalibration of the model as additional information has been learned from long-term operation of the source containment wells, though the estimate of mass has not changed significantly since 2003. The estimates of initial mass presented in previous annual reports as estimated from model recalibration are listed below:

Year	Estimated Initial Mass (kg)
1999	2178
2000	3097
2001	3295
2002	4647
2003	7342

Year	Estimated Initial Mass (kg)
2004	6638
2005	6908
2006	6908
2007	6881

6.2.3 Model Calculated TCE Mass Removal Rates and Concentration

The observed TCE mass removal and TCE concentrations at CW-1 and CW-2 near the end of each year of system operation and the mass removal rates and concentrations calculated with the recalibrated transport model are tabulated below:

Date	Cumulative TCE mass removed by both wells (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
1/4/2008	4,692	4,702	960	969	100	133

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 2007, though, slightly overestimated 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 2007, the correspondence between observed and calculated concentrations is excellent.

The average calculated concentration at CW-1 during 2007 was 1020 μg/L, slightly less than the average measured concentration of 1050 μg/L based on monthly samples. The average calculated concentration at CW-2 during 2007 was 144 μg/L which was slightly higher than the average measured concentration of 130 μg/L

A comparison of calculated to observed concentrations of TCE at all monitoring wells for all samples analyzed between November 1998 and November 2007 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 2007 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 2008

The groundwater transport model was applied to predict TCE concentrations through December 2008 after 121 months of pumping at well CW-1, and after 84 months of pumping at CW-2. In this predictive simulation, the 2008 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 2007 are specified as the initial conditions for the predictive groundwater transport model.

The predicted TCE concentrations in December 2008 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 404 kg (961 lbs) of TCE by containment well CW-1 and 11.4 kg (23 lbs) from containment well CW-2 is predicted for the period of January 2008 to December 2008. The calculated TCE concentration in December 2008 is 855 μg/L at well CW-1 and 109 μg/L at CW-2.

The calibrated TCE concentrations in November 1998 prior to start of groundwater extraction, the calculated TCE concentrations in November 2001, November 2004, November 2007, and the predicted TCE concentrations for November 2008 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 noted in Section 6.1.1, the number of layers in the groundwater model will be increased next year to better represent the stratrigraphy below the 4800-foot clay unit. 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 2007 was the ninth 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[15] on-site infiltration ponds, and (4) associated conveyance and monitoring components. The year 2007 was the sixth 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 2007, 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 223 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 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 the Groundwater Monitoring Program Plan (Monitoring Plan [Attachment A to the Consent Decree]) and the State of New Mexico Groundwater Discharge Permit DP-1184 (Discharge Permit). 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 above plan and permit 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 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 2007 and to predict concentrations in November 2008.[16]

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

[15] 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.

[16] This task was carried out in early 2008 as part of the preparation of this 2007 Annual Report.

quickly developed a capture zone that controls any potential on-site sources that may be contributing to groundwater contamination. To restore the well discharge rate, which had declined in 2006, the well pump was replaced in May 2007 and the pipeline connecting the well to the air-stripper building was cleaned in June 2007. Except for a few days during the pump replacement, the well continued to maintain an adequate capture zone throughout 2007.

The extent of groundwater contamination, as defined by the extent of the TCE plume, did not change significantly during 2007. Of 56 wells sampled both in November 2006 and 2007, the 2007 concentrations of TCE were lower than in 2006 in 24 wells, higher in 9 wells, and remained the same in 23 wells (21 below detection limits). The corresponding numbers for DCE were 17 wells with lower, 4 wells with higher, and 35 wells with the same (33 below detection limits) concentrations. Well MW-60, at 5,700 µg/L continued to be the most contaminated off-site well. The TCA plume ceased to exist during 2003, and this condition continued through 2007, 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 of contaminants in the water pumped from CW-1 since the beginning of its operation, and the concentrations detected at MW-60 indicate that there are areas of high concentration upgradient from both CW-1 and MW-60. This conclusion is confirmed by the model calibration results.

Evaluation of the dissolved oxygen and oxidation/reduction potential data collected from monitoring wells annually since 1998 indicates that groundwater conditions at the site are not suitable for the degradation of TCE, or of other chlorinated solvents found at the site, through reductive dechlorination, and that further collection of these data is unlikely to provide useful information with respect to site remediation.

The off-site and source containment wells operated at a combined average rate of 269 gpm during 2007. A total of about 141.1 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 1.192 billion gallons and represents 105 percent of the initial volume of contaminated groundwater (pore volume).

Approximately 500 kg (1,100 lbs) of contaminants consisting of 470 kg (1,030 lbs) of TCE, 33 kg (73 lbs) of DCE, and 1.1 kg (2.4 lbs) of TCA were removed from the aquifer by the two containment wells during 2007. The total mass that was removed since the beginning of the of the current remedial operations is 4,990 kg (11,000 lbs) consisting of 4,695 kg (10,350 lbs) of TCE, 280 kg (620 lbs) of DCE, and 14 kg (31 lbs) of TCA. This represents about 68 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.

DFZ monitoring well MW-79, which was installed in 2006 to address the continuing presence of contaminants in monitoring well MW-71R, continued to be free of any site-related contaminants throughout 2007. Well MW-71R, however, continued to be contaminated; TCE concentrations in the well were about 70 µg/L during the 2007 quarterly sampling events.

The containment systems were shutdown several times during 2007 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 15 minutes to about 5 days and 7 hours.

7.2 Future Plans

The off-site and source containment systems will continue to operate during 2008. Data collection will continue in accordance with the Monitoring Plan and the Discharge Permit, 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 well MW-33 was dry throughout 2007 and could not be sampled. This well was also dry during the first three quarters of 2006 and did not have sufficient water for sampling in the fourth quarter of 2006. It is proposed that this well be plugged and abandoned in 2008. Monitoring well MW-13 was dry during the third and fourth quarters of 2007 and well MW-57 was dry during the fourth quarter. These two wells and wells MW-9, MW-48, MW-53, and MW-58, which did not have sufficient water for sampling, were not sampled in November 2007. Conditions in these wells will continue to be monitored during 2008 to assess whether they should be abandoned, and if abandoned, whether they should be replaced. If wells MW-53 and MW-58 continue to have insufficient water for sampling, one of these wells, MW-53, will be deepened during 2008.

Based on the evaluation of the DO and ORP data collected from monitoring wells since 1998, and the conclusion that these data are unlikely to provide any useful information on site remediation, it is proposed that collection of these data be discontinued upon approval of this Annual Report.

Since the Draft Fact Sheet for 2002 through 2004 has not yet been approved by USEPA and NMED, a new the Fact Sheet covering the period of 2002 through 2007 will be prepared in 2008, and if approved by the agencies, it 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

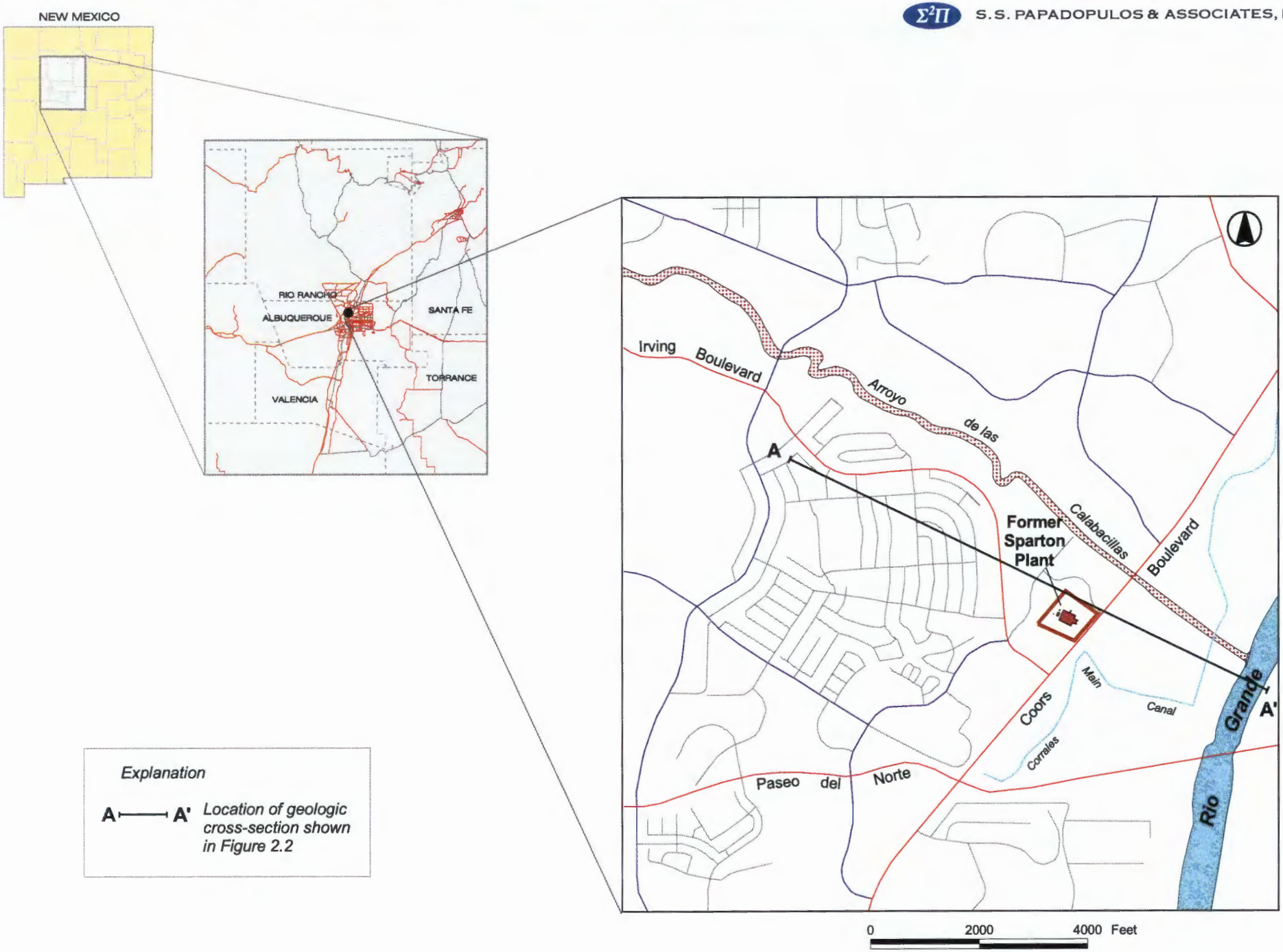


Figure 1.1 Location of the Former Sparton Coors Road Plant

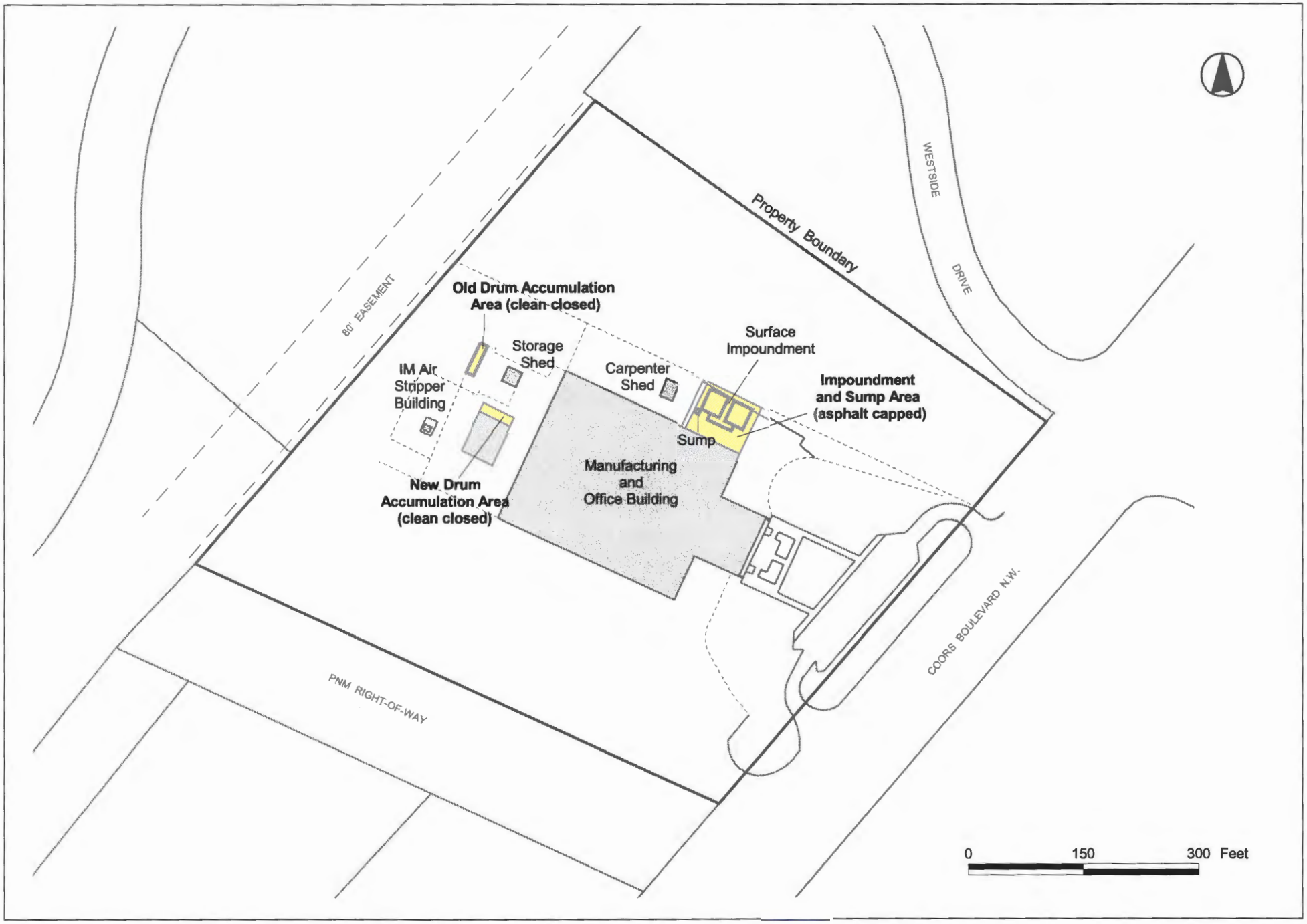
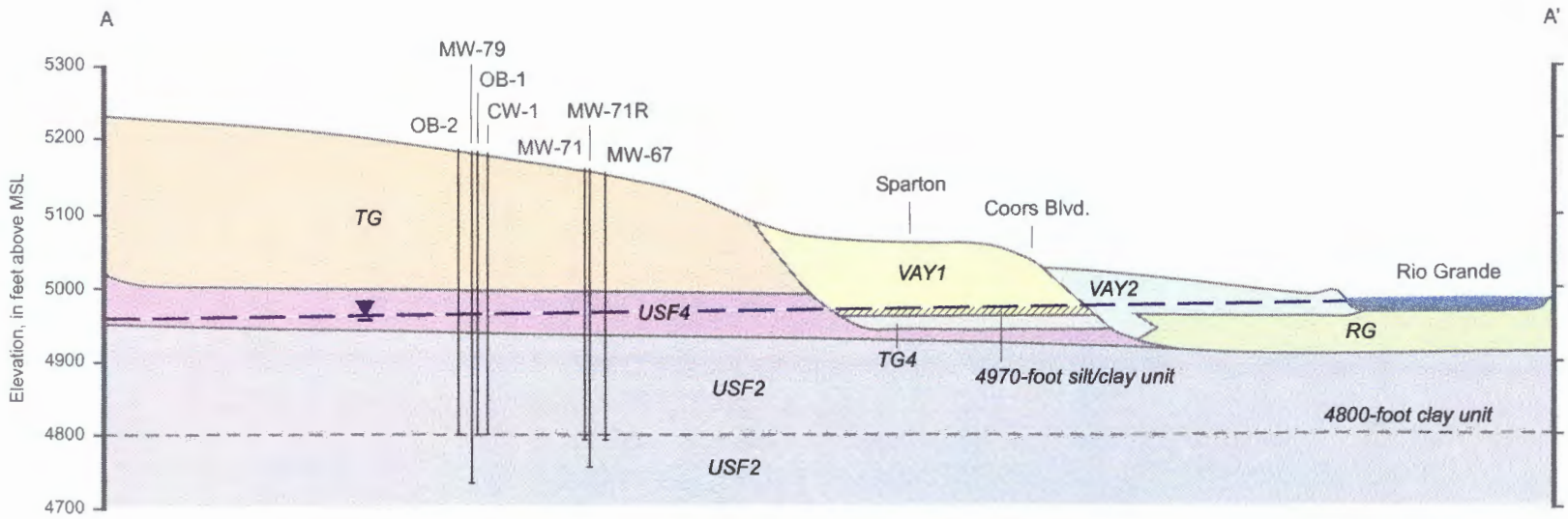


Figure 2.1 The Former Sparton Coors Road Plant



Vertical Exaggeration 5x

Note: See Figure 1.1 for location of cross section

Explanation

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

Figure 2.2 Geologic Cross Section Showing Shallow Deposits

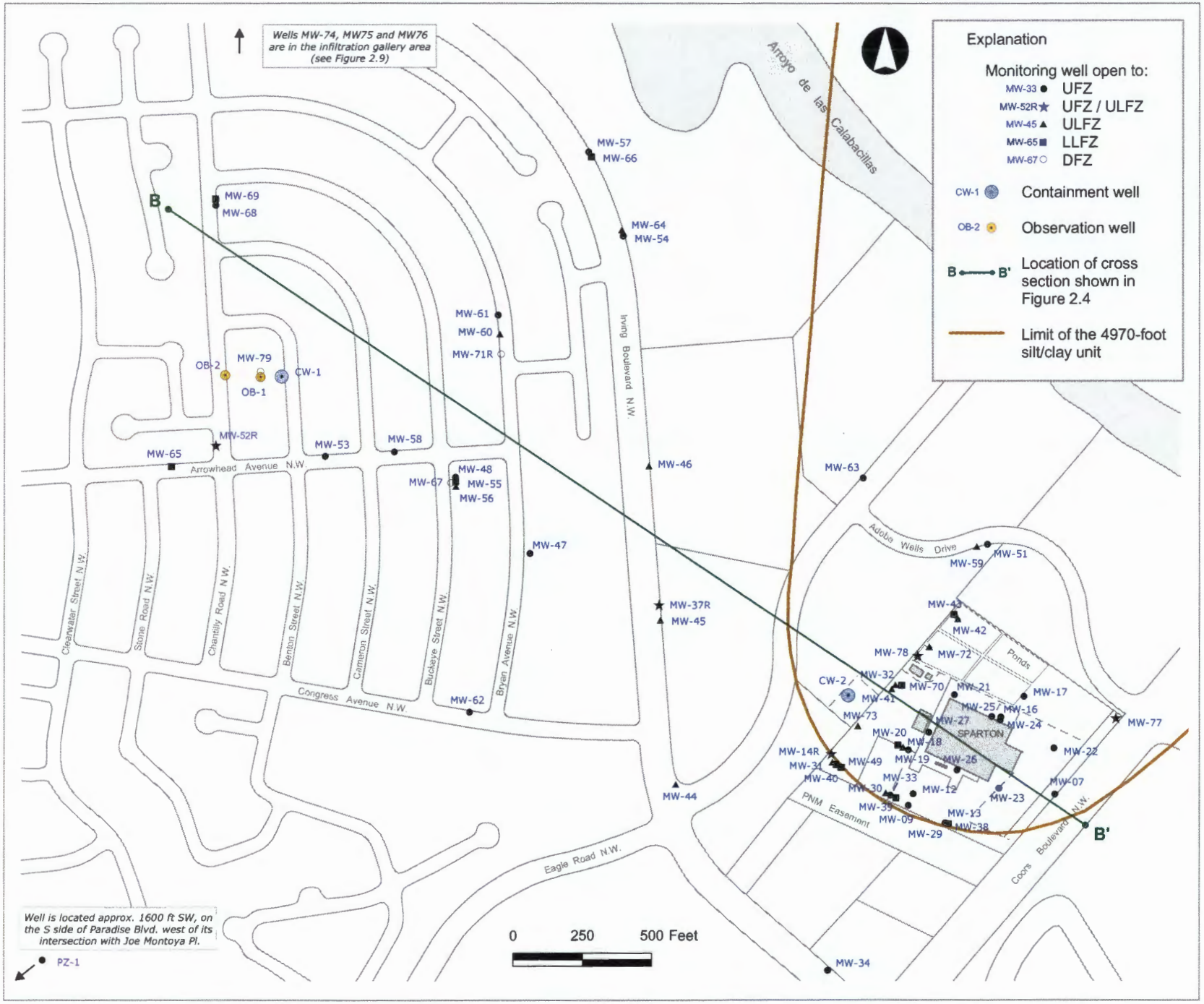


Figure 2.3 Location of Wells

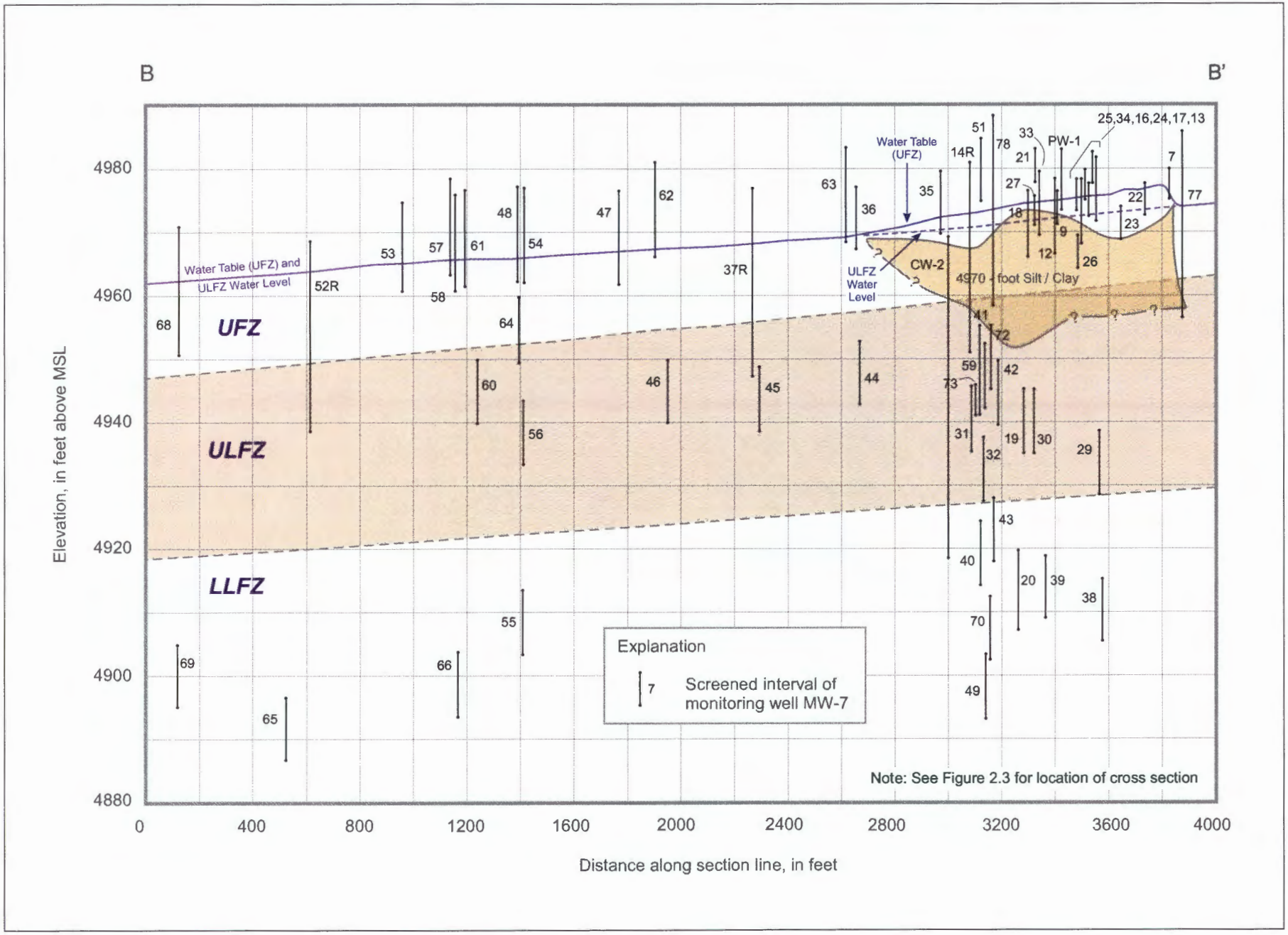


Figure 2.4 Schematic Cross-Section Showing Screened Interval of Monitoring Wells and Relation to Flow Zones

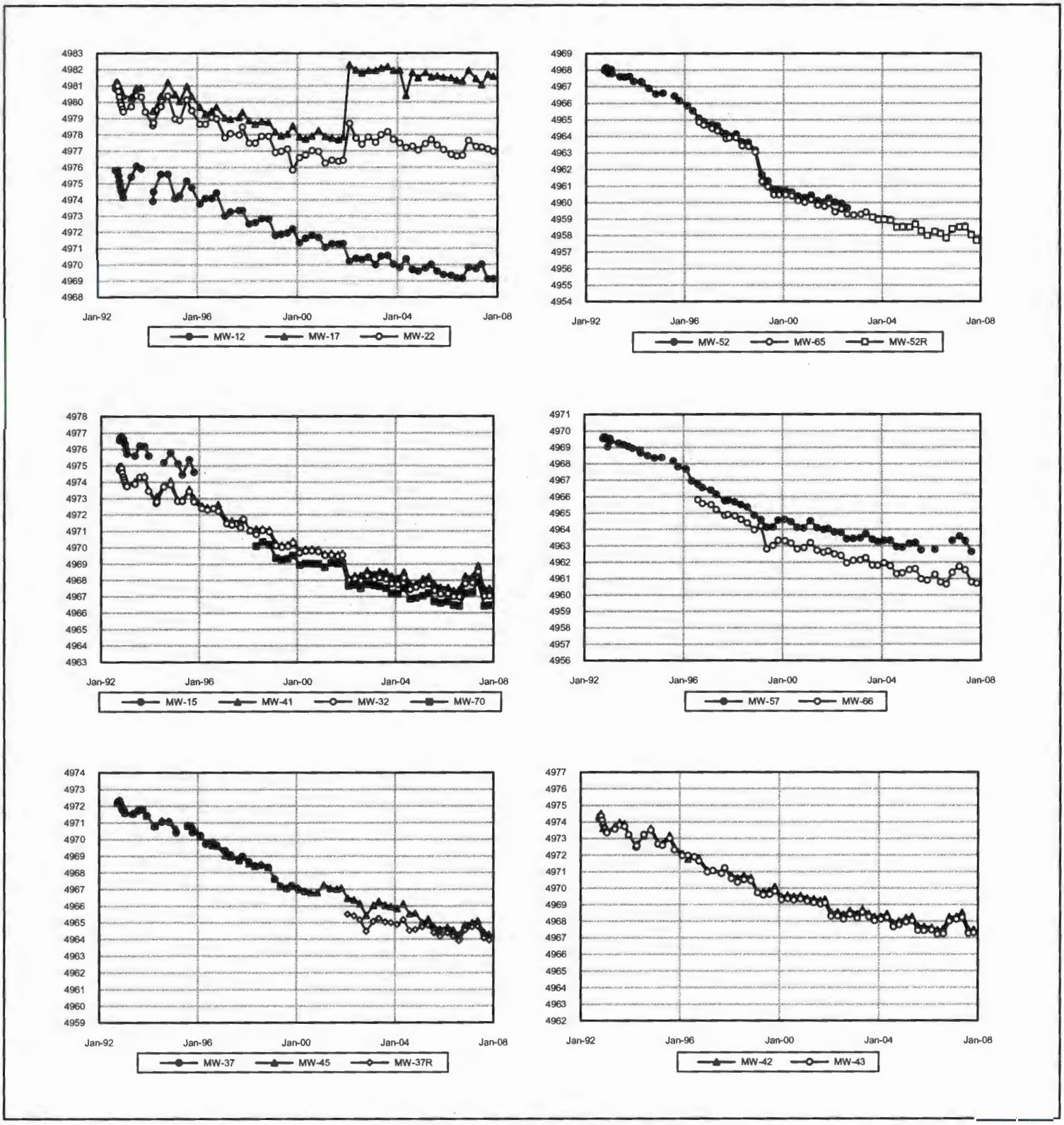


Figure 2.5 Monitoring Well Hydrographs

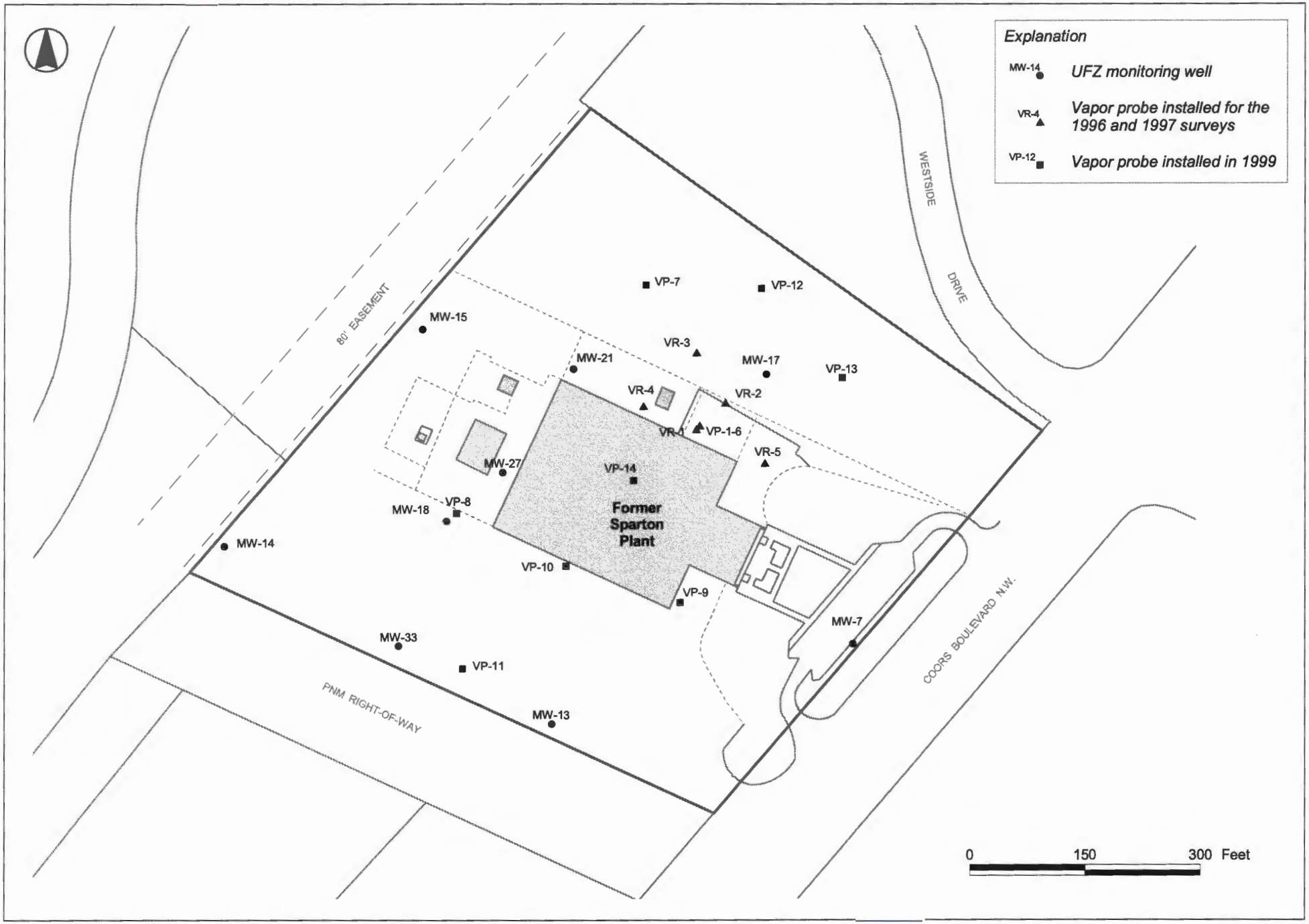


Figure 2.6 Location of Vapor Probes and On-Site Monitoring Wells Used in Vadose Zone Characterizations

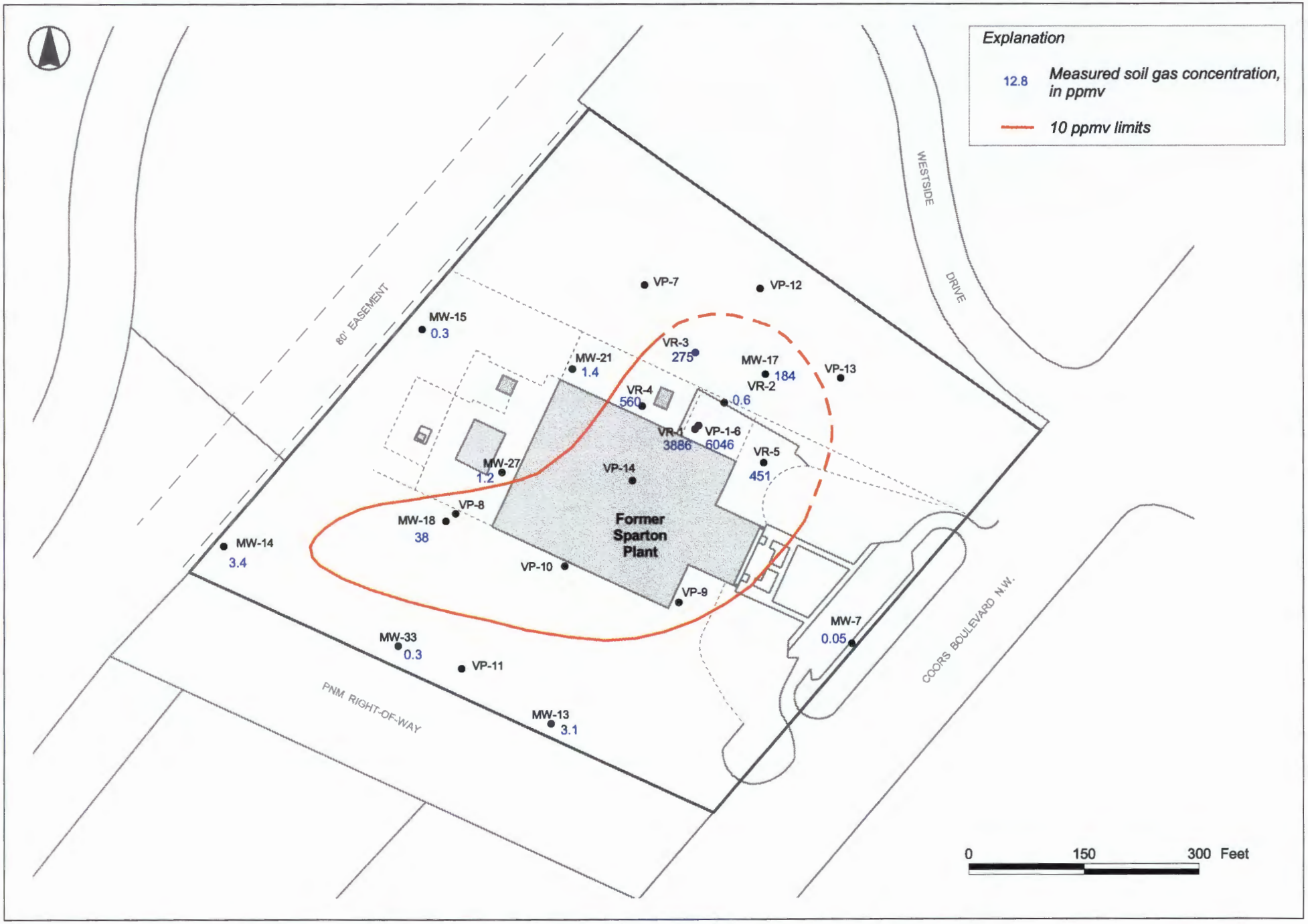


Figure 2.7 TCE Concentrations in Soil Gas - April 1996 - February 1997 Survey

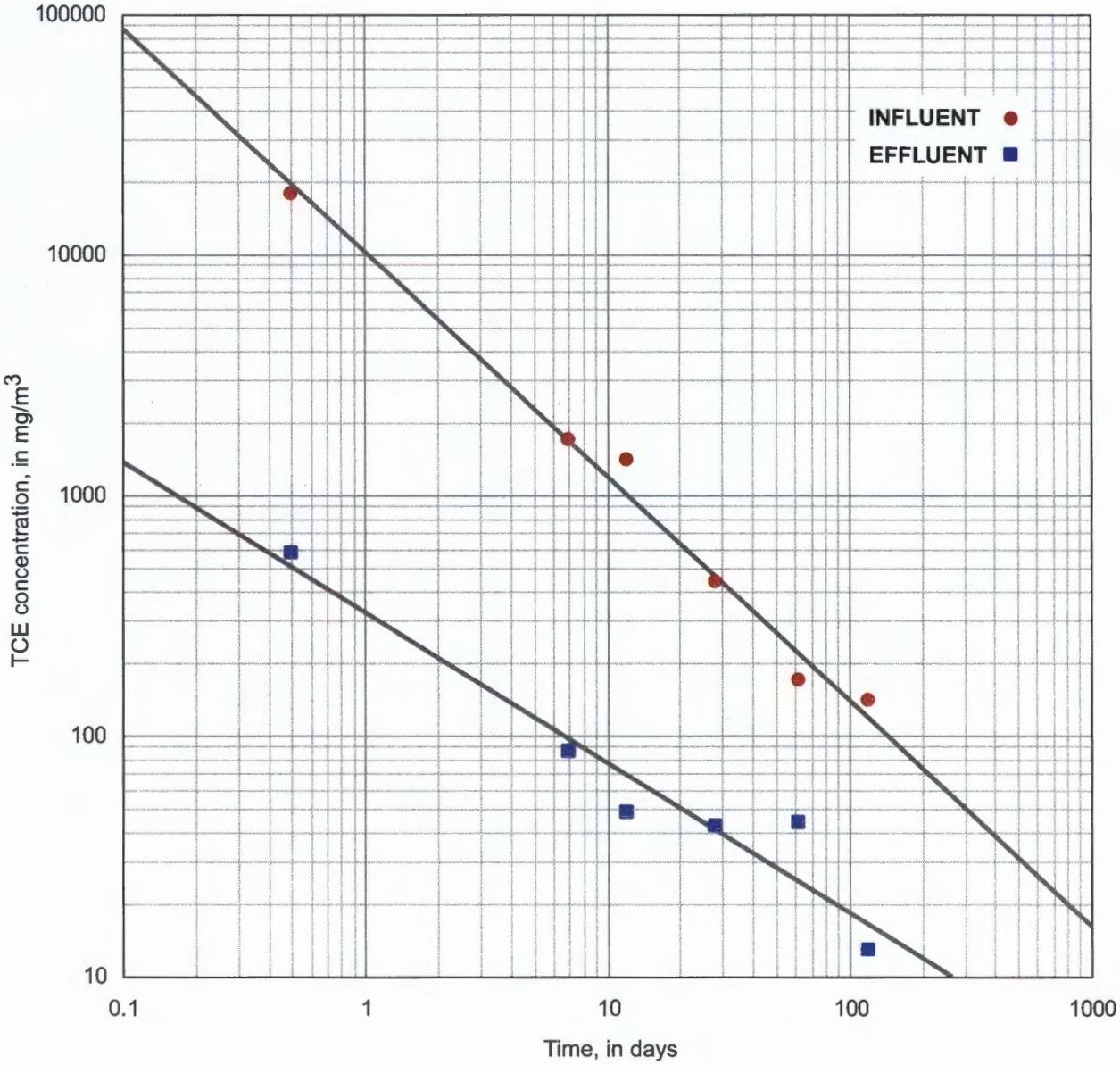


Figure 2.8 Influent and Effluent Concentrations - SVE Operation
April 8 - October 20, 1998

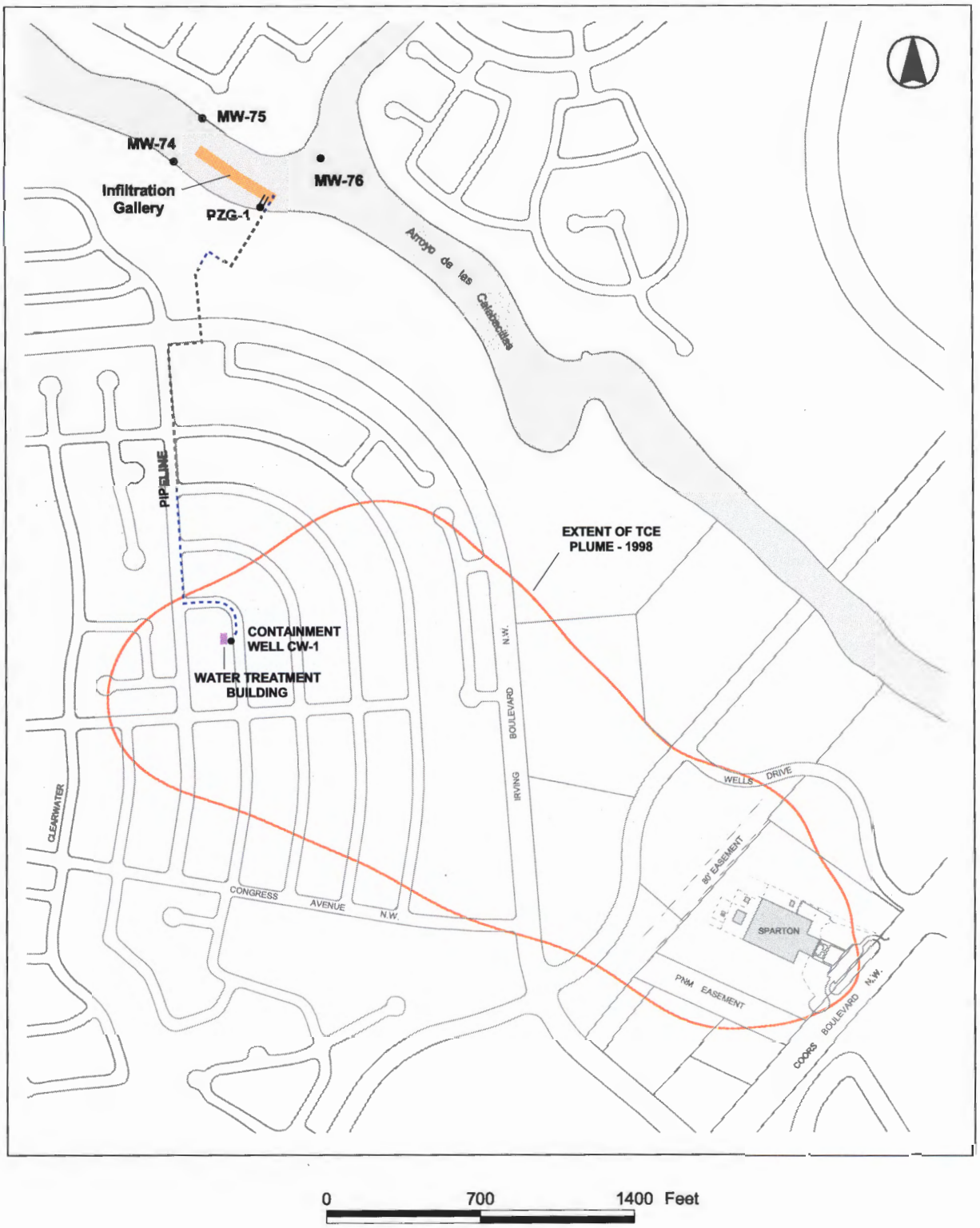


Figure 2.9 Layout of the Off-Site Containment System Components

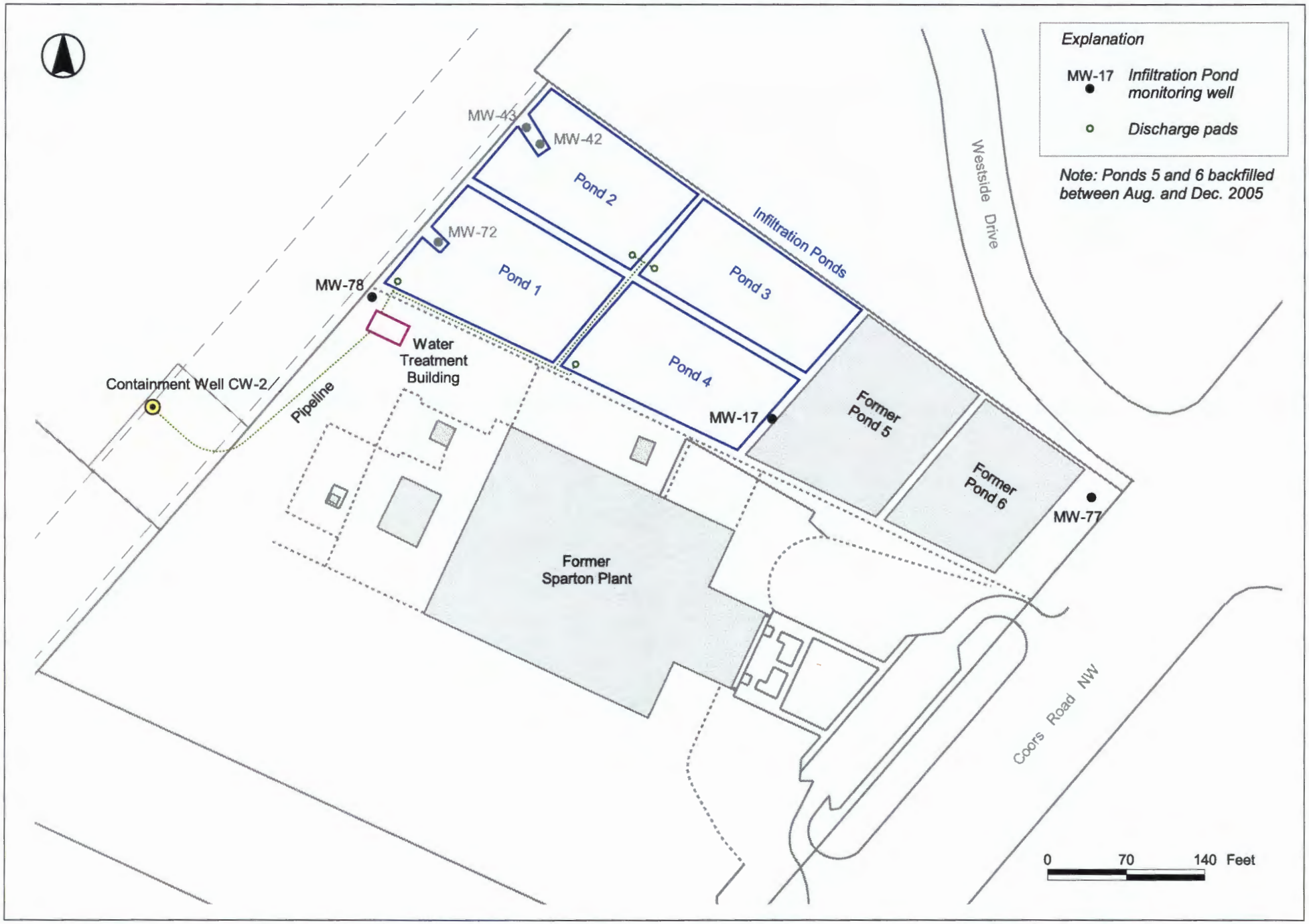


Figure 2.10 Layout of the Source Containment System Components

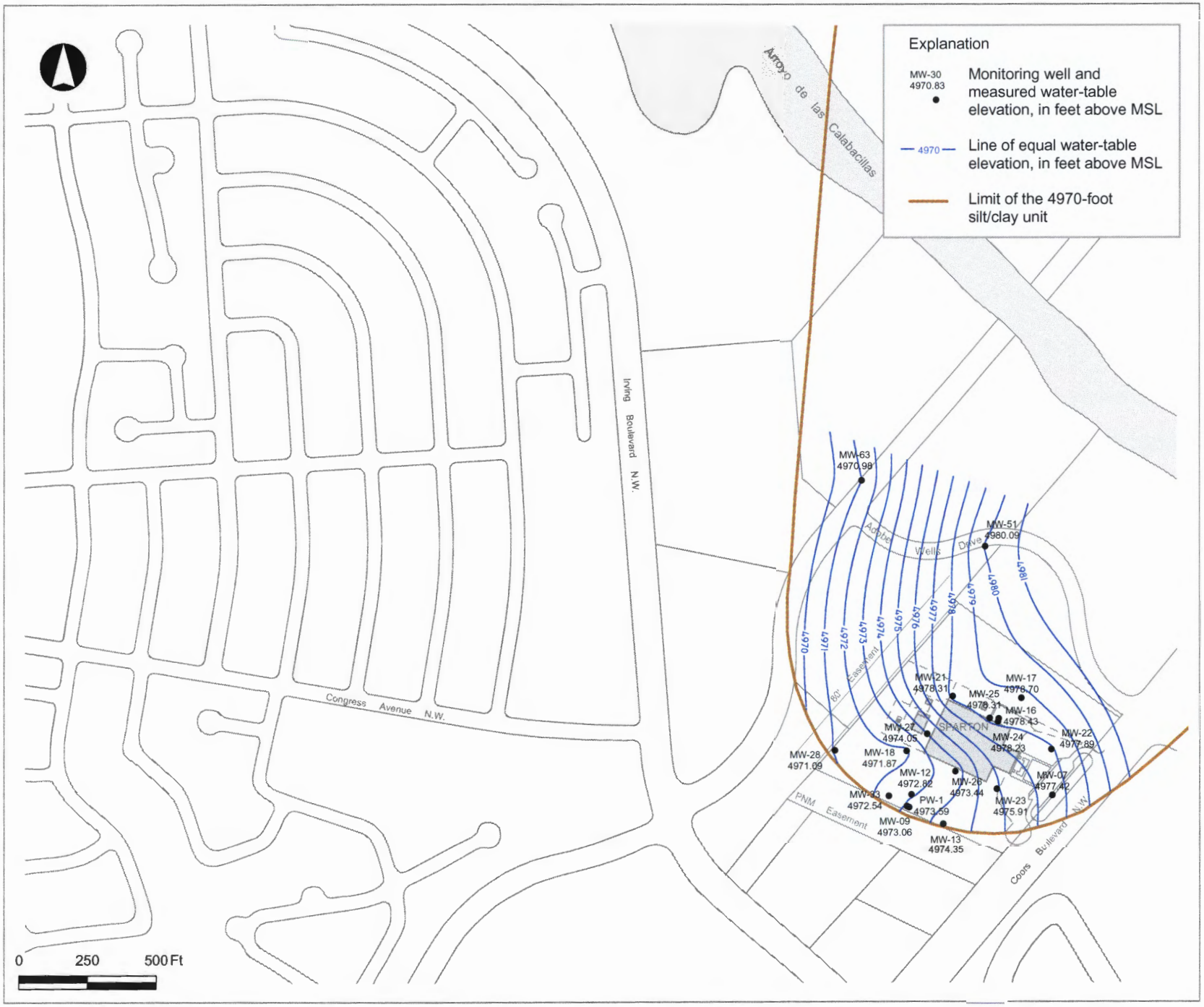


Figure 2.11 Elevation of the On-Site Water Table - November 1998

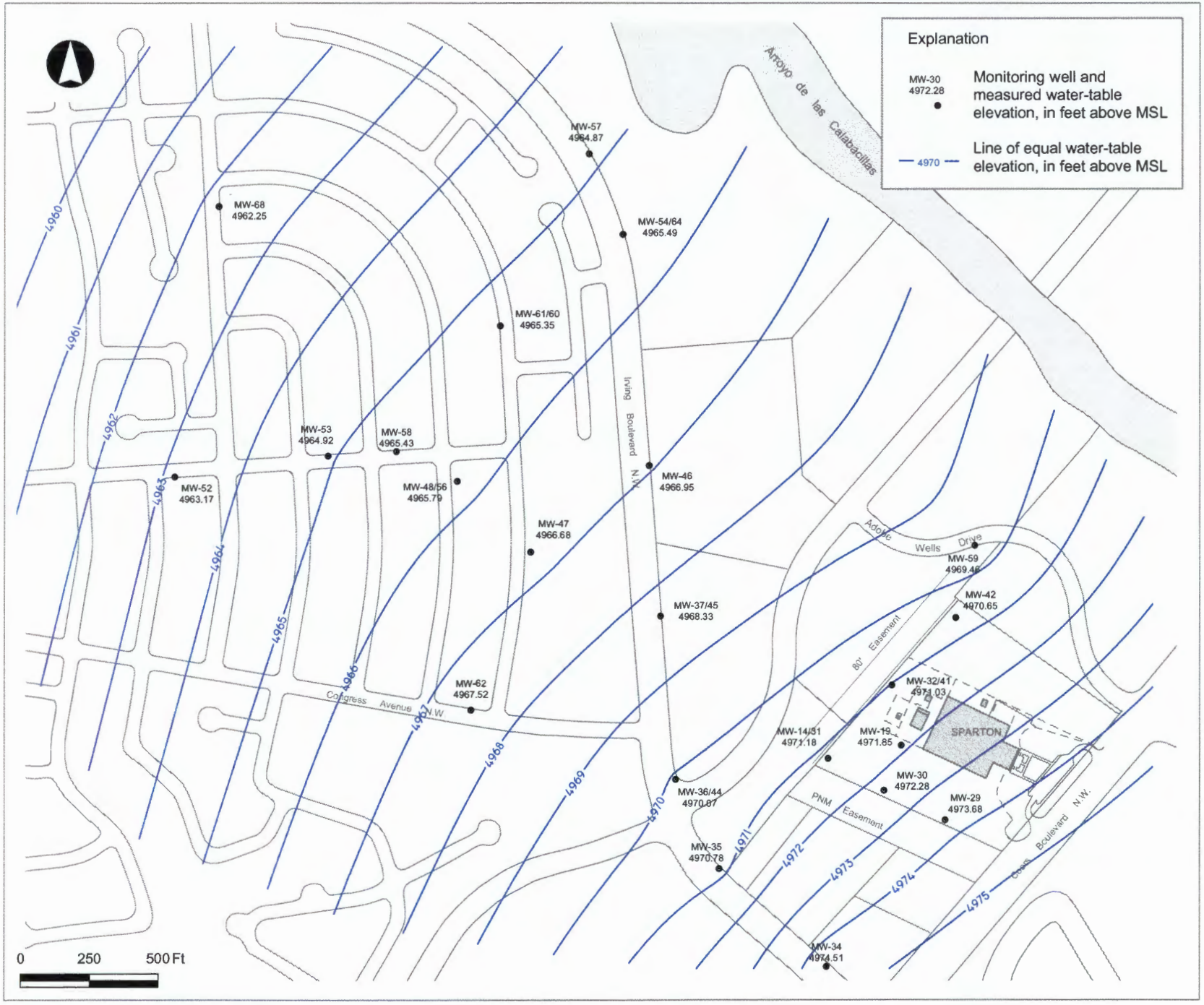


Figure 2.12 Elevation of the Water Levels in the UFZ/ULFZ - November 1998

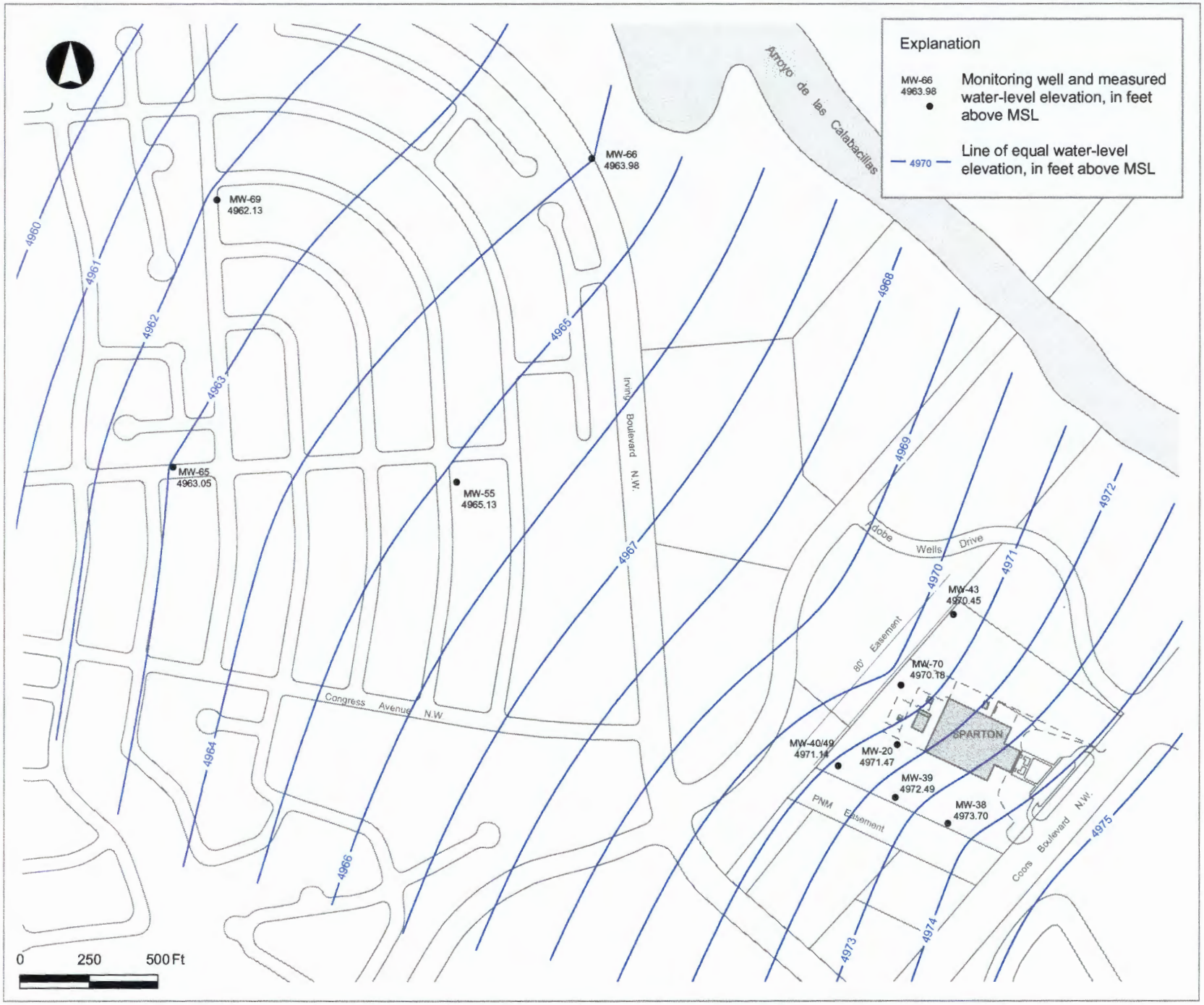


Figure 2.13 Elevation of the Water Levels in the LLFZ - November 1998

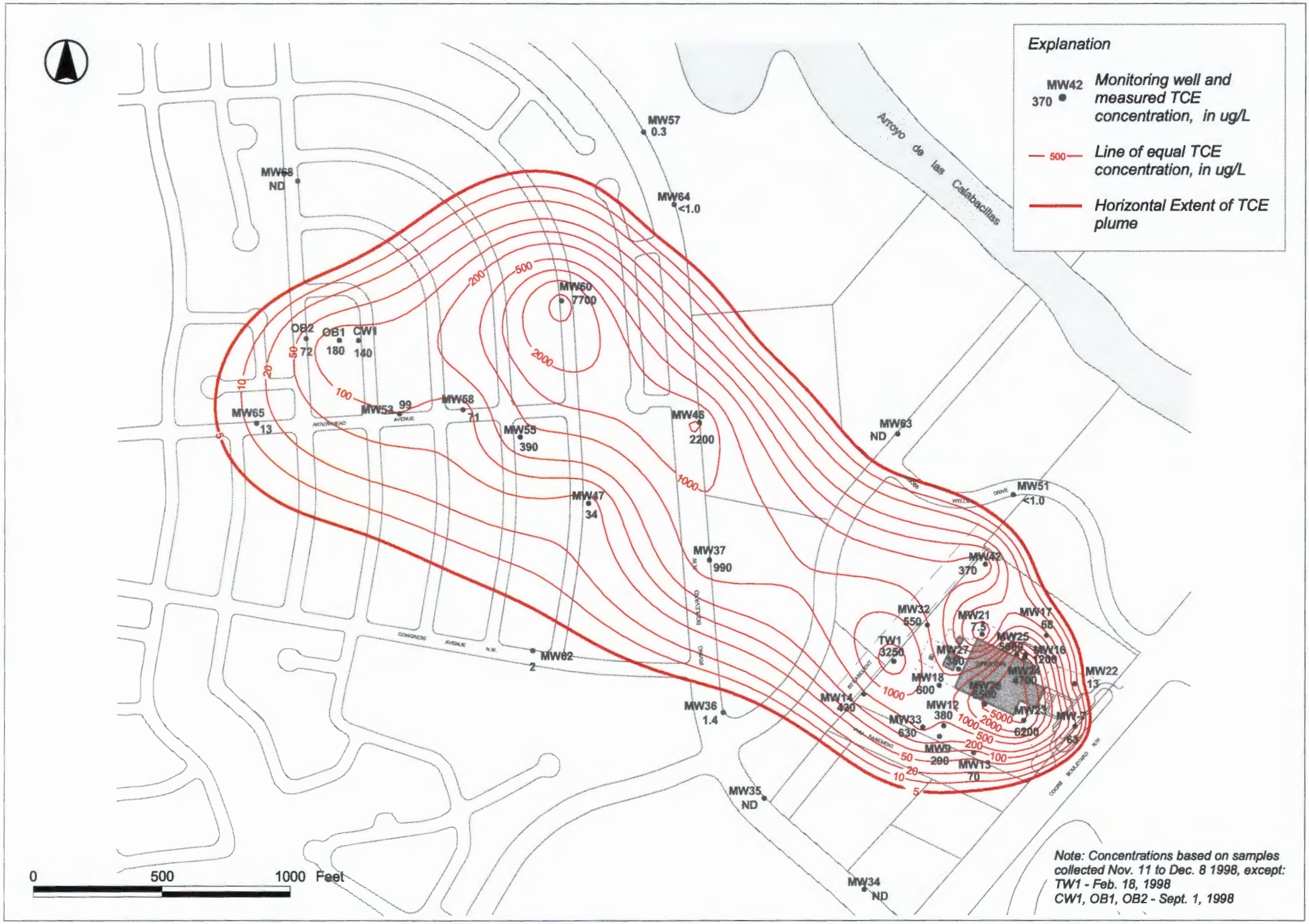


Figure 2.14 Horizontal Extent of TCE Plume - November 1998

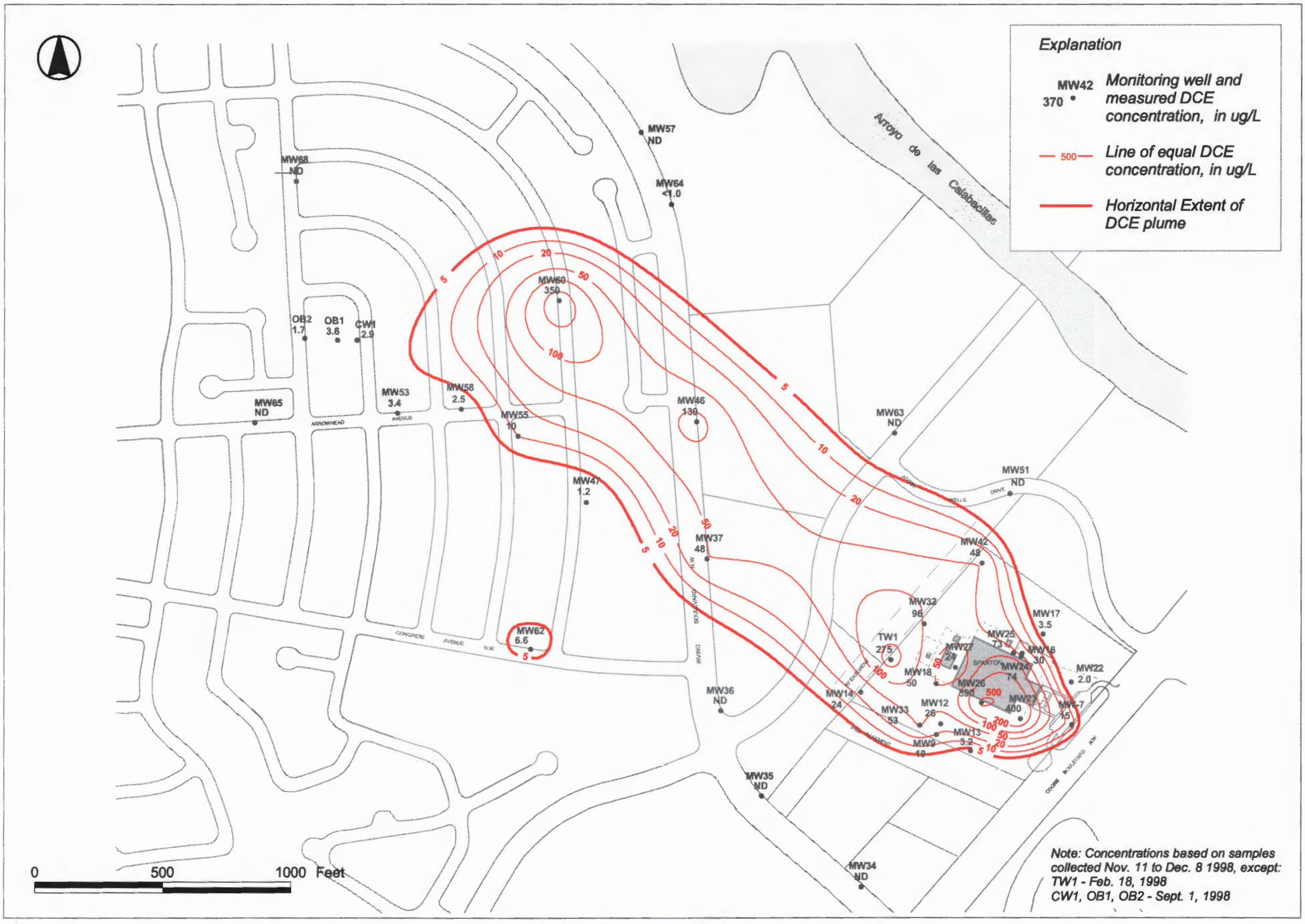


Figure 2.15 Horizontal Extent of DCE Plume - November 1998

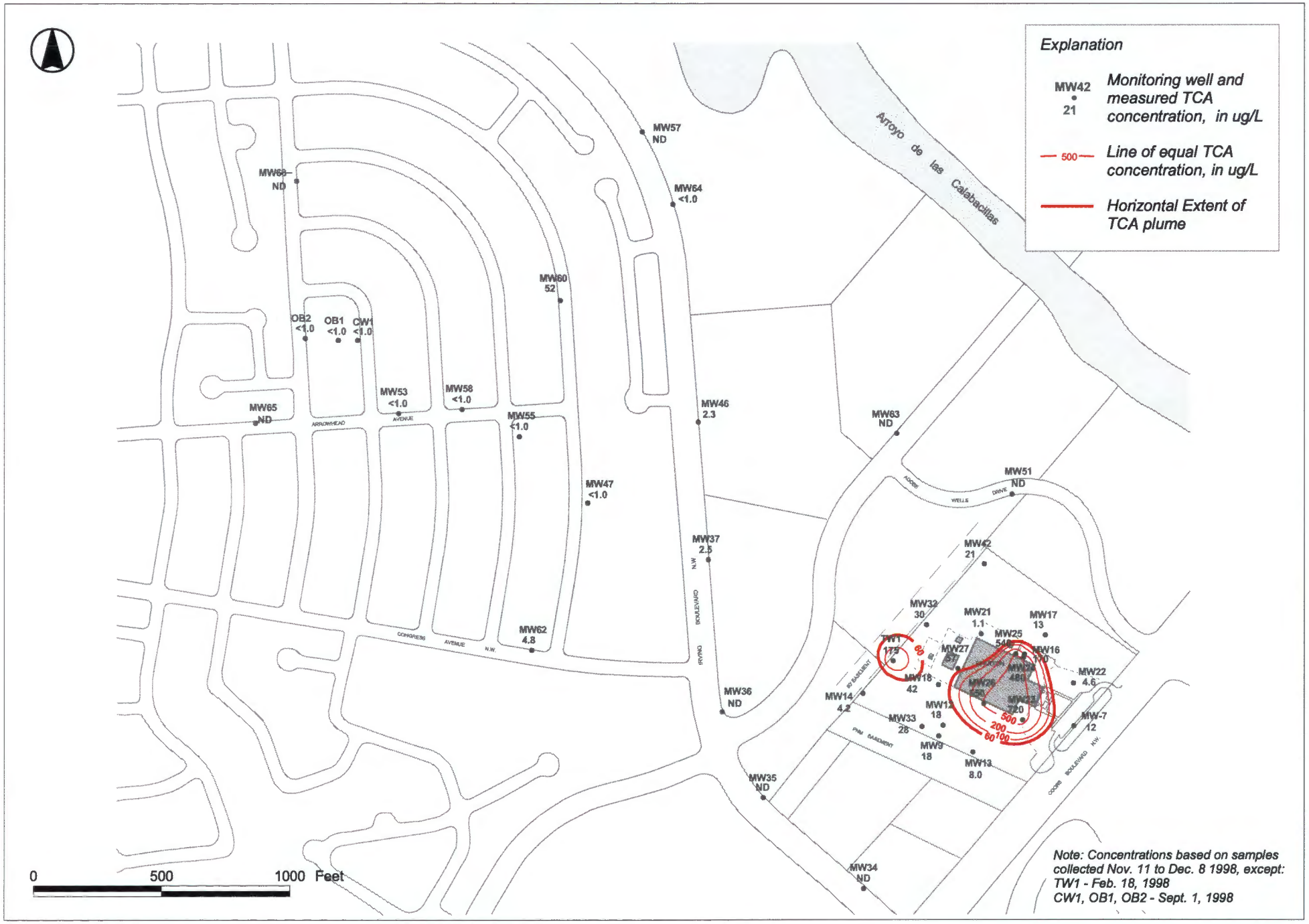


Figure 2.16 Horizontal Extent of TCA Plume - November 1998

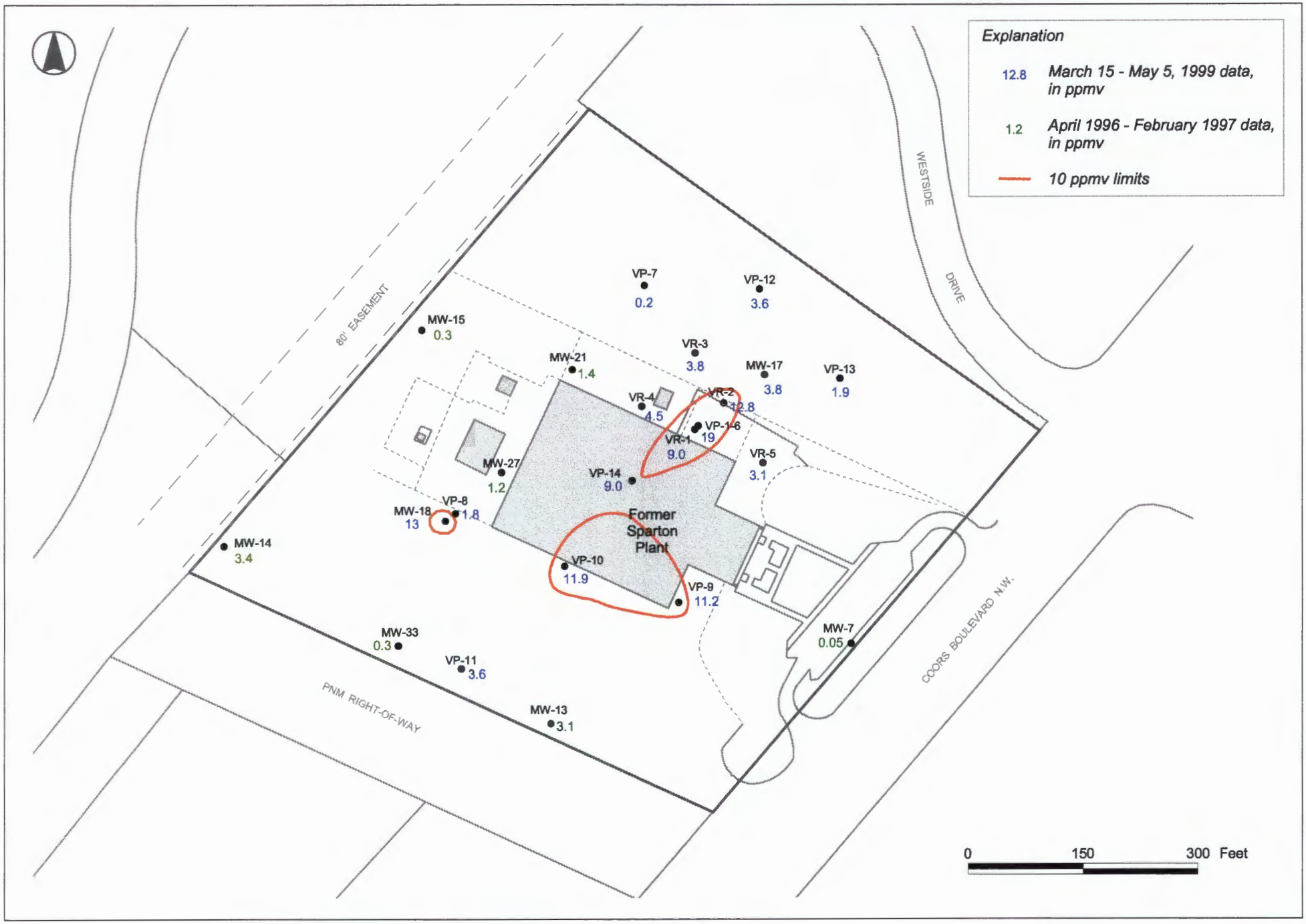


Figure 2.17 TCE Soil Gas Concentrations Prior to the 1999 Resumption of SVE System Operations

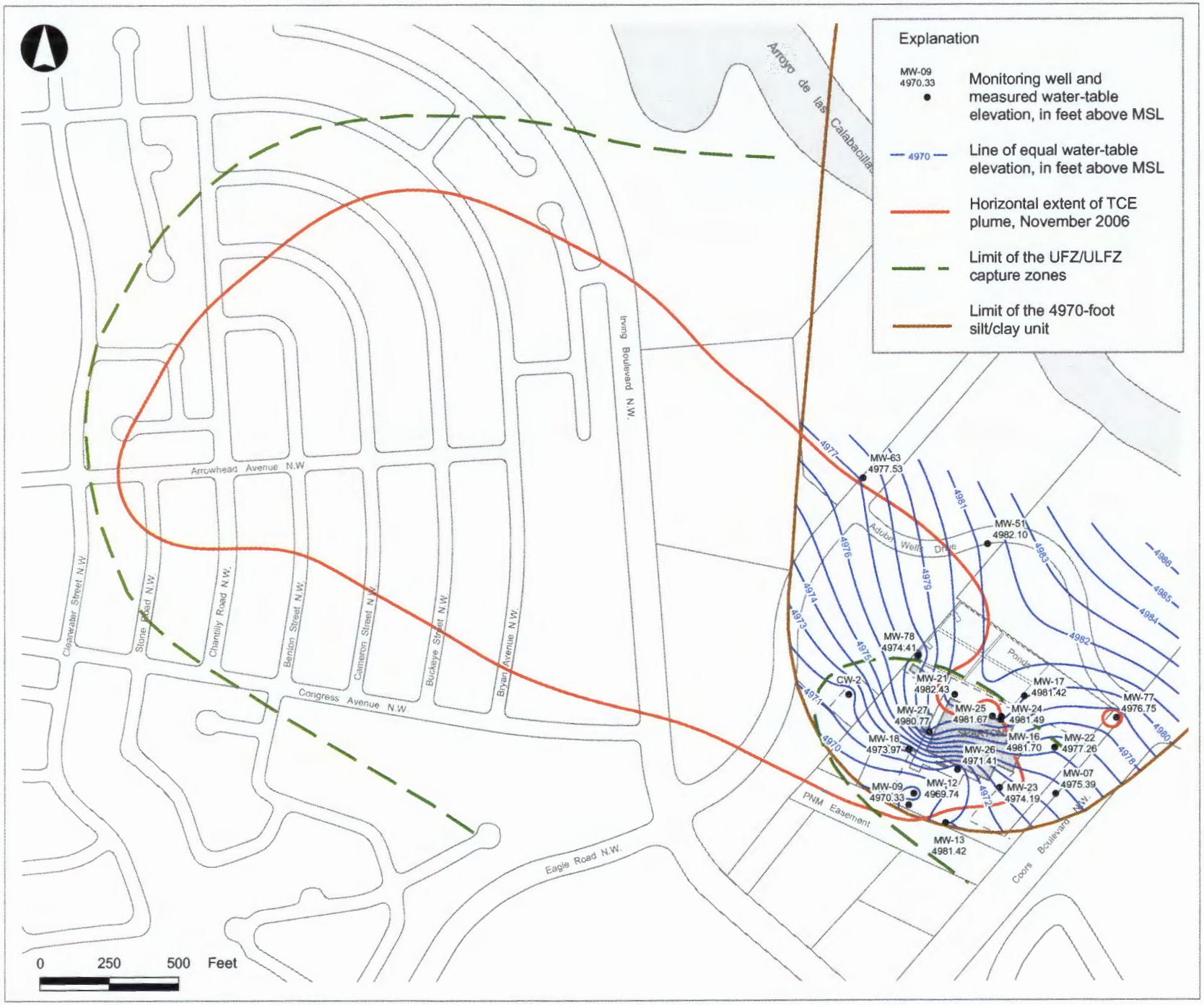


Figure 5.1 Elevation of the On-Site Water Table - February 21, 2007

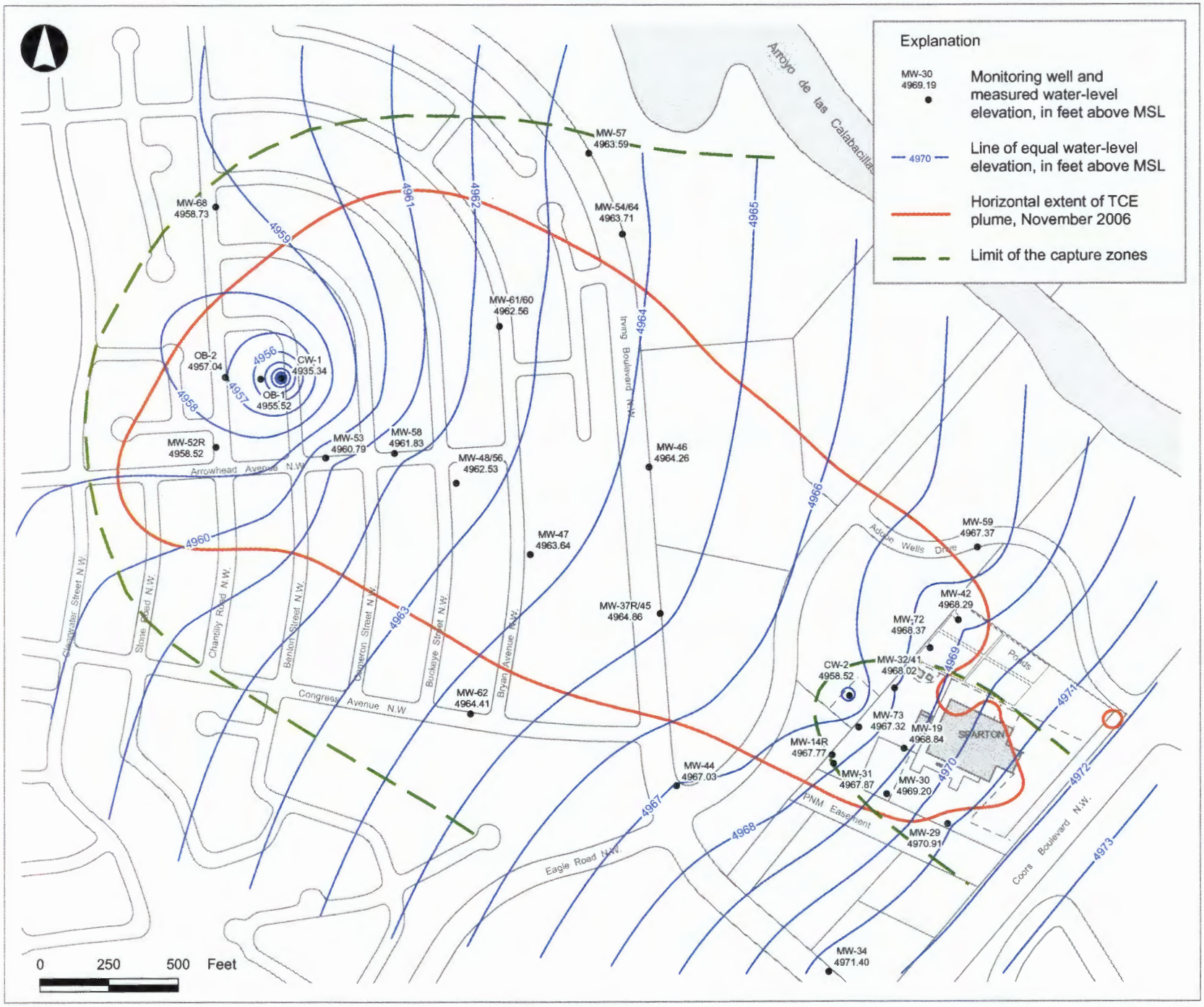


Figure 5.2 Elevation of Water Levels and Limits of Containment Well Capture Zones in the UFZ/ULFZ - February 21, 2007

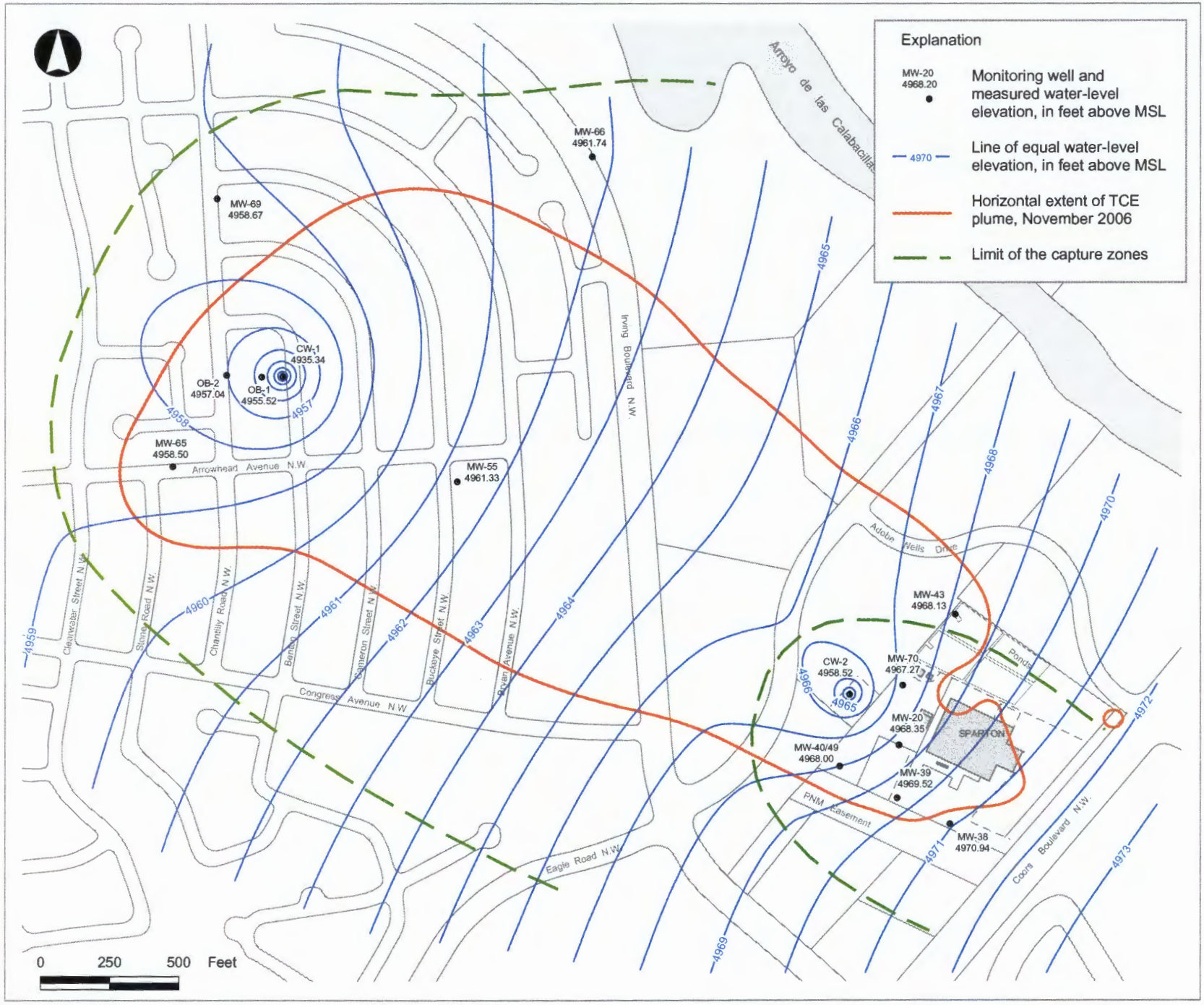


Figure 5.3 Elevation of Water Levels and Limits of Containment Well Capture Zones in the LLFZ - February 21, 2007

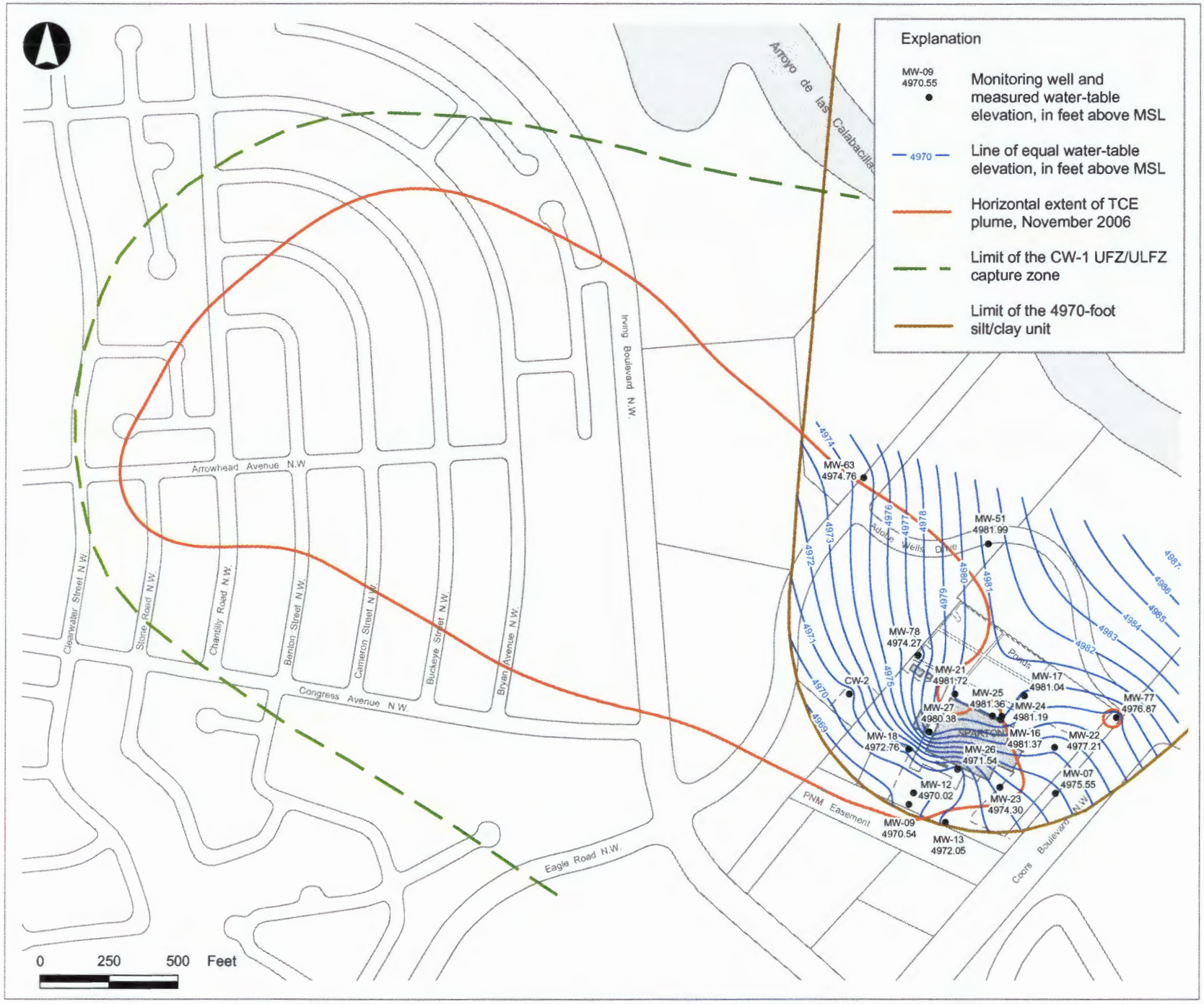


Figure 5.4 Elevation of the On-Site Water Table - May 15, 2007

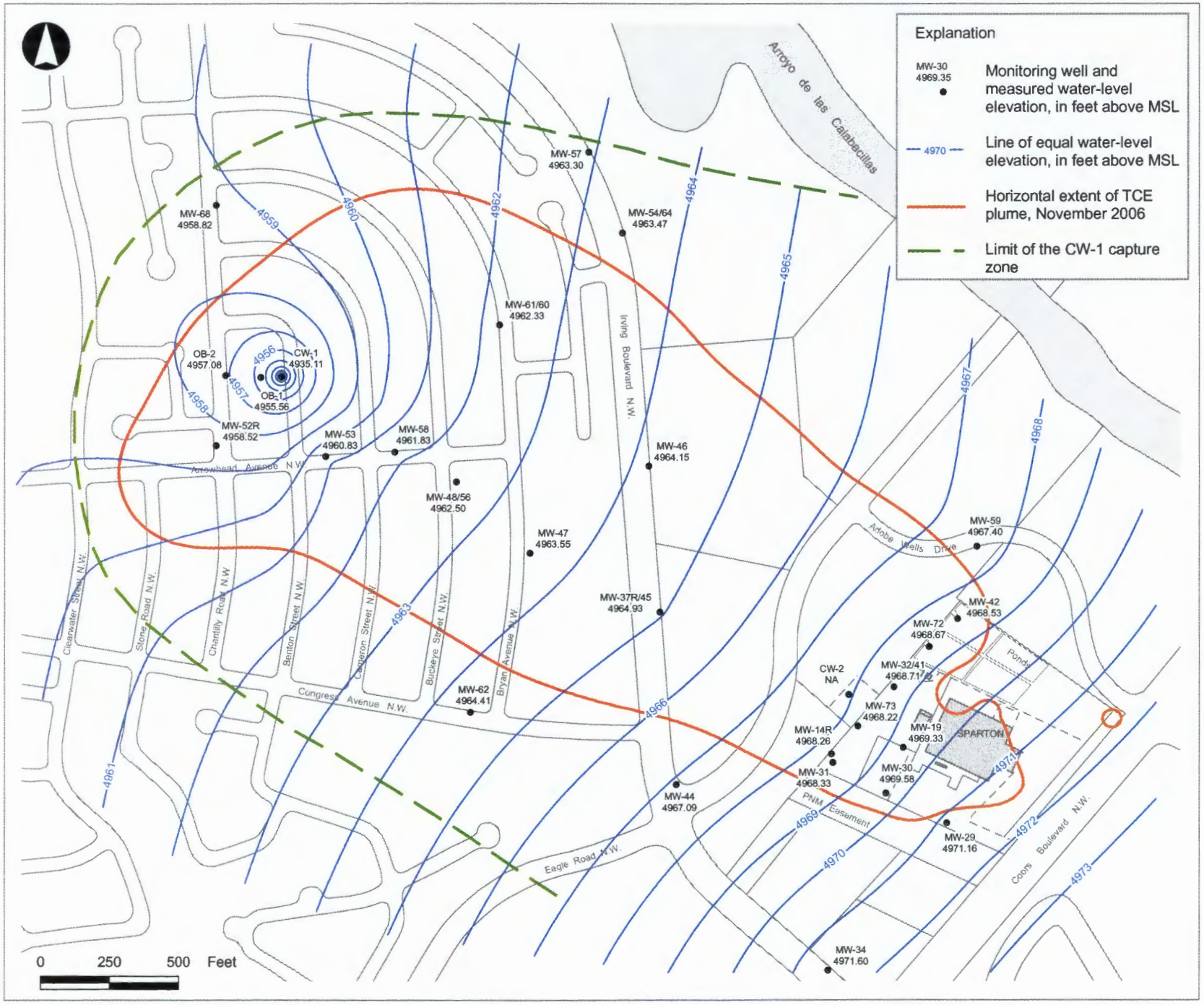


Figure 5.5 Elevation of Water Levels and Limits of Off-Site Containment Well Capture Zone in the UFZ/ULFZ - May 15, 2007

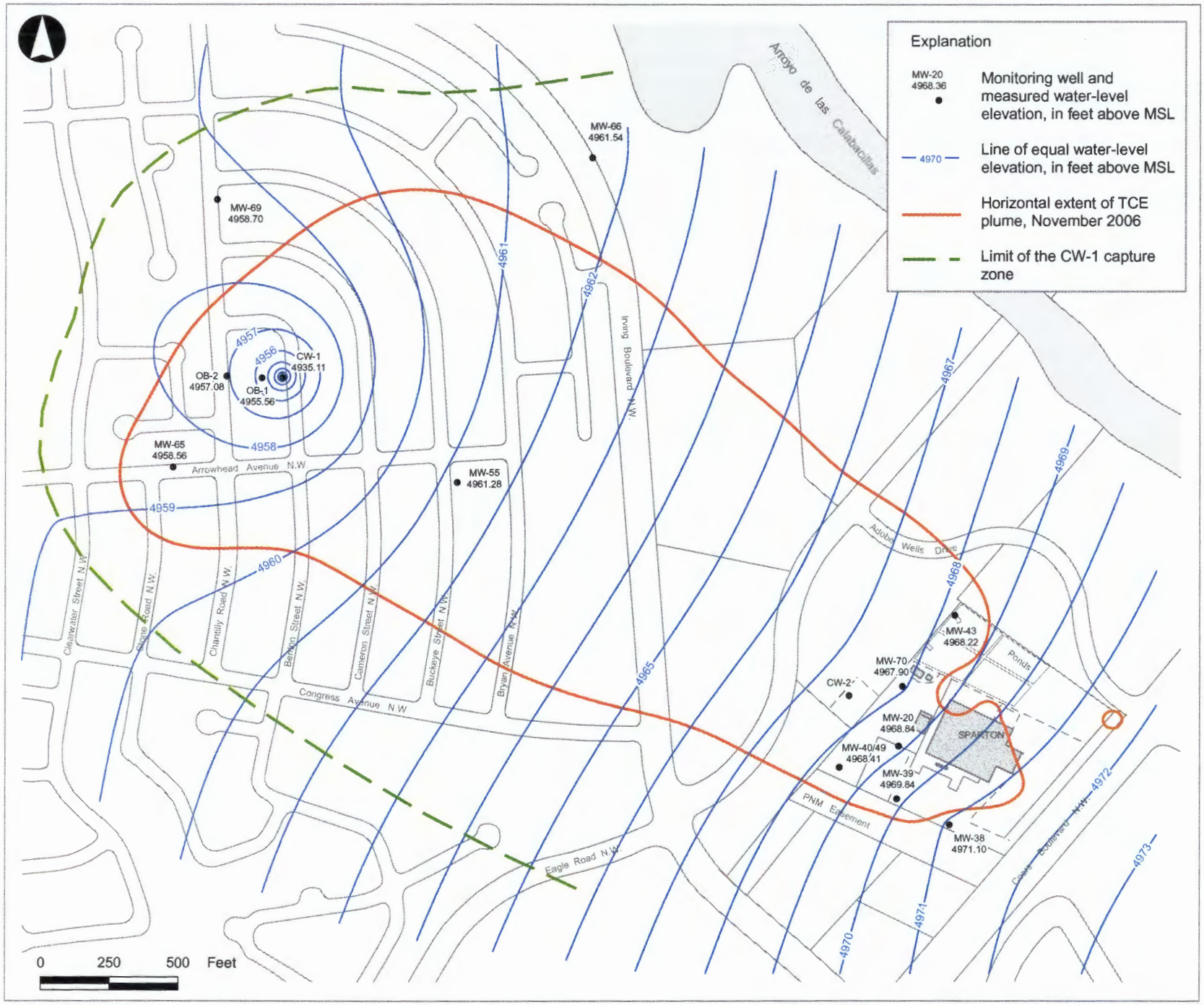


Figure 5.6 Elevation of Water Levels and Limits of Off-Site Containment Well Capture Zone in the LLFZ - May 15, 2007

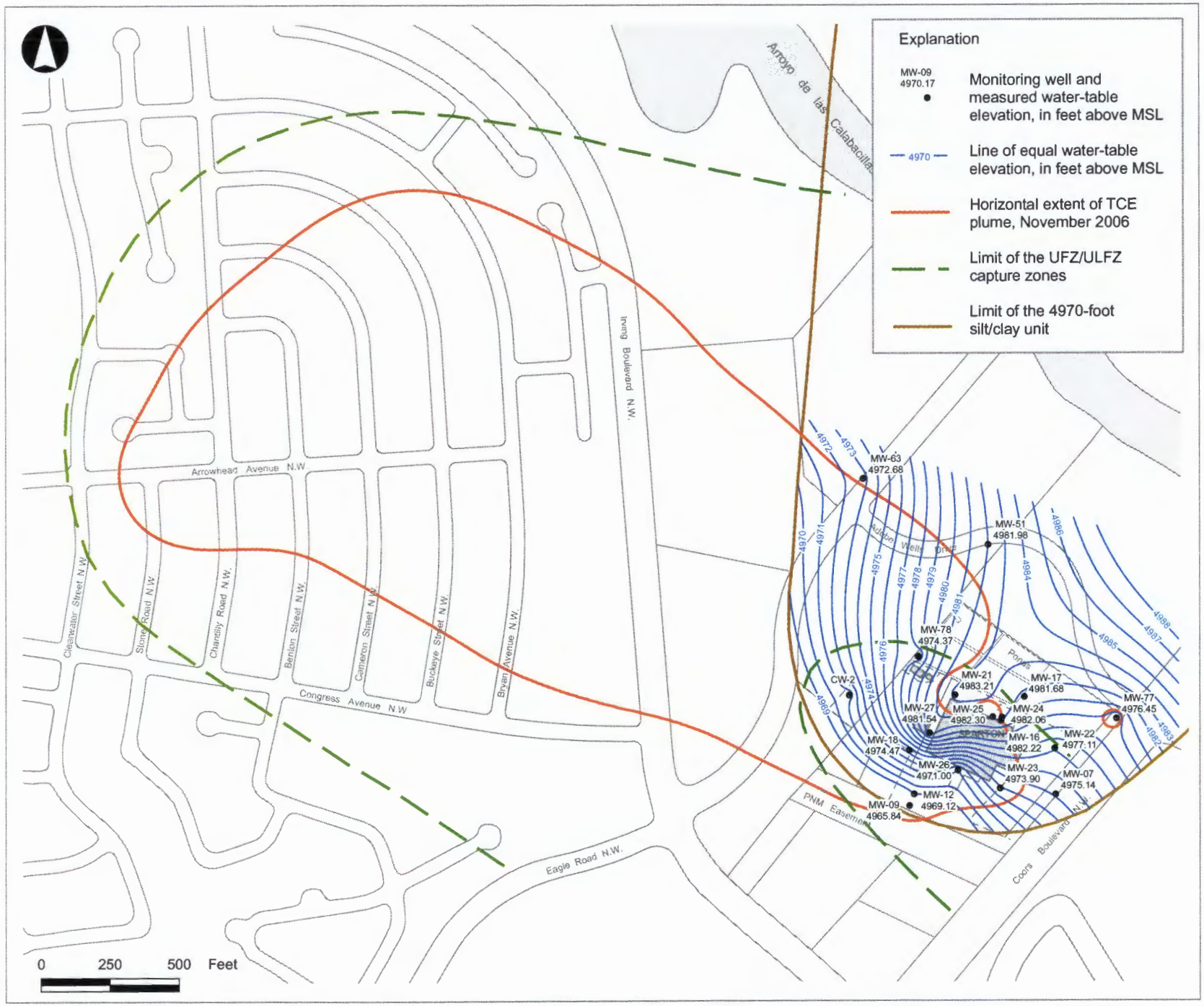


Figure 5.7 Elevation of the On-Site Water Table - August 15, 2007

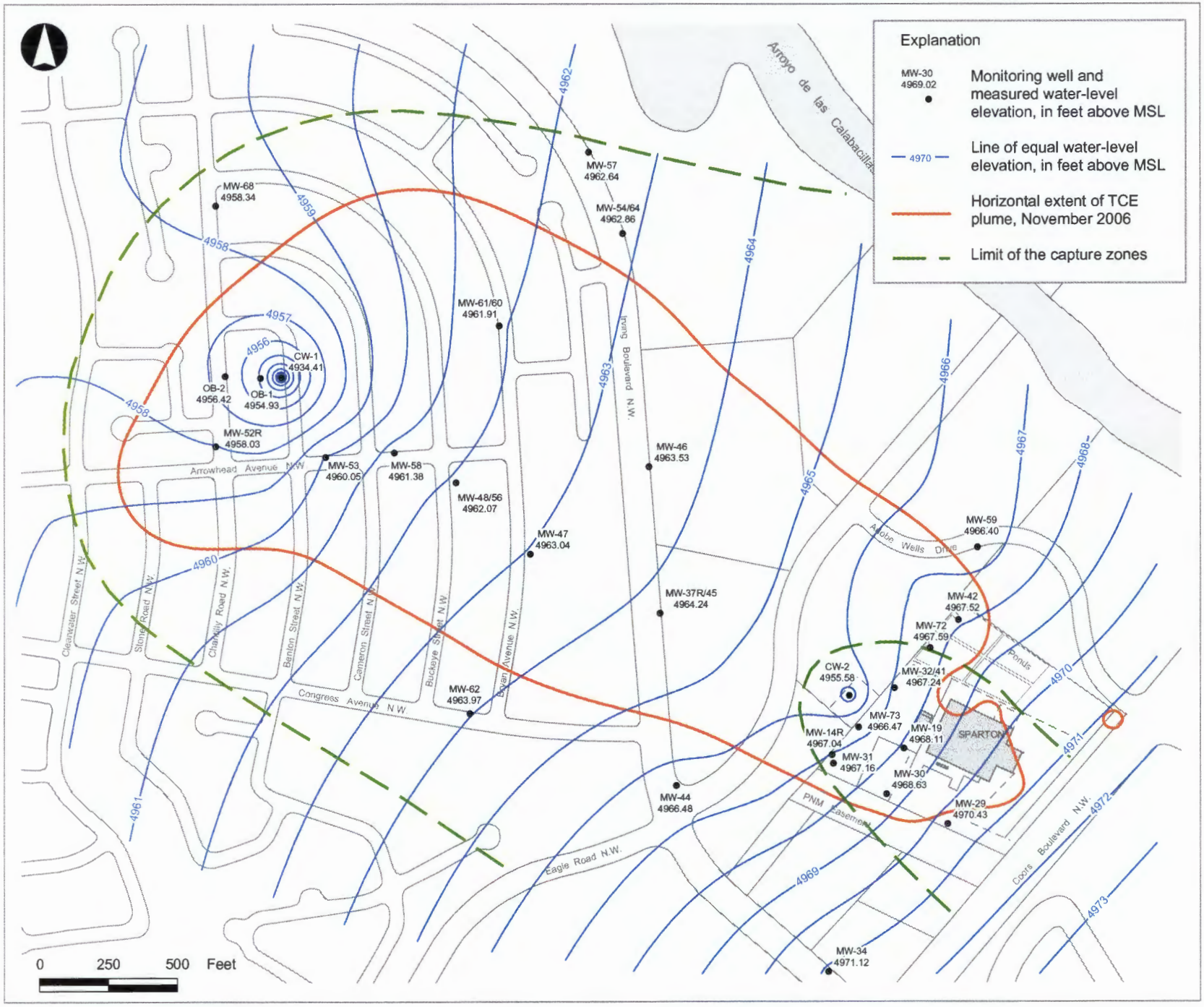


Figure 5.8 Elevation of Water Levels and Limits of Containment Well Capture Zones in the UFZ/ULFZ - August 15, 2007

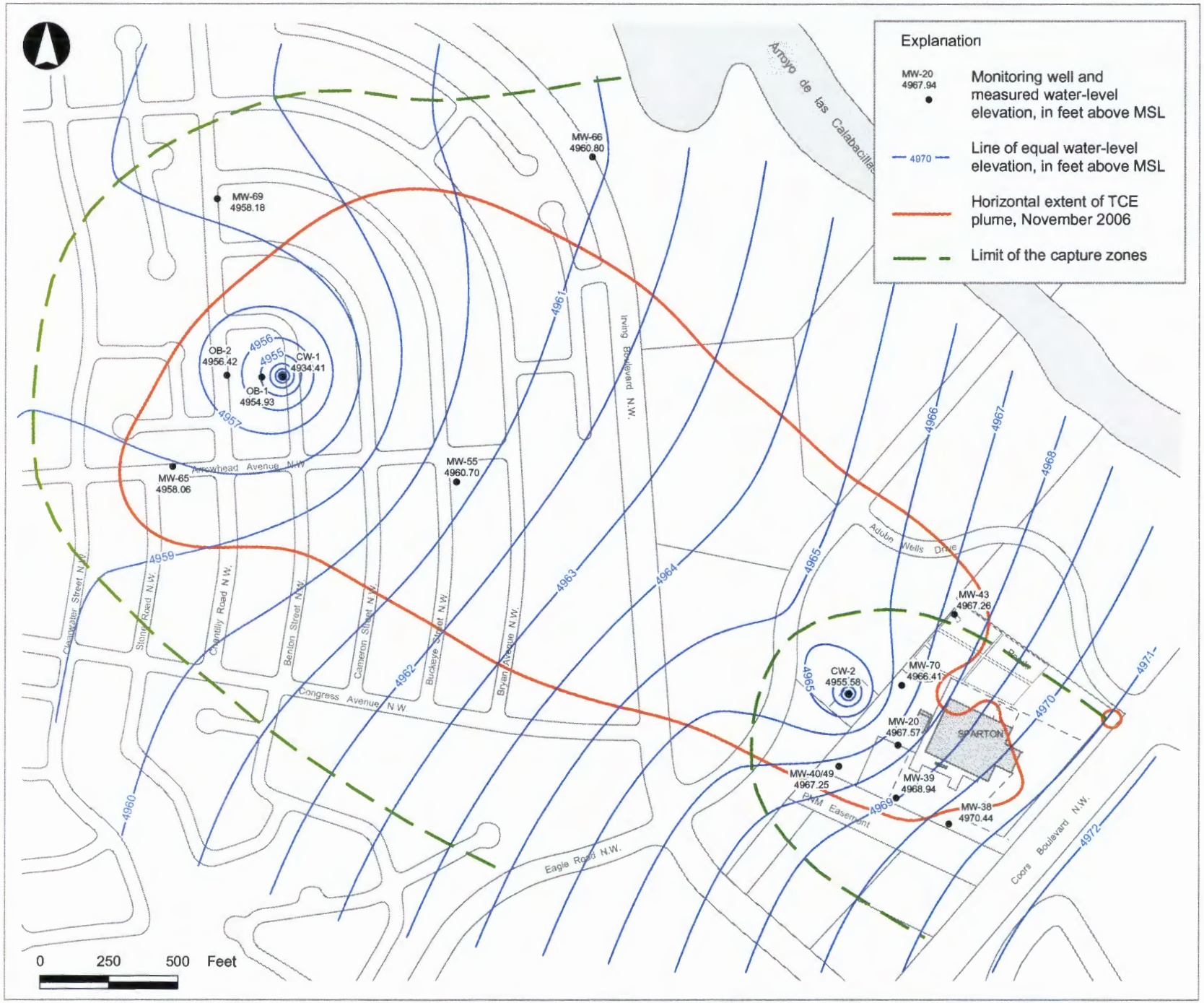


Figure 5.9 Elevation of Water Levels and Limits of Containment Well Capture Zones in the LLFZ - August 15, 2007

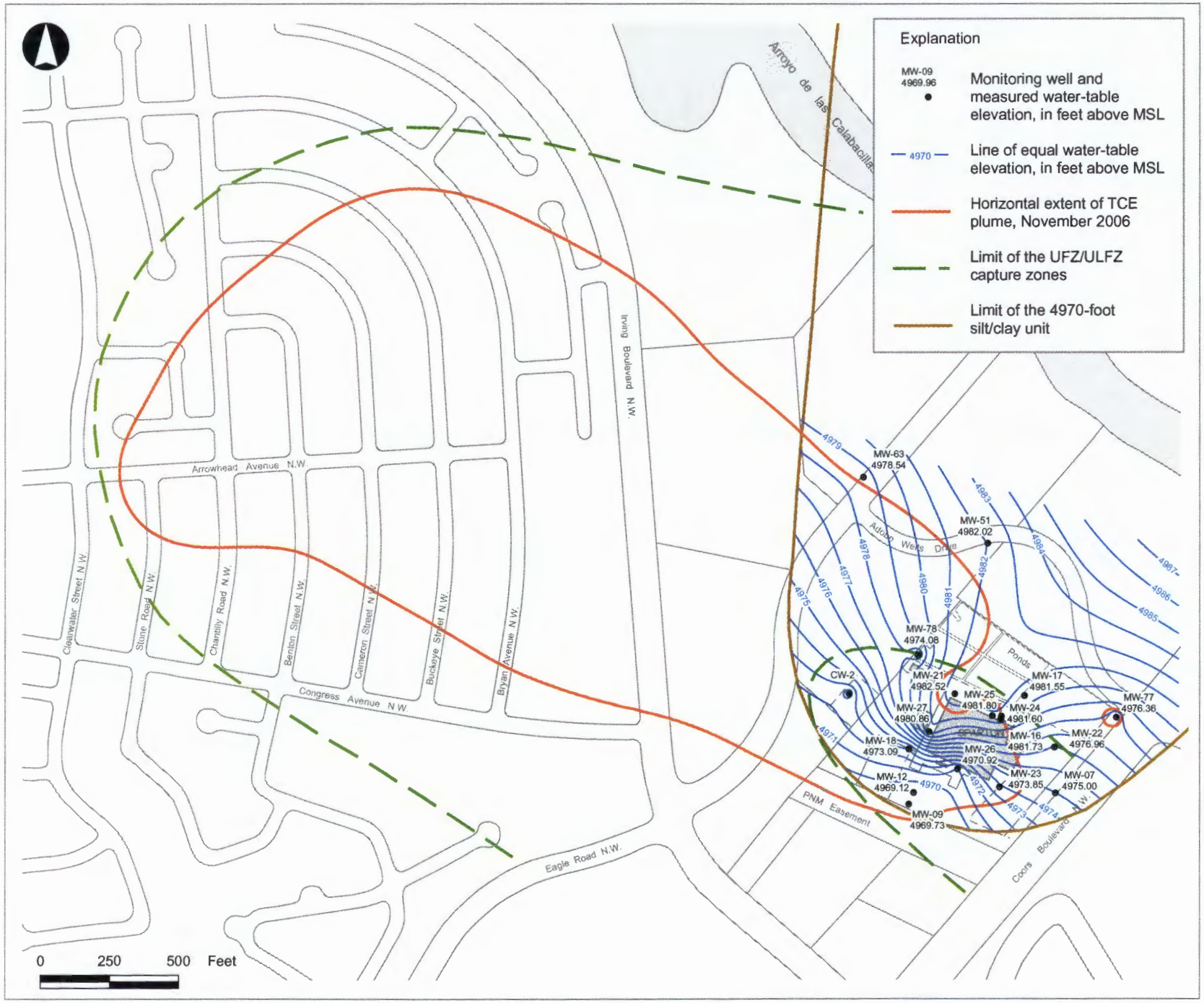


Figure 5.10 Elevation of the On-Site Water Table - November 1, 2007

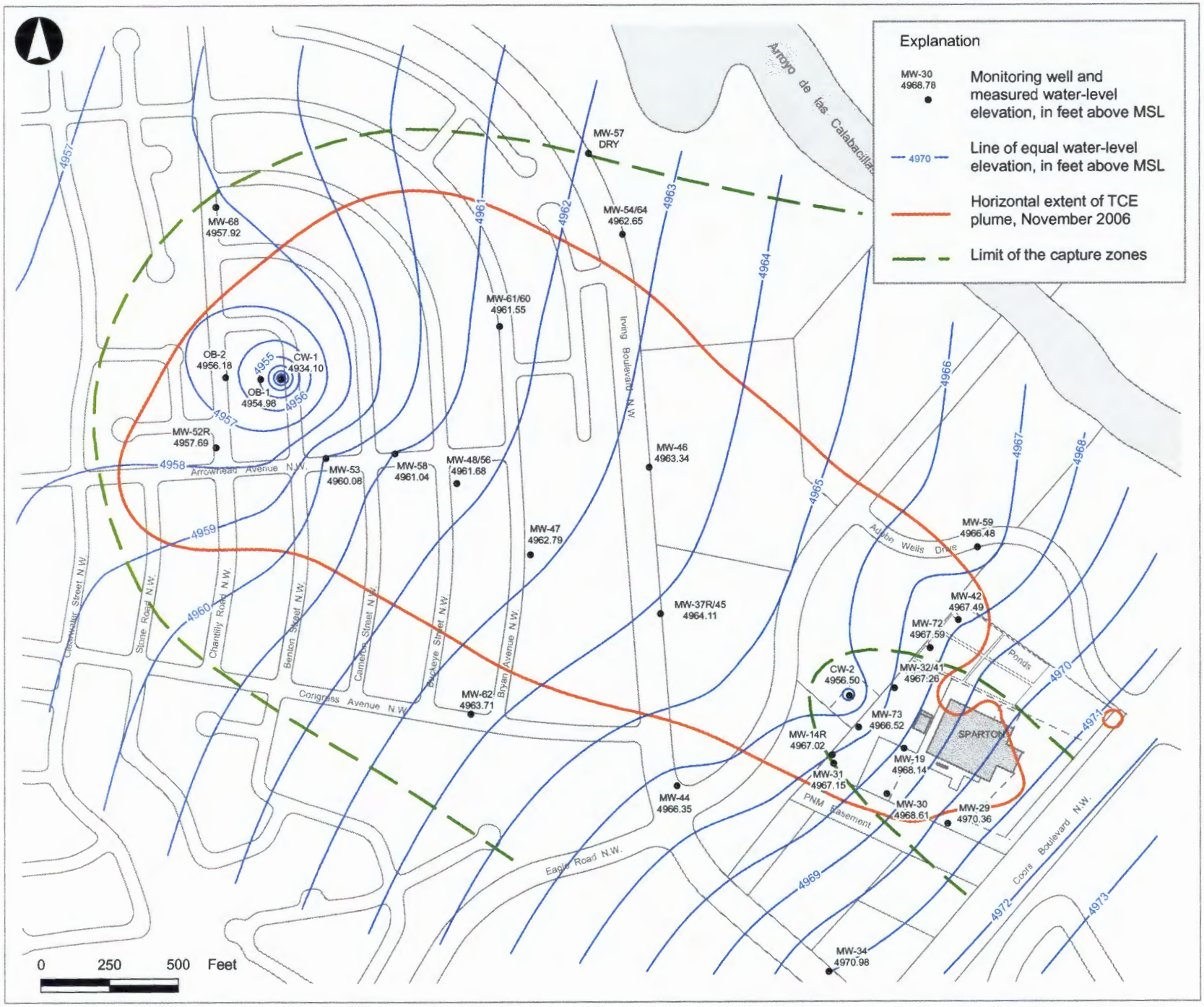


Figure 5.11 Elevation of Water Levels and Limits of Containment Well Capture Zones in the UFZ/ULFZ - November 1, 2007

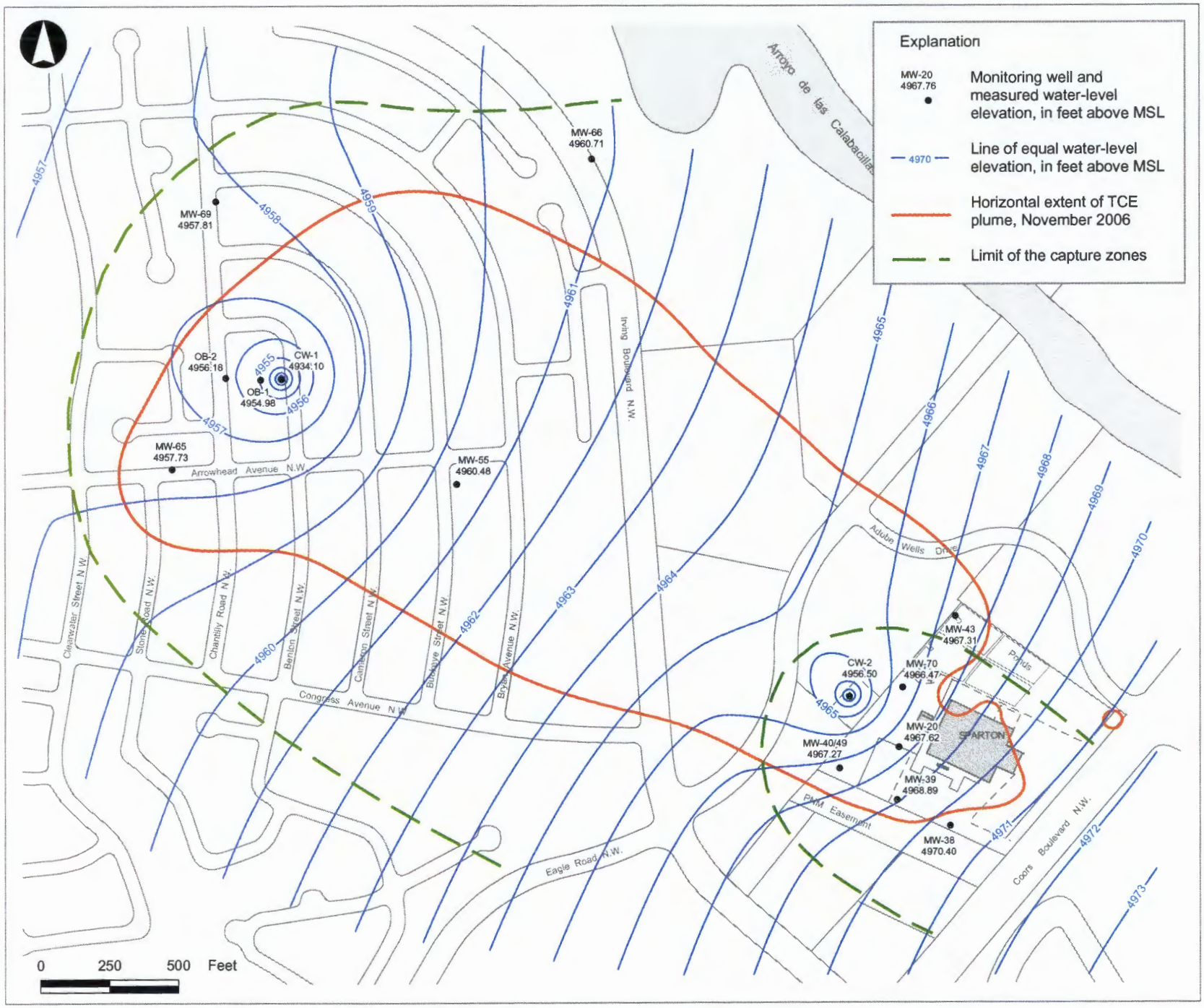


Figure 5.12 Elevation of Water Levels and Limits of Containment Well Capture Zones in the LLFZ - November 1, 2007

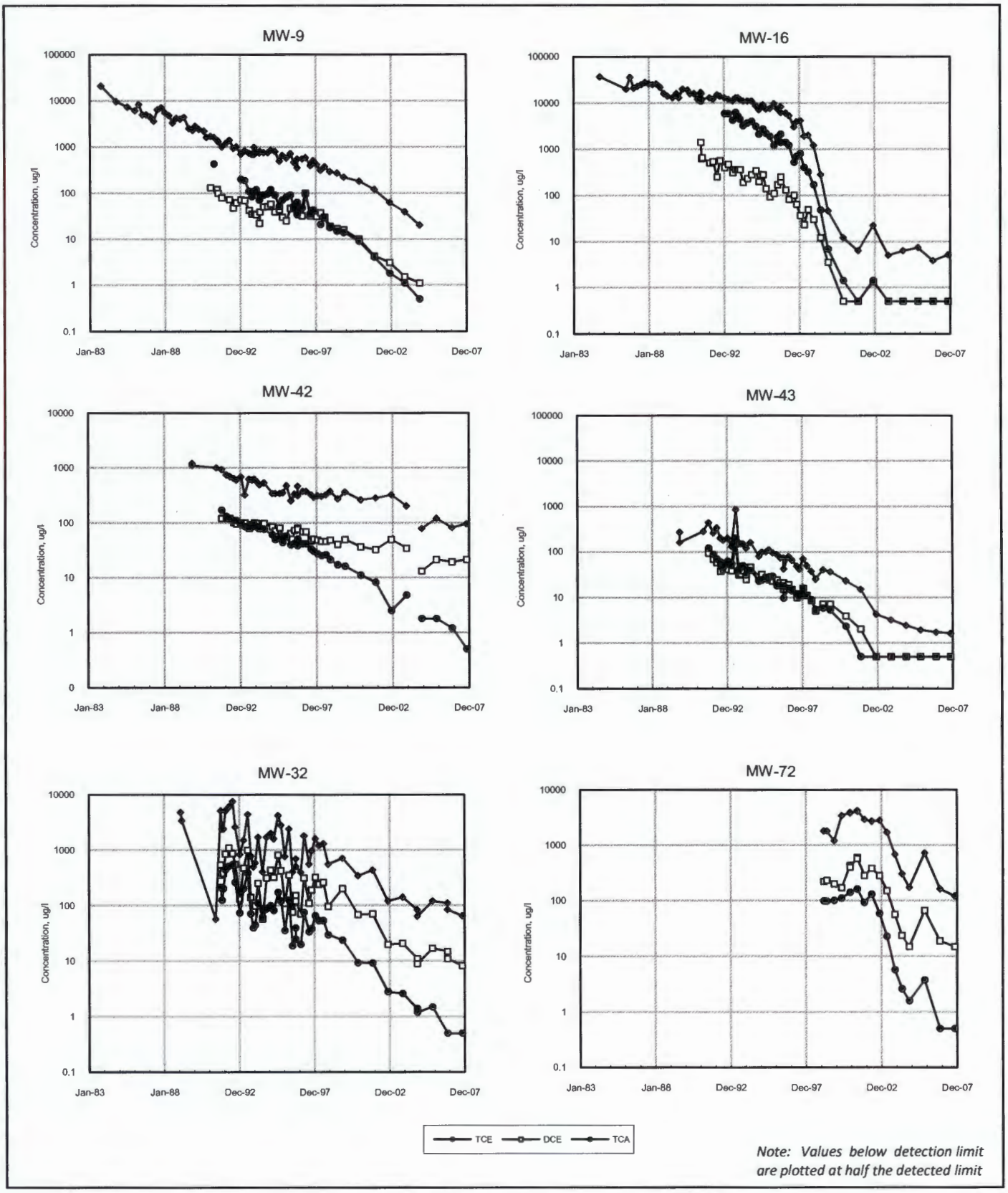


Figure 5.13 Contaminant Concentration Trends in On-Site Monitoring Wells

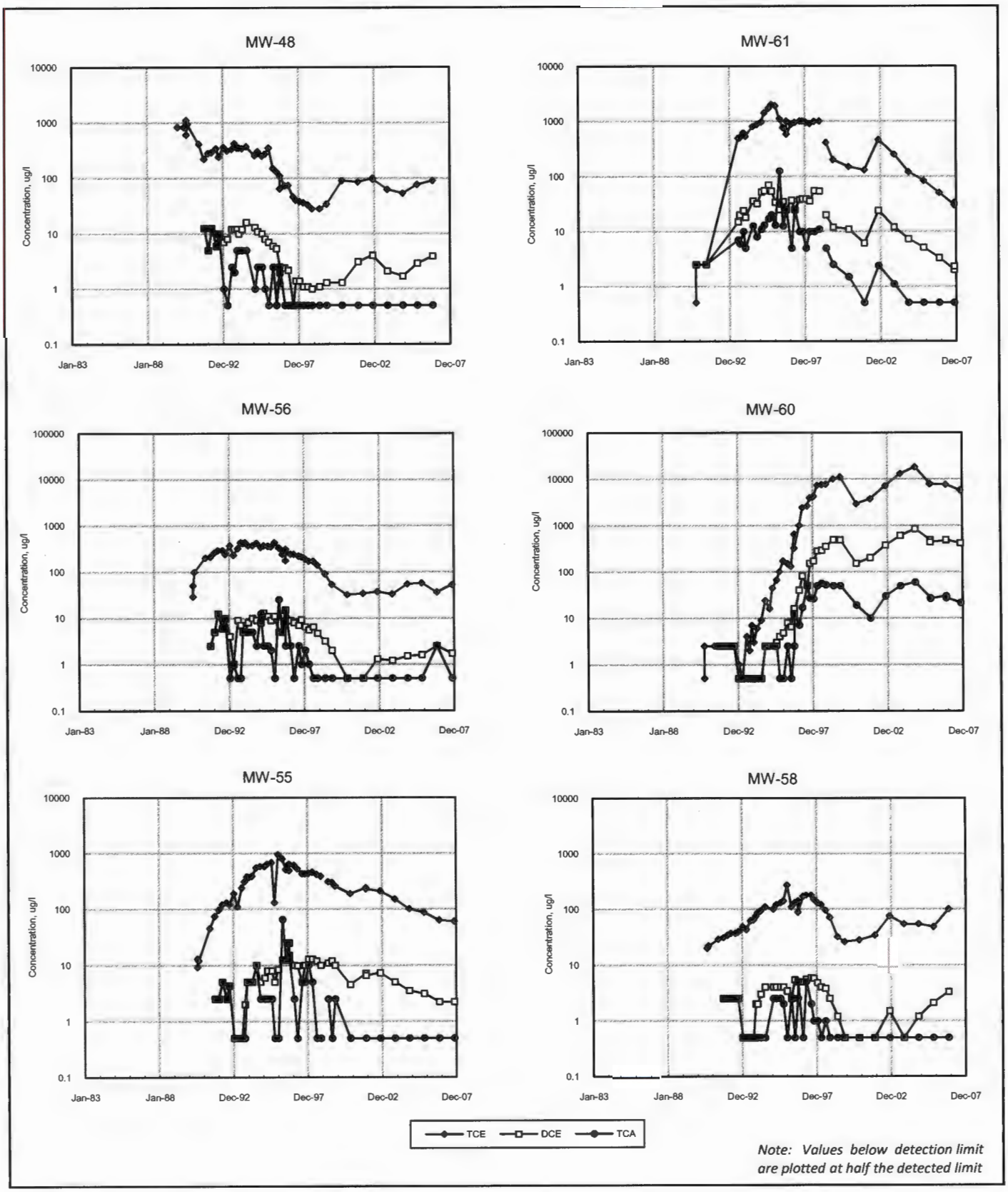


Figure 5.14 Contaminant Concentration Trends in Off-Site Monitoring Wells

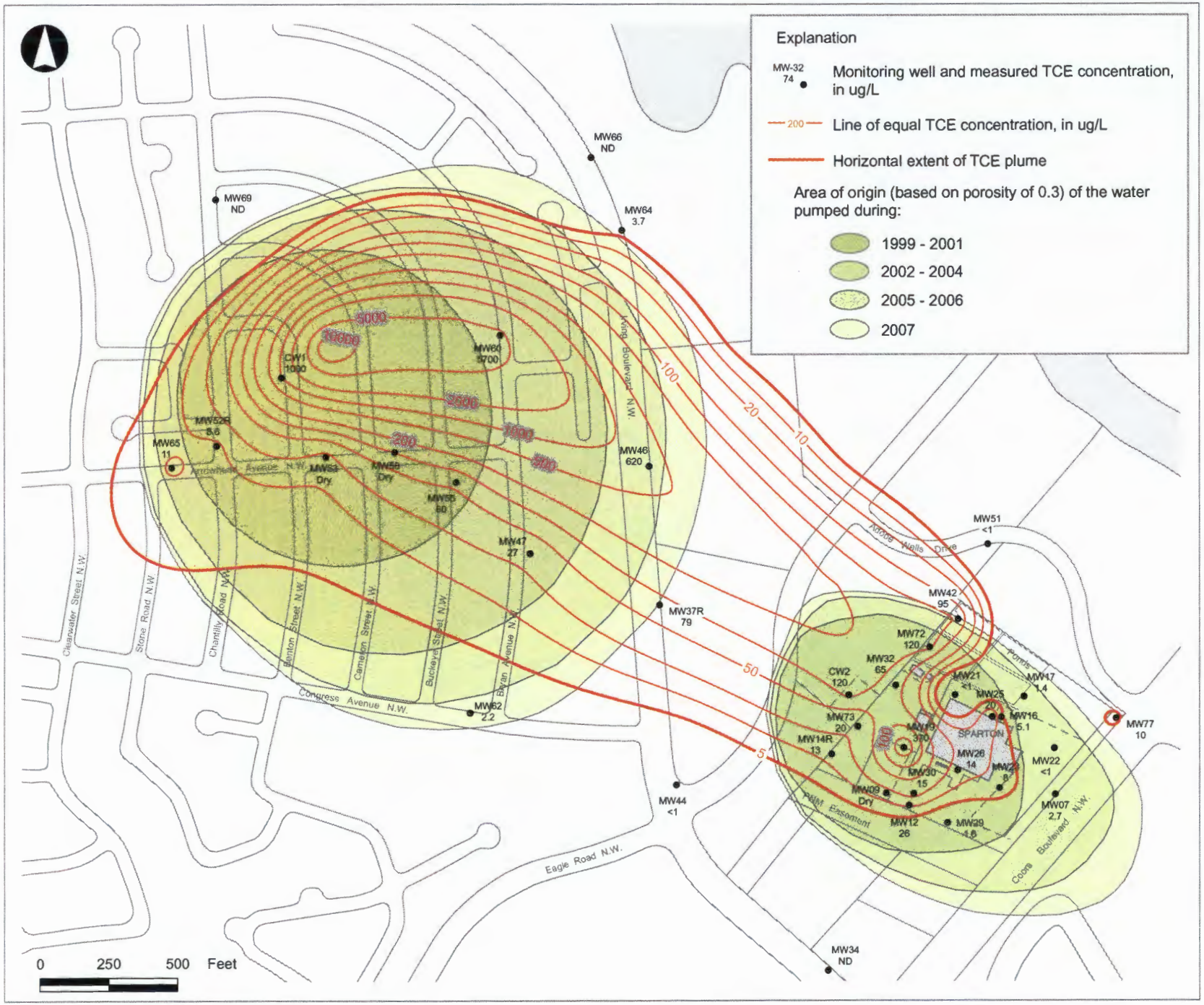


Figure 5.15 Horizontal Extent of TCE Plume - November 2007

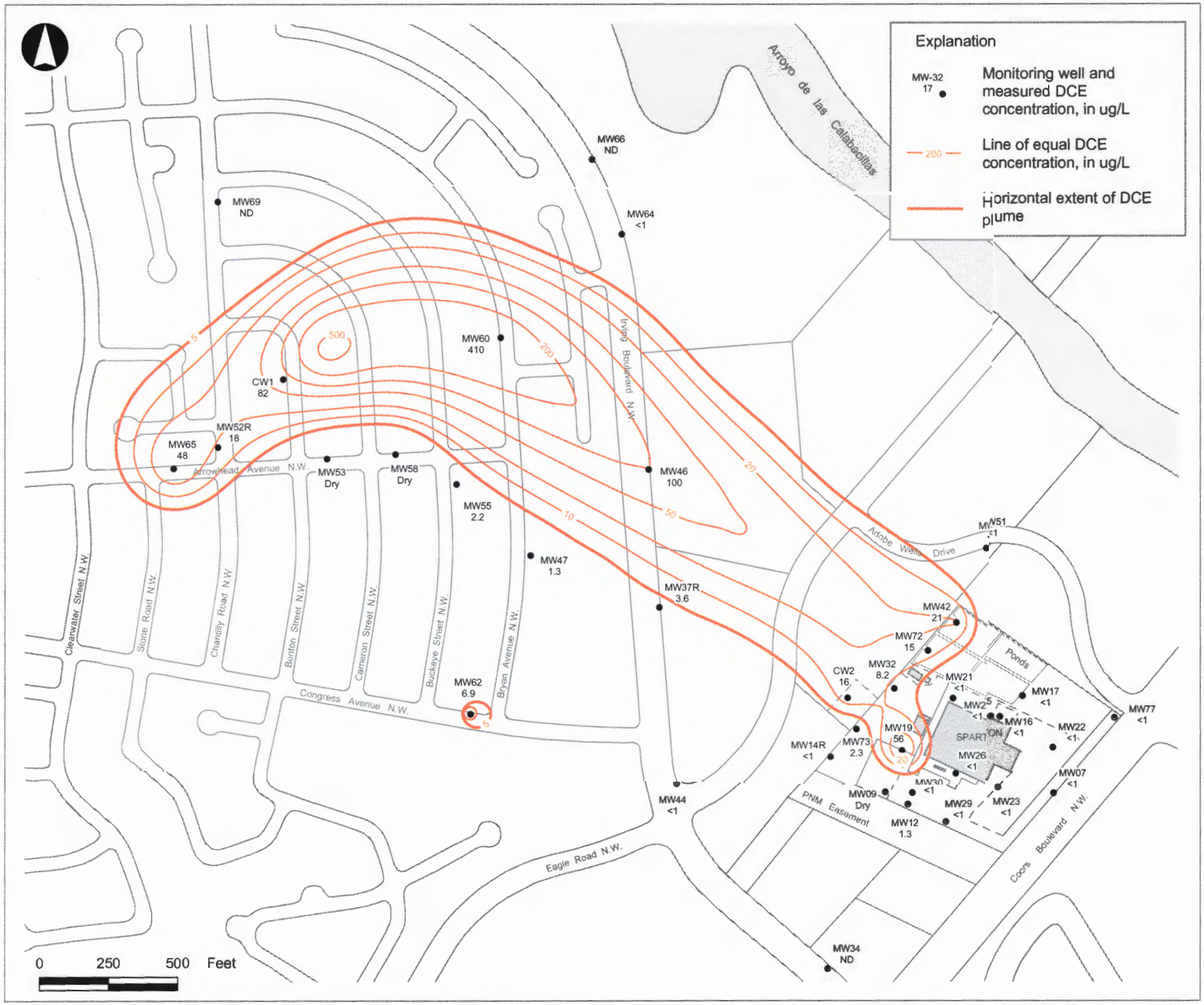


Figure 5.16 Horizontal Extent of DCE Plume - November 2007

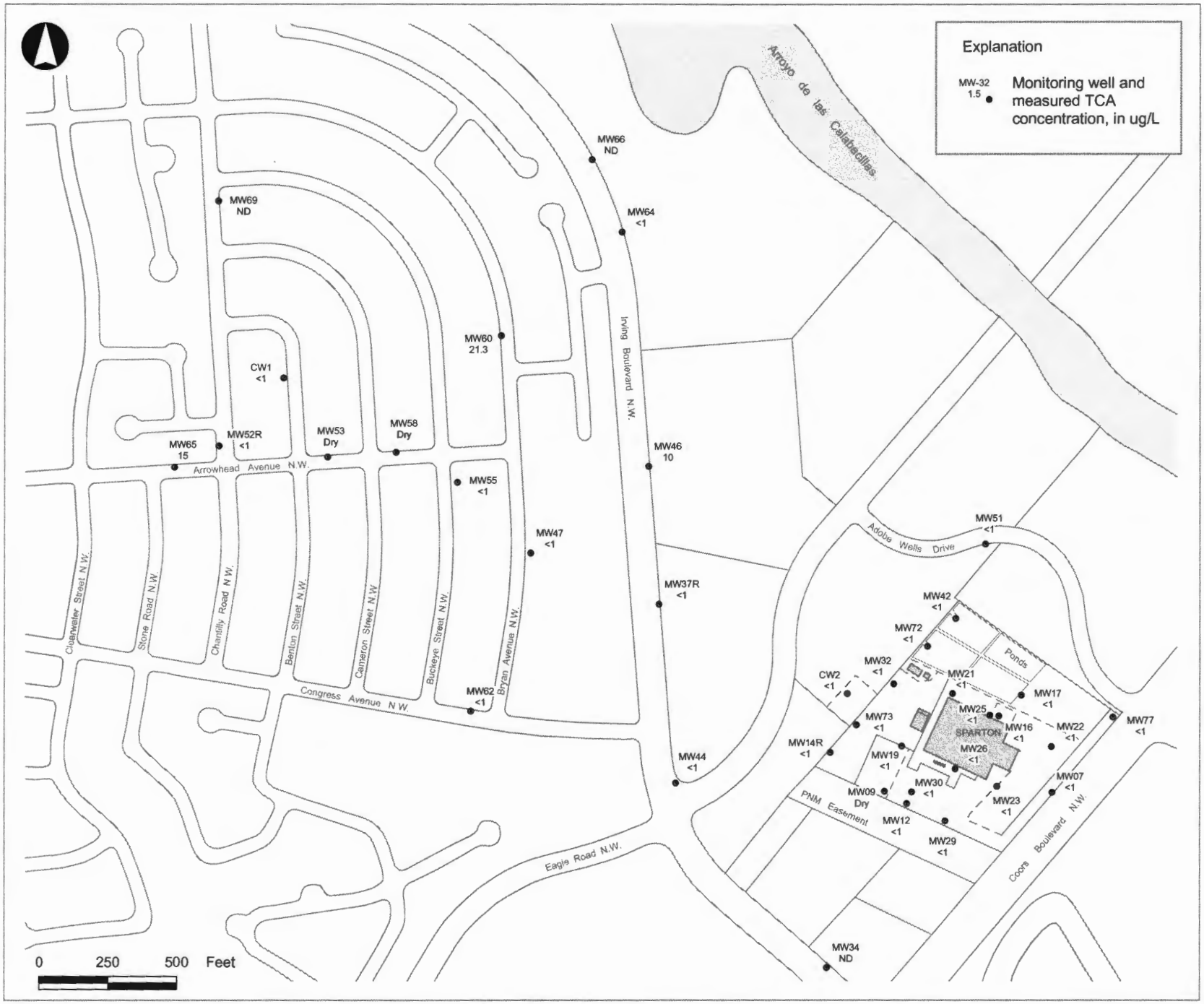


Figure 5.17 Maximum Concentrations of TCA in Wells - November 2007

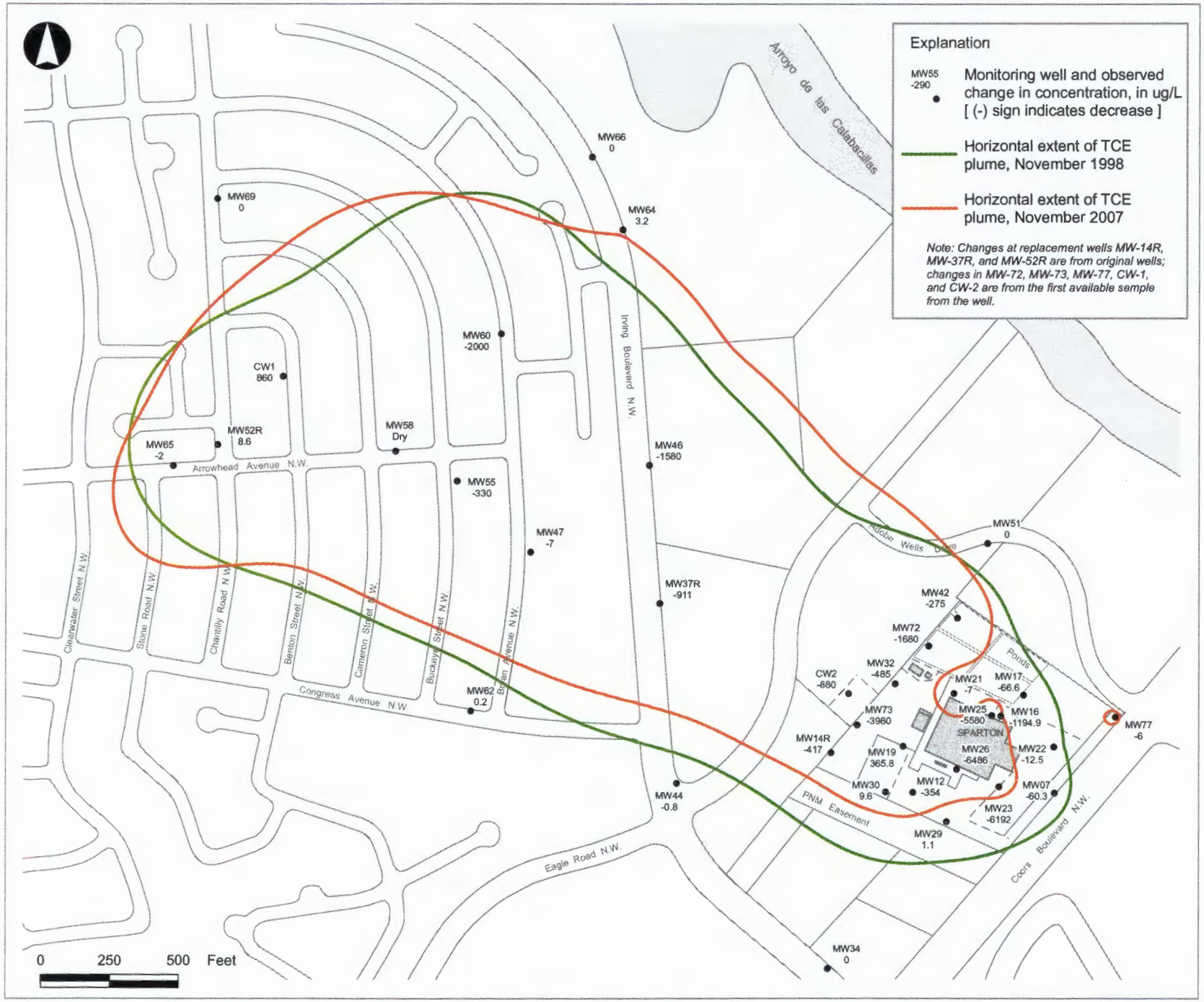


Figure 5.18 Changes in TCE Concentrations at Wells Used for Plume Definition - November 1998 to November 2007

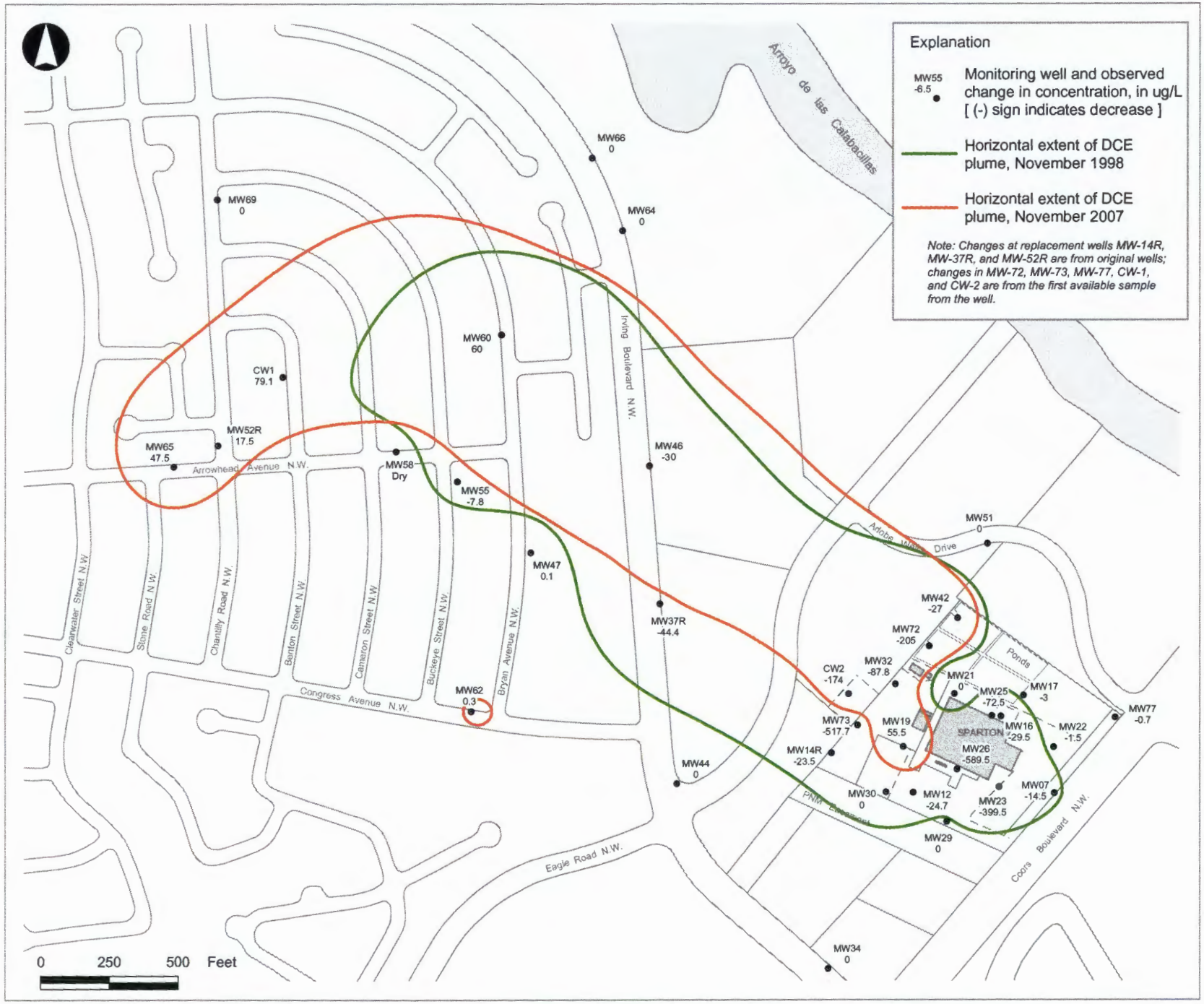


Figure 5.19 Changes in DCE Concentrations at Wells Used for Plume Definition - November 1998 to November 2007

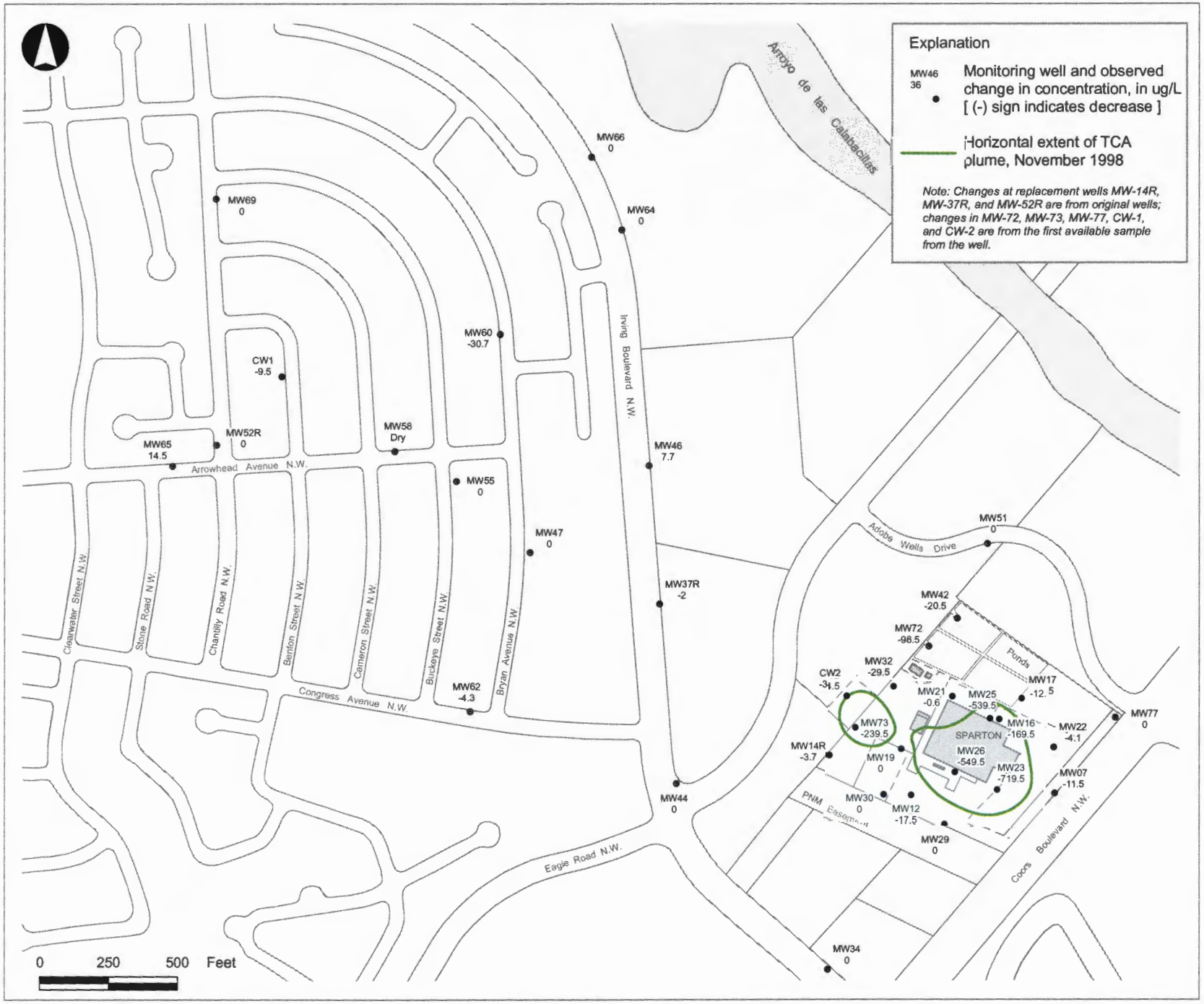


Figure 5.20 Changes in TCA Concentrations at Wells Used for Plume Definition - November 1998 to November 2007

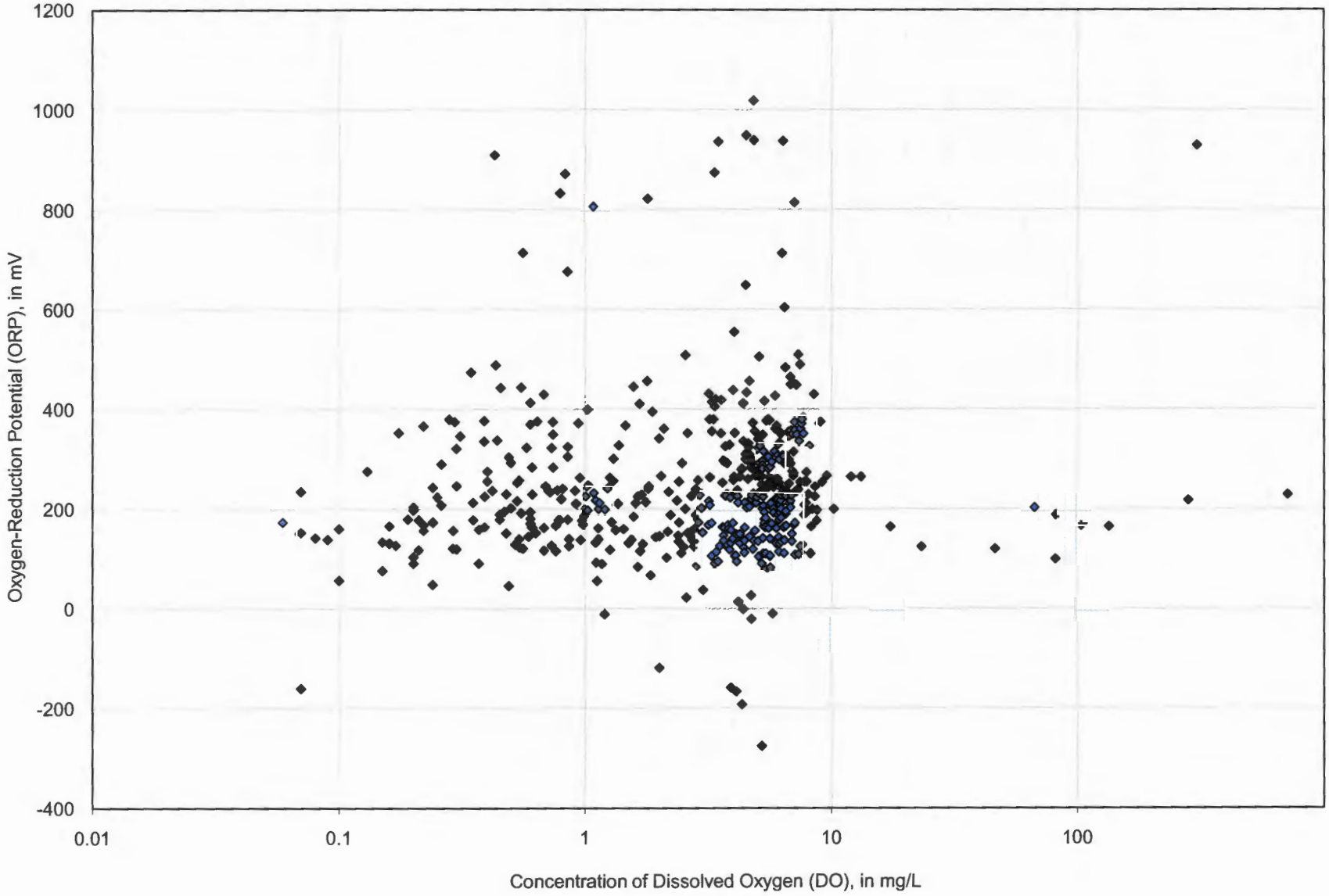


Figure 5.21 Data on DO Concentrations and ORP in Annual Samples from Monitoring Wells - 1998 to 2007

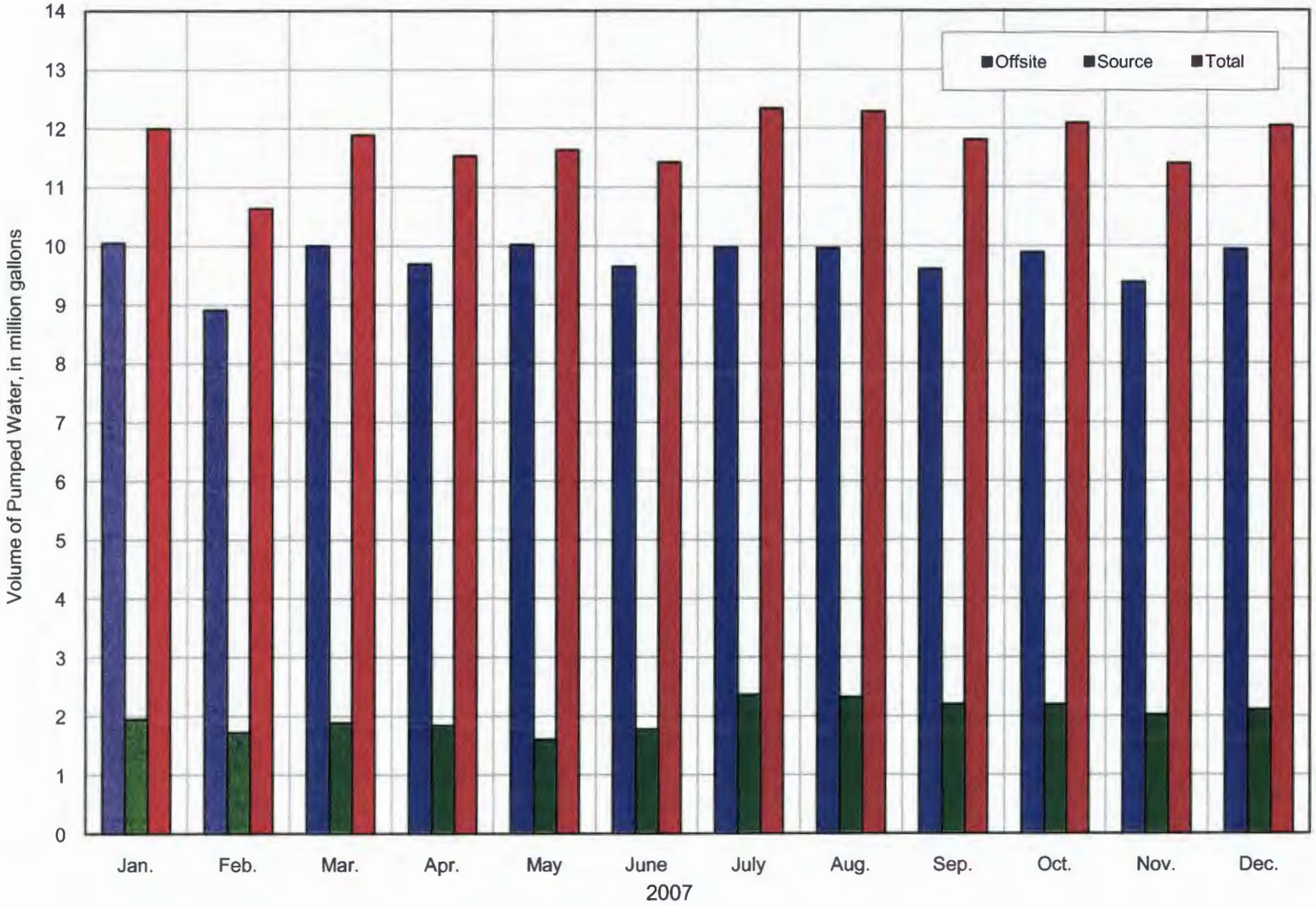


Figure 5.22 Monthly Volume of Water Pumped by the Off-Site Containment Wells - 2007

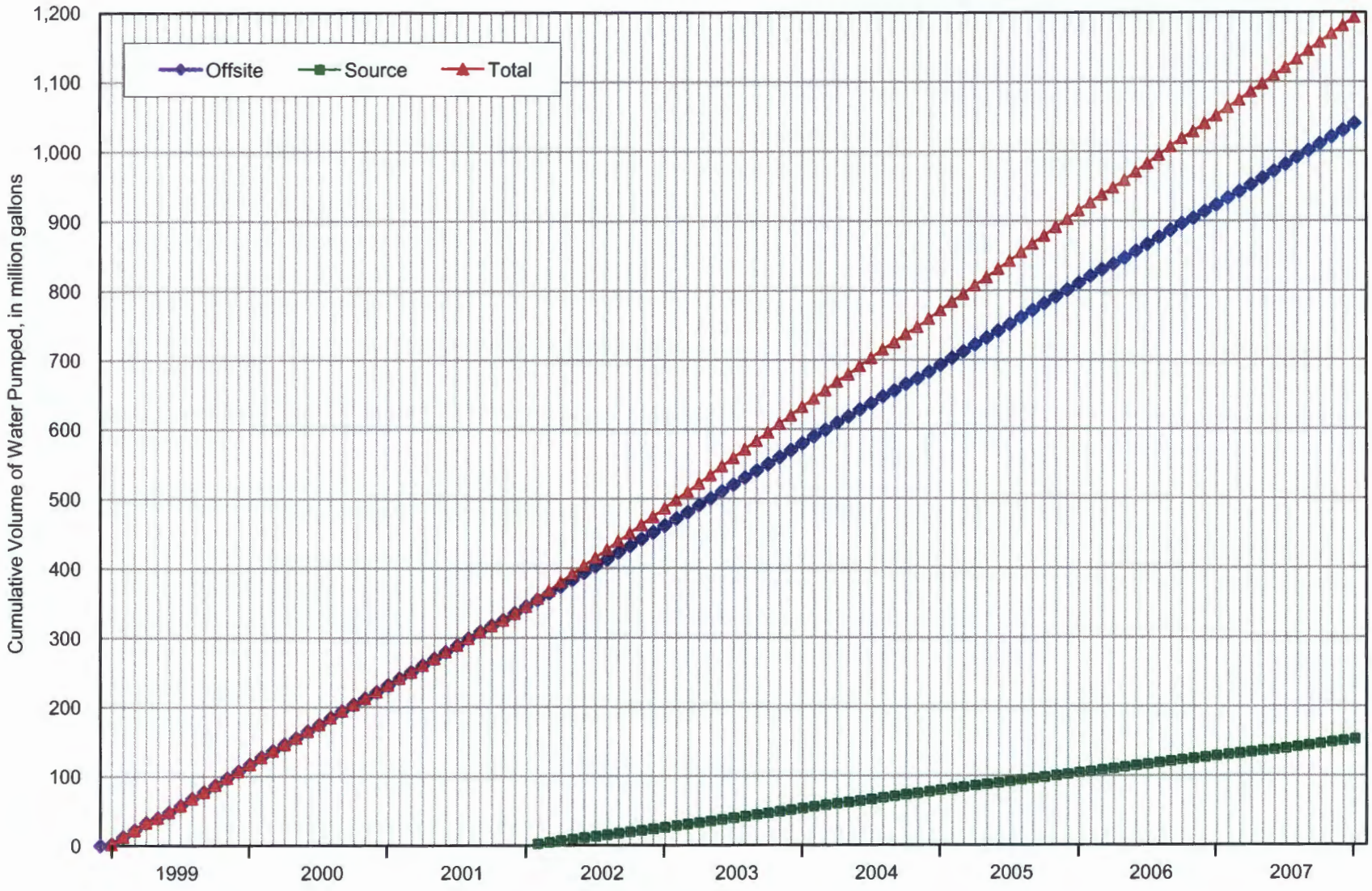


Figure 5.23 Cumulative Volume of Water Pumped by the Off-Site and Source Containment Wells

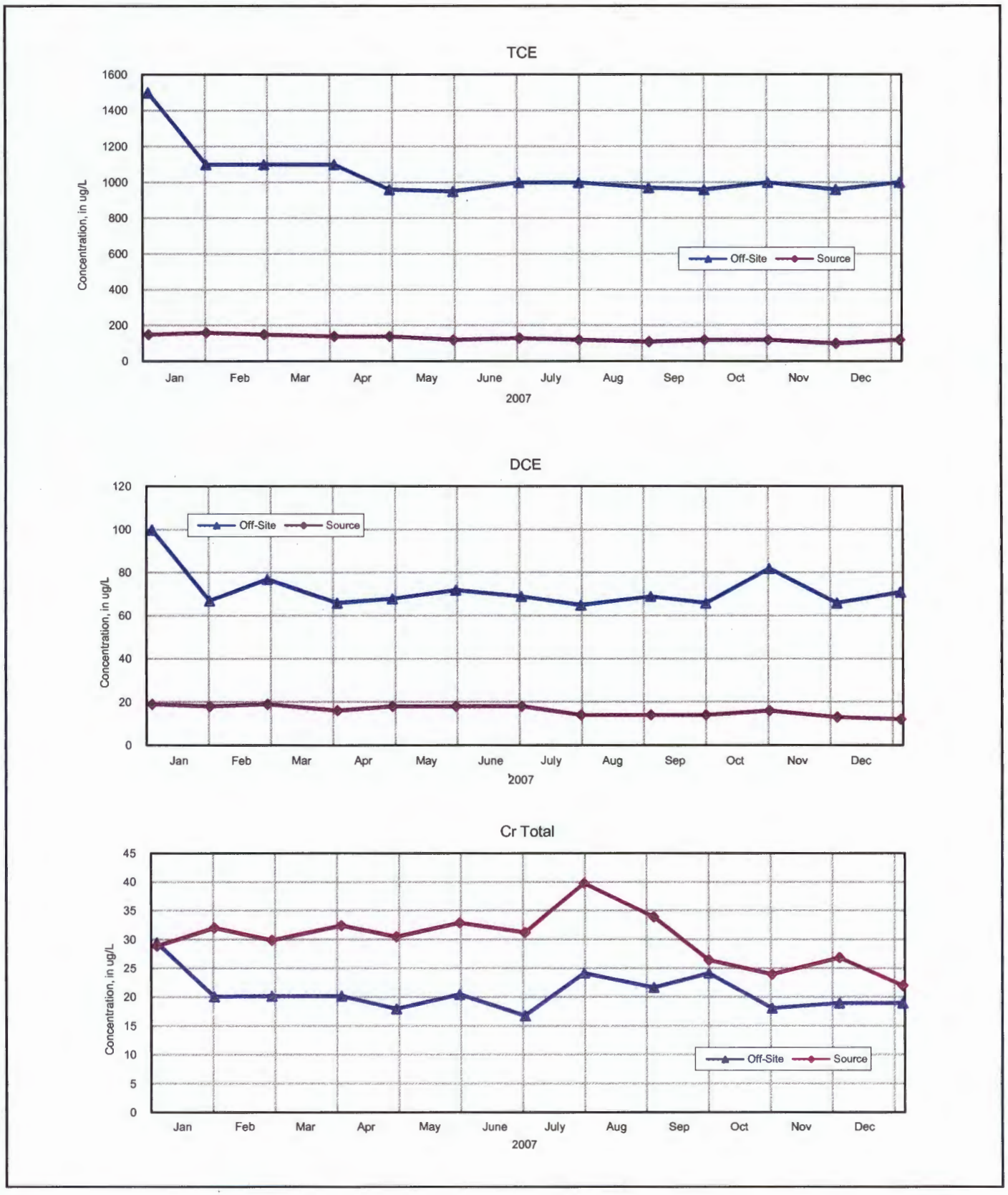


Figure 5.24 Source and Off-Site Containment Systems - TCE, DCE, and Total Chromium Concentrations in the Influent - 2007

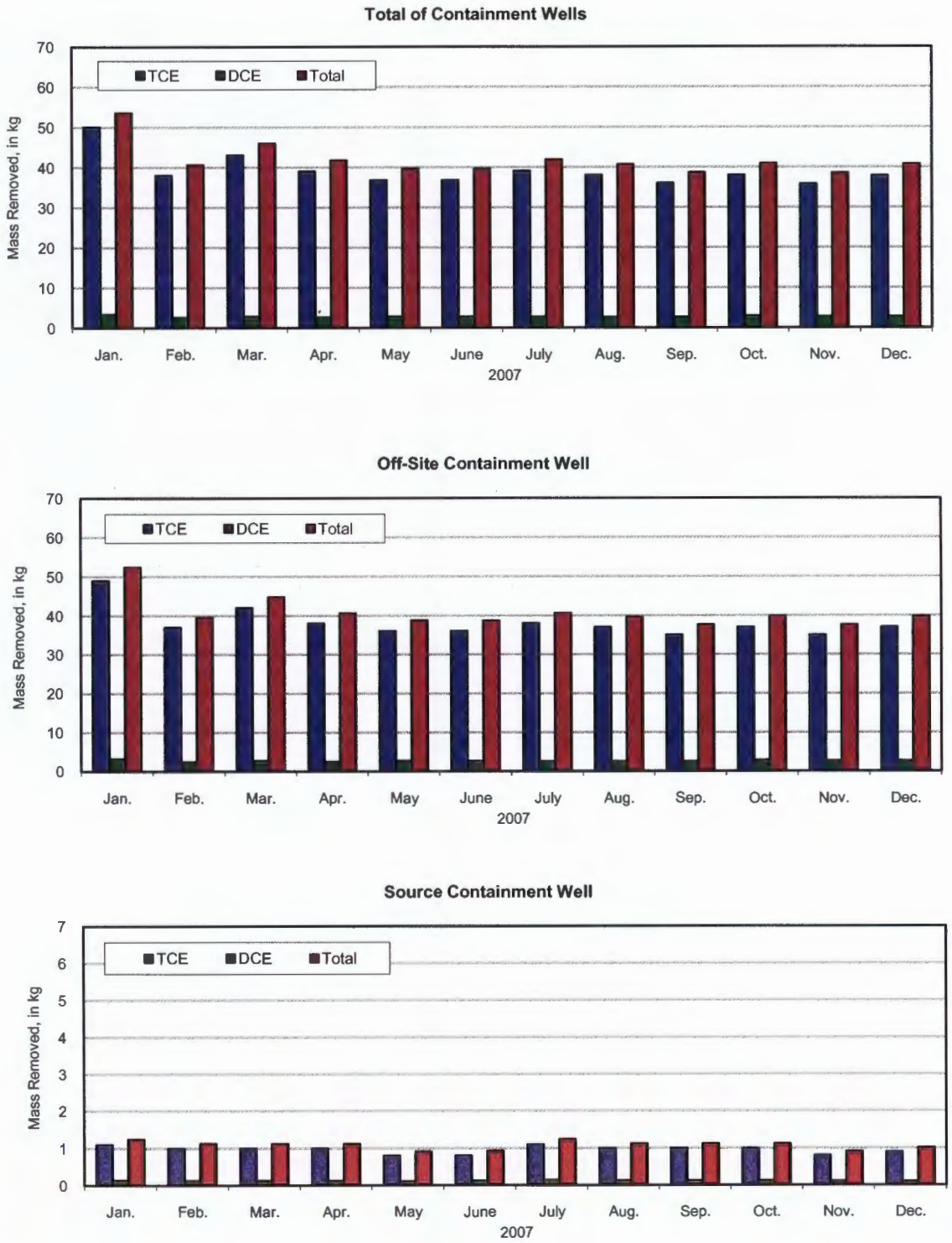


Figure 5.25 Monthly Contaminant Mass Removal by the Containment Wells - 2007

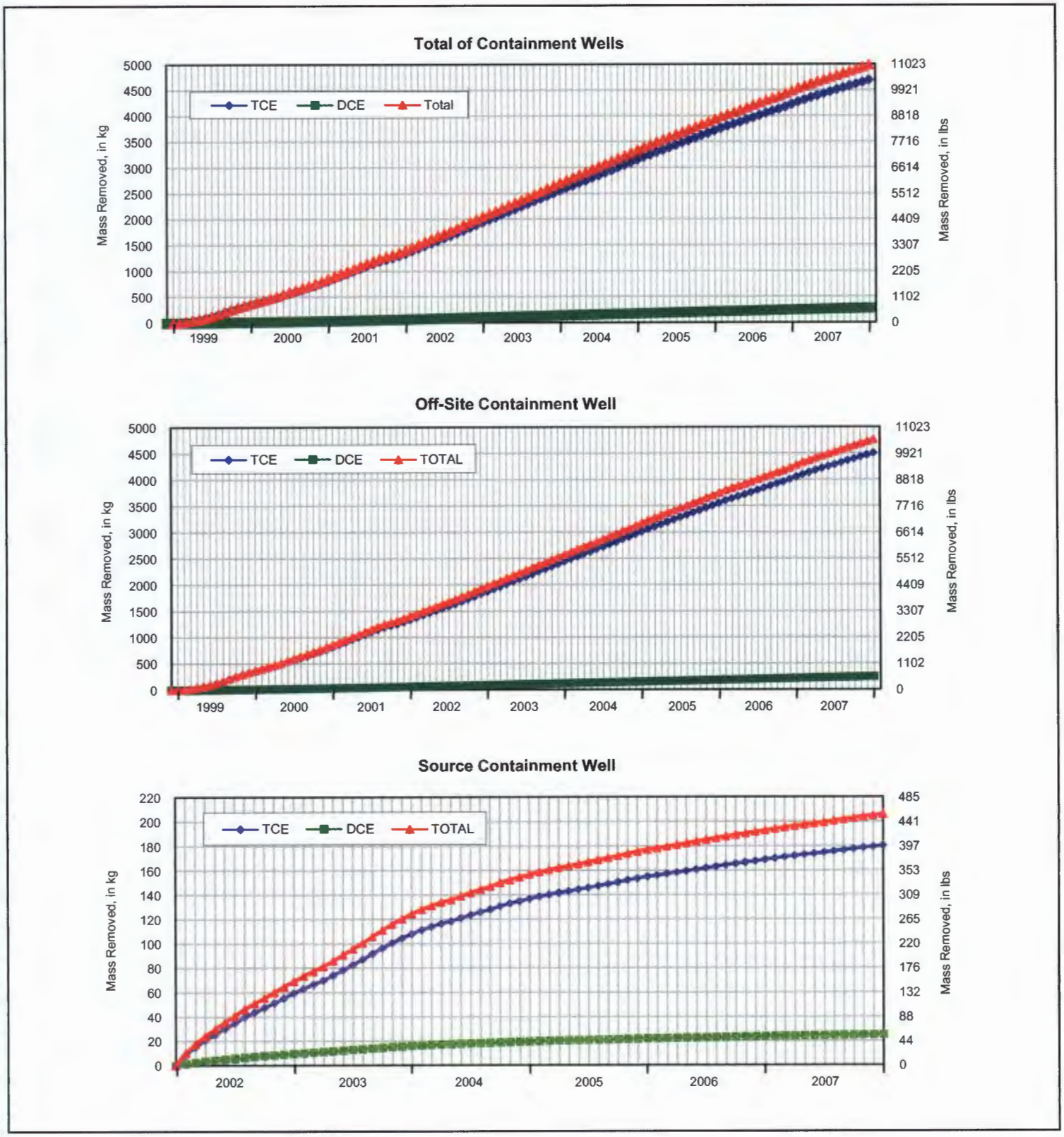


Figure 5.26 Cumulative Containment Mass Removal by the Source and Off-Site Containment Wells

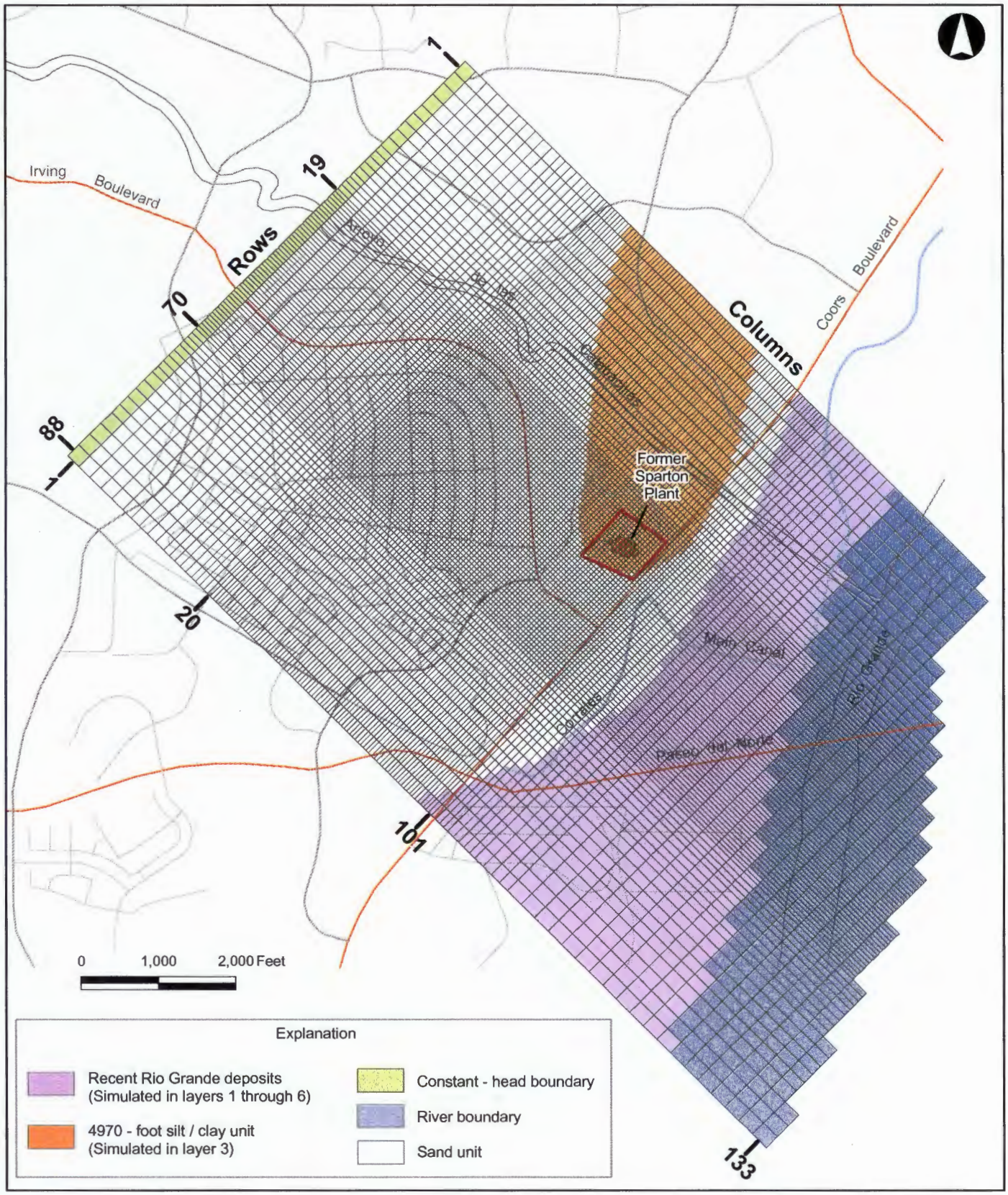


Figure 6-1 Model Grid, Hydraulic Property Zones and Boundary Conditions

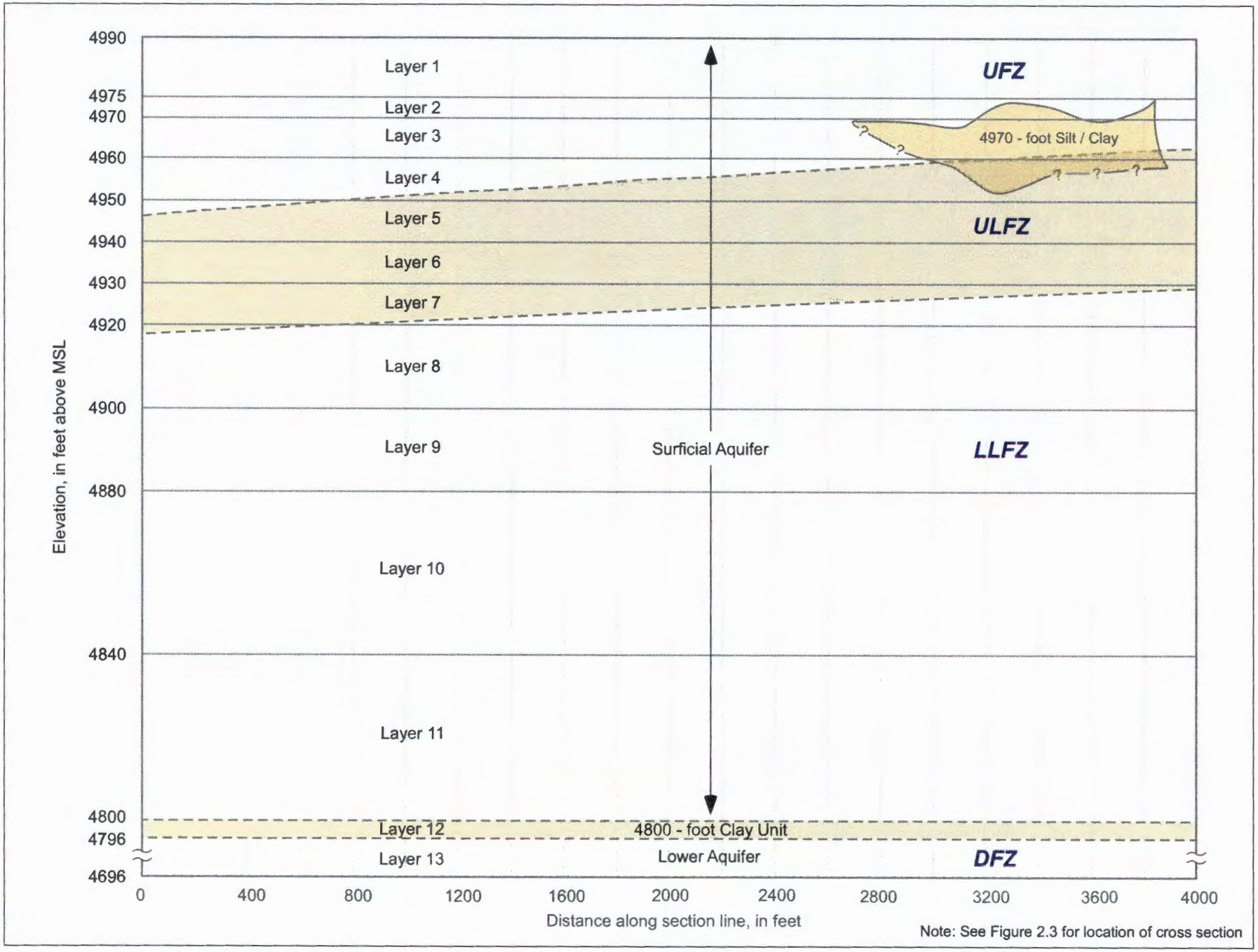


Figure 6.2 Model Layers

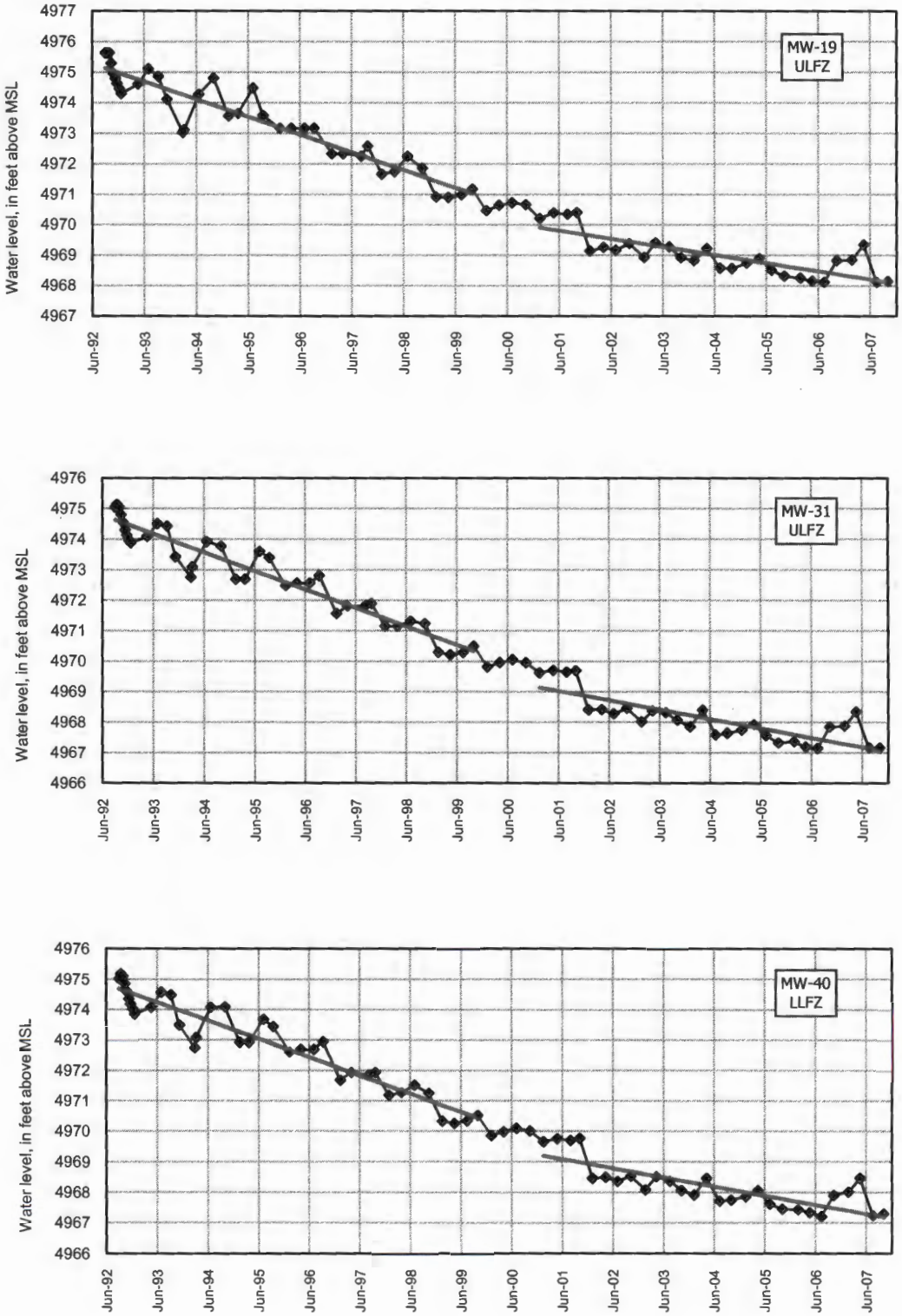
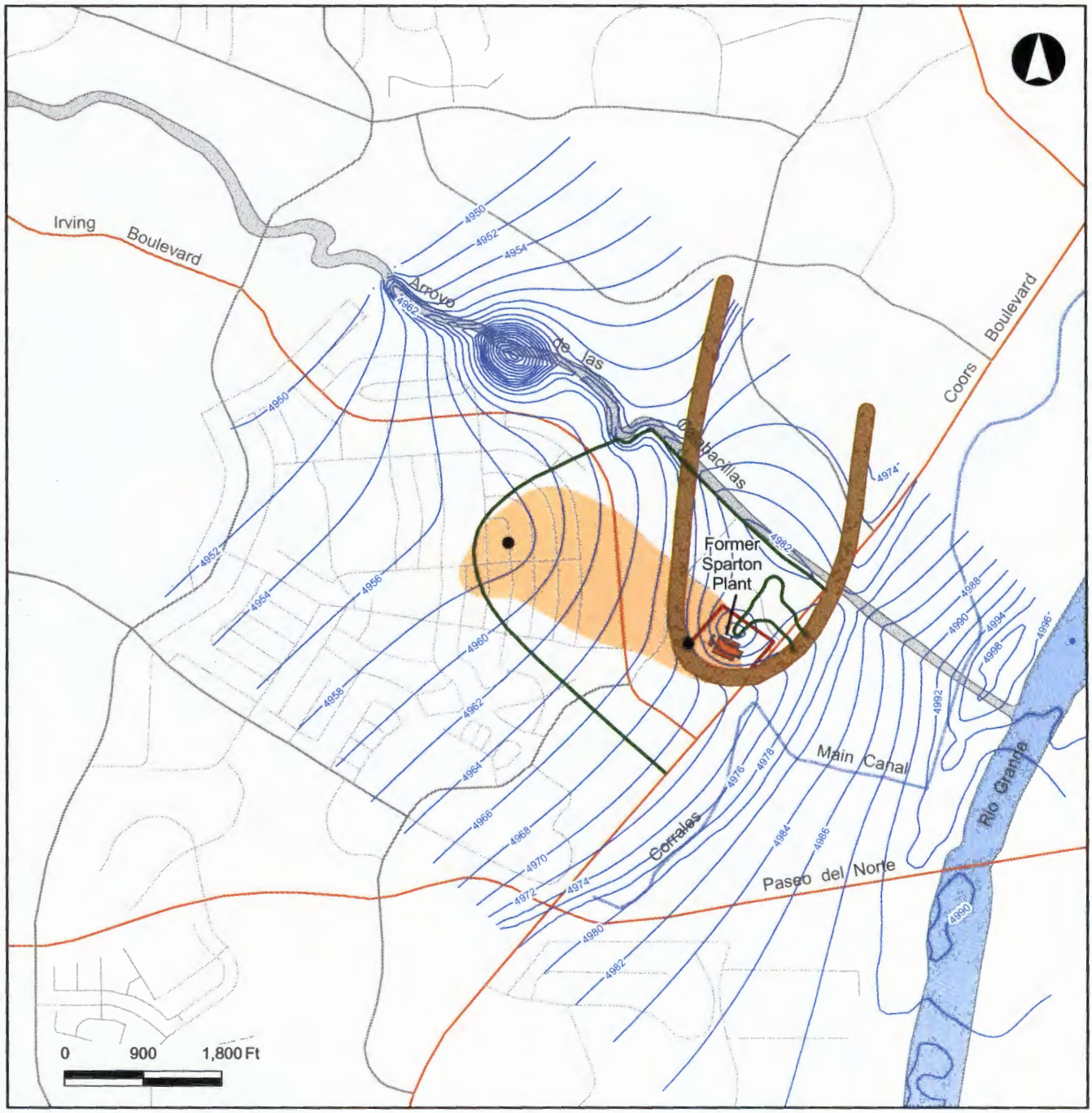


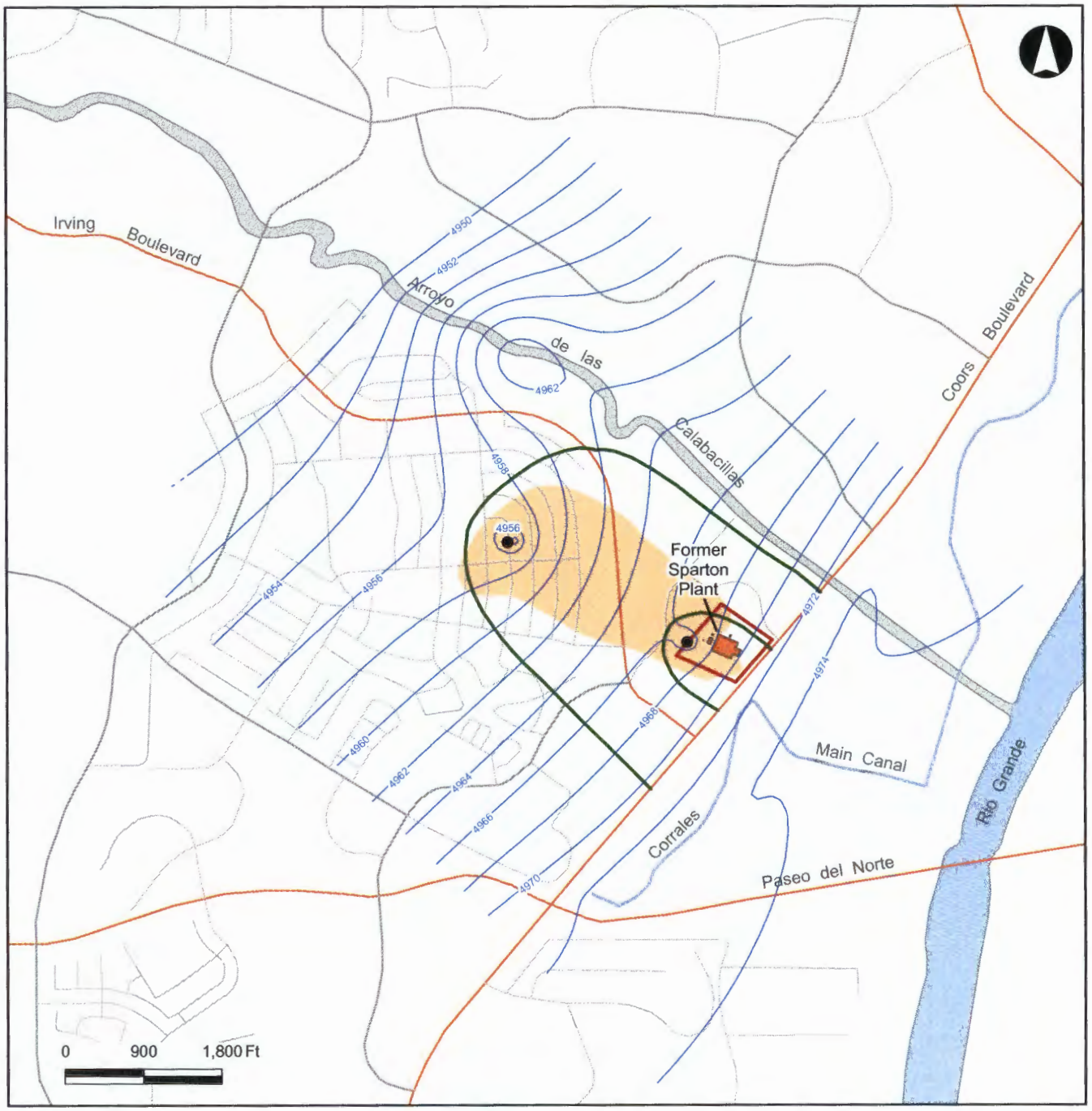
Figure 6.3 Regional Water Level Trends



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 2006

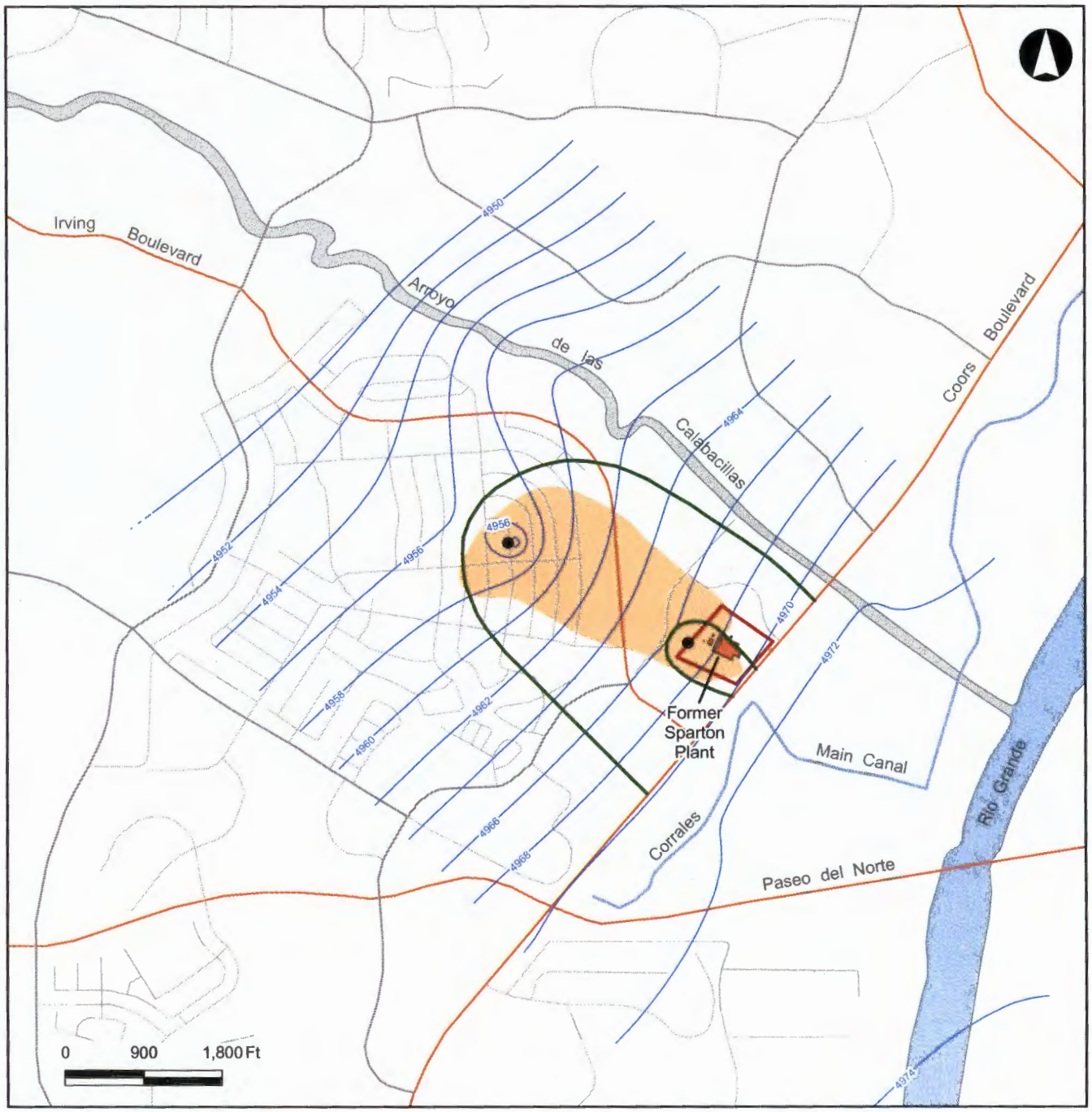
Figure 6.4 Calculated Water Table (UFZ) and Comparison of the Calculated Capture Zone to the TCE Plume Extent



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 2006

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 2006

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

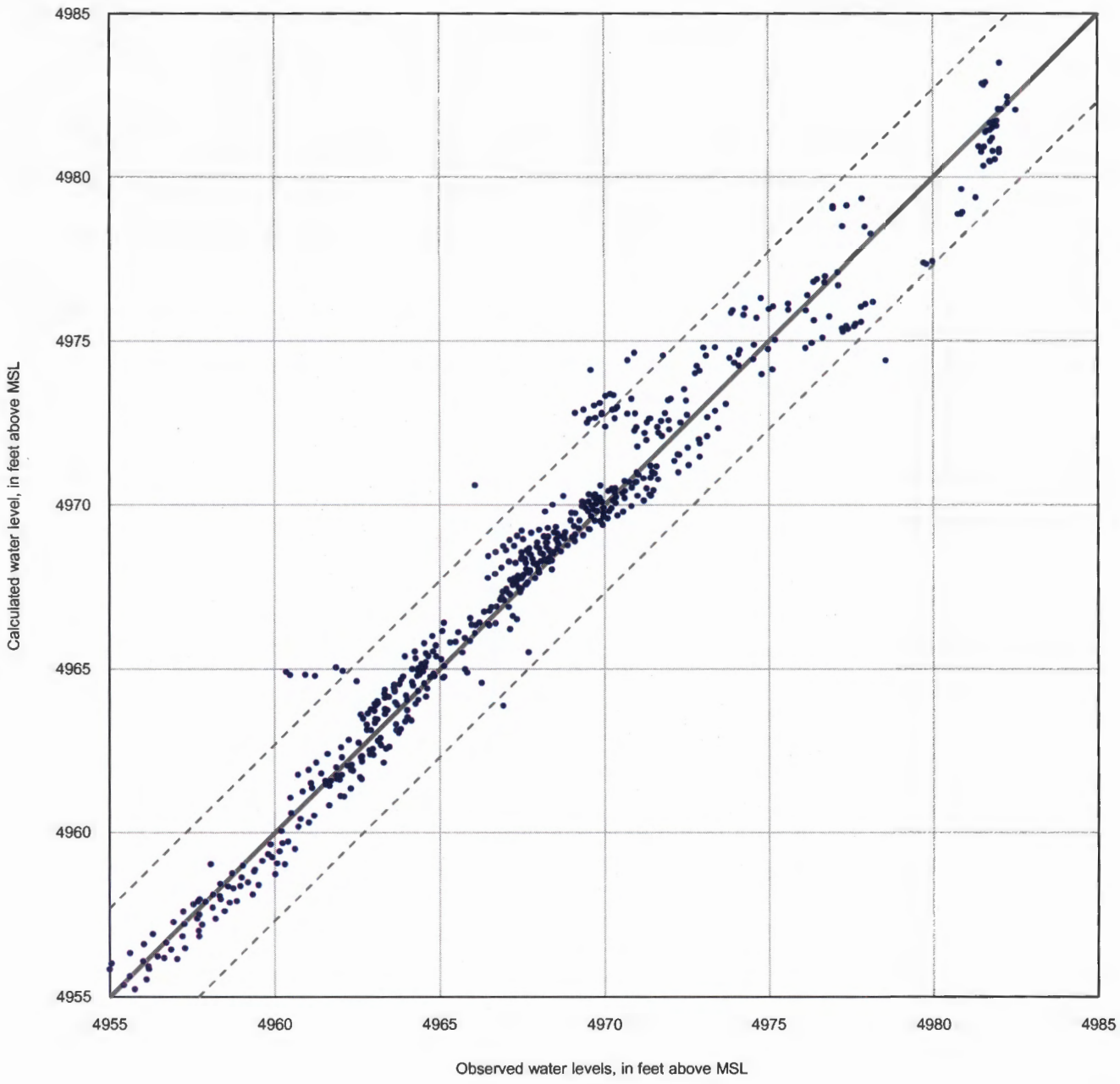


Figure 6.7 Comparison of Calculated to Observed Water Levels - November 1998 to November 2007

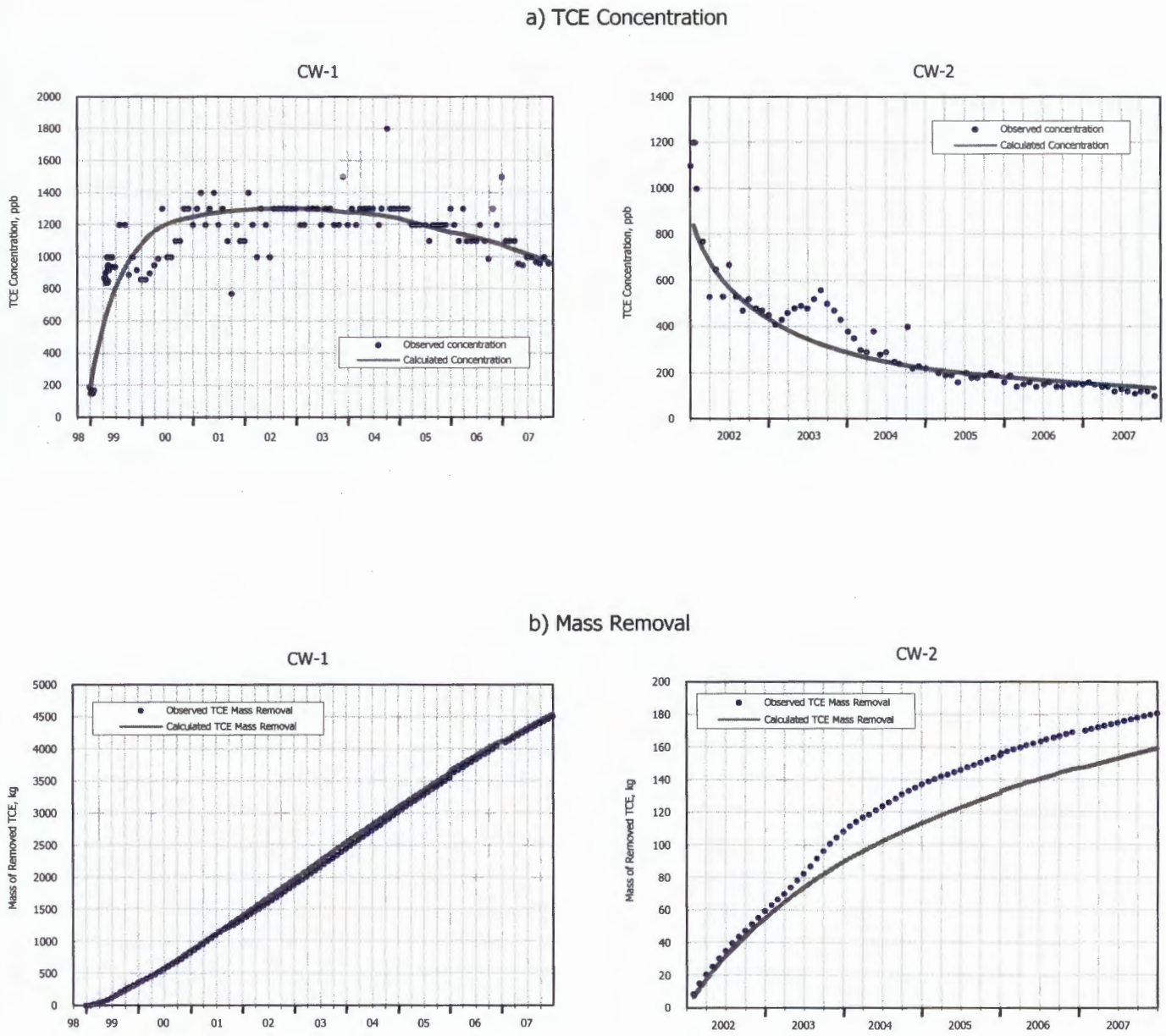
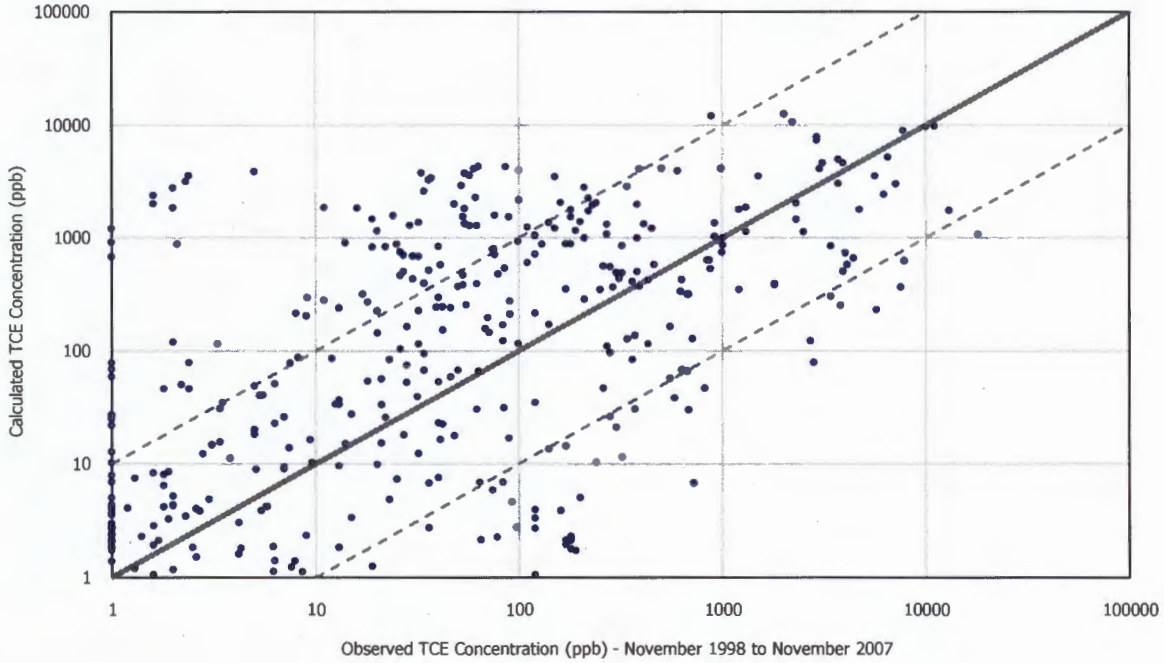


Figure 6.8 Comparison of Calculated to Observed TCE Concentrations and Mass Removal



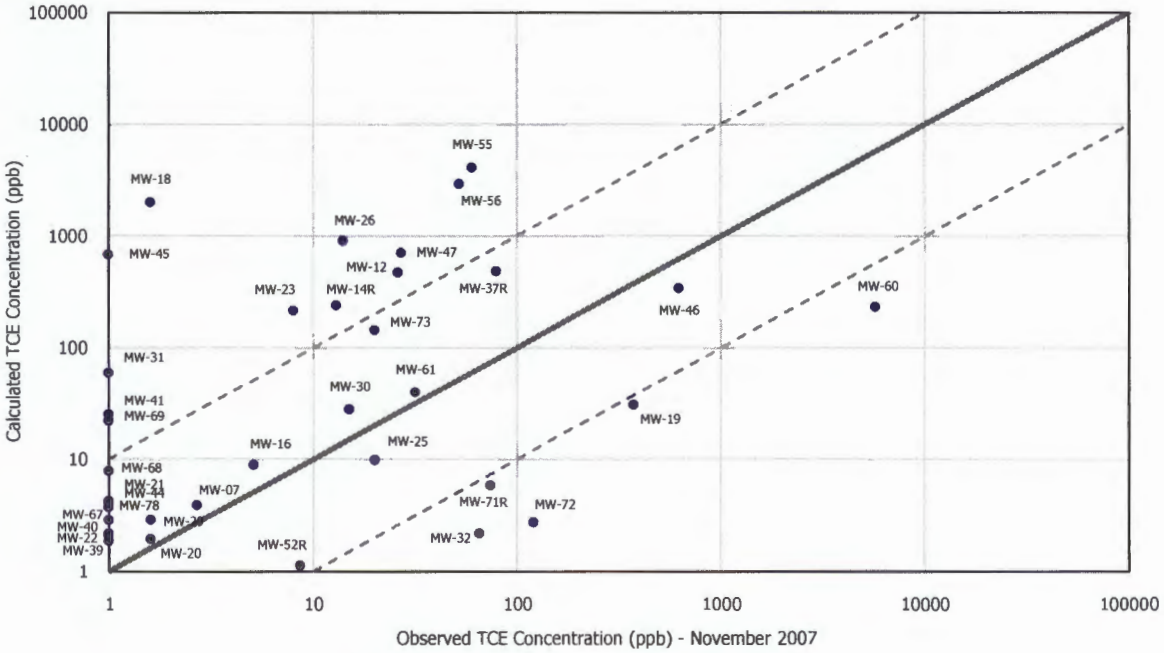


Figure 6.9 Comparisons of Calculated to Observed TCE Concentrations

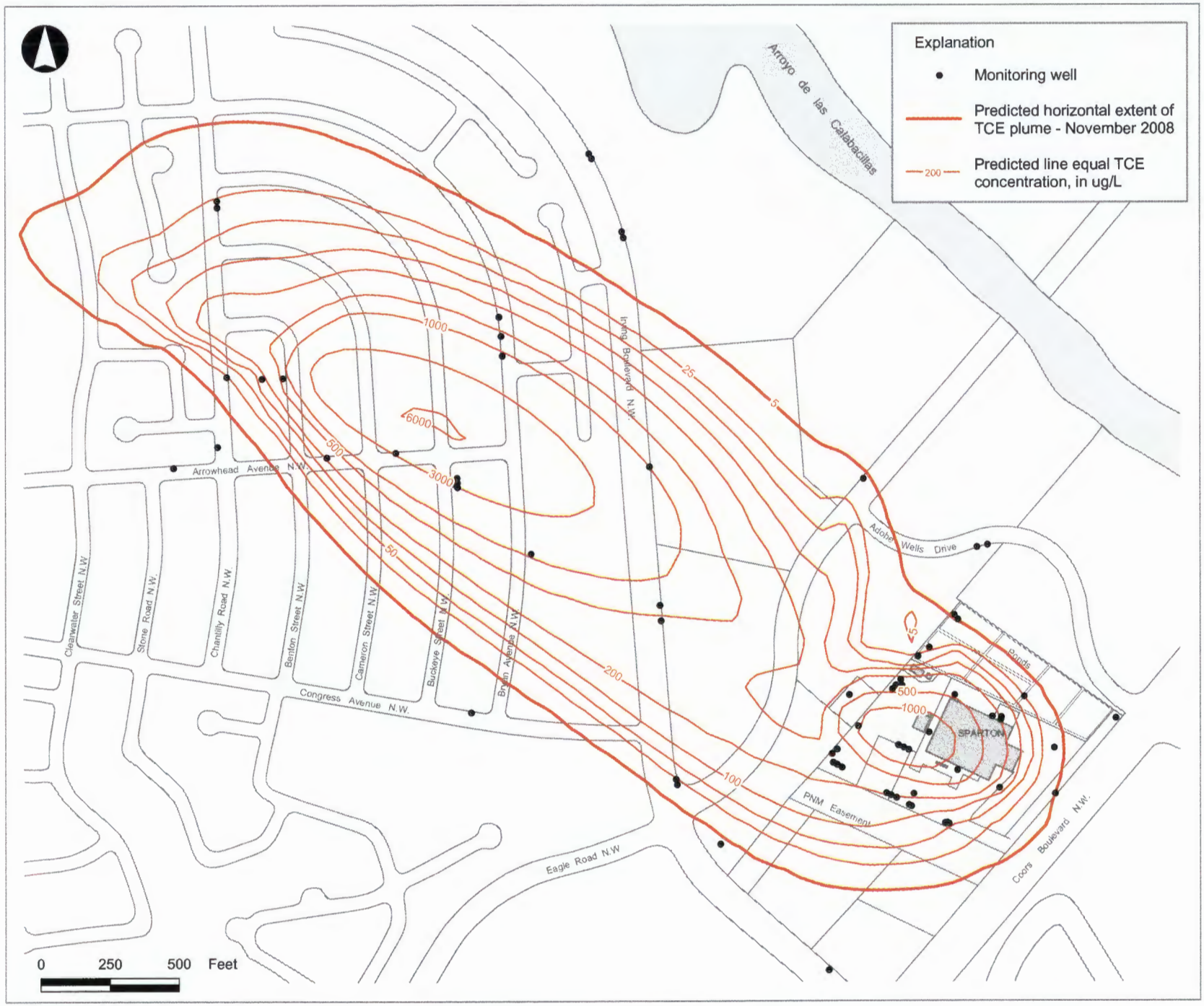


Figure 6.10 Predicted Extent of TCE Plume - November 2008

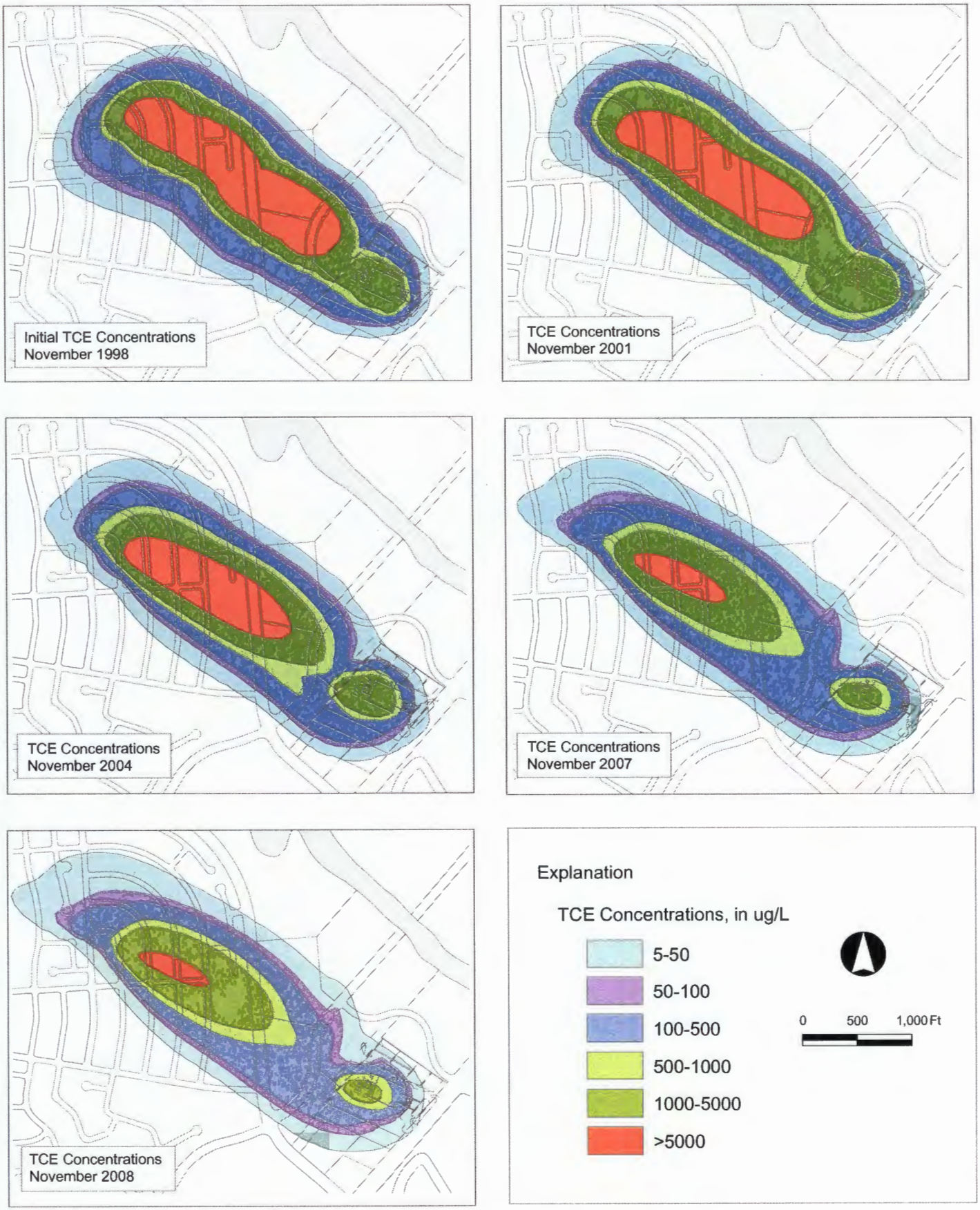


Figure 6.11 Model Calculated TCE Concentrations

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
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-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
MW-44	ULFZ	376166.14	1524136.09	5058.63[d]

Well ID	Flow Zone[a]	Easting[b]	Northing[b]	Elevation[c]
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
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-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
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

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-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 (gal)	Average Discharge Rate (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 (gal)	**4,416,550**	
Average Discharge Rate (gpm)		**0.77**

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

[b] System opertaions were terminated on November 16, 1999.

Table 2.4

Water-Level Elevations - Fourth Quarter 1998[a]

Well ID	Flow Zone	Elevation (ft above MSL)
PW-1	UFZ	4973.59
PZ-1	UFZ	4956.59
MW-7	UFZ O/S [b]	4977.42
MW-9	UFZ O/S	4973.06
MW-12	UFZ O/S	4972.82
MW-13	UFZ O/S	4974.35
MW-14	UFZ	4971.12
MW-15	UFZ	Dry
MW-16	UFZ O/S	4978.43
MW-17	UFZ O/S	4978.70
MW-18	UFZ O/S	4971.87
MW-19	ULFZ	4971.85
MW-20	LLFZ	4971.47
MW-21	UFZ O/S	4978.31
MW-22	UFZ O/S	4977.89
MW-23	UFZ O/S	4975.91
MW-24	UFZ O/S	4978.23
MW-25	UFZ O/S	4978.31
MW-26	UFZ O/S	4973.44
MW-27	UFZ O/S	4974.05
MW-28	UFZ O/S	4971.09
MW-29	ULFZ	4973.68
MW-30	ULFZ	4972.28
MW-31	ULFZ	4971.23
MW-32	ULFZ [c]	4970.96
MW-33	UFZ O/S	4972.54
MW-34	UFZ	4974.51
MW-35	UFZ	4970.78
MW-36	UFZ	4970.03
MW-37	UFZ	4968.32
MW-38	LLFZ	4973.70
MW-39	LLFZ	4972.49

Well	Flow Zone	Elevation (ft above MSL)
MW-40	LLFZ	4971.25
MW-41	ULFZ	4971.09
MW-42	ULFZ	4970.65
MW-43	LLFZ	4970.45
MW-44	ULFZ	4970.11
MW-45	ULFZ	4968.33
MW-46	ULFZ	4966.95
MW-47	UFZ	4966.68
MW-48	UFZ	4965.81
MW-49	LLFZ [c]	4971.03
MW-50	UFZ	Dry
MW-51	UFZ O/S	4980.09
MW-52	UFZ	4963.17
MW-53	UFZ	4964.92
MW-54	UFZ	4965.56
MW-55	LLFZ	4965.13
MW-56	ULFZ	4965.76
MW-57	UFZ	4964.87
MW-58	UFZ	4965.43
MW-59	ULFZ	4969.46
MW-60	ULFZ	4965.33
MW-61	UFZ	4965.37
MW-62	UFZ	4967.52
MW-63	UFZ O/S	4970.98
MW-64	ULFZ	4965.41
MW-65	LLFZ	4963.05
MW-66	LLFZ	4963.98
MW-67	DFZ	4958.56
MW-68	UFZ	4962.25
MW-69	LLFZ	4962.13
MW-70	LLFZ [d]	4970.18
MW-71	DFZ	4958.51

[a] Water levels were measured on November 10, 1998, except for wells PW-1, MW-18, and MW-23 through MW-28 which were measured on November 25, 1998.

[b] UFZ O/S denotes UFZ wells, mostly on-site, which are screened above or within the 4970-foot silt/clay.

[c] Previously classified as LLFZ.

[d] Previously classified as 3rdFZ.

Table 2.5

Water-Quality Data - Fourth Quarter 1998[a]

Well ID	Sampling Date	Concentration (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	1.0	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	8.0
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	2.0	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	380	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 (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	1.0	<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	2.0	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
	02/18/98	3400	270	170
TW-2	02/19/98	18	<1.0	<1.0
	02/19/98	16	<1.0	<1.0

[a] Includes February 18, 1998 data from temporary well TW-1/2 which was drilled at the current location of well MW-73, and September 1, 1998 data from the containment well CW-1 and observation wells OB-1 and OB-2.

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 mg/L for TCE and DCE, and 60 mg/L for TCA).

Table 3.1

Downtime in the Operation of the Containment Systems - 2007

(a) Off-Site Containment System

Date of Downtime		Duration (hours)	Cause
From	To		
16-Feb	16-Feb	3.50	Radio signal error from inflitration gallery
26-Feb	26-Feb	6.75	Radio signal error from inflitration gallery
20-Jun	20-Jun	2.63	Power outage
17-Jul	17-Jul	1.16	System evaluation
23-Aug	23-Aug	1.58	Power outage
5-Sep	5-Sep	3.00	Data logger installation
17-Sep	17-Sep	0.25	Routine maintenance
2-Oct	2-Oct	2.12	Power outage
3-Oct	3-Oct	2.58	Routine maintenance
24-Oct	24-Oct	0.68	Radio testing
6-Nov	6-Nov	5.12	High air stripper sump alarm
21-Nov	21-Nov	5.92	Install data logger modem
28-Nov	28-Nov	12.60	Low chemical tank
11-Dec	11-Dec	0.45	Finalize radio, data logger, modem installation
Total Downtime		**48.34**	

(b) Source Containment System

Date of Downtime		Duration (hours)	Cause
From	To		
30-Mar	30-Mar	3.08	Filter service at inflitration pond meters
11-May	16-May	127.40	Replace CW-2 pump
13-Jun	13-Jun	1.07	Clean water meter valve
14-Jun	14-Jun	1.47	Clean check valve
22-Jun	25-Jun	77.30	Clean influent line from well
5-Jul	5-Jul	1.07	Power outage
7-Jul	7-Jul	0.81	Power outage
23-Aug	23-Aug	1.37	Power outage
17-Sep	17-Sep	0.50	Routine maintenance
2-Oct	2-Oct	2.48	Power outage
23-Oct	23-Oct	3.03	Routine maintenance
24-Oct	24-Oct	2.38	High air stripper sump alarm
Total Downtime		**221.96**	

Table 4.1

Quarterly Water-Level Elevations - 2007

Well ID	Flow Zone	Elevation (feet above MSL)			
		Feb. 21	May 15	Aug. 15	Nov. 1
CW-1	UFZ&LFZ	4935.34	4935.11	4934.41	4934.10
CW-2[a]	UFZ&LFZ	4958.52	NA	4955.58	4956.50
OB-1	UFZ&LFZ	4955.52	4955.56	4954.93	4954.98
OB-2	UFZ&LFZ	4957.04	4957.08	4956.42	4956.18
PZ-1	UFZ	4953.77	4953.76	4953.06	4952.74
MW-7	UFZ O/S	4975.39	4975.55	4975.14	4975.00
MW-9[b]	UFZ O/S	4970.33	4970.54	4969.84	4969.73
MW-12	UFZ O/S	4969.74	4970.02	4969.12	4969.12
MW-13	UFZ O/S	4971.85	4972.05	Dry	Dry
MW-14R	UFZ/ULFZ	4967.77	4968.26	4967.04	4967.02
MW-16	UFZ O/S	4981.70	4981.37	4982.22	4981.73
MW-17	UFZ O/S	4981.42	4981.04	4981.68	4981.55
MW-18	UFZ O/S	4973.97	4972.76	4974.47	4973.09
MW-19	ULFZ	4968.84	4969.33	4968.11	4968.14
MW-20	LLFZ	4968.35	4968.84	4967.57	4967.62
MW-21	UFZ O/S	4982.43	4981.72	4983.21	4982.52
MW-22	UFZ O/S	4977.26	4977.21	4977.11	4976.96
MW-23	UFZ O/S	4974.19	4974.30	4973.90	4973.85
MW-24	UFZ O/S	4981.49	4981.19	4982.06	4981.60
MW-25	UFZ O/S	4981.67	4981.36	4982.30	4981.80
MW-26	UFZ O/S	4971.41	4971.54	4971.00	4970.92
MW-27	UFZ O/S	4980.77	4980.38	4981.54	4980.86
MW-29	ULFZ	4970.91	4971.16	4970.43	4970.36
MW-30	ULFZ	4969.20	4969.58	4968.63	4968.61
MW-31	ULFZ	4967.87	4968.33	4967.16	4967.15
MW-32	ULFZ	4967.84	4968.52	4967.01	4967.03
MW-34	UFZ	4971.40	4971.60	4971.12	4970.98
MW-37R	UFZ/ULFZ	4964.73	4964.77	4964.07	4963.95
MW-38	LLFZ	4970.94	4971.10	4970.44	4970.40
MW-39	LLFZ	4969.52	4969.84	4968.94	4968.89
MW-40	LLFZ	4968.01	4968.46	4967.24	4967.29
MW-41	ULFZ	4968.19	4968.89	4967.47	4967.49
MW-42	ULFZ	4968.29	4968.53	4967.52	4967.49
MW-43	LLFZ	4968.13	4968.22	4967.26	4967.31
MW-44	ULFZ	4967.03	4967.09	4966.48	4966.35
MW-45	ULFZ	4964.99	4965.09	4964.40	4964.27

Note: Well MW-33 was not listed because it was dry all year.

Well ID	Flow Zone	Elevation (feet above MSL)			
		Feb. 21	May 15	Aug. 15	Nov. 1
MW-46	ULFZ	4964.26	4964.15	4963.53	4963.34
MW-47	UFZ	4963.64	4963.55	4963.04	4962.79
MW-48	UFZ	4962.59	4962.47	4962.05	4961.70
MW-49	LLFZ	4967.99	4968.35	4967.26	4967.25
MW-51	UFZ O/S	4982.10	4981.99	4981.98	4982.02
MW-52R	UFZ/ULFZ	4958.52	4958.52	4958.03	4957.69
MW-53	UFZ	4960.79	4960.83	4960.05	4960.08
MW-54	UFZ	4963.72	4963.48	4962.82	4962.61
MW-55	LLFZ	4961.33	4961.28	4960.70	4960.48
MW-56	ULFZ	4962.46	4962.53	4962.09	4961.66
MW-57	UFZ	4963.59	4963.30	4962.64	Dry
MW-58	UFZ	4961.83	4961.83	4961.38	4961.04
MW-59	ULFZ	4967.37	4967.40	4966.40	4966.48
MW-60	ULFZ	4962.60	4962.43	4961.95	4961.55
MW-61	UFZ	4962.52	4962.23	4961.86	4961.54
MW-62	UFZ	4964.41	4964.41	4963.97	4963.71
MW-63	UFZ O/S	4977.53	4974.76	4972.68	4978.54
MW-64	ULFZ	4963.69	4963.45	4962.89	4962.68
MW-65	LLFZ	4958.50	4958.56	4958.06	4957.73
MW-66	LLFZ	4961.74	4961.54	4960.80	4960.71
MW-67	DFZ	4955.84	4955.09	4954.29	4954.39
MW-68	UFZ	4958.73	4958.82	4958.34	4957.92
MW-69	LLFZ	4958.67	4958.70	4958.18	4957.81
MW-70	LLFZ	4967.27	4967.90	4966.41	4966.47
MW-71R	DFZ	4955.90	4955.34	4954.27	4954.44
MW-72	ULFZ	4968.37	4968.67	4967.59	4967.59
MW-73	ULFZ	4967.32	4968.22	4966.47	4966.52
MW-74	UFZ/ULFZ	4961.43	4961.38	4960.71	4960.36
MW-75	UFZ/ULFZ	4965.66	4965.67	4965.06	4964.82
MW-76	UFZ/ULFZ	4967.07	4967.15	4966.68	4966.21
MW-77	UFZ/ULFZ	4976.75	4976.87	4976.45	4976.36
MW-78	UFZ/ULFZ	4974.41	4974.27	4974.37	4974.08
MW-79	DFZ	4953.68	4953.38	4952.14	4953.34
PZG-1	Infilt. Gall.	Dry	Dry	Dry	Dry
Canal[c]		Dry	4991.12	4991.25	Dry

[a] Pump out of well. MP not available on May 15, 2007.

[b] Water level corrected for August 15, 2007 and was below screen November 11, 2007

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

Table 4.2

Water-Quality Data - Fourth Quarter 2007

Well ID	Sampling Date	Concentration (µg/L)		
		TCE	DCE	TCA
CW-1	11/01/07	1000	82	<1.0
CW-2	11/01/07	120	16	<1.0
MW-7	11/08/07	2.7	<1.0	<1.0
MW-9[a]	11/08/07	----	----	----
MW-12	11/08/07	26	1.3	<1.0
MW-13[a]	11/08/07	----	----	----
MW-14R	11/08/07	13	<1.0	<1.0
MW-16	11/09/07	5.1	<1.0	<1.0
MW-17	11/13/07	1.4	<1.0	<1.0`
MW-18	11/08/07	1.6	<1.0	<1.0
MW-19	11/07/07	370	56	<1.0
MW-20	11/07/07	1.6	<1.0	<1.0
MW-21	11/09/07	<1.0	<1.0	<1.0
MW-22	11/07/07	<1.0	<1.0	<1.0
MW-23	11/09/07	8	<1.0	<1.0
MW-25	11/09/07	20	<1.0	<1.0
MW-26	11/09/07	14	<1.0	<1.0
MW-29	11/09/07	1.6	<1.0	<1.0
MW-30	11/08/07	15	<1.0	<1.0
MW-31	11/08/07	<1.0	<1.0	<1.0
MW-32	11/07/07	65	8.2	<1.0
MW-34	11/09/07	<1.0	<1.0	<1.0
MW-37R	11/12/07	79	3.6	<1.0
MW-38	11/09/07	<1.0	<1.0	<1.0
MW-39	11/09/07	<1.0	<1.0	<1.0
MW-40	11/08/07	<1.0	<1.0	<1.0
MW-41	11/07/07	<1.0	<1.0	<1.0
MW-42	11/07/07	95	21	<1.0
MW-43	11/07/07	1.6	<1.0	<1.0
MW-44	11/12/07	<1.0	<1.0	<1.0
MW-45	11/12/07	<1.0	<1.0	<1.0

Well ID	Sampling Date	Concentration (µg/L)		
		TCE	DCE	TCA
MW-46[b]	11/12/07	620	100	10
MW-47	11/13/07	27	1.3	<1.0
MW-48	11/08/07	----	----	----
MW-49	11/08/07	<1.0	<1.0	<1.0
MW-51	11/13/07	<1.0	<1.0	<1.0
MW-52R	11/15/07	8.6	18	<1.0
MW-53[a]	11/08/07	----	----	----
MW-55	11/13/07	60	2.2	<1.0
MW-56	11/13/07	52	1.7	<1.0
MW-57[a]	11/08/07	----	----	----
MW-58[a]	11/08/07	----	----	----
MW-59	11/12/07	<1.0	<1.0	<1.0
MW-60	11/14/07	5700	410	21.3
MW-61[b]	11/14/07	31.5	2.2	<1.0
MW-62	11/12/07	2.2	6.9	<1.0
MW-64	11/12/07	3.7	<1.0	<1.0
MW-65	11/14/07	11	48	15
MW-66	11/14/07	<1.0	<1.0	<1.0
MW-67	11/13/07	<1.0	<1.0	<1.0
MW-68	11/14/07	<1.0	<1.0	<1.0
MW-69	11/14/07	<1.0	<1.0	<1.0
MW-70	11/08/07	16	1.1	<1.0
MW-71R	11/14/07	74	2.7	<1.0
MW-72	11/07/07	120	15	<1.0
MW-73[b]	11/07/07	20	2.3	<1.0
MW-74	11/13/07	<1.0	<1.0	<1.0
MW-75	11/13/07	<1.0	<1.0	<1.0
MW-76	11/13/07	<1.0	<1.0	<1.0
MW-77	11/13/07	10	<1.0	<1.0
MW-78	11/13/07	<1.0	<1.0	<1.0
MW-79	11/13/07	<1.0	<1.0	<1.0

[a] Well not sampled because it was dry or did not have sufficient water for sampling.

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

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 mg/L for TCE and DCE, and 60 mg/L for TCA).

Table 4.3

Flow Rates - 2007

Month	Off-Site Containment Well		Source Containment Well		Total	
	Volume Pumped (gal)	Average Rate (gpm)	Volume Pumped (gal)	Average Rate (gpm)	Volume Pumped (gal)	Average Rate (gpm)
Jan.	10,054,421	225	1,944,960	44	11,999,381	269
Feb.	8,915,184	221	1,722,251	43	10,637,435	264
Mar.	10,005,663	224	1,885,708	42	11,891,371	266
Apr.	9,695,346	224	1,841,255	43	11,536,601	267
May	10,025,649	225	1,604,981	36	11,630,630	261
June	9,649,046	223	1,774,849	41	11,423,895	264
July	9,975,083	223	2,362,623	53	12,337,706	276
Aug.	9,961,036	223	2,324,312	52	12,285,348	275
Sep.	9,606,981	222	2,202,617	51	11,809,598	273
Oct.	9,890,435	222	2,197,397	49	12,087,832	271
Nov.	9,382,516	217	2,018,932	47	11,401,448	264
Dec.	9,937,060	223	2,103,918	47	12,040,978	270
Total or Average	**117,098,422**	**223**	**23,983,802**	**46**	**141,082,224**	**269**

Table 4.4

Influent and Effluent Quality - 2007[a]

(a) Off-Site Containment System

Sampling Date	Concentration (µg/L)							
	Influent				Effluent			
	TCE	DCE	TCA	Cr Total	TCE	DCE	TCA	Cr Total
01/04/07	1500	100	4.5	30	<1.0	<1.0	<1.0	30
02/01/07	1100	67	4.5	20	<1.0	<1.0	<1.0	24
03/01/07	1100	77	3.5	20	<1.0	<1.0	<1.0	20
04/04/07	1100	66	3.1	20	<1.0	<1.0	<1.0	23
05/01/07	960	68	2.9	18	<1.0	<1.0	<1.0	20
06/01/07	950	72	<1.0	21	<1.0	<1.0	<1.0	21
07/03/07	1000	69	3.4	17	<1.0	<1.0	<1.0	25
08/01/07	1000	65	3.1	24	<1.0	<1.0	<1.0	22
09/04/07	970	69	<1.0	22	<1.0	<1.0	<1.0	22
10/01/07	960	66	3.1	24	<1.0	<1.0	<1.0	20
11/01/07	1000	82	<1.0	18	<1.0	<1.0	<1.0	18
12/04/07	960	66	<1.0	19	<1.0	<1.0	<1.0	19
01/04/08	1000	71	<1.0	19	<1.0	<1.0	<1.0	20

(b) Source Containment System

Sampling Date	Concentration (µg/L)							
	Influent				Effluent			
	TCE	DCE	TCA	Cr Total	TCE	DCE	TCA	Cr Total
01/04/07	150	19	<1.0	29	<1.0	<1.0	<1.0	32
02/01/07	160	18	<1.0	32	<1.0	<1.0	<1.0	36
03/01/07	150	19	<1.0	30	<1.0	<1.0	<1.0	27
04/04/07	140	16	<1.0	32	<1.0	<1.0	<1.0	31
05/01/07	140	18	<1.0	31	<1.0	<1.0	<1.0	29
06/01/07	120	18	<1.0	33	<1.0	<1.0	<1.0	29
07/03/07	130	18	<1.0	31	<1.0	<1.0	<1.0	41
08/01/07	120	14	<1.0	40	<1.0	<1.0	<1.0	35
09/04/07	110	14	<1.0	34	<1.0	<1.0	<1.0	31
10/01/07	120	14	<1.0	27	<1.0	<1.0	<1.0	35
11/01/07	120	16	<1.0	24	<1.0	<1.0	<1.0	26
12/04/07	100	13	<1.0	27	<1.0	<1.0	<1.0	25
01/04/08	120	12	<1.0	22	<1.0	<1.0	<1.0	29

[a] Data from January 4, 2008 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).

Table 5.1

Concentration Changes in Monitoring Wells - 1998 to 2007

Well ID	Change in Concentration (µg/l)		
	TCE	DCE	TCA
CW-1	860	79	-9.5
CW-2[a]	-880	-174	-35
MW-07	-60	-15	-12
MW-12	-354	-25	-18
MW-14R[b]	-417	-24	-3.7
MW-16	-1195	-30	-170
MW-17	-67	-3	-13
MW-18	-598	-50	-42
MW-19	366	56	0
MW-20	1.1	0	0
MW-21	-7	0	-0.6
MW-22	-13	-1.5	-4.1
MW-23	-6192	-400	-720
MW-25	-5580	-73	-540
MW-26	-6486	-590	-550
MW-29	1	0	0
MW-30	10	0	0
MW-31	0	0	0
MW-32	-485	-88	-30
MW-34	0	0	0
MW-37R[b]	-911	-44	-2
MW-38	0	0	0
MW-39	0	0	0
MW-40	0	0	0
MW-41	-170	-26	-7
MW-42	-275	-27	-21

Well ID	Change in Concentration (µg/l)		
	TCE	DCE	TCA
MW-43	-23	-4.6	-4.9
MW-44	-0.8	0	0
MW-45	-40	-1.2	0
MW-46	-1580	-30	7.7
MW-47	-7	0.1	0
MW-49	0	0	0
MW-51	0	0	0
MW-52R[b]	9	18	0
MW-55	-330	-7.8	0
MW-56	-88	-3	0
MW-59	0	0	0
MW-60	-2000	60	-31
MW-61	-968.5	-51.85	-10.5
MW-62	0.2	0.3	-4.3
MW-64	3.2	0	0
MW-65	-2	48	15
MW-66	0	0	0
MW-67	0	0	0
MW-68	0	0	0
MW-69	0	0	0
MW-70	16	0.6	0
MW-71R	18	1.1	0
MW-72[a]	-1680	-205	-99
MW-73[a]	-3980	-518	-240
MW-77[a]	-6	-0.7	0
MW-78	-5	0	0

[a] Change from concentration in first available sample.

[b] Change from concentration in original well.

Note: Shaded cells indicate well used in plume definition.

Table 5.2

Summary of Annual Flow Rates - 1998 to 2007

Year	Off-Site Containment Well		Source Containment Well		Total	
	Volume Pumped (gal)	Average Rate (gpm)	Volume Pumped (gal)	Average Rate (gpm)	Volume Pumped (gal)	Average Rate (gpm)
1998*	1,694,830				1,694,830	
1999	114,928,700	219			114,928,700	219
2000	114,094,054	216			114,094,054	216
2001	113,654,183	216			113,654,183	216
2002	116,359,389	221	25,403,490	49	141,762,879	270
2003	118,030,036	225	27,292,970	52	145,323,006	277
2004	113,574,939	215	26,105,202	50	139,680,141	265
2005	118,018,628	225	25,488,817	48	143,507,445	273
2006	112,213,088	213	24,133,264	46	136,346,352	259
2007	117,098,422	223	23,983,802	46	141,082,224	269
Total or Average	**1,039,666,269**	**219**	**152,407,545**	**49**	**1,192,073,814**	**252**

* Volume pumped during the testing of the well in early December, and during the first day of operation on December 31, 1998.

Table 5.3
Contaminant Mass Removal - 2007

(a) Total

	Mass Removed	(kg)	(lbs)
2007	TCE	467.8	1031.5
	DCE	33.0	72.8
	TCA	1.1	2.4
	Total	501.9	1106.7

(b) Off-Site Containment Well

Month	Mass Removed						Total	
	TCE		DCE		TCA			
	(kg)	(lbs)	(kg)	(lbs)	(kg)	(lbs)	(kg)	(lbs)
Jan.	49.5	109.1	3.2	7.0	0.17	0.38	52.8	116.5
Feb.	37.1	81.8	2.4	5.4	0.13	0.30	39.7	87.5
Mar.	41.7	91.9	2.7	6.0	0.12	0.28	44.5	98.1
Apr.	37.8	83.3	2.5	5.4	0.11	0.24	40.4	89.0
May	36.2	79.9	2.7	5.9	0.06	0.14	39.0	85.9
June	35.6	78.5	2.6	5.7	0.07	0.16	38.3	84.4
July	37.8	83.2	2.5	5.6	0.12	0.27	40.4	89.1
Aug.	37.1	81.9	2.5	5.6	0.07	0.15	39.7	87.6
Sep.	35.1	77.4	2.5	5.4	0.07	0.14	37.7	82.9
Oct.	36.7	80.9	2.8	6.1	0.07	0.15	39.6	87.1
Nov.	34.8	76.7	2.6	5.8	0.02	0.04	37.4	82.6
Dec.	36.9	81.3	2.6	5.7	0.02	0.04	39.5	87.0
Total	**456.3**	**1005.9**	**31.6**	**69.6**	**1.03**	**2.29**	**488.9**	**1077.8**

(c) Source Containment Well

Month	Mass Removed						Total	
	TCE		DCE		TCA			
	(kg)	(lbs)	(kg)	(lbs)	(kg)	(lbs)	(kg)	(lbs)
Jan.	1.1	2.5	0.14	0.30	0.004	0.008	1.2	2.8
Feb.	1.0	2.2	0.12	0.27	0.003	0.007	1.1	2.5
Mar.	1.0	2.3	0.12	0.28	0.004	0.008	1.1	2.6
Apr.	1.0	2.2	0.12	0.26	0.003	0.008	1.1	2.5
May	0.8	1.7	0.11	0.24	0.003	0.007	0.9	1.9
June	0.8	1.9	0.12	0.27	0.003	0.007	0.9	2.2
July	1.1	2.5	0.14	0.32	0.004	0.010	1.2	2.8
Aug.	1.0	2.2	0.12	0.27	0.004	0.010	1.1	2.5
Sep.	1.0	2.1	0.12	0.26	0.004	0.009	1.1	2.4
Oct.	1.0	2.2	0.12	0.28	0.004	0.009	1.1	2.5
Nov.	0.8	1.9	0.11	0.24	0.004	0.008	0.9	2.1
Dec.	0.9	1.9	0.10	0.22	0.004	0.009	1.0	2.1
Total	**11.5**	**25.6**	**1.44**	**3.21**	**0.044**	**0.100**	**13.0**	**28.9**

Table 5.4

Summary of Contaminant Mass Removal - 1998 to 2007

(a) Total

Year	Mass Removed							
	TCE		DCE		TCA		Total	
	kg	lbs	kg	lbs	kg	lbs	kg	lbs
1998*	1.3	2.9	0.0	0.1	0.0	0.0	1.3	3.0
1999	357.5	789.3	16.2	35.9	0.0	0.0	373.7	825.2
2000	462.7	1,021.3	23.3	51.4	0.0	0.0	486.0	1,072.7
2001	519.0	1,144.1	26.6	58.7	0.0	0.0	545.6	1,202.8
2002	603.0	1,329.4	40.6	89.5	3.60	8.10	647.2	1,427.0
2003	616.6	1,359.3	38.1	84.1	3.10	6.80	657.8	1,450.2
2004	596.0	1,313.7	35.3	77.8	2.43	5.37	633.7	1,396.8
2005	558.0	1,230.0	34.7	76.3	2.01	4.43	594.7	1,310.8
2006	512.8	1,129.2	34.3	75.6	1.67	3.68	548.7	1,208.4
2007	467.8	1,031.6	33.0	72.8	1.07	2.39	501.9	1,106.8
Total	**4,694.7**	**10,350.8**	**282.1**	**622.1**	**13.88**	**30.77**	**4,990.6**	**11,003.7**

(b) Off-Site Containment Well

Year	Mass Removed							
	TCE		DCE		TCA		Total	
	kg	lbs	kg	lbs	kg	lbs	kg	lbs
1998*	1.3	2.9	0.0	0.1	0.00	0.00	1.3	3.0
1999	357.5	789.3	16.2	35.9	0.00	0.00	373.7	825.2
2000	462.7	1,021.3	23.3	51.4	0.00	0.00	486.0	1,072.7
2001	519.0	1,144.1	26.6	58.7	0.00	0.00	545.6	1,202.8
2002	543.4	1,198.0	30.9	68.2	2.00	4.50	576.3	1,270.7
2003	567.9	1,252.0	31.6	69.7	2.10	4.60	601.6	1,326.3
2004	567.0	1,250.0	31.7	69.9	1.96	4.33	600.7	1,324.2
2005	540.0	1,190.0	32.4	71.3	1.79	3.95	574.2	1,265.3
2006	499.0	1,099.0	32.5	71.7	1.57	3.47	533.1	1,174.2
2007	456.3	1,006.0	31.6	69.6	1.03	2.29	488.9	1,077.9
Total	**4,514.1**	**9,952.6**	**256.8**	**566.5**	**10.45**	**23.14**	**4,781.4**	**10,542.2**

(c) Source Containment Well

Year	Mass Removed							
	TCE		DCE		TCA		Total	
	kg	lbs	kg	lbs	kg	lbs	kg	lbs
2002	59.6	131.4	9.7	21.3	1.60	3.60	70.9	156.3
2003	48.7	107.3	6.5	14.4	1.00	2.20	56.2	123.9
2004	29.0	63.7	3.6	7.9	0.47	1.04	33.0	72.6
2005	18.0	40.0	2.3	5.0	0.22	0.48	20.5	45.5
2006	13.8	30.2	1.8	3.9	0.10	0.21	15.7	34.3
2007	11.5	25.6	1.4	3.2	0.04	0.10	13.0	28.9
Total	**180.6**	**398.2**	**25.2**	**55.7**	**3.43**	**7.63**	**209.3**	**461.5**

* Mass removed during the testing of the well in early December, and during the first day of operation on December 31, 1998.

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	0.4	3601.7
2	15.2	33.6	4849.8
3	391.9	863.9	5674.9
4	885.4	1951.9	29859.8
5	1050.0	2314.9	30858.5
6	1090.0	2403.1	29977.3
7	1038.8	2290.2	43893.4
8	1372.3	3025.5	20015.1
9	812.0	1790.1	19957.1
10	201.2	443.7	533.9
11	24.2	53.3	71.4
Total Mass	**6,881**	**15,171**	

APPENDIX A

APPENDIX A

Appendix A

2007 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
2007 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	11/08/07	2.7	<1.0	<1.0	0.0169	0.0149	
MW-12	11/08/07	26	1.3	<1.0	0.00618	0.00251	
MW-14-R	11/08/07	13	<1.0	<1.0	0.0814	NA	
MW-16	11/09/07	5.1	<1.0	<1.0	0.228	0.106	
MW-17	11/13/07	1.4	<1.0	<1.0`	0.0389	0.0262	
MW-18	11/08/07	1.6	<1.0	<1.0	0.0258	0.0261	
MW-19	11/07/07	370	56	<1.0	0.0354	NA	PCE: 1.0
MW-20	11/07/07	1.6	<1.0	<1.0	<0.00100	NA	
MW-21	11/09/07	<1.0	<1.0	<1.0	0.325	0.0252	
MW-22	11/07/07	<1.0	<1.0	<1.0	0.00114	NA	
MW-23	11/09/07	8.0	<1.0	<1.0	0.189	0.0468	
MW-25	11/09/07	20	<1.0	<1.0	0.119	0.0416	
MW-26	11/09/07	14	<1.0	<1.0	0.378	0.0923	
MW-29	11/09/07	1.6	<1.0	<1.0	<0.00100	NA	
MW-30	11/08/07	15.0	<1.0	<1.0	0.0190	NA	
MW-31	11/08/07	<1.0	<1.0	<1.0	0.00123	NA	
MW-32	11/07/07	65	8.2	<1.0	0.0286	NA	
MW-34	11/09/07	<1.0	<1.0	<1.0	0.863	0.00634	
MW-37-R	11/12/07	79	3.6	<1.0	0.0480	NA	
MW-38	11/09/07	<1.0	<1.0	<1.0	0.00504	NA	
MW-39	11/09/07	<1.0	<1.0	<1.0	0.0705	NA	
MW-40	11/08/07	<1.0	<1.0	<1.0	0.00124	NA	
MW-41	11/07/07	<1.0	<1.0	<1.0	0.0276	NA	
MW-42	11/07/07	95	21	<1.0	0.0238	NA	
MW-43	11/07/07	1.6	<1.0	<1.0	0.00137	NA	
MW-44	11/12/07	<1.0	<1.0	<1.0	<0.00100	NA	
MW-45	11/12/07	<1.0	<1.0	<1.0	0.0082	NA	
MW-46	11/12/07	590	100	10	0.0186	NA	112-TCTFA:7.1, Chlor:1.9, PCE:4.0
MW-46	11/12/07	650	100	10	0.0189	NA	112-TCTFA:7.5, Chlor:1.9, PCE:4.1
MW-47	11/13/07	27	1.3	<1.0	0.0154	0.0149	
MW-49	11/08/07	<1.0	<1.0	<1.0	<0.00100	NA	

Appendix A-1

Groundwater Monitoring Program Wells
2007 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-51	11/13/07	<1.0	<1.0	<1.0	0.0243	NA	
MW-52R	02/26/07	7.2	17	1.7	0.0132	NA	
	02/26/07	7.6	17	1.7	0.0142	NA	
	05/16/07	7.3	15	1.5	0.0250	NA	
	08/16/07	7.8	17	1.9	0.0166	NA	
	11/15/07	8.6	18	<1.0	0.0152	NA	
MW-53	11/01/07	NA	NA	NA	NA	NA	
MW-55	11/13/07	60	2.2	<1.0	0.0239	NA	
MW-56	11/13/07	52	1.7	<1.0	0.0305	NA	
MW-57	02/22/07	<1.0	<1.0	<1.0	0.00993	0.00316	
	05/17/07	<1.0	<1.0	<1.0	0.0194	0.00829	
	08/15/07	NA	NA	NA	NA	NA	
	11/01/07	NA	NA	NA	NA	NA	
MW-58	11/01/07	NA	NA	NA	NA	NA	
MW-59	11/12/07	<1.0	<1.0	<1.0	0.0234	NA	
MW-60	11/14/07	5700	410	21.3	0.0293	0.00921	cis1,2-DCE:6.0, 1,1,2-TCTFA:51,1,1-DCA:3.2, Chlor:7.2, 1,1,2-TCA:5.7, PCE:41
MW-61	11/14/07	33	2.3	<1.0	0.0409	0.00410	
	11/14/07	30	2.0	<1.0	0.0296	0.00436	
MW-62	02/22/07	2.7	8.0	4.7	0.0067	0.00400	
	05/16/07	1.8	4.9	3.2	0.0206	0.00739	
	05/16/07	1.8	5.1	3.3	0.0190	0.00812	
	08/21/07	1.9	4.7	3.5	0.0112	0.00503	
	11/12/07	2.2	6.9	<1.0	0.0093	0.00329	
MW-64	11/12/07	3.7	<1.0	<1.0	0.00276	NA	
MW-65	02/22/07	13	54	21	0.00508	NA	
	05/17/07	11	46	18	0.00426	NA	
	08/21/07	11	44	17	0.00240	NA	
	11/14/07	11	48	15	<0.00100	NA	

Appendix A-1

Groundwater Monitoring Program Wells
2007 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-66	02/22/07	<1.0	<1.0	<1.0	0.00113	NA	
	05/25/07	<1.0	<1.0	<1.0	0.00146	NA	
	08/16/07	<1.0	<1.0	<1.0	0.00217	NA	
	11/14/07	<1.0	<1.0	<1.0	<0.00100	NA	
MW-67	05/17/07	<1.0	<1.0	<1.0	0.00962	NA	
	11/13/07	<1.0	<1.0	<1.0	<0.00100	NA	
MW-68	02/22/07	<1.0	<1.0	<1.0	0.00254	NA	
	05/16/07	<1.0	<1.0	<1.0	0.00998	NA	
	08/16/07	<1.0	<1.0	<1.0	<0.00100	NA	
	11/14/07	<1.0	<1.0	<1.0	<0.00100	NA	
MW-69	02/22/07	<1.0	<1.0	<1.0	0.00152	NA	
	05/16/07	<1.0	<1.0	<1.0	0.01050	NA	
	08/16/07	<1.0	<1.0	<1.0	0.00142	NA	
	11/14/07	<1.0	<1.0	<1.0	<0.00100	NA	
MW-70	11/08/07	16	1.1	<1.0	0.00419	NA	
MW-71R	02/26/07	76	2.4	<1.0	0.0001	NA	
	05/17/07	66	2.1	<1.0	0.00388	NA	
	08/21/07	72	2.4	<1.0	<0.00100	NA	
	08/21/07	71	2.2	<1.0	<0.00100	NA	
	11/14/07	74	2.7	<1.0	<0.00100	NA	
MW-72	11/07/07	120	15	<1.0	0.0248	NA	
MW-73	11/07/07	20	2.3	<1.0	0.0362	NA	
	11/07/07	20	2.3	<1.0	0.0364	NA	
MW-79	05/16/07	<1.0	<1.0	<1.0	0.0114	NA	
	11/13/07	<1.0	<1.0	<1.0	<0.00100	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

2007 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	02/26/07	1.4	<1.0	<1.0	0.0351	3.23	0.108	0.0284	0.0126	<0.01000
	05/17/07	<1.0	<1.0	<1.0	0.0434	2.50	0.102	0.0321	0.0157	<0.0100
	08/21/07	<1.0	<1.0	<1.0	0.0341	2.36	0.0848	0.0324	0.0242	<0.0100
	11/13/07	1.4	<1.0	<1.0	0.0389	4.73	0.179	0.0262	0.0215	<0.0100
MW-74	02/26/07	<1.0	<1.0	<1.0	0.0156	0.0131	<0.0100			
	05/16/07	<1.0	<1.0	<1.0	0.0256	0.0128	<0.0100			
	08/16/07	<1.0	<1.0	<1.0	0.0184	<0.0100	<0.0100			
	11/13/07	<1.0	<1.0	<1.0	0.0185	<0.0100	<0.0100			
MW-75	02/26/07	<1.0	<1.0	<1.0	0.0176	<0.0100	<0.0100			0.01
	05/16/07	<1.0	<1.0	<1.0	0.0246	<0.0100	<0.0100			
	08/16/07	<1.0	<1.0	<1.0	0.0197	<0.0100	<0.0100			
	11/13/07	<1.0	<1.0	<1.0	0.0186	0.0138	<0.0100			
MW-76	02/26/07	<1.0	<1.0	<1.0	0.0208	<0.0100	<0.0100			
	05/16/07	<1.0	<1.0	<1.0	0.0255	<0.0100	<0.0100			
	08/16/07	<1.0	<1.0	<1.0	0.0208	<0.0100	<0.0100			
	11/13/07	<1.0	<1.0	<1.0	0.0276	0.083	0.0108			
MW-77	02/26/07	13	1.4	<1.0	<0.00100	0.0325	0.673	<0.00100	0.0313	0.663
	05/17/07	4.8	<1.0	<1.0	0.00310	0.0716	2.56	0.00286	`0.0114	0.531
	08/16/07	8.0	<1.0	<1.0	0.00101	0.065	3.76	<0.00100	<0.0100	0.509
	11/13/07	10	<1.0	<1.0	0.0016	0.063	5.75	0.00148	0.0205	8.45
MW-78	02/26/07	<1.0	<1.0	<1.0	0.0270	0.307	0.0293	0.0261	0.0536	0.0187
	05/17/07	<1.0	<1.0	<1.0	0.0351	0.0879	0.0126	0.0322	<0.0100	<0.0100
	08/16/07	<1.0	<1.0	<1.0	0.0330	0.0459	0.0111	0.0285	<0.0100	<0.0100
	11/13/07	<1.0	<1.0	<1.0	0.0276	0.083	0.0108	0.0257	0.0142	<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

Groundwater Monitoring Program Plan Wells – Annual Dissolved Oxygen and Oxidation/Reduction Potential Measurements – 1998 to 2007

Appendix B

Groundwater Monitoring Program Plan Wells
Annual Dissolved Oxygen and Oxidation/Reduction Potential Measurements, 1998 - 2007

WELL	DATE	DO (%)	DO (mg/l)	ORP (mV)	TEMP (C)	NOTES
MW-7	Nov-98	57.3	4.63	309	17.3	
	Nov-99	125.5	10.20	200	16.8	
	Nov-00	49.0	4.10	109	16.3	
	Nov-01	59.2	6.19	147	15.9	
	Nov-02	82.2	7.20	176	13.1	
	Nov-03	84.8	6.90	220	16.9	
	Nov-04	63.3	5.14	263	17.3	b
	Nov-05	68.0	5.60	284	16.4	b
	Nov-06	50.0	4.03	144	16.7	b
	Nov-07	56.3	4.58	206	17.9	b
MW-9	Nov-98	4.7	3.63	297	18.0	
	Nov-99	47.3	3.55	352	20.1	
	Nov-00	56.0	4.70	-21	14.6	
	Nov-01	52.2	4.71	148	17.2	
	Nov-03	48.5	3.45	117	16.4	
	Nov-04	-	307.00	929	21.0	b
MW-12	Nov-98	44.7	3.70	326	14.5	
	Nov-99	95.4	8.00	196	17.1	
	Nov-00	38.0	3.30	109	15.7	
	Nov-01	17.9	1.50	132	16.9	
	Nov-02	44.2	3.60	253	16.7	
	Nov-03	50.3	4.15	153	17.1	
	Nov-04	43.2	3.47	937	17.9	b
	Nov-05	54.0	4.20	228	20.2	b
	Nov-06	31.7	2.57	22	19.1	b
	Nov-07	46.3	2.86	179	24.0	b
MW-13	Nov-98	54.6	4.58	332	15.1	
	Nov-99	85.2	81.40	188	18.0	
	Nov-00	41.0	3.40	94	16.2	
	Nov-01	34.1	2.16	155	16.4	
	Nov-02	50.3	4.18	152	17.1	
	Nov-05	54.0	4.20	228	20.2	b
MW-14	Nov-98	47.4	3.85	329	16.9	
MW-14-R	Nov-01	6.4	0.55	192	15.2	
	Nov-02	9.0	0.53	216	17.4	
	Nov-03	13.3	1.02	228	16.9	
	Nov-05	69.0	6.60	295	17.2	
	Nov-06	62.9	4.95	160	17.7	
	Nov-07	7.0	0.54	140	20.3	

Appendix B

Groundwater Monitoring Program Plan Wells
Annual Dissolved Oxygen and Oxidation/Reduction Potential Measurements, 1998 - 2007

WELL	DATE	DO (%)	DO (mg/l)	ORP (mV)	TEMP (C)	NOTES
MW-16	Nov-98	44.7	4.46	310	8.4	
	Nov-99	63.7	5.89	196	17.1	
	Nov-00	19.9	1.54	139	16.9	
	Nov-01	17.7	1.10	132	14.1	
	Nov-02	36.3	2.71	138	19.4	
	Nov-03	27.4	2.35	217	15.5	
	Nov-04	32.8	2.60	152	-	b
	Nov-05	19.0	1.60	212	17.6	b
	Nov-06	22.7	1.93	144	18.4	b
	Nov-07	19.5	1.63	225	16.7	b
MW-17	Nov-98	77.1	6.19	353	17.6	
	Nov-99	101.1	8.05	230	17.5	
	Nov-00	67.0	5.70	109	16.8	
	Nov-02	77.2	6.48	234	16.9	
	Nov-03	96.5	7.29	240	16.8	
	Nov-04	74.6	6.29	221	20.0	b
	Nov-05	93.0	6.70	299	21.3	b
	Nov-06	87.8	6.53	141	19.9	b
MW-18	Nov-98	71.0	5.93	319	15.3	
	Nov-99	103.3	9.57	267	14.8	
	Nov-00	68.6	5.38	169	16.7	
	Nov-01	70.2	6.23	134	15.0	
	Nov-02	93.6	1.12	220	16.9	
	Nov-03	96.1	7.86	212	16.7	
	Nov-04	75.6	6.36	938	15.1	b
	Nov-05	84.0	6.40	311	17.9	b
	Nov-06	114.9	8.74	198	17.9	b
	Nov-07	53.8	4.30	135	18.2	b
MW-19	Nov-98	85.1	6.95	454	17.1	
	Nov-99	9.3	0.74	375	17.8	
	Nov-00	16.7	0.20	91	16.7	
	Nov-01	0.0	0.06	175	18.0	
	Nov-02	13.4	1.25	244	17.1	
	Nov-03	2.6	0.20	198	17.9	
	Nov-04	7.6	0.72	234	17.3	
	Nov-05	77.0	6.20	182	17.4	
	Nov-06	12.6	0.98	169	18.0	
	Nov-07	39.5	2.95	231	19.5	

Appendix B

Groundwater Monitoring Program Plan Wells
Annual Dissolved Oxygen and Oxidation/Reduction Potential Measurements, 1998 - 2007

WELL	DATE	DO (%)	DO (mg/l)	ORP (mV)	TEMP (C)	NOTES
MW-20	Nov-98	7.5	0.74	350	15.9	
	Nov-99	2.7	0.22	366.5	17.8	
	Nov-00	2.0	0.20	104	16.4	
	Nov-01	0.0	0.00	181	18.7	
	Nov-02	10.5	0.95	263	15.9	
	Nov-03	2.6	0.21	178	17.2	
	Nov-04	12.7	0.99	186	17.2	
	Nov-05	59.0	4.80	281	17.0	
	Nov-06	1.7	0.10	57	18.7	
	Nov-07	38.4	282.00	217	22.6	
MW-21	Nov-98	78.4	6.71	356	13.9	
	Nov-99	-	-	172	-	
	Nov-02	77.0	6.21	118	17.1	
	Nov-03	94.1	7.75	255	16.2	
	Nov-04	77.4	6.34	138	17.4	b
	Nov-05	64.0	5.20	283	18.7	b
	Nov-06	-	3.91	122	-	b
	Nov-07	65.4	4.14	238	21.5	b
MW-22	Nov-98	56.8	5.02	340	14.5	
	Nov-99	79.0	5.89	361	15.7	
	Nov-00	59.6	5.10	139	15.1	
	Nov-01	47.0	3.30	175	20.9	
	Nov-02	87.4	6.91	276	17.0	
	Nov-03	87.4	7.13	172	16.6	
	Nov-04	79.4	6.02	261	21.2	
	Nov-05	82.0	6.30	232	18.1	
	Nov-06	83.1	6.62	170	18.1	
	Nov-07	79.7	6.10	247	17.6	
MW-23	Nov-98	49.9	4.01	265	16.9	
	Nov-99	77.1	6.80	350	16.5	
	Nov-00	46.4	3.83	131	16.2	
	Nov-01	50.6	4.18	14	16.0	
	Nov-02	42.2	3.74	230	17.9	
	Nov-03	36.9	3.00	205	16.7	
	Nov-04	20.1	1.57	185	19.0	
	Nov-05	43.0	3.20	264	19.9	
	Nov-06	68.1	5.28	94	19.3	
	Nov-07	0.0	0.00	147	18.1	

Appendix B

Groundwater Monitoring Program Plan Wells
Annual Dissolved Oxygen and Oxidation/Reduction Potential Measurements, 1998 - 2007

WELL	DATE	DO (%)	DO (mg/l)	ORP (mV)	TEMP (C)	NOTES
MW-25	Nov-98	97.7	7.77	355	15.6	
	Nov-99	67.0	12.00	265	15.7	
	Nov-00	51.1	4.86	123	9.6	
	Nov-01	31.0	3.57	129	16.0	
	Nov-03	77.9	6.49	238	15.7	
	Nov-04	57.8	4.77	224	15.9	b
	Nov-05	63.0	5.30	284	15.5	b
	Nov-06	68.5	5.34	145	17.2	b
	Nov-07	46.2	3.77	230	16.1	b
MW-26	Nov-98	54.5	1.46	368	17.9	
	Nov-99	50.4	4.46	300	18.8	
	Nov-00	45.8	3.79	129	15.7	
	Nov-01	49.1	3.95	135	18.3	
	Nov-02	66.0	5.16	267	18.6	
	Nov-03	88.7	6.97	231	18.5	
	Nov-04	60.9	4.81	1019	17.7	b
	Nov-05	72.0	5.60	308	18.4	b
	Nov-06	84.7	6.82	215	18.6	b
	Nov-07	64.0	5.05	268	18.8	b
MW-29	Nov-98	10.3	0.85	325	17.7	
	Nov-99	3.7	0.31	346	17.5	
	Nov-00	4.0	0.30	120	16.2	
	Nov-01	0.0	0.00	129	18.5	
	Nov-02	8.3	1.03	248	16.9	
	Nov-03	6.5	0.61	163	16.1	
	Nov-04	7.9	0.56	715	19.7	
	Nov-05	18.0	1.30	257	19.2	
	Nov-06	1.2	0.10	160	17.5	
	Nov-07	0.0	0.00	165	17.2	
MW-30	Nov-98	96.1	7.90	274	16.7	
	Nov-99	60.4	4.78	373	18.5	
	Nov-00	0.1	2.00	-119	15.9	
	Nov-01	0.6	0.45	189	18.0	
	Nov-02	6.7	0.50	293	17.1	
	Nov-03	2.4	0.19	180	17.0	
	Nov-04	8.7	0.83	873	12.7	
	Nov-05	63.0	4.70	27.3	20.3	
	Nov-06	1.5	0.15	134	22.0	
	Nov-07	0.0	0.00	174	17.6	

Appendix B

Groundwater Monitoring Program Plan Wells
Annual Dissolved Oxygen and Oxidation/Reduction Potential Measurements, 1998 - 2007

WELL	DATE	DO (%)	DO (mg/l)	ORP (mV)	TEMP (C)	NOTES
MW-31	Nov-98	4.5	0.44	489	17.6	
	Nov-99	8.6	0.68	430	17.0	
	Nov-00	14.3	1.22	202	16.6	
	Nov-01	0.0	0.00	184	18.1	
	Nov-02	0.9	0.07	153	17.9	
	Nov-03	3.8	0.35	213	16.7	
	Nov-04	5.9	0.43	910	17.7	
	Nov-05	60.0	4.50	216	18.8	
	Nov-06	24.8	1.67	116	17.3	
	Nov-07	0.0	0.00	136	22.2	
MW-32	Nov-98	19.8	1.66	412	16.7	
	Nov-99	5.3	0.40	275	16.8	
	Nov-00	6.4	0.37	159	16.5	
	Nov-01	14.5	2.40	173	15.5	
	Nov-02	2.6	0.24	174	17.1	
	Nov-03	2.5	0.39	164	-	
	Nov-04	6.6	0.54	124	17.8	
	Nov-05	65.0	5.30	291	17.5	
	Nov-06	5.3	46.00	120	17.0	
MW-33	Nov-98	64.5	5.78	298	13.7	
	Nov-99	106.7	8.70	177	17.1	
	Nov-00	49.0	3.90	-158	11.2	
	Nov-01	29.6	2.38	147	17.2	
MW-34	Nov-98	92.0	7.02	354	19.9	
	Nov-99	48.1	3.56	419	21.1	
	Nov-00	29.3	2.39	135	17.7	
	Nov-02	36.1	3.24	211	18.4	
	Nov-03	60.3	4.83	296	17.9	purge not met
	Nov-04	58.5	4.51	950	16.7	b
	Nov-05	88.0	7.00	272	19.6	b
	Nov-06	68.1	5.35	210	18.9	b
	Nov-07	57.1	4.32	281	20.3	b
MW-35	Nov-98	dry	dry	dry	dry	
	Nov-99	dry	dry	dry	dry	
	Nov-00	dry	dry	dry	dry	
	Nov-01	dry	dry	dry	dry	
	Nov-02	dry	dry	dry	dry	
	Nov-03	dry	dry	dry	dry	
	Nov-04	no data sheet	dry	dry	dry	b
	Nov-05	no data sheet	dry	dry	dry	b

Appendix B

Groundwater Monitoring Program Plan Wells
Annual Dissolved Oxygen and Oxidation/Reduction Potential Measurements, 1998 - 2007

WELL	DATE	DO (%)	DO (mg/l)	ORP (mV)	TEMP (C)	NOTES
MW-36	Nov-98	59.2	5.35	319	11.5	
	Nov-99	134.4	8.26	165	18.9	
	Nov-00	48.6	3.69	150	17.6	
	Nov-01	44.9	5.71	110	8.5	
MW-37	Nov-98	52.6	4.57	297	13.1	
MW-37-R	Nov-01	24.3	23.20	124	15.8	
	Nov-02	63.9	4.57	260	17.9	
	Nov-03	67.5	5.60	264	16.0	
	Nov-04	57.6	4.78	285	16.0	
	Nov-05	78.0	6.10	311	19.4	
	Nov-06	4.7	6.03	135	16.8	
	Nov-07	46.7	3.96	161	17.6	
MW-38	Nov-98	86.9	6.78	350	18.8	
	Nov-99	8.8	0.73	323	16.6	
	Nov-00	10.4	0.85	179	16.9	
	Nov-01	8.5	0.73	127	19.6	
	Nov-02	14.4	1.01	202	17.1	
	Nov-03	15.8	0.91	237	16.5	
	Nov-04	8.5	0.71	237	18.6	
	Nov-05	45.0	2.40	255	20.3	
	Nov-06	3.4	0.25	224	18.6	
	Nov-07	14.0	1.10	235	20.0	
MW-39	Nov-98	95.5	8.55	225	14.9	
	Nov-99	63.0	5.18	329.5	18.0	
	Nov-00	13.0	1.20	-11	15.7	
	Nov-01	25.5	2.21	188	16.2	
	Nov-02	6.3	0.30	246	16.8	
	Nov-03	8.3	0.79	178	16.3	
	Nov-04	12.0	0.79	834	18.1	
	Nov-05	40.0	2.80	240	19.2	
	Nov-06	1.9	0.16	166	20.0	
	Nov-07	2.4	0.42	237	18.4	
MW-40	Nov-98	101.3	8.45	430	15.5	
	Nov-99	7.0	0.55	444	18.7	
	Nov-00	6.8	0.60	194	15.8	
	Nov-01	4.3	0.45	179	14.8	
	Nov-02	9.1	0.85	305	16.3	
	Nov-03	4.5	0.39	225	16.8	
	Nov-04	20.4	1.79	823	17.5	
	Nov-05	72.0	6.20	351	17.4	
	Nov-06	3.3	0.26	208	16.9	
	Nov-07	12.9	0.86	126	18.5	

Appendix B

Groundwater Monitoring Program Plan Wells
Annual Dissolved Oxygen and Oxidation/Reduction Potential Measurements, 1998 - 2007

WELL	DATE	DO (%)	DO (mg/l)	ORP (mV)	TEMP (C)	NOTES
MW-41	Nov-98	99.2	8.23	330	16.0	
	Nov-99	6.7	0.58	323	17.1	
	Nov-00	8.0	0.76	167	16.8	
	Nov-01	2.5	0.24	173	20.2	
	Nov-02	57.8	4.50	166	17.1	
	Nov-03	85.0	715.00	228	15.8	
	Nov-04	72.7	6.44	605	14.9	
	Nov-05	62.0	4.70	283	19.7	
	Nov-06	15.7	1.28	174	17.2	
	Nov-07	76.8	6.01	224	19.6	
MW-42	Nov-98	40.6	3.19	380	16.5	
	Nov-99	60.3	4.87	356	15.3	
	Nov-00	42.9	3.86	163	16.2	
	Nov-01	38.6	2.92	176	15.2	
	Nov-02	5.5	67.70	207	15.9	
	Nov-03	67.0	5.34	228	16.9	
	Nov-04	75.1	6.28	714	14.3	
	Nov-05	74.0	5.70	210	19.7	
	Nov-06	13.8	1.13	140	16.8	
	Nov-07	68.7	8.47?	226	14.3	
MW-43	Nov-98	40.6	3.26	356	17.7	
	Nov-99	5.3	0.44	338	15.9	
	Nov-00	9.7	1.13	162	15.6	
	Nov-01	0.0	0.00	171	17.8	
	Nov-02	10.0	0.61	284	16.4	
	Nov-03	7.4	0.60	181	17.7	
	Nov-04	11.6	0.85	677	16.8	
	Nov-05	66.0	5.10	282	18.4	
	Nov-06	3.3	0.29	121	17.2	
	Nov-07	78.3	5.48	167	18.5	
MW-44	Nov-98	91.0	7.16	378	18.2	
	Nov-99	4.1	0.35	474	18.6	
	Nov-00	3.2	0.26	290	16.0	
	Nov-01	0.0	0.00	119	18.0	
	Nov-02	10.1	0.77	238	16.8	
	Nov-03	9.7	0.69	246	14.4	
	Nov-04	6.7	0.49	304	16.8	
	Nov-05	9.3	0.74	284	17.5	
	Nov-06	1.7	0.15	77	17.9	
	Nov-07	13.8	1.36	211	20.9	

Appendix B

Groundwater Monitoring Program Plan Wells
Annual Dissolved Oxygen and Oxidation/Reduction Potential Measurements, 1998 - 2007

WELL	DATE	DO (%)	DO (mg/l)	ORP (mV)	TEMP (C)	NOTES
MW-45	Nov-98	22.3	7.47	340	35.1	
	Nov-99	20.1	1.57	446	18.4	
	Nov-00	17.6	1.37	328	15.9	
	Nov-01	2.3	0.56	121	17.1	
	Nov-02	14.8	1.15	203	17.0	
	Nov-03	17.3	1.69	229	15.4	purge not met
	Nov-04	32.0	2.86	258	16.8	
	Nov-05	61.0	5.90	253	19.2	
	Nov-06	2.2	0.21	118	19.9	
	Nov-07	16.0	0.92	211	19.9	
MW-46	Nov-98	59.7	4.63	457	18.5	
	Nov-99	54.7	4.50	434	17.3	
	Nov-00	27.2	2.08	362	19.1	
	Nov-01	15.5	1.26	119	15.7	
	Nov-02	12.1	1.12	56	16.0	
	Nov-03	14.6	1.16	215	16.6	
	Nov-04	16.0	1.26	263	-	
	Nov-05	85.0	6.80	291	17.4	
	Nov-06	7.7	0.59	145	16.8	
	Nov-07	25.2	1.80	241	18.5	
MW-47	Nov-98	54.9	4.38	336	16.8	
	Nov-99	89.6	7.18	362	17.6	
	Nov-00	72.3	5.75	-10	16.5	
	Nov-01	82.7	1.11	93	14.8	
	Nov-02	69.5	7.83	192	17.1	
	Nov-03	76.9	6.32	204	16.0	
	Nov-04	64.8	4.84	940	16.3	
	Nov-05	58.0	4.90	267	15.8	b
	Nov-06	14.1	1.33	158	3.7	b
	Nov-07	64.3	5.03	227	18.9	b
MW-48	Nov-98	96.7	3.97	439	16.0	
	Nov-99	88.3	7.19	449	16.3	
	Nov-00	47.7	4.32	-192	-	
	Nov-01	69.1	5.72	86	16.1	
	Nov-02	73.1	5.90	259	-	
	Nov-03	84.7	6.26	196	20.4	
	Nov-04	82.8	7.06	815	15.3	b
	Nov-05	77.0	5.80	244	19.2	b
	Nov-06	44.3	3.72	165	16.2	b

Appendix B

Groundwater Monitoring Program Plan Wells
Annual Dissolved Oxygen and Oxidation/Reduction Potential Measurements, 1998 - 2007

WELL	DATE	DO (%)	DO (mg/l)	ORP (mV)	TEMP (C)	NOTES
MW-49	Nov-98	3.8	0.30	375	13.7	
	Nov-99	3.7	0.39	336	17.1	
	Nov-00	4.6	0.47	195	15.3	
	Nov-01	0.0	0.00	184	19.9	
	Nov-02	4.8	0.13	276	16.8	
	Nov-03	4.4	0.48	230	16.4	
	Nov-04	14.1	1.09	810	20.7	
	Nov-05	84.0	6.50	295	18.7	
	Nov-06	2.6	0.16	132	22.0	
	Nov-07	12.2	0.78	178	18.1	
MW-51	Nov-98	95.8	7.55	365	17.8	
	Nov-99	84.0	6.47	484	19.1	
	Nov-00	58.0	4.60	324	15.8	
	Nov-01	57.0	4.46	126	18.0	
	Nov-02	89.5	7.44	254	16.3	
	Nov-03	87.5	1.81	246	9.9	
	Nov-04	85.4	7.00	315	15.3	
	Nov-05	23.0	5.70	288	19.2	
	Nov-06	16.9	134.00	165	18.6	
	Nov-07	90.7	8.57	245	11.4	
MW-52	Nov-98	48.5	4.37	412	20.7	
	Nov-99	75.2	6.13	223	16.7	
	Nov-00	50.0	4.30	153	12.8	
	Nov-01	51.5	4.49	116	14.8	
MW-52R	Nov-03	66.3	5.40	183	16.9	
	Nov-04	62.4	5.20	249		
	Nov-05	81.0	6.60	194	16.8	
	Nov-06	33.5	2.69	155	16.1	
	Nov-07	50.4	4.03	175	17.4	
MW-53	Nov-98	44.7	3.17	432	23.2	
	Nov-99	73.2	5.97	367	16.5	
	Nov-00	54.0	4.10	-166	14.8	
	Nov-01	55.7	4.14	110	11.5	
	Nov-02	66.7	5.40	197	17.0	
	Nov-03	76.1	6.26	212	15.6	
	Nov-04	75.2	6.32	186	18.7	b
	Nov-06	37.6	3.66	167	13.5	b

Appendix B

Groundwater Monitoring Program Plan Wells
Annual Dissolved Oxygen and Oxidation/Reduction Potential Measurements, 1998 - 2007

WELL	DATE	DO (%)	DO (mg/l)	ORP (mV)	TEMP (C)	NOTES
MW-55	Nov-98	31.2	2.54	200	15.2	
	Nov-99	22.3	1.87	396	15.4	
	Nov-00	20.4	1.84	67	16.3	
	Nov-01	19.1	1.17	90	16.0	
	Nov-02	5.6	3.70	140	16.3	
	Nov-03	11.8	0.97	177	17.9	
	Nov-04	1.2	17.30	165	17.3	
	Nov-05	11.0	0.80	220	17.6	
	Nov-06	10.8	0.96	138	16.2	
	Nov-07	31.6	2.55	509	27.2	
MW-56	Nov-98	101.7	8.36	200	16.5	
	Nov-99	39.8	3.35	406	16.2	
	Nov-00	58.0	4.37	-1	16.3	
	Nov-01	48.1	3.51	98	16.2	
	Nov-02	43.0	3.03	156	16.8	
	Nov-03	40.1	3.20	171	17.2	
	Nov-04	53.4	4.03	555	19.8	
	Nov-05	58.0	4.70	208	16.7	
	Nov-06	33.4	2.80	188	15.8	
	Nov-07	59.7	4.80	231	18.7	
MW-57	Nov-98	104.4	9.02	375	13.7	
	Nov-99	117.3	7.59	129	17.5	
	Nov-00	59.4	5.40	175	15.9	
	Nov-01	74.4	5.48	114	9.8	
	Nov-02	15.2	6.15	192	17.2	
MW-58	Nov-98	99.3	7.44	490	20.0	
	Nov-99	141.0	13.16	265	15.9	
	Nov-00	66.0	5.20	-275	15.5	
	Nov-01	76.2	7.46	113	10.0	
	Nov-02	73.9	6.05	165	17.1	
	Nov-03	83.5	6.48	167	not recorded	
	Nov-04	86.2	7.00	139	16.7	b
	Nov-05	dry	dry	dry	dry	b
	Nov-06	49.9	4.18	98	13.7	b
	Nov-07	dry	dry	dry	dry	b
MW-59	Nov-98	95.2	7.62	375	18.0	
	Nov-99	50.2	4.04	353	16.5	
	Nov-00	90.4	7.29	353	17.1	
	Nov-01	31.2	2.76	125	19.2	
	Nov-02	73.7	5.78	246	16.4	
	Nov-03	92.4	9.16	254	-	
	Nov-04	78.2	6.47	309	15.3	
	Nov-05	81.0	6.20	303	19.9	
	Nov-06	17.4	1.43	160	18.1	
	Nov-07	19.7	5.88	204	19.7	

Appendix B

Groundwater Monitoring Program Plan Wells
Annual Dissolved Oxygen and Oxidation/Reduction Potential Measurements, 1998 - 2007

WELL	DATE	DO (%)	DO (mg/l)	ORP (mV)	TEMP (C)	NOTES
MW-60	Nov-98	97.0	7.66	384	17.6	
	Nov-99	41.0	3.26	415	18.1	
	Nov-00	50.9	4.24	265	16.0	
	Nov-01	37.0	2.84	87	18.1	
	Nov-02	45.8	3.93	226	16.7	
	Nov-03	35.2	3.21	219	14.1	
	Nov-04	14.3	2.70	143	18.1	
	Nov-05	38.0	3.00	38	18.5	
	Nov-06	8.3	0.68	117	15.7	
	Nov-07	12.0	0.86	140	19.9	
MW-61	Nov-98	59.2	5.35	319	11.5	
	Nov-99	31.8	2.60	353	17.8	
	Nov-00	62.0	5.70	144	14.3	
	Nov-01	62.8	5.47	82	15.2	
	Nov-02	74.0	5.31	204	20.0	
	Nov-03	89.7	7.30	239	16.3	
	Nov-04	88.5	7.22	112	21.3	b
	Nov-05	92.0	6.60	230	17.1	b
	Nov-06	30.7	2.50	124	15.3	b
MW-62	Nov-98	60.6	5.42	377	11.8	
	Nov-99	80.7	6.14	333	18.6	
	Nov-00	53.3	4.49	140	15.3	
	Nov-01	-	-	109	10.3	
	Nov-02	73.3	5.96	257	15.8	
	Nov-03	62.0	5.16	295	15.5	
	Nov-04	41.7	3.34	876	-	b
	Nov-05	53.0	4.20	229	16.3	b
	Nov-06	46.1	3.85	171	16.5	b
	Nov-07	48.4	3.99	258	16.8	b
MW-64	Nov-98	13.3	5.90	427	16.5	
	Nov-99	66.6	5.32	417	18.0	
	Nov-00	66.6	5.25	349	17.3	
	Nov-01	61.4	5.13	108	16.8	
	Nov-02	69.5	5.04	323	18.5	
	Nov-03	65.1	5.52	251	16.3	
	Nov-04	62.4	4.48	650	22.9	
	Nov-05	63.0	5.00	216	19.7	
	Nov-06	13.5	105.00	171	18.0	
	Nov-07	90.7	7.91	255	17.0	
MW-65	Nov-98	91.4	7.32	510	18.7	
	Nov-99	6.6	0.60	414	18.3	
	Nov-00	4.9	0.53	253	16.9	
	Nov-01	0.0	0.00	81	15.9	
	Nov-02	1.2	0.07	235	18.0	
	Nov-03	9.1	0.63	152	16.9	
	Nov-04	28.4	2.18	235	23.1	
	Nov-05	89.0	6.90	207	18.4	
	Nov-06	2.5	0.20	204	16.8	
	Nov-07	57.0	4.23	216	22.0	

Appendix B

Groundwater Monitoring Program Plan Wells
Annual Dissolved Oxygen and Oxidation/Reduction Potential Measurements, 1998 - 2007

WELL	DATE	DO (%)	DO (mg/l)	ORP (mV)	TEMP (C)	NOTES
MW-66	Nov-98	85.2	6.81	450	17.5	
	Nov-99	21.5	1.78	457	16.8	
	Nov-00	22.1	1.99	342	15.9	
	Nov-01	19.9	1.63	84	17.5	
	Nov-02	30.9	2.47	292	18.5	
	Nov-03	error	error	173	17.4	
	Nov-04	35.0	2.69	226	18.0	
	Nov-05	53.0	4.30	279	18.4	
	Nov-06	8.3	0.68	163	16.3	
	Nov-07	84.9	6.98	267	19.0	
MW-67	Nov-98	12.8	1.03	400	18.3	
	Nov-99	6.3	0.60	370	18.0	
	Nov-00	2.7	0.24	48	14.9	
	Nov-01	0.4	0.37	91	15.1	
	Nov-02	7.6	0.81	241	17.1	
	Nov-03	11.1	0.61	230	15.4	
	Nov-04	6.6	0.50	202	19.2	
	Nov-05	86.0	6.60	199	-	
	Nov-06	2.1	0.17	127	16.3	
	Nov-07	1.7	0.54	258	18.9	
MW-68	Nov-98	64.7	5.59	378	14.2	
	Nov-99	69.2	5.54	380	18.3	
	Nov-00	77.0	6.50	115	16.2	
	Nov-01	70.5	5.63	165	18.5	
	Nov-02	83.0	6.70	251	17.3	
	Nov-03	81.6	7.00	154	17.5	
	Nov-04	6.3	80.90	100	17.4	
	Nov-05	71.0	5.40	239	18.8	
	Nov-06	98.7	8.21	111	17.6	
	Nov-07	68.6	5.74	215	16.9	
MW-69	Nov-98	42.8	3.31	380	13.1	
	Nov-99	11.0	0.94	373	16.6	
	Nov-00	27.0	2.00	146	15.8	
	Nov-01	20.2	1.71	130	17.8	
	Nov-02	27.7	2.03	267	17.2	
	Nov-03	35.5	2.80	138	17.2	
	Nov-04	29.2	2.14	102	21.1	
	Nov-05	38.0	2.80	162	-	
	Nov-06	4.0	0.29	157	21.3	
	Nov-07	55.9	4.90	140	17.9	

Appendix B

Groundwater Monitoring Program Plan Wells
Annual Dissolved Oxygen and Oxidation/Reduction Potential Measurements, 1998 - 2007

WELL	DATE	DO (%)	DO (mg/l)	ORP (mV)	TEMP (C)	NOTES
MW-70	Nov-98	1.9	0.18	353	18.2	
	Nov-99	3.0	0.28	380	18.2	
	Nov-00	6.2	0.60	171	16.6	
	Nov-01	0.0	0.00	173	27.5	
	Nov-02	5.1	0.22	168	17.1	
	Nov-03	2.7	0.24	244	16.2	
	Nov-04	9.8	0.76	116	18.6	
	Nov-05	21.0	1.30	301	17.8	
	Nov-06	1.5	0.09	139	24.1	
	Nov-07	7.3	0.48	152	22.2	
MW-71	Nov-98	5.7	0.46	443.5	17.7	
	Nov-99	8.7	0.64	376	17.8	
	Nov-00	4.0	0.39	377	16.2	
MW-71R	Nov-02	2.7	0.22	157	17.6	
	Nov-03	7.4	0.52	129	18.7	
	Nov-04	-	0.49	46	20.0	
	Nov-05	6.0	0.40	256	22.8	
	Nov-06	1.1	0.08	142	20.6	
	Nov-07	50.8	3.76	292	21.4	
MW-72	Nov-99	85.6	6.80	465	19.2	
	Nov-00	88.4	6.92	361	16.9	
	Nov-01	32.9	2.45	112	17.6	
	Nov-02	45.4	3.68	295	16.4	
	Nov-03	68.8	5.43	167	17.7	
	Nov-04	73.2	5.35	114	18.0	
	Nov-05	75.0	6.10	253	17.0	
	Nov-06	21.7	1.76	214	17.0	
	Nov-07	75.6	5.79	174	18.5	
MW-73	Nov-99	41.8	3.38	421	18.5	
	Nov-00	4.0	0.30	321	16.9	
	Nov-01	0.0	0.00	172	22.7	
	Nov-02	13.4	0.35	178	17.3	
	Nov-03	62.8	5.11	235	16.8	
	Nov-04	62.3	5.07	506	18.8	
	Nov-05	68.0	5.30	299	20.7	
	Nov-06	13.1	1.04	200	18.0	
	Nov-07	73.8	5.48	185	22.3	
MW-79	Nov-06	1.9	0.16	131	16.2	
	Nov-07	0.8	0.07	-160	17.0	

Notes: b = Sampled with a bailer

APPENDIX C

APPENDIX C

Appendix C

2007 Containment Well Flow Rate Data

C-1: Off-Site Containment Well

C-2: Source Containment Well

C-1: Off-Site Containment Well

Appendix C-1

Off-Site Containment Well
2007 Flow Rate Data

Date	Time	Instantaneous Discharge (gpm)	Totalizer Reading (gallons)	Average Discharge (gpm)	Total Volume (gallons)[a]
12/30/06	10:21	---	885775688		921458188
				144	
01/04/07	12:30	---	886831800		922514300
				225	
01/09/07	13:45	224	888471000		924153500
				225	
01/16/07	12:20	---	890717100		926399600
				225	
01/22/07	16:00	---	892706400		928388900
				225	
01/30/07	12:37	---	895250100		930932600
				224	
02/01/07	11:07	---	895876400		931558900
				225	
02/08/07	14:00	---	898181000		933863500
				221	
02/16/07	12:30	---	900703900		936386400
				218	
02/26/07	7:21	---	903773000		939455500
				224	
03/01/07	12:47	---	904816000		940498500
				224	
03/07/07	6:50	---	906674500		942357000
				223	
03/14/07	12:08	---	908994400		944676900
				225	
03/26/07	13:30	---	912892200		948574700
				224	
04/03/07	18:50	---	915549700		951232200
				224	
04/04/07	11:30	222	915773900		951456400
				224	
04/12/07	12:56	---	918378900		954061400
				224	
04/19/07	11:45	---	920624700		956307200
				224	
04/26/07	11:00	---	922876000		958558500
				225	
05/01/07	11:57	---	924506100		960188600
				225	
05/10/07	12:27	---	927426600		963109100

Appendix C-1

Off-Site Containment Well
2007 Flow Rate Data

Date	Time	Instantaneous Discharge (gpm)	Totalizer Reading (gallons)	Average Discharge (gpm)	Total Volume (gallons)[a]
				225	
05/16/07	10:42	---	929343000		965025500
				224	
05/17/07	14:15	---	929714000		965396500
				224	
05/23/07	14:08	---	931651900		967334400
				225	
05/25/07	16:40	---	932332950		968015450
				224	
06/01/07	12:12	---	934534800		970217300
				224	
06/07/07	13:12	---	936486300		972168800
				224	
06/13/07	11:27	----	938400800		974083300
				224	
06/20/07	10:50	---	940653100		976335600
				39	
06/21/07	18:45	---	940728000		976410500
				253	
06/29/07	12:00	---	943537500		979220000
				224	
07/03/07	12:30	---	944832200		980514700
				224	
07/16/07	15:45	---	949067500		984750000
				223	
07/26/07	11:50	---	952221300		987903800
				224	
08/01/07	13:53	---	954181500		989864000
				224	
08/09/07	10:30	---	956710900		992393400
				224	
08/15/07	8:27	222	958615700		994298200
				223	
08/21/07	11:55	---	960593000		996275500
				217	
08/23/07	19:11	---	961313560		996996060
				224	
08/30/07	19:15	---	963569400		999251900
				224	
09/04/07	11:57	---	965081190		1000763690
				214	

Appendix C-1

Off-Site Containment Well
2007 Flow Rate Data

Date	Time	Instantaneous Discharge (gpm)	Totalizer Reading (gallons)	Average Discharge (gpm)	Total Volume (gallons)[a]
09/07/07	11:46	---	966004900		1001687400
				223	
09/12/07	10:47	221	967599200		1003281700
				223	
09/20/07	9:35	---	970154200		1005836700
				223	
09/28/07	10:32	224	972738100		1008420600
				224	
10/01/07	11:14	---	973713300		1009395800
				202	
10/02/07	11:10	---	974003400		1009685900
				223	
10/04/07	16:22	---	974715900		1010398400
				223	
10/05/07	12:18	---	974982900		1010665400
				223	
10/09/07	9:02	---	976224900		1011907400
				223	
10/16/07	16:44	---	978578200		1014260700
				223	
10/19/07	12:10	---	979481300		1015163800
				223	
10/23/07	13:30	---	980784600		1016467100
				195	
10/24/07	10:30	---	981030880		1016713380
				221	
10/26/07	12:30	---	981694100		1017376600
				223	
11/01/07	8:17	225	983564900		1019247400
				225	
11/06/07	7:14	---	985172600		1020855100
				116	
11/06/07	18:00	---	985247600		1020930100
				208	
11/21/07	11:15	---	989659100		1025341600
				223	
11/22/07	11:00	---	989976490		1025658990
				236	
11/28/07	13:10	---	992046100		1027728600
				224	
12/01/07	10:25	---	992975100		1028657600

Appendix C-1

Off-Site Containment Well
2007 Flow Rate Data

Date	Time	Instantaneous Discharge (gpm)	Totalizer Reading (gallons)	Average Discharge (gpm)	Total Volume (gallons)[a]
				224	
12/04/07	12:00	---	993962400		1029644900
				224	
12/11/07	11:00	---	996201900		1031884400
				215	
12/14/07	12:15	---	997145800		1032828300
				224	
12/20/07	13:30	---	999095200		1034777700
				224	
01/02/08	6:50	---	1003189900		1038872400

[a]Total pumpage since December 31, 1998

C-2: Source Containment Well

Appendix C-2

Source Containment Well
2007 Flow Rate Data

Date	Time	Instantaneous Discharge (gpm)	Totalizer Reading (gallons)	Average Discharge (gpm)	Total Volume (gallons)
12/23/06	13:30	---	127968500		127968500
				44	
01/04/07	11:48	---	128726310		128726310
				44	
01/11/07	11:46	---	129168280		129168280
				44	
01/16/07	12:40	---	129485360		129485360
				43	
01/30/07	12:02	---	130358790		130358790
				43	
02/01/07	10:45	---	130479810		130479810
				43	
02/08/07	13:17	---	130920080		130920080
				43	
02/16/07	12:11	---	131410210		131410210
				43	
02/23/07	15:50	---	131848660		131848660
				42	
02/26/07	16:20	---	132032800		132032800
				42	
03/01/07	12:30	---	132206340		132206340
				43	
03/07/07	15:38	42.0	132589569		132589569
				41	
03/14/07	11:26	42.9	132996220		132996220
				42	
03/26/07	14:10	---	133735550		133735550
				42	
04/03/07	18:10	---	134229480		134229480
				43	
04/04/07	11:00	42.9	134272800		134272800
				43	
04/08/07	9:45	42.7	134516340		134516340
				43	
04/12/07	13:27	---	134772200		134772200
				43	
04/19/07	11:20	---	135197090		135197090
				43	
04/26/07	12:53	---	135629850		135629850
				42	
05/01/07	11:26	---	135931280		135931280

Appendix C-2

Source Containment Well
2007 Flow Rate Data

Date	Time	Instantaneous Discharge (gpm)	Totalizer Reading (gallons)	Average Discharge (gpm)	Total Volume (gallons)
				42	
05/10/07	12:10	---	136480440		136480440
				42	
05/11/07	8:42		136532220		136532220
				25	
05/23/07	12:35	---	136967390		136967390
				44	
06/01/07	11:45	---	137539350		137539350
				44	
06/07/07	12:10	---	137920760		137920760
				44	
06/13/07	12:17	---	138299070		138299070
				43	
06/20/07	11:25	----	138732100		138732100
				17	
06/25/07	13:30	---	138860100		138860100
				53	
06/29/07	11:18	---	139160270		139160270
				54	
07/03/07	11:30	53.8	139470660		139470660
				53	
07/07/07	21:40	---	139805814		139805814
				53	
07/16/07	15:30	---	140474220		140474220
				53	
07/26/07	12:26	---	141225590		141225590
				53	
08/01/07	14:50	---	141690250		141690250
				53	
08/09/07	12:25	---	142289290		142289290
				52	
08/16/07	8:13	---	142802480		142802480
				52	
08/21/07	12:40	---	143189900		143189900
				50	
08/23/07	18:59	---	143353799		143353799
				52	
09/04/07	11:25	---	144223500		144223500
				51	
09/07/07	11:23	51.2	144445450		144445450
				51	

Appendix C-2

Source Containment Well
2007 Flow Rate Data

Date	Time	Instantaneous Discharge (gpm)	Totalizer Reading (gallons)	Average Discharge (gpm)	Total Volume (gallons)
09/12/07	11:30	---	144814350		144814350
				51	
09/20/07	9:55	---	145396450		145396450
				51	
09/28/07	11:19	---	145986040		145986040
				51	
10/01/07	11:50	---	146206160		146206160
				45	
10/02/07	11:20	---	146269999		146269999
				51	
10/05/07	12:30	---	146492320		146492320
				68	
10/08/07	8:15	---	146770580		146770580
				46	
10/19/07	11:39	---	147504800		147504800
				50	
10/23/07	9:39	---	147786805		147786805
				41	
10/24/07	12:33	---	147852265		147852265
				48	
10/26/07	11:52	---	147989220		147989220
				48	
11/01/07	7:26	48.0	148389100		148389100
				47	
11/20/07	12:38	---	149697220		149697220
				46	
11/28/07	12:22	---	150225350		150225350
				45	
12/01/07	10:36	---	150416690		150416690
				45	
12/11/07	7:35	44.0	151050909		151050909
				50	
12/14/07	12:05	---	151278230		151278230
				49	
12/20/07	13:07	---	151706750		151706750
				48	
01/02/08	7:13	---	152579400		152579400

APPENDIX D

Appendix D

2007 Influent / Effluent Quality Data

D-1: Off-Site Treatment System

D-2: Source Treatment System

D-1: Off-Site Treatment System

Appendix D-1

Off-Site Treatment System
2007 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)
01/04/07	1500	100	4.5	0.030	0.0124	<0.0100	<1.0	<1.0	<1.0	0.030	0.0119	<0.0100
02/01/07	1100	67	<1.0	0.020	0.0455	<0.0100	<1.0	<1.0	<1.0	0.024	0.0262	<0.0100
03/01/07	1100	77	3.5	0.020	<0.0100	<0.0100	<1.0	<1.0	<1.0	0.020	0.0789	<0.0100
04/04/07	1100	66	3.1	0.020	<0.0100	<0.0100	<1.0	<1.0	<1.0	0.023	0.0123	<0.0100
05/01/07	960	68	2.9	0.018	0.0349	<0.0100	<1.0	<1.0	<1.0	0.020	0.0755	<0.0100
06/01/07	950	72	<1.0	0.021	0.0148	<0.0100	<1.0	<1.0	<1.0	0.021	<0.0100	<0.0100
07/03/07	1000	69	3.4	0.017	<0.0100	<0.0100	<1.0	<1.0	<1.0	0.025	0.0133	<0.0100
08/01/07	1000	65	3.1	0.024	<0.0100	<0.0100	<1.0	<1.0	<1.0	0.022	<0.0100	<0.0100
09/04/07	970	69	<1.0	0.022	0.0382	<0.0100	<1.0	<1.0	<1.0	0.022	<0.0100	<0.0100
10/01/07	960	66	2.9	0.024	0.0300	0.0323	<1.0	<1.0	<1.0	0.020	<0.0100	<0.0100
11/01/07	1000	82	<1.0	0.018	<0.0100	<0.0100	<1.0	<1.0	<1.0	0.018	0.0135	<0.0100
12/04/07	960	66	<1.0	0.019	0.0112	<0.0100	<1.0	<1.0	<1.0	0.019	0.0511	<0.0100
01/04/08	1000	71	<1.0	0.020	<0.0100	<0.0100	<1.0	<1.0	<1.0	0.020	<0.0100	<0.0100

[a] Data from January 4, 2008 has been included to show conditions at the end of the year.

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 ug/L for TCE and DCE, 60 ug/L for TCA and 50 ug/L for total chromium).

D-2: Source Treatment System

Appendix D-2

Source Treatment System
2007 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)
01/04/07	150	19	<1.0	0.029	0.0177	1.080	<1.0	<1.0	<1.0	0.032	0.0152	0.044
02/01/07	160	18	<1.0	0.032	0.0196	0.236	<1.0	<1.0	<1.0	0.036	0.0117	0.065
03/01/07	150	19	<1.0	0.030	0.0303	0.828	<1.0	<1.0	<1.0	0.027	<0.0100	0.056
04/04/07	140	16	<1.0	0.032	0.0238	0.263	<1.0	<1.0	<1.0	0.031	<0.0100	0.043
05/01/07	140	18	<1.0	0.031	0.0108	0.225	<1.0	<1.0	<1.0	0.029	<0.0100	0.038
06/01/07	120	18	<1.0	0.033	0.0192	0.679	<1.0	<1.0	<1.0	0.029	<0.0100	0.135
07/03/07	130	18	<1.0	0.031	<0.0100	0.133	<1.0	<1.0	<1.0	0.041	<0.0100	0.117
08/01/07	120	14	<1.0	0.040	<0.0100	0.205	<1.0	<1.0	<1.0	0.035	<0.0100	0.100
09/04/07	110	14	<1.0	0.034	<0.0100	0.112	<1.0	<1.0	<1.0	0.031	<0.0100	0.065
10/01/07	120	14	<1.0	0.027	<0.0100	0.219	<1.0	<1.0	<1.0	0.035	0.1060	0.187
11/01/07	120	16	<1.0	0.024	<0.0100	0.117	<1.0	<1.0	<1.0	0.026	<0.0100	0.047
12/04/07	100	13	<1.0	0.027	<0.0100	0.354	<1.0	<1.0	<1.0	0.025	<0.0100	0.038
01/04/08	120	12	<1.0	0.022	<0.0100	0.067	<1.0	<1.0	<1.0	0.029	<0.0100	0.222

[a] Data from January 4, 2008 has been included to show conditions at the end of the year.

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 ug/L for TCE and DCE, 60 ug/L for TCA and 50 ug/L for total chromium).

APPENDIX E

Appendix E

Results of Analysis of Data from Aquifer Tests Conducted on DFZ Well CW-3/MW-79

APPENDIX E

RESULTS OF ANALYSIS OF DATA FROM AQUIFER TESTS CONDUCTED ON DFZ WELL CW-3/MW-79

1.0 Introduction

This Appendix presents the results of the analysis of aquifer test data from the Deep Flow Zone (DFZ) well that was installed near the off-site containment well CW-1 in January-February 2006, and tested in April 2006. This well, originally installed as a potential DFZ containment well CW-3, was later designated as monitoring well MW-79 on the basis of the chemical analysis results for the initial samples from the well. The results of these chemical analyses and all other data collected during the installation and testing of the well were presented in a letter submitted to the United States Environmental Protection Agency (USEPA) and the New Mexico Environment Department (NMED) on June 2, 2006.[1] Although the current designation of the well is MW-79, in this Appendix, the well will be referred to as CW-3 to be consistent with the designation used during its testing.

A description of the testing of CW-3 was included in the above referenced June 2, 2006 letter. Briefly, the testing sequence involved the following steps:

1. Reduction of the pumping rate of well CW-1 to 150 gallons per minute (gpm), to allow for the treatment of the water to be pumped from CW-3 at the off-site treatment system. To minimize the potential effects of this reduced rate on test data, the reduction was implemented on March 15, 2006, more than two weeks prior to the testing of CW-3, and continued until April 10, 2006.

2. Installation of pressure transducers attached to data recorders for the collection of water-level data from the new DFZ well (CW-3), the two other DFZ wells (MW-67 and MW-71R), and the two near-by observation wells (OB-1 and OB-2) which are completed in flow zones overlying the DFZ. In addition, barometric pressure data was collected at the test site, and groundwater temperature was measured in well OB-2. Data collection began at noon on March 28, 2006, about one week prior to any test-pumping, and continued until the morning of April 9, about four days after the end of test-pumping. The frequency of data collection was at half-hour intervals except that the frequency was increased to a logarithmic sequence after each change in pumping rate, including any shutdown (recovery cycle).

[1] Letter to Project Coordinators Charles A. Barnes and John Kieling of the USEPA and NMED, respectively, and to Director, Water & Waste Management Division, Chief, Hazardous Waste Bureau, Chief, Groundwater Quality Bureau, and Mr. Baird Swanson of NMED, from Stavros S. Papadopulos of SSP&A and Gary L. Richardson of Metric Corporation on the subject of "Sparton Technology, Inc. Former Coors Road Plant Remedial Program - Transmittal of Data from the Installation, Testing, and Sampling of a new DFZ Well."

3. Conduct of a step-drawdown test on April 3, 2006. This test consisted of three 2-hour steps at pumping rates of about 20, 40, and 60 gpm. The test started at 8:00 AM and was completed at 2:00 PM; data collection during the recovery of the water level in the well continued until the start of the constant-rate pumping test the next morning.

4. Conduct of a 24-hour constant-rate pumping test at a rate of about 60 gpm. The test started at 8:00 AM on April 4, 2006 and ended at 8:00 AM on April 5, 2006. Collection of data during the recovery of the water levels continued until the morning of April 9, 2006.

The pressure transducers installed in the wells measured the depth to water (DTW) in each well. The analyses presented in this Appendix are based on changes in water level, that is, changes in DTW, rather than the elevations of the water levels; therefore, conversion of the data to water-level elevations was not necessary, and the DTW data, as measured by the transducers, were used in the analyses.

2.0 Barometric Efficiency and Water-Level Trend Analysis from Pre-Test Data

The DTW and barometric-pressure (BP) data collected during the pre-test period, that is prior to the start of the step test on CW-3, are plotted in Figure E-1. In preparing this figure, as well as other figures presenting BP data, the BP measurements which were made in inches of mercury (Hg) were converted to feet of water (H_2O) to provide a one-to-one correspondence with water-level measurements. As shown in the plots presented in Figure E-1, the DTW in each well reacted as expected to BP trends and fluctuations, increasing when the BP increased (declining water level) and decreasing when the BP decreased (rising water level). Some disturbance in the DTW data occurred at the beginning of the data collection program on March 28, and again about a day later, on March 29. To eliminate the potential effect of these disturbances on the barometric efficiency and trend calculations, data collected prior to March 30 was not used in this analysis.

Examination of the data indicated that peaks and troughs in the DTW lagged behind the troughs and peaks in BP. This time-lag averaged[2] about 2.5 hours for the DFZ wells (CW-3, MW-67, and MW-71R) and about 0.5 hour for the wells completed above the DFZ (OB-1 and OB-2). The time-lag in the DFZ wells is illustrated in Figure E-2 where the pre-test DTW in well MW-67 is compared to the BP during this period. These time-lags were taken into consideration in calculating the barometric efficiency of each well from pre-test data as well as in correcting data collected during the subsequent tests for barometric effects.

The results of the barometric efficiency and water-level trend analysis for each of the five monitored wells are presented in Figures E-3 through E-7. Each figure shows (1) the measured DTW, (2) the DTW that would have prevailed if water-level changes were solely due to BP changes and water-level trends, and (3) the DTW corrected for BP effects and water-level trends. (The corrected DTW represents the DTW that would have prevailed in the well if BP had remained constant throughout the analysis period and there were no water-level trends during that period.)

[2] Because both barometric pressure and water-levels during the pre-test period were measured at half-hour intervals, the calculated average time-lag was rounded to the nearest half hour.

Note that, since an increase in the DTW corresponds to a decline in water level, DTW in these, and in the remaining figures of this Appendix, has been plotted as increasing downward to reflect better the behavior of water levels. The barometric efficiency of each well and the water-level trend in each well are summarized below:

Well	Barometric Efficiency, ft/ft	Water-Level Trend, ft/d
CW-3	0.487	-0.00509
MW-67	0.420	-0.00381
MW-71R	0.441	-0.00567
OB-1	0.745	0.0401
OB-2	0.790	0.0358

Note that a positive water-level trend indicates a rising water level (decreasing DTW) and a negative water-level trend a declining water level (increasing DTW). The barometric efficiency of the DFZ wells, CW-3, MW-67, and MW-71R (Figures E-3, E-4, and E-5), ranges about 0.4 to 0.5 foot of water-level change per foot of change in BP (expressed in feet of H_2O), and BP effects account for most of the water-level changes observed in these wells. The water-level trend in these wells is small and does not have a significant effect on the data collected during the subsequent testing of the well (less than 0.035 ft in the six days of data collection between April 3 and 9, 2006). The trend in these wells is downward, which consistent with regional trends observed in monitoring wells associated with the Sparton site and in other wells in the Albuquerque area. The barometric efficiency of the wells completed above the DFZ, OB-1 and OB-2 (Figures E-6 and E-7), is higher, about 0.75-0.8 ft/ft, and BP effects also cause most of the water-level fluctuations in these wells. The water level in these wells, however, has a relatively strong rising trend indicating that these wells were still recovering in response to the reduction in the pumping rate of the offsite containment well CW-1. The corrected water levels in all five wells have some minor fluctuations (less then $\pm$ 0.036 ft); these fluctuations are most probably due to earth tides and to a certain extent due to measurement errors.[3]

3.0 Evaluation of Step-Test Data

The DTW data collected during the conduct of the step-test on well CW-3, including data from a few hours before and after the test, are shown in Figure E-8. These data were not corrected for barometric effects or water-level trends because the total water-level change due to these factors was estimated to be less than 0.08 ft during the 6-hour test period and, therefore, negligible compared to the 20-70 ft of water-level changes that were observed during the test.

The DTW in the well was about 215 ft prior to the start of the test. When the pump was turned on at 8:00 AM on April 3, 2006, the water-level suddenly declined by almost 60 ft but then quickly rose to a DTW between 230 and 240 ft as the pumping rate was adjusted to 20 gpm. At the end of this first 2-hour step, the DTW was at about 235 ft. During the 40-gpm second step, the DTW increased to about 260 ft; at the end of this step the DTW was at about 261.5 ft. During the

[3] The measurement range of the transducers used for the water-level measurements was 100 psi for well CW-3, 50 psi for OB-1, and 30 psi for the remaining three wells, with an accuracy of ±0.05 percent; therefore, the possible water-level measurement errors are ±0.12 ft for well CW-3, ±0.06 ft for OB-1, and ±0.03 ft for the remaining three wells.

third 60-gpm step, the DTW increased to about 280 ft, reaching a DTW of about 282 ft at the end of the test. After the shutdown of the well, the water level rose to a DTW of about 215 ft within an hour of the shutdown. The data from the test are summarized below:

Test Step	Pumping Rate, gpm	Incremental Pumping Rate, gpm	Observed DTW, ft	Drawdown, ft	Incremental Drawdown, ft
Pre-Test	0	0	215.0	0	0
1	20	20	235.0	20.0	20.0
2	40	20	261.5	46.5	26.5
3	60	20	282.0	67.0	20.5
Post-Test	0	-60	215.0	0	-67.0

Note that the drawdown (water-level decline) during the first step at 20 gpm was 20 ft; when the pumping rate was doubled to 40 gpm during the second step, the drawdown increased to 46.5 ft, more than double that observed during the first step. This indicated the presence of well losses which, as expected, increased with the pumping rate. During the third step, however, the incremental drawdown due to an increase of 20 gpm in the pumping rate was 20.5 ft, essentially the same as that observed during the first step and less than the incremental drawdown of 26.5 ft observed during the second step. This indicates that during the third step the well improved, resulting in lower well losses than those observed during the first two steps. Under these circumstances, a well loss coefficient cannot be determined from the step-test data (see Walton, 1962[4]).

4.0 Correction of DTW Data Collected during Constant Rate Test

The barometric efficiency and water-level trend parameters determined from the analysis of the pre-test data were used to correct the DTW data collected during the conduct of the constant rate test for barometric pressure effects and for changes due to water-level trends. These corrections were applied to the data collected during the pumping cycle of the test and during the first day and a half of the recovery cycle.

Plots of the corrected DTW against time since the start of pumping, that is, since beginning of the test, for the two observation wells completed above the 4800-foot clay, OB-1 and OB-2, are shown in Figure E-9. As shown in this figure, the water level in these two wells appears to respond to pumping by a small but steep decline during the first 50-100 minutes of the test, and then continues to decline at a less steep but essentially constant rate until shutdown. At shutdown, there is a sudden spike in the water level, which is attributed to a sudden compressive strain that apparently occurred in the overlying aquifer at shutdown, followed by a recovery of less than 0.1 foot during the next few hundred minutes. The water level then begins to decline again at approximately the same rate as before the shutdown. Note that the pre-test data from these wells had indicated a strong rising trend due to the recovery of the water levels in response to the reduction of the pumping rate of the off-site containment well CW-1 (see Section 2.0); however, the

[4] Walton, William C., 1962, *Selected Analytical Methods for Well and Aquifer Evaluation*, Bulletin 49, State of Illinois, Department of Registration and Education, Illinois State Water Survey, Urbana, IL., 81 pp.

behavior of the corrected DTW in these two wells during the constant-rate test (Figure E-9) indicates that the rising trend observed in the pre-test data had abated and overcome by regional or other unknown declining trends. This led to the conclusion that trend correction applied to the test data from these two wells is not valid; data from these wells was not, therefore, considered in the evaluation of the constant rate test.

The DTW measured in well CW-3 during the pumping cycle of the test, the corrected DTW for the well, and the drawdown calculated using the corrected DTW are presented on Table E-1; the DTW measured in the well during the recovery cycle, and the corresponding corrected DTW and residual drawdown[5] are presented on Table E-2. The corresponding measured and corrected DTWs, and drawdowns, or residual drawdowns, for wells MW-67 and MW-71R are presented on Tables E-3 and E-4. Plots of the drawdown and of the residual drawdown in each of these three DFZ wells are presented in Figures E-10 through E-12. Three plots are shown in each figure. The top plot is a linear plot of the drawdown and of the residual drawdown against time since the start of pumping, that is, since beginning of the test. The middle plot is a semi-logarithmic plot of the drawdown against the time since the start of pumping and the bottom plot is a semi-logarithmic plot of the residual drawdown against the time since shutdown.

Note that the water level in the pumped well CW-3 (Figure E-10) declined by 50 feet within the first minute of pumping then continued to decline another 20 feet during the next 7.5 minutes and then recovered by 5 feet to a total drawdown of about 65 feet in the next 40 minutes; the water level then began gradually to decline until the end of the test. The reason for this behavior during the early part of the test is not known; it could be the effect of rate adjustments during the beginning of the test, but most likely, it is the effect of additional improvement of the well during the early pumping period. A similar thing also happened when the well was shutdown; the water level shot up almost 10 feet above the pre-pumping water level, then declined to about 2 feet below the initial level and then began to recover gradually. This was due to the sudden release of the water in the pump-discharge column when the well was shut down. Because of this behavior of the water levels in this well during the early periods of the pumping and recovery cycles, data from the first 50 minutes of the pumping cycle and the first 9 minutes of the recovery cycle for this well were not considered in the evaluation of the aquifer test.

5.0 Evaluation of Constant-Rate Test Data

Well CW-3 was completed with two 15-foot screens placed 5 feet apart between elevations of 4,733 and 4,768 ft MSL; thus, the top of the upper screen is about 30 feet below the 4,800-foot clay unit and the well is partially penetrating the DFZ underlying the unit. Wells MW-67 and MW – 71R with their 10-foot and 5-foot screens, respectively, also partially penetrate the DFZ. Analysis of the data from the test must, therefore, consider partial penetration effects. The drawdown plots presented in Figures E-10 through E-12 show that water levels had essentially stabilized near the end of the pumping cycle of the test; this indicates that water levels were affected by leakage from adjacent beds and that, therefore, the analysis must also consider leakage effects.

[5] Residual drawdown refers to the drawdown (with respect to the pre-test water level in the well) that remains in the well after shutdown; as the water levels continue to recover, the residual drawdown approaches zero.

To consider the effects of both partial penetration and of leakage in the analysis of the constant-rate test data, a numerical radial-vertical model (r-z model) was used. The finite-difference grid for this model is shown in Figure E-13. As shown in this figure, the model consists of 69 columns and 98 rows. The first column represents a small circle having the diameter of CW-3; the remaining columns represent concentric rings around the small circle (the well) with logarithmically increasing widths. Thus, in 69 columns the model extends to a radial distance of 50,000 feet where a no-flow boundary is imposed. This distance was arbitrarily selected to be large so that conditions on the outer boundary have no effect on calculated water levels in the vicinity of the pumped well. Vertically, the first 15 rows, or layers, of the model represent the surficial aquifer above the 4,800-foot clay, and rows 16-19, each one foot thick, represent the 4,800-ft clay. The log of the USGS Hunter Ridge Park 1 Boring,[6] located about 0.5 mile north of the site on the north side of the Arroyo de las Calabacillas, was the basis of the model structure below the 4,800-foot clay unit. This log shows a 15-foot clay layer between elevations of 4,705 to 4,720 ft and a 20-foot sandy clay layer between elevations 4,520 and 4,540 ft (55-60 percent silt/clay), with 165 ft of sand and gravel between these layers. Based on this log, rows 20-91, each one foot thick, represent the DFZ within which wells CW-3, MW-67, and MW-71R are completed; rows 92-93 and 96-97 represent the 15-ft clay and the 20-ft sandy clay mentioned above. The 165 ft of sand and gravel that lie between these two layers is represented by layers 94 and 95. Finally, a 2-ft row was placed at the bottom of the model to impose a constant-head boundary that represents the source of water that may leak into the model domain from deeper aquifers.

The surficial aquifer (rows 1-15) and the 4,800-foot clay (rows 16-19) assigned hydraulic properties identical to those in the calibrated regional groundwater flow model of the site (see Section 6 of the main report). The hydraulic properties of the surficial aquifer were also assigned to the 165-foot thick sand and gravel unit (rows 94-95). The hydraulic properties of the DFZ (rows 20-91) and of the underlying 15-foot clay unit (rows 92-93) were the parameters that were determined through the calibration of the model against the data from the constant-rate test. The properties of the sandy clay unit at the bottom of the modeled interval (rows 96-97) were also determined during the calibration process, but this is not significant because to a certain extent the properties of this unit are influenced by the properties that were assumed for the overlying sand and gravel.

Early model runs during the calibration process indicated that while the drawdown in wells MW-67 and MW-71R could be simulated with a set of parameters, the drawdown calculated with these parameters for the pumping well, CW-3, was much smaller than the drawdowns measured in this well. After several attempts, it was concluded that the model needed to take well losses into consideration. To simulate well losses a skin, that is a ring of low radial hydraulic conductivity, was added into the model by reducing the hydraulic conductivity of column 2 in the rows across the screened interval of well CW-3. The model was then recalibrated with the radial hydraulic conductivity of the skin being also determined in the calibration process.

[6] Johnson, Peggy, S. D. Connell, B. Allred, and B. D. Allen, 1996, *Field Boring Log Reports, City of Albuquerque Piezometer Nests, Sisters City Park, Del Sol Dividers, Hunters Ridge Park 1, West Bluff Park, Garfield Park*, New Mexico Bureau of Mines and Mineral Resources Open-file Report 426.

A good match with the measured drawdowns in all three wells (CW-3, MW-67, and MW-71R) was obtained with a skin hydraulic conductivity of 0.685 ft/d and the following properties for the DFZ and the underlying clay unit:

Hydrogeologic Unit	Hydraulic Conductivity, ft/d		Specific Storage, ft^{-1}
	Radial (Horizontal)	Vertical	
DFZ	22.6	0.0679	4.2×10^{-6}
Underlying Clay Unit	0.196	0.0575	2×10^{-6}

Comparisons of measured and model calculated drawdowns and residual drawdowns for the three wells are presented in Figures E-14, E-15, and E-16.

Finally, the calibrated model was run to simulate the step test that was conducted prior to the constant rate test. The results of this simulation are presented in Figure 17a. Note that the calculated drawdowns for the second and third steps are a few feet less than the measured drawdowns. A better match was obtained by reducing the hydraulic conductivity of the skin to 0.645 ft/d (see Figure 17b). This is consistent with the earlier determination that the well had improved during the third step of the test (see Section 3.0) and possibly also during the early period of the constant rate test.

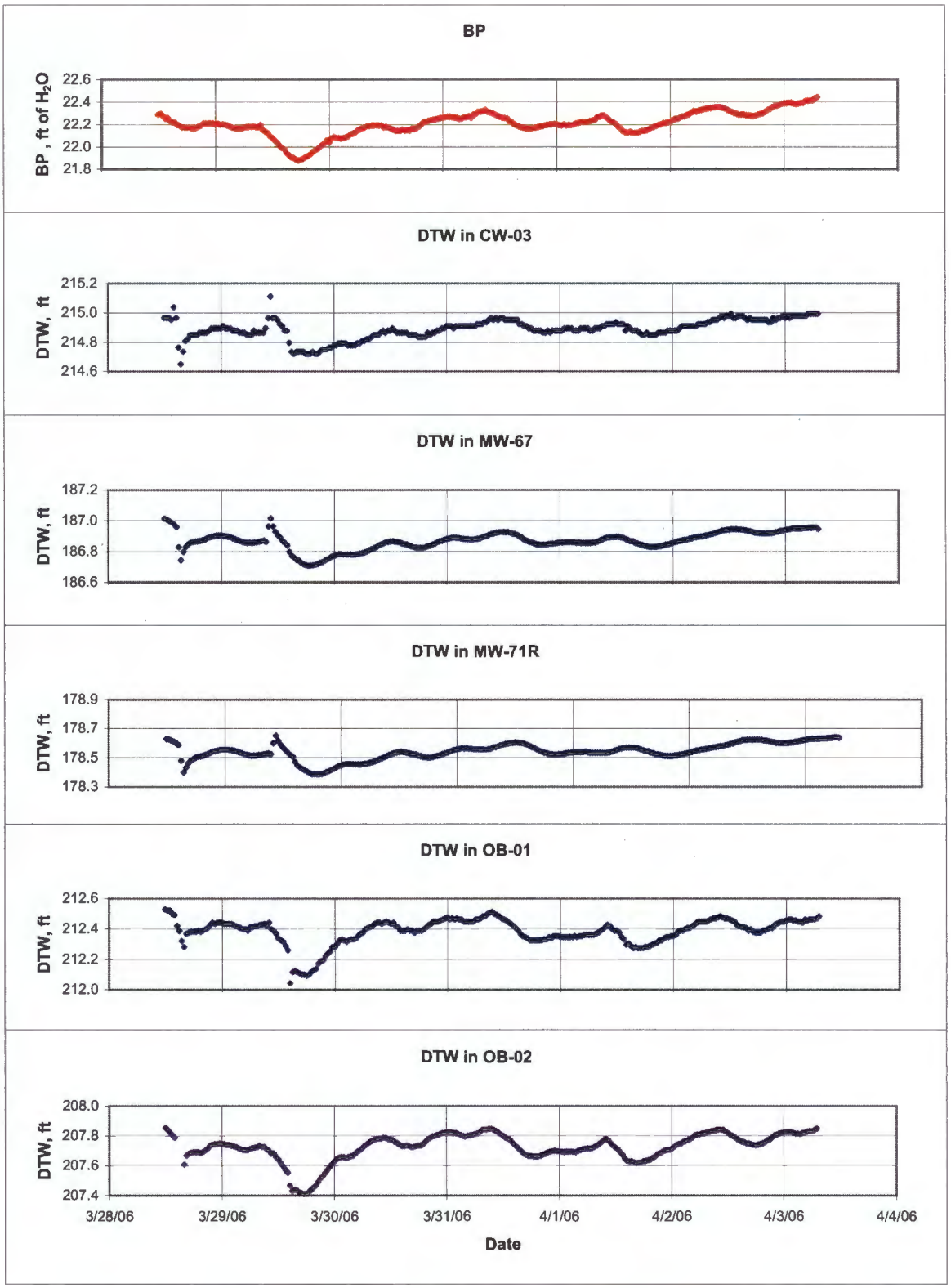


Figure E-1 Pre-Test Barometric Pressure (BP) and Depth to Water (DTW) in the Monitored Wells

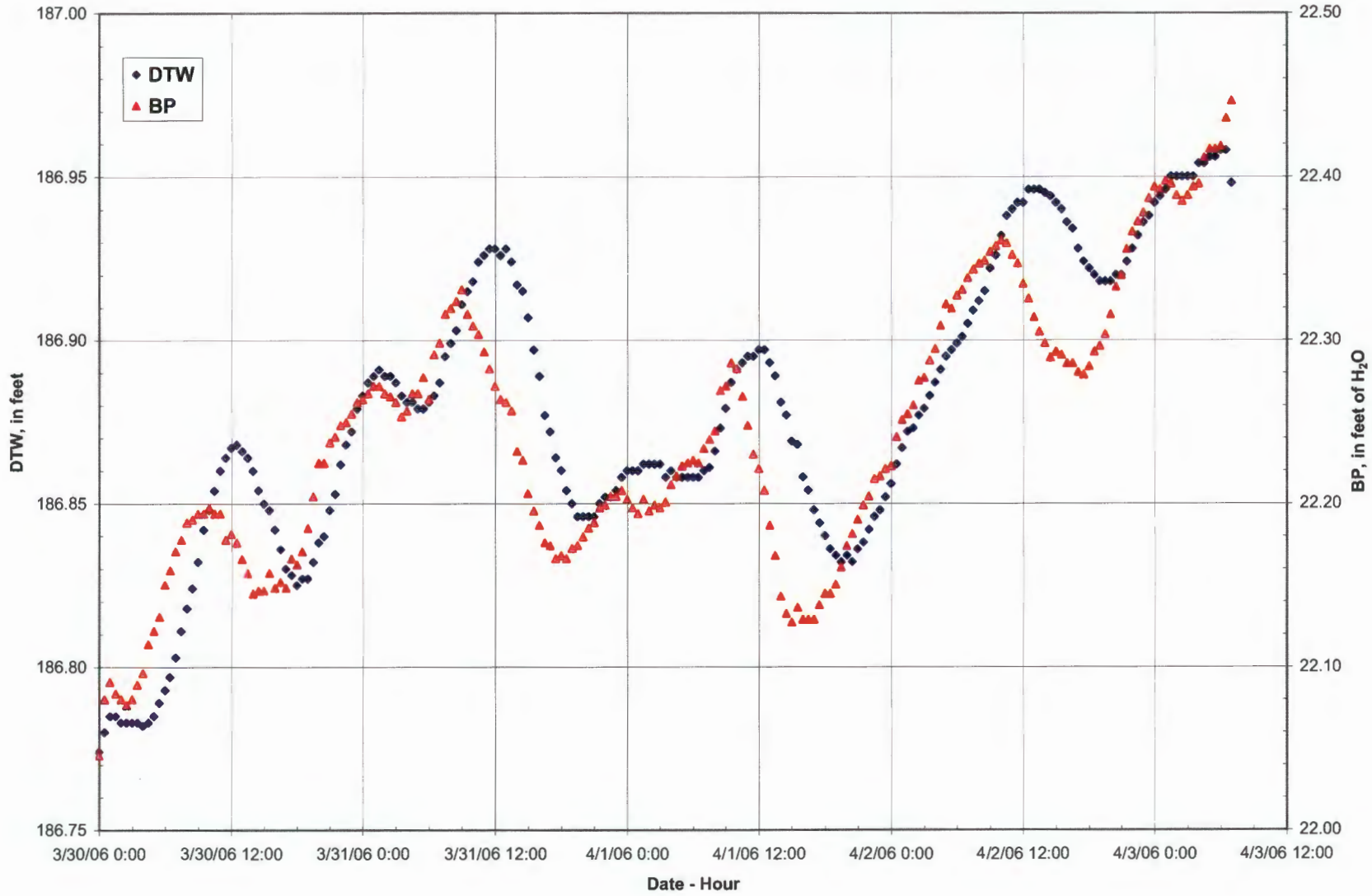


Figure E-2 Comparison of BP to DTW in well MW-67 during the Pre-Test Period

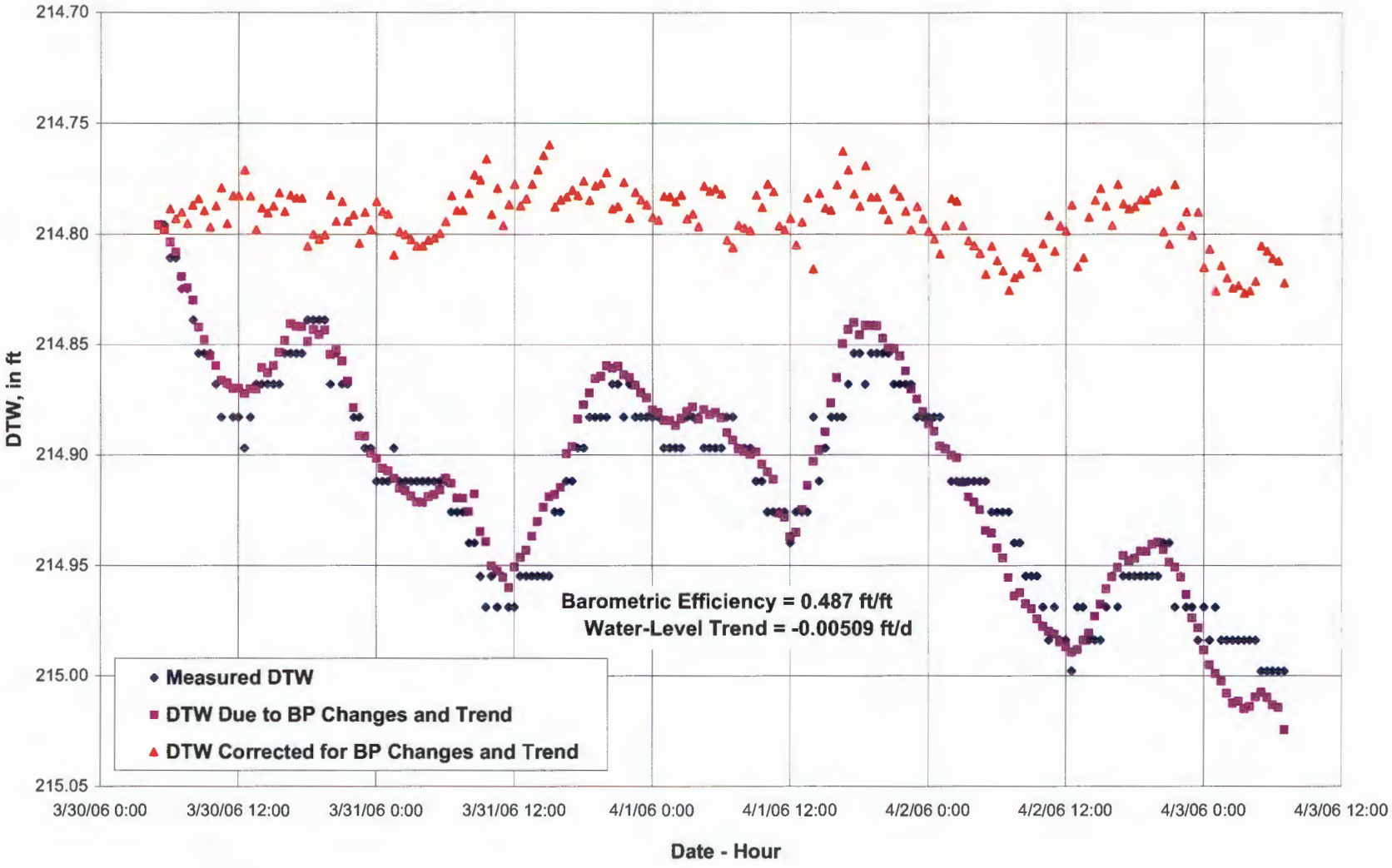


Figure E-3 Correction of the Pre-Test DTW in Well CW-3 for Barometric Effects and Water-Level Trend

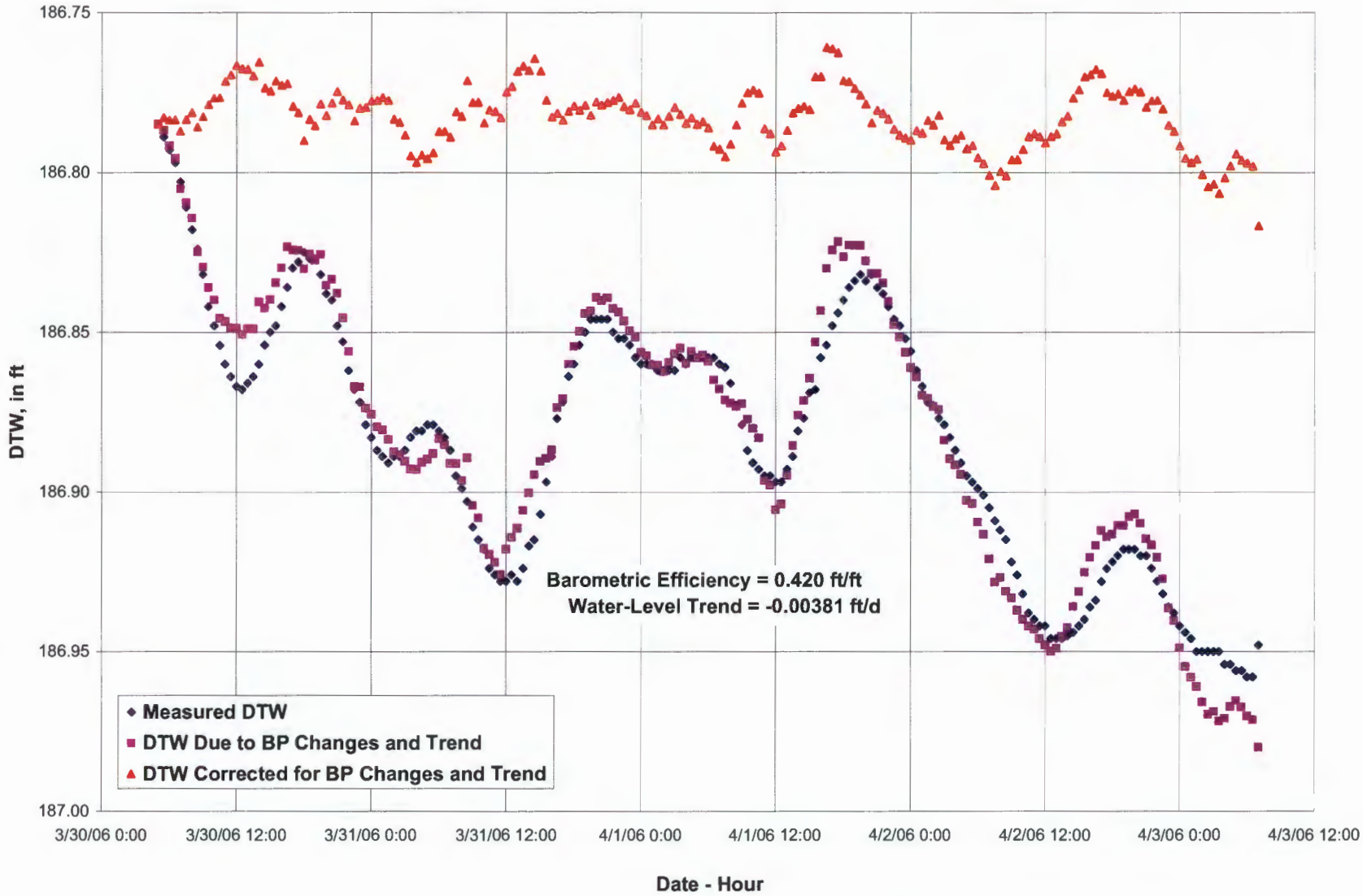


Figure E-4 Correction of the Pre-Test DTW in Well MW-67 for Barometric Effects and Water-Level Trends

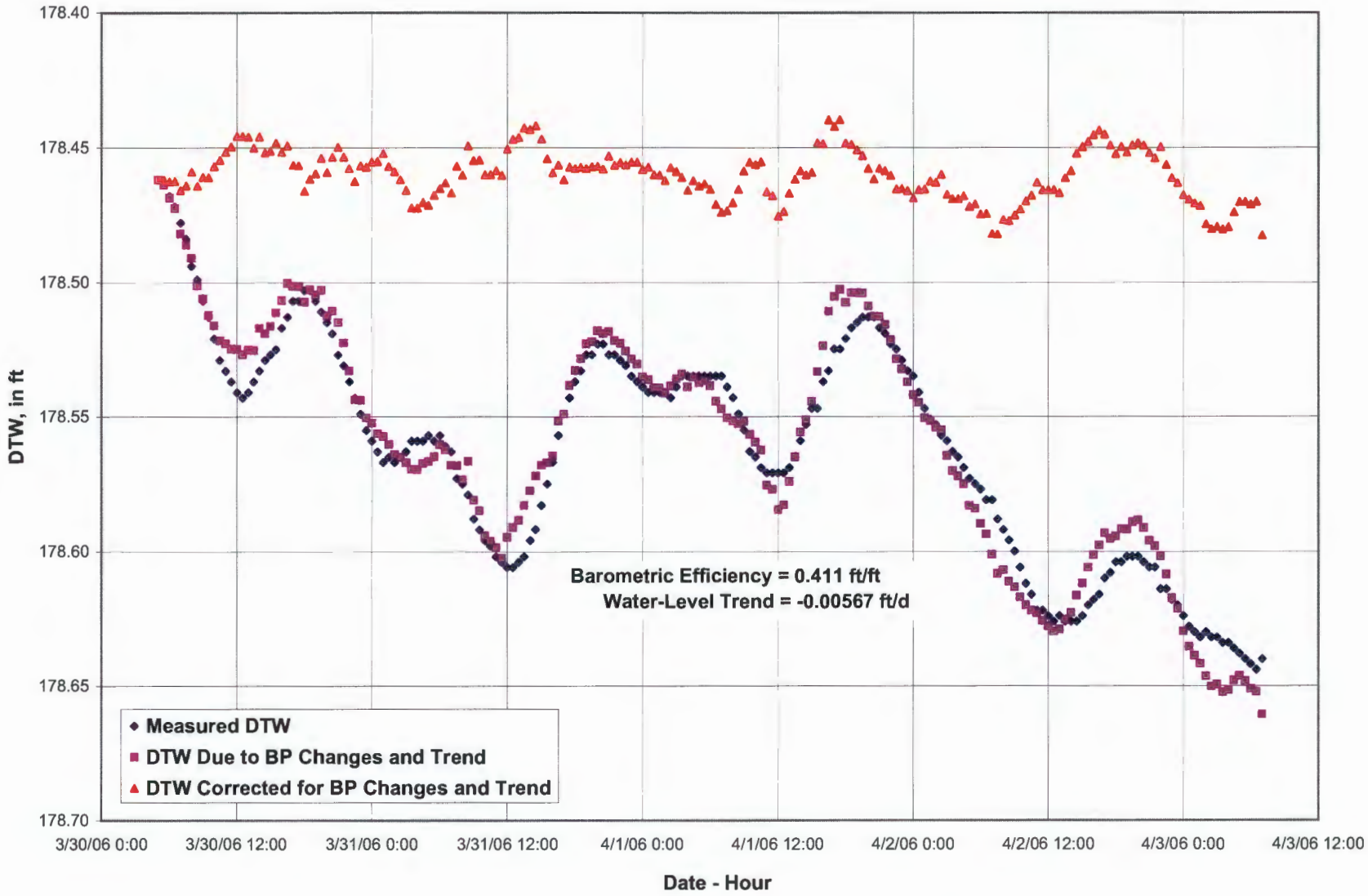


Figure E-5 Correction of the Pre-Test DTW in Well MW-71R for Barometric Effects and Water-Level Trend

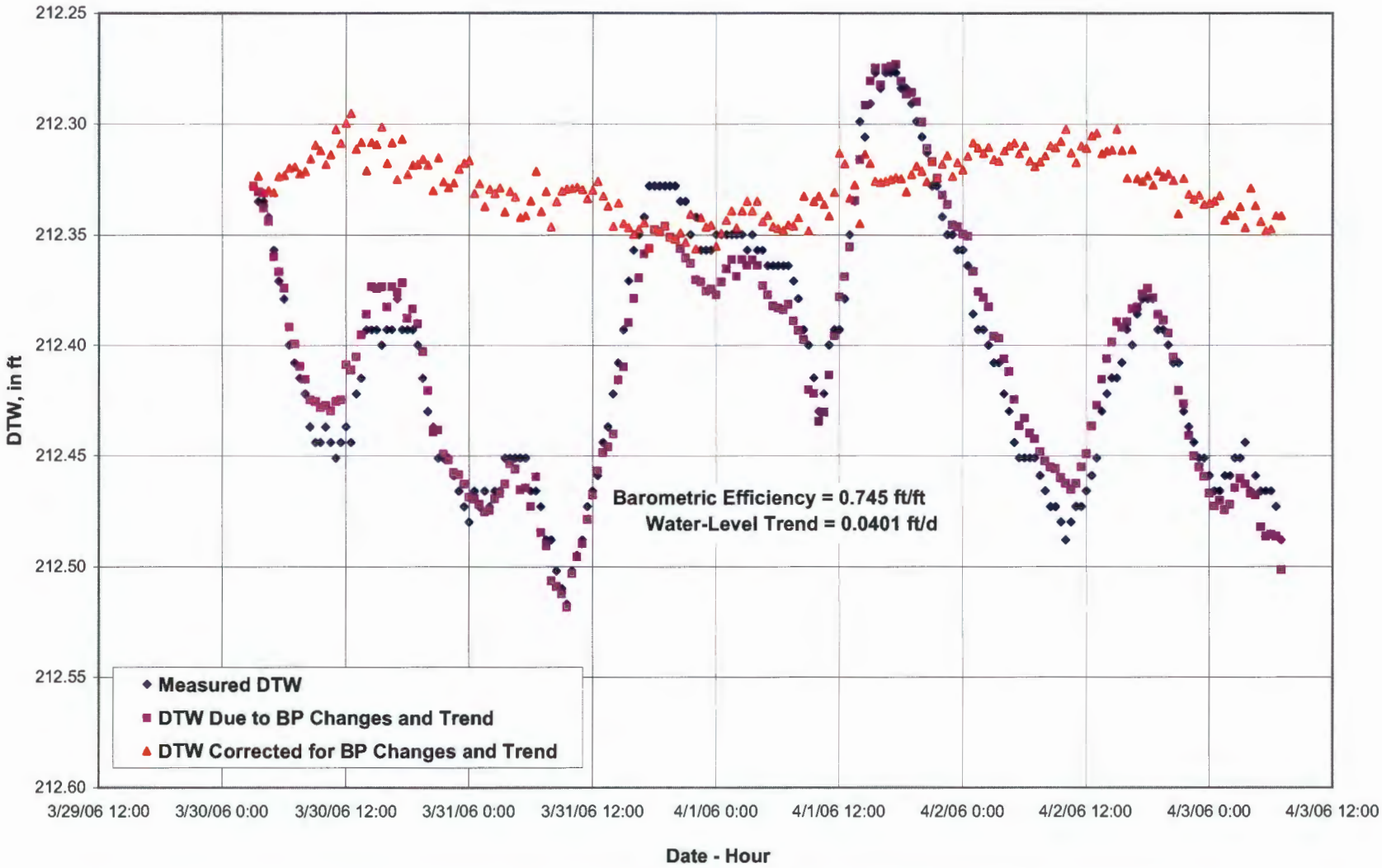
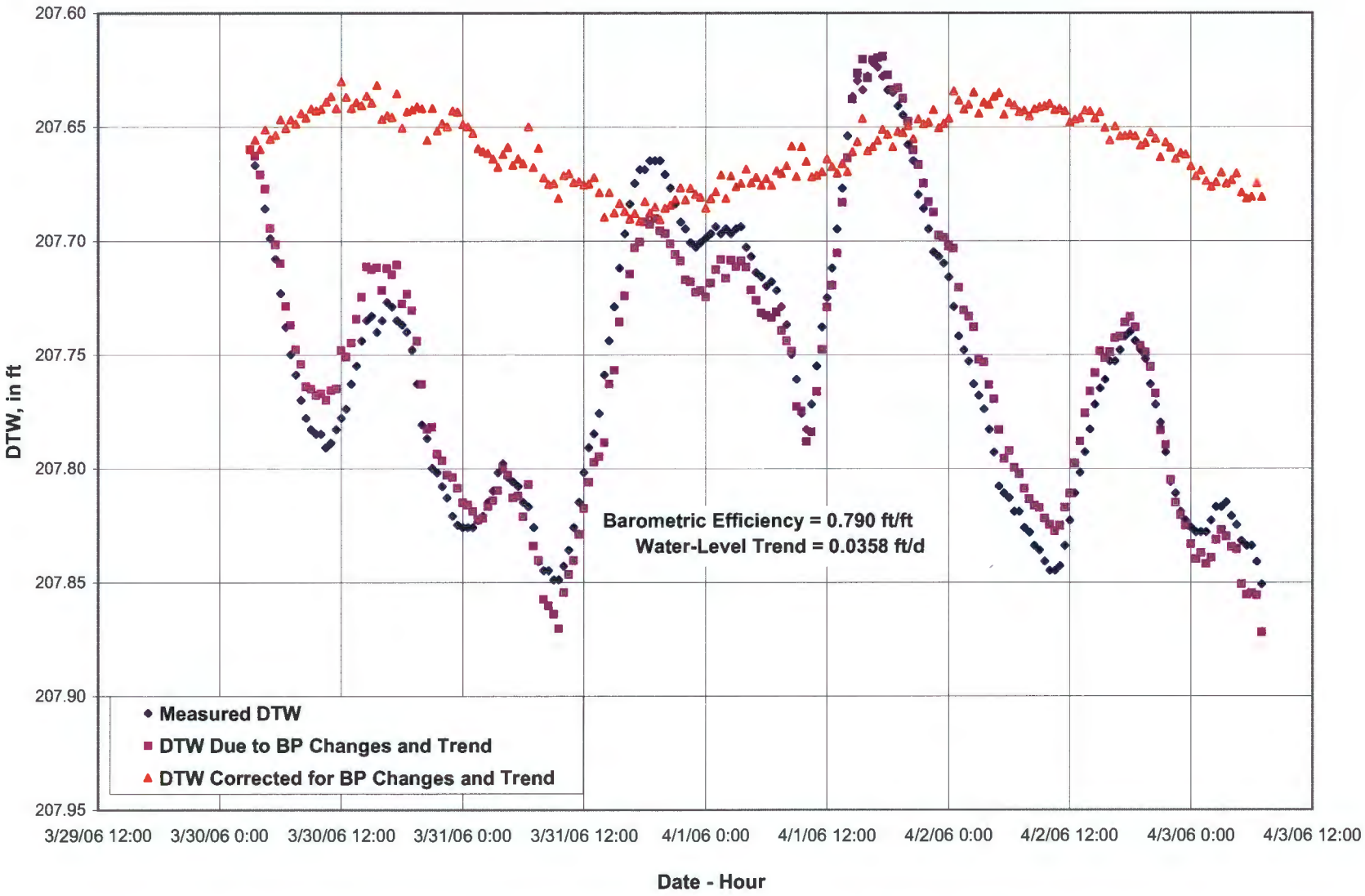


Figure E-6 Correction of the Pre-Test DTW in Well OB-1 for Barometric Effects and Water-Level Trend



Figue E-7 Correction of the Pre-Test DTW in Well OB-2 for Barometric Effects and Water-Level Trend

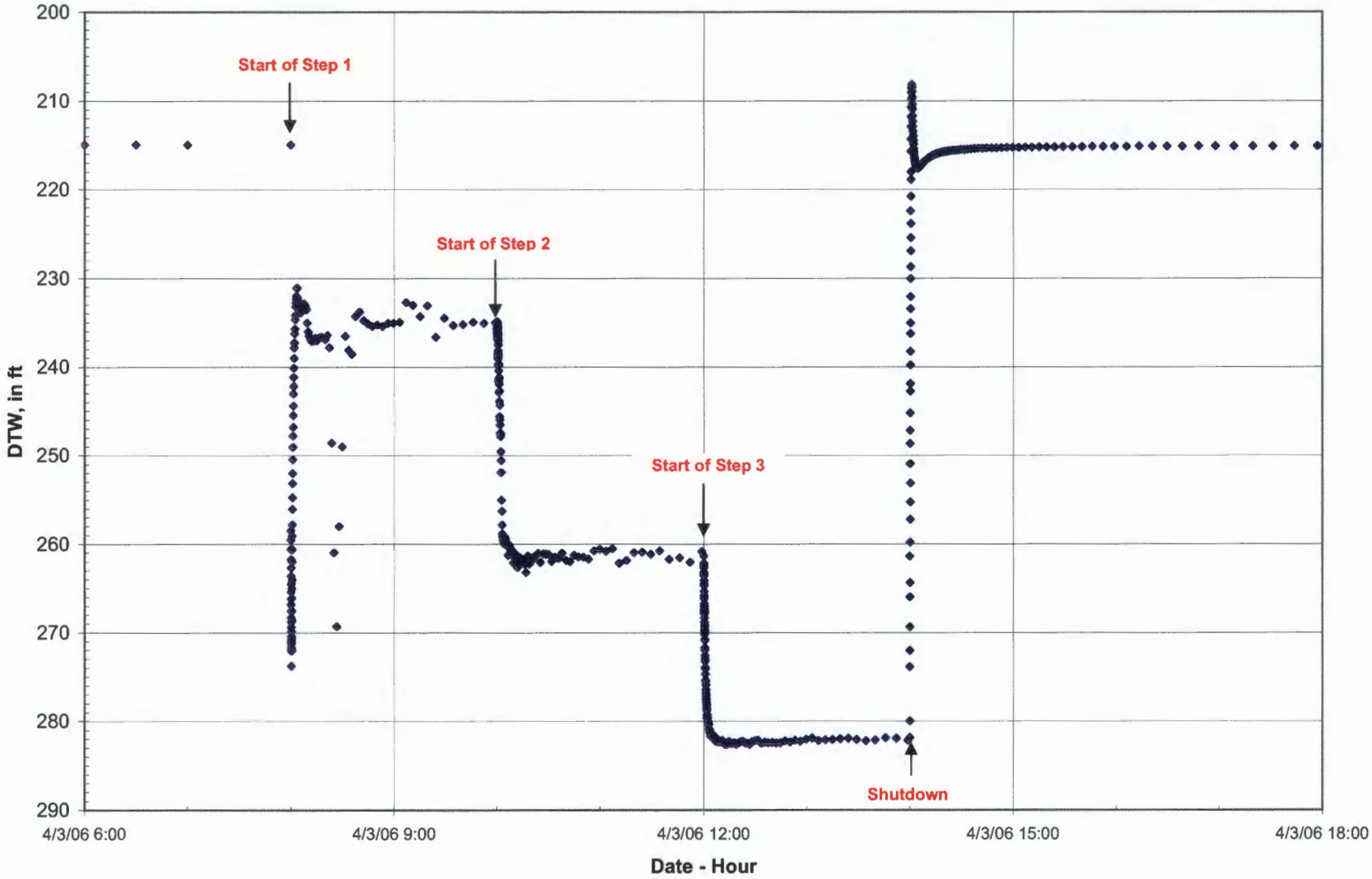


Figure E-8 DTW in Well CW-3 during the Conduct of the Step Test

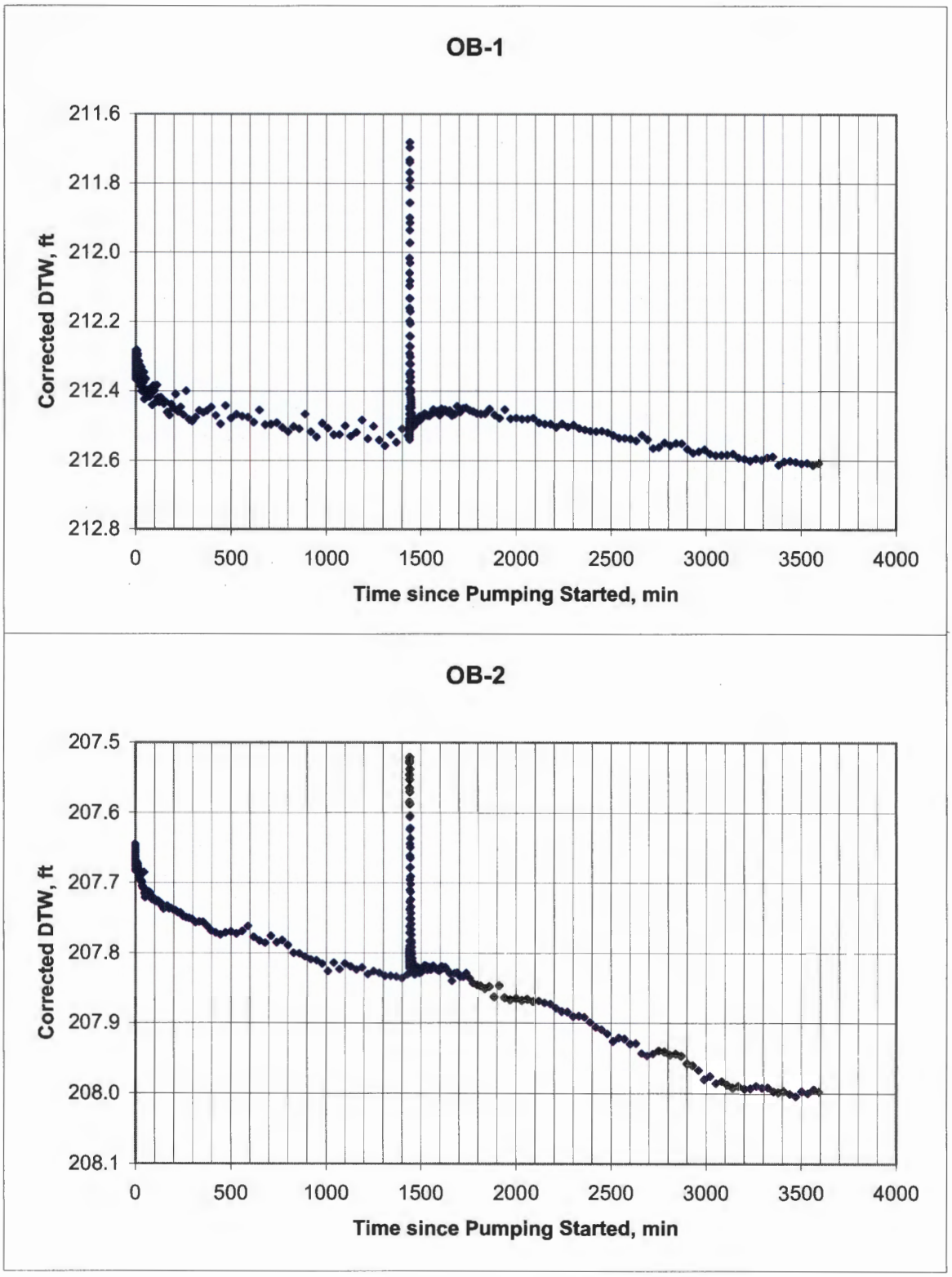


Figure E-9 Corrected DTW in Wells OB-1 and OB-2 during Constant Rate Test

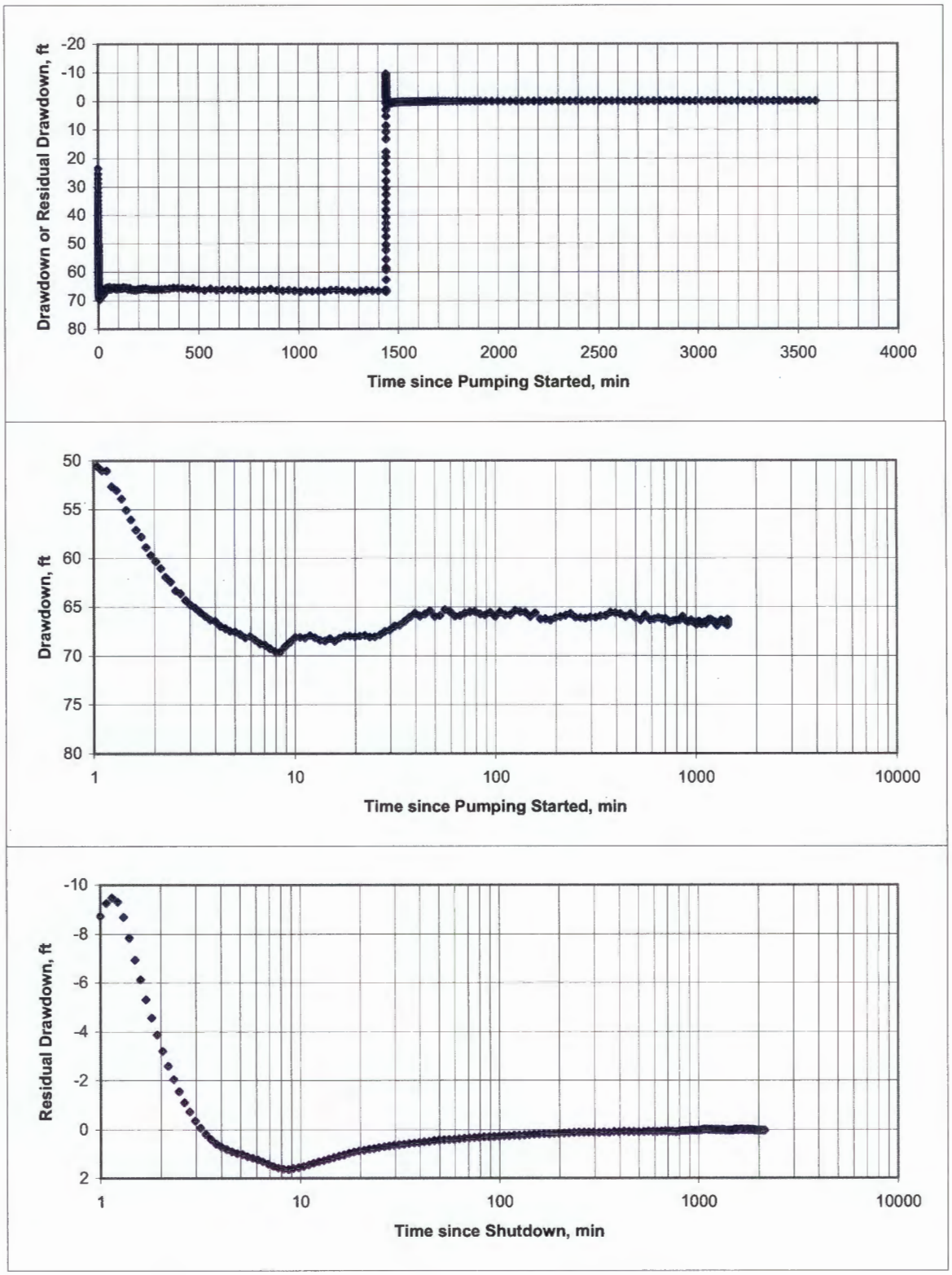


Figure E-10 Drawdown and Residual Drawdown Plots for Well CW-3

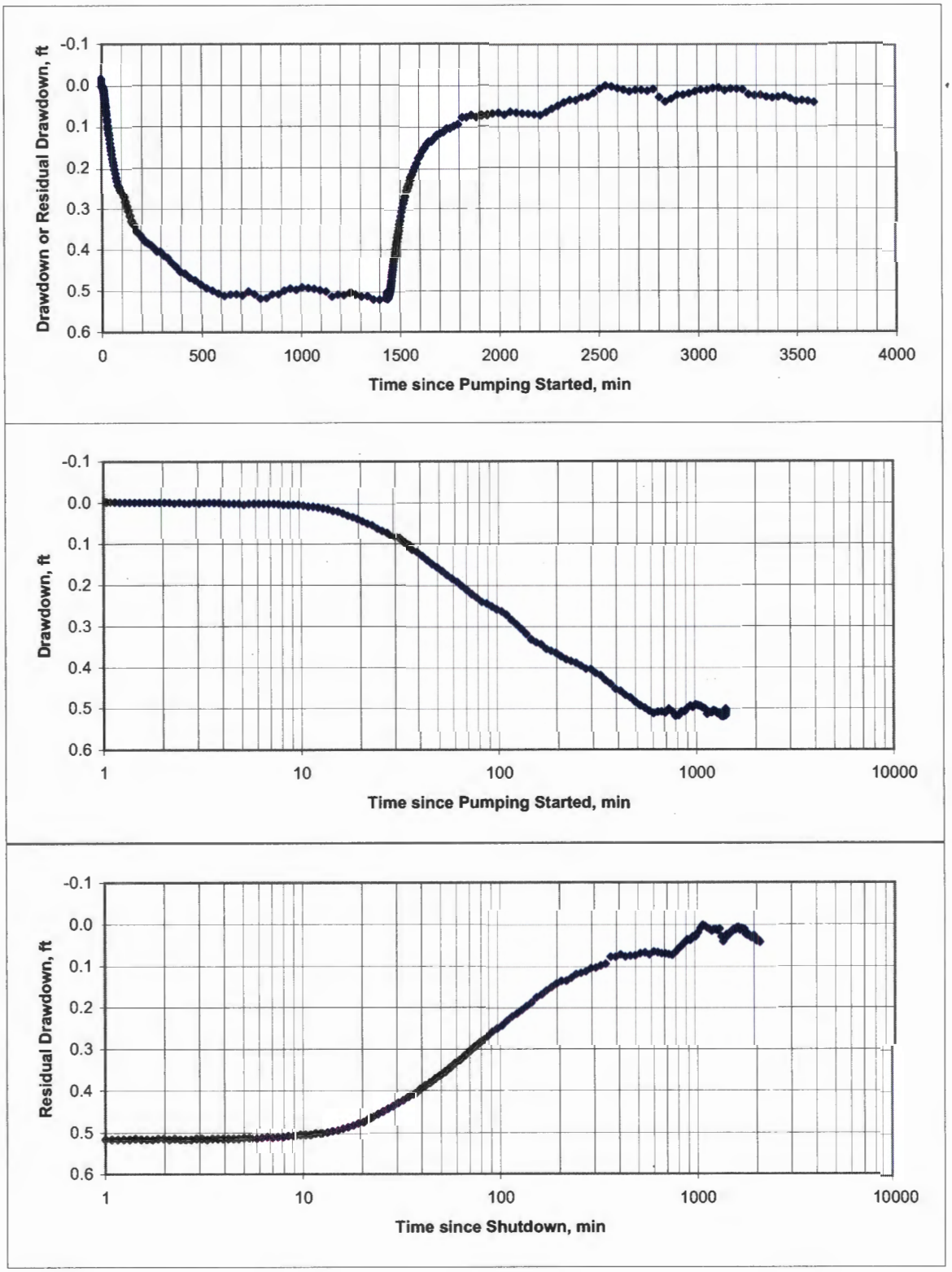


Figure E-11 Drawdown and Residual Drawdown Plots for Well MWE-67

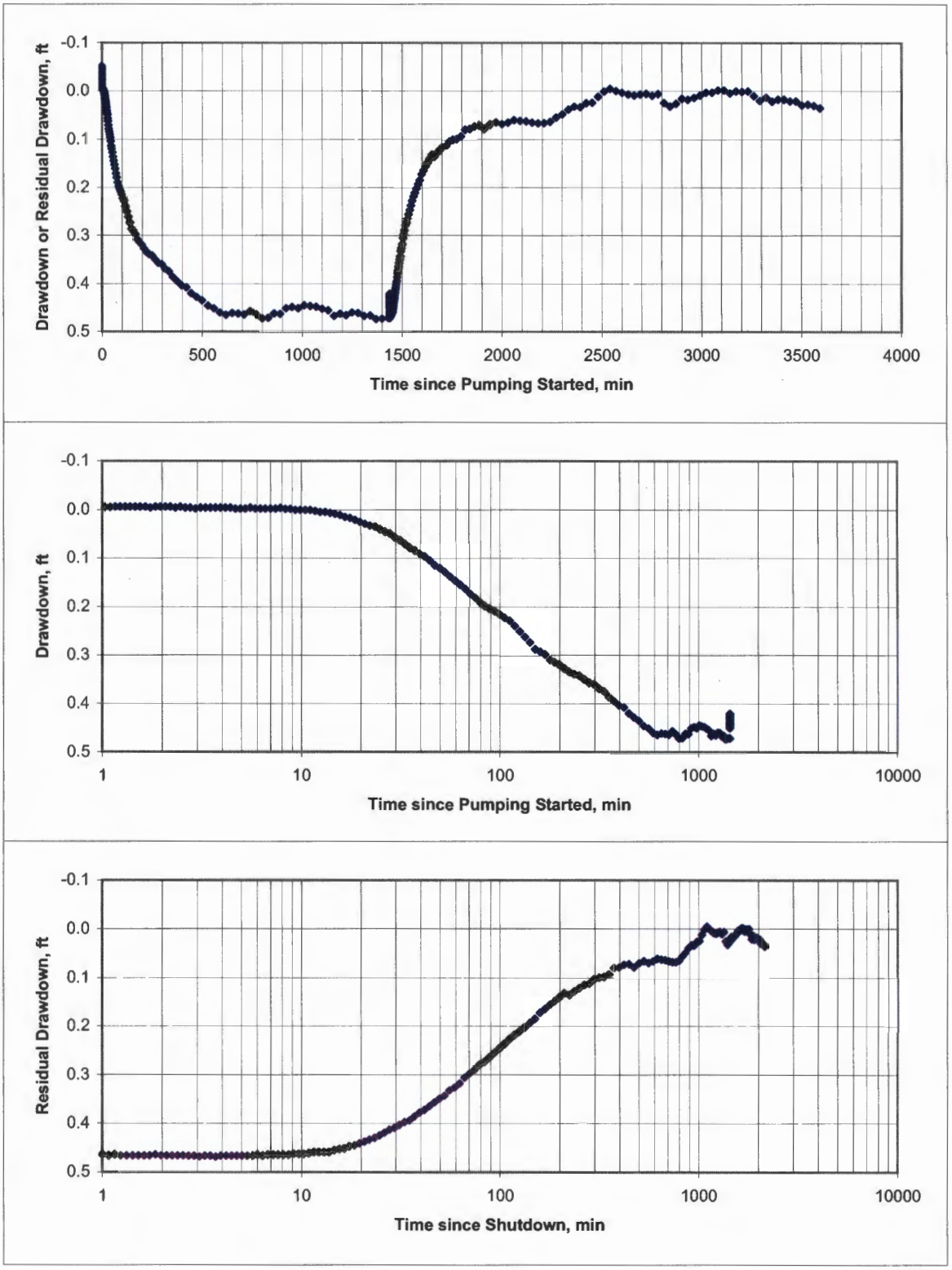


Figure E-12 Drawdown and Residual Drawdown Plots for Well MW-71R

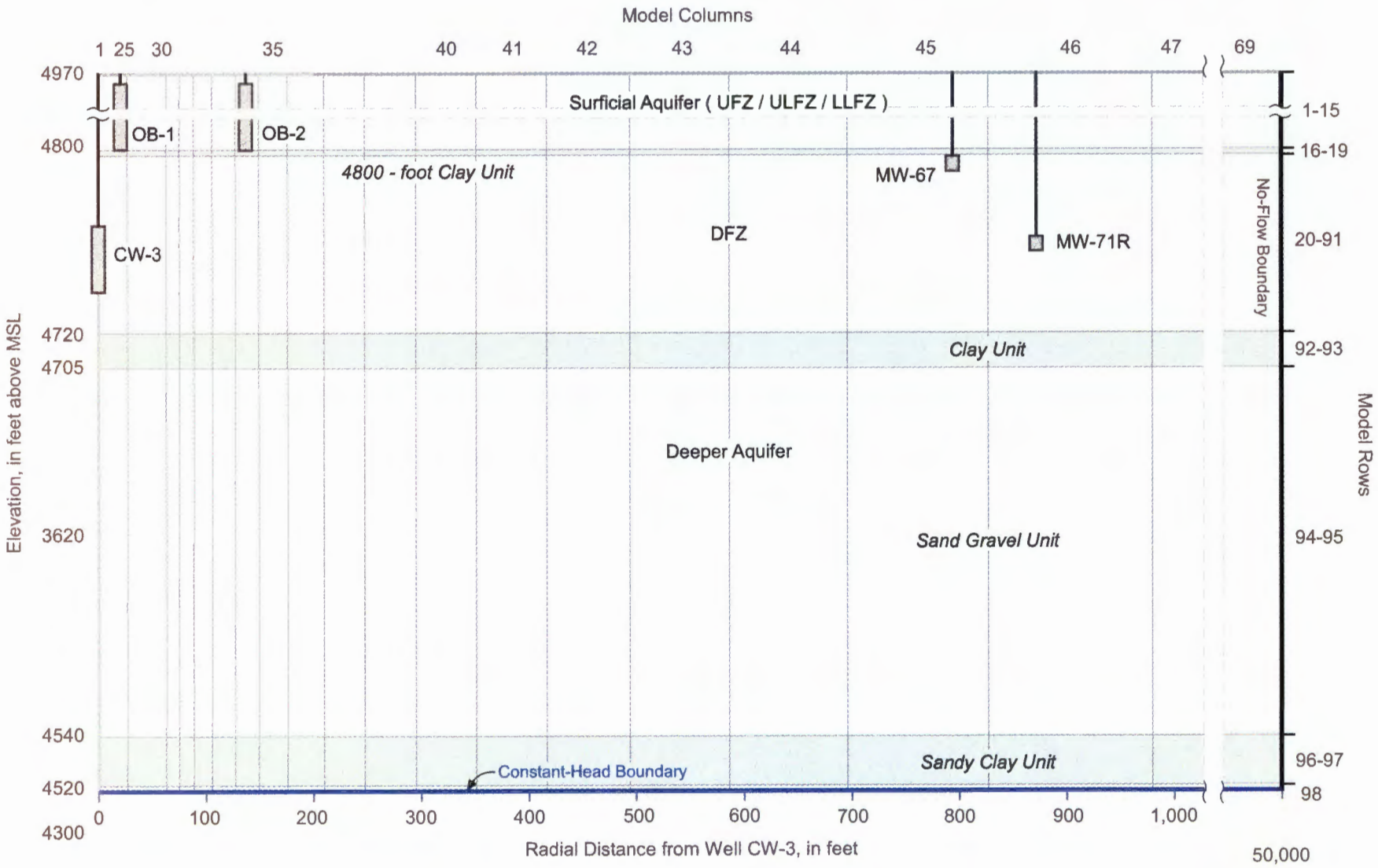


Figure E-13 Finite-Difference Grid Used to Simulate Water-Level Changes During the Constant-Rate Pumping Test

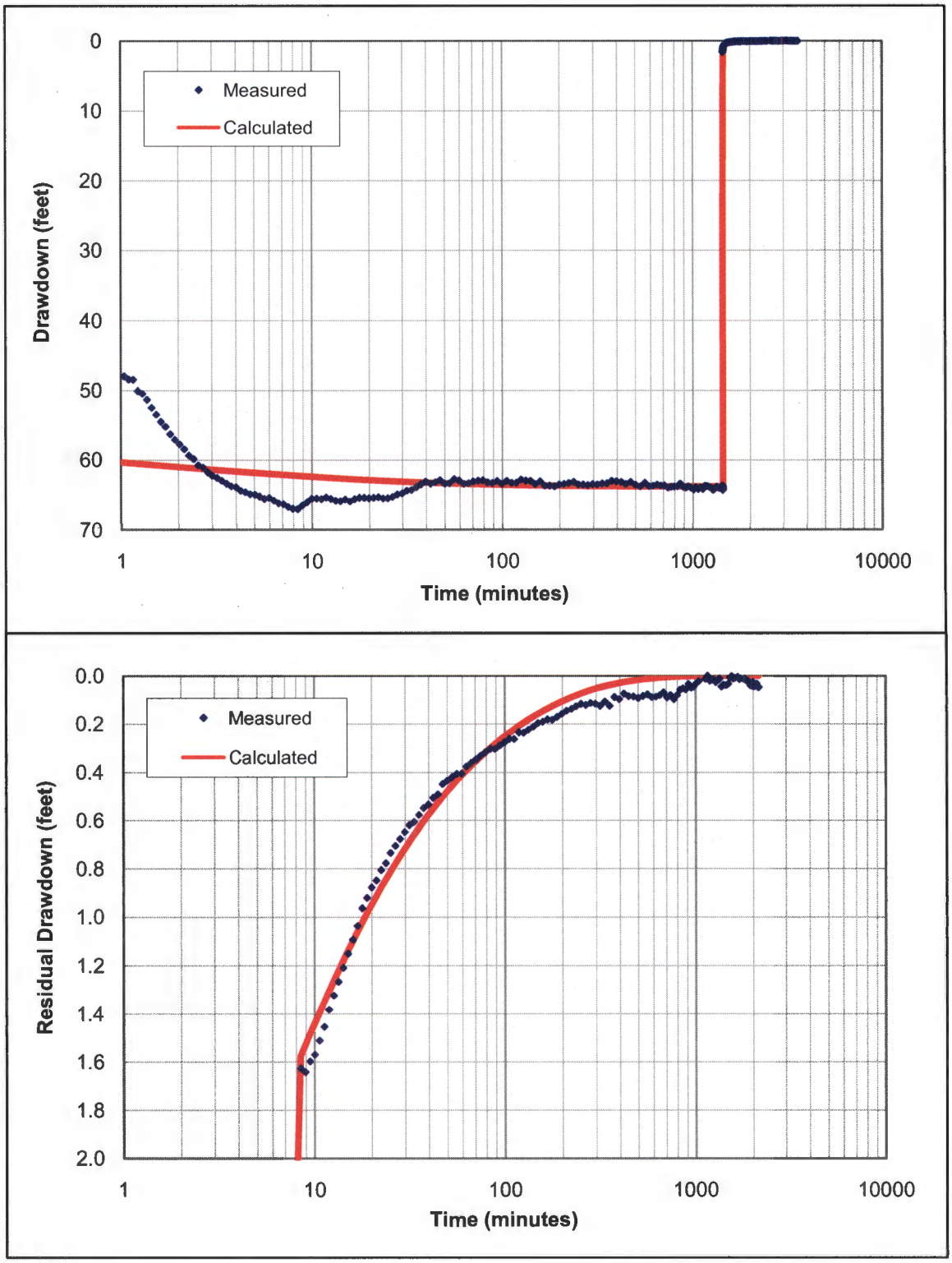


Figure E-14 Comparison of Measured and Calculated Drawdown and Residual Drawdown for Well CW-3

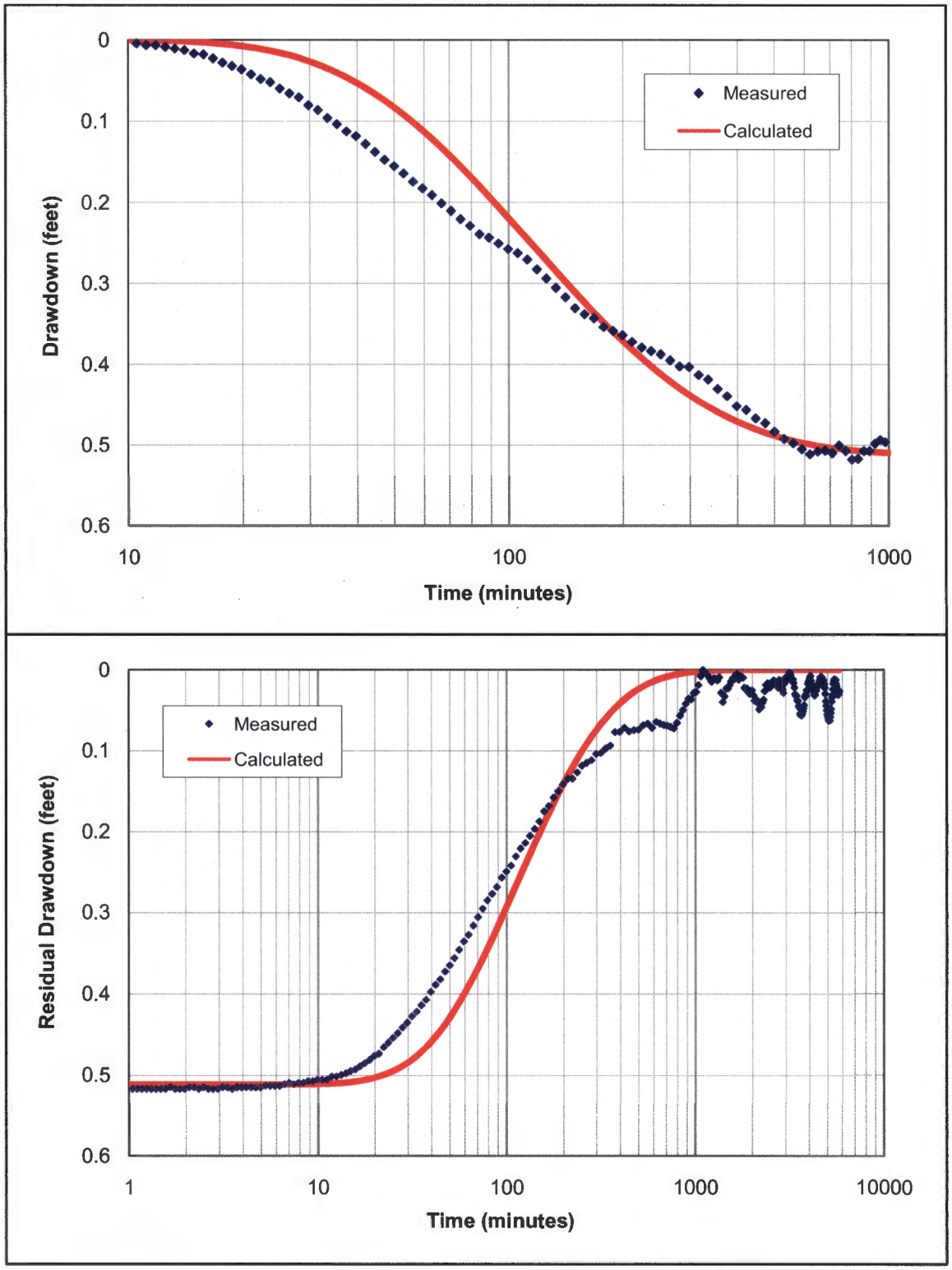


Figure E-15 Comparison of Measured and Calculated Drawdown and Residual Drawdown for Well MW-67

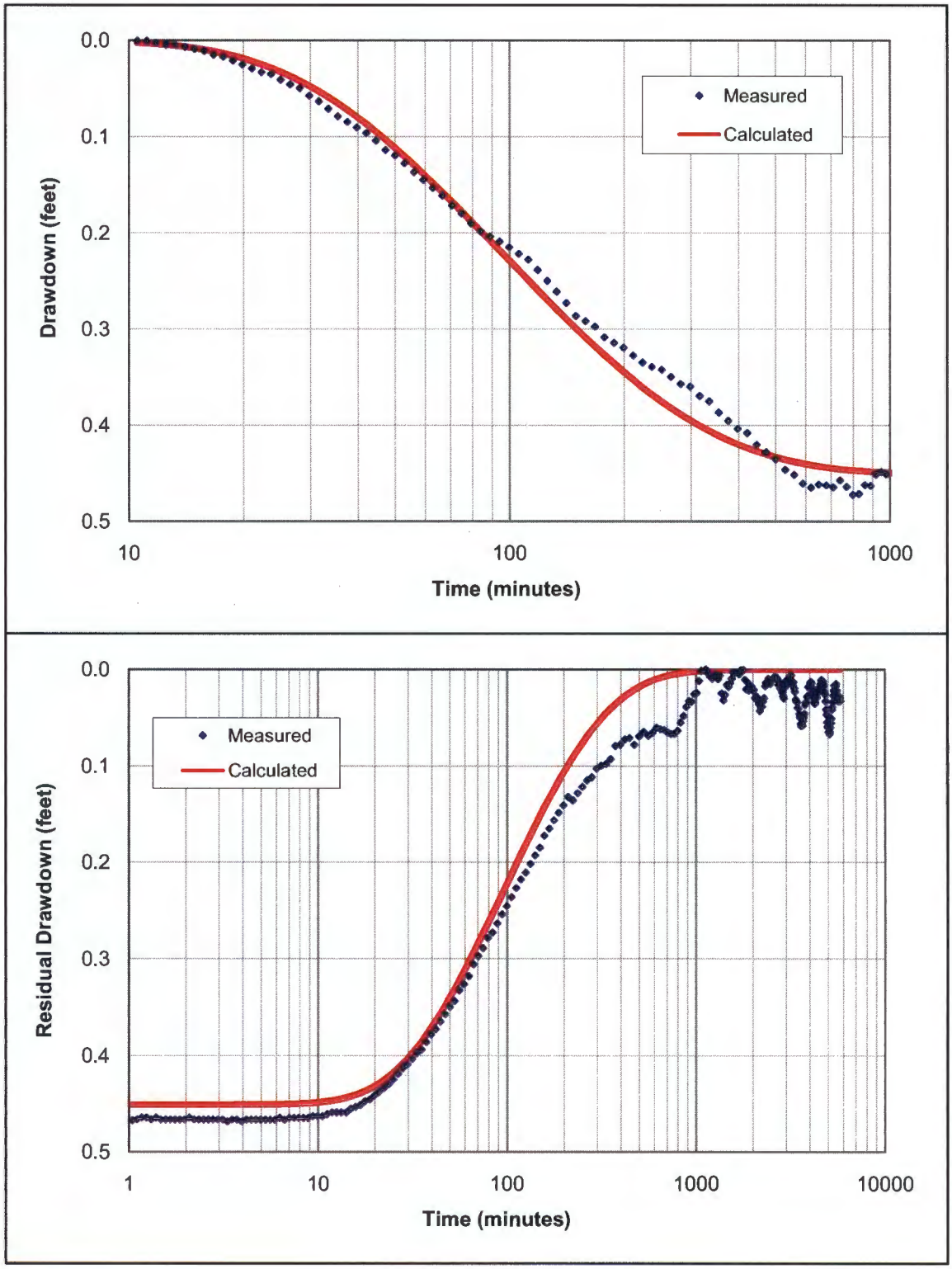


Figure E-16 Comparison of Measured and Calculated Drawdown and Residual Drawdown for Well MW-71R

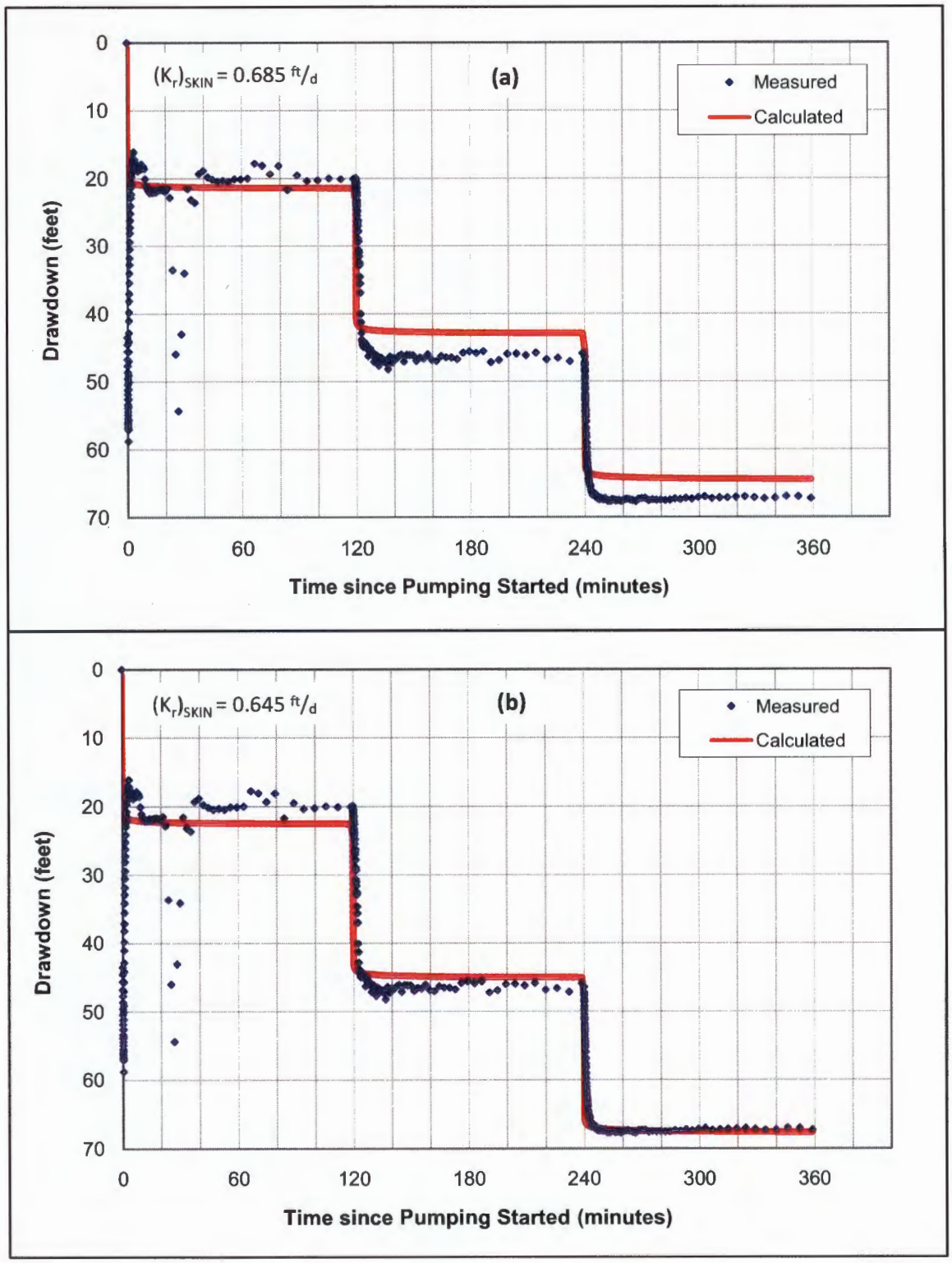


Figure E-17 Comparisons of Measured and Calculated Drawdown During the Step Test

Table E-1

Measured and Corrected DTW, and Drawdown in Wells CW-3 during the Pumping Cycle of the Constant Rate Pumping Test

Date	Time	Elapsed Time (min)	Well CW-3			
			BP* in. of Hg	DTW (ft) Measured	DTW (ft) Corrected	Drawdown (ft)
4/4/2006	8:00:00	0.0000	25.182	215.041	215.041	0.00
4/4/2006	8:00:00	0.0165	25.182	238.605	238.605	23.56
4/4/2006	8:00:01	0.0330	25.182	240.538	240.538	25.50
4/4/2006	8:00:02	0.0495	25.182	242.284	242.284	27.24
4/4/2006	8:00:03	0.0660	25.182	243.813	243.813	28.77
4/4/2006	8:00:04	0.0825	25.182	245.371	245.371	30.33
4/4/2006	8:00:05	0.0990	25.182	247.015	247.015	31.97
4/4/2006	8:00:06	0.1155	25.182	248.429	248.429	33.39
4/4/2006	8:00:07	0.1320	25.182	249.770	249.770	34.73
4/4/2006	8:00:08	0.1485	25.182	251.169	251.169	36.13
4/4/2006	8:00:09	0.1650	25.182	252.453	252.453	37.41
4/4/2006	8:00:10	0.1815	25.182	253.578	253.578	38.54
4/4/2006	8:00:11	0.1980	25.182	254.962	254.962	39.92
4/4/2006	8:00:12	0.2145	25.182	256.001	256.001	40.96
4/4/2006	8:00:13	0.2310	25.182	257.025	257.025	41.98
4/4/2006	8:00:14	0.2475	25.182	258.106	258.106	43.07
4/4/2006	8:00:15	0.2640	25.182	259.217	259.217	44.18
4/4/2006	8:00:16	0.2805	25.182	260.212	260.212	45.17
4/4/2006	8:00:17	0.2970	25.182	261.091	261.091	46.05
4/4/2006	8:00:18	0.3135	25.182	261.956	261.956	46.92
4/4/2006	8:00:19	0.3300	25.182	262.850	262.850	47.81
4/4/2006	8:00:20	0.3467	25.182	263.889	263.889	48.85
4/4/2006	8:00:21	0.3643	25.182	264.566	264.566	49.53
4/4/2006	8:00:22	0.3830	25.182	265.489	265.489	50.45
4/4/2006	8:00:24	0.4028	25.182	266.196	266.196	51.16
4/4/2006	8:00:25	0.4238	25.182	267.176	267.176	52.14
4/4/2006	8:00:26	0.4460	25.182	267.854	267.854	52.81
4/4/2006	8:00:28	0.4695	25.182	268.820	268.820	53.78
4/4/2006	8:00:29	0.4943	25.182	269.699	269.699	54.66
4/4/2006	8:00:31	0.5207	25.182	270.492	270.492	55.45
4/4/2006	8:00:32	0.5487	25.182	271.314	271.314	56.27
4/4/2006	8:00:34	0.5783	25.182	272.049	272.049	57.01
4/4/2006	8:00:36	0.6097	25.182	273.073	273.073	58.03
4/4/2006	8:00:38	0.6428	25.182	273.059	273.059	58.02
4/4/2006	8:00:40	0.6780	25.182	271.847	271.847	56.81
4/4/2006	8:00:42	0.7153	25.182	270.838	270.838	55.80
4/4/2006	8:00:45	0.7548	25.182	269.397	269.397	54.36
4/4/2006	8:00:47	0.7967	25.182	268.200	268.200	53.16
4/4/2006	8:00:50	0.8410	25.182	267.609	267.609	52.57
4/4/2006	8:00:53	0.8880	25.182	266.412	266.412	51.37
4/4/2006	8:00:56	0.9378	25.182	265.922	265.922	50.88
4/4/2006	8:00:59	0.9905	25.182	265.677	265.677	50.64
4/4/2006	8:01:02	1.0463	25.182	265.619	265.619	50.58
4/4/2006	8:01:06	1.1055	25.182	266.066	266.066	51.03
4/4/2006	8:01:10	1.1682	25.182	266.080	266.080	51.04

Table E-1

Measured and Corrected DTW, and Drawdown in Wells CW-3 during the Pumping Cycle of the Constant Rate Pumping Test

Date	Time	Elapsed Time (min)	Well CW-3			
			BP* in. of Hg	DTW (ft) Measured	DTW (ft) Corrected	Drawdown (ft)
4/4/2006	8:01:14	1.2345	25.182	267.710	267.710	52.67
4/4/2006	8:01:18	1.3048	25.182	268.099	268.099	53.06
4/4/2006	8:01:22	1.3793	25.182	268.964	268.964	53.92
4/4/2006	8:01:27	1.4583	25.182	270.132	270.132	55.09
4/4/2006	8:01:32	1.5420	25.182	271.127	271.127	56.09
4/4/2006	8:01:37	1.6305	25.182	272.165	272.165	57.12
4/4/2006	8:01:43	1.7243	25.182	272.871	272.871	57.83
4/4/2006	8:01:49	1.8237	25.182	273.938	273.938	58.90
4/4/2006	8:01:55	1.9290	25.182	274.731	274.731	59.69
4/4/2006	8:02:02	2.0405	25.182	275.380	275.380	60.34
4/4/2006	8:02:09	2.1587	25.182	276.086	276.086	61.05
4/4/2006	8:02:17	2.2838	25.181	276.980	276.980	61.94
4/4/2006	8:02:24	2.4163	25.181	277.470	277.470	62.43
4/4/2006	8:02:33	2.5568	25.181	278.378	278.378	63.34
4/4/2006	8:02:42	2.7057	25.181	278.681	278.681	63.64
4/4/2006	8:02:51	2.8632	25.181	279.358	279.358	64.32
4/4/2006	8:03:01	3.0300	25.181	279.863	279.863	64.82
4/4/2006	8:03:12	3.2068	25.181	280.165	280.165	65.12
4/4/2006	8:03:23	3.3942	25.181	280.584	280.584	65.54
4/4/2006	8:03:35	3.5925	25.181	280.987	280.987	65.95
4/4/2006	8:03:48	3.8027	25.181	281.376	281.376	66.34
4/4/2006	8:04:01	4.0253	25.181	281.506	281.506	66.47
4/4/2006	8:04:15	4.2612	25.181	282.011	282.011	66.97
4/4/2006	8:04:30	4.5110	25.181	282.227	282.227	67.19
4/4/2006	8:04:46	4.7757	25.181	282.501	282.501	67.46
4/4/2006	8:05:03	5.0560	25.181	282.573	282.573	67.53
4/4/2006	8:05:21	5.3528	25.181	282.847	282.847	67.81
4/4/2006	8:05:40	5.6673	25.181	283.192	283.192	68.15
4/4/2006	8:06:00	6.0005	25.181	283.048	283.048	68.01
4/4/2006	8:06:21	6.3533	25.181	283.423	283.423	68.38
4/4/2006	8:06:43	6.7272	25.181	283.812	283.813	68.77
4/4/2006	8:07:07	7.1232	25.181	283.942	283.943	68.90
4/4/2006	8:07:32	7.5425	25.181	284.317	284.318	69.28
4/4/2006	8:07:59	7.9868	25.181	284.591	284.592	69.55
4/4/2006	8:08:27	8.4575	25.181	284.648	284.649	69.61
4/4/2006	8:08:57	8.9560	25.181	284.115	284.116	69.07
4/4/2006	8:09:29	9.4840	25.181	283.639	283.640	68.60
4/4/2006	8:10:02	10.0433	25.180	283.149	283.150	68.11
4/4/2006	8:10:38	10.6358	25.180	283.135	283.136	68.09
4/4/2006	8:11:15	11.2633	25.180	283.207	283.208	68.17
4/4/2006	8:11:55	11.9282	25.180	282.962	282.963	67.92
4/4/2006	8:12:37	12.6323	25.180	283.192	283.193	68.15
4/4/2006	8:13:22	13.3782	25.180	283.438	283.439	68.40
4/4/2006	8:14:10	14.1682	25.180	283.510	283.511	68.47
4/4/2006	8:15:00	15.0050	25.180	283.265	283.266	68.23

Table E-1

Measured and Corrected DTW, and Drawdown in Wells CW-3 during the Pumping Cycle of the Constant Rate Pumping Test

Date	Time	Elapsed Time (min)	Well CW-3			
			BP* in. of Hg	DTW (ft) Measured	DTW (ft) Corrected	Drawdown (ft)
4/4/2006	8:15:53	15.8915	25.180	283.553	283.554	68.51
4/4/2006	8:16:49	16.8305	25.180	283.221	283.222	68.18
4/4/2006	8:17:49	17.8252	25.179	283.020	283.021	67.98
4/4/2006	8:18:52	18.8788	25.179	283.020	283.021	67.98
4/4/2006	8:19:59	19.9948	25.179	283.092	283.094	68.05
4/4/2006	8:21:10	21.1770	25.179	283.020	283.022	67.98
4/4/2006	8:22:25	22.4292	25.179	282.947	282.948	67.91
4/4/2006	8:23:45	23.7557	25.180	283.106	283.107	68.07
4/4/2006	8:25:09	25.1607	25.180	283.092	283.093	68.05
4/4/2006	8:26:38	26.6490	25.180	282.890	282.891	67.85
4/4/2006	8:28:13	28.2255	25.180	282.529	282.530	67.49
4/4/2006	8:29:53	29.8953	25.181	282.400	282.401	67.36
4/4/2006	8:31:39	31.6642	25.181	281.996	281.996	66.96
4/4/2006	8:33:32	33.5378	25.182	281.895	281.895	66.85
4/4/2006	8:35:31	35.5225	25.182	281.520	281.520	66.48
4/4/2006	8:37:37	37.6248	25.182	281.102	281.102	66.06
4/4/2006	8:39:51	39.8517	25.183	280.684	280.683	65.64
4/4/2006	8:42:12	42.2105	25.183	281.002	281.001	65.96
4/4/2006	8:44:42	44.7092	25.184	280.800	280.799	65.76
4/4/2006	8:47:21	47.3558	25.184	280.468	280.466	65.43
4/4/2006	8:50:09	50.1593	25.185	281.016	281.014	65.97
4/4/2006	8:53:07	53.1290	25.185	280.929	280.927	65.89
4/4/2006	8:56:16	56.2747	25.184	280.324	280.322	65.28
4/4/2006	8:59:36	59.6067	25.184	280.526	280.525	65.48
4/4/2006	9:03:08	63.1362	25.183	281.002	281.001	65.96
4/4/2006	9:06:52	66.8747	25.183	280.929	280.928	65.89
4/4/2006	9:10:50	70.8348	25.182	280.684	280.683	65.64
4/4/2006	9:15:01	75.0297	25.182	280.555	280.555	65.51
4/4/2006	9:19:28	79.4730	25.181	280.497	280.497	65.46
4/4/2006	9:24:10	84.1797	25.185	280.800	280.798	65.76
4/4/2006	9:29:09	89.1652	25.190	280.901	280.896	65.85
4/4/2006	9:34:26	94.4460	25.196	280.612	280.603	65.56
4/4/2006	9:40:02	100.0398	25.202	281.016	281.004	65.96
4/4/2006	9:45:57	105.9652	25.209	280.598	280.582	65.54
4/4/2006	9:52:14	112.2415	25.213	280.886	280.867	65.83
4/4/2006	9:58:53	118.8898	25.206	280.872	280.857	65.82
4/4/2006	10:05:55	125.9320	25.199	280.425	280.414	65.37
4/4/2006	10:13:23	133.3915	25.192	280.569	280.562	65.52
4/4/2006	10:21:17	141.2930	25.185	280.584	280.582	65.54
4/4/2006	10:29:39	149.6627	25.177	281.045	281.047	66.01
4/4/2006	10:38:31	158.5283	25.179	280.656	280.657	65.62
4/4/2006	10:47:55	167.9193	25.179	281.290	281.291	66.25
4/4/2006	10:57:52	177.8668	25.173	281.275	281.280	66.24
4/4/2006	11:08:24	188.4037	25.179	281.405	281.406	66.37
4/4/2006	11:19:33	199.5648	25.181	281.131	281.131	66.09

Table E-1

Measured and Corrected DTW, and Drawdown in Wells CW-3 during the Pumping Cycle of the Constant Rate Pumping Test

Date	Time	Elapsed Time (min)	Well CW-3			
			BP* in. of Hg	DTW (ft) Measured	DTW (ft) Corrected	Drawdown (ft)
4/4/2006	11:31:23	211.3875	25.176	281.030	281.033	65.99
4/4/2006	11:43:54	223.9107	25.178	280.901	280.903	65.86
4/4/2006	11:57:10	237.1758	25.177	280.728	280.730	65.69
4/4/2006	12:11:13	251.2270	25.179	281.117	281.118	66.08
4/4/2006	12:26:06	266.1108	25.176	281.131	281.134	66.09
4/4/2006	12:41:52	281.8765	25.173	281.203	281.208	66.17
4/4/2006	12:58:34	298.5763	25.171	281.074	281.080	66.04
4/4/2006	13:16:15	316.2658	25.163	281.117	281.127	66.09
4/4/2006	13:35:00	335.0035	25.156	280.958	280.973	65.93
4/4/2006	13:54:51	354.8513	25.143	280.929	280.951	65.91
4/4/2006	14:15:52	375.8753	25.128	280.569	280.600	65.56
4/4/2006	14:38:08	398.1450	25.110	280.627	280.669	65.63
4/4/2006	15:01:44	421.7343	25.100	280.713	280.761	65.72
4/4/2006	15:26:43	446.7213	25.082	280.973	281.032	65.99
4/4/2006	15:53:11	473.1890	25.074	280.699	280.763	65.72
4/4/2006	16:21:13	501.2248	25.062	281.088	281.159	66.12
4/4/2006	16:50:55	530.9220	25.043	281.319	281.401	66.36
4/4/2006	17:20:55	560.9220	25.032	280.785	280.874	65.83
4/4/2006	17:50:55	590.9220	25.025	281.275	281.368	66.33
4/4/2006	18:20:55	620.9220	25.024	281.203	281.297	66.26
4/4/2006	18:50:55	650.9220	25.031	281.059	281.148	66.11
4/4/2006	19:20:55	680.9220	25.033	281.203	281.291	66.25
4/4/2006	19:50:55	710.9220	25.039	281.175	281.259	66.22
4/4/2006	20:20:55	740.9220	25.059	281.520	281.592	66.55
4/4/2006	20:50:55	770.9220	25.057	281.405	281.478	66.44
4/4/2006	21:20:55	800.9220	25.043	281.347	281.429	66.39
4/4/2006	21:50:55	830.9220	25.045	281.304	281.384	66.34
4/4/2006	22:20:55	860.9220	25.069	280.944	281.010	65.97
4/4/2006	22:50:55	890.9220	25.071	281.391	281.455	66.41
4/4/2006	23:20:55	920.9220	25.092	281.520	281.572	66.53
4/4/2006	23:50:55	950.9220	25.102	281.347	281.393	66.35
4/5/2006	0:20:55	980.9220	25.096	281.564	281.613	66.57
4/5/2006	0:50:55	1010.9220	25.096	281.809	281.858	66.82
4/5/2006	1:20:55	1040.9220	25.096	281.477	281.526	66.48
4/5/2006	1:50:55	1070.9220	25.088	281.751	281.805	66.76
4/5/2006	2:20:55	1100.9220	25.084	281.564	281.620	66.58
4/5/2006	2:50:55	1130.9220	25.077	281.722	281.782	66.74
4/5/2006	3:20:55	1160.9220	25.047	281.261	281.339	66.30
4/5/2006	3:50:55	1190.9220	25.057	281.261	281.333	66.29
4/5/2006	4:20:55	1220.9220	25.045	281.405	281.484	66.44
4/5/2006	4:50:55	1250.9220	25.053	281.535	281.609	66.57
4/5/2006	5:20:55	1280.9220	25.051	281.866	281.942	66.90
4/5/2006	5:50:55	1310.9220	25.041	281.636	281.717	66.68
4/5/2006	6:20:55	1340.9220	25.039	281.347	281.430	66.39
4/5/2006	6:50:55	1370.9220	25.022	281.506	281.599	66.56

Table E-1

Measured and Corrected DTW, and Drawdown in Wells CW-3 during the Pumping Cycle of the Constant Rate Pumping Test

Date	Time	Elapsed Time (min)	Well CW-3			
			BP* in. of Hg	DTW (ft) Measured	DTW (ft) Corrected	Drawdown (ft)
4/5/2006	7:20:55	1400.9220	25.020	281.593	281.687	66.65
4/5/2006	7:50:55	1430.9220	25.018	281.549	281.644	66.60
4/5/2006	8:00:00	1440.0050	25.017	281.679	281.775	66.73
4/5/2006	8:00:00	1440.0215	25.017	281.636	281.732	66.69
4/5/2006	8:00:01	1440.0380	25.017	281.362	281.458	66.42
4/5/2006	8:00:02	1440.0545	25.017	281.520	281.616	66.57
4/5/2006	8:00:03	1440.0710	25.017	281.477	281.573	66.53
4/5/2006	8:00:04	1440.0875	25.017	281.607	281.703	66.66
4/5/2006	8:00:05	1440.1040	25.017	281.809	281.905	66.86
4/5/2006	8:00:06	1440.1205	25.017	281.780	281.876	66.83
4/5/2006	8:00:07	1440.1370	25.017	281.708	281.804	66.76
4/5/2006	8:00:08	1440.1535	25.017	281.823	281.919	66.88
4/5/2006	8:00:09	1440.1700	25.017	281.578	281.674	66.63
4/5/2006	8:00:10	1440.1865	25.017	281.477	281.573	66.53
4/5/2006	8:00:11	1440.2030	25.017	281.218	281.314	66.27
4/5/2006	8:00:12	1440.2195	25.017	281.535	281.631	66.59
4/5/2006	8:00:13	1440.2360	25.017	281.448	281.544	66.50

* Barometric pressure offset by 2.5 hours for well CW-3

Table E-2

Measured and Corrected DTW, and Residual Drawdown in Well CW-3 during the recovery Cycle of the Constant Rate Pumping Test

Date	Time	Elapsed Time (min)	Well CW-3			
			BP* in. of Hg	DTW (ft) Measured	DTW (ft) Corrected	Residual Drawdown (ft)
4/5/2006	8:00:13	0.0000	25.017	281.448	281.544	66.50
4/5/2006	8:00:14	0.0165	25.017	274.269	274.365	59.32
4/5/2006	8:00:15	0.0330	25.017	277.744	277.840	62.80
4/5/2006	8:00:16	0.0495	25.017	273.520	273.616	58.57
4/5/2006	8:00:17	0.0660	25.017	270.579	270.675	55.63
4/5/2006	8:00:18	0.0825	25.017	267.364	267.460	52.42
4/5/2006	8:00:19	0.0990	25.017	265.460	265.556	50.51
4/5/2006	8:00:20	0.1157	25.017	262.605	262.701	47.66
4/5/2006	8:00:21	0.1333	25.017	259.995	260.091	45.05
4/5/2006	8:00:22	0.1520	25.017	257.818	257.914	42.87
4/5/2006	8:00:24	0.1718	25.017	255.698	255.794	40.75
4/5/2006	8:00:25	0.1928	25.017	253.030	253.126	38.08
4/5/2006	8:00:26	0.2150	25.017	250.506	250.602	35.56
4/5/2006	8:00:28	0.2385	25.017	247.751	247.847	32.81
4/5/2006	8:00:29	0.2633	25.017	245.443	245.539	30.50
4/5/2006	8:00:31	0.2897	25.017	242.904	243.000	27.96
4/5/2006	8:00:32	0.3177	25.017	239.745	239.841	24.80
4/5/2006	8:00:34	0.3473	25.017	236.888	236.984	21.94
4/5/2006	8:00:36	0.3787	25.017	234.580	234.676	19.63
4/5/2006	8:00:38	0.4118	25.017	232.719	232.815	17.77
4/5/2006	8:00:40	0.4470	25.017	228.203	228.299	13.26
4/5/2006	8:00:42	0.4843	25.017	225.750	225.846	10.80
4/5/2006	8:00:45	0.5238	25.017	223.513	223.609	8.57
4/5/2006	8:00:47	0.5657	25.017	220.266	220.362	5.32
4/5/2006	8:00:50	0.6100	25.017	218.000	218.096	3.05
4/5/2006	8:00:53	0.6570	25.017	215.763	215.859	0.82
4/5/2006	8:00:56	0.7068	25.017	213.555	213.651	-1.39
4/5/2006	8:00:59	0.7595	25.017	211.606	211.702	-3.34
4/5/2006	8:01:02	0.8153	25.017	209.903	209.999	-5.04
4/5/2006	8:01:06	0.8745	25.017	208.431	208.527	-6.51
4/5/2006	8:01:10	0.9372	25.017	207.117	207.213	-7.83
4/5/2006	8:01:14	1.0035	25.017	206.222	206.318	-8.72
4/5/2006	8:01:18	1.0738	25.017	205.702	205.798	-9.24
4/5/2006	8:01:22	1.1483	25.017	205.471	205.567	-9.47
4/5/2006	8:01:27	1.2273	25.017	205.659	205.755	-9.29
4/5/2006	8:01:32	1.3110	25.017	206.265	206.361	-8.68
4/5/2006	8:01:37	1.3995	25.017	207.117	207.213	-7.83
4/5/2006	8:01:43	1.4933	25.017	208.012	208.108	-6.93
4/5/2006	8:01:49	1.5927	25.017	208.820	208.916	-6.13
4/5/2006	8:01:55	1.6980	25.017	209.629	209.725	-5.32
4/5/2006	8:02:02	1.8095	25.017	210.379	210.475	-4.57
4/5/2006	8:02:09	1.9277	25.017	211.072	211.168	-3.87
4/5/2006	8:02:17	2.0528	25.016	211.736	211.832	-3.21
4/5/2006	8:02:24	2.1853	25.016	212.357	212.453	-2.59
4/5/2006	8:02:33	2.3258	25.016	212.905	213.001	-2.04
4/5/2006	8:02:42	2.4747	25.016	213.396	213.492	-1.55

Table E-2

Measured and Corrected DTW, and Residual Drawdown in Well CW-3 during the recovery Cycle of the Constant Rate Pumping Test

Date	Time	Elapsed Time (min)	Well CW-3			
			BP* in. of Hg	DTW (ft) Measured	DTW (ft) Corrected	Residual Drawdown (ft)
4/5/2006	8:02:51	2.6322	25.016	213.844	213.940	-1.10
4/5/2006	8:03:01	2.7990	25.016	214.219	214.315	-0.73
4/5/2006	8:03:12	2.9758	25.016	214.594	214.690	-0.35
4/5/2006	8:03:23	3.1632	25.016	214.883	214.979	-0.06
4/5/2006	8:03:35	3.3615	25.016	215.128	215.224	0.18
4/5/2006	8:03:48	3.5717	25.016	215.345	215.441	0.40
4/5/2006	8:04:01	3.7943	25.016	215.532	215.628	0.59
4/5/2006	8:04:15	4.0302	25.016	215.662	215.758	0.72
4/5/2006	8:04:30	4.2800	25.016	215.763	215.859	0.82
4/5/2006	8:04:46	4.5447	25.016	215.850	215.946	0.91
4/5/2006	8:05:03	4.8250	25.016	215.922	216.018	0.98
4/5/2006	8:05:21	5.1218	25.016	215.965	216.061	1.02
4/5/2006	8:05:40	5.4363	25.016	216.052	216.148	1.11
4/5/2006	8:06:00	5.7695	25.016	216.110	216.206	1.17
4/5/2006	8:06:21	6.1223	25.016	216.182	216.278	1.24
4/5/2006	8:06:43	6.4962	25.016	216.268	216.364	1.32
4/5/2006	8:07:07	6.8922	25.016	216.355	216.451	1.41
4/5/2006	8:07:32	7.3115	25.016	216.456	216.552	1.51
4/5/2006	8:07:59	7.7558	25.016	216.528	216.624	1.58
4/5/2006	8:08:27	8.2265	25.016	216.571	216.667	1.63
4/5/2006	8:08:57	8.7250	25.016	216.586	216.682	1.64
4/5/2006	8:09:29	9.2530	25.016	216.542	216.638	1.60
4/5/2006	8:10:02	9.8123	25.015	216.514	216.611	1.57
4/5/2006	8:10:38	10.4048	25.015	216.456	216.553	1.51
4/5/2006	8:11:15	11.0323	25.015	216.398	216.495	1.45
4/5/2006	8:11:55	11.6972	25.015	216.326	216.423	1.38
4/5/2006	8:12:37	12.4013	25.015	216.268	216.365	1.32
4/5/2006	8:13:22	13.1472	25.015	216.211	216.308	1.27
4/5/2006	8:14:10	13.9372	25.015	216.153	216.250	1.21
4/5/2006	8:15:00	14.7740	25.015	216.095	216.192	1.15
4/5/2006	8:15:53	15.6605	25.015	216.037	216.134	1.09
4/5/2006	8:16:49	16.5995	25.015	215.980	216.077	1.04
4/5/2006	8:17:49	17.5942	25.014	215.907	216.004	0.96
4/5/2006	8:18:52	18.6478	25.014	215.864	215.961	0.92
4/5/2006	8:19:59	19.7638	25.014	215.821	215.918	0.88
4/5/2006	8:21:10	20.9460	25.014	215.792	215.889	0.85
4/5/2006	8:22:25	22.1982	25.014	215.749	215.847	0.81
4/5/2006	8:23:45	23.5247	25.013	215.720	215.818	0.78
4/5/2006	8:25:09	24.9297	25.013	215.677	215.775	0.73
4/5/2006	8:26:38	26.4180	25.012	215.648	215.746	0.71
4/5/2006	8:28:13	27.9945	25.012	215.619	215.718	0.68
4/5/2006	8:29:53	29.6643	25.012	215.590	215.689	0.65
4/5/2006	8:31:39	31.4332	25.011	215.561	215.660	0.62
4/5/2006	8:33:32	33.3068	25.011	215.547	215.646	0.61
4/5/2006	8:35:31	35.2915	25.010	215.518	215.618	0.58
4/5/2006	8:37:37	37.3938	25.010	215.489	215.589	0.55

Table E-2

Measured and Corrected DTW, and Residual Drawdown in Well CW-3 during the recovery Cycle of the Constant Rate Pumping Test

Date	Time	Elapsed Time (min)	Well CW-3			
			BP* in. of Hg	DTW (ft) Measured	DTW (ft) Corrected	Residual Drawdown (ft)
4/5/2006	8:39:51	39.6207	25.009	215.474	215.574	0.53
4/5/2006	8:42:12	41.9795	25.008	215.446	215.547	0.51
4/5/2006	8:44:42	44.4782	25.008	215.431	215.532	0.49
4/5/2006	8:47:21	47.1248	25.007	215.388	215.490	0.45
4/5/2006	8:50:09	49.9283	25.006	215.373	215.475	0.43
4/5/2006	8:53:07	52.8980	25.006	215.359	215.461	0.42
4/5/2006	8:56:16	56.0437	25.007	215.345	215.447	0.41
4/5/2006	8:59:36	59.3757	25.007	215.345	215.446	0.41
4/5/2006	9:03:08	62.9052	25.008	215.316	215.417	0.38
4/5/2006	9:06:52	66.6437	25.008	215.301	215.402	0.36
4/5/2006	9:10:50	70.6038	25.009	215.287	215.387	0.35
4/5/2006	9:15:01	74.7987	25.009	215.272	215.372	0.33
4/5/2006	9:19:28	79.2420	25.010	215.258	215.358	0.32
4/5/2006	9:24:10	83.9487	25.009	215.244	215.344	0.30
4/5/2006	9:29:09	88.9342	25.008	215.244	215.345	0.30
4/5/2006	9:34:26	94.2150	25.007	215.229	215.330	0.29
4/5/2006	9:40:02	99.8088	25.006	215.215	215.317	0.28
4/5/2006	9:45:57	105.7342	25.005	215.200	215.303	0.26
4/5/2006	9:52:14	112.0105	25.004	215.200	215.303	0.26
4/5/2006	9:58:53	118.6588	25.001	215.171	215.276	0.23
4/5/2006	10:05:55	125.7010	24.999	215.171	215.277	0.24
4/5/2006	10:13:23	133.1605	24.997	215.157	215.265	0.22
4/5/2006	10:21:17	141.0620	24.994	215.143	215.252	0.21
4/5/2006	10:29:39	149.4317	24.994	215.128	215.237	0.20
4/5/2006	10:38:31	158.2973	25.003	215.128	215.231	0.19
4/5/2006	10:47:55	167.6883	24.996	215.114	215.222	0.18
4/5/2006	10:57:52	177.6358	24.993	215.114	215.224	0.18
4/5/2006	11:08:24	188.1727	24.988	215.099	215.212	0.17
4/5/2006	11:19:33	199.3338	24.987	215.085	215.198	0.16
4/5/2006	11:31:23	211.1565	24.984	215.070	215.185	0.14
4/5/2006	11:43:54	223.6797	24.972	215.056	215.178	0.14
4/5/2006	11:57:10	236.9448	24.967	215.041	215.166	0.13
4/5/2006	12:11:13	250.9960	24.959	215.027	215.157	0.12
4/5/2006	12:26:06	265.8798	24.952	215.027	215.161	0.12
4/5/2006	12:41:52	281.6455	24.941	215.013	215.153	0.11
4/5/2006	12:58:34	298.3453	24.937	215.013	215.156	0.12
4/5/2006	13:16:15	316.0348	24.922	215.013	215.165	0.12
4/5/2006	13:35:00	334.7725	24.904	214.984	215.147	0.11
4/5/2006	13:54:51	354.6203	24.897	214.998	215.165	0.12
4/5/2006	14:15:52	375.6443	24.909	214.969	215.129	0.09
4/5/2006	14:38:08	397.9140	24.895	214.969	215.137	0.10
4/5/2006	15:01:44	421.5033	24.885	214.940	215.114	0.07
4/5/2006	15:26:43	446.4903	24.866	214.940	215.125	0.08
4/5/2006	15:53:11	472.9580	24.842	214.926	215.126	0.08
4/5/2006	16:21:13	500.9938	24.830	214.926	215.133	0.09
4/5/2006	16:50:55	530.6910	24.821	214.912	215.125	0.08

Table E-2

Measured and Corrected DTW, and Residual Drawdown in Well CW-3 during the recovery Cycle of the Constant Rate Pumping Test

Date	Time	Elapsed Time (min)	Well CW-3			
			BP* in. of Hg	DTW (ft) Measured	DTW (ft) Corrected	Residual Drawdown (ft)
4/5/2006	17:20:55	560.6910	24.808	214.897	215.117	0.08
4/5/2006	17:50:55	590.6910	24.788	214.897	215.129	0.09
4/5/2006	18:20:55	620.6910	24.791	214.897	215.127	0.09
4/5/2006	18:50:55	650.6910	24.778	214.883	215.121	0.08
4/5/2006	19:20:55	680.6910	24.772	214.868	215.110	0.07
4/5/2006	19:50:55	710.6910	24.762	214.883	215.131	0.09
4/5/2006	20:20:55	740.6910	24.754	214.868	215.120	0.08
4/5/2006	20:50:55	770.6910	24.750	214.883	215.138	0.10
4/5/2006	21:20:55	800.6910	24.752	214.868	215.121	0.08
4/5/2006	21:50:55	830.6910	24.766	214.854	215.099	0.06
4/5/2006	22:20:55	860.6910	24.776	214.854	215.093	0.05
4/5/2006	22:50:55	890.6910	24.792	214.868	215.097	0.06
4/5/2006	23:20:55	920.6910	24.805	214.854	215.075	0.03
4/5/2006	23:50:55	950.6910	24.803	214.868	215.090	0.05
4/6/2006	0:20:55	980.6910	24.811	214.868	215.085	0.04
4/6/2006	0:50:55	1010.6910	24.809	214.854	215.072	0.03
4/6/2006	1:20:55	1040.6910	24.823	214.854	215.064	0.02
4/6/2006	1:50:55	1070.6910	24.837	214.839	215.040	0.00
4/6/2006	2:20:55	1100.6910	24.845	214.839	215.035	-0.01
4/6/2006	2:50:55	1130.6910	24.839	214.854	215.054	0.01
4/6/2006	3:20:55	1160.6910	24.835	214.839	215.041	0.00
4/6/2006	3:50:55	1190.6910	24.827	214.854	215.061	0.02
4/6/2006	4:20:55	1220.6910	24.809	214.839	215.057	0.02
4/6/2006	4:50:55	1250.6910	24.809	214.839	215.057	0.02
4/6/2006	5:20:55	1280.6910	24.817	214.854	215.067	0.03
4/6/2006	5:50:55	1310.6910	24.829	214.854	215.060	0.02
4/6/2006	6:20:55	1340.6910	24.841	214.854	215.052	0.01
4/6/2006	6:50:55	1370.6910	24.809	214.868	215.085	0.04
4/6/2006	7:20:55	1400.6910	24.798	214.854	215.078	0.04
4/6/2006	7:50:55	1430.6910	24.819	214.868	215.079	0.04
4/6/2006	8:20:55	1460.6910	24.845	214.883	215.078	0.04
4/6/2006	8:50:55	1490.6910	24.853	214.883	215.074	0.03
4/6/2006	9:20:55	1520.6910	24.870	214.868	215.048	0.01
4/6/2006	9:50:55	1550.6910	24.880	214.868	215.042	0.00
4/6/2006	10:20:55	1580.6910	24.888	214.883	215.052	0.01
4/6/2006	10:50:55	1610.6910	24.892	214.883	215.050	0.01
4/6/2006	11:20:55	1640.6910	24.898	214.868	215.031	-0.01
4/6/2006	11:50:55	1670.6910	24.898	214.883	215.046	0.00
4/6/2006	12:20:55	1700.6910	24.884	214.883	215.054	0.01
4/6/2006	12:50:55	1730.6910	24.888	214.883	215.052	0.01
4/6/2006	13:20:55	1760.6910	24.882	214.868	215.040	0.00
4/6/2006	13:50:55	1790.6910	24.884	214.883	215.054	0.01
4/6/2006	14:20:55	1820.6910	24.862	214.868	215.052	0.01
4/6/2006	14:50:55	1850.6910	24.849	214.868	215.060	0.02
4/6/2006	15:20:55	1880.6910	24.847	214.868	215.061	0.02
4/6/2006	15:50:55	1910.6910	24.833	214.868	215.070	0.03

Table E-2

Measured and Corrected DTW, and Residual Drawdown in Well CW-3 during the recovery Cycle of the Constant Rate Pumping Test

Date	Time	Elapsed Time (min)	Well CW-3			
			BP* in. of Hg	DTW (ft) Measured	DTW (ft) Corrected	Residual Drawdown (ft)
4/6/2006	16:20:55	1940.6910	24.841	214.883	215.080	0.04
4/6/2006	16:50:55	1970.6910	24.837	214.883	215.082	0.04
4/6/2006	17:20:55	2000.6910	24.837	214.868	215.067	0.03
4/6/2006	17:50:55	2030.6910	24.833	214.883	215.084	0.04
4/6/2006	18:20:55	2060.6910	24.823	214.868	215.075	0.03
4/6/2006	18:50:55	2090.6910	24.827	214.868	215.073	0.03
4/6/2006	19:20:55	2120.6910	24.829	214.883	215.086	0.05
4/6/2006	19:50:55	2150.6910	24.827	214.883	215.088	0.05

* Barometric pressure offset by 2.5 hours for well CW-3

Table E-3

Measured and Corrected DTW, and Drawdown in Wells MW-67 and MW-71R during the Pumping Cycle of the Constant Rate Pumping Test

Date	Time	Elapsed Time (min)	BP* inches of Hg	Well MW-67			Well MW-71R		
				DTW (ft)		Drawdown (ft)	DTW (ft)		Drawdown (ft)
				Measured	Corrected		Measured	Corrected	
4/4/2006	8:00:00	0.0000	25.182	187.030	187.030	0.000	178.630	178.630	0.000
4/4/2006	8:00:00	0.0048	25.182	187.021	187.021	-0.009	178.605	178.605	-0.025
4/4/2006	8:00:00	0.0098	25.182	187.019	187.019	-0.011	178.597	178.597	-0.033
4/4/2006	8:00:00	0.0150	25.182	187.017	187.017	-0.013	178.591	178.591	-0.039
4/4/2006	8:00:01	0.0198	25.182	187.017	187.017	-0.013	178.589	178.589	-0.041
4/4/2006	8:00:01	0.0250	25.182	187.015	187.015	-0.015	178.587	178.587	-0.043
4/4/2006	8:00:01	0.0300	25.182	187.015	187.015	-0.015	178.585	178.585	-0.045
4/4/2006	8:00:02	0.0350	25.182	187.016	187.016	-0.014	178.583	178.583	-0.047
4/4/2006	8:00:02	0.0398	25.182	187.016	187.016	-0.014	178.583	178.583	-0.047
4/4/2006	8:00:02	0.0450	25.182	187.016	187.016	-0.014	178.583	178.583	-0.047
4/4/2006	8:00:03	0.0500	25.182	187.014	187.014	-0.016	178.581	178.581	-0.049
4/4/2006	8:00:03	0.0548	25.182	187.014	187.014	-0.016	178.581	178.581	-0.049
4/4/2006	8:00:03	0.0600	25.182	187.014	187.014	-0.016	178.581	178.581	-0.049
4/4/2006	8:00:03	0.0648	25.182	187.014	187.014	-0.016	178.581	178.581	-0.049
4/4/2006	8:00:04	0.0700	25.182	187.014	187.014	-0.016	178.581	178.581	-0.049
4/4/2006	8:00:04	0.0750	25.182	187.014	187.014	-0.016	178.579	178.579	-0.051
4/4/2006	8:00:04	0.0798	25.182	187.014	187.014	-0.016	178.579	178.579	-0.051
4/4/2006	8:00:05	0.0848	25.182	187.014	187.014	-0.016	178.579	178.579	-0.051
4/4/2006	8:00:05	0.0900	25.182	187.014	187.014	-0.016	178.579	178.579	-0.051
4/4/2006	8:00:05	0.0950	25.182	187.014	187.014	-0.016	178.579	178.579	-0.051
4/4/2006	8:00:06	0.1000	25.182	187.014	187.014	-0.016	178.579	178.579	-0.051
4/4/2006	8:00:06	0.1057	25.182	187.014	187.014	-0.016	178.579	178.579	-0.051
4/4/2006	8:00:06	0.1118	25.182	187.012	187.012	-0.018	178.579	178.579	-0.051
4/4/2006	8:00:07	0.1185	25.182	187.014	187.014	-0.016	178.579	178.579	-0.051
4/4/2006	8:00:07	0.1255	25.182	187.012	187.012	-0.018	178.579	178.579	-0.051
4/4/2006	8:00:08	0.1327	25.182	187.014	187.014	-0.016	178.579	178.579	-0.051
4/4/2006	8:00:08	0.1405	25.182	187.014	187.014	-0.016	178.579	178.579	-0.051
4/4/2006	8:00:08	0.1488	25.182	187.014	187.014	-0.016	178.580	178.580	-0.050
4/4/2006	8:00:09	0.1578	25.182	187.014	187.014	-0.016	178.580	178.580	-0.050
4/4/2006	8:00:10	0.1670	25.182	187.020	187.020	-0.010	178.595	178.595	-0.035
4/4/2006	8:00:10	0.1768	25.182	187.022	187.022	-0.008	178.599	178.599	-0.031
4/4/2006	8:00:11	0.1875	25.182	187.021	187.021	-0.009	178.601	178.601	-0.029
4/4/2006	8:00:11	0.1985	25.182	187.021	187.021	-0.009	178.603	178.603	-0.027
4/4/2006	8:00:12	0.2100	25.182	187.023	187.023	-0.007	178.605	178.605	-0.025
4/4/2006	8:00:13	0.2225	25.182	187.023	187.023	-0.007	178.607	178.607	-0.023
4/4/2006	8:00:14	0.2358	25.182	187.023	187.023	-0.007	178.609	178.609	-0.021
4/4/2006	8:00:15	0.2498	25.182	187.023	187.023	-0.007	178.611	178.611	-0.019
4/4/2006	8:00:15	0.2647	25.182	187.023	187.023	-0.007	178.611	178.611	-0.019
4/4/2006	8:00:16	0.2803	25.182	187.023	187.023	-0.007	178.613	178.613	-0.017
4/4/2006	8:00:17	0.2970	25.182	187.023	187.023	-0.007	178.613	178.613	-0.017
4/4/2006	8:00:18	0.3145	25.182	187.025	187.025	-0.005	178.613	178.613	-0.017
4/4/2006	8:00:20	0.3333	25.182	187.025	187.025	-0.005	178.615	178.615	-0.015
4/4/2006	8:00:21	0.3532	25.182	187.027	187.027	-0.003	178.615	178.615	-0.015
4/4/2006	8:00:22	0.3740	25.182	187.027	187.027	-0.003	178.617	178.617	-0.013
4/4/2006	8:00:23	0.3963	25.182	187.027	187.027	-0.003	178.617	178.617	-0.013
4/4/2006	8:00:25	0.4198	25.182	187.027	187.027	-0.003	178.619	178.619	-0.011

Table E-3

Measured and Corrected DTW, and Drawdown in Wells MW-67 and MW-71R during the Pumping Cycle of the Constant Rate Pumping Test

Date	Time	Elapsed Time (min)	BP* inches of Hg	Well MW-67			Well MW-71R		
				DTW (ft)		Drawdown (ft)	DTW (ft)		Drawdown (ft)
				Measured	Corrected		Measured	Corrected	
4/4/2006	8:00:26	0.4445	25.182	187.027	187.027	-0.003	178.619	178.619	-0.011
4/4/2006	8:00:28	0.4695	25.182	187.027	187.027	-0.003	178.619	178.619	-0.011
4/4/2006	8:00:29	0.4963	25.182	187.027	187.027	-0.003	178.619	178.619	-0.011
4/4/2006	8:00:31	0.5247	25.182	187.027	187.027	-0.003	178.621	178.621	-0.009
4/4/2006	8:00:33	0.5547	25.182	187.027	187.027	-0.003	178.621	178.621	-0.009
4/4/2006	8:00:35	0.5862	25.182	187.027	187.027	-0.003	178.623	178.623	-0.007
4/4/2006	8:00:37	0.6213	25.182	187.027	187.027	-0.003	178.623	178.623	-0.007
4/4/2006	8:00:39	0.6578	25.182	187.027	187.027	-0.003	178.623	178.623	-0.007
4/4/2006	8:00:41	0.6963	25.182	187.027	187.027	-0.003	178.623	178.623	-0.007
4/4/2006	8:00:44	0.7380	25.182	187.027	187.027	-0.003	178.623	178.623	-0.007
4/4/2006	8:00:46	0.7813	25.182	187.027	187.027	-0.003	178.623	178.623	-0.007
4/4/2006	8:00:49	0.8278	25.182	187.029	187.029	-0.001	178.623	178.623	-0.007
4/4/2006	8:00:52	0.8762	25.182	187.029	187.029	-0.001	178.623	178.623	-0.007
4/4/2006	8:00:55	0.9278	25.182	187.029	187.029	-0.001	178.625	178.625	-0.005
4/4/2006	8:00:59	0.9828	25.182	187.028	187.028	-0.002	178.623	178.623	-0.007
4/4/2006	8:01:02	1.0412	25.182	187.028	187.028	-0.002	178.625	178.625	-0.005
4/4/2006	8:01:06	1.1030	25.182	187.028	187.028	-0.002	178.625	178.625	-0.005
4/4/2006	8:01:10	1.1678	25.182	187.028	187.028	-0.002	178.624	178.624	-0.006
4/4/2006	8:01:14	1.2380	25.182	187.028	187.028	-0.002	178.624	178.624	-0.006
4/4/2006	8:01:18	1.3113	25.182	187.028	187.028	-0.002	178.624	178.624	-0.006
4/4/2006	8:01:23	1.3895	25.182	187.028	187.028	-0.002	178.624	178.624	-0.006
4/4/2006	8:01:28	1.4728	25.182	187.028	187.028	-0.002	178.624	178.624	-0.006
4/4/2006	8:01:33	1.5613	25.182	187.028	187.028	-0.002	178.624	178.624	-0.006
4/4/2006	8:01:39	1.6547	25.182	187.028	187.028	-0.002	178.624	178.624	-0.006
4/4/2006	8:01:45	1.7530	25.182	187.028	187.028	-0.002	178.626	178.626	-0.004
4/4/2006	8:01:51	1.8580	25.182	187.028	187.028	-0.002	178.624	178.624	-0.006
4/4/2006	8:01:58	1.9678	25.182	187.028	187.028	-0.002	178.624	178.624	-0.006
4/4/2006	8:02:05	2.0845	25.182	187.028	187.028	-0.002	178.624	178.624	-0.006
4/4/2006	8:02:12	2.2097	25.181	187.028	187.028	-0.002	178.624	178.624	-0.006
4/4/2006	8:02:20	2.3412	25.181	187.030	187.030	0.000	178.626	178.626	-0.004
4/4/2006	8:02:28	2.4812	25.181	187.028	187.028	-0.002	178.624	178.624	-0.006
4/4/2006	8:02:37	2.6297	25.181	187.030	187.030	0.000	178.626	178.626	-0.004
4/4/2006	8:02:47	2.7863	25.181	187.030	187.030	0.000	178.626	178.626	-0.004
4/4/2006	8:02:57	2.9530	25.181	187.028	187.028	-0.002	178.628	178.628	-0.002
4/4/2006	8:03:07	3.1297	25.181	187.030	187.030	0.000	178.626	178.626	-0.004
4/4/2006	8:03:19	3.3162	25.181	187.028	187.028	-0.002	178.626	178.626	-0.004
4/4/2006	8:03:30	3.5145	25.181	187.028	187.028	-0.002	178.626	178.626	-0.004
4/4/2006	8:03:43	3.7245	25.181	187.028	187.028	-0.002	178.626	178.626	-0.004
4/4/2006	8:03:56	3.9463	25.181	187.028	187.028	-0.002	178.626	178.626	-0.004
4/4/2006	8:04:10	4.1812	25.181	187.030	187.030	0.000	178.626	178.626	-0.004
4/4/2006	8:04:25	4.4295	25.181	187.030	187.030	0.000	178.626	178.626	-0.004
4/4/2006	8:04:41	4.6928	25.181	187.030	187.030	0.000	178.628	178.628	-0.002
4/4/2006	8:04:58	4.9728	25.181	187.030	187.030	0.000	178.628	178.628	-0.002
4/4/2006	8:05:16	5.2697	25.181	187.032	187.032	0.002	178.628	178.628	-0.002
4/4/2006	8:05:35	5.5830	25.181	187.030	187.030	0.000	178.626	178.626	-0.004
4/4/2006	8:05:54	5.9145	25.181	187.030	187.030	0.000	178.628	178.628	-0.002

Table E-3

Measured and Corrected DTW, and Drawdown in Wells MW-67 and MW-71R during the Pumping Cycle of the Constant Rate Pumping Test

Date	Time	Elapsed Time (min)	BP* inches of Hg	Well MW-67			Well MW-71R		
				DTW (ft)		Drawdown (ft)	DTW (ft)		Drawdown (ft)
				Measured	Corrected		Measured	Corrected	
4/4/2006	8:06:16	6.2663	25.181	187.030	187.030	0.000	178.628	178.628	-0.002
4/4/2006	8:06:38	6.6395	25.181	187.030	187.030	0.000	178.628	178.628	-0.002
4/4/2006	8:07:02	7.0345	25.181	187.030	187.030	0.000	178.628	178.628	-0.002
4/4/2006	8:07:27	7.4530	25.181	187.030	187.030	0.000	178.628	178.628	-0.002
4/4/2006	8:07:53	7.8962	25.181	187.030	187.030	0.000	178.626	178.626	-0.004
4/4/2006	8:08:22	8.3663	25.181	187.032	187.033	0.003	178.628	178.628	-0.002
4/4/2006	8:08:51	8.8645	25.181	187.032	187.033	0.003	178.628	178.629	-0.001
4/4/2006	8:09:23	9.3913	25.181	187.032	187.033	0.003	178.630	178.631	0.001
4/4/2006	8:09:57	9.9497	25.180	187.032	187.033	0.003	178.630	178.631	0.001
4/4/2006	8:10:32	10.5413	25.180	187.034	187.035	0.005	178.630	178.631	0.001
4/4/2006	8:11:10	11.1680	25.180	187.036	187.037	0.007	178.630	178.631	0.001
4/4/2006	8:11:49	11.8312	25.180	187.036	187.037	0.007	178.632	178.633	0.003
4/4/2006	8:12:32	12.5347	25.180	187.038	187.039	0.009	178.634	178.635	0.005
4/4/2006	8:13:16	13.2795	25.180	187.040	187.041	0.011	178.634	178.635	0.005
4/4/2006	8:14:04	14.0695	25.180	187.042	187.043	0.013	178.636	178.637	0.007
4/4/2006	8:14:54	14.9062	25.180	187.046	187.047	0.017	178.638	178.639	0.009
4/4/2006	8:15:47	15.7913	25.180	187.047	187.048	0.018	178.640	178.641	0.011
4/4/2006	8:16:43	16.7295	25.180	187.052	187.053	0.023	178.644	178.645	0.015
4/4/2006	8:17:43	17.7230	25.179	187.057	187.058	0.028	178.646	178.647	0.017
4/4/2006	8:18:46	18.7762	25.179	187.061	187.062	0.032	178.650	178.651	0.021
4/4/2006	8:19:53	19.8913	25.179	187.065	187.066	0.036	178.654	178.655	0.025
4/4/2006	8:21:04	21.0730	25.179	187.071	187.072	0.042	178.658	178.659	0.029
4/4/2006	8:22:19	22.3247	25.179	187.077	187.078	0.048	178.662	178.663	0.033
4/4/2006	8:23:39	23.6497	25.180	187.081	187.082	0.052	178.664	178.665	0.035
4/4/2006	8:25:03	25.0545	25.180	187.089	187.090	0.060	178.670	178.671	0.041
4/4/2006	8:26:32	26.5428	25.180	187.095	187.096	0.066	178.675	178.676	0.046
4/4/2006	8:28:07	28.1178	25.180	187.100	187.101	0.071	178.679	178.680	0.050
4/4/2006	8:29:47	29.7863	25.181	187.110	187.110	0.080	178.687	178.687	0.057
4/4/2006	8:31:33	31.5545	25.181	187.116	187.116	0.086	178.693	178.693	0.063
4/4/2006	8:33:25	33.4280	25.182	187.126	187.126	0.096	178.701	178.701	0.071
4/4/2006	8:35:24	35.4112	25.182	187.134	187.134	0.104	178.709	178.709	0.079
4/4/2006	8:37:30	37.5130	25.182	187.143	187.143	0.113	178.715	178.715	0.085
4/4/2006	8:39:44	39.7397	25.183	187.149	187.148	0.118	178.721	178.720	0.090
4/4/2006	8:42:05	42.0980	25.183	187.159	187.158	0.128	178.727	178.726	0.096
4/4/2006	8:44:35	44.5963	25.184	187.169	187.168	0.138	178.735	178.734	0.104
4/4/2006	8:47:14	47.2428	25.184	187.179	187.178	0.148	178.745	178.744	0.114
4/4/2006	8:50:02	50.0463	25.185	187.187	187.185	0.155	178.751	178.749	0.119
4/4/2006	8:53:00	53.0147	25.185	187.196	187.194	0.164	178.759	178.757	0.127
4/4/2006	8:56:09	56.1595	25.184	187.206	187.205	0.175	178.768	178.767	0.137
4/4/2006	8:59:29	59.4913	25.184	187.214	187.213	0.183	178.776	178.775	0.145
4/4/2006	9:03:01	63.0195	25.183	187.222	187.221	0.191	178.784	178.783	0.153
4/4/2006	9:06:45	66.7580	25.183	187.232	187.231	0.201	178.792	178.791	0.161
4/4/2006	9:10:43	70.7178	25.182	187.241	187.241	0.211	178.802	178.801	0.171
4/4/2006	9:14:54	74.9113	25.182	187.251	187.251	0.221	178.810	178.810	0.180
4/4/2006	9:19:21	79.3545	25.181	187.259	187.259	0.229	178.820	178.820	0.190
4/4/2006	9:24:03	84.0613	25.184	187.271	187.270	0.240	178.830	178.828	0.198

Table E-3

Measured and Corrected DTW, and Drawdown in Wells MW-67 and MW-71R during the Pumping Cycle of the Constant Rate Pumping Test

Date	Time	Elapsed Time (min)	BP* inches of Hg	Well MW-67			Well MW-71R		
				DTW (ft)		Drawdown (ft)	DTW (ft)		Drawdown (ft)
				Measured	Corrected		Measured	Corrected	
4/4/2006	9:29:02	89.0462	25.190	187.278	187.274	0.244	178.838	178.834	0.204
4/4/2006	9:34:19	94.3262	25.196	187.288	187.281	0.251	178.846	178.839	0.209
4/4/2006	9:39:55	99.9197	25.202	187.298	187.288	0.258	178.855	178.845	0.215
4/4/2006	9:45:50	105.8447	25.208	187.306	187.293	0.263	178.865	178.852	0.222
4/4/2006	9:52:07	112.1197	25.213	187.316	187.301	0.271	178.873	178.858	0.228
4/4/2006	9:58:46	118.7678	25.206	187.325	187.313	0.283	178.881	178.869	0.239
4/4/2006	10:05:48	125.8095	25.200	187.333	187.324	0.294	178.889	178.880	0.250
4/4/2006	10:13:16	133.2678	25.192	187.341	187.336	0.306	178.897	178.892	0.262
4/4/2006	10:21:10	141.1678	25.185	187.349	187.347	0.317	178.905	178.903	0.273
4/4/2006	10:29:32	149.5363	25.177	187.359	187.361	0.331	178.915	178.916	0.286
4/4/2006	10:38:24	158.4012	25.179	187.367	187.368	0.338	178.921	178.922	0.292
4/4/2006	10:47:47	167.7912	25.179	187.372	187.373	0.343	178.927	178.928	0.298
4/4/2006	10:57:44	177.7380	25.173	187.380	187.384	0.354	178.935	178.939	0.309
4/4/2006	11:08:16	188.2745	25.179	187.388	187.389	0.359	178.944	178.944	0.314
4/4/2006	11:19:26	199.4345	25.181	187.394	187.394	0.364	178.950	178.950	0.320
4/4/2006	11:31:15	211.2562	25.176	187.400	187.402	0.372	178.956	178.958	0.328
4/4/2006	11:43:46	223.7780	25.178	187.408	187.409	0.379	178.964	178.965	0.335
4/4/2006	11:57:02	237.0428	25.177	187.412	187.414	0.384	178.968	178.969	0.339
4/4/2006	12:11:05	251.0928	25.179	187.417	187.418	0.388	178.972	178.972	0.342
4/4/2006	12:25:58	265.9762	25.176	187.423	187.425	0.395	178.978	178.980	0.350
4/4/2006	12:41:44	281.7412	25.173	187.429	187.432	0.402	178.984	178.987	0.357
4/4/2006	12:58:26	298.4397	25.171	187.429	187.433	0.403	178.986	178.990	0.360
4/4/2006	13:16:07	316.1280	25.163	187.435	187.443	0.413	178.992	178.999	0.369
4/4/2006	13:34:51	334.8647	25.156	187.437	187.448	0.418	178.994	179.005	0.375
4/4/2006	13:54:42	354.7113	25.143	187.443	187.460	0.430	179.000	179.016	0.386
4/4/2006	14:15:44	375.7347	25.128	187.445	187.469	0.439	179.002	179.025	0.395
4/4/2006	14:38:00	398.0030	25.110	187.449	187.482	0.452	179.002	179.034	0.404
4/4/2006	15:01:35	421.5912	25.101	187.449	187.486	0.456	179.002	179.038	0.408
4/4/2006	15:26:34	446.5780	25.083	187.451	187.497	0.467	179.006	179.050	0.420
4/4/2006	15:53:02	473.0447	25.074	187.453	187.503	0.473	179.010	179.058	0.428
4/4/2006	16:21:04	501.0795	25.063	187.458	187.513	0.483	179.012	179.065	0.435
4/4/2006	16:50:46	530.7763	25.043	187.458	187.522	0.492	179.014	179.076	0.446
4/4/2006	17:20:46	560.7763	25.032	187.458	187.528	0.498	179.014	179.082	0.452
4/4/2006	17:50:46	590.7763	25.025	187.462	187.535	0.505	179.020	179.091	0.461
4/4/2006	18:20:46	620.7763	25.024	187.468	187.541	0.511	179.024	179.095	0.465
4/4/2006	18:50:46	650.7763	25.031	187.468	187.538	0.508	179.024	179.092	0.462
4/4/2006	19:20:46	680.7763	25.033	187.468	187.537	0.507	179.026	179.092	0.462
4/4/2006	19:50:46	710.7763	25.039	187.474	187.540	0.510	179.031	179.095	0.465
4/4/2006	20:20:46	740.7763	25.059	187.474	187.530	0.500	179.033	179.087	0.457
4/4/2006	20:50:46	770.7763	25.057	187.480	187.537	0.507	179.039	179.094	0.464
4/4/2006	21:20:46	800.7763	25.043	187.484	187.548	0.518	179.041	179.102	0.472
4/4/2006	21:50:46	830.7763	25.045	187.484	187.547	0.517	179.041	179.101	0.471
4/4/2006	22:20:46	860.7763	25.069	187.486	187.537	0.507	179.043	179.092	0.462
4/4/2006	22:50:46	890.7763	25.071	187.487	187.537	0.507	179.045	179.093	0.463
4/4/2006	23:20:46	920.7763	25.092	187.488	187.528	0.498	179.043	179.081	0.451
4/4/2006	23:50:46	950.7763	25.102	187.488	187.523	0.493	179.045	179.078	0.448

Table E-3

Measured and Corrected DTW, and Drawdown in Wells MW-67 and MW-71R during the Pumping Cycle of the Constant Rate Pumping Test

Date	Time	Elapsed Time (min)	BP* inches of Hg	Well MW-67			Well MW-71R		
				DTW (ft)		Drawdown (ft)	DTW (ft)		Drawdown (ft)
				Measured	Corrected		Measured	Corrected	
4/5/2006	0:20:46	980.7763	25.096	187.488	187.526	0.496	179.045	179.081	0.451
4/5/2006	0:50:46	1010.7763	25.096	187.482	187.520	0.490	179.039	179.075	0.445
4/5/2006	1:20:46	1040.7763	25.096	187.484	187.522	0.492	179.041	179.077	0.447
4/5/2006	1:50:46	1070.7763	25.088	187.482	187.524	0.494	179.039	179.078	0.448
4/5/2006	2:20:46	1100.7763	25.084	187.484	187.527	0.497	179.041	179.082	0.452
4/5/2006	2:50:46	1130.7763	25.077	187.484	187.531	0.501	179.041	179.085	0.455
4/5/2006	3:20:46	1160.7763	25.047	187.482	187.543	0.513	179.039	179.097	0.467
4/5/2006	3:50:46	1190.7763	25.057	187.482	187.538	0.508	179.039	179.092	0.462
4/5/2006	4:20:46	1220.7763	25.045	187.478	187.540	0.510	179.037	179.096	0.466
4/5/2006	4:50:46	1250.7763	25.053	187.476	187.534	0.504	179.035	179.090	0.460
4/5/2006	5:20:46	1280.7763	25.051	187.478	187.537	0.507	179.035	179.091	0.461
4/5/2006	5:50:46	1310.7763	25.041	187.478	187.541	0.511	179.037	179.097	0.467
4/5/2006	6:20:46	1340.7763	25.039	187.476	187.540	0.510	179.035	179.096	0.466
4/5/2006	6:50:46	1370.7763	25.022	187.476	187.548	0.518	179.035	179.104	0.474
4/5/2006	7:20:46	1400.7763	25.020	187.476	187.549	0.519	179.033	179.103	0.473
4/5/2006	7:50:46	1430.7763	25.018	187.472	187.546	0.516	179.031	179.101	0.471
4/5/2006	8:00:00	1440.0050	25.017	187.472	187.546	0.516	179.031	179.102	0.472
4/5/2006	8:00:00	1440.0098	25.017	187.465	187.539	0.509	179.006	179.077	0.447
4/5/2006	8:00:00	1440.0148	25.017	187.463	187.537	0.507	178.998	179.069	0.439
4/5/2006	8:00:00	1440.0200	25.017	187.461	187.535	0.505	178.992	179.063	0.433
4/5/2006	8:00:01	1440.0248	25.017	187.459	187.533	0.503	178.990	179.061	0.431
4/5/2006	8:00:01	1440.0300	25.017	187.459	187.533	0.503	178.988	179.059	0.429
4/5/2006	8:00:01	1440.0350	25.017	187.459	187.533	0.503	178.988	179.059	0.429
4/5/2006	8:00:02	1440.0400	25.017	187.459	187.533	0.503	178.986	179.057	0.427
4/5/2006	8:00:02	1440.0448	25.017	187.457	187.531	0.501	178.984	179.055	0.425
4/5/2006	8:00:02	1440.0500	25.017	187.459	187.533	0.503	178.984	179.055	0.425
4/5/2006	8:00:03	1440.0550	25.017	187.458	187.532	0.502	178.984	179.055	0.425
4/5/2006	8:00:03	1440.0598	25.017	187.458	187.532	0.502	178.984	179.055	0.425
4/5/2006	8:00:03	1440.0650	25.017	187.458	187.532	0.502	178.984	179.055	0.425
4/5/2006	8:00:03	1440.0698	25.017	187.458	187.532	0.502	178.982	179.053	0.423
4/5/2006	8:00:04	1440.0750	25.017	187.458	187.532	0.502	178.982	179.053	0.423
4/5/2006	8:00:04	1440.0800	25.017	187.458	187.532	0.502	178.982	179.053	0.423
4/5/2006	8:00:04	1440.0848	25.017	187.458	187.532	0.502	178.982	179.053	0.423
4/5/2006	8:00:05	1440.0898	25.017	187.458	187.532	0.502	178.980	179.051	0.421
4/5/2006	8:00:05	1440.0950	25.017	187.456	187.530	0.500	178.982	179.053	0.423
4/5/2006	8:00:05	1440.1000	25.017	187.458	187.532	0.502	178.982	179.053	0.423
4/5/2006	8:00:06	1440.1050	25.017	187.458	187.532	0.502	178.980	179.051	0.421
4/5/2006	8:00:06	1440.1107	25.017	187.458	187.532	0.502	178.980	179.051	0.421
4/5/2006	8:00:06	1440.1168	25.017	187.458	187.532	0.502	178.982	179.053	0.423
4/5/2006	8:00:07	1440.1235	25.017	187.458	187.532	0.502	178.980	179.051	0.421
4/5/2006	8:00:07	1440.1305	25.017	187.458	187.532	0.502	178.982	179.053	0.423
4/5/2006	8:00:08	1440.1377	25.017	187.458	187.532	0.502	178.980	179.051	0.421
4/5/2006	8:00:08	1440.1455	25.017	187.458	187.532	0.502	178.980	179.051	0.421
4/5/2006	8:00:08	1440.1538	25.017	187.458	187.532	0.502	178.980	179.051	0.421
4/5/2006	8:00:09	1440.1628	25.017	187.456	187.530	0.500	178.980	179.051	0.421
4/5/2006	8:00:10	1440.1720	25.017	187.463	187.537	0.507	178.996	179.067	0.437

Table E-3

Measured and Corrected DTW, and Drawdown in Wells MW-67 and MW-71R during the Pumping Cycle of the Constant Rate Pumping Test

Date	Time	Elapsed Time (min)	BP* inches of Hg	Well MW-67			Well MW-71R		
				DTW (ft)		Drawdown (ft)	DTW (ft)		Drawdown (ft)
				Measured	Corrected		Measured	Corrected	
4/5/2006	8:00:10	1440.1818	25.017	187.463	187.537	0.507	179.000	179.071	0.441
4/5/2006	8:00:11	1440.1925	25.017	187.463	187.537	0.507	179.002	179.073	0.443
4/5/2006	8:00:11	1440.2035	25.017	187.465	187.539	0.509	179.004	179.075	0.445
4/5/2006	8:00:12	1440.2150	25.017	187.465	187.539	0.509	179.008	179.079	0.449
4/5/2006	8:00:13	1440.2275	25.017	187.467	187.541	0.511	179.010	179.081	0.451

* Barometric pressure offset by 2.5 hours for wells MW-67 and MW-71R

Table E-4

Measured and Corrected DTW, and Residual Drawdown in Wells MW-67 and MW-71R during the Recovery Cycle of the Constant Rate Pumping Test

Date	Time	Elapsed Time (min)	BP* inches of Hg	Well MW-67			Well MW-71R		
				DTW (ft)		Residual	DTW (ft)		Residual
				Measured	Corrected	Drawdown (ft)	Measured	Corrected	Drawdown (ft)
4/5/2006	8:00:14	0.0048	25.017	187.467	187.541	0.511	179.010	179.081	0.451
4/5/2006	8:00:15	0.0188	25.017	187.467	187.541	0.511	179.012	179.083	0.453
4/5/2006	8:00:15	0.0337	25.017	187.469	187.543	0.513	179.012	179.083	0.453
4/5/2006	8:00:16	0.0493	25.017	187.469	187.543	0.513	179.014	179.085	0.455
4/5/2006	8:00:17	0.0660	25.017	187.469	187.543	0.513	179.014	179.085	0.455
4/5/2006	8:00:18	0.0835	25.017	187.469	187.543	0.513	179.016	179.087	0.457
4/5/2006	8:00:20	0.1023	25.017	187.469	187.543	0.513	179.016	179.087	0.457
4/5/2006	8:00:21	0.1222	25.017	187.471	187.545	0.515	179.018	179.089	0.459
4/5/2006	8:00:22	0.1430	25.017	187.469	187.543	0.513	179.018	179.089	0.459
4/5/2006	8:00:23	0.1653	25.017	187.469	187.543	0.513	179.018	179.089	0.459
4/5/2006	8:00:25	0.1888	25.017	187.471	187.545	0.515	179.020	179.091	0.461
4/5/2006	8:00:26	0.2135	25.017	187.471	187.545	0.515	179.020	179.091	0.461
4/5/2006	8:00:28	0.2385	25.017	187.471	187.545	0.515	179.020	179.091	0.461
4/5/2006	8:00:29	0.2653	25.017	187.471	187.545	0.515	179.022	179.093	0.463
4/5/2006	8:00:31	0.2937	25.017	187.471	187.546	0.516	179.022	179.093	0.463
4/5/2006	8:00:33	0.3237	25.017	187.471	187.546	0.516	179.022	179.093	0.463
4/5/2006	8:00:35	0.3552	25.017	187.471	187.546	0.516	179.022	179.093	0.463
4/5/2006	8:00:37	0.3903	25.017	187.471	187.546	0.516	179.022	179.093	0.463
4/5/2006	8:00:39	0.4268	25.017	187.471	187.546	0.516	179.024	179.095	0.465
4/5/2006	8:00:41	0.4653	25.017	187.471	187.546	0.516	179.024	179.095	0.465
4/5/2006	8:00:44	0.5070	25.017	187.471	187.546	0.516	179.024	179.095	0.465
4/5/2006	8:00:46	0.5503	25.017	187.471	187.546	0.516	179.024	179.095	0.465
4/5/2006	8:00:49	0.5968	25.017	187.473	187.548	0.518	179.024	179.095	0.465
4/5/2006	8:00:52	0.6452	25.017	187.473	187.548	0.518	179.024	179.095	0.465
4/5/2006	8:00:55	0.6968	25.017	187.473	187.548	0.518	179.026	179.097	0.467
4/5/2006	8:00:59	0.7518	25.017	187.472	187.547	0.517	179.026	179.097	0.467
4/5/2006	8:01:02	0.8102	25.017	187.472	187.547	0.517	179.026	179.097	0.467
4/5/2006	8:01:06	0.8720	25.017	187.472	187.547	0.517	179.025	179.096	0.466
4/5/2006	8:01:10	0.9368	25.017	187.472	187.547	0.517	179.023	179.094	0.464
4/5/2006	8:01:14	1.0070	25.017	187.472	187.547	0.517	179.023	179.094	0.464
4/5/2006	8:01:18	1.0803	25.017	187.472	187.547	0.517	179.025	179.096	0.466
4/5/2006	8:01:23	1.1585	25.017	187.472	187.547	0.517	179.023	179.094	0.464
4/5/2006	8:01:28	1.2418	25.017	187.472	187.547	0.517	179.025	179.096	0.466
4/5/2006	8:01:33	1.3303	25.017	187.472	187.547	0.517	179.025	179.096	0.466
4/5/2006	8:01:39	1.4237	25.017	187.470	187.545	0.515	179.025	179.096	0.466
4/5/2006	8:01:45	1.5220	25.017	187.472	187.547	0.517	179.025	179.096	0.466
4/5/2006	8:01:51	1.6270	25.017	187.472	187.547	0.517	179.025	179.096	0.466
4/5/2006	8:01:58	1.7368	25.017	187.472	187.547	0.517	179.025	179.096	0.466
4/5/2006	8:02:05	1.8535	25.017	187.470	187.545	0.515	179.023	179.094	0.464
4/5/2006	8:02:12	1.9787	25.016	187.470	187.545	0.515	179.025	179.096	0.466
4/5/2006	8:02:20	2.1102	25.016	187.472	187.547	0.517	179.025	179.096	0.466
4/5/2006	8:02:28	2.2502	25.016	187.470	187.545	0.515	179.025	179.096	0.466
4/5/2006	8:02:37	2.3987	25.016	187.472	187.547	0.517	179.025	179.096	0.466
4/5/2006	8:02:47	2.5553	25.016	187.472	187.547	0.517	179.025	179.096	0.466
4/5/2006	8:02:57	2.7220	25.016	187.472	187.547	0.517	179.025	179.096	0.466
4/5/2006	8:03:07	2.8987	25.016	187.470	187.545	0.515	179.025	179.096	0.466

Table E-4

Measured and Corrected DTW, and Residual Drawdown in Wells MW-67 and MW-71R during the Recovery Cycle of the Constant Rate Pumping Test

Date	Time	Elapsed Time (min)	BP* inches of Hg	Well MW-67			Well MW-71R		
				DTW (ft)		Residual	DTW (ft)		Residual
				Measured	Corrected	Drawdown (ft)	Measured	Corrected	Drawdown (ft)
4/5/2006	8:03:19	3.0852	25.016	187.470	187.545	0.515	179.027	179.098	0.468
4/5/2006	8:03:30	3.2835	25.016	187.472	187.547	0.517	179.025	179.096	0.466
4/5/2006	8:03:43	3.4935	25.016	187.470	187.545	0.515	179.025	179.096	0.466
4/5/2006	8:03:56	3.7153	25.016	187.470	187.545	0.515	179.027	179.098	0.468
4/5/2006	8:04:10	3.9502	25.016	187.470	187.545	0.515	179.025	179.096	0.466
4/5/2006	8:04:25	4.1985	25.016	187.470	187.545	0.515	179.025	179.096	0.466
4/5/2006	8:04:41	4.4618	25.016	187.470	187.545	0.515	179.025	179.096	0.466
4/5/2006	8:04:58	4.7418	25.016	187.470	187.545	0.515	179.025	179.096	0.466
4/5/2006	8:05:16	5.0387	25.016	187.468	187.543	0.513	179.025	179.096	0.466
4/5/2006	8:05:35	5.3520	25.016	187.468	187.543	0.513	179.025	179.096	0.466
4/5/2006	8:05:54	5.6835	25.016	187.468	187.543	0.513	179.025	179.096	0.466
4/5/2006	8:06:16	6.0353	25.016	187.468	187.543	0.513	179.023	179.094	0.464
4/5/2006	8:06:38	6.4085	25.016	187.466	187.541	0.511	179.025	179.096	0.466
4/5/2006	8:07:02	6.8035	25.016	187.464	187.539	0.509	179.023	179.094	0.464
4/5/2006	8:07:27	7.2220	25.016	187.466	187.541	0.511	179.023	179.094	0.464
4/5/2006	8:07:53	7.6652	25.016	187.464	187.539	0.509	179.023	179.094	0.464
4/5/2006	8:08:22	8.1353	25.016	187.464	187.539	0.509	179.023	179.094	0.464
4/5/2006	8:08:51	8.6335	25.016	187.462	187.537	0.507	179.023	179.094	0.464
4/5/2006	8:09:23	9.1603	25.016	187.462	187.537	0.507	179.021	179.093	0.463
4/5/2006	8:09:57	9.7187	25.015	187.460	187.535	0.505	179.021	179.093	0.463
4/5/2006	8:10:32	10.3103	25.015	187.460	187.535	0.505	179.021	179.093	0.463
4/5/2006	8:11:10	10.9370	25.015	187.460	187.535	0.505	179.019	179.091	0.461
4/5/2006	8:11:49	11.6002	25.015	187.456	187.531	0.501	179.017	179.089	0.459
4/5/2006	8:12:32	12.3037	25.015	187.456	187.531	0.501	179.017	179.089	0.459
4/5/2006	8:13:16	13.0485	25.015	187.454	187.529	0.499	179.017	179.089	0.459
4/5/2006	8:14:04	13.8385	25.015	187.452	187.527	0.497	179.017	179.089	0.459
4/5/2006	8:14:54	14.6752	25.015	187.449	187.524	0.494	179.013	179.085	0.455
4/5/2006	8:15:47	15.5603	25.015	187.447	187.522	0.492	179.011	179.083	0.453
4/5/2006	8:16:43	16.4985	25.015	187.443	187.518	0.488	179.009	179.081	0.451
4/5/2006	8:17:43	17.4920	25.014	187.439	187.515	0.485	179.005	179.077	0.447
4/5/2006	8:18:46	18.5452	25.014	187.435	187.511	0.481	179.003	179.075	0.445
4/5/2006	8:19:53	19.6603	25.014	187.430	187.506	0.476	178.999	179.071	0.441
4/5/2006	8:21:04	20.8420	25.014	187.427	187.503	0.473	178.995	179.067	0.437
4/5/2006	8:22:19	22.0937	25.014	187.419	187.495	0.465	178.991	179.063	0.433
4/5/2006	8:23:39	23.4187	25.013	187.413	187.489	0.459	178.987	179.059	0.429
4/5/2006	8:25:03	24.8235	25.013	187.407	187.483	0.453	178.982	179.055	0.425
4/5/2006	8:26:32	26.3118	25.012	187.401	187.477	0.447	178.976	179.049	0.419
4/5/2006	8:28:07	27.8868	25.012	187.394	187.471	0.441	178.970	179.043	0.413
4/5/2006	8:29:47	29.5553	25.012	187.388	187.465	0.435	178.966	179.039	0.409
4/5/2006	8:31:33	31.3235	25.011	187.380	187.457	0.427	178.960	179.033	0.403
4/5/2006	8:33:25	33.1970	25.011	187.374	187.451	0.421	178.954	179.028	0.398
4/5/2006	8:35:24	35.1802	25.010	187.366	187.444	0.414	178.950	179.024	0.394
4/5/2006	8:37:30	37.2820	25.010	187.359	187.437	0.407	178.942	179.016	0.386
4/5/2006	8:39:44	39.5087	25.009	187.349	187.427	0.397	178.934	179.008	0.378
4/5/2006	8:42:05	41.8670	25.008	187.340	187.418	0.388	178.928	179.003	0.373
4/5/2006	8:44:35	44.3653	25.008	187.333	187.412	0.382	178.920	178.995	0.365

Table E-4

Measured and Corrected DTW, and Residual Drawdown in Wells MW-67 and MW-71R during the Recovery Cycle of the Constant Rate Pumping Test

Date	Time	Elapsed Time (min)	BP* inches of Hg	Well MW-67			Well MW-71R		
				DTW (ft)		Residual	DTW (ft)		Residual
				Measured	Corrected	Drawdown (ft)	Measured	Corrected	Drawdown (ft)
4/5/2006	8:47:14	47.0118	25.007	187.323	187.402	0.372	178.912	178.987	0.357
4/5/2006	8:50:02	49.8153	25.006	187.315	187.394	0.364	178.904	178.980	0.350
4/5/2006	8:53:00	52.7837	25.006	187.306	187.385	0.355	178.898	178.974	0.344
4/5/2006	8:56:09	55.9285	25.007	187.296	187.375	0.345	178.887	178.962	0.332
4/5/2006	8:59:29	59.2603	25.007	187.286	187.365	0.335	178.881	178.956	0.326
4/5/2006	9:03:01	62.7885	25.008	187.278	187.357	0.327	178.873	178.948	0.318
4/5/2006	9:06:45	66.5270	25.008	187.267	187.345	0.315	178.861	178.936	0.306
4/5/2006	9:10:43	70.4868	25.009	187.257	187.335	0.305	178.853	178.927	0.297
4/5/2006	9:14:54	74.6803	25.009	187.247	187.325	0.295	178.845	178.919	0.289
4/5/2006	9:19:21	79.1235	25.010	187.237	187.315	0.285	178.835	178.909	0.279
4/5/2006	9:24:03	83.8303	25.009	187.229	187.307	0.277	178.829	178.903	0.273
4/5/2006	9:29:02	88.8152	25.008	187.220	187.298	0.268	178.819	178.894	0.264
4/5/2006	9:34:19	94.0952	25.007	187.208	187.287	0.257	178.809	178.884	0.254
4/5/2006	9:39:55	99.6887	25.006	187.200	187.279	0.249	178.800	178.875	0.245
4/5/2006	9:45:50	105.6137	25.005	187.192	187.272	0.242	178.790	178.866	0.236
4/5/2006	9:52:07	111.8887	25.004	187.180	187.260	0.230	178.780	178.857	0.227
4/5/2006	9:58:46	118.5368	25.001	187.169	187.250	0.220	178.770	178.848	0.218
4/5/2006	10:05:48	125.5785	24.999	187.161	187.244	0.214	178.762	178.841	0.211
4/5/2006	10:13:16	133.0368	24.997	187.151	187.235	0.205	178.752	178.832	0.202
4/5/2006	10:21:10	140.9368	24.994	187.141	187.226	0.196	178.742	178.823	0.193
4/5/2006	10:29:32	149.3053	24.994	187.132	187.217	0.187	178.734	178.815	0.185
4/5/2006	10:38:24	158.1702	25.004	187.124	187.204	0.174	178.726	178.802	0.172
4/5/2006	10:47:47	167.5602	24.996	187.114	187.198	0.168	178.715	178.795	0.165
4/5/2006	10:57:44	177.5070	24.993	187.102	187.187	0.157	178.705	178.786	0.156
4/5/2006	11:08:16	188.0435	24.988	187.092	187.180	0.150	178.695	178.779	0.149
4/5/2006	11:19:26	199.2035	24.987	187.083	187.171	0.141	178.687	178.771	0.141
4/5/2006	11:31:15	211.0252	24.984	187.075	187.164	0.134	178.677	178.762	0.132
4/5/2006	11:43:46	223.5470	24.972	187.069	187.164	0.134	178.675	178.766	0.136
4/5/2006	11:57:02	236.8118	24.967	187.059	187.157	0.127	178.665	178.758	0.128
4/5/2006	12:11:05	250.8618	24.959	187.047	187.148	0.118	178.655	178.752	0.122
4/5/2006	12:25:58	265.7452	24.952	187.040	187.145	0.115	178.645	178.745	0.115
4/5/2006	12:41:44	281.5102	24.941	187.032	187.141	0.111	178.637	178.742	0.112
4/5/2006	12:58:26	298.2087	24.937	187.022	187.134	0.104	178.626	178.733	0.103
4/5/2006	13:16:07	315.8970	24.922	187.014	187.133	0.103	178.616	178.730	0.100
4/5/2006	13:34:51	334.6337	24.904	187.000	187.127	0.097	178.606	178.728	0.098
4/5/2006	13:54:42	354.4803	24.897	186.993	187.123	0.093	178.598	178.723	0.093
4/5/2006	14:15:44	375.5037	24.909	186.982	187.107	0.077	178.590	178.709	0.079
4/5/2006	14:38:00	397.7720	24.895	186.975	187.106	0.076	178.582	178.708	0.078
4/5/2006	15:01:35	421.3602	24.885	186.965	187.101	0.071	178.572	178.703	0.073
4/5/2006	15:26:34	446.3470	24.866	186.961	187.106	0.076	178.562	178.701	0.071
4/5/2006	15:53:02	472.8137	24.842	186.948	187.104	0.074	178.558	178.708	0.078
4/5/2006	16:21:04	500.8485	24.831	186.942	187.104	0.074	178.544	178.699	0.069
4/5/2006	16:50:46	530.5453	24.821	186.932	187.098	0.068	178.535	178.695	0.065
4/5/2006	17:20:46	560.5453	24.808	186.924	187.096	0.066	178.533	178.699	0.069
4/5/2006	17:50:46	590.5453	24.789	186.920	187.101	0.071	178.521	178.696	0.066
4/5/2006	18:20:46	620.5453	24.791	186.914	187.094	0.064	178.517	178.690	0.060

Table E-4

Measured and Corrected DTW, and Residual Drawdown in Wells MW-67 and MW-71R during the Recovery Cycle of the Constant Rate Pumping Test

Date	Time	Elapsed Time (min)	BP* inches of Hg	Well MW-67			Well MW-71R		
				DTW (ft)		Residual	DTW (ft)		Residual
				Measured	Corrected	Drawdown (ft)	Measured	Corrected	Drawdown (ft)
4/5/2006	18:50:46	650.5453	24.778	186.910	187.096	0.066	178.513	178.692	0.062
4/5/2006	19:20:46	680.5453	24.772	186.909	187.098	0.068	178.511	178.693	0.063
4/5/2006	19:50:46	710.5453	24.762	186.905	187.098	0.068	178.509	178.695	0.065
4/5/2006	20:20:46	740.5453	24.754	186.903	187.100	0.070	178.507	178.697	0.067
4/5/2006	20:50:46	770.5453	24.750	186.903	187.102	0.072	178.505	178.697	0.067
4/5/2006	21:20:46	800.5453	24.752	186.897	187.095	0.065	178.503	178.694	0.064
4/5/2006	21:50:46	830.5453	24.766	186.895	187.086	0.056	178.501	178.685	0.055
4/5/2006	22:20:46	860.5453	24.776	186.893	187.079	0.049	178.499	178.678	0.048
4/5/2006	22:50:46	890.5453	24.792	186.893	187.072	0.042	178.497	178.669	0.039
4/5/2006	23:20:46	920.5453	24.805	186.893	187.066	0.036	178.497	178.663	0.033
4/5/2006	23:50:46	950.5453	24.803	186.893	187.066	0.036	178.497	178.663	0.033
4/6/2006	0:20:46	980.5453	24.811	186.889	187.059	0.029	178.493	178.656	0.026
4/6/2006	0:50:46	1010.5453	24.809	186.887	187.057	0.027	178.491	178.654	0.024
4/6/2006	1:20:46	1040.5453	24.823	186.885	187.049	0.019	178.485	178.642	0.012
4/6/2006	1:50:46	1070.5453	24.837	186.881	187.038	0.008	178.481	178.631	0.001
4/6/2006	2:20:46	1100.5453	24.845	186.877	187.030	0.000	178.479	178.625	-0.005
4/6/2006	2:50:46	1130.5453	24.839	186.877	187.033	0.003	178.481	178.630	0.000
4/6/2006	3:20:46	1160.5453	24.835	186.879	187.037	0.007	178.483	178.634	0.004
4/6/2006	3:50:46	1190.5453	24.827	186.879	187.040	0.010	178.483	178.637	0.007
4/6/2006	4:20:46	1220.5453	24.809	186.875	187.045	0.015	178.477	178.640	0.010
4/6/2006	4:50:46	1250.5453	24.809	186.871	187.041	0.011	178.475	178.638	0.008
4/6/2006	5:20:46	1280.5453	24.817	186.875	187.041	0.011	178.477	178.636	0.006
4/6/2006	5:50:46	1310.5453	24.829	186.883	187.043	0.013	178.487	178.640	0.010
4/6/2006	6:20:46	1340.5453	24.841	186.885	187.039	0.009	178.489	178.636	0.006
4/6/2006	6:50:46	1370.5453	24.809	186.889	187.058	0.028	178.493	178.655	0.025
4/6/2006	7:20:46	1400.5453	24.798	186.895	187.070	0.040	178.495	178.662	0.032
4/6/2006	7:50:46	1430.5453	24.819	186.898	187.063	0.033	178.499	178.656	0.026
4/6/2006	8:20:46	1460.5453	24.845	186.901	187.053	0.023	178.501	178.646	0.016
4/6/2006	8:50:46	1490.5453	24.853	186.905	187.053	0.023	178.507	178.648	0.018
4/6/2006	9:20:46	1520.5453	24.870	186.909	187.049	0.019	178.511	178.644	0.014
4/6/2006	9:50:46	1550.5453	24.880	186.909	187.044	0.014	178.511	178.639	0.009
4/6/2006	10:20:46	1580.5453	24.888	186.909	187.040	0.010	178.509	178.634	0.004
4/6/2006	10:50:46	1610.5453	24.892	186.912	187.041	0.011	178.511	178.634	0.004
4/6/2006	11:20:46	1640.5453	24.898	186.910	187.036	0.006	178.509	178.629	-0.001
4/6/2006	11:50:46	1670.5453	24.898	186.909	187.035	0.005	178.509	178.629	-0.001
4/6/2006	12:20:46	1700.5453	24.884	186.909	187.042	0.012	178.509	178.635	0.005
4/6/2006	12:50:46	1730.5453	24.888	186.907	187.038	0.008	178.507	178.631	0.001
4/6/2006	13:20:46	1760.5453	24.882	186.905	187.039	0.009	178.505	178.632	0.002
4/6/2006	13:50:46	1790.5453	24.884	186.907	187.040	0.010	178.505	178.631	0.001
4/6/2006	14:20:46	1820.5453	24.862	186.909	187.052	0.022	178.505	178.641	0.011
4/6/2006	14:50:46	1850.5453	24.849	186.905	187.054	0.024	178.509	178.651	0.021
4/6/2006	15:20:46	1880.5453	24.847	186.903	187.053	0.023	178.501	178.643	0.013
4/6/2006	15:50:46	1910.5453	24.833	186.901	187.058	0.028	178.503	178.652	0.022
4/6/2006	16:20:46	1940.5453	24.841	186.907	187.060	0.030	178.503	178.648	0.018
4/6/2006	16:50:46	1970.5453	24.837	186.903	187.058	0.028	178.501	178.648	0.018
4/6/2006	17:20:46	2000.5453	24.837	186.901	187.055	0.025	178.505	178.652	0.022

Table E-4

Measured and Corrected DTW, and Residual Drawdown in Wells MW-67 and MW-71R during the Recovery Cycle of the Constant Rate Pumping Test

Date	Time	Elapsed Time (min)	BP* inches of Hg	Well MW-67			Well MW-71R		
				DTW (ft)		Residual Drawdown (ft)	DTW (ft)		Residual Drawdown (ft)
				Measured	Corrected		Measured	Corrected	
4/6/2006	17:50:46	2030.5453	24.833	186.905	187.061	0.031	178.503	178.651	0.021
4/6/2006	18:20:46	2060.5453	24.823	186.907	187.068	0.038	178.507	178.660	0.030
4/6/2006	18:50:46	2090.5453	24.827	186.907	187.066	0.036	178.507	178.658	0.028
4/6/2006	19:20:46	2120.5453	24.829	186.910	187.068	0.038	178.511	178.661	0.031
4/6/2006	19:50:46	2150.5453	24.827	186.912	187.071	0.041	178.515	178.666	0.036

* Barometric pressure offset by 2.5 hours for wells MW-67 and MW-71R

APPENDIX F

Appendix F

Water Level Residuals – December 1998 to December 2007 Simulation

Appendix F

Water Level Residuals
December 1998 to December 2007 Simulation

Monitoring Well	Year	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-07	1999	4976.62	4975.11	1.51
MW-09	1999	4972.33	4972.53	-0.20
MW-12	1999	4971.95	4972.59	-0.65
MW-13	1999	4973.67	4973.09	0.58
MW-16	1999	4977.80	4975.59	2.20
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	4972.86	4972.02	0.85
MW-30	1999	4971.40	4971.21	0.19
MW-31	1999	4970.32	4970.40	-0.08
MW-32	1999	4970.12	4970.34	-0.21
MW-33	1999	4971.64	4972.21	-0.57
MW-34	1999	4973.45	4972.35	1.09
MW-35	1999	4970.57	4970.23	0.34
MW-36	1999	4969.02	4969.03	-0.01
MW-37	1999	4967.30	4967.77	-0.47
MW-38	1999	4972.88	4971.49	1.39
MW-39	1999	4971.63	4970.80	0.83
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	4969.11	4968.94	0.18
MW-45	1999	4967.25	4967.60	-0.35
MW-46	1999	4965.98	4966.56	-0.58
MW-47	1999	4965.56	4965.84	-0.28
MW-48	1999	4964.66	4964.41	0.25
MW-49	1999	4970.15	4969.82	0.33
MW-51	1999	4979.97	4977.45	2.52
MW-52	1999	4961.24	4961.38	-0.14
MW-53	1999	4963.42	4962.58	0.84
MW-54	1999	4964.83	4965.55	-0.72
MW-55	1999	4963.44	4963.78	-0.34
MW-56	1999	4964.63	4964.17	0.46
MW-57	1999	4964.41	4965.04	-0.63
MW-58	1999	4964.19	4963.44	0.75
MW-59	1999	4968.77	4970.28	-1.52
MW-60	1999	4964.33	4963.94	0.39
MW-61	1999	4964.41	4964.07	0.34
MW-62	1999	4966.53	4966.34	0.19
MW-64	1999	4964.90	4965.40	-0.50

Appendix F

Water Level Residuals
December 1998 to December 2007 Simulation

Monitoring Well	Year	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-65	1999	4960.92	4960.43	0.49
MW-66	1999	4963.35	4963.63	-0.28
MW-67	1999	4957.76	4957.99	-0.23
MW-68	1999	4960.83	4960.19	0.63
MW-69	1999	4960.73	4959.51	1.22
MW-70	1999	4969.37	4970.06	-0.69
MW-71	1999	4957.75	4956.85	0.90
MW-72	1999	4970.03	4970.61	-0.58
MW-73	1999	4970.15	4970.44	-0.29
OB-1	1999	4958.39	4959.05	-0.66
OB-2	1999	4960.02	4959.36	0.67
MW-07	2000	4976.31	4974.95	1.36
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	0.49
MW-16	2000	4977.65	4975.53	2.12
MW-17	2000	4977.94	4976.14	1.80
MW-18	2000	4970.68	4972.79	-2.11
MW-19	2000	4970.62	4970.74	-0.12
MW-20	2000	4970.26	4970.16	0.10
MW-22	2000	4976.81	4975.76	1.05
MW-23	2000	4975.10	4974.15	0.95
MW-24	2000	4977.35	4975.47	1.88
MW-25	2000	4977.38	4975.38	2.00
MW-26	2000	4972.49	4972.76	-0.27
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	0.10
MW-31	2000	4969.94	4970.11	-0.17
MW-32	2000	4969.76	4970.05	-0.29
MW-33	2000	4971.28	4971.99	-0.71
MW-34	2000	4973.13	4972.11	1.02
MW-35	2000	4970.22	4969.91	0.31
MW-36	2000	4968.58	4968.69	-0.11
MW-37	2000	4966.90	4967.37	-0.47
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	4968.68	4968.59	0.09

Appendix F

Water Level Residuals
December 1998 to December 2007 Simulation

Monitoring Well	Year	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-45	2000	4966.90	4967.20	-0.30
MW-46	2000	4965.56	4966.13	-0.57
MW-47	2000	4965.04	4965.31	-0.27
MW-48	2000	4964.01	4963.75	0.26
MW-49	2000	4969.89	4969.52	0.37
MW-51	2000	4979.73	4977.40	2.33
MW-52	2000	4960.50	4960.61	-0.11
MW-53	2000	4962.62	4961.65	0.97
MW-54	2000	4964.57	4965.22	-0.65
MW-55	2000	4962.90	4963.15	-0.24
MW-56	2000	4964.01	4963.53	0.48
MW-57	2000	4964.32	4964.80	-0.48
MW-58	2000	4963.46	4962.64	0.82
MW-59	2000	4968.44	4970.02	-1.58
MW-60	2000	4963.94	4963.40	0.54
MW-61	2000	4964.02	4963.52	0.50
MW-62	2000	4965.92	4965.87	0.05
MW-63	2000	4970.20	4973.40	-3.20
MW-64	2000	4964.55	4965.08	-0.52
MW-65	2000	4960.24	4959.69	0.54
MW-66	2000	4963.03	4963.36	-0.33
MW-67	2000	4957.24	4957.61	-0.37
MW-68	2000	4960.40	4959.74	0.67
MW-69	2000	4960.31	4959.05	1.26
MW-70	2000	4969.01	4969.77	-0.76
MW-71	2000	4957.28	4956.49	0.80
MW-72	2000	4969.73	4970.34	-0.61
MW-73	2000	4969.77	4970.15	-0.39
MW-74	2000	4963.03	4963.94	-0.92
MW-75	2000	4966.92	4963.89	3.03
MW-76	2000	4967.69	4965.53	2.17
OB-1	2000	4957.54	4957.83	-0.29
OB-2	2000	4958.96	4958.39	0.57
MW-07	2001	4976.10	4974.80	1.31
MW-09	2001	4971.71	4972.12	-0.41
MW-12	2001	4971.18	4972.21	-1.02
MW-13	2001	4973.09	4972.69	0.40
MW-16	2001	4977.76	4975.46	2.31
MW-17	2001	4978.05	4976.06	1.98
MW-18	2001	4970.28	4972.65	-2.38
MW-19	2001	4970.28	4970.52	-0.24
MW-20	2001	4969.92	4969.93	-0.01

Appendix F

Water Level Residuals
December 1998 to December 2007 Simulation

Monitoring Well	Year	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-22	2001	4976.51	4975.64	0.87
MW-23	2001	4974.77	4974.00	0.77
MW-24	2001	4977.38	4975.38	2.00
MW-25	2001	4977.39	4975.30	2.09
MW-26	2001	4971.70	4972.57	-0.87
MW-27	2001	4972.74	4974.03	-1.29
MW-29	2001	4972.19	4971.56	0.63
MW-30	2001	4970.72	4970.72	0.00
MW-31	2001	4969.60	4969.87	-0.27
MW-32	2001	4969.44	4969.82	-0.38
MW-33	2001	4970.96	4971.80	-0.83
MW-34	2001	4972.86	4971.89	0.97
MW-35	2001	4969.97	4969.66	0.31
MW-36	2001	4968.32	4968.41	-0.10
MW-38	2001	4972.21	4971.02	1.20
MW-39	2001	4970.97	4970.29	0.68
MW-40	2001	4969.65	4969.53	0.12
MW-41	2001	4969.55	4970.00	-0.45
MW-42	2001	4969.30	4970.12	-0.82
MW-43	2001	4969.09	4969.76	-0.67
MW-44	2001	4968.38	4968.32	0.06
MW-45	2001	4967.06	4966.90	0.16
MW-46	2001	4965.30	4965.82	-0.53
MW-47	2001	4964.50	4964.94	-0.43
MW-48	2001	4963.66	4963.32	0.34
MW-49	2001	4969.49	4969.28	0.21
MW-51	2001	4979.79	4977.36	2.43
MW-52	2001	4960.20	4960.06	0.14
MW-53	2001	4962.08	4961.12	0.96
MW-54	2001	4964.34	4964.97	-0.63
MW-55	2001	4962.53	4962.76	-0.23
MW-56	2001	4963.67	4963.14	0.54
MW-57	2001	4964.15	4964.62	-0.47
MW-58	2001	4963.28	4962.15	1.13
MW-59	2001	4968.18	4969.81	-1.63
MW-60	2001	4963.74	4963.06	0.68
MW-61	2001	4963.80	4963.17	0.63
MW-62	2001	4965.68	4965.52	0.16
MW-63	2001	4970.02	4973.34	-3.32
MW-64	2001	4964.36	4964.84	-0.48
MW-65	2001	4959.90	4959.27	0.64
MW-66	2001	4962.79	4963.15	-0.36

Appendix F

Water Level Residuals
December 1998 to December 2007 Simulation

Monitoring Well	Year	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-67	2001	4956.95	4957.28	-0.33
MW-68	2001	4960.12	4959.44	0.68
MW-69	2001	4960.00	4958.75	1.24
MW-70	2001	4968.91	4969.54	-0.63
MW-71	2001	4956.98	4956.16	0.82
MW-72	2001	4969.48	4970.12	-0.64
MW-73	2001	4969.35	4969.92	-0.57
MW-74	2001	4962.46	4964.64	-2.18
MW-75	2001	4966.26	4964.59	1.67
MW-76	2001	4967.18	4966.22	0.96
OB-1	2001	4957.25	4957.23	0.02
OB-2	2001	4958.61	4957.88	0.72
MW-07	2002	4976.12	4975.95	0.18
MW-09	2002	4970.95	4972.80	-1.86
MW-12	2002	4970.35	4972.95	-2.60
MW-13	2002	4972.49	4973.20	-0.71
MW-14R	2002	4968.29	4969.31	-1.02
MW-16	2002	4981.76	4981.12	0.63
MW-17	2002	4981.91	4982.11	-0.20
MW-18	2002	4970.93	4974.43	-3.50
MW-19	2002	4969.24	4969.30	-0.07
MW-20	2002	4968.78	4969.07	-0.29
MW-22	2002	4977.86	4978.50	-0.64
MW-23	2002	4974.63	4975.72	-1.08
MW-24	2002	4981.50	4980.79	0.71
MW-25	2002	4981.61	4980.95	0.66
MW-26	2002	4971.44	4972.65	-1.22
MW-27	2002	4978.42	4978.28	0.14
MW-29	2002	4971.53	4970.98	0.54
MW-30	2002	4969.78	4969.83	-0.05
MW-31	2002	4968.39	4968.57	-0.19
MW-32	2002	4968.10	4968.30	-0.20
MW-33	2002	4970.04	4972.40	-2.36
MW-34	2002	4972.27	4971.55	0.73
MW-36	2002	4967.34	4967.88	-0.54
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	-0.07
MW-41	2002	4968.35	4968.29	0.06
MW-42	2002	4968.54	4969.34	-0.79
MW-43	2002	4968.31	4969.05	-0.74

Appendix F

Water Level Residuals
December 1998 to December 2007 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	4964.65	4965.41	-0.76
MW-47	2002	4964.18	4964.51	-0.33
MW-48	2002	4963.20	4962.90	0.30
MW-49	2002	4968.46	4968.58	-0.11
MW-51	2002	4980.94	4979.65	1.29
MW-52	2002	4959.81	4959.65	0.16
MW-53	2002	4961.52	4960.28	1.23
MW-54	2002	4963.82	4964.69	-0.87
MW-55	2002	4962.03	4962.32	-0.28
MW-56	2002	4963.21	4962.70	0.51
MW-57	2002	4963.62	4964.38	-0.76
MW-58	2002	4962.57	4961.72	0.86
MW-59	2002	4967.50	4969.23	-1.72
MW-60	2002	4963.21	4962.69	0.52
MW-61	2002	4963.12	4962.82	0.29
MW-62	2002	4965.13	4965.11	0.02
MW-63	2002	4969.61	4974.13	-4.51
MW-64	2002	4963.78	4964.55	-0.77
MW-65	2002	4959.39	4958.84	0.55
MW-66	2002	4962.24	4962.85	-0.61
MW-67	2002	4956.31	4956.91	-0.61
MW-68	2002	4959.64	4959.15	0.49
MW-69	2002	4959.52	4958.42	1.10
MW-70	2002	4967.68	4968.63	-0.95
MW-71R	2002	4956.36	4955.85	0.50
MW-72	2002	4968.59	4969.14	-0.55
MW-73	2002	4967.69	4967.66	0.04
MW-74	2002	4962.06	4964.96	-2.90
MW-75	2002	4965.83	4964.90	0.93
MW-76	2002	4967.31	4966.52	0.79
MW-77	2002	4977.09	4976.71	0.38
MW-78	2002	4973.01	4974.25	-1.25
OB-1	2002	4956.73	4956.66	0.06
OB-2	2002	4957.91	4957.39	0.52
MW-07	2003	4976.17	4976.42	-0.25
MW-09	2003	4970.82	4973.25	-2.42
MW-12	2003	4970.28	4973.36	-3.08
MW-13	2003	4972.42	4973.54	-1.12
MW-14R	2003	4968.03	4969.25	-1.22
MW-16	2003	4982.26	4982.48	-0.22

Appendix F

Water Level Residuals
December 1998 to December 2007 Simulation

Monitoring Well	Year	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-17	2003	4982.02	4983.52	-1.50
MW-18	2003	4975.16	4975.05	0.11
MW-19	2003	4969.13	4969.11	0.02
MW-20	2003	4968.59	4968.87	-0.28
MW-21	2003	4983.36	4983.79	-0.43
MW-22	2003	4977.84	4979.36	-1.52
MW-23	2003	4974.75	4976.32	-1.58
MW-24	2003	4982.08	4982.10	-0.02
MW-25	2003	4982.27	4982.30	-0.03
MW-26	2003	4971.84	4972.81	-0.97
MW-27	2003	4981.28	4979.40	1.88
MW-29	2003	4971.41	4970.85	0.55
MW-30	2003	4969.61	4969.67	-0.06
MW-31	2003	4968.19	4968.35	-0.17
MW-32	2003	4968.01	4968.05	-0.05
MW-33	2003	4969.93	4972.83	-2.89
MW-34	2003	4972.12	4971.36	0.77
MW-36	2003	4967.27	4967.60	-0.33
MW-37R	2003	4965.06	4966.17	-1.11
MW-38	2003	4971.41	4970.30	1.11
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	0.36
MW-42	2003	4968.48	4969.17	-0.69
MW-43	2003	4968.27	4968.87	-0.60
MW-44	2003	4967.35	4967.50	-0.15
MW-45	2003	4966.05	4966.11	-0.06
MW-46	2003	4964.45	4965.17	-0.72
MW-47	2003	4963.98	4964.20	-0.23
MW-48	2003	4962.97	4962.57	0.39
MW-49	2003	4968.30	4968.37	-0.07
MW-51	2003	4981.88	4980.57	1.32
MW-52R	2003	4959.26	4959.01	0.24
MW-53	2003	4961.29	4959.92	1.37
MW-54	2003	4963.61	4964.46	-0.84
MW-55	2003	4961.61	4962.01	-0.41
MW-56	2003	4962.98	4962.39	0.59
MW-57	2003	4963.46	4964.16	-0.71
MW-58	2003	4962.29	4961.37	0.93
MW-59	2003	4967.36	4969.07	-1.71
MW-60	2003	4962.90	4962.41	0.49
MW-61	2003	4962.87	4962.53	0.33

Appendix F

Water Level Residuals
December 1998 to December 2007 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	4971.76	4974.57	-2.81
MW-64	2003	4963.63	4964.33	-0.69
MW-65	2003	4959.19	4958.51	0.68
MW-66	2003	4962.01	4962.62	-0.61
MW-67	2003	4956.05	4956.61	-0.56
MW-68	2003	4959.40	4958.88	0.52
MW-69	2003	4959.33	4958.14	1.20
MW-70	2003	4967.49	4968.42	-0.93
MW-71R	2003	4956.13	4955.54	0.59
MW-72	2003	4968.55	4968.97	-0.42
MW-73	2003	4967.45	4967.35	0.10
MW-74	2003	4961.85	4965.06	-3.21
MW-75	2003	4965.77	4965.01	0.76
MW-76	2003	4967.22	4966.62	0.60
MW-77	2003	4977.08	4977.11	-0.02
MW-78	2003	4974.97	4974.77	0.20
OB-1	2003	4956.46	4956.24	0.21
OB-2	2003	4957.70	4957.02	0.68
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	4974.23	4975.81	-1.57
MW-24	2004	4981.54	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	4970.94	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

Appendix F

Water Level Residuals
December 1998 to December 2007 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	4967.10	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	4963.65	4963.99	-0.34
MW-48	2004	4962.64	4962.35	0.29
MW-49	2004	4967.96	4968.22	-0.25
MW-51	2004	4981.84	4981.22	0.62
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	4958.75	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	4959.00	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	4965.10	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	4974.54	4974.90	-0.35

Appendix F

Water Level Residuals
December 1998 to December 2007 Simulation

Monitoring Well	Year	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
OB-1	2004	4956.02	4956.10	-0.07
OB-2	2004	4957.22	4956.84	0.38
MW-07	2005	4975.58	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	4981.94	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	4968.06	4968.55	-0.49
MW-21	2005	4982.73	4982.54	0.18
MW-22	2005	4977.38	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	4971.29	4972.53	-1.24
MW-27	2005	4980.90	4978.95	1.95
MW-29	2005	4970.83	4970.55	0.29
MW-30	2005	4969.08	4969.37	-0.28
MW-31	2005	4967.63	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	4971.30	4971.03	0.27
MW-37R	2005	4964.56	4965.80	-1.23
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	4967.71	4968.55	-0.84
MW-44	2005	4966.73	4967.12	-0.40
MW-45	2005	4964.90	4965.73	-0.83
MW-46	2005	4963.81	4964.78	-0.98
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	4963.16	4964.03	-0.87

Appendix F

Water Level Residuals
December 1998 to December 2007 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	4963.11	4963.73	-0.63
MW-58	2005	4961.65	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	4963.06	4963.90	-0.84
MW-65	2005	4958.37	4957.99	0.39
MW-66	2005	4961.42	4962.16	-0.74
MW-67	2005	4955.06	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	4966.88	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	4966.96	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	4976.03	-0.90
MW-09	2006	4969.93	4972.77	-2.84
MW-12	2006	4969.38	4972.91	-3.53
MW-14R	2006	4967.27	4968.85	-1.58
MW-16	2006	4981.87	4981.48	0.39
MW-17	2006	4981.50	4982.61	-1.11
MW-18	2006	4970.92	4974.58	-3.67
MW-19	2006	4968.33	4968.75	-0.41
MW-20	2006	4967.83	4968.46	-0.64
MW-21	2006	4982.64	4982.13	0.51
MW-22	2006	4976.96	4978.99	-2.03
MW-23	2006	4973.90	4975.88	-1.98
MW-24	2006	4981.65	4981.20	0.44
MW-25	2006	4981.84	4981.32	0.52
MW-26	2006	4970.98	4972.41	-1.44
MW-27	2006	4980.89	4978.75	2.14

Appendix F

Water Level Residuals
December 1998 to December 2007 Simulation

Monitoring Well	Year	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-29	2006	4970.55	4970.45	0.10
MW-30	2006	4968.82	4969.27	-0.46
MW-31	2006	4967.38	4967.98	-0.60
MW-32	2006	4967.22	4967.71	-0.49
MW-34	2006	4971.19	4970.90	0.29
MW-37R	2006	4964.25	4965.65	-1.40
MW-38	2006	4970.57	4969.89	0.69
MW-39	2006	4969.11	4968.99	0.12
MW-40	2006	4967.47	4967.90	-0.44
MW-41	2006	4967.63	4967.72	-0.09
MW-42	2006	4967.73	4968.78	-1.05
MW-43	2006	4967.48	4968.46	-0.98
MW-44	2006	4966.57	4966.99	-0.42
MW-45	2006	4964.59	4965.60	-1.01
MW-46	2006	4963.63	4964.64	-1.02
MW-47	2006	4963.11	4963.59	-0.48
MW-48	2006	4962.03	4961.92	0.11
MW-49	2006	4967.53	4967.93	-0.40
MW-51	2006	4981.83	4980.68	1.15
MW-52R	2006	4958.15	4958.31	-0.17
MW-53	2006	4960.41	4959.28	1.13
MW-54	2006	4962.92	4963.86	-0.95
MW-55	2006	4960.85	4961.43	-0.58
MW-56	2006	4961.97	4961.78	0.19
MW-58	2006	4961.20	4960.69	0.51
MW-59	2006	4966.71	4968.66	-1.95
MW-60	2006	4961.88	4961.79	0.09
MW-61	2006	4961.87	4961.89	-0.02
MW-62	2006	4964.02	4964.18	-0.16
MW-63	2006	4973.80	4974.46	-0.66
MW-64	2006	4962.83	4963.74	-0.92
MW-65	2006	4958.13	4957.90	0.23
MW-66	2006	4961.03	4962.03	-1.00
MW-67	2006	4955.01	4955.96	-0.95
MW-68	2006	4958.34	4958.20	0.14
MW-69	2006	4958.22	4957.51	0.71
MW-70	2006	4966.69	4968.01	-1.32
MW-71R	2006	4955.03	4954.85	0.19
MW-72	2006	4967.77	4968.60	-0.83
MW-73	2006	4966.74	4967.07	-0.34
MW-74	2006	4960.47	4964.58	-4.11
MW-75	2006	4964.72	4964.52	0.20

Appendix F

Water Level Residuals
December 1998 to December 2007 Simulation

Monitoring Well	Year	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-76	2006	4965.97	4966.13	-0.16
MW-77	2006	4976.46	4976.86	-0.40
MW-78	2006	4973.94	4974.29	-0.35
OB-1	2006	4955.44	4955.64	-0.20
OB-2	2006	4956.66	4956.40	0.26
MW-07	2007	4975.27	4975.96	-0.69
MW-09	2007	4970.11	4972.67	-2.56
MW-12	2007	4969.50	4972.82	-3.32
MW-14R	2007	4967.52	4968.72	-1.19
MW-16	2007	4981.76	4981.46	0.29
MW-17	2007	4981.42	4982.60	-1.17
MW-18	2007	4973.57	4974.51	-0.94
MW-19	2007	4968.61	4968.62	-0.01
MW-20	2007	4968.10	4968.34	-0.24
MW-21	2007	4982.47	4982.08	0.39
MW-22	2007	4977.14	4978.95	-1.81
MW-23	2007	4974.06	4975.81	-1.75
MW-24	2007	4981.59	4981.18	0.40
MW-25	2007	4981.78	4981.30	0.48
MW-26	2007	4971.22	4972.31	-1.09
MW-27	2007	4980.89	4978.72	2.16
MW-29	2007	4970.72	4970.33	0.38
MW-30	2007	4969.01	4969.15	-0.14
MW-31	2007	4967.63	4967.84	-0.21
MW-32	2007	4967.60	4967.57	0.03
MW-34	2007	4971.28	4970.78	0.49
MW-37R	2007	4964.38	4965.50	-1.12
MW-38	2007	4970.72	4969.77	0.95
MW-39	2007	4969.30	4968.87	0.43
MW-40	2007	4967.75	4967.77	-0.02
MW-41	2007	4968.01	4967.59	0.42
MW-42	2007	4967.96	4968.65	-0.70
MW-43	2007	4967.73	4968.33	-0.60
MW-44	2007	4966.74	4966.85	-0.11
MW-45	2007	4964.69	4965.44	-0.75
MW-46	2007	4963.82	4964.48	-0.66
MW-47	2007	4963.26	4963.42	-0.17
MW-48	2007	4962.20	4961.74	0.47
MW-49	2007	4967.71	4967.80	-0.09
MW-51	2007	4982.02	4980.65	1.37
MW-52R	2007	4958.19	4958.09	0.10
MW-53	2007	4960.44	4959.08	1.36

Appendix F

Water Level Residuals
December 1998 to December 2007 Simulation

Monitoring Well	Year	Water-level Elevation, in feet above MSL		Residual Difference (ft)
		Observed	Computed	
MW-54	2007	4963.16	4963.70	-0.54
MW-55	2007	4960.95	4961.22	-0.28
MW-56	2007	4962.19	4961.58	0.60
MW-58	2007	4961.52	4960.47	1.05
MW-59	2007	4966.91	4968.53	-1.62
MW-60	2007	4962.13	4961.60	0.53
MW-61	2007	4962.04	4961.71	0.32
MW-62	2007	4964.13	4964.02	0.11
MW-63	2007	4975.88	4974.39	1.49
MW-64	2007	4963.18	4963.58	-0.40
MW-65	2007	4958.21	4957.68	0.54
MW-66	2007	4961.20	4961.87	-0.68
MW-67	2007	4954.90	4955.86	-0.96
MW-68	2007	4958.45	4958.02	0.43
MW-69	2007	4958.34	4957.32	1.02
MW-70	2007	4967.01	4967.88	-0.87
MW-71R	2007	4954.99	4954.77	0.22
MW-72	2007	4968.06	4968.47	-0.41
MW-73	2007	4967.13	4966.93	0.20
MW-74	2007	4960.97	4964.70	-3.73
MW-75	2007	4965.30	4964.65	0.66
MW-76	2007	4966.78	4966.21	0.56
MW-77	2007	4976.61	4976.79	-0.18
MW-78	2007	4974.28	4974.21	0.07
OB-1	2007	4955.25	4955.31	-0.06
OB-2	2007	4956.68	4956.13	0.55

Number of active observation points =	561	
Number of inactive observation points =	11	
Mean of residuals =	0.21	ft
Standard Deviation of residuals =	1.09	ft
Sum of squared residuals =	684	ft^2
Mean of absolute residuals =	0.79	ft
Minimum residual =	-3.05	ft
Maximum residual =	4.54	ft
Range in observed heads =	28.46	ft