TETRA TECH

Ken Eden
Project Manager

June 19, 2009

Ms. Christine Wagner (3HS32)
On-Scene Coordinator
U.S. Environmental Protection Agency Region 3
1650 Arch Street
Philadelphia, PA 19103

Subject: Draft Assessment Report for Battlefield Golf Club Site April 2009
EPA Contract No. EP-S3-05-02
Technical Direction Document No. E33-020-09-04-003
Document Tracking No. 0748

Dear Ms. Wagner:

Tetra Tech EM Inc. (Tetra Tech) is submitting the draft assessment report for the Battlefield Golf Club Fly Ash Assessment site summarizing sampling activities conducted in April 2009. If you have any questions regarding this report, please contact me by phone at (215) 681-0722 or via electronic mail at ken.eden@ttemi.com.

Sincerely,

Ken Eden

Ken Eden
Project Manager

Enclosure

cc: TDD File

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DRAFT TRIP REPORT
FOR THE
BATTLEFIELD GOLF CLUB SITE
CHESAPEAKE, VIRGINIA

Prepared for

U.S. Environmental Protection Agency Region 3
1650 Arch Street
Philadelphia, Pennsylvania 19103

Submitted by

Tetra Tech EM Inc.
7 Creek Parkway
Boothwyn, Pennsylvania 19061

EPA Contract No. EP-S3-05-02

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June 19, 2009

Prepared by

Ken Eden

Ken Eden
Environmental Scientist

Approved by

Donna Davies
START Backup Point of Contact

CONTENTS

TABLES

1.0 INTRODUCTION

Under Eastern Area Superfund Technical Assessment and Response Team (START) Contract No. EP-S3-05-02, Technical Direction Document (TDD) No. E33-020-09-04-003, U.S. Environmental Protection Agency (EPA) Region 3 tasked Tetra Tech EM Inc. (Tetra Tech) to assist with assessment activities at the Battlefield Golf Club Fly Ash site in the City of Chesapeake, Virginia. The objective of this assessment is to collect groundwater samples from monitoring wells to evaluate the quality of groundwater beneath the site.

This report provides site background information in Section 2.0, describes site activities in Section 3.0, summarizes analytical results in Section 4.0, and provides conclusions and recommendations in Section 5.0. References are provided after the text.

2.0 BACKGROUND

This section provides background information on the site, including its location, description, and history of site activities and investigations.

2.1 SITE LOCATION

The Battlefield Golf Club site is located at 1001 South Centerville Turnpike, Chesapeake, Virginia (Appendix A, Figure 1, Site Location Map). The geographic coordinates of the approximate center of the site are 36.68982 degrees north latitude and 76.17790 degrees west longitude (USGS 1986). The site is surrounded by a mix of residential and agricultural properties, bordered to the north by Whittamore Road, to the south by Murray Drive, and to the west South Centerville Turnpike. Residential homes are located adjacent to the site to the west (along Centerville Pike South), to the south (along Murray Drive) and to the east and southeast (along Whittamore Road).

2.2 SITE DESCRIPTION

The approximately 217-acre site is the location of the currently active Battlefield Golf Club, which opened to the public on October 13, 2007. The course consists of 18 holes built around seven man-made lakes. The original elevation of the property has been altered to create

elevations up to 40 feet above sea level (CPM 2002). In addition to the course, a trailer that functions as an office/club house and parking area are located on the site (Tetra Tech 2008b). The site layout is depicted in Appendix A, Figure 2, Site Layout Map. Prior to development as a golf course, the site was utilized for agricultural use. There are currently 16 monitoring wells located on the site. These wells were installed by contractors for Dominion Power. The well construction specifics have not been released to EPA and therefore are not available for inclusion in this report.

3.0 SITE ACTIVITIES

This section discusses the groundwater sampling performed at the Battlefield Golf Club site during the April 2009 assessment completed by Tetra Tech. The sampling event was conducted in accordance with the Final Sampling and Analysis Plan (SAP) for the Battlefield Golf Fly Ash Assessment submitted to EPA on April 27, 2009 (Tetra Tech 2009). Tetra Tech documented site activities in accordance with Tetra Tech Standard Operating Procedure (SOP) No. 024, "Recording of Notes in Field Logbook" (Tetra Tech 1999e). A copy of the Tetra Tech field logbook notes is provided in Appendix B.

3.1 GROUNDWATER SAMPLING

On April 30, 2009, Tetra Tech and EPA collected a total of 13 groundwater samples (including one duplicate sample) from 12 of the 16 monitoring wells that currently exist on site. The strategy for selecting which monitoring wells to sample was based on the objective of collecting and analyzing groundwater located upgradient and downgradient to where fly ash was placed on the site. The monitoring wells that were sampled are identified as MW-7A, MW-7B, MW-8A, MW-8B, MW-9A, MW-9B, MW-10A, MW-10B MW-11A, MW-11B, MW-12A, and MW-12B. Based on groundwater gauging data and an elevation survey of temporary monitoring points completed during Tetra Tech's 2008 assessment and a groundwater elevation map completed by a consultant to the City of Chesapeake, the estimated groundwater flow direction in the vicinity of the site is to the southeast; therefore, MW-7A and MW-7B are located in locations that are upgradient to the remaining monitoring wells and also the fly ash placed on the site (Tetra Tech 2008, Kimley-Horn). The monitoring wells present on site were installed in pairs, one installed at a shallower depth and one screened at a deeper depth. The screening depths for the

monitoring wells have not been released to EPA. Monitoring wells designated with an "A" suffix (e.g. MW-7A) denote the shallow wells, monitoring wells designated with a "B" suffix (e.g. MW-8B) denote the deeper wells. Monitoring well depth to water and depth to bottom measurements recorded by Tetra Tech prior to well purging and sampling are provided in Table 1. Monitoring well locations are shown in Appendix A, Figure 3, Monitoring Well Location Map.

TABLE 1

MONITORING WELL MEASUREMENTS

Monitoring Well Identifier	Depth to Bottom (feet)	Depth to Water (feet)	Date
MW-5A	14.34	1.72	4/30/2009
MW-5B	33.78	1.78	4/30/2009
MW-6A	15.00	2.20	4/30/2009
MW-6B	41.82	2.28	4/30/2009
MW-7A	14.16	3.04	4/30/2009
MW-7B	41.54	2.39	4/30/2009
MW-8A	22.00	9.65	4/30/2009
MW-8B	44.80	9.28	4/30/2009
MW-9A	22.28	8.28	4/30/2009
MW-9B	41.78	7.92	4/30/2009
MW-10A	22.52	9.10	4/30/2009
MW-10B	37.18	8.73	4/30/2009
MW-11A	22.64	8.99	4/30/2009
MW-11B	35.36	8.76	4/30/2009
MW-12A	22.09	8.48	4/30/2009
MW-12B	40.60	8.77	4/30/2009

In addition to the groundwater samples collected from the monitoring wells, two quality assurance/quality control (QA/QC) samples were collected including one field blank and one equipment rinsate blank sample. Split samples for all thirteen samples collected by Tetra Tech were provided to Randall Morrison of MACTEC, a contractor for Dominion Power.

Tetra Tech followed the groundwater sampling procedures outlined in Tetra Tech SOP No. 010, "Groundwater Sampling" and detailed in the April 27, 2009 SAP prepared for this sampling event (Tetra Tech 2000 and 2009). Prior to sampling, each monitoring well was purged of three

volumes of water. Groundwater from the shallower depth (designated as "A") was purged and the subsequent sample was collected using a peristaltic pump. Groundwater purged and collected from the deeper depth monitoring wells (designated with "B") was collected using a stainless steel submersible pump. During well purging, water quality measurements were collected from each location. Measurements include temperature, specific conductance, dissolved oxygen, pH, turbidity, and oxidation-reduction potential and are summarized in Table 2. Copies of the monitoring well purging forms are provided in Appendix C. Water quality measurements were collected using a YSI water quality meter in accordance with Tetra Tech SOPs No. 011, "Field Measurement of Water Temperature," No. 012, "Field Measurement of pH," No. 013, "Field Measurement of Specific Conductance," and No. 088, "Field Measurement of Water Turbidity" (Tetra Tech 1999c, 1999a, 1999b, 1999d).

TABLE 2

GROUNDWATER QUALITY MEASUREMENTS

Monitoring Location	Temperature (Degrees Celsius)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	pH	Oxidation-Reduction Potential	Turbidity (NTU)
MW-7A	15.43	155	0.17	5.24	121.7	7.5
MW-7B	17.20	129	3.28	5.96	35.5	790.6
MW-8A	14.09	1114	0.17	3.92	155.1	1.8
MW-8B	16.91	271	1.06	6.2	-56	32.5
MW-9A	14.92	359	0.15	7.05	-94.3	28.1
MW-9B	16.79	361	1.51	7.41	-75.9	354.4
MW-10A	15.21	695	0.14	6.81	-100.5	28.1
MW-10B	18.71	584	1.70	7.30	-84.3	201.2
MW-11A	14.72	502	0.16	6.20	21.7	15.5
MW-11B	17.65	665	1.82	6.84	-49.3	679.3
MW-12A	14.47	380	0.18	5.71	57.9	2.7
MW-12B	16.13	514	4.44	6.35	-7.2	1917.4

Notes:
µS/cm = Microsiemens per centimeter
mg/L = Milligrams per liter
NTU = Nephelometric turbidity unit
°C = Degrees Celsius
MW = Monitoring well

After purging and collecting water quality measurements from each well, samples were collected by pumping groundwater directly into two certified-clean, labeled, 32-ounce nalgene high-density, polyethylene wide-mouthed containers. The water samples were then preserved with nitric acid. Dedicated tubing and nitrile gloves were used during sampling. Nondedicated

equipment used during sample collection (e.g. stainless steel submersible pump) was decontaminated between each use in accordance with Tetra Tech SOP No. 002, "General Equipment Decontamination" (Tetra Tech 1999f). The groundwater samples were submitted to a laboratory assigned under EPA's Contract Laboratory Program (CLP) for Target Analyte List (TAL) metals and boron analysis.

Table 3 summarizes the sample identifiers, laboratory identifiers, purge volume, sampling dates and times, and analytical methods for groundwater samples collected during the Battlefield Golf Club Fly Ash assessment.

TABLE 3

GROUNDWATER SAMPLING SUMMARY

Sample Identifier	CLP Identifier	Purge Volume (gallons)	Sample Date	Collection Time	Analysis
BG0904-MW-7A	MC0153	3.5	4/30/2009	0825	TAL metals (Total) and boron
BG0904-MW-7B	MC0154	19	4/30/2009	0830	TAL metals (Total) and boron
BG0904-MW-8A	MC0155	2.5	4/30/2009	1030	TAL metals (Total) and boron
BG0904-MW-8B (Dupl. of MW-8BD)	MC0156	17	4/30/2009	1040	TAL metals (Total) and boron
BG0904-MW-8BD (Dupl. of MW-8B)	MC0157	17	4/30/2009	1040	TAL metals (Total) and boron
BG0904-MW-9A	MC0158	4	4/30/2009	1210	TAL metals (Total) and boron
BG0904-MW-9B	MC0183	16.4	4/30/2009	1155	TAL metals (Total) and boron
BG0904-MW-10A	MC0146	4	4/30/2009	1335	TAL metals (Total) and boron
BG0904-MW-10B	MC0	14	4/30/2009	1335	TAL metals (Total) and boron
BG0904-MW-11A	MC0149	4	4/30/2009	1440	TAL metals (Total) and boron
BG0904-MW-11B	MC0150	13	4/30/2009	1435	TAL metals (Total) and boron
BG0904-MW-12A	MC0151	4	4/30/2009	1625	TAL metals (Total) and boron

TABLE 3

GROUNDWATER SAMPLING SUMMARY (CONTINUED)

Sample Identifier	CLP Identifier	Purge Volume	Sample Date	Collection Time	Analysis
BG0904-MW-12B	MC0152	15.5	4/30/2009	1620	TAL metals (Total) and boron
BG0904-FB	MC0152	NA	5/1/2009	0900	TAL metals (Total) and boron
BG0904-RB	MC02L4	NA	5/1/2009	0935	TAL metals (Total) and boron

Notes:
"A" = Sample collected from shallower screened well
Assessment "B" = Sample collected from deeper screened well
Program
"D" = Duplicate sample
GW = Groundwater sample
NA = Not applicable
TAL = Target analyte list
BG0904 = Battlefield Golf April 2009
CLP = Contract Laboratory
FB = Field Blank
MW = Monitoring well
RB = Rinsate Blank

3.2 SAMPLE MANAGEMENT

Samples were handled and packaged in accordance with the Tetra Tech SOP No. 019, "Packaging and Shipping Samples" (Tetra Tech 2008a) and with the Tetra Tech "Quality Assurance Project Plan (QAPP) for START" (Tetra Tech 2006). All shipping containers were properly labeled with EPA chain-of-custody seals and delivered with signed chain-of-custody forms and appropriate hazard warnings for laboratory personnel. Samples were submitted to A4 Scientific, Inc. under CLP case number 38507 for inorganic analysis on May 5, 2009. Copies of the inorganic traffic report and chain of custody records are provided in Appendix D. All samples were preserved and kept on ice during delivery to the assigned laboratory.

4.0 ANALYTICAL RESULTS

This section summarizes analytical results for the on-site monitoring well samples collected during the Battlefield Golf Club Fly Ash Assessment site in April 2009.

A summary of the analytical data for the monitoring well samples is included in Appendix E. The CLP analytical data package is provided as an attachment to this report. Data were qualified

as part of laboratory QC procedures during data validation by the EPA Region 3 Office of Analytical Services and Quality Assurance Branch.

Tetra Tech compared the monitoring well groundwater sample analytical data to EPA Maximum Contaminant Levels (MCL) established for public drinking water systems (EPA 2008). Of the 12 monitoring wells sampled on the Battlefield Golf property, only one groundwater sample had a compound that exceeded the established MCL. Beryllium was detected in sample BG0904-MW-8A (CLP sample # MC0155) at a concentration of 9.9 micrograms per liter (µg/L), which is above the EPA established MCL for beryllium of 4 µg/L. The beryllium result was "J" qualified, indicating that the analyte is present, but that the result may not be accurate or precise. Beryllium was not detected above the laboratory contract required quantitation limit of 1 µg/L in any of the other samples analyzed. No other monitoring well samples exceeded the MCLs for any detected analyte.

The groundwater results reported for the shallow and deep downgradient wells (MW-8, MW-9, MW-10, MW-11, MW-12) were also compared to the results reported for MW-7. Based on groundwater flow gradient maps, MW-7 is located in an upgradient location relative to the remaining monitoring wells and areas where fly ash was placed. Manganese was the only analyte detected in all of the shallow downgradient monitoring wells (81.7 µg/L to 718 µg/L) three times or greater than the level detected in MW-7 (19.4 µg/L). Boron was the only analyte detected in all of the deeper downgradient wells (33.3 µg/L to 97.4 µg/L) three times or greater than the level reported in the upgradient well (6.1 µg/L).

5.0 CONCLUSION

The laboratory results indicated that detectable concentrations of TAL metals were present at all monitoring well sample locations. The following total metals: arsenic, barium, beryllium, cadmium, chromium, cobalt, lead, manganese, nickel, vanadium, and zinc were detected. Boron was also present at all monitoring well sample locations. Beryllium was detected in one sample at a concentration that exceeded the EPA MCL established for beryllium. Beryllium was not detected in any of the other samples collected. The results of this sampling event indicated that manganese levels were elevated in shallow downgradient monitoring wells and boron levels were elevated in the deeper downgradient monitoring wells.

Based on the analytical data, Tetra Tech recommends that the groundwater beneath the site be sampled and analyzed for TAL metals and boron on a quarterly or semi-annual basis to determine if TAL metals and boron concentrations in groundwater are increasing, decreasing or remaining constant. Tetra Tech also recommends that all 16 monitoring well clusters be sampled to provide additional analytical data on the upgradient, background levels of metals in groundwater in the vicinity of the site. Finally, Tetra Tech recommends that all of the monitoring wells are surveyed so that groundwater gradient maps may be generated based on the monitoring wells that currently exist on the site.

REFERENCES

Combustion Products Management. 2002. Letter Regarding Etheridge Greens Golf Course. From Mark L. Baker, PE, Director of Operations, Combustion Products Management, Inc. To Karen Sismour, Director, Waste Division, Virginia Department of Environmental Quality. March 8.

EPA. Soil Screening Levels Master Table. September 12, 2008. Available at: http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/master_sl_table_run_12SEP2008.pdf

Kimley-Horn and Associates, Inc. Analytical Summary Data Sheets and Figures. 2008.

Tetra Tech EM Inc. (Tetra Tech). 1999a. "Field Measurement of pH." Standard Operating Procedure (SOP) No. 012. November.

Tetra Tech. 1999b. "Field Measurement of Specific Conductance." SOP No. 013. November.

Tetra Tech. 1999c. "Field Measurement of Water Temperature." SOP No. 011. November.

Tetra Tech. 1999d. "Field Measurement of Water Turbidity." SOP No. 088. November.

Tetra Tech. 1999e. "Recording of Notes in Field Logbook." SOP No. 024. November.

Tetra Tech. 1999f. "General Equipment Decontamination." SOP No. 002. December.

Tetra Tech. 2000. "Groundwater Sampling." SOP No. 010. March.

Tetra Tech. 2006. "Quality Assurance Project Plan [QAPP] for START." August.

Tetra Tech. 2008a. "Packaging and Shipping Samples." SOP No. 019. January.

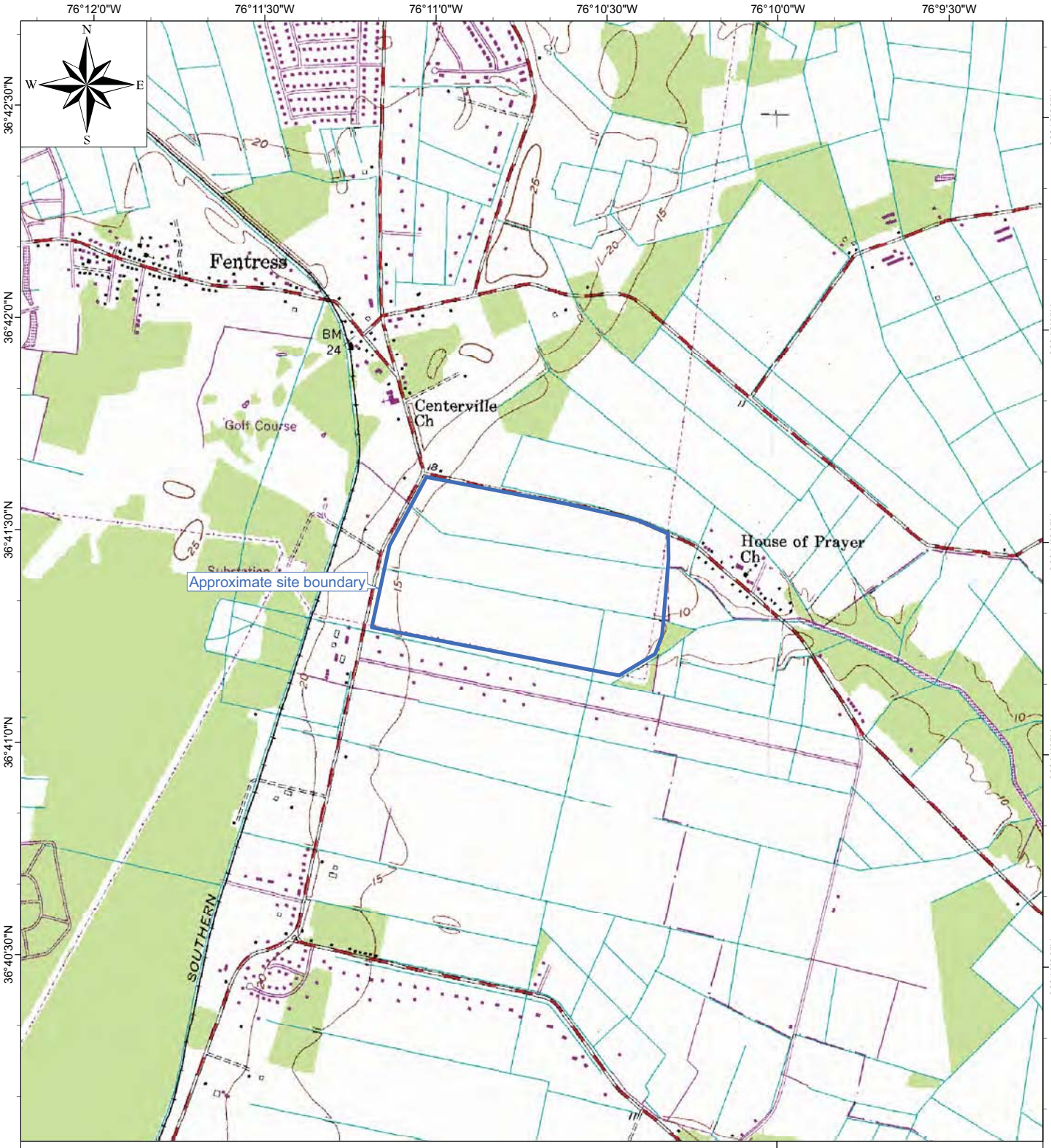
Tetra Tech. 2008b. Tetra Tech EM, Inc. (Tetra Tech). Final Trip Report for Battlefield Golf Fly Ash Assessment. DTN 0575. December 11.

Tetra Tech. 2009. "Sampling and Analysis Plan for the Battelfield Golf Fly Ash Assessment Site" DTN 0716. April 27.

U.S. Geological Survey (USGS). 7.5-Minute Series Topographic Map for the Fentress, Virginia Quadrangle. 1954. Photo revised 1986.

APPENDIX A

FIGURES

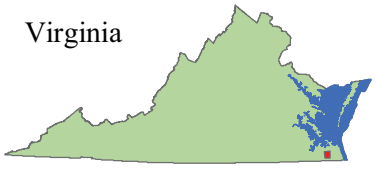


Source: Modified from USGS 7.5 Minute Series Topographic Quadrangle; Fentress, Virginia, 1954, Photorevised 1986

0 0.25 0.5 Miles

Quadrangle Location = ■

Virginia



Battlefield Golf Club Fly Ash Assessment
Chesapeake, Virginia

Figure 1
Site Location Map

TDD No. E33 020 09 04 003
EPA Contract No. EP S3 05 02

Map created on April 21, 2009
by D. Call, Tetra Tech EM Inc.

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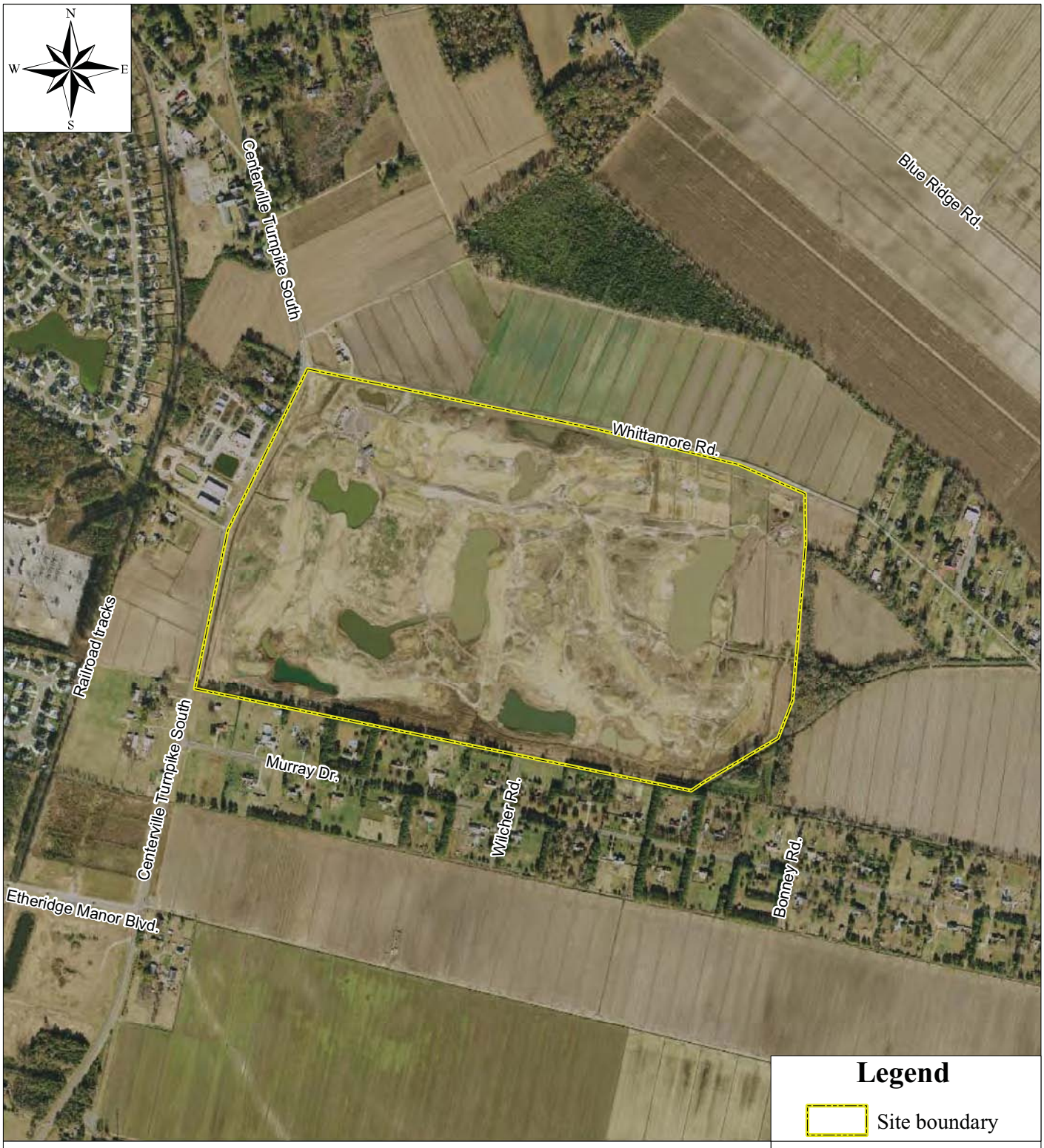


Legend

Site boundary

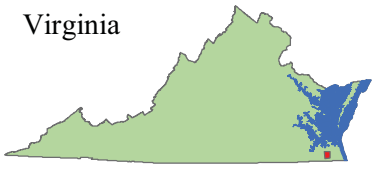
Source: Modified from DigitalGlobe aerial photography, January 1, 2009.

0 500 1,000

Feet

Approximate Site Location =

Virginia



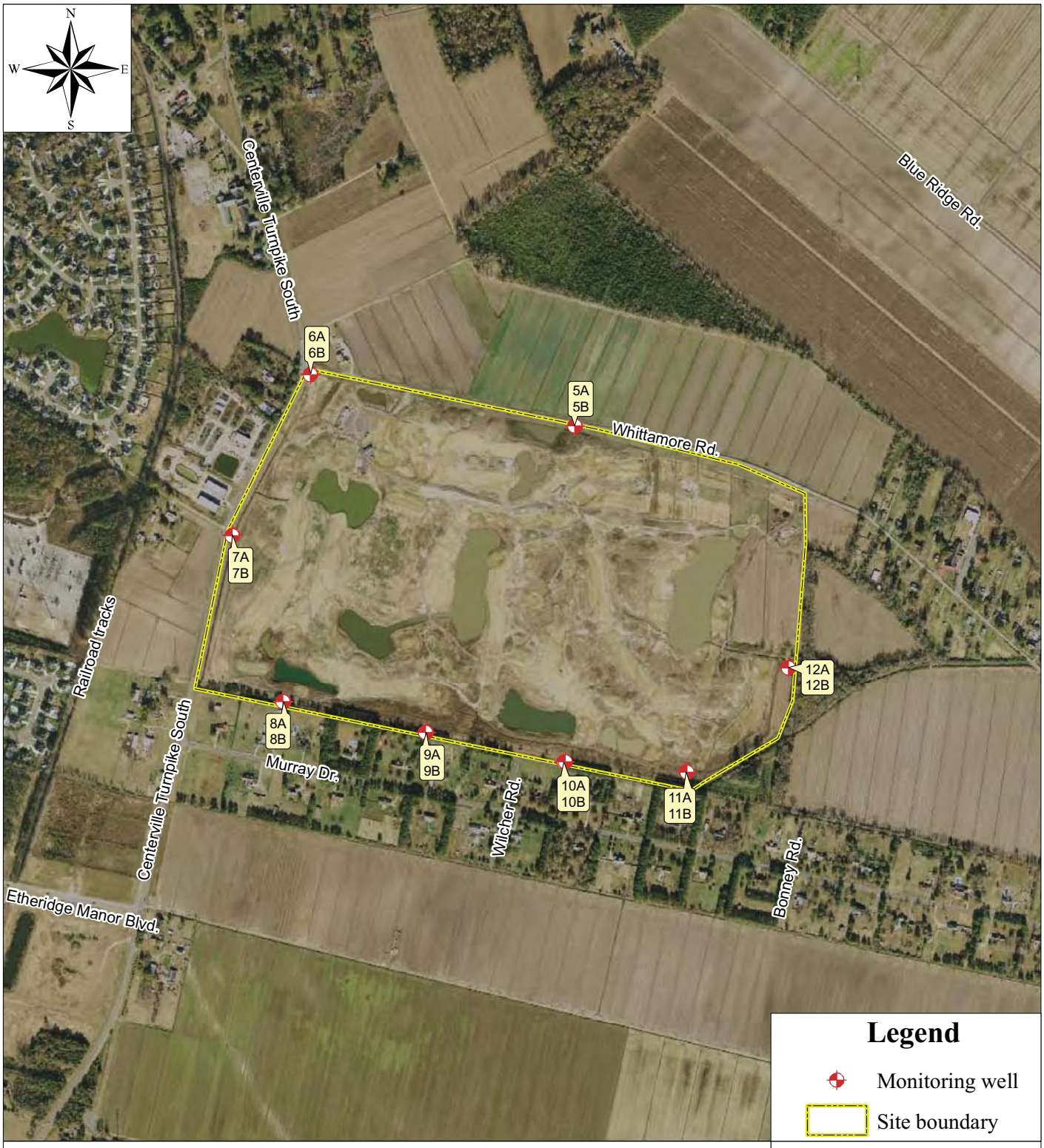
Battlefield Golf Club Fly Ash Assessment
Chesapeake, Virginia

Figure 2
Site Layout Map

TDD No. E33 020 09 04 003
EPA Contract No. EP S3 05 02

Map created on May 29, 2009
by D. Call, Tetra Tech EM Inc.

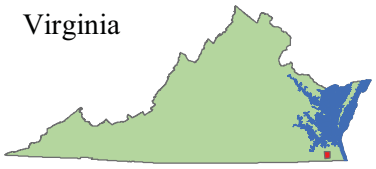
TETRA TECH



Source: Modified from DigitalGlobe aerial photography, January 1, 2009.

Approximate Site Location =

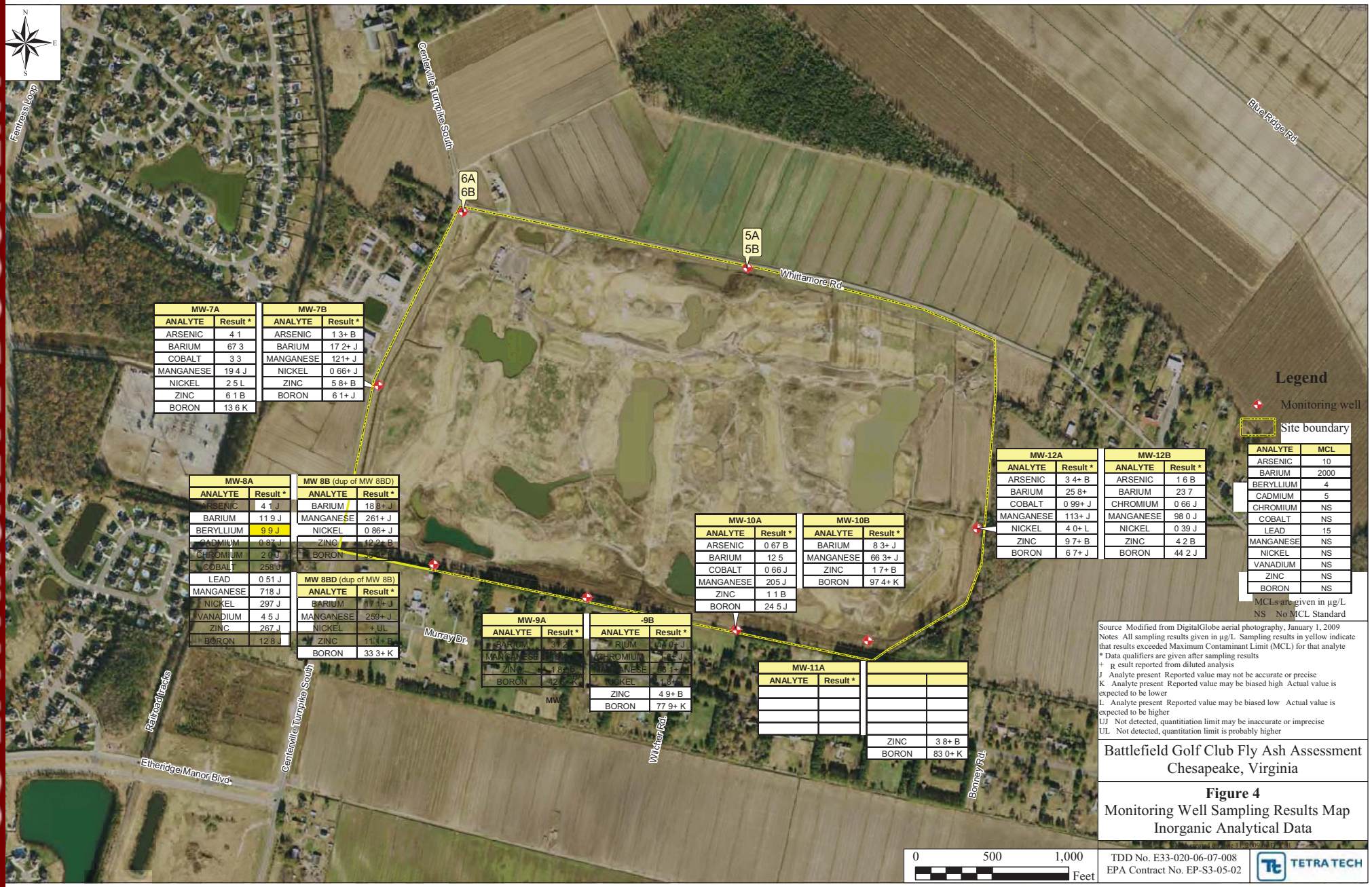
Virginia



Battlefield Golf Club Fly Ash Assessment
Chesapeake, Virginia

Figure 3
Monitoring Well Location Map

TDD No. E33 020 09 04 003 EPA Contract No. EP S3 05 02	Map created on May 29, 2009 by D. Call, Tetra Tech EM Inc.	TETRA TECH



MW-7A

ANALYTE	Result *
ARSENIC	4 1
BARIUM	67 3
COBALT	3 3
MANGANESE	19 4 J
NICKEL	2 5 L
ZINC	6 1 B
BORON	13 6 K

MW-7B

ANALYTE	Result *
ARSENIC	1 3+ B
BARIUM	17 2+ J
MANGANESE	121+ J
NICKEL	0 66+ J
ZINC	5 8+ B
BORON	6 1+ J

MW-8A

ANALYTE	Result *
ARSENIC	4 1 J
BARIUM	11 9 J
BERYLLIUM	9 9 J
CADMIUM	0 87 J
CHROMIUM	2 0 J
COBALT	258 J
LEAD	0 51 J
MANGANESE	718 J
NICKEL	297 J
VANADIUM	4 5 J
ZINC	267 J
BORON	12 8 J

MW 8B (dup of MW 8BD)

ANALYTE	Result *
BARIUM	18 8+ J
MANGANESE	261+ J
NICKEL	0 86+ J
ZINC	12 2+ B
BORON	35 [illegible]

MW 8BD (dup of MW 8B)

ANALYTE	Result *
BARIUM	17 1+ J
MANGANESE	259+ J
NICKEL	+ UL
ZINC	11 4+ B
BORON	33 3+ K

MW-9A

ANALYTE	Result *
BARIUM	3 2 [illegible]
MANGANESE	[illegible]
ZINC	1 8+ B
BORON	42 [illegible] K

MW

-9B

ANALYTE	Result *
RIUM	17 0+ J
CHROMIUM	0 [illegible] J
MANGANESE	66 1+
NICKEL	1 8+
ZINC	4 9+ B
BORON	77 9+ K

MW-10A

ANALYTE	Result *
ARSENIC	0 67 B
BARIUM	12 5
COBALT	0 66 J
MANGANESE	205 J
ZINC	1 1 B
BORON	24 5 J

MW-10B

ANALYTE	Result *
BARIUM	8 3+ J
MANGANESE	66 3+ J
ZINC	1 7+ B
BORON	97 4+ K

MW-11A

ANALYTE	Result *
ZINC	3 8+ B
BORON	83 0+ K

MW-12A

ANALYTE	Result *
ARSENIC	3 4+ B
BARIUM	25 8+
COBALT	0 99+ J
MANGANESE	113+ J
NICKEL	4 0+ L
ZINC	9 7+ B
BORON	6 7+ J

MW-12B

ANALYTE	Result *
ARSENIC	1 6 B
BARIUM	23 7
CHROMIUM	0 66 J
MANGANESE	98 0 J
NICKEL	0 39 J
ZINC	4 2 B
BORON	44 2 J

ANALYTE	MCL
ARSENIC	10
BARIUM	2000
BERYLLIUM	4
CADMIUM	5
CHROMIUM	NS
COBALT	NS
LEAD	15
MANGANESE	NS
NICKEL	NS
VANADIUM	NS
ZINC	NS
BORON	NS

MCLs are given in µg/L
NS No MCL Standard

Source Modified from DigitalGlobe aerial photography, January 1, 2009
Notes All sampling results given in µg/L Sampling results in yellow indicate that results exceeded Maximum Contaminant Limit (MCL) for that analyte
* Data qualifiers are given after sampling results
+ Result reported from diluted analysis
J Analyte present Reported value may not be accurate or precise
K Analyte present Reported value may be biased high Actual value is expected to be lower
L Analyte present Reported value may be biased low Actual value is expected to be higher
UJ Not detected, quantitation limit may be inaccurate or imprecise
UL Not detected, quantitation limit is probably higher

Battlefield Golf Club Fly Ash Assessment
Chesapeake, Virginia

Figure 4
Monitoring Well Sampling Results Map
Inorganic Analytical Data

TDD No. E33-020-06-07-008
EPA Contract No. EP-S3-05-02

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APPENDIX B

FIELD LOGBOOK NOTES

Tuesday
4/28/09 Battlefield Fly Ash - Chesapeake, VA
0700 Eden, START, departs for site via rental mini-van
1400 Eden arrives at site. Met w/ Chris Wagner, OSC - EPA Reg. III and Dominic Ventura, EPA. We discussed sampling strategies, onsite monitoring well locations, residential well sampling.
1500 Met with Mike and Willie from the golf club. Willie escorted me around golf course to locate onsite monitoring wells.
1545 Located 16 monitoring wells. They are nested in pairs.
- Flushmount wells:
5A, 5B, 6A, 6B, 7A, 7B.
- Stickup Wells:
8A, 8B, 9A, 9B, 10A, 10B, 11A, 11B, 12A, 12B
- We will open and measure wells tomorrow.
1630 START and EPA depart site for the day

Ken S. Eden
4/28/09

Wed.
4/29/09 Battlefield Golf Fly Ash - VA
0710 Depart for site.
0730 Eden, START, onsite. Chris Wagner, OSC onsite. Met at Golf Club parking lot.
0745 Dom Ventura onsite.
0800 Arrive at Station 022.
0801 Started purging @ Laundry room sink. First faucet after holding tank. There are no filters or water treatment components on water delivery system.
0816 Collected [redacted] (Filtered + Non-Filtered)
0830 Preparing to measure water levels in monitoring wells

Well ID	DTW (ft TOC)	DTB (ft TOC)
5A	1.72	14.34
5B	1.78	33.78
6A	2.20	15.00
6B	2.28	41.82
7A	3.04	14.16
7B	2.39	41.54
8A	9.65	22.00
8B	9.28	44.80
9A	8.28	22.28

Ken S. Eden 4/29/09

Wed.
4/29/09 Battlefield - Chesapeake - VA

Well ID	DTW (ft TOC)	DTB (ft TOC)
9B	7.92	41.78
10A	9.10	22.52
10B	8.73	37.18
11A	8.99	22.64
11B	8.76	35.36
12A	8.48	22.09
12B	8.77	40.60

1640 Collected (b) (6)(b) (6)(b) (6)
1700 START and EPA offsite.

Ken S. Eden
4/29/09

Thurs.
4/30/09 Battlefield - Chesapeake, VA
0700 START, Eden departs for site.
0715 Arrive onsite at Golf Course parking lot. Joe Gawarzewski, START and Dave Scerbo, START also on site. Chris Wagner, EPA on site.
0730 Set up Joe G and Dave S to begin monitoring wells sampling. They are starting with MW7A/7B
0808 Collected (b) (6)(b) (6)(b) (6) (Pre Treat)
0810 Collected (b) (6)(b) (6)(b) (6) (Post Treat) @ Kitchen Sink after softner + Filter.
1145 Located two off site monitoring wells on Bonney at end of street on east side (b) (6)(b) (6)
1415 Collected (b) (6)(b) (6) (PRE Treat)
1420 Collected (b) (6)(b) (6)(b) (6) (Post Treat) @ Kitchen Sink after softner.
~~1605~~ 1605 Collected (b) (6)(b) (6) (From outside Garden Faucet)
1730 Monitoring well sampling generated 3 drums of purge water. Currently These 3 drums are staged on site. Approx 4 drums
1740 Split Samples Collected With Randall Morrison - MACTEC - Monitoring Well Samples Only.
Ken S. Eden 4/30/09

6 4/30/09 Chesapeake, VA
Thursday Battlefield Golf Fly Ash.

Well	Sample Time	
MW7A	0825	
MW7B	0830	
MW8A	1030	
MW8B	1040	
MW8BD	1045	(Dup of MW8B)
MW9A	1210	
MW9B	1155	(MS/MSD)
MW10A	1335	
MW10B	1335	
MW11A	1440	
MW11B	1435	
MW12A	1625	
MW12B	1620	

Ellen Chu
4/30/09

7 5/1/09
Friday Battlefield Golf Fly Ash - Chesapeake, VA
0800 START, Ellen, Joe G. and Dave Scerbo onsite. Prepping samples.
0900 Collected Field Blank.
0935 Collected Rinsate Blank
1400 Attempted to collect sample at (b) (6)(b) (6). No one was home.
1445 START Team departs site. Chris Wagner Departed site @ 1420.
2030 Returned home
(1630) Chris Wagner called. She was able to collect samples from (b) (6) (b) (6)
(1615) - (b) (6)(b) (6) (b) (6)
(1617) - (b) (6)(b) (6) (b) (6) Pre-Treat)
(1619) - (b) (6)(b) (6) (b) (6) Post-Treat/Sink)

APPENDIX C

MONITORING WELL PURGING FORMS

TETRA TECH

Monitoring Well Purging Form

WELL ID: MW-7A
COMPANY: THEMI
CLIENT:
PROJECT: BF6
LOCATION:
COMMENTS:

CONTAIN: (YES) – NO WITH WELL(S): MW-7B MW-8A MW-8B
HISTORICALLY DRY: YES - (NO)
DEDICATED PUMP: YES - (NO)

WELL OBSERVATIONS

CASING & LID: (OK) - DAMAGED – NO LID LOCKED: (YES) - NO WELL DIAMETER: (2') - 4' – 6' – OTHER:
MEASURING POINT: TIC - (TOC) - GRS TUBING: OK – DAMAGED – OTHER: New

PURGING CALCULATIONS

(A) DEPTH TO WELL BOTTOM: 14.16 FT
(B) DEPTH TO WATER: 3.04 FT
(C) WATER COLUMN HEIGHT (A - B): 11.12 FT
(D) CASING VOLUME FACTOR: .16 GPF
(E) CASING VOLUME (C x D): 1.779 GAL
(F) VOLUMES TO BE PURGED:
(G) TOTAL PURGE VOLUME (E x F): 5.13 GAL

CASING FACTOR (GPF FOR INCHES) = 0.041(WELL DIAMETER)^2
2"=0.16; 4"=0.65; 6"=1.47; 8"=2.61 GPF

PURGING INFORMATION

PURGING METHOD: GRUNDFOS PUMP – DEDICATED PUMP - PERISTALTIC PUMP – BLADDER PUMP STABILIZATION
PURGING ENDPOINT: VOLUME OR WELL DRY 3 x (FOR GRUNDFOS) – ½ HR OR WELL DRY (FOR DEDICATED)
PUMP INTAKE: SCREEN/WELL BOTTOM PURGE WATER: DISCHARGED TO GROUND - STORED IN DRUMS
FIELD MEASUREMENTS METER: : YSI

DATE	TIME	PURGE RATE or VOLUME (GPM)	FIELD MEASUREMENTS AND UNITS							COMMENTS
			pH	Cond.	D.O.	Sal.	Turb.	Temp.	ORP	
				mS/cm	mg/L	%	NTU	°C	mV	
4/30	0755	~350 mL/min								START PURGE
	0800		5.77	148	0.55	—	21.9	15.38	126.0	
	0805		5.21	148	0.23	—	21.7	15.46	131.4	
	0810		5.20	150	0.19	—	13.3	15.39	127.5	
	0815		5.23	154	0.17	—	9.5	15.42	125.0	
	0820		5.24	155	0.17	—	7.5	15.93	121.7	
	825									COLLECT SAMPLE

TOTAL PURGE TIME: 25 (MIN) – HRS TOTAL PURGE VOL.: ~3.5 GAL RECOVERY: (FAST) - SLOW – V.SLOW

SAMPLER:
SIGNATURE:
SAMPLE COMMENTS (COLOR/ODOR/DUPLICATE/ETC):

TETRA TECH

Monitoring Well Purging Form

WELL ID: MW-7B
COMPANY: TEMI
CLIENT:
PROJECT: BFG
LOCATION:
COMMENTS:

CONTAIN: (YES) – NO WITH WELL(S): MW-7A MW8A MW8B
HISTORICALLY DRY: YES - (NO)
DEDICATED PUMP: YES – (NO)

WELL OBSERVATIONS

CASING & LID: (OK) – DAMAGED – NO LID LOCKED: (YES) – NO WELL DIAMETER: (2") – 4' – 6' – OTHER:
MEASURING POINT: (TIC) – (TOC) – GRS TUBING: OK – DAMAGED – OTHER: new

PURGING CALCULATIONS

(A) DEPTH TO WELL BOTTOM: 41.54 FT
(B) DEPTH TO WATER: 2.39 FT
(C) WATER COLUMN HEIGHT (A - B): 39.15 FT
(D) CASING VOLUME FACTOR: .16 GPF
(E) CASING VOLUME (C x D): 6.264 GAL
(F) VOLUMES TO BE PURGED: 3
(G) TOTAL PURGE VOLUME (E x F): 18.79 GAL

CASING FACTOR (GPF FOR INCHES) = 0.041(WELL DIAMETER)^2
2"=0.16; 4"=0.65; 6"=1.47; 8"=2.61 GPF

PURGING INFORMATION

PURGING METHOD: GRUNDFOS PUMP – DEDICATED PUMP - PERISTALTIC PUMP – BLADDER PUMP
PURGING ENDPOINT: VOLUME OR WELL DRY 3 x (FOR GRUNDFOS) – ½ HR OR WELL DRY (FOR DEDICATED)
PUMP INTAKE: SCREEN/WELL BOTTOM PURGE WATER: DISCHARGED TO GROUND – STORED IN DRUMS
FIELD MEASUREMENTS METER: : YSI

DATE	TIME	PURGE RATE or VOLUME (GPM)	FIELD MEASUREMENTS AND UNITS							COMMENTS
			pH	Cond.	D.O.	Sal.	Turb.	Temp.	ORP	
				mS/cm	mg/L	%	NTU	°C	mV	
4/30	0800									START PURGE
"	0810							17+		~10 GAL
"	0820									Total Purge Vol
~~"~~	~~0830~~									
4/30	0830		5.96	129	3.28	—	790.6	17.20	35.5	COLLECT SAMPLE

TOTAL PURGE TIME: 30 (MIN) – HRS TOTAL PURGE VOL.: ~19 GAL RECOVERY: (FAST) – SLOW – V.SLOW

SAMPLER:
SIGNATURE:
SAMPLE COMMENTS (COLOR/ODOR/DUPLICATE/ETC):

TETRA TECH

Monitoring Well Purging Form

WELL ID: MW-8A
COMPANY: TtEMI
CLIENT:
PROJECT: BFG
LOCATION:
COMMENTS:

CONTAIN: (YES) – NO WITH WELL(S): MW-7A MW-7B MW-8B
HISTORICALLY DRY: YES (NO)
DEDICATED PUMP: YES – (NO)

WELL OBSERVATIONS

CASING & LID: (OK) – DAMAGED – NO LID LOCKED: (YES) – NO WELL DIAMETER: (2") – 4" – 6" – OTHER: ____
MEASURING POINT: (TIC) – TOC – GRS TUBING: OK – DAMAGED – OTHER: new

PURGING CALCULATIONS

(A) DEPTH TO WELL BOTTOM: 22.00 FT
(B) DEPTH TO WATER: 9.65 FT
(C) WATER COLUMN HEIGHT (A - B): 12.35 FT
(D) CASING VOLUME FACTOR: .16 GPF
(E) CASING VOLUME (C x D): 1.98 GAL
(F) VOLUMES TO BE PURGED:
(G) TOTAL PURGE VOLUME (E x F): 5.93 GAL

CASING FACTOR (GPF FOR INCHES) = 0.041(WELL DIAMETER)^2
2"=0.16; 4"=0.65; 6"=1.47; 8"=2.61 GPF

PURGING INFORMATION

PURGING METHOD: GRUNDFOS PUMP – DEDICATED PUMP – (PERISTALTIC PUMP) – BLADDER PUMP (STABILI-FLO)
PURGING ENDPOINT: VOLUME OR WELL DRY 3 x (FOR GRUNDFOS) – ½ HR OR WELL DRY (FOR DEDICATED)
PUMP INTAKE: SCREEN/WELL BOTTOM PURGE WATER: DISCHARGED TO GROUND – (STORED IN DRUMS)
FIELD MEASUREMENTS METER: : YSI

DATE	TIME	PURGE RATE or VOLUME (GPM)	FIELD MEASUREMENTS AND UNITS							COMMENTS
			pH	Cond. mS/cm	D.O. mg/L	Sal. %	Turb. NTU	Temp. °C	ORP mV	
4/30	1000	~300								START PURGE
4/30	1005		3.95	1121	0.71	—	10.8	14.52	164.7	
	1010		3.89	1119	0.20	—	7.4	14.26	158.6	
	1015		3.92	1118	0.19	—	3.8	14.15	156.1	
	1020		3.92	1116	0.18	—	2.1	14.15	155.8	
	1025		3.92	1114	0.17	—	1.8	14.09	155.1	
	(1030)									COLLECT SAMPLE

TOTAL PURGE TIME: 25 (MIN) – HRS TOTAL PURGE VOL.: ~2.5 GAL RECOVERY: (FAST) – SLOW – V.SLOW

SAMPLER: David Spada
SIGNATURE:

SAMPLE COMMENTS (COLOR/ODOR/DUPLICATE/ETC): Collected sample @ 1030

TETRA TECH

Monitoring Well Purging Form

WELL ID: MW-8B
COMPANY: TEMI
CLIENT:
PROJECT: BFG
LOCATION:
COMMENTS: ALSO COLLECTED MW-8BD

CONTAIN: (YES) NO WITH WELL(S): MW-7A MW-8A MW-7B
HISTORICALLY DRY: YES - (NO)
DEDICATED PUMP: YES - (NO)

WELL OBSERVATIONS

CASING & LID: (OK) DAMAGED – NO LID LOCKED: (YES) NO WELL DIAMETER: (2") 4" – 6" – OTHER:
MEASURING POINT: (TIC) – TOC – GRS TUBING: OK – DAMAGED – OTHER: new

PURGING CALCULATIONS

(A) DEPTH TO WELL BOTTOM: 44.80 FT
(B) DEPTH TO WATER: 9.28 FT
(C) WATER COLUMN HEIGHT (A - B): 35.52 FT
(D) CASING VOLUME FACTOR: .16 GPF
(E) CASING VOLUME (C x D): 5.68 GAL
(F) VOLUMES TO BE PURGED:
(G) TOTAL PURGE VOLUME (E x F): 17.05 GAL

CASING FACTOR (GPF FOR INCHES) = $0.041(\text{WELL DIAMETER})^2$
2"=0.16; 4"=0.65; 6"=1.47; 8"=2.61 GPF

PURGING INFORMATION

PURGING METHOD: (GRUNDFOS PUMP) – DEDICATED PUMP - PERISTALTIC PUMP – BLADDER PUMP
PURGING ENDPOINT: VOLUME OR WELL DRY 3 x (FOR GRUNDFOS) – ½ HR OR WELL DRY (FOR DEDICATED)
PUMP INTAKE: SCREEN/WELL BOTTOM PURGE WATER: DISCHARGED TO GROUND – (STORED IN DRUMS)
FIELD MEASUREMENTS METER: : YSI

DATE	TIME	PURGE RATE or VOLUME (GPM)	FIELD MEASUREMENTS AND UNITS							COMMENTS
			pH	Cond.	D.O.	Sal.	Turb.	Temp.	ORP	
				mS/cm	mg/L	%	NTU	°C	mV	
4/30/08	1000									START PURGE
	1015									~5 gal
	1025									~10 gal
	1035									~17 gal
4/30/08	1040		6.2	271	1.06	—	32.5	16.91	-56	COLLECT SAMPLE

DUPLICATE
1045
MW-8BD

TOTAL PURGE TIME: 35 (MIN) – HRS TOTAL PURGE VOL.: ~17 (GAL) RECOVERY: (FAST) – SLOW – V.SLOW

SAMPLER:
SIGNATURE:

SAMPLE COMMENTS (COLOR/ODOR/DUPLICATE/ETC): MW-8BD is a duplicate of MW-8B

TETRA TECH

Monitoring Well Purging Form

WELL ID: MW-9A
COMPANY: TTEMI
CLIENT:
PROJECT: BFG&F
LOCATION:
COMMENTS:

CONTAIN: (YES) – NO WITH WELL(S): MW9B, 10A, 10B
HISTORICALLY DRY: YES (NO)
DEDICATED PUMP: YES (NO)

WELL OBSERVATIONS

CASING & LID: (OK) – DAMAGED – NO LID LOCKED: (YES) – NO WELL DIAMETER: (2") – 4" – 6" – OTHER:
MEASURING POINT: (TIC) – TOC – GRS TUBING: OK – DAMAGED – OTHER: new

PURGING CALCULATIONS

(A) DEPTH TO WELL BOTTOM: 8.28 FT
(B) DEPTH TO WATER: 22.28 FT
(C) WATER COLUMN HEIGHT (A - B): 14.0 FT
(D) CASING VOLUME FACTOR: .16 GPF
(E) CASING VOLUME (C x D): 2.24 GAL
(F) VOLUMES TO BE PURGED:
(G) TOTAL PURGE VOLUME (E x F): 6.72 GAL

CASING FACTOR (GPF FOR INCHES) = 0.041(WELL DIAMETER)^2
2"=0.16; 4"=0.65; 6"=1.47; 8"=2.61 GPF

PURGING INFORMATION

PURGING METHOD: GRUNDFOS PUMP – DEDICATED PUMP – (PERISTALTIC PUMP) – BLADDER PUMP (STABILIRATI
PURGING ENDPOINT: VOLUME OR WELL DRY 3 x (FOR GRUNDFOS) – ½ HR OR WELL DRY (FOR DEDICATED)
PUMP INTAKE: SCREEN/WELL BOTTOM PURGE WATER: DISCHARGED TO GROUND (STORED IN DRUMS)
FIELD MEASUREMENTS METER: : YSI

DATE	TIME	PURGE RATE or VOLUME (GPM)	FIELD MEASUREMENTS AND UNITS							COMMENTS
			pH	Cond.	D.O.	Sal.	Turb.	Temp.	ORP	
				mS/cm	mg/L	%	NTU	°C	mV	
4/30	1130	~300 mL/min								START PURGE
	1135		6.99	326	1.50	—	119.1	15.33	-58.6	
	1140		7.06	321	0.37	—	156.2	15.06	-74.5	
	1145		7.05	336	0.17	—	105.5	14.91	-84.4	
	1155		7.04	352	0.15	—	45.3	14.96	-91.2	
	1200		7.03	358	0.16	—	34.1	15.14	-92.8	
	1205		7.05	359	0.15	—	28.1	14.92	-94.3	
	1210									COLLECT SAMPLE

TOTAL PURGE TIME: 35 (MIN) – HRS TOTAL PURGE VOL.: ~4 GAL RECOVERY: (FAST) – SLOW – V.SLOW

SAMPLER: David Sanders
SIGNATURE:

SAMPLE COMMENTS (COLOR/ODOR/DUPLICATE/ETC): Collected sample @ 1210

TETRA TECH

Monitoring Well Purging Form

WELL ID: MW-9B
COMPANY: TTEMI
CLIENT:
PROJECT: BF Golf
LOCATION:
COMMENTS:

CONTAIN: (YES) – NO WITH WELL(S): MW-9A, 10A, 10B
HISTORICALLY DRY: YES – (NO)
DEDICATED PUMP: YES – (NO)

WELL OBSERVATIONS

CASING & LID: (OK) – DAMAGED – NO LID LOCKED: (YES) – NO WELL DIAMETER: (2') – 4' – 6' – OTHER: ____
MEASURING POINT: (TIC) – TOC – GRS TUBING: OK – DAMAGED – OTHER: new

PURGING CALCULATIONS

(A) DEPTH TO WELL BOTTOM: 41.78 FT
(B) DEPTH TO WATER: 7.92 FT
(C) WATER COLUMN HEIGHT (A - B): 33.86 FT
(D) CASING VOLUME FACTOR: .16 GPF
(E) CASING VOLUME (C x D): 5.42 GAL
(F) VOLUMES TO BE PURGED:
(G) TOTAL PURGE VOLUME (E x F): 16.25 GAL

CASING FACTOR (GPF FOR INCHES) = 0.041(WELL DIAMETER)^2
2"=0.16; 4"=0.65; 6"=1.47; 8"=2.61 GPF

PURGING INFORMATION

PURGING METHOD: (GRUNDFOS PUMP) – DEDICATED PUMP - PERISTALTIC PUMP – BLADDER PUMP
PURGING ENDPOINT: (VOLUME OR WELL DRY 3 x (FOR GRUNDFOS)) – ½ HR OR WELL DRY (FOR DEDICATED)
PUMP INTAKE: SCREEN/WELL BOTTOM PURGE WATER: DISCHARGED TO GROUND – (STORED IN DRUMS)
FIELD MEASUREMENTS METER: : YSI

DATE	TIME	PURGE RATE or VOLUME (GPM)	FIELD MEASUREMENTS AND UNITS							COMMENTS
			pH	Cond.	D.O.	Sal.	Turb.	Temp.	ORP	
				mS/cm	mg/L	%	NTU	°C	mV	
4/30/09	1130									START PURGE
"	1135									~5 gal
"	1142									~10 gal
										~16.5 gal
4/30/09	1155		7.41	361	1.51	—	354.4	16.79	-75.9	COLLECT SAMPLE

TOTAL PURGE TIME: 12 (MIN) – HRS TOTAL PURGE VOL.: 16.5 GAL RECOVERY: (FAST) – SLOW – V.SLOW

SAMPLER:
SIGNATURE:

SAMPLE COMMENTS (COLOR/ODOR/DUPLICATE/ETC): MS/MSD - 2 bottles collected

TETRA TECH

Monitoring Well Purging Form

WELL ID: MW 10A
COMPANY: TtEMI
CLIENT:
PROJECT: BF Golf
LOCATION:
COMMENTS:

CONTAIN: (YES) – NO WITH WELL(S): MW10B, 9A, 9B
HISTORICALLY DRY: YES – (NO)
DEDICATED PUMP: YES – (NO)

WELL OBSERVATIONS

CASING & LID: (OK) – DAMAGED – NO LID LOCKED: (YES) – NO WELL DIAMETER: (2") – 4" – 6" – OTHER: ____
MEASURING POINT: TIC – (TOC) – GRS TUBING: OK – DAMAGED – OTHER: new

PURGING CALCULATIONS

(A) DEPTH TO WELL BOTTOM: 22.52 FT (E) CASING VOLUME (C x D): 2.147 GAL
(B) DEPTH TO WATER: 9.10 FT (F) VOLUMES TO BE PURGED:
(C) WATER COLUMN HEIGHT (A - B): 13.42 FT 6.44
(D) CASING VOLUME FACTOR: .16 GPF (G) TOTAL PURGE VOLUME (E x F): GAL

CASING FACTOR (GPF FOR INCHES) = 0.041(WELL DIAMETER)^2
2"=0.16; 4"=0.65; 6"=1.47; 8"=2.61 GPF

PURGING INFORMATION

PURGING METHOD: GRUNDFOS PUMP – DEDICATED PUMP – (PERISTALTIC PUMP) – BLADDER PUMP
PURGING ENDPOINT: VOLUME OR WELL DRY 3 x (FOR GRUNDFOS) – ½ HR OR WELL DRY (FOR DEDICATED)
PUMP INTAKE: SCREEN/WELL BOTTOM PURGE WATER: DISCHARGED TO GROUND – (STORED IN DRUMS)
FIELD MEASUREMENTS METER: : YSI

STABILIZATION

DATE	TIME	PURGE RATE or VOLUME (GPM)	FIELD MEASUREMENTS AND UNITS							COMMENTS
			pH	Cond.	D.O.	Sal.	Turb.	Temp.	ORP	
				mS/cm	mg/L	%	NTU	°C	mV	
4/30	1300	~300 mL/min								START PURGE
	1310		6.82	689	0.30	—	47.1	15.24	-88.4	
	1315		6.82	708	0.20	—	37.6	15.31	-93.4	
	1320		6.82	705	0.15	—	40.6	15.21	-93.0	
	1325		6.83	698	0.15	—	27.6	15.23	-100.3	
	1330		6.81	695	0.14	—	28.1	15.21	-100.5	
	1335									COLLECT SAMPLE

TOTAL PURGE TIME: 30 (MIN) – HRS TOTAL PURGE VOL.: ~4 GAL RECOVERY: FAST – SLOW – V.SLOW

SAMPLER: David Soares
SIGNATURE:

SAMPLE COMMENTS (COLOR/ODOR/DUPLICATE/ETC): Sample collected @ 1335

TETRA TECH

Monitoring Well Purging Form

WELL ID: MW10B
COMPANY: TTEMI
CLIENT: BPGolf
PROJECT: _____
LOCATION: _____
COMMENTS: _____

CONTAIN: (YES) NO WITH WELL(S): MW10A, 9A, 9B
HISTORICALLY DRY: YES - (NO)
DEDICATED PUMP: YES – (NO)

WELL OBSERVATIONS

CASING & LID: (OK) DAMAGED – NO LID LOCKED: (YES) NO WELL DIAMETER (2") 4" – 6" – OTHER: ____
MEASURING POINT: TIC – (TOC) GRS TUBING: OK – DAMAGED – OTHER: new

PURGING CALCULATIONS

(A) DEPTH TO WELL BOTTOM: 37.18 FT
(B) DEPTH TO WATER: 8.73 FT
(C) WATER COLUMN HEIGHT (A - B): 28.45 FT
(D) CASING VOLUME FACTOR: .16 GPF
(E) CASING VOLUME (C x D): 4.55 GAL
(F) VOLUMES TO BE PURGED:
(G) TOTAL PURGE VOLUME (E x F): 13.66 GAL

CASING FACTOR (GPF FOR INCHES) = 0.041(WELL DIAMETER)^2
2"=0.16; 4"=0.65; 6"=1.47; 8"=2.61 GPF

PURGING INFORMATION

PURGING METHOD: (GRUNDFOS PUMP) – DEDICATED PUMP - PERISTALTIC PUMP – BLADDER PUMP
PURGING ENDPOINT: (VOLUME) OR WELL DRY 3 x (FOR GRUNDFOS) – ½ HR OR WELL DRY (FOR DEDICATED)
PUMP INTAKE: SCREEN/WELL BOTTOM PURGE WATER: DISCHARGED TO GROUND – (STORED IN DRUMS)
FIELD MEASUREMENTS METER: : YSI

DATE	TIME	PURGE RATE or VOLUME (GPM)	FIELD MEASUREMENTS AND UNITS							COMMENTS
			pH	Cond.	D.O.	Sal.	Turb.	Temp.	ORP	
				mS/cm	mg/L	%	NTU	°C	mV	
4/30/09	1300									START PURGE
	1310									~5 gal.
	1315									~10 gal
	1320									~14 gal.
4/30/09	1335		7.30	584	1.70	—	201.2	18.71	-84.3	COLLECT SAMPLE

TOTAL PURGE TIME: 20 (MIN) – HRS TOTAL PURGE VOL.: 14 (GAL) RECOVERY (FAST) – SLOW – V.SLOW

SAMPLER: _____
SIGNATURE: _____
SAMPLE COMMENTS (COLOR/ODOR/DUPLICATE/ETC): _____

TETRA TECH

Monitoring Well Purging Form

WELL ID: MW11A
COMPANY: THEMI
CLIENT:
PROJECT: BFGoIP
LOCATION:
COMMENTS:

CONTAIN: (YES) – NO WITH WELL(S): MW11B, 12A, 12B
HISTORICALLY DRY: YES – (NO)
DEDICATED PUMP: YES – (NO)

WELL OBSERVATIONS

CASING & LID: (OK) – DAMAGED – NO LID LOCKED: (YES) – NO WELL DIAMETER: 2' – 4' – 6' – OTHER: ____
MEASURING POINT: TIC – (TOC) – GRS TUBING: (OK) – DAMAGED – OTHER: new

PURGING CALCULATIONS

(A) DEPTH TO WELL BOTTOM: 22.64 FT (E) CASING VOLUME (C x D): 2.184 GAL
(B) DEPTH TO WATER: 8.99 FT (F) VOLUMES TO BE PURGED: 3
(C) WATER COLUMN HEIGHT (A - B): 13.65 FT 6.552
(D) CASING VOLUME FACTOR: 0.16 GPF (G) TOTAL PURGE VOLUME (E x F): GAL

CASING FACTOR (GPF FOR INCHES) = $0.041(\text{WELL DIAMETER})^2$
2"=0.16; 4"=0.65; 6"=1.47; 8"=2.61 GPF

PURGING INFORMATION

PURGING METHOD: GRUNDFOS PUMP – DEDICATED PUMP – (PERISTALTIC PUMP) – BLADDER PUMP (STABILIZING)
PURGING ENDPOINT: VOLUME OR WELL DRY 3 x (FOR GRUNDFOS) – ½ HR OR WELL DRY (FOR DEDICATED)
PUMP INTAKE: SCREEN/WELL BOTTOM PURGE WATER: DISCHARGED TO GROUND – (STORED IN DRUMS)
FIELD MEASUREMENTS METER: : YSI

DATE	TIME	PURGE RATE or VOLUME (GPM)	FIELD MEASUREMENTS AND UNITS							COMMENTS
			pH	Cond.	D.O.	Sal.	Turb.	Temp.	ORP	
				mS/cm	mg/L	%	NTU	°C	mV	
4/30	1405	325 mL/min								START PURGE
	1415		6.26	468	0.31	—	66.2	15.09	30.7	
	1420		6.27	480	~~0.23~~ 0.21	—	65.4	15.59	26.3	
	1425		6.17	487	0.18	—	43.3	14.48	24.0	
	1430		6.16	495	0.17	—	26.4	14.62	22.2	
	1435		6.20	502	0.16	—	15.5	14.72	21.7	
										COLLECT SAMPLE

TOTAL PURGE TIME: 30 (MIN) – HRS TOTAL PURGE VOL.: ~4 GAL RECOVERY: (FAST) – SLOW – V.SLOW

SAMPLER: David Scerbo
SIGNATURE:

SAMPLE COMMENTS (COLOR/ODOR/DUPLICATE/ETC): Collect Sample @ 1440

TETRA TECH

Monitoring Well Purging Form

WELL ID: MW11B
COMPANY: THEMI
CLIENT:
PROJECT: BFGolf
LOCATION:
COMMENTS:

CONTAIN: (YES) NO WITH WELL(S): MW11A, 12A, 12B
HISTORICALLY DRY: YES (NO)
DEDICATED PUMP: YES (NO)

WELL OBSERVATIONS

CASING & LID: (OK) – DAMAGED – NO LID LOCKED: (YES) – NO WELL DIAMETER: (2") – 4' – 6' – OTHER:
MEASURING POINT: TIC – (TOC) – GRS TUBING: (OK) – DAMAGED – OTHER: NEW

PURGING CALCULATIONS

(A) DEPTH TO WELL BOTTOM: 35.36 FT
(B) DEPTH TO WATER: 8.76 FT
(C) WATER COLUMN HEIGHT (A - B): 26.6 FT
(D) CASING VOLUME FACTOR: 0.16 GPF
(E) CASING VOLUME (C x D): 4.256 GAL
(F) VOLUMES TO BE PURGED: 3
(G) TOTAL PURGE VOLUME (E x F): 12.77 GAL

CASING FACTOR (GPF FOR INCHES) = $0.041(\text{WELL DIAMETER})^2$
2"=0.16; 4"=0.65; 6"=1.47; 8"=2.61 GPF

PURGING INFORMATION

PURGING METHOD: (GRUNDFOS PUMP) – DEDICATED PUMP - PERISTALTIC PUMP – BLADDER PUMP
PURGING ENDPOINT: (VOLUME) OR WELL DRY 3 x (FOR GRUNDFOS) – ½ HR OR WELL DRY (FOR DEDICATED)
PUMP INTAKE: SCREEN/WELL BOTTOM PURGE WATER: DISCHARGED TO GROUND – (STORED IN DRUMS)
FIELD MEASUREMENTS METER: : YSI

DATE	TIME	PURGE RATE or VOLUME (GPM)	FIELD MEASUREMENTS AND UNITS							COMMENTS
			pH	Cond.	D.O.	Sal.	Turb.	Temp.	ORP	
				mS/cm	mg/L	%	NTU	°C	mV	
4/30/09	1410									START PURGE
	1415									~4 gal.
	1420									~8 gal
	1425									~13 gal.
4/30/09	(1435)		6.54	665	1.82	—	679.3	17.65	-49.3	COLLECT SAMPLE

TOTAL PURGE TIME: 15 (MIN) – HRS TOTAL PURGE VOL.: 13 (GAL) RECOVERY: FAST – SLOW – V.SLOW

SAMPLER:
SIGNATURE:
SAMPLE COMMENTS (COLOR/ODOR/DUPLICATE/ETC):

TETRA TECH

Monitoring Well Purging Form

WELL ID: MW-12A
COMPANY: THEMI
CLIENT:
PROJECT: BF Golf
LOCATION:
COMMENTS:

CONTAIN: (YES) – NO WITH WELL(S): MW12B, 11A, 11B
HISTORICALLY DRY: YES – (NO)
DEDICATED PUMP: YES – (NO)

WELL OBSERVATIONS

CASING & LID: (OK) – DAMAGED – NO LID LOCKED: (YES) – NO WELL DIAMETER: (2') – 4' – 6' – OTHER:
MEASURING POINT: (TIC) – TOC – GRS TUBING: OK – DAMAGED – OTHER: new

PURGING CALCULATIONS

(A) DEPTH TO WELL BOTTOM: 22.09 FT
(B) DEPTH TO WATER: 8.48 FT
(C) WATER COLUMN HEIGHT (A - B): 13.61 FT
(D) CASING VOLUME FACTOR: 0.16 GPF
(E) CASING VOLUME (C x D): 2.178 GAL
(F) VOLUMES TO BE PURGED: 3
(G) TOTAL PURGE VOLUME (E x F): 6.53 GAL

CASING FACTOR (GPF FOR INCHES) = $0.041(\text{WELL DIAMETER})^2$
2"=0.16; 4"=0.65; 6"=1.47; 8"=2.61 GPF

PURGING INFORMATION

PURGING METHOD: GRUNDFOS PUMP – DEDICATED PUMP – (PERISTALTIC PUMP) – BLADDER PUMP STABILIZATION
PURGING ENDPOINT: VOLUME OR WELL DRY 3 x (FOR GRUNDFOS) – ½ HR OR WELL DRY (FOR DEDICATED)
PUMP INTAKE: SCREEN/WELL BOTTOM PURGE WATER: DISCHARGED TO GROUND – (STORED IN DRUMS)
FIELD MEASUREMENTS METER: : YSI

DATE	TIME	PURGE RATE or VOLUME (GPM)	FIELD MEASUREMENTS AND UNITS							COMMENTS
			pH	Cond.	D.O.	Sal.	Turb.	Temp.	ORP	
				mS/cm	mg/L	%	NTU	°C	mV	
4/30	1550	325 mL/min								START PURGE
	1555		5.77	388	0.82	—	17.5	14.93	80.7	
	1600		5.69	389	0.40	—	17.7	14.85	75.1	
	1605		5.67	385	0.30	—	12.1	14.54	63.2	
	1610		5.70	381	0.17	—	5.2	14.44	59.2	
	1615		5.70	380	0.19	—	4.0	14.40	58.1	
	1620		5.71	380	0.18	—	2.7	14.47	57.9	
										COLLECT SAMPLE

TOTAL PURGE TIME: 30 (MIN) – HRS TOTAL PURGE VOL.: ~4 GAL RECOVERY: (FAST) – SLOW – V.SLOW

SAMPLER: David Scerbo
SIGNATURE:

SAMPLE COMMENTS (COLOR/ODOR/DUPLICATE/ETC): Collect sample @ 1625

TETRA TECH

Monitoring Well Purging Form

WELL ID: MW-12B
COMPANY: TtEMI
CLIENT:
PROJECT: BF Golf
LOCATION:
COMMENTS:

CONTAIN: (YES) – NO WITH WELL(S): MW12A, 11A, 11B
HISTORICALLY DRY: YES - NO
DEDICATED PUMP: YES – NO

WELL OBSERVATIONS

CASING & LID: (OK) – DAMAGED – NO LID LOCKED: (YES) – NO WELL DIAMETER: (2") – 4' – 6' – OTHER: ____
MEASURING POINT: (TIC) – TOC – GRS TUBING: OK – DAMAGED – OTHER: new

PURGING CALCULATIONS

(A) DEPTH TO WELL BOTTOM: 40.60 FT
(B) DEPTH TO WATER: 8.77 FT
(C) WATER COLUMN HEIGHT (A - B): 31.83 FT
(D) CASING VOLUME FACTOR: 0.16 GPF
(E) CASING VOLUME (C x D): 5.093 GAL
(F) VOLUMES TO BE PURGED: 3
(G) TOTAL PURGE VOLUME (E x F): 15.278 GAL

CASING FACTOR (GPF FOR INCHES) = $0.041(\text{WELL DIAMETER})^2$
2"=0.16; 4"=0.65; 6"=1.47; 8"=2.61 GPF

PURGING INFORMATION

PURGING METHOD: (GRUNDFOS PUMP) – DEDICATED PUMP - PERISTALTIC PUMP – BLADDER PUMP
PURGING ENDPOINT: (VOLUME) OR WELL DRY 3 x (FOR GRUNDFOS) – ½ HR OR WELL DRY (FOR DEDICATED)
PUMP INTAKE: SCREEN/WELL BOTTOM PURGE WATER: DISCHARGED TO GROUND (STORED IN DRUMS)
FIELD MEASUREMENTS METER: : YSI

DATE	TIME	PURGE RATE or VOLUME (GPM)	FIELD MEASUREMENTS AND UNITS							COMMENTS
			pH	Cond.	D.O.	Sal.	Turb.	Temp.	ORP	
				mS/cm	mg/L	%	NTU	°C	mV	
4/30/01	1550 ~~1650~~									START PURGE
	1555									~5 gal.
	1600									~10 gal.
	1605									~15.5 gal
	(1620)		6.35	514	4.44	—	1917.9	16.13	-7.2	COLLECT SAMPLE

TOTAL PURGE TIME: 15 (MIN) – HRS TOTAL PURGE VOL.: 15.5 (GAL) RECOVERY: (FAST) – SLOW – V.SLOW

SAMPLER:
SIGNATURE:
SAMPLE COMMENTS (COLOR/ODOR/DUPLICATE/ETC):

Well ID	Above msl Elev. GS.	From TOC DTW	From TOC DTB	Lat (N)	Long (W)
Flush 2" 5A		1.72	14.34		
5B		1.78	33.78		
2" 6A		2.20	15.0	36° 41' 39.074"	76° 10' 59.612"
6B		2.28	41.82		
7A		3.04	14.16 ✓ To Samp 6		
7B		2.39	41.54 ✓		
Stickup 8A		9.65	22.00 ✓		
8B		9.28	44.80 ✓		
9A		8.28	22.28		
9B		7.92	41.78		
10A		9.10	22.52		
10B		8.73	37.18		
11A		8.99	22.64		
11B		8.76	35.36		
12A		8.48	22.09		
12B		8.77	40.60		

7A/B - Access via Centerville Rd. (across st. from 1104 mailbox)

APPENDIX D

INORGANIC TRAFFIC REPORT AND CHAIN OF CUSTODY RECORDS

USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 38507
DAS No:
R

Region:	3
Project Code:	CT 4554
Account Code:	
CERCLIS ID:	VAN000306614
Spill ID:	ALM
Site Name/State:	Battlefield Golf - April 2009/VA
Project Leader:	Ken Eden
Action:	Removal Assessment
Sampling Co:	Tetra Tech EMI

Date Shipped:	5/4/2009
Carrier Name:	FedEx
Airbill:	857499683000
Shipped to:	A4 Scientific 1544 Sawdust Road, Suite 505 The Woodlands TX 77380 (281) 292-5277

Chain of Custody Record

Relinquished By	(Date / Time)	Received By	(Date / Time)
1			
2			
3			
4			

Sampler Signature:

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		ORGANIC SAMPLE No.	QC Type
MC0146	Ground Water/ Ken Eden	L/G	Metals+BO (7)	510 (HNO3) (1)	BG0904-MW-10A	S: 4/30/2009	13:35		--
MC0147	Ground Water/ Ken Eden	L/G	Metals+BO (7)	512 (HNO3) (1)	BG0904-FB	S: 5/1/2009	9:00		Field Blank
MC0148	Ground Water/ Ken Eden	L/G	Metals+BO (7)	513 (HNO3) (1)	BG0904-MW-10B	S: 4/30/2009	13:35		--
MC0149	Ground Water/ Ken Eden	L/G	Metals+BO (7)	514 (HNO3) (1)	BG0904-MW-11A	S: 4/30/2009	14:40		--
MC0150	Ground Water/ Ken Eden	L/G	Metals+BO (7)	515 (HNO3) (1)	BG0904-MW-11B	S: 4/30/2009	14:35		--
MC0151	Ground Water/ Ken Eden	L/G	Metals+BO (7)	516 (HNO3) (1)	BG0904-MW-12A	S: 4/30/2009	16:25		--
MC0152	Ground Water/ Ken Eden	L/G	Metals+BO (7)	517 (HNO3) (1)	BG0904-MW-12B	S: 4/30/2009	16:20		--
MC0153	Ground Water/ Ken Eden	L/G	Metals+BO (7)	518 (HNO3) (1)	BG0904-MW-7A	S: 4/30/2009	8:25		--
MC0154	Ground Water/ Ken Eden	L/G	Metals+BO (7)	519 (HNO3) (1)	BG0904-MW-7B	S: 4/30/2009	8:30		--
MC0155	Ground Water/ Ken Eden	L/G	Metals+BO (7)	521 (HNO3) (1)	BG0904-MW-8A	S: 4/30/2009	10:30		--
MC0156	Ground Water/ Ken Eden	L/G	Metals+BO (7)	522 (HNO3) (1)	BG0904-MW-8B	S: 4/30/2009	10:40		--

Shipment for Case Complete? N	**Sample(s) to be used for laboratory QC:** MC0183	**Additional Sampler Signature(s):**	**Chain of Custody Seal Number:**
Analysis Key:	**Concentration:** L = Low, M = Low/Medium, H = High	**Type/Designate:** Composite = C, Grab = G	**Shipment Iced?**

Metals+BO = ICP Metals + BORON Total, Metals+BOd = ICP Metals + BORON Dissolved

TR Number: 3-510515489-050109-0001

PR provides preliminary results. Requests for preliminary results will increase analytical costs.

Send Copy to: (b) (4)(b) (4)(b) (4)(b) (4) : (b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4) (b) (4)

REGION COPY

USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 38507
DAS No:
R

Region:	3
Project Code:	CT 4554
Account Code:	
CERCLIS ID:	VAN000306614
Spill ID:	ALM
Site Name/State:	Battlefield Golf - April 2009/VA
Project Leader:	Ken Eden
Action:	Removal Assessment
Sampling Co:	Tetra Tech EMI

Date Shipped:	5/4/2009
Carrier Name:	FedEx
Airbill:	857499683000
Shipped to:	A4 Scientific 1544 Sawdust Road, Suite 505 The Woodlands TX 77380 (281) 292-5277

Chain of Custody Record

Sampler Signature:

Relinquished By	(Date / Time)	Received By	(Date / Time)
1			
2			
3			
4			

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		ORGANIC SAMPLE No.	QC Type
MC0157	Ground Water/ Ken Eden	L/G	Metals+BO (7)	523 (HNO3) (1)	BG0904-MW-8BD	S: 4/30/2009	10:45		eld Duplicate of BG0904-MW-8
MC0158	Ground Water/ Ken Eden	L/G	Metals+BO (7)	524 (HNO3) (1)	BG0904-MW-9A	S: 4/30/2009	12:10		--
MC0160	Ground Water/ Ken Eden	L/G	Metals+BO (7)	527 (HNO3) (1)	BG0904-RB	S: 5/1/2009	9:35		Rinsate Blank
MC0175	Ground Water/ Ken Eden	L/G	Metals+BOd (7)	556 (HNO3) (1)	BG0904-FBF	S: 5/1/2009	9:00		Field Blank
MC0176	Ground Water/ Ken Eden	L/G	Metals+BOd (7)	557 (HNO3) (1)	BG0904-RBF	S: 5/1/2009	9:35		Rinsate
MC0183	Ground Water/ Ken Eden	L/G	Metals+BO (7)	569 (HNO3), 570 (HNO3) (2)	BG0904-MW-9B	S: 4/30/2009	11:55		--

Shipment for Case Complete? N	**Sample(s) to be used for laboratory QC:** MC0183	**Additional Sampler Signature(s):**	**Chain of Custody Seal Number:**
Analysis Key:	**Concentration:** L = Low, M = Low/Medium, H = High	**Type/Designate:** Composite = C, Grab = G	**Shipment Iced?**

Metals+BO = ICP Metals + BORON Total, Metals+BOd = ICP Metals + BORON Dissolved

TR Number: 3-510515489-050109-0001

PR provides preliminary results. Requests for preliminary results will increase analytical costs.

Send Copy to: (b) (4)(b) (4)(b) (4)(b) (4) : (b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4) (b) (4)

REGION COPY

APPENDIX E

DATA SUMMARY TABLE

Battlefield Golf Club Site

Summary of Monitoring Well Sampling Inorganic Analytical Data

Total Metals

Sample Number :			MC0153		MC0154		MC0155		MC0156		MC0157		MC0158		MC0183		MC0146	
Sampling Location : (Prefix : BG0904-)			MW-7A		MW-7B		MW-8A		MW-8B		MW-8BD		MW-9A		MW-9B		MW-10A	
Field QC :									Dup of MC0157		Dup of MC0156							
Matrix :			Water		Water		Water		Water		Water		Water		Water		Water	
Units :			ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
Laboratory			A4		A4		A4		A4		A4		A4		A4		A4	
Case #			38507		38507		38507		38507		38507		38507		38507		38507	
SDG			MC0146		MC0146		MC0146		MC0146		MC0146		MC0146		MC0146		MC0146	
Date Sampled :			4/30/2009		4/30/2009		4/30/2009		4/30/2009		4/30/2009		4/30/2009		4/30/2009		4/30/2009	
Time Sampled :			08:25		08:30		10:30		10:40		10:45		12:10		11:55		13:35	
Dilution Factor :			1.0		2.0 / 1.0		1.0		2.0 / 1.0		2.0 / 1.0		2.0 / 1.0		2.0 / 1.0		1.0	
ANALYTE	CRQL	MCL	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag
ANTIMONY	2	6			+			UJ	+		+		+		+			
*ARSENIC	1	10	4.1		1.3+	B	4.1	J	+		+		+		+		0.67	B
BARIUM	10	2000	67.3		17.2+	J	11.9	J	18.8+	J	17.1+	J	31.2+		14.0+	J	12.5	
BERYLLIUM	1	4			+		**9.9**	J	+		+		+		+			UJ
*CADMIUM	1	5			+		0.87	J	+		+		+		+			UJ
*CHROMIUM	2	NS		UL	+	UL	2.0	J	+	UL	+	UL	+	UL	1.6+	J		UJ
COBALT	1	NS	3.3		+		258	J	+		+		+		+		0.66	J
COPPER	2	1300		UL	+	UL		UJ	+	UL	+	UL	+	UL	+	UL		UJ
*LEAD	1	15*			+		0.51	J	+		+		+		+			
MANGANESE	1	NS	19.4	J	121+	J	718	J	261+	J	259+	J	164+	J	56.1+	J	205	J
MERCURY	0.2	2																
*NICKEL	1	NS	2.5	L	0.66+	J	297	J	0.86+	J	+	UL	+	UL	1.8+	J		UJ
SELENIUM	5	50			+			UJ	+		+		+		+			UJ
SILVER	1	NS			+			UJ	+		+		+		+			UJ
THALLIUM	1	2			+			UJ	+		+		+		+			
VANADIUM	5	NS		UL	+	UL	4.5	J	+	UL	+	UL	+	UL	+	UL		UJ
ZINC	2	NS	6.1	B	5.8+	B	267	J	12.2+	B	11.1+	B	1.8+	B	4.9+	B	1.1	B
BORON	7	NS	13.6	K	6.1+	J	12.8	J	35.0+	K	33.3+	K	42.6+	K	77.9+	K	24.5	J

CRQL = Contract Required Quantitation Limit *Action Level Exists

To calculate sample quantitation limits: (CRQL * Dilution Factor)

Prefix : All sample locations are prefixed BG0904-

+ = Result reported from diluted analysis.

J= Analyte present. Reported value may not be accurate or precise

K= Analyte present. Reported value may be biased high. Actual value is expected to be lower.

L= Analyte present. Reported value may be biased low. Actual value is expected to be higher.

UJ= Not detected, quantitiation limit may be inaccurate or imprecise.

UL= Not detected, quantitation limit is probably higher

MCL = Maximum Contaminant Level

NS = No MCL standard

Result in Bold font = Compound concentration exceeded MCL

Battlefield Golf Club Site

Summary of Monitoring Well Sampling Inorganic Analytical Data

Total Metals

Sample Number :			MC0148		MC0149		MC0150		MC0151		MC0152		MC0147		MC0160	
Sampling Location : (Prefix : BG0904-)			MW-10B		MW-11A		MW-11B		MW-12A		MW-12B		FB		RB	
Field QC :													Field Blank		Rinsate Blank	
Matrix :			Water		Water		Water		Water		Water		Water		Water	
Units :			ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
Laboratory					A4		A4		A4		A4		A4		A4	
Case #					38507		38507		38507		38507		38507		38507	
SDG					MC0146		MC0146		MC0146		MC0146		MC0146		MC0146	
Date Sampled :			4/30/2009		4/30/2009		4/30/2009		4/30/2009		4/30/2009		5/1/2009		5/1/2009	
Time Sampled :			13:35		14:40		14:35		16:25		16:20		09:00		09:35	
Dilution Factor :			2.0 / 1.0		2.0 / 1.0		2.0 / 1.0		2.0 / 1.0		1.0		1.0		1.0	
ANALYTE	CRQL	MCL	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag
ANTIMONY	2	6	+		+		+		+							
*ARSENIC	1	10	+		1.4+	B	0.99+	B	3.4+	B	1.6	B	0.47	J		
BARIUM	10	2000	8.3+	J	10.2+	J	22.6+		25.8+		23.7					
BERYLLIUM	1	4	+		+		+		+			UJ				
*CADMIUM	1	5	+		+		+		+			UJ				
*CHROMIUM	2	NS	+	UL	+	UL	+	UL	+	UL	0.66	J		UL		UL
COBALT	1	NS	+		+		+		0.99+	J		UJ				
COPPER	2	1300	+	UL	+	UL	+	UL	+	UL		UJ		UL		UL
*LEAD	1	15*	+		+		+		+							
MANGANESE	1	NS	66.3+	J	81.7+	J	137+	J	113+	J	98.0	J			0.53	J
MERCURY	0.2	2														
*NICKEL	1	NS	+	UL	+	UL	0.88+	J	4.0+	L	0.39	J		UL		UL
SELENIUM	5	50	+		+		+		+			UJ				
SILVER	1	NS	+		+		+		+			UJ				
THALLIUM	1	2	+		+		+		+							
VANADIUM	5	NS	+	UL	+	UL	+	UL	+	UL		UJ		UL		UL
ZINC	2	NS	1.7+	B	+	UL	3.8+	B	9.7+	B	4.2	B	1.5	J	2.9	L
BORON	7	NS	97.4+	K	16.8+	K	83.0+	K	6.7+	J	44.2	J				

CRQL = Contract Required Quantitation Limit *Action Level Exists

To calculate sample quantitation limits: (CRQL * Dilution Factor)

Prefix : All sample locations are prefixed BG0904-

+ = Result reported from diluted analysis.

J= Analyte present. Reported value may not be accurate or precise

K= Analyte present. Reported value may be biased high. Actual value is expected to be lower.

L= Analyte present. Reported value may be biased low. Actual value is expected to be higher.

UJ= Not detected, quantitiation limit may be inaccurate or imprecise.

UL= Not detected, quantitation limit is probably higher

MCL = Maximum Contaminant Level

NS = No MCL standard

Result in Bold font = Compound concentration exceeded MCL

ATTACHMENT
ANALYTICAL DATA PACKAGE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
Environmental Sciences Center
701 Mapes Road
Fort Meade, Maryland 20755-5350

DATE: May 26, 2009

SUBJECT: Region III Data QA Review

FROM: Colleen Walling
Region III ESAT RPO (3EA20)

TO: Christine Wagner
Regional Project Manager (3HS21)

Attached is the inorganic data validation report for the Battlefield Golf Club site (Case #: 38507; SDG#: MC0146) completed by the Region III Environmental Services Assistance Team (ESAT) contractor under the direction of Region III EAID.

If you have any questions regarding this review, please call Mike Mahoney at (410)305-2631 or me at (410) 305-2763.

Attachment

cc: Joshua Cope (TTEMI)

TO: #0021 TDF: #05035

LOCKHEED MARTIN
We never forget who we're working for™

Lockheed Martin Enterprise Solutions & Services
ESAT Region 3
US EPA Environmental Science Center
701 Mapes Road Ft. Meade, MD 20755-5350
Telephone 410-305-3037 Facsimile 410-305-3597

DATE: May 20, 2009

SUBJECT: Inorganic Data Validation (IM2 Level)
Case: 38507
SDG: MC0146
Site: Battlefield Golf Club

FROM: (b) (4) (b) (4)
Inorganic Data Reviewer

(b) (4) (b) (4)
Senior Oversight Chemist

TO: Colleen Walling
ESAT Region 3 Project Officer

OVERVIEW

Case 38507, Sample Delivery Group (SDG) MC0146, consisted of eighteen (18) unfiltered aqueous samples analyzed for total metals and boron (B) by A4 Scientific, Inc. (A4). The sample set included one (1) field blank, one (1) rinsate blank and one (1) field duplicate pair. Samples were analyzed in accordance with Contract Laboratory Program (CLP) Statement of Work (SOW) ILM05.4 (with modification 1621.0) through the Routine Analytical Services (RAS) program. Modifications include analysis of B at the Contract Required Quantitation Limit (CRQL) of 7.0 µg/L.

SUMMARY

Data were validated according to Region III Modifications to the National Functional Guidelines for Inorganic Data Review, Level IM2. Areas of concern with respect to data usability are listed below.

Samples in this SDG were analyzed by the ICP-MS method which does not include analysis for aluminum (Al), calcium (Ca), iron (Fe), magnesium (Mg), mercury (Hg), potassium (K) and sodium (Na). Hg was analyzed in this SDG using a cold vapor technique.

Data in this case have been impacted by outliers present in the field and rinsate blanks as well as the matrix spike, ICP serial dilution and ICP-MS internal standard analyses. Details of these outliers are discussed under "Minor Problems", specific samples affected are outlined in "Table 1A" and qualified analytical results for all samples are summarized on the Data Summary Forms (DSFs).

MINOR PROBLEMS

Field (FB) and/or rinsate (RB) blanks had reported results greater than the Method Detection Limits (MDLs) for the analytes listed below. Positive results for these analytes in affected samples which are less than or equal to five times (≤5X) the blank concentrations may be biased high and have been qualified "B" on the DSFs.

Blank	Affected Analytes
FB	arsenic (As)
RB	manganese (Mn), zinc (Zn)

The matrix spike recovery was high (>125%) for B. Positive results for this analyte in affected samples may be biased high and have been qualified "K" on the DSFs unless superseded by "J".

Matrix spike recoveries were low (<75% but >30%) for chromium (Cr), copper (Cu), nickel (Ni), vanadium (V) and Zn. Low recoveries may be attributed to matrix interferences or analyte lost during the digestion process. Positive results for these analytes in affected samples may be biased low and have been qualified "L" on the DSFs unless superseded by "B" or "J". Quantitation limits for these analytes in affected samples may be biased low and have been qualified "UL" on the DSFs unless superseded by "UJ".

The percent difference (%D) in the ICP serial dilution analysis was outside the control limit (>10%) for Mn. Positive results for this analyte in affected samples are estimated due to possible matrix interferences and have been qualified "J" on the DSFs unless superseded by "B".

Relative intensities for internal standard scandium (Sc)-45 were above the upper QC limit (>125%) for all samples (and the associated matrix spike) except MC0147, MC0153 and MC0160. In addition, the relative intensity for internal standard terbium (Tb)-159 was outside the upper QC limit (>125%) for sample MC0155. Per SOW, these samples were reanalyzed at a two-fold dilution (2X). Internal standard responses in the diluted analysis were within QC limits for samples MC0006, MC0148, MC0149, MC0150, MC0151, MC0154, MC0156, MC0157, MC0158 and MC0183. Results for all analytes except Hg in these samples were reported from the 2X dilution and annotated with a "+" on the DSFs. CRQLs are elevated in these samples due to the dilution. Samples MC0007, MC0008, MC0146, MC0152 and MC0155 had similar internal standard recoveries in the diluted analysis, thus results were reported from the undiluted initial analysis of these samples. Positive results and quantitation limits for analytes with masses greater than six (>6) but less than one hundred fifteen (<115) [less than two hundred nine (<209) in the case of MC0155] in these samples are estimated and have been qualified "J" and "UJ", respectively, on the DSFs unless superseded by "B".

NOTES

Reported results between MDLs and CRQLs were qualified "J" on the DSFs unless superseded by "B".

Reported results for field duplicate pair MC0156/MC0157 were within 20% RPD, ±CRQL for all analytes.

Post-digestion spike recoveries were low (<75% but >30%) for Ni and Zn. No data were qualified based on these findings.

Data for Case 38507, SDG MC0146, were reviewed in accordance with the National Functional Guidelines for Evaluating Inorganic Analyses with Modifications for use within Region III.

ATTACHMENTS

INFORMATION REGARDING REPORT CONTENT

Table 1A is a summary of qualifiers applied to the laboratory-generated results during data validation.

TABLE 1A	SUMMARY OF QUALIFIERS ON DATA SUMMARY FORMS AFTER DATA VALIDATION
TABLE 1B	CODES USED IN COMMENTS COLUMN OF TABLE 1A
APPENDIX A	GLOSSARY OF DATA QUALIFIER CODES
APPENDIX B	DATA SUMMARY FORMS
APPENDIX C	CHAIN OF CUSTODY RECORDS
APPENDIX D	LABORATORY CASE NARRATIVE

DCN: 38507.MC0146IM2.doc

TABLE 1A
SUMMARY OF QUALIFIERS ON DATA SUMMARY FORM AFTER DATA VALIDATION

Case 38507, SDG MC0146

ANALYTE	SAMPLES AFFECTED	POSITIVE VALUES	NON-DETECTED VALUES	BIAS	COMMENTS*
Sb	MC0155		UJ		ISH (127% - 317%)
As	MC0007, MC0008, MC0146, MC0152	B		High	FB (0.47 J µg/L) ISH (127% - 317%)
	MC0149, MC0150, MC0151, MC0154	B		High	FB (0.47 J µg/L)
	MC0155	J			ISH (127% - 317%)
Ba	MC0155	J			ISH (127% - 317%)
Be	MC0007, MC0008, MC0146, MC0152, MC0155	J	UJ		ISH (127% - 317%)
Cd	MC0007, MC0008, MC0146, MC0152, MC0155	J	UJ		ISH (127% - 317%)
Cr	MC0007, MC0008, MC0146, MC0152, MC0155	J	UJ		ISH (127% - 317%) MSL (68%)
	MC0183	J			>MDL<CRQL MSL (68%)
	All Samples Except MC0007, MC0008, MC0146, MC0152, MC0155, MC0183		UL	Low	MSL (68%)

* See explanation of comments in Table 1B

TABLE 1A
SUMMARY OF QUALIFIERS ON DATA SUMMARY FORM AFTER DATA VALIDATION

Case 38507, SDG MC0146

ANALYTE	SAMPLES AFFECTED	POSITIVE VALUES	NON-DETECTED VALUES	BIAS	COMMENTS*
Co	MC0007, MC0008, MC0146, MC0152, MC0155	J	UJ		ISH (127% - 317%)
Cu	MC0007, MC0008, MC0146, MC0152, MC0155	J	UJ		ISH (127% - 317%) MSL (68%)
	All Samples Except MC0007, MC0008, MC0146, MC0152, MC0155		UL	Low	MSL (68%)
Pb	MC0155	J			ISH (127% - 317%)
Mn	MC0007, MC0008	B		High	RB (0.53 J µg/L) ISH (127% - 317%) ISD (14%)
	MC0146, MC0152, MC0155	J			ISH (127% - 317%) ISD (14%)
	All Samples Except MC0007, MC0008, MC0146, MC0147, MC0152, MC0155	J			ISD (14%)
Ni	MC0007, MC0008, MC0146, MC0152, MC0155	J	UJ		ISH (127% - 317%) MSL (70%)
	MC0150, MC0154, MC0156, MC0183	J			>MDL<CRQL MSL (70%)

* See explanation of comments in Table 1B

TABLE 1A
SUMMARY OF QUALIFIERS ON DATA SUMMARY FORM AFTER DATA VALIDATION

Case 38507, SDG MC0146

ANALYTE	SAMPLES AFFECTED	POSITIVE VALUES	NON-DETECTED VALUES	BIAS	COMMENTS*
Ni	MC0006, MC0147, MC0148, MC0149, MC0151, MC0153, MC0157, MC0158, MC0160	L	UL	Low	MSL (70%)
Se	MC0007, MC0008, MC0146, MC0152, MC0155		UJ		ISH (127% - 317%)
Ag	MC0007, MC0008, MC0146, MC0152, MC0155		UJ		ISH (127% - 317%)
Tl	MC0155		UJ		ISH (127% - 317%)
V	MC0007, MC0008, MC0146, MC0152, MC0155	J	UJ		ISH (127% - 317%) MSL (74%)
	All Samples Except MC0007, MC0008, MC0146, MC0152, MC0155		UL	Low	MSL (74%)
Zn	MC0146, MC0152	B		High	RB (2.9 µg/L) ISH (127% - 317%) MSL (70%)
	MC0148, MC0150, MC0151, MC0153, MC0154, MC0156, MC0157, MC0158, MC0183	B		High	RB (2.9 µg/L) MSL (70%)

* See explanation of comments in Table 1B

TABLE 1A
SUMMARY OF QUALIFIERS ON DATA SUMMARY FORM AFTER DATA VALIDATION

Case 38507, SDG MC0146

ANALYTE	SAMPLES AFFECTED	POSITIVE VALUES	NON-DETECTED VALUES	BIAS	COMMENTS*
Zn	MC0007, MC0008, MC0155	J	UJ		ISH (127% - 317%) MSL (70%)
	MC0147	J			>MDL<CRQL MSL (70%)
	MC0006, MC0149, MC0160	L	UL	Low	MSL (70%)
B	MC0007, MC0008, MC0146, MC0152, MC0155	J			ISH (127% - 317%) MSH (219.1%)
	MC0151, MC0154	J			>MDL<CRQL MSH (219.1%)
	All Samples Except MC0007, MC0008, MC0146, MC0147, MC0151, MC0152, MC0154, MC0155, MC0160	K		High	MSH (219.1%)

* See explanation of comments in Table 1B

TABLE 1B
CODES USED IN COMMENTS COLUMN

ISH	=	Internal standard had relative intensities above the upper QC limit (>125%) [% relative intensities are in parenthesis]. Positive results and quantitation limits are estimated.
FB	=	Field blank had a result >MDL [result is in parenthesis]. Positive results which are ≤5X the blank concentration may be biased high.
MSL	=	Matrix spike recoveries were low (<75% but >30%) [% recoveries are in parenthesis]. Positive results and quantitation limits may be biased low.
>MDL = <CRQL		Reported results are greater than MDLs but less than CRQLs and are considered estimated.
RB	=	Rinsate blank had results >MDLs [results are in parenthesis]. Positive results which are ≤5X the blank concentrations may be biased high.
ISD	=	Percent difference (%D) in the ICP serial dilution analysis was outside the control limit (>10%) [%D is in parenthesis]. Positive results are estimated.
MSH	=	Matrix spike recovery was high (>125%) [% recovery is in parenthesis]. Positive results may be biased high.

Appendix A

Glossary of Data Qualifier Codes

GLOSSARY OF DATA QUALIFIER CODES (INORGANIC)

CODES RELATED TO IDENTIFICATION
(confidence concerning presence or absence of analytes):

U = Not detected. The associated number indicates approximate sample concentration necessary to be detected.

(NO CODE) = Confirmed identification.

B = Not detected substantially above the level reported in laboratory or field blanks.

R = Unusable result. Analyte may or may not be present in the sample. Supporting data necessary to confirm result.

N = Tentative identification. Consider present.
Special methods may be needed to confirm its presence or absence in future sampling efforts.

CODES RELATED TO QUANTITATION
(can be used for both positive results and sample quantitation limits):

J = Analyte Present. Reported value may not be accurate or precise.

K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.

L = Analyte present. Reported value may be biased low.
Actual value is expected to be higher.

UJ = Not detected, quantitation limit may be inaccurate or imprecise.

UL = Not detected, quantitation limit is probably higher.

OTHER CODES

Q = No analytical result.

Appendix B

Data Summary Forms

Case #: 38507 SDG : MC0146 Number of Soil Samples : 0

Site : BATTLEFIELD GOLF CLUB Number of Water Samples : 18

Lab. : A4

ALL TOTAL METALS

Sample Number :		(b) (6)		(b) (6)		(b) (6)		MC0146		MC0147	
Sampling Location : (Prefix : BG0904-)		(b) (6)		(b) (6)		(b) (6)		MW-10A		FB	
Field QC :										Field Blank	
Matrix :		Water		Water		Water		Water		Water	
Units :		ug/L		ug/L		ug/L		ug/L		ug/L	
Date Sampled :		5/1/2009		5/1/2009		5/1/2009		4/30/2009		5/1/2009	
Time Sampled :		16:15		16:17		16:19		13:35		09:00	
Dilution Factor :		2.0 / 1.0		1.0		1.0		1.0		1.0	
ANALYTE	CRQL	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag
ANTIMONY	2	+									
*ARSENIC	1	+		0.67	B	0.62	B	0.67	B	0.47	J
BARIUM	10	16.4+	J					12.5			
BERYLLIUM	1	+			UJ		UJ		UJ		
*CADMIUM	1	+			UJ		UJ		UJ		
*CHROMIUM	2	+	UL		UJ		UJ		UJ		UL
COBALT	1	+			UJ		UJ	0.66	J		
COPPER	2	+	UL	823	J	7.7	J		UJ		UL
*LEAD	1	+		321		0.47	J				
MANGANESE	1	128+	J	0.63	B	0.32	B	205	J		
MERCURY	0.2										
*NICKEL	1	+	UL	0.37	J	0.79	J		UJ		UL
SELENIUM	5	+			UJ		UJ		UJ		
SILVER	1	+			UJ		UJ		UJ		
THALLIUM	1	+									
VANADIUM	5	+	UL		UJ		UJ		UJ		UL
ZINC	2	39.8+	L	50.2	J	16.2	J	1.1	B	1.5	J
BORON	7	35.6+	K	39.6	J	39.1	J	24.5	J		

CRQL = Contract Required Quantitation Limit *Action Level Exists SEE NARRATIVE FOR CODE DEFINITIONS

To calculate sample quantitation limits: (CRQL * Dilution Factor) Revised 09/99

Prefix : All sample locations are prefixed BG0904-

+ = Result reported from diluted analysis.

Case #: 38507 SDG : MC0146

Site : BATTLEFIELD GOLF CLUB

Lab. : A4

ALL TOTAL METALS

Sample Number :		MC0148		MC0149		MC0150		MC0151		MC0152	
Sampling Location : (Prefix : BG0904-)		MW-10B		MW-11A		MW-11B		MW-12A		MW-12B	
Matrix :		Water		Water		Water		Water		Water	
Units :		ug/L		ug/L		ug/L		ug/L		ug/L	
Date Sampled :		4/30/2009		4/30/2009		4/30/2009		4/30/2009		4/30/2009	
Time Sampled :		13:35		14:40		14:35		16:25		16:20	
Dilution Factor :		2.0 / 1.0		2.0 / 1.0		2.0 / 1.0		2.0 / 1.0		1.0	
ANALYTE	CRQL	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag
ANTIMONY	2	+		+		+		+			
*ARSENIC	1	+		1.4+	B	0.99+	B	3.4+	B	1.6	B
BARIUM	10	8.3+	J	10.2+	J	22.6+		25.8+		23.7	
BERYLLIUM	1	+		+		+		+			UJ
*CADMIUM	1	+		+		+		+			UJ
*CHROMIUM	2	+	UL	+	UL	+	UL	+	UL	0.66	J
COBALT	1	+		+		+		0.99+	J		UJ
COPPER	2	+	UL	+	UL	+	UL	+	UL		UJ
*LEAD	1	+		+		+		+			
MANGANESE	1	66.3+	J	81.7+	J	137+	J	113+	J	98.0	J
MERCURY	0.2										
*NICKEL	1	+	UL	+	UL	0.88+	J	4.0+	L	0.39	J
SELENIUM	5	+		+		+		+			UJ
SILVER	1	+		+		+		+			UJ
THALLIUM	1	+		+		+		+			
VANADIUM	5	+	UL	+	UL	+	UL	+	UL		UJ
ZINC	2	1.7+	B	+	UL	3.8+	B	9.7+	B	4.2	B
BORON	7	97.4+	K	16.8+	K	83.0+	K	6.7+	J	44.2	J

CRQL = Contract Required Quantitation Limit *Action Level Exists SEE NARRATIVE FOR CODE DEFINITIONS

To calculate sample quantitation limits: (CRQL * Dilution Factor) Revised 09/99

Prefix : All sample locations are prefixed BG0904-

+ = Result reported from diluted analysis.

Case #: 38507 SDG : MC0146

Site : BATTLEFIELD GOLF CLUB

Lab. : A4

ALL TOTAL METALS

Sample Number :		MC0153		MC0154		MC0155		MC0156		MC0157	
Sampling Location : (Prefix : BG0904-)		MW-7A		MW-7B		MW-8A		MW-8B		MW-8BD	
Field QC :								Dup of MC0157		Dup of MC0156	
Matrix :		Water		Water		Water		Water		Water	
Units :		ug/L		ug/L		ug/L		ug/L		ug/L	
Date Sampled :		4/30/2009		4/30/2009		4/30/2009		4/30/2009		4/30/2009	
Time Sampled :		08:25		08:30		10:30		10:40		10:45	
Dilution Factor :		1.0		2.0 / 1.0		1.0		2.0 / 1.0		2.0 / 1.0	
ANALYTE	CRQL	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag
ANTIMONY	2			+			UJ	+		+	
*ARSENIC	1	4.1		1.3+	B	4.1	J	+		+	
BARIUM	10	67.3		17.2+	J	11.9	J	18.8+	J	17.1+	J
BERYLLIUM	1			+		9.9	J	+		+	
*CADMIUM	1			+		0.87	J	+		+	
*CHROMIUM	2		UL	+	UL	2.0	J	+	UL	+	UL
COBALT	1	3.3		+		258	J	+		+	
COPPER	2		UL	+	UL		UJ	+	UL	+	UL
*LEAD	1			+		0.51	J	+		+	
MANGANESE	1	19.4	J	121+	J	718	J	261+	J	259+	J
MERCURY	0.2										
*NICKEL	1	2.5	L	0.66+	J	297	J	0.86+	J	+	UL
SELENIUM	5			+			UJ	+		+	
SILVER	1			+			UJ	+		+	
THALLIUM	1			+			UJ	+		+	
VANADIUM	5		UL	+	UL	4.5	J	+	UL	+	UL
ZINC	2	6.1	B	5.8+	B	267	J	12.2+	B	11.1+	B
BORON	7	13.6	K	6.1+	J	12.8	J	35.0+	K	33.3+	K

CRQL = Contract Required Quantitation Limit *Action Level Exists SEE NARRATIVE FOR CODE DEFINITIONS

To calculate sample quantitation limits: (CRQL * Dilution Factor) Revised 09/99

Prefix : All sample locations are prefixed BG0904-

+ = Result reported from diluted analysis.

Case #: 38507 SDG : MC0146

Site : BATTLEFIELD GOLF CLUB

Lab. : A4

ALL TOTAL METALS

Sample Number :		MC0158		MC0160		MC0183					
Sampling Location :		BG0904-MW-9A		BG0904-RB		BG0904-MW-9B					
Field QC :				Rinsate Blank							
Matrix :		Water		Water		Water					
Units :		ug/L		ug/L		ug/L					
Date Sampled :		4/30/2009		5/1/2009		4/30/2009					
Time Sampled :		12:10		09:35		11:55					
Dilution Factor :		2.0 / 1.0		1.0		2.0 / 1.0					
ANALYTE	CRQL	Result	Flag	Result	Flag	Result	Flag	Result	Flag	Result	Flag
ANTIMONY	2	+				+					
*ARSENIC	1	+				+					
BARIUM	10	31.2+				14.0+	J				
BERYLLIUM	1	+				+					
*CADMIUM	1	+				+					
*CHROMIUM	2	+	UL		UL	1.6+	J				
COBALT	1	+				+					
COPPER	2	+	UL		UL	+	UL				
*LEAD	1	+				+					
MANGANESE	1	164+	J	0.53	J	56.1+	J				
MERCURY	0.2										
*NICKEL	1	+	UL		UL	1.8+	J				
SELENIUM	5	+				+					
SILVER	1	+				+					
THALLIUM	1	+				+					
VANADIUM	5	+	UL		UL	+	UL				
ZINC	2	1.8+	B	2.9	L	4.9+	B				
BORON	7	42.6+	K			77.9+	K				

CRQL = Contract Required Quantitation Limit *Action Level Exists SEE NARRATIVE FOR CODE DEFINITIONS

To calculate sample quantitation limits: (CRQL * Dilution Factor) Revised 09/99

+ = Result reported from diluted analysis.

Appendix C

Chain-of-Custody Records

USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 38507
DAS No:
R

Region:	3	Date Shipped:	5/5/2009	Chain of Custody Record	Sampler Signature: K Eden
Project Code:	CT34554	Carrier Name:	FedEx	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:		Airbill:	857499849011	1 K Eden 5/5/09 1800	
CERCLIS ID:	VAN000306614	Shipped to:	A4 Scientific 1544 Sawdust Road Suite 505 The Woodlands TX 77380 (281) 292-5277	2	
Spill ID:	ALM			3	
Site Name/State:	Battlefield Golf Potable/VA			4	
Project Leader:	Ken Eden				
Action:	Removal Assessment				
Sampling Co:	Tetra Tech EM, Inc				

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No/ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		ORGANIC SAMPLE No.	QC Type
(b) (6)	Potable Well/ Ken Eden	L/G	Metals+BO (7)	120 (HNO3) (1)	(b) (6)(b) (6)	S: 5/1/2009	16:15		–
(b) (6)	Potable Well/ Ken Eden	L/G	Metals+BO (7)	121 (HNO3) (1)	(b) (6)(b) (6)(b) (6)	S: 5/1/2009	16:17		–
(b) (6)	Potable Well/ Ken Eden	L/G	Metals+BO (7)	122 (HNO3) (1)	(b) (6)(b) (6)	S: 5/1/2009	16:19		–

Shipment for Case Complete? Y	Sample(s) to be used for laboratory QC:	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key:	Concentration: L = Low, M = Low/Medium, H = High	Type/Designate: Composite = C, Grab = G	Shipment Iced?
Metals+BO = ICP Metals + BORON Total			

TR Number: 3-082800255-050509-0001

REGION COPY

PR provides preliminary results. Requests for preliminary results will increase analytical costs.

Send Copy to: (b) (4)(b) (4)(b) (4)(b) (4) (b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)

USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 38507
DAS No:
R

Region:	3	**Date Shipped:**	5/4/2009	**Chain of Custody Record**	**Sampler Signature:**
Project Code:	CT 4554	**Carrier Name:**	FedEx	**Relinquished By (Date / Time)**	**Received By (Date / Time)**
Account Code:		**Airbill:**	857499683000	1	
CERCLIS ID:	VAN000306614	**Shipped to:**	A4 Scientific 1544 Sawdust Road, Suite 505 The Woodlands TX 77380 (281) 292-5277	2	
Spill ID:	ALM			3	
Site Name/State:	Battlefield Golf - April 2009/VA			4	
Project Leader:	Ken Eden				
Action:	Removal Assessment				
Sampling Co:	Tetra Tech EMI				

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		ORGANIC SAMPLE No.	QC Type
MC0146	Ground Water/ Ken Eden	L/G	Metals+BO (7)	510 (HNO3) (1)	BG0904-MW-10A	S: 4/30/2009	13:35		–
MC0147	Ground Water/ Ken Eden	L/G	Metals+BO (7)	512 (HNO3) (1)	BG0904-FB	S: 5/1/2009	9:00		Field Blank
MC0148	Ground Water/ Ken Eden	L/G	Metals+BO (7)	513 (HNO3) (1)	BG0904-MW-10B	S: 4/30/2009	13:35		–
MC0149	Ground Water/ Ken Eden	L/G	Metals+BO (7)	514 (HNO3) (1)	BG0904-MW-11A	S: 4/30/2009	14:40		–
MC0150	Ground Water/ Ken Eden	L/G	Metals+BO (7)	515 (HNO3) (1)	BG0904-MW-11B	S: 4/30/2009	14:35		–
MC0151	Ground Water/ Ken Eden	L/G	Metals+BO (7)	516 (HNO3) (1)	BG0904-MW-12A	S: 4/30/2009	16:25		–
MC0152	Ground Water/ Ken Eden	L/G	Metals+BO (7)	517 (HNO3) (1)	BG0904-MW-12B	S: 4/30/2009	16:20		–
MC0153	Ground Water/ Ken Eden	L/G	Metals+BO (7)	518 (HNO3) (1)	BG0904-MW-7A	S: 4/30/2009	8:25		–
MC0154	Ground Water/ Ken Eden	L/G	Metals+BO (7)	519 (HNO3) (1)	BG0904-MW-7B	S: 4/30/2009	8:30		–
MC0155	Ground Water/ Ken Eden	L/G	Metals+BO (7)	521 (HNO3) (1)	BG0904-MW-8A	S: 4/30/2009	10:30		–
MC0156	Ground Water/ Ken Eden	L/G	Metals+BO (7)	522 (HNO3) (1)	BG0904-MW-8B	S: 4/30/2009	10:40		–

Shipment for Case Complete? N	**Sample(s) to be used for laboratory QC:** MC0183	**Additional Sampler Signature(s):**	**Chain of Custody Seal Number:**
Analysis Key:	**Concentration:** L = Low, M = Low/Medium, H = High	**Type/Designate:** Composite = C, Grab = G	**Shipment Iced?** _____
Metals+BO = ICP Metals + BORON Total, Metals+BOd = ICP Metals + BORON Dissolved			

TR Number: 3-510515489-050109-0001

REGION COPY

PR provides preliminary results. Requests for preliminary results will increase analytical costs.

Send Copy to: (b) (4)(b) (4)(b) (4)(b) (4) (b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)

USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 38507
DAS No:
R

Region:	3	**Date Shipped:**	5/4/2009	**Chain of Custody Record**	**Sampler Signature:**
Project Code:	CT 4554	**Carrier Name:**	FedEx	**Relinquished By (Date / Time)**	**Received By (Date / Time)**
Account Code:		**Airbill:**	857499683000	1	
CERCLIS ID:	VAN000306614	**Shipped to:**	A4 Scientific 1544 Sawdust Road, Suite 505 The Woodlands TX 77380 (281) 292-5277	2	
Spill ID:	ALM			3	
Site Name/State:	Battlefield Golf - April 2009/VA			4	
Project Leader:	Ken Eden				
Action:	Removal Assessment				
Sampling Co:	Tetra Tech EMI				

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		ORGANIC SAMPLE No.	QC Type
MC0157	Ground Water/ Ken Eden	L/G	Metals+BO (7)	523 (HNO3) (1)	BG0904-MW-8BD	S: 4/30/2009	10:45		eld Duplicate of BG0904-MW-8
MC0158	Ground Water/ Ken Eden	L/G	Metals+BO (7)	524 (HNO3) (1)	BG0904-MW-9A	S: 4/30/2009	12:10		--
MC0160	Ground Water/ Ken Eden	L/G	Metals+BO (7)	527 (HNO3) (1)	BG0904-RB	S: 5/1/2009	9:35		Rinsate Blank
MC0175	Ground Water/ Ken Eden	L/G	Metals+BOd (7)	556 (HNO3) (1)	BG0904-FBF	S: 5/1/2009	9:00		Field Blank
MC0176	Ground Water/ Ken Eden	L/G	Metals+BOd (7)	557 (HNO3) (1)	BG0904-RBF	S: 5/1/2009	9:35		Rinsate
MC0183	Ground Water/ Ken Eden	L/G	Metals+BO (7)	569 (HNO3), 570 (HNO3) (2)	BG0904-MW-9B	S: 4/30/2009	11:55		--

Shipment for Case Complete? N	**Sample(s) to be used for laboratory QC:** MC0183	**Additional Sampler Signature(s):**	**Chain of Custody Seal Number:**
Analysis Key:	**Concentration:** L = Low, M = Low/Medium, H = High	**Type/Designate:** Composite = C, Grab = G	**Shipment Iced?** _____

Metals+BO = ICP Metals + BORON Total, Metals+BOd = ICP Metals + BORON Dissolved

TR Number: 3-510515489-050109-0001

PR provides preliminary results. Requests for preliminary results will increase analytical costs.

REGION COPY

Send Copy to: (b) (4)(b) (4)(b) (4)(b) (4)(b) (4) (b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)(b) (4)

U.S. EPA Region III Analytical Request Form

Revision 10.06

ASQAB USE ONLY		
RAS#	CT4554	Analytical TAT
DAS#		7
NSE#		

38507

Date: 4/21/09	Site Activity: Removal ASSESSMENT			
Site Name: Battlefield Golf Club		Street Address: 1001 South Centerville Turnpike		
City: Chesapeake	State: VA	Latitude: 36.68982		Longitude: 76.17790
Program: Superfund	Acct. #: 2009 T03 N 302DC6C A3LM RS00		CERCLIS #: VAN000306614	
Site ID:	Spill ID: A3LM		Operable Unit:	
Site Specific QA Plan Submitted: ☒ No ☐ Yes	Title: START3 QAPP			Date Approved: November 2006
EPA Project Leader: CHRIS WAGNER	Phone#:	Cell Phone #: 804-337-3049		E-mail: Wagner.Christine@epa.gov
Request Preparer: JOSHUA COPE	Phone#: 610-364-2130	Cell Phone #: 215-768-8114		E-mail: Joshua.cope@ttemi.com
Site Leader: Ken Eden	Phone#: 610-364-2125	Cell Phone #: 215 681 0722		E-mail: Ken.eden@ttemi.com
Contractor: Tetra Tech EM Inc		EPA CO/PO: Jeff Fang/Karen Wodarczyk		
#Samples 1*	Matrix: potable water	Parameter: TAL metals Low + Hg + B - total	A4	Method: ILM05.4 ICPMS
#Samples 1*	Matrix: potable water	Parameter: TAL metals Low +Hg + B - dissolved		Method: ILM05.4 ICPMS
#Samples 1*	Matrix: non-potable water	Parameter: TAL metals Low + Hg + B - total		Method: ILM05.4 ICPMS
#Samples 1*	Matrix: non- potable water	Parameter: TAL metals Low +Hg + B - dissolved		Method: ILM05.4 ICPMS
#Samples	Matrix:	Parameter:		Method:
Ship Date From: 4/28/09	Ship Date To: 4/30/09	Org. Validation Level		Inorg. Validation Level IM2

30510

Unvalidated Data Requested: ☐ No ☒ Yes If Yes, TAT Needed: ☐ 14days ☒ 7days ☐ 72hrs ☐ 48hrs ☐ 24hrs ☐ Other (Specify) by ESAT

Validated Data Package Due: ☐ 42 days ☐ 30 days ☒ 21days ☐ 14 days ☐ Other (Specify) 7/14

Electronic Data Deliverables Required: ☐ No ☒ Yes (EDDs will be provided in Region 3 EDD Format)

Special Instructions: Detection limits are attached please note addition of Boron analysis. *PLEASE AWARD SPLIT SAMPLES TO A SEPARATE LAB FOR COMPARISON.

Appendix D

Laboratory Case Narrative

USEPA-CLP

COVER PAGE

Lab Name: A4 Scientific, Inc. Contract: EPW08063

Lab Code: A4 Case No: 38507 NRAS No.: 1621.0 SDG No: MC0146

SOW No.: ILM05.4

EPA Sample No.	Lab Sample ID
MC0006	0010264-01
MC0007	0010264-02
MC0008	0010264-03
MC0146	0010259-01
MC0147	0010259-02
MC0148	0010259-03
MC0149	0010259-04
MC0150	0010259-05
MC0151	0010259-06
MC0152	0010259-07
MC0153	0010259-08
MC0154	0010259-09
MC0155	0010259-10
MC0156	0010259-11
MC0157	0010259-12
MC0158	0010259-13
MC0160	0010259-14
MC0183	0010259-15
MC0183D	0010259-15D
MC0183S	0010259-15S

		ICP-AES	ICP-MS
›re ICP-AES and ICP-MS interelement corrections ›plied?	(Yes/No)	YES	YES
›re ICP-AES and ICP-MS background corrections ›plied?	(Yes/No)	YES	YES
If yes, were raw data generated before application of background corrections?	(Yes/No)	NO	NO

›mments: The %D for Boron and Manganese exceeded the QC limits in the serial dilution. Interferences are suspected.

certify that this data package is in compliance with the terms and conditions of the ›ntract, both technically and for completeness, for other than the conditions detailed ›ove. Release of the data contained in this hardcopy data package and in the computer-readable data ›bmitted on diskette (or via an alternate means of electronic ›ansmission, if approved in advance by USEPA) has been authorized by the Laboratory ›nager or the Manager's designee, as verified by the following signature.

›gnature: (b) (4) (b) (4) Name: (b) (4)(b) (4)(b) (4)

›e: 05/12/09 Title: (b) (4)(b) (4) 000000001

A4 SCIENTIFIC, INC.

1544 Sawdust Road, Suite 505 • The Woodlands, TX 77380 • Phone (281) 292-5277

Contract #: EPW08063	Case #: 38507	SDG #: MC0146

SDG NARRATIVE

SAMPLE RECIEPT & LOGIN

The following samples were received on the dates listed against them. The samples were logged in for analysis as listed.

Client Sample	*Lab Sample*	*Matrix*	*#Cont.*	*Received*	*Analysis*	*Comments*
MC0146	0010259-01	Water	1	05/05/09 10:08	ILM05.4-TOTAL HG	SDG FIRST SX-MA 1621.0
					ILM05.4-TOTAL ICPMS	
MC0147	0010259-02	Water	1	05/05/09 10:08	ILM05.4-TOTAL HG	MA 1621.0
					ILM05.4-TOTAL ICPMS	
MC0148	0010259-03	Water	1	05/05/09 10:08	ILM05.4-TOTAL HG	MA 1621.0
					ILM05.4-TOTAL ICPMS	
MC0149	0010259-04	Water	1	05/05/09 10:08	ILM05.4-TOTAL HG	MA 1621.0
					ILM05.4-TOTAL ICPMS	
MC0150	0010259-05	Water	1	05/05/09 10:08	ILM05.4-TOTAL HG	MA 1621.0
					ILM05.4-TOTAL ICPMS	
MC0151	0010259-06	Water	1	05/05/09 10:08	ILM05.4-TOTAL ICPMS	MA 1621.0
					ILM05.4-TOTAL HG	
MC0152	0010259-07	Water	1	05/05/09 10:08	ILM05.4-TOTAL ICPMS	MA 1621.0
					ILM05.4-TOTAL HG	
MC0153	0010259-08	Water	1	05/05/09 10:08	ILM05.4-TOTAL ICPMS	MA 1621.0
					ILM05.4-TOTAL HG	
MC0154	0010259-09	Water	1	05/05/09 10:08	ILM05.4-TOTAL HG	MA 1621.0

A4 SCIENTIFIC, INC.

1544 Sawdust Road, Suite 505 • The Woodlands, TX 77380 • Phone (281) 292-5277

Contract #: EPW08063	Case #: 38507	SDG #: MC0146

SDG NARRATIVE

					ILM05.4-TOTAL ICPMS	
MC0155	0010259-10	Water	1	05/05/09 10:08	ILM05.4-TOTAL HG	MA 1621.0
					ILM05.4-TOTAL ICPMS	
MC0156	0010259-11	Water	1	05/05/09 10:08	ILM05.4-TOTAL HG	MA 1621.0
					ILM05.4-TOTAL ICPMS	
MC0157	0010259-12	Water	1	05/05/09 10:08	ILM05.4-TOTAL HG	MA 1621.0
					ILM05.4-TOTAL ICPMS	
-	-	-	-	-	-	-
MC0158	0010259-13	Water	1	05/05/09 10:08	ILM05.4-TOTAL ICPMS	MA 1621.0
					ILM05.4-TOTAL HG	
MC0160	0010259-14	Water	1	05/05/09 10:08	ILM05.4-TOTAL HG	MA 1621.0
					ILM05.4-TOTAL ICPMS	
MC0183	0010259-15	Water	2	05/05/09 10:08	ILM05.4-TOTAL ICPMS	MS/DUP-MA 1621.(
					ILM05.4-TOTAL HG	
MC0006	0010264-01	Water	1	05/06/09 10:04	ILM05.4-TOTAL HG	
					ILM05.4-TOTAL ICPMS	
MC0007	0010264-02	Water	1	05/06/09 10:04	ILM05.4-TOTAL ICPMS	
					ILM05.4-TOTAL HG	
MC0008	0010264-03	Water	1	05/06/09 10:04	ILM05.4-TOTAL ICPMS	SDG FINAL SX
					ILM05.4-TOTAL HG	

A4 SCIENTIFIC, INC.

1544 Sawdust Road, Suite 505 • The Woodlands, TX 77380 • Phone (281) 292-5277

Contract #: EPW08063	Case #: 38507	SDG #: MC0146

SDG NARRATIVE

Samples were received in the following coolers.

DATE RECEIVED	COOLER NO.	Temp (in °C)	AIRBILL NO.
05/05/2009	1	5	857499683000
05/06/2009	1	3	857499849011

No other discrepancies or issues were noted during receipt and login.

pH of the water samples was verified upon sample receipt and is listed below:

EPA SAMPLE #	LAB SAMPLE #	pH- ICP-MS
MC0006	10264-01	<2
MC0007	10264-02	<2
MC0008	10264-03	<2
MC0146	10259-01	<2
MC0147	10259-02	<2
MC0148	10259-03	<2
MC0149	10259-04	<2
MC0150	10259-05	<2
MC0151	10259-06	<2
MC0152	10259-07	<2
MC0153	10259-08	<2
MC0154	10259-09	<2
MC0155	10259-10	<2
MC0156	10259-11	<2
MC0157	10259-12	<2
MC0158	10259-13	<2
MC0160	10259-14	<2
MC0183	10259-15	<2

ICP-MS

Water samples were digested by Hot-Block technique (HW3) and analyzed using a Thermo Electron Corporation ICP MS model X-II.

No problems were encountered during sample preparation. Several samples were failed for the internal standards lab did a 2X dilution for the failed samples. Interferences are suspected.

MS and DUP were performed on sample "MC0183" and they were within the QC limits. The %R for several analytes exceeded the QC limits in the Matrix Spike, Post digestion spike was performed.

Serial Dilution was performed on sample "MC0183" and it was within the QC limits.

All samples were prepared and analyzed according to the modified analysis instructions and prepared and analyzed with in the contractual holding times.

A4 SCIENTIFIC, INC.

1544 Sawdust Road, Suite 505 • The Woodlands, TX 77380 • Phone (281) 292-5277

Contract #: EPW08063	Case #: 38507	SDG #: MC0146

SDG NARRATIVE

The following equations were used for calculation of sample results from raw instrument output data:

ICP-MS
WATER Samples:

Concentration (µg/L) = $C * \frac{V_f}{V_i} * DF$

Where,
C = Instrument value in µg/L (The average of all replicate integrations).
V_f = Final digestion volume (mL) (50ml)
V_i = Initial digestion volume (mL) (50ml)
DF = Dilution Factor

Request for Quote (RFQ) for Modified Analysis

Date: April 22, 2009

Subject: Modification Reference Number: 1621.0
Title: Addition of Boron by ICP-MS
Sample Matrix: Water
Fraction Affected: Metals
Statement of Work: ILM05.4

Purpose:

The Contractor Laboratory is requested to perform the following modified analyses under the Inorganic Statement of Work (SOW) ILM05.4, based on the additional specifications listed below. Unless specifically modified by this modification, all analyses, Quality Control (QC), and reporting requirements specified in SOW ILM05.4 remain unchanged and in full force and effect. The number of samples requested in this modification is not guaranteed.

Please note that accepting a modified analysis request is voluntary, and that the Laboratory is not required to accept the modified analysis. There will be no adverse effect to the Laboratory for not accepting the modified analysis request. However, once the Laboratory accepts the request for modified analysis, it shall perform the analysis in accordance with this modification and as specified in SOW ILM05.4.

The Laboratory is requested to review the modification described herein, determine whether or not it shall accept the requested modified analyses, and complete the attached response form. The Laboratory shall provide comments in response to the required changes in the designated area, in order to ensure that the modified analysis can be completed in accordance with the specifications described herein.

Notice to Contractors: Acceptance of Modified Analysis samples will not count against the monthly capacity.

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1.0/5-1621.0-9

Modification to the SOW Specifications:

The contract Laboratory shall analyze water samples for the Target Analyte List (TAL), and the additional analyte Boron (B, CASRN 7440-42-8), by ICP-MS as indicated on the Traffic Report/Chain of Custody record.

The CRQL for B is 7 ug/L.

A Method Detection Limit (MDL) study, by the preparation and analysis procedures used, is required. The MDL for B shall be less than one-half the CRQL listed above.

The Laboratory shall add B to the ICV/CCV solutions at an appropriate level, if it is not already present in the standards.

The Laboratory is not required to adjust the concentrations of the CRQL Check Standard (CRI) solution.

The Matrix Spike level for aqueous B is 100 ug/L.

The Laboratory shall add B to the LCSW at the Matrix Spike level, if it is not already present in the solution being used.

The Laboratory is not required to add B to the ICSA/ICSAB solutions.

The Laboratory shall not use borosilicate glassware to digest the samples for metals analysis or prepare any sample dilutions to avoid contaminating samples with B. The Laboratory shall use polymer digestion vessels instead.

It is recommended that the Laboratory purchase reagent water that is guaranteed to have low levels of B. Some standard Laboratory reagent water systems may not be able to supply clean enough water to allow the laboratory blanks to meet the required CRQL.

Reporting Requirements:

Hardcopy and electronic data reporting are required as specified per SOW ILM05.4. All hardcopy and electronic data shall be adjusted to incorporate modified specifications. This includes attaching a copy of the requirements for modified analysis to the SDG Narrative. If specific problems occur with incorporation of the modified analysis into the hardcopy and/or electronic deliverable, the Laboratory shall contact the DASS Manager within the Sample Management Office (SMO) at (b) (4)(b) (4) or via email at (b) (4)(b) (4)(b) (4)(b) (4) for resolution.

All samples analyzed for the same fraction within an SDG must be analyzed under the same fractional requirements. The Laboratory shall not include data for the same fraction with different requirements in the same SDG.

The Laboratory shall include the Modification Reference Number 1621.0 on each hardcopy data form under the "NRAS No:" header appearing on each form as well as the "NRAS No." field on the Record type 21 of the electronic deliverable (if diskette deliverable is required). The Laboratory shall also document the Modification Reference Number and Solicitation Number on the SDG Coversheet.

Clarifications/Revisions to the RFQ for Modified Analysis:

Laboratory Name:
Laboratory Comments:

000006 610
11/5-12-05
1621.0