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Pinellas Environmental Restoration Project

Semiannual Progress Report for the 4.5 Acre Site December 2008 through May 2009

June 2009

U.S. DEPARTMENT OF ENERGY | Legacy Management

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Abbreviations

bls	below land surface
°C	degrees Celsius
cDCE	cis-1,2-dichloroethene
COPC	contaminants of potential concern
CTL	cleanup target level
DCE	dichloroethene
DOE	U.S. Department of Energy
DPE	dual-phase extraction
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
ft	feet
IRA	Interim Remedial Action
LDA	large-diameter auger
µg/L	micrograms per liter
µmhos/cm	micromhos per centimeter
MCL	maximum contaminant level
MDL	method detection limit
mg/L	milligrams per liter
msl	mean sea level
mV	millivolts
NGVD	national geodetic vertical datum
NTU	Nephelometric Turbidity Units
QA/QC	quality assurance/quality control
RBCA	Risk-Based Corrective Action
RPD	relative percent difference
STAR Center	Young - Rainey Science, Technology, and Research Center
TCE	trichloroethene
TCOPC	total contaminants of potential concern
tDCE	trans-1,2-dichloroethene
VC	vinyl chloride
VOCs	volatile organic compounds

1.0 Introduction

The *Pinellas Environmental Restoration Project Semiannual Progress Report 4.5 Acre Site* describes environmental restoration activities for the Pinellas 4.5 Acre Site located in Pinellas County, Largo, Florida (Figure 1). The former U.S. Department of Energy (DOE) Pinellas Plant facility consisted of the 4.5 Acre Site and the Young - Rainey Science, Technology, and Research Center (STAR Center) (Figure 2). The facility was constructed in the mid-1950s as part of a nationwide nuclear weapons research, development, and production complex. Production of weapons-related components ceased in September 1994. However, as a result of these operations, contamination exists in the surficial groundwater beneath the site.

Administration of DOE activities at the 4.5 Acre Site is the responsibility of the DOE Office of Legacy Management in Grand Junction, Colorado. S.M. Stoller Corporation (Stoller), a prime contractor to DOE's Office of Legacy Management, provides technical support to DOE for the remediation and closure of all active solid-waste management units on site and for the 4.5 Acre Site.

The 4.5 Acre Site is located to the northwest of the STAR Center, in the northeast quarter of Section 13, Township 30 South, Range 15 East (Figure 1). DOE owned this parcel from 1957 to 1972, at which time it was sold to a private landowner. During the period of DOE ownership, the property was used for disposal of drums of waste resins and solvents. As a result of this practice, the surficial aquifer was impacted by volatile organic compounds (VOCs), primarily vinyl chloride (VC), toluene, trichloroethene (TCE), and 1,2-dichloroethene (DCE). DOE completed a source removal in 1985.

An Interim Remedial Action (IRA) consisting of groundwater extraction and treatment via air stripping, and a routine groundwater monitoring program were initiated in May 1990. In July 1997, a modification of the IRA, involving the installation of dual-phase extraction (DPE) wells, provided a more aggressive system to remove groundwater contamination. In November 1999, the DPE/air-stripping system was replaced with an in-situ biosparge treatment system.

The *4.5 Acre Site Biosparge System Integration Plan* (DOE 2000) was approved by the Florida Department of Environmental Protection (FDEP) on January 17, 2001. This plan states that performance monitoring would be undertaken on a quarterly basis. Therefore, in April 2001, performance monitoring of the remedial system through the use of direct push technology was undertaken. However, the biosparge systems were shut off in May 2003 with no plans to restart them and no performance monitoring data have been collected since April 2003. Subsequent monitoring was then adapted to fit the new remediation scenario and performance monitoring as defined in the *Interim Remedial Action Plan for Ground Water Recovery at the 4.5 Acre Site* (DOE 2003b).

The IRA Plan for Ground Water Recovery at the 4.5 Acre Site was submitted to FDEP on August 29, 2003, and approved by FDEP on September 19, 2003. Implementation of the IRA Plan commenced on March 8, 2004, when construction activities began on the IRA treatment system. The treatment system consisted of an extraction well field (three recovery wells), pumps and associated piping, a transmission water pipeline, a utility connection, a low profile tray air stripper unit, and effluent piping. The new IRA system began operations on April 26, 2004.

The IRA system was a temporary measure that was outlined in the *Remedial Action Plan for the Pinellas 4.5 Acre Site* (DOE 2001) as a contingency option in the event that biosparging resulted in extending the contaminant plume. In April 2005, the *Pinellas Environmental Restoration Project 4.5 Acre Site Remedial Action Plan Addendum* (DOE 2005) was submitted to FDEP. This document presented a proposed final action for the 4.5 Acre Site that involves the closure of the site using the provisions of the recently adopted State of Florida Global Risk-Based Corrective Action (RBCA) regulations.

Technical discussions between FDEP and DOE regarding the proposed final action continue. Part of DOE's proposed final action for the 4.5 Acre Site was to shut down the IRA system and begin a 2-year monitoring period. Approval from FDEP to shut down the IRA system was received on December 20, 2005, thus commencing the DOE's 2-year monitoring period.

Although DOE has conducted numerous remediation activities at the 4.5 Acre Site since 1985, FDEP in 2005 suggested that, based on elevated levels of VOCs in groundwater, a source of VOCs may remain in the subsurface, and that removal of contaminated soil may be necessary (FDEP 2005). To investigate this concern, 1,172 soil samples were collected from 138 soil borings installed at two areas of the site during the summer of 2007. Analytical results demonstrated that the following contaminants were present in site sediments at concentrations that likely represent a source of contamination to groundwater: TCE; cis-1,2-DCE (cDCE); trans-1,2-DCE (tDCE); and toluene. Results from this characterization effort can be found in the *4.5 Acre Site Source Characterization Data Report* (DOE 2007).

In April 2008, DOE presented a feasibility study that evaluated the available contaminant source removal technologies. The preferred option for source removal at the 4.5 Acre Site was determined to be soil excavation using a large-diameter auger (LDA) and off-site disposal of soil (DOE 2008a). In a letter dated May 17, 2008, FDEP states "the report is acceptable for its intended purpose" and "the preferred option for source removal of soil excavation using large diameter auger and off-site soil disposal is also acceptable to the Department."

An *Interim Remedial Action Plan for Source Removal at the 4.5 Acre Site* (DOE 2008b) was prepared in late July 2008 and approved by FDEP on August 19, 2008. The objective of this IRA was to remove the source of contamination at the site. On March 31, 2009, LDA operations commenced at the 4.5 Acre Site and were completed on May 27, 2009. Two hundred twenty-one large-diameter and 325 small-diameter borings were completed. Approximately 7,035 cubic yards of soil were excavated; of this total, 4,464 cubic yards were removed as clean overburden, and 2,571 cubic yards of contaminated soil were removed, characterized for waste disposal, and disposed of at a Resource Conservation and Recovery Act Subtitle D landfill. Additional information regarding the 4.5 Acre Site LDA work can be found in the *Interim Remedial Action Final Report for Source Removal at the 4.5 Acre Site*. This report will be finalized in the next few months.

This document is the semiannual progress report for the 4.5 Acre Site for December 2008 through May 2009, as requested by FDEP. The results of monitoring activities and a summary of ongoing and projected work are provided in this report.

1.1 Site Activities

- Obtained water-level measurements from all monitoring wells on March 18, 2009.
- Conducted the semiannual sampling event (i.e., collected groundwater samples for VOCs analysis from 38 monitoring wells in March 2009).
- Reported the results of the semiannual sampling event (this document).
- Performed source area removal.
- A stormwater permit was obtained for the 4.5 Acre Site LDA project in February 2009.

2.0 Monitoring Data

2.1 Groundwater Elevations and Flow

On March 18, 2009, depth-to-water measurements were taken in all monitoring wells and former recovery wells at the 4.5 Acre Site. The depth to water in each well was measured with an electronic water-level indicator. The groundwater elevation data are listed in Table 1. Surface water elevations for Pond 5 (southeast of the 4.5 Acre Site), the West Pond (to the east), and the pond immediately north of the 4.5 Acre Site are listed in Table 2. The water elevation data were used to construct contours of water levels in the shallow and deep portions of the surficial aquifer (Figures 3 and 4). Groundwater in the shallow surficial aquifer generally flows to the west/northwest, although in the southeastern part of the site there is a southeastward component of flow toward Pond 5. Groundwater in the deep surficial aquifer generally flows to the west.

The average hydraulic gradient across the site was approximately 0.002 feet per foot in March 2009. This gradient is similar to that observed the previous 2 ½ years at the site. Calculations using Darcy's Law along with approximations of 1 ft/day for hydraulic conductivity and 0.3 for effective porosity indicate that groundwater at the site is estimated to move about 2.5 ft/year. This velocity is on the low end of previously observed velocities of 2 to 10 ft/year.

2.2 Groundwater Sampling

Groundwater samples were collected from 38 monitoring wells at the 4.5 Acre Site in March 2009. Samples from all 38 wells were analyzed for VOCs.

All samples were collected in accordance with the Stoller *Sampling Procedures for the Young - Rainey STAR Center and 4.5 Acre Site* (DOE 2006), using FDEP procedures. All samples were submitted to TestAmerica, Tampa, Florida for analysis. TestAmerica in Tampa, Florida, is accredited by the Florida Department of Health in accordance with the National Environmental Laboratory Accreditation Conference, certification number E84282. VOCs were analyzed using U.S. Environmental Protection Agency method SW-846 8260B. All monitoring wells were micropurged using a dedicated bladder pump, and sampling was performed when the field measurements stabilized. Table 3 lists field measurements of pH, specific conductance, dissolved oxygen, oxidation-reduction potential, turbidity, and temperature recorded at the time the samples were collected. Measurements were made with a flow cell and a multiparameter instrument.

2.3 Groundwater Analytical Results

Table 4 presents individual contaminants of potential concern (COPC) and total COPCs (TCOPCs) concentrations in samples collected from wells at the 4.5 Acre Site. The results from the previous two semiannual sampling events are included in Table 4 for comparison. Figure 5 shows the TCOPCs concentrations for March 2009.

The maximum TCOPCs value detected in September was 2,332 micrograms per liter (µg/L) at PIN20−M060. The compound detected at the highest concentration in PIN20−M060 was VC at a concentration of 2,200 µg/L.

Laboratory reports for semiannual samples collected in March 2009 are provided in Appendix A.

2.4 Quality Assurance/Quality Control

The results from the analytical laboratory, TestAmerica, were checked for quality assurance/quality control (QA/QC) through duplicate samples and trip blanks. For this sampling event, collection of duplicate samples was focused on the Northeast Site and the Building 100 Area at the STAR Center, so no duplicate samples were collected at the 4.5 Acre Site. Duplicate results for the Northeast Site and the Building 100 Area are listed in the *Sitewide Environmental Monitoring Semiannual Progress Report for the Young - Rainey STAR Center*.

As specified in the *Sampling Procedures for the Young - Rainey STAR Center and 4.5 Acre Site* (DOE 2006), duplicate samples should be collected at a frequency of one duplicate for every 20 or fewer samples. For the STAR Center and the 4.5 Acre Site, there were 128 samples collected for volatile analysis and 9 duplicates. There were 30 samples collected for metal analysis and 4 duplicates. The duplicate requirements for this sampling event were met. In addition, 17 trip blanks and 2 equipment blanks were collected during this event.

A data validation software module for identifying and tracking anomalous groundwater data within the SEEPro database was used to generate a report of analytical results that fall outside of historical minimum or maximum values. There were no anomalies associated with these result and the data are acceptable as qualified.

3.0 Data Interpretation

This data interpretation section is included to aid in evaluating plume stability. This section consists of plots showing contaminant concentration trends (Section 3.1), plume maps (Section 3.2), and a discussion of site geochemistry (Section 3.3).

While most of the previous documents for the Pinellas site have compared groundwater contaminant concentrations to drinking water standards (i.e., maximum contaminant levels [MCLs]), those standards are not the applicable default CTLs for the purpose of evaluating site remediation under RBCA. Based on a comprehensive review of background data for the site (DOE 2003a), it has been determined that aluminum and iron levels in the shallow groundwater in the site vicinity are naturally elevated and far exceed State of Florida Secondary Drinking

Water Standards (Chapter 62-550, Florida Administrative Code [F.A.C.]). Specifically, the average background concentration of 1.1 milligrams per liter (mg/L) for aluminum exceeds the 0.2 mg/L secondary standard, and the average background concentration for iron (9.3 mg/L) exceeds the 0.3 mg/L secondary standard. The ambient shallow groundwater in the area is therefore designated as "poor quality" as defined in 62-780.200 (35), F.A.C. Thus, the applicable groundwater CTLs are those for groundwater of "low yield/poor quality" provided in Table 1 of Chapter 62-777, F.A.C. In essence, these CTL values are a factor of 10 higher than the MCL values.

3.1 Contaminant Concentration Trends

Figure 6 and Figure 7 show the cDCE and VC concentration trends in wells PIN20−0502 and −M001, respectively. These two wells, located hydraulically downgradient from the area of highest contaminant concentrations, have shown increasing concentration trends over the last few years. This appears to be a result of past operation of the biosparging system, as described in previous reports. However, it appears that the contaminant concentrations in both wells are now decreasing.

Figure 8 and Figure 9 show TCE, cDCE, and VC concentration trends in wells PIN20−MWL4 and −M063. These two wells are in the area of highest contaminant concentrations on the eastern side of the site. Concentrations in these wells have shown an overall decreasing trend. The contaminant concentrations in well M063 decreased significantly since March 2007. This change may be due to a change in the local hydrology caused by numerous soil borings installed during the summer of 2007.

Figure 10 and Figure 11 show TCE, cDCE, and VC concentration trends in wells PIN20−M060 and −M061. These wells are in the area of elevated contaminant concentrations near the southwest property boundary. The contaminant concentrations in these wells have varied considerably in the past but have been generally stable or decreasing over the last 2 years.

3.2 Plume Maps

Plume maps were generated for TCOPCs (Figure 5) and the individual site COPCs: TCE (Figure 12), cDCE (Figure 13), and VC (Figure 14). The inferred plume boundaries for the individual compounds are the respective CTLs of the compounds. Concentrations that are below the CTL are not included in the individual compound plumes. The TCOPCs map is a summary of the individual compound maps. The plume maps also show the plume boundary from the previous year to show any changes over the last year.

In summary, the 2009 contaminant plume at the 4.5 Acre Site is similar in size to the 2008 plume. No COPCs were detected above the CTL in off-site wells. The plume appears stable in terms of area.

3.3 Geochemical Parameters

Geochemical parameters measured in the field in all wells at the 4.5 Acre Site during March 2009 are summarized in Table 3. Conditions across the site generally are reducing as

evidenced by the low values of dissolved oxygen and oxygen reduction potential. Figures 15 and 16 show the values of dissolved oxygen and oxygen reduction potential for each well.

4.0 Upcoming Tasks

The following major tasks are scheduled during the next semiannual period (June through November 2009).

- Semiannual sampling and analysis of groundwater in August and September 2009.
- Collect water-level measurements in August 2009.

5.0 References

DOE (U.S. Department of Energy), 2000. *4.5 Acre Site Biosparge System Integration Plan*, GJO–2000–182–TAR, MAC–PIN 25.5.1.1, prepared by U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado, December.

DOE (U.S. Department of Energy), 2001. *Remedial Action Plan for the Pinellas 4.5 Acre Site*, U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado, July.

DOE (U.S. Department of Energy), 2003a. *Historical Review and Evaluation of Contaminants of Potential Concern*, GJO-2002-359-TAC, February.

DOE (U.S. Department of Energy), 2003b. *Pinellas Environmental Restoration Project Interim Remedial Action Plan for Ground Water Recovery at the 4.5 Acre Site*, GJO-2003-480-TAC, prepared by U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado, August.

DOE (U.S. Department of Energy), 2005. *Pinellas Environmental Restoration Project 4.5 Acre Site Remedial Action Plan Addendum*, DOE-LM/GJ858-2005, prepared by the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado, April.

DOE (U.S. Department of Energy), 2006. *Pinellas Environmental Restoration Project Sampling Procedures for the Young - Rainey STAR Center and 4.5 Acre Site*, DOE-LM/GJ1159-2006, prepared by U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado, April.

DOE (U.S. Department of Energy), 2007. *4.5 Acre Site Source Characterization Data Report*, DOE-LM/1549-2007, prepared by U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado, December.

DOE (U.S. Department of Energy), 2008a. *4.5 Acre Site Source Removal Feasibility Study*, DOE-LM/1549-2008, prepared by U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado, April.

DOE (U.S. Department of Energy), 2008b. *Interim Remedial Action Plan for Source Removal at the 4.5 Acre Site*, LMS/PIN/N01215, prepared by U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado, July.

FDEP (Florida Department of Environmental Protection), 2005. Letter from John Armstrong (FDEP) to David Ingle (DOE), dated July 7, 2005.

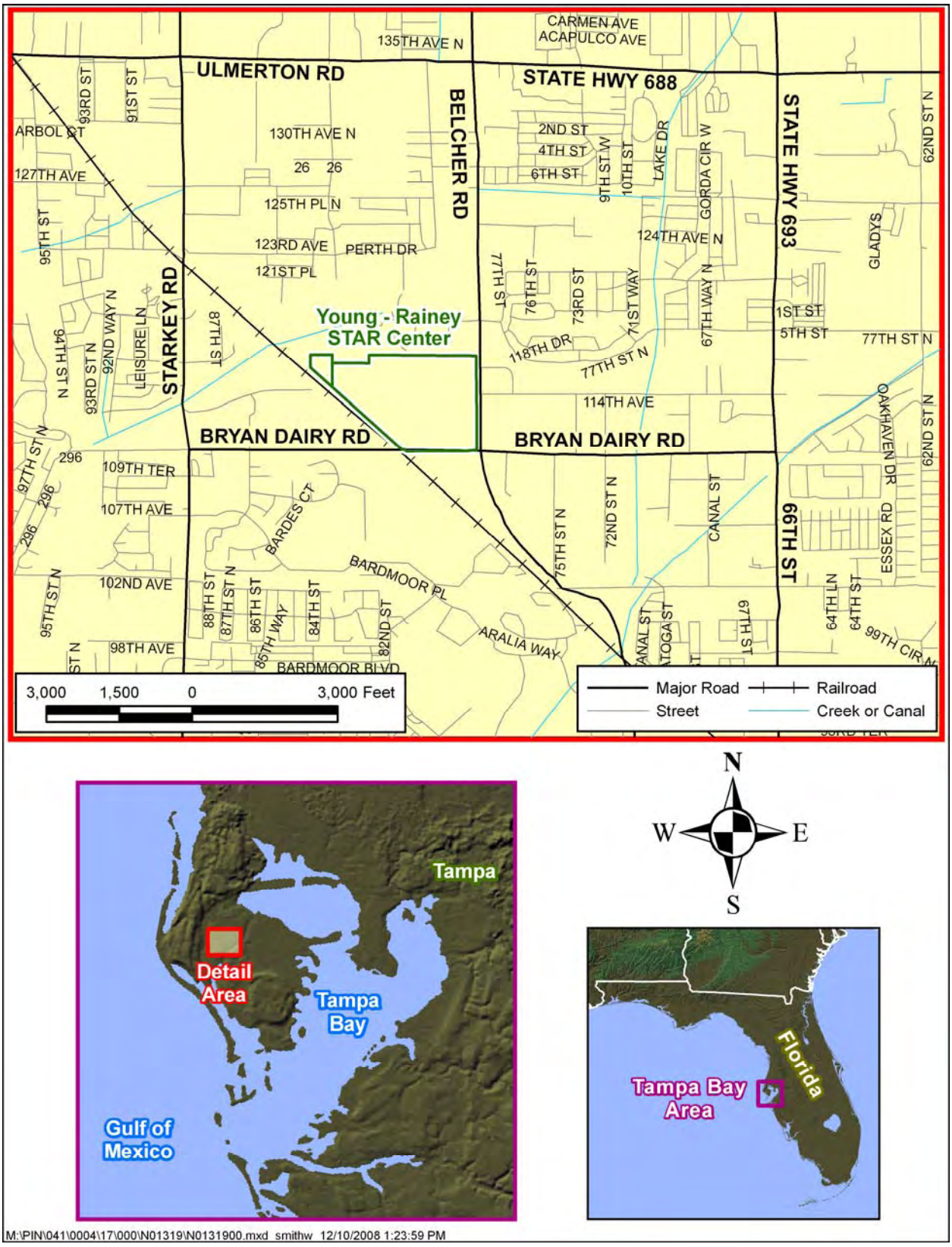

Figure 1. Young - Rainey STAR Center Location

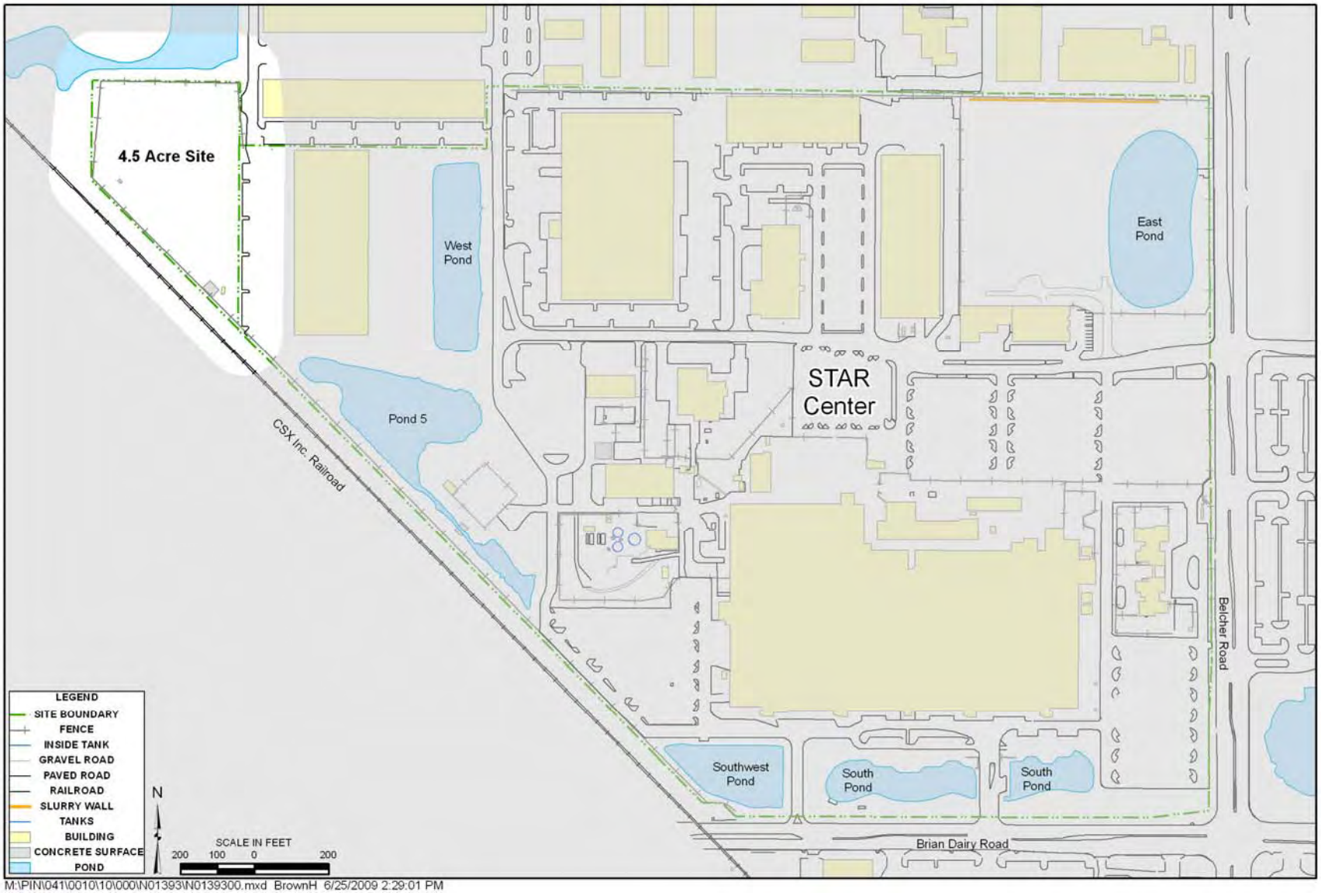

Figure 2. 4.5 Acre Site Location

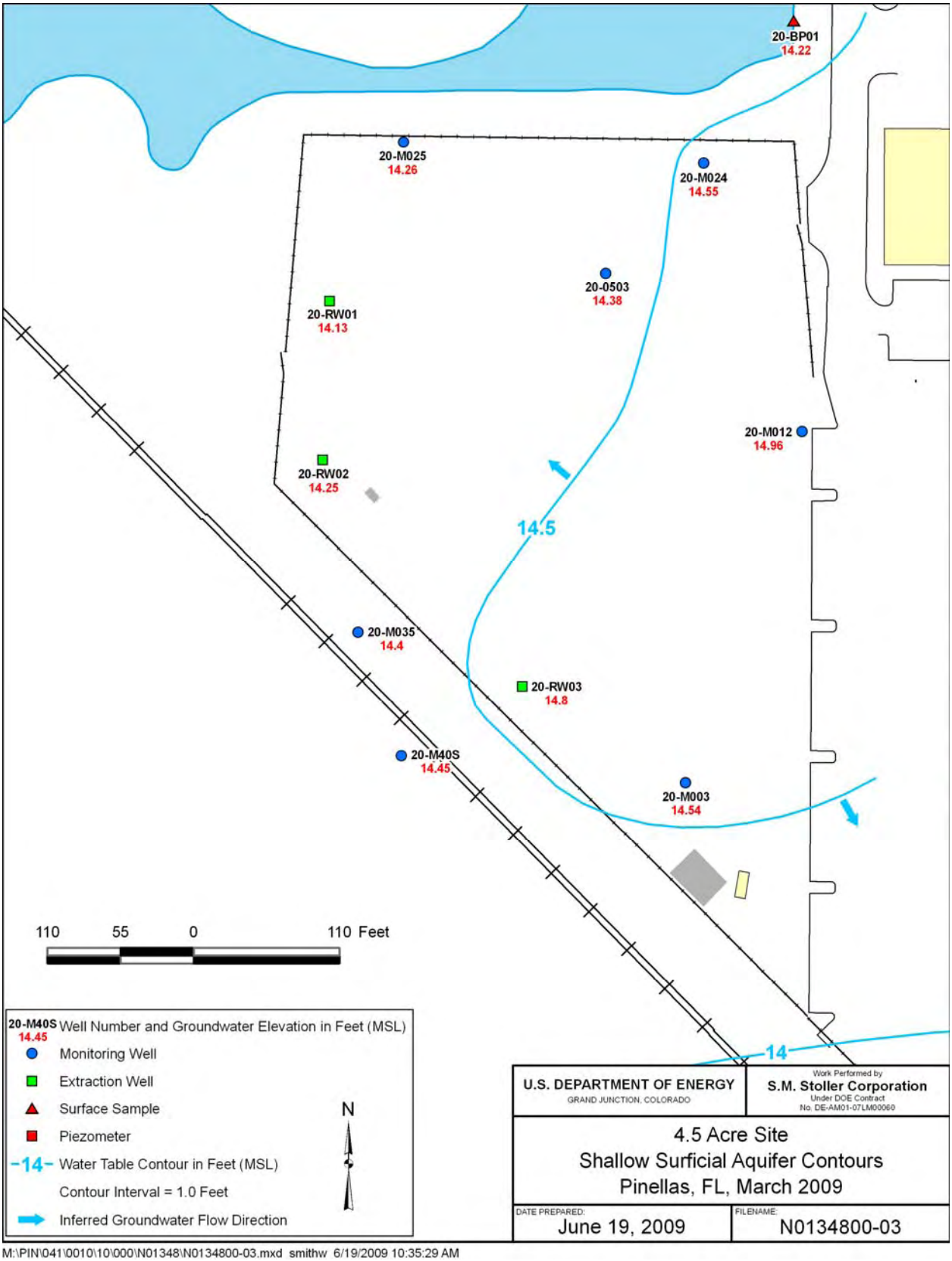

Figure 3. Groundwater Elevations and Shallow Surficial Aquifer Flow, 4.5 Acre Site, March 2009

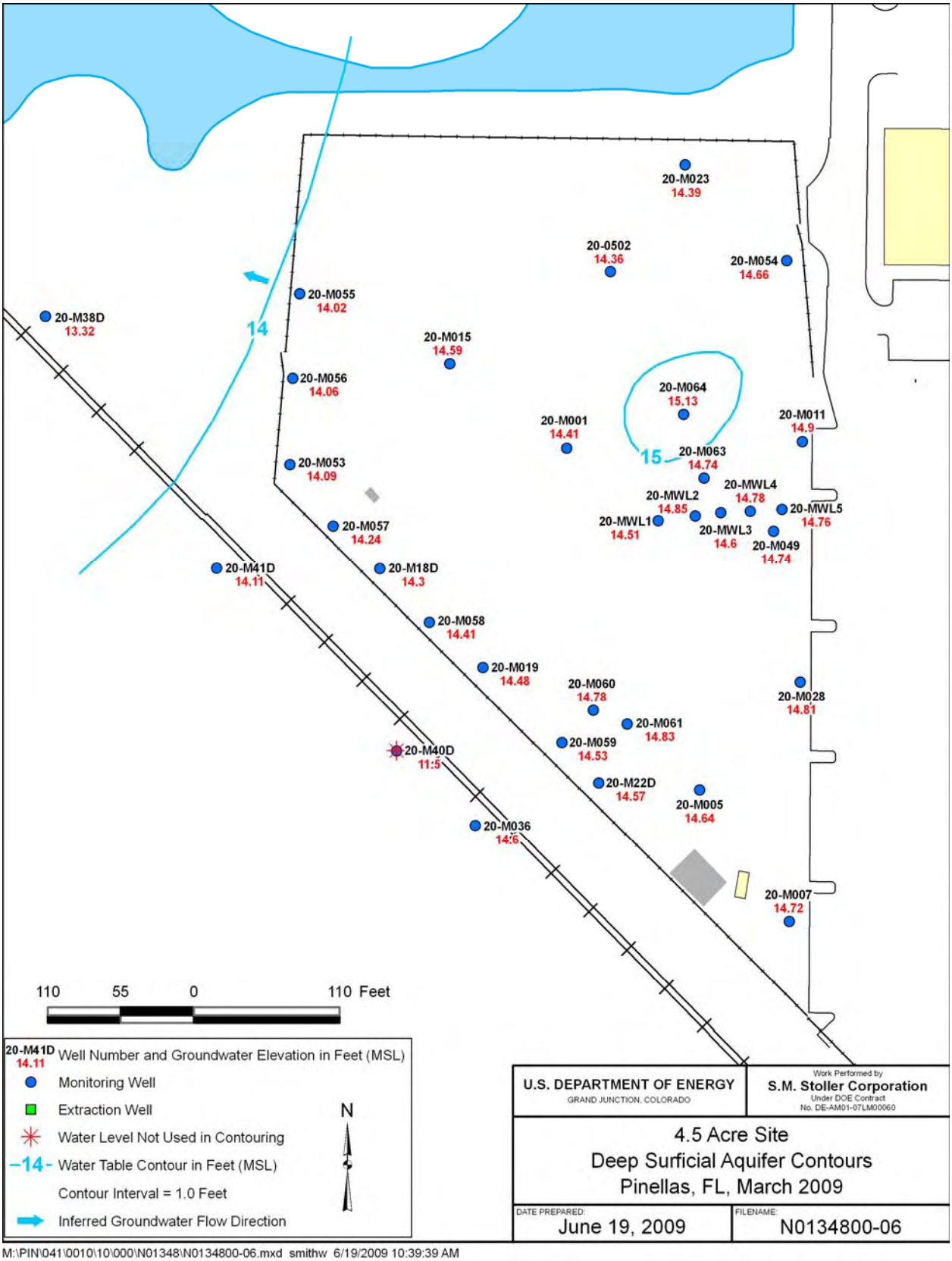

Figure 4. Groundwater Elevations and Deep Surficial Aquifer Flow, 4.5 Acre Site, March 2009

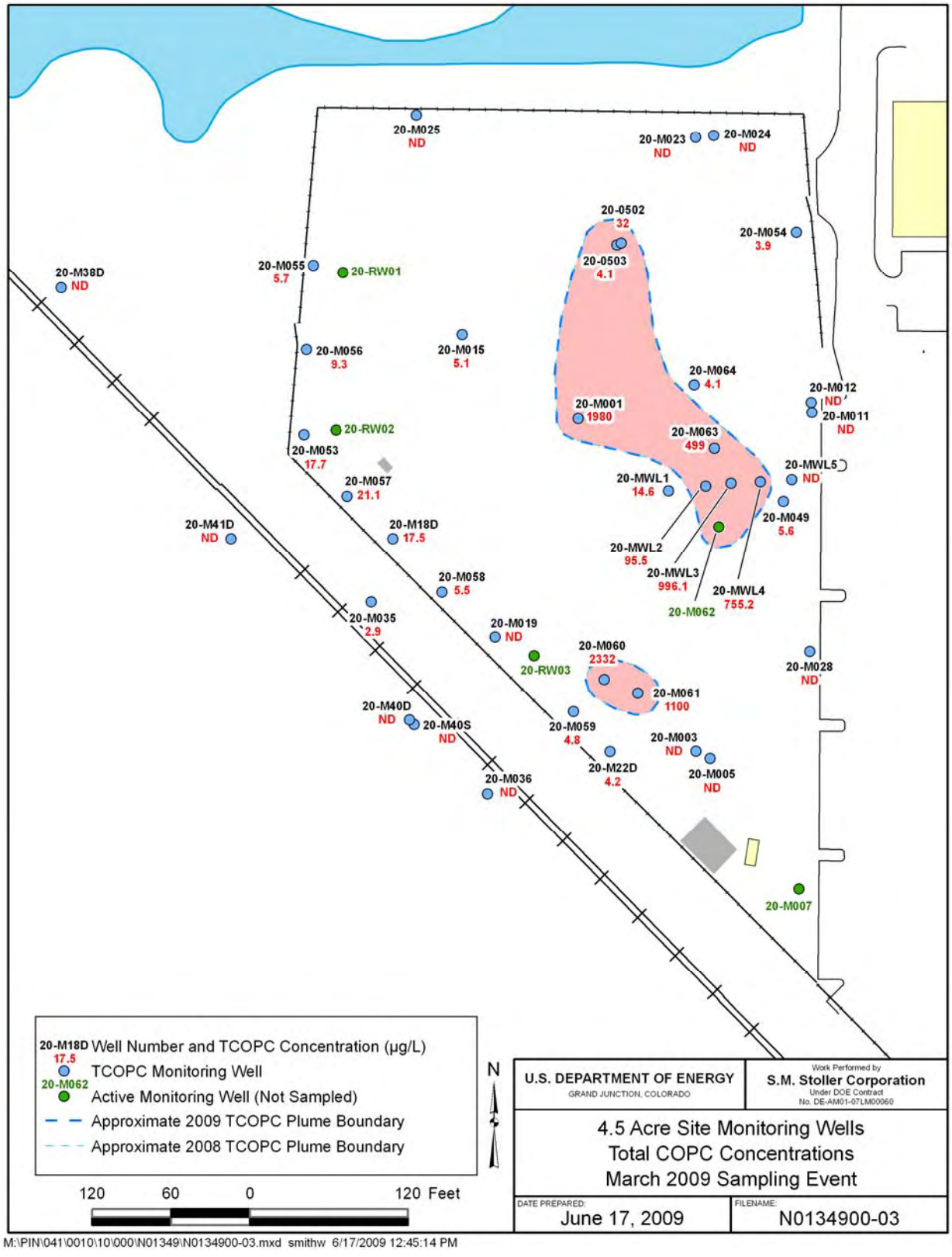

Figure 5. 4.5 Acre Site TCOPC Concentrations March 2009 Sampling Event

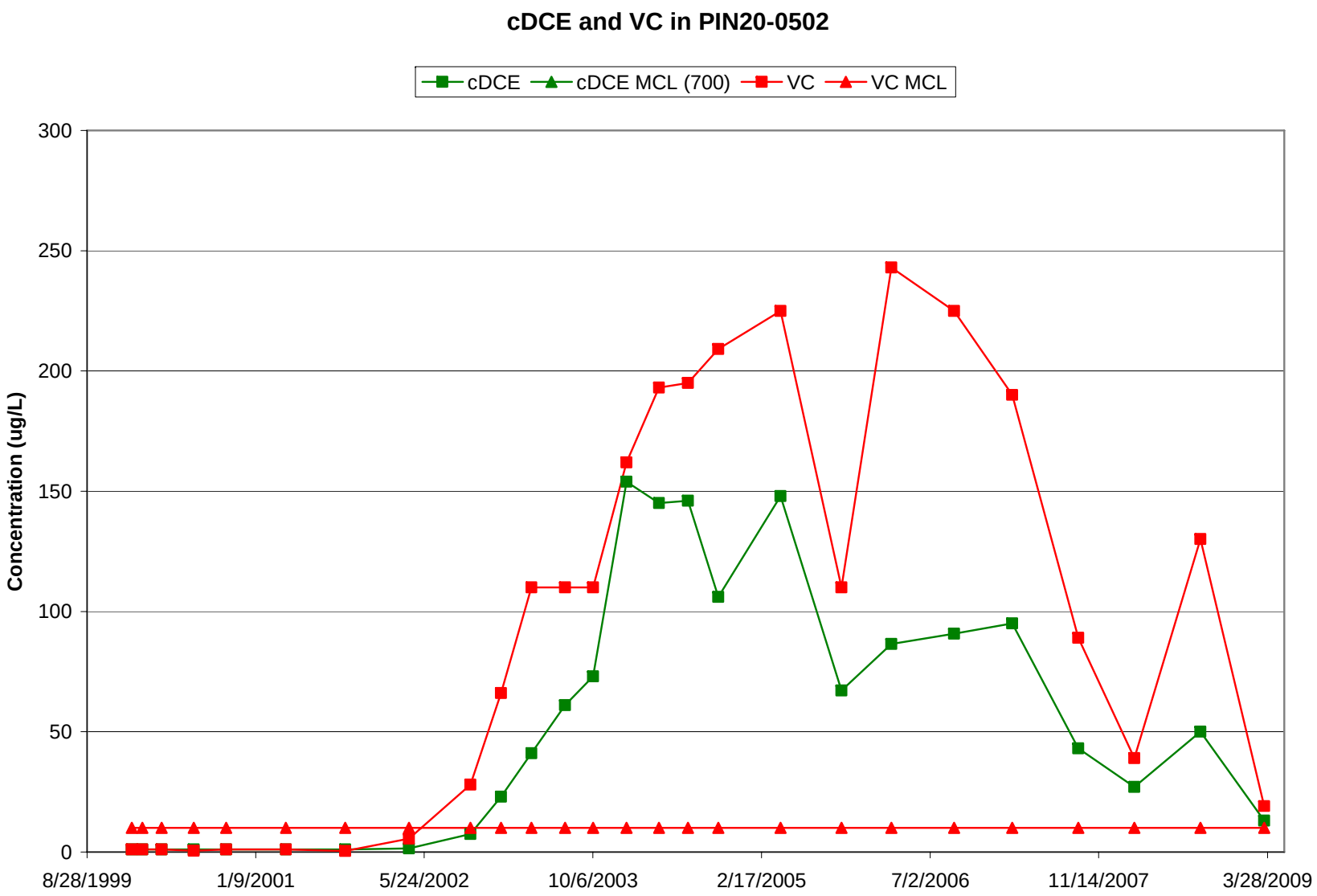

Figure 6. cDCE and VC in PIN20−0502

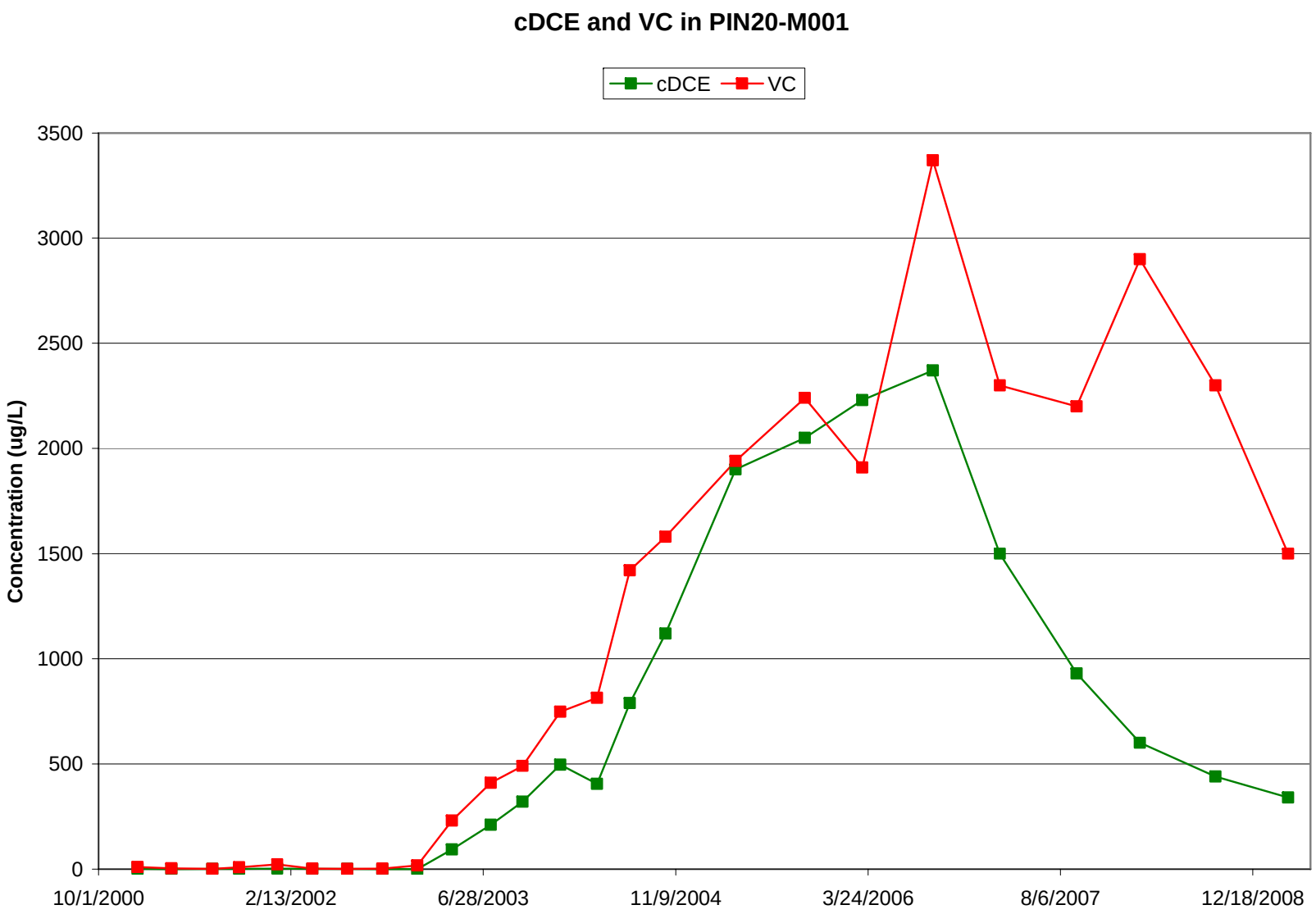

Figure 7. cDCE and VC in PIN20−M001

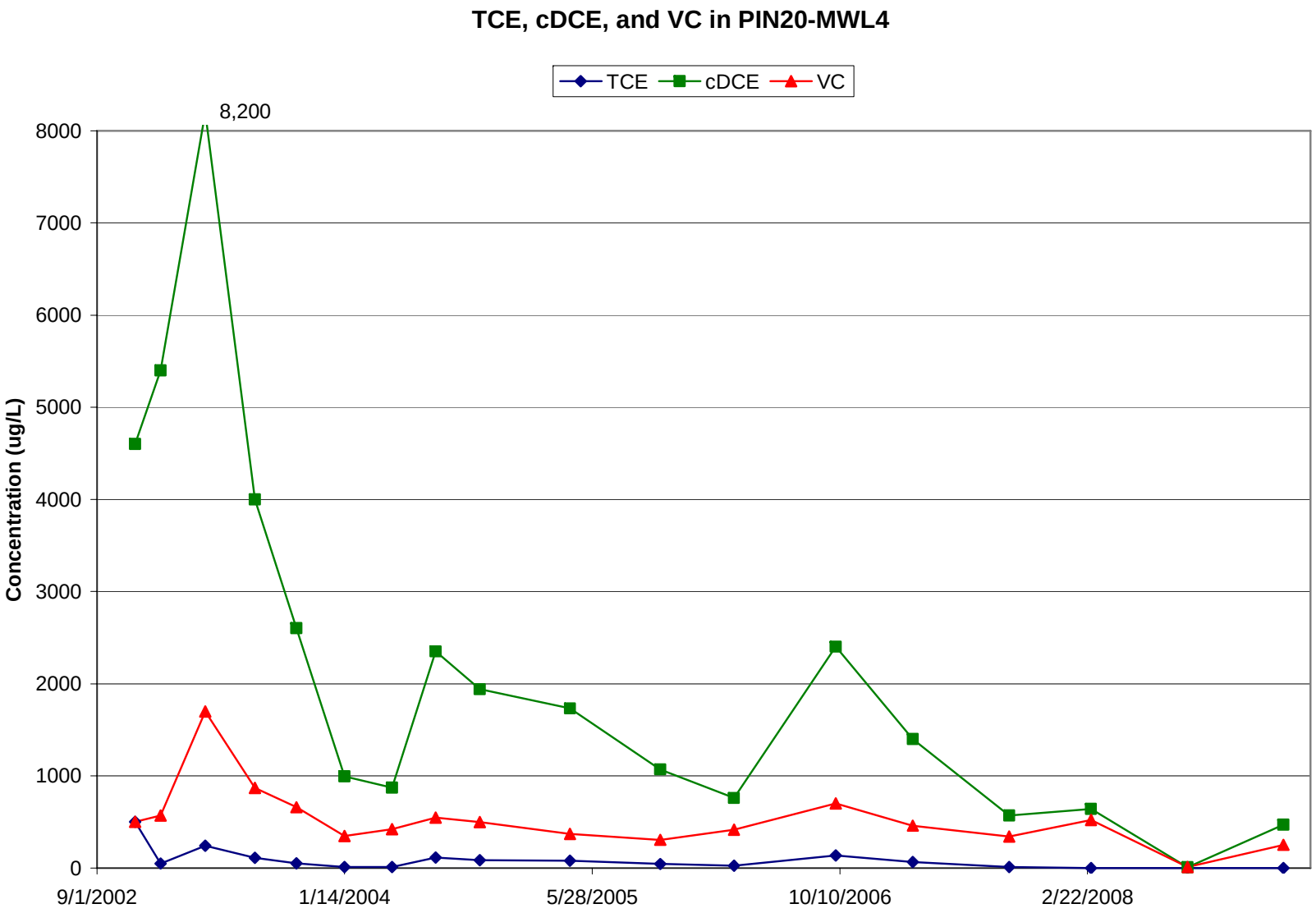

Figure 8. TCE, cDCE, and VC in PIN20−MWL4

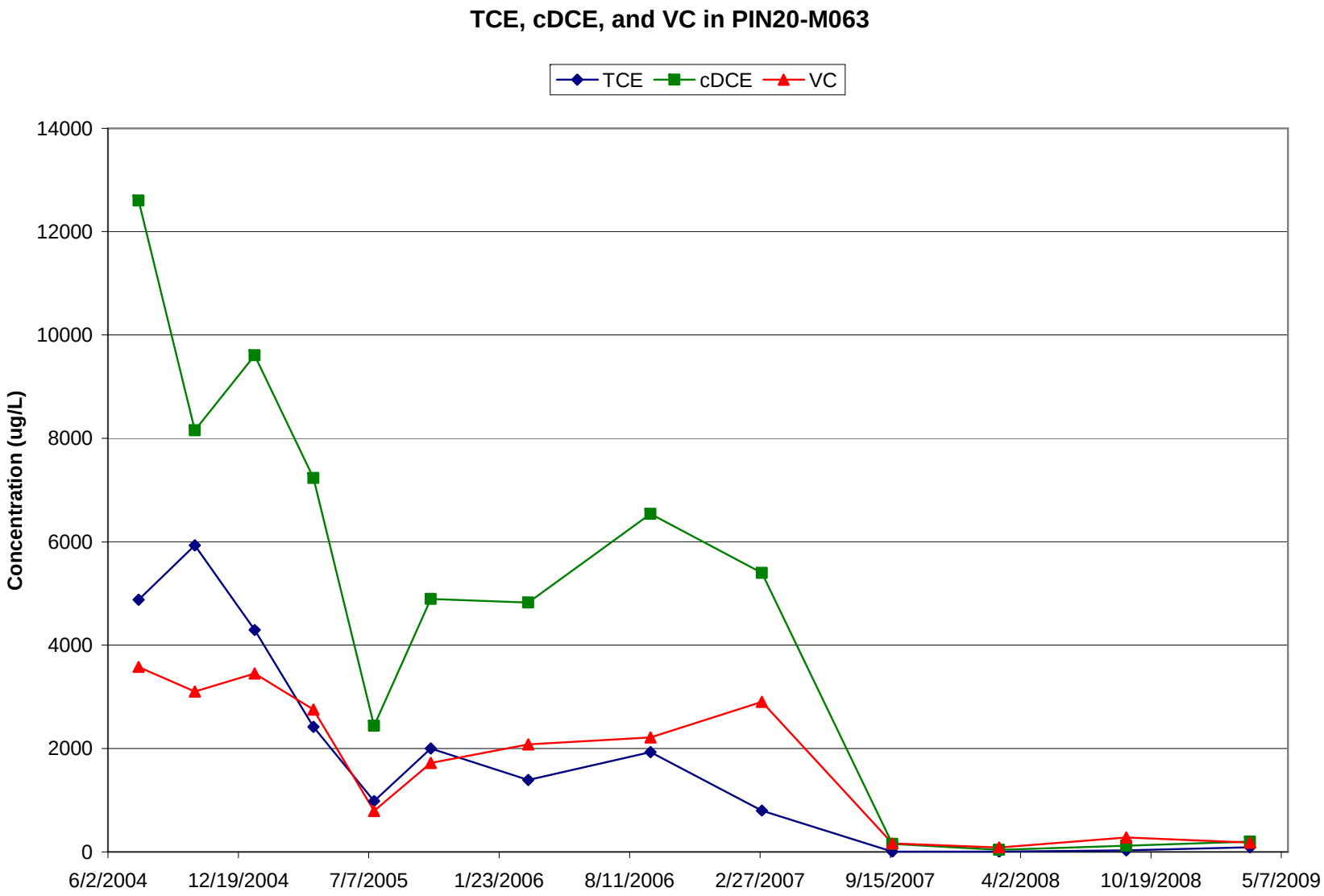

Figure 9. TCE, cDCE, and VC in PIN20−M063

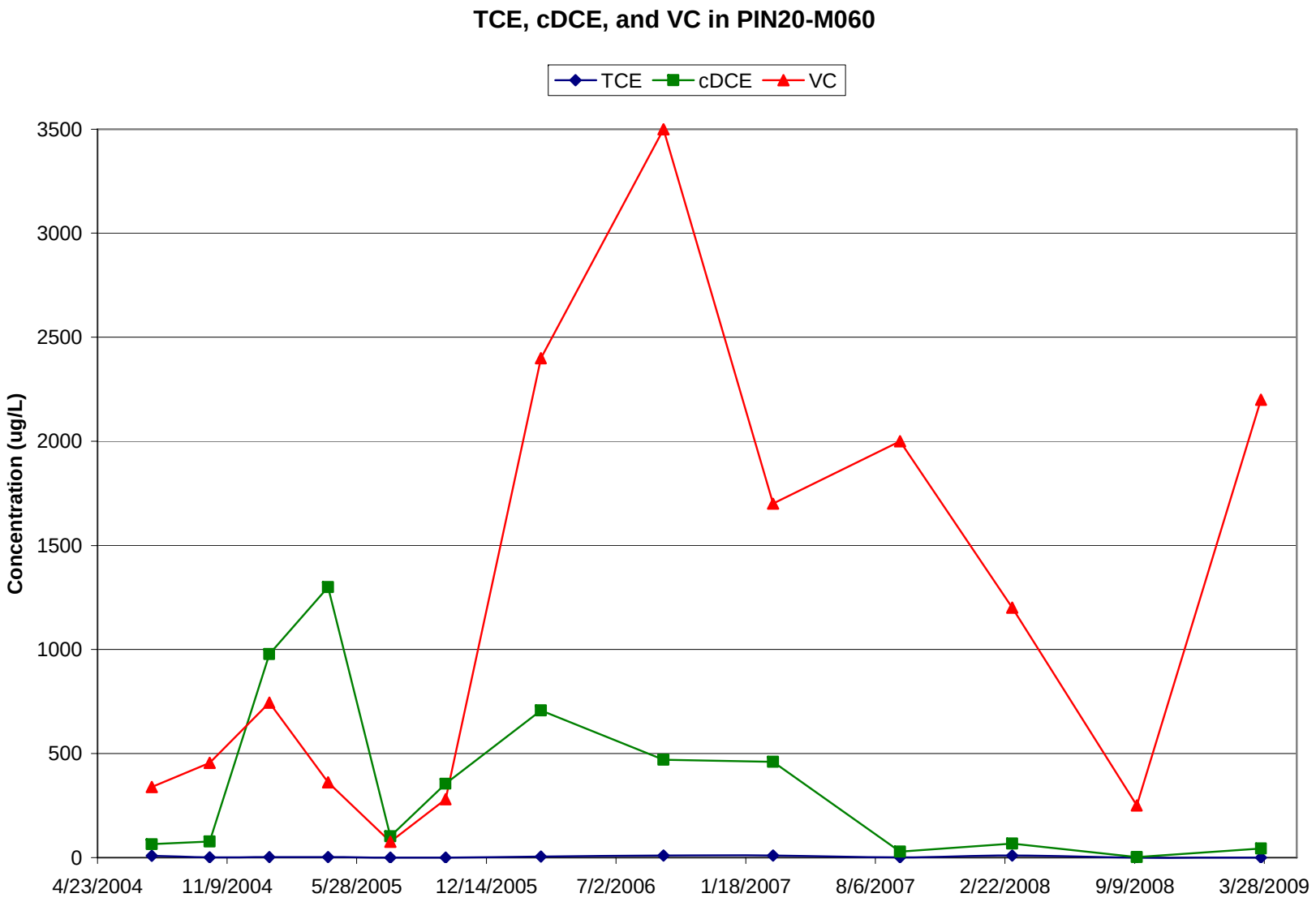

Figure 10. TCE, cDCE, and VC in PIN20−M060

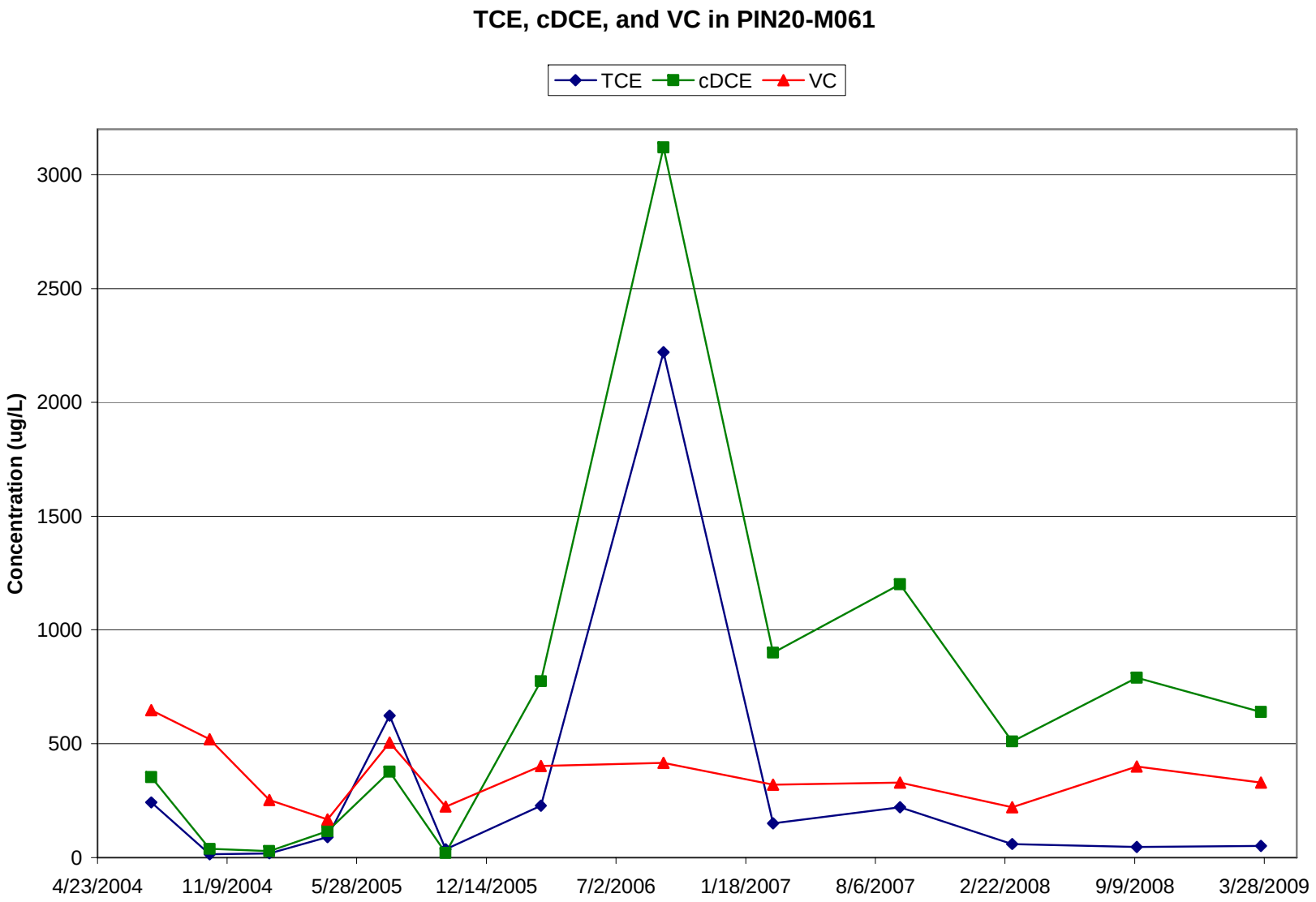

Figure 11. TCE, cDCE, and VC in PIN20−M061

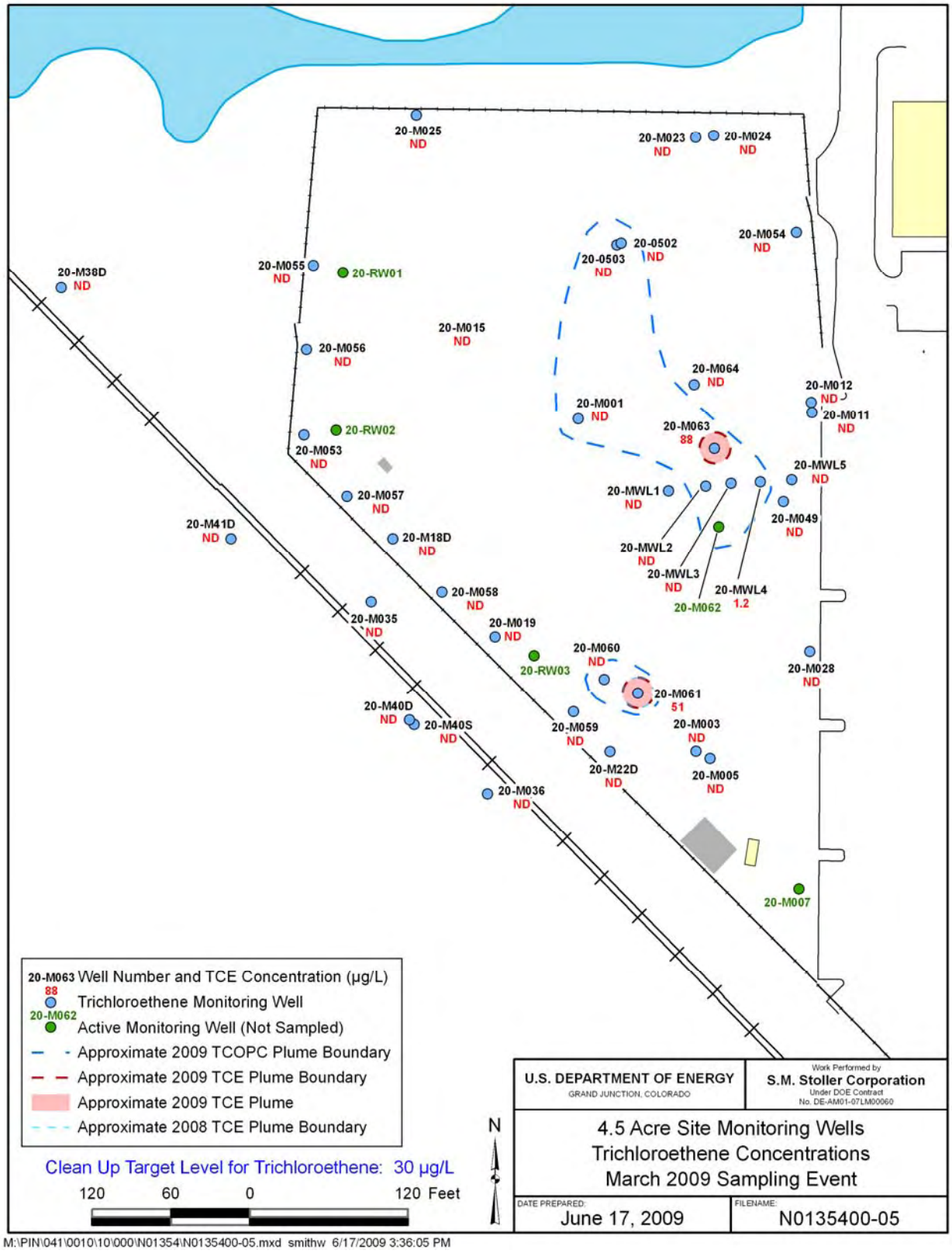

Figure 12. 4.5 Acre Site Trichloroethene Concentrations March 2009 Sampling Event

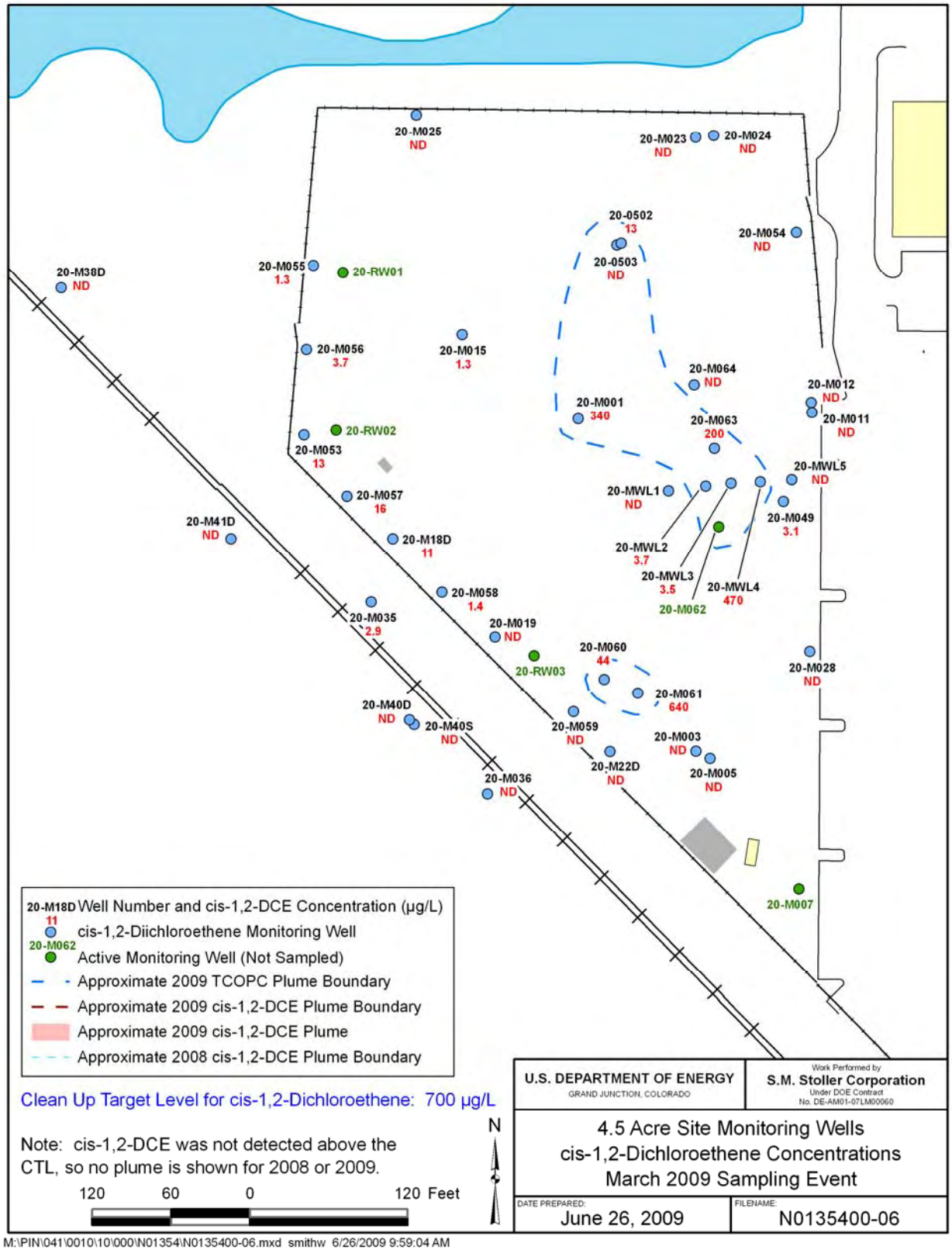

Figure 13. 4.5 Acre Site cis-1,2-Dichloroethene Concentrations March 2009 Sampling Event

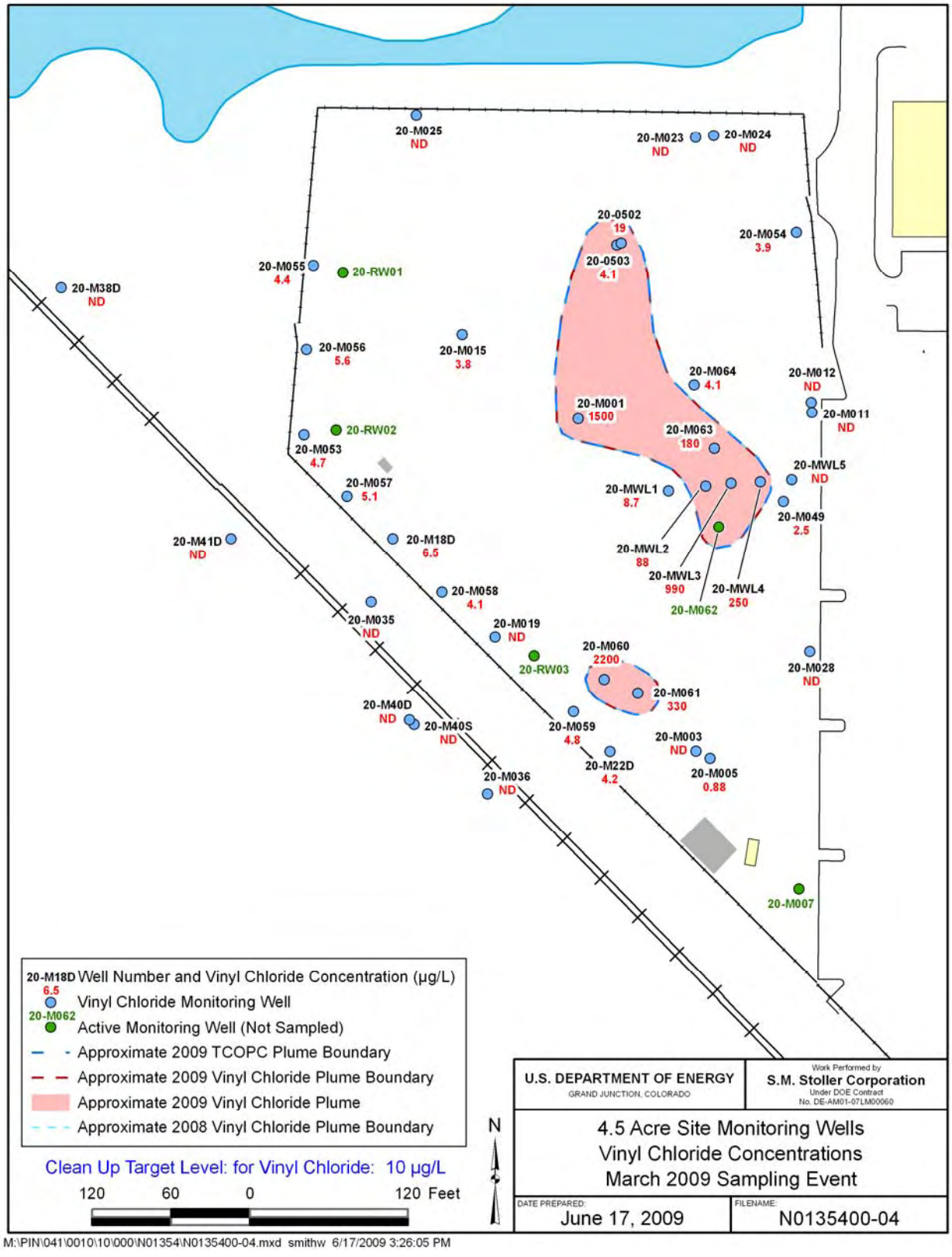

Figure 14. 4.5 Acre Site Vinyl Chloride Concentrations March 2009 Sampling Event

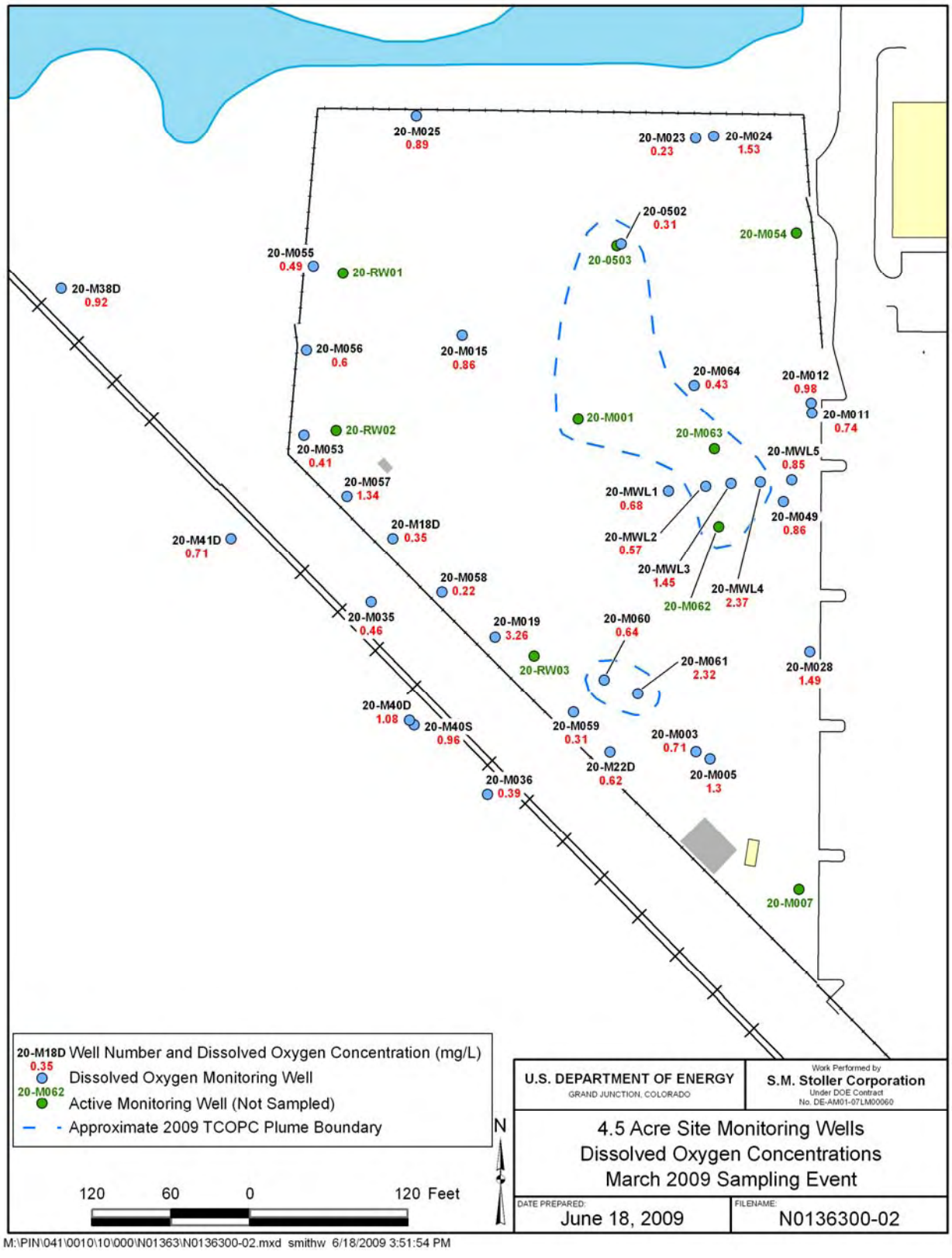

Figure 15. 4.5 Acre Site Dissolved Oxygen Concentrations March 2009 Sampling Event

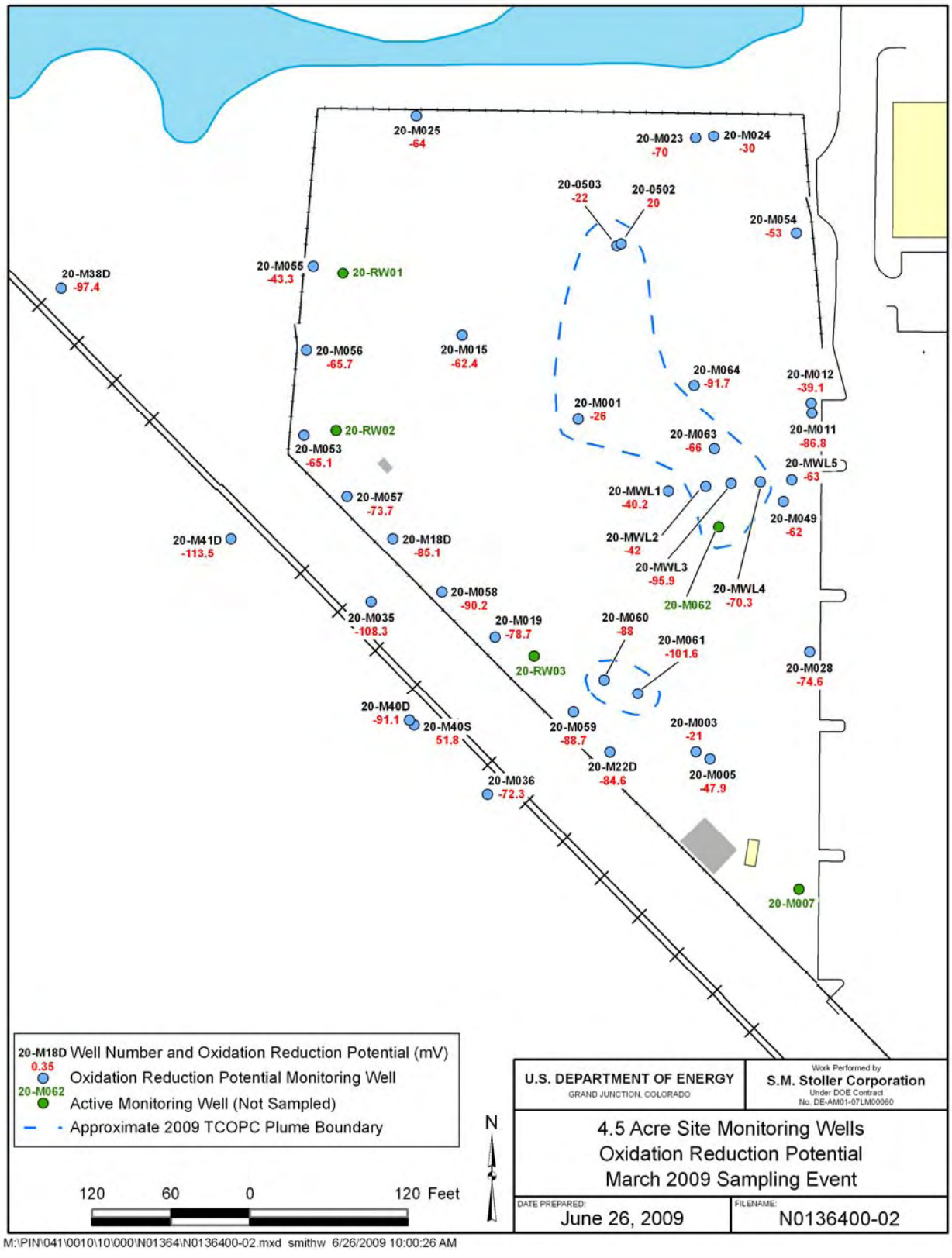

Figure 16. 4.5 Acre Site Monitoring Wells Oxidation Reduction Potential March 2009 Sampling Event

Table 1. Water-Level Data at the 4.5 Acre Site

Location	Measurement		Water Depth From Land Surface (ft)	Groundwater Elevation (ft NGVD)
	Date	Time		
PIN20	**4.5 Acre Site**			
0502	3/18/09	10:04	3.04	14.36
0503	3/18/09	10:09	3.02	14.38
M001	3/18/09	10:23	3.19	14.41
M003	3/18/09	11:14	3.66	14.54
M005	3/18/09	11:11	3.66	14.64
M007	3/18/09	13:49	4.73	14.72
M011	3/18/09	13:45	3.20	14.90
M012	3/18/09	13:38	3.04	14.96
M015	3/18/09	10:15	2.91	14.59
M019	3/18/09	11:23	3.52	14.48
M023	3/18/09	10:00	5.08	14.39
M024	3/18/09	09:59	3.25	14.55
M025	3/18/09	10:01	2.04	14.26
M028	3/18/09	13:47	3.39	14.81
M035	3/18/09	09:02	4.40	14.40
M036	3/18/09	09:09	4.70	14.60
M049	3/18/09	11:02	3.06	14.74
M053	3/18/09	11:35	3.11	14.09
M054	3/18/09	09:56	3.04	14.66
M055	3/18/09	09:13	3.38	14.02
M056	3/18/09	11:36	3.04	14.06
M057	3/18/09	11:32	3.66	14.24
M058	3/18/09	11:28	3.29	14.41
M059	3/18/09	11:19	3.13	14.67
M059	3/18/09	11:21	3.27	14.53
M060	3/18/09	11:38	2.55	14.78
M061	3/18/09	13:51	2.45	14.83
M062*				
M063	3/18/09	10:35	3.36	14.74
M064	3/18/09	11:41	2.58	15.13
M18D	3/18/09	11:30	3.40	14.30
M22D	3/18/09	11:19	3.23	14.57
M38D	3/18/09	08:57	5.18	13.32
M40D	3/18/09	09:04	7.90	11.50
M40S	3/18/09	09:07	4.75	14.45
M41D	3/18/09	08:59	4.99	14.11
MWL1	3/18/09	10:42	3.73	14.51
MWL2	3/18/09	10:38	2.92	14.85
MWL3	3/18/09	10:53	3.10	14.60
MWL4	3/18/09	10:50	2.96	14.78
MWL5	3/18/09	10:59	3.81	14.76
RW01	3/18/09	10:10	3.47	14.13
RW02	3/18/09	11:34	2.85	14.25
RW03	3/18/09	11:23	2.80	14.80

* M062 Well is damaged, no reading possible

Table 2. 4.5 Acre Site Surface Water Elevations

Location	Measurement		Surface Water Elevation (ft NGVD)
	Date	Time	
PIN01	**Pond 5**		
P501	3/18/09	15:00	13.46
P502	3/18/09	14:52	13.79
PIN02	**West Pond**		
W005	3/18/09	14:30	14.25
PIN20	**4.5 Acre Site**		
BP01	3/18/09	13:56	14.22

Table 3. Field Measurements of Samples Collected at the 4.5 Acre Site

Location	Screen Depth (ft bls)	Temperature (°C)	Specific Conductance (µmhos/cm)[a]	Turbidity (NTU)	pH	Oxidation Reduction Potential (mV)	Dissolved Oxygen (mg/L)
PIN20	**4.5 Acre Site**						
0502	21.2–31.2	23.96	1,491	4.46	6.89	20	0.31
0503	13.2–23.2	22.52	1,752	48.1	6.7	-22	-
M001	20–25	22.87	1,612	8.47	6.64	-26	0.1
M003	9–14	21	1,181	1.12	6.88	-21	0.71
M005	25.8–30.7	22.64	1,011	1.37	6.96	-47.9	1.3
M011	23.7–28.7	21.86	916	10.1	6.81	-86.8	0.74
M012	8.6–13.6	19.82	783	9.9	6.82	-39.1	0.98
M015	20.8–25.8	21.24	1,303	2.5	6.82	-62.4	0.86
M019	22–27	19.37	2,092	13.1	6.89	-78.7	3.26
M023	19.8–24.8	24.12	1,005	13.4	6.75	-70	0.23
M024	8.7–13.7	23.27	827	2.68	6.8	-30	1.53
M025	8.6–13.6	22.36	2,197	17.2	6.61	-64	0.89
M028	22–27	22.59	917	9.7	6.8	-74.6	1.49
M035	9–14	20.98	2,542	14.3	6.86	-108.3	0.46
M036	25–30	22.51	839	18.7	6.88	-72.3	0.39
M049	20–30	22.19	1,075	138	6.63	-62	0.86
M053	20–30	24.22	1,615	35.6	6.86	-65.1	0.41
M054	20–30	22.12	1,234	16.5	6.75	-53	-
M055	21–31	24.53	1,390	11.4	6.86	-43.3	0.49
M056	19–29	23.7	1,595	4.54	6.81	-65.7	0.6
M057	20–30	21.85	2,035	9	6.84	-73.7	1.34
M058	18–28	23.8	1,734	61.1	6.89	-90.2	0.22
M059	19–29	22.55	1,611	32.6	6.84	-88.7	0.31
M060	18–28	21.93	954	7.64	6.95	-88	0.64
M061	20–30	20.41	1,171	5.5	6.93	-101.6	2.32
M063	19.5–29.5	23.32	2,312	30.5	6.22	-66	-
M064	15–25	23.34	2,901	80.3	6.43	-91.7	0.43
M18D	20–30	22.44	2,010	15.3	6.89	-85.1	0.35
M22D	20–30	22.56	1,363	1.6	6.85	-84.6	0.62
M38D	20–30	21.17	834	14.3	6.95	-97.4	0.92
M40D	18–28	21.63	2,078	26.5	6.76	-91.1	1.08
M40S	4–14	19.77	247	4.8	6.27	51.8	0.96
M41D	16–26	21.41	1,984	20	6.86	-113.5	0.71
MWL1	21–26	21.88	2,446	5.3	5.97	-40.2	0.68
MWL2	21–26	21.33	2,705	4	6.29	-42	0.57
MWL3	21–26	21.91	1,939	7.8	6.39	-95.9	1.45
MWL4	20.8–25.8	20.42	856	4.5	6.88	-70.3	2.37
MWL5	20.8–25.8	21.68	828	2.66	6.69	-63	0.85

[a]Temperature corrected to 25 °C
- = not measured

Table 4. COPC Concentrations from Wells at the 4.5 Acre Site[a]
(reported in micrograms per liter)

Location	Screen Depth (ft)	Date Sampled	TCE	cis-1,2-DCE	trans-1,2-DCE	Total 1,2-DCE[b]	Vinyl chloride	Benzene	Total COPC[c]
	CTL		**30**	**700**	**1,000**	**630**	**10**	**10**	
PIN20	**4.5 Acre Site**								
0502	21.2–31.2	2/27/08	<0.5	27	<0.44	27	39	<0.5	66
		9/10/08	<0.5	50	0.59J	50	130	<0.5	180
		3/19/09	<0.5	13	<0.44	13	19	<0.5	32
0503	13.2–23.2	2/27/08	<0.5	<0.65	<0.44	ND	0.79J	<0.5	ND
		9/10/08	<0.5	<0.65	<0.44	ND	3.1	<0.5	3.1
		3/20/09	<0.5	<0.65	<0.44	ND	4.1	<0.5	4.1
M001	20–25	2/29/08	<12	600	68	668	2,900	<12	3,568
		9/12/08	4	440	70	510	2,300	2.4	2,816.4
		3/20/09	<12	340	140	480	1,500	<12	1,980
M003	9–14	3/4/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		9/15/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		3/23/09	<5	<6.5	<4.4	ND	<5	<5	ND
M005	25.8–30.7	3/4/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		9/15/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		3/23/09	<0.5	<0.65	<0.44	ND	0.88J	<0.5	ND
M011	23.7–28.7	3/3/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		9/15/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		3/20/09	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M012	8.6–13.6	3/3/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		9/15/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		3/20/09	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M015	20.8–25.8	2/29/08	<0.5	<0.65	<0.44	ND	1.4	<0.5	1.4
		9/12/08	<0.5	<0.65	<0.44	ND	3	<0.5	3
		3/19/09	<0.5	1.3	<0.44	1.3	3.8	<0.5	5.1
M019	22–27	3/3/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		9/12/08	<0.5	0.71J	<0.44	0.71J	0.8J	<0.5	ND
		3/23/09	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M023	19.8–24.8	2/27/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		9/10/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		3/19/09	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M024	8.7–13.7	2/27/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		9/11/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		3/19/09	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M025	8.6–13.6	2/27/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		9/10/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		3/19/09	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M028	22–27	3/3/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		9/12/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		3/20/09	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND

Table 4 (continued). COPC Concentrations from Wells at the 4.5 Acre Site[a] (reported in micrograms per liter)

Location	Screen Depth (ft)	Date Sampled	TCE	cis-1,2-DCE	trans-1,2-DCE	Total 1,2-DCE[b]	Vinyl chloride	Benzene	Total COPC[c]
	CTL		30	700	1,000	630	10	10	
M035	9–14	2/28/08	<0.5	2.8	0.52J	2.8	<0.5	<0.5	2.8
		9/15/08	<0.5	2.4	<0.44	2.4	<0.5	<0.5	2.4
		3/19/09	<0.5	2.9	<0.44	2.9	<0.5	<0.5	2.9
M036	25–30	2/28/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		9/15/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		3/19/09	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M049	20–30	2/29/08	<0.5	2.8	0.59J	2.8	4.7	<0.5	7.5
		9/11/08	<0.5	5.8	0.56J	5.8	7.5	<0.5	13.3
		3/23/09	<0.5	3.1	<0.44	3.1	2.5	<0.5	5.6
M053	20–30	2/28/08	<0.5	7.7	<0.44	7.7	1.4	<0.5	9.1
		9/12/08	<0.5	10	<0.44	10	2.1	<0.5	12.1
		3/19/09	<0.5	13	<0.44	13	4.7	<0.5	17.7
M054	20–30	2/27/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		9/10/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		3/20/09	<0.5	<0.65	<0.44	ND	3.9	<0.5	3.9
		4/6/09	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M055	21–31	2/27/08	<0.5	0.66J	<0.44	0.66J	0.68J	<0.5	ND
		9/12/08	<0.5	1.6	<0.44	1.6	2	<0.5	3.6
		3/19/09	<0.5	1.3	<0.44	1.3	4.4	<0.5	5.7
M056	19–29	2/27/08	<0.5	3.1	<0.44	3.1	2.5	<0.5	5.6
		9/12/08	<0.5	3.1	<0.44	3.1	2.8	<0.5	5.9
		3/19/09	<0.5	3.7	<0.44	3.7	5.6	<0.5	9.3
M057	20–30	2/28/08	<0.5	12	<0.44	12	1.8	<0.5	13.8
		9/12/08	<0.5	13	0.48J	13	3	<0.5	16
		3/20/09	<0.5	16	<0.44	16	5.1	<0.5	21.1
M058	18–28	3/3/08	<0.5	1.6	0.46J	1.6	<0.5	<0.5	1.6
		9/12/08	<0.5	2.3	<0.44	2.3	2.3	<0.5	4.6
		3/20/09	<0.5	1.4	<0.44	1.4	4.1	<0.5	5.5
M059	19–29	3/3/08	<0.5	<0.65	<0.44	ND	4.1	<0.5	4.1
		9/12/08	<0.5	1.4	0.5J	1.4	8.3	<0.5	9.7
		3/20/09	<0.5	<0.65	<0.44	ND	4.8	<0.5	4.8
M060	18–28	3/4/08	<10	67	55	122	1,200	<10	1,322
		9/12/08	<0.5	2.1	3.5	5.6	250	<0.5	255.6
		3/23/09	<0.5	44	88	132	2,200	<0.5	2,332
M061	20–30	3/4/08	59	510	60	570	220	<0.5	849
		9/12/08	46	790	83	873	400	<0.5	1,319
		3/23/09	51	640	79	719	330	<0.5	1,100
M062	20–30	2/29/08	<0.5	130	1.5	131.5	350	<0.5	481.5
M063	19.5–29.5	2/29/08	5.3	38	5.1	43.1	86	<1	134.4
		9/11/08	26	120	22	142	280	0.52J	448
		3/20/09	88	200	31	231	180	<1	499
M064	15–25	2/29/08	<0.5	0.98J	<0.44	0.98J	2.3	<0.5	2.3
		9/12/08	<0.5	<0.65	<0.44	ND	1.2	<0.5	1.2
		3/19/09	<0.5	<0.65	<0.44	ND	4.1	<0.5	4.1

Table 4 (continued). COPC Concentrations from Wells at the 4.5 Acre Site[a] (reported in micrograms per liter)

Location	Screen Depth (ft)	Date Sampled	TCE	cis-1,2-DCE	trans-1,2-DCE	Total 1,2-DCE[b]	Vinyl chloride	Benzene	Total COPC[c]
	CTL		30	700	1,000	630	10	10	
M18D	20–30	2/28/08	<0.5	7.4	0.59J	7.4	5.1	<0.5	12.5
		9/12/08	<0.5	7.5	0.57J	7.5	6.1	<0.5	13.6
		3/20/09	<0.5	11	<0.44	11	6.5	<0.5	17.5
M22D	20–30	3/3/08	<0.5	<0.65	<0.44	ND	0.71J	<0.5	ND
		9/15/08	<0.5	<0.65	<0.44	ND	0.77J	<0.5	ND
		3/20/09	<0.5	<0.65	<0.44	ND	4.2	<0.5	4.2
M38D	20–30	2/28/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		9/15/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		3/19/09	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M40D	18–28	2/28/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		9/15/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		3/19/09	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M40S	4–14	2/28/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		9/15/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		3/19/09	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
M41D	16–26	2/28/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		9/15/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		3/19/09	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
MWL1	21–26	3/1/08	<0.5	<0.65	<0.44	ND	6.5	3.3	9.8
		9/11/08	<0.5	<0.65	<0.44	ND	7.6	2.7	10.3
		3/20/09	<0.5	<0.65	<0.44	ND	8.7	5.9	14.6
MWL2	21–26	2/29/08	<0.5	2.6	4.8	7.4	43	0.56J	50.4
		9/11/08	<0.5	<0.65	2.9	2.9	73	<0.5	75.9
		3/23/09	<0.5	3.7	3.8	7.5	88	<0.5	95.5
MWL3	21–26	2/29/08	<5	<6.5	5.2J	5.2J	1,000	<5	1,000
		9/11/08	<0.5	4	2.5	6.5	840	<0.5	846.5
		3/23/09	<0.5	3.5	2.6	6.1	990	<0.5	996.1
MWL4	20.8–25.8	2/29/08	<5	640	33	673	520	<5	1,193
		9/11/08	<0.5	8.5	0.53J	8.5	12	<0.5	20.5
		3/23/09	1.2	470	34	504	250	<0.5	755.2
MWL5	20.8–25.8	2/29/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		9/11/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
		3/23/09	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND
MWL6	21.5–26.5	3/4/08	<0.5	<0.65	<0.44	ND	<0.5	<0.5	ND

[a]"<" values are reporting limits.
[b]Total 1,2–DCE is the sum of cDCE and tDCE.
[c]Total COPC is the sum of the individual COPC concentrations. The cDCE and tDCE values are not part of the total COPC value because these values are included in the total 1,2–DCE value. "J" values are not included in the total COPC value.
ND = Not detected.
J = Estimated value, result is between the reporting limit and the method detection limit.