Final
Remedial Investigation Report Addendum No.2
for the
Former Waldorf Nike (W-44) Battery, Launch Area
Charles County, Maryland

Prepared for:

U.S. Army Corps of Engineers
Baltimore District

Contract W912DR-06-D-0002
Delivery Order 0003

Prepared by:

ERT, Inc.
6100 Frost Place, Suite A
Laurel, MD 20707
240-554-0161

December 2012

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Approvers:

December 10, 2012

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Project Manager

March 14, 2012

Michael Dorman — Date
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COMPLETION OF SENIOR TECHNICAL REVIEW

This document has been produced within the framework of the ERT, Inc. (ERT) quality management system. As such, a senior technical review has been conducted. This included review of all elements addressed within the document, proposed or utilized technologies and alternatives and their applications with respect to project objectives and framework of U.S. Army Corps of Engineers regulatory constraints under the current project, within which this work has been completed.

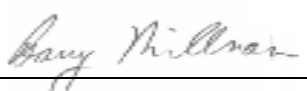
March 09, 2012

Thomas Bachovchin — Date

Senior Technical Reviewer

COMPLETION OF INDEPENDENT TECHNICAL REVIEW

This document has been produced within the framework of ERT's quality management system. As such, an independent technical review, appropriate to the level of risk and complexity inherent in the project, has been conducted. This included review of assumptions, alternatives evaluated, the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the project objectives. Comments and concerns resulting from review of the document have been addressed and corrected as necessary.



March 12, 2012

Barry Millman, Professional Engineer — Date

Independent Technical Reviewer

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EXECUTIVE SUMMARY

ERT, Inc. (ERT) was contracted by the U.S. Army Corps of Engineers (USACE) to perform an additional investigation at the Former Waldorf Nike (W-44) Battery, Launch Area in Charles County, Maryland, herein referred to as the "site" (Figure 1-1). This investigation was conducted under Contract Number W912DR-06-D-0002, Delivery Order 0003, with the USACE- Baltimore District. The intent of the investigation was to supplement the previously completed *Remedial Investigation Addendum for the Waldorf Nike (W-44) Site, Launch Area, Charles County, Maryland* (ERT, 2009) and the *Remedial Investigation Report for Nike Battery Launch Area (W-44), Waldorf, Maryland* [Weston Solutions, Inc. (Weston), 2005] by addressing identified data gaps. The results of this investigation do not alter the previously recommended further action provided in the original *Remedial Investigation Report for Nike Battery Launch Area (W-44), Waldorf, Maryland* (Weston, 2005) or in the *Focused Feasibility Study for Nike Battery Launch Area (W-44), Formerly Used Defense Site, Waldorf, Maryland* (Weston, 2011). Rather, the results address previously identified data gaps associated with the location of the source area and refine the extent of the associated groundwater plume. Location of the source area and refinement of the groundwater plume are necessary inputs into the development of an adequate environmental management decision.

In order to address data gap concerns expressed by the Maryland Department of the Environment (MDE), 17 boreholes were advanced in June 2011, in the area of concern to the south and to the east of the existing plume, within the source area. From each borehole, a soil sample and screening level groundwater sample were collected and laboratory analyzed for Target Compound List (TCL) volatile organic compounds (VOCs). In all but one instance, soil samples were collected from the vadose zone above the groundwater interface. At location soil boring (SB)-3, the soil sample was collected from an area above the groundwater interface where elevated total VOC concentrations were detected. Additionally, groundwater samples were collected from nine existing conventional monitoring wells (MWs) and laboratory analyzed for TCL VOCs. A data quality assessment was performed which shows that all project data quality objectives were met.

From the 17 soil samples collected, trichloroethylene (TCE) was detected in one sample, the sample collected from location SB-3, at a concentration of 287 micrograms per kilogram (µg/kg), below the U.S. Environmental Protection Agency Regional Screening Level of 910 µg/kg. SB-3 is located south-southeast of MW-4 and MW-12, and approximately 15 feet to the north-northwest of an identified 55-gallon drum. Upon inspection, the identified 55-gallon drum was found to be empty, corroded, broken, and tipped on its side in a ditch. The drum was determined to be of significance due to its location upgradient of the groundwater plume and associated concentrations of TCE in soil samples collected adjacent to the drum. Due to the apparent age and condition of the drum, the location of the drum upgradient of the groundwater plume, and the associated TCE concentrations detected in a soil samples adjacent to the drum it was determined that the deteriorated drum is the most likely source of contamination causing the groundwater plume.

From the 26 groundwater samples collected at the site, carbon tetrachloride (CCl_4) was detected in 11 groundwater samples above the USEPA Maximum Contaminant Level (MCL) of 5 micrograms per liter (µg/L). The highest concentration of CCl_4 was detected in the sample collected from MW-4. In four groundwater samples, TCE was detected at concentrations above the USEPA MCL of 5 µg/L. The highest concentrations of TCE were detected southwest and south-southeast of MW-4, in the groundwater samples collected at locations SB-2 and SB-3.

The additional data collected confirms that a residual source area does exist adjacent to MW-4 and MW-12, the current location of the groundwater plume. A suspected residual source area is likely associated with location SB-3 and a 55-gallon drum identified during the investigation. Due to the proximity of the SB-3 location to MW-4 and MW-12, the residual source area associated with the SB-3 location is suspected to be associated with the observed groundwater plume at the site.

New groundwater data collected from the site has substantiated previous analytical data. During the upcoming preliminary design phase for the remedial action to address the groundwater contaminant plume, USACE has agreed with MDE that additional groundwater sample collection outside of the existing sampling perimeter will be conducted to fully characterize the boundary of the groundwater contaminant plume.

Newly acquired data suggests that TCE concentrations in groundwater may also be contributing risk to human and environmental receptors. The identification and addition of TCE does not alter the previous risk assessment assumptions (Weston, 2005) or alter the remedial alternative evaluation developed as part of the feasibility study (Weston, 2011), as the screening of process options conducted for CCl_4 also are applicable to account for concentrations of TCE that have been detected in groundwater at the site.

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

ASTM	American Society for Testing and Materials
bgs	below ground surface
CCl_4	carbon tetrachloride
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	contract laboratory program
DERP	Defense Environmental Restoration Program
DO	dissolved oxygen
DQA	data quality assessment
DQO	data quality objective
EDS	Environmental Data Services, Inc.
ERB	equipment rinsate blanks
ERT	ERT, Inc.
ft	feet/foot
FUDS	Formerly Used Defense Site
IDW	investigation derived waste
J	estimated data value
LCS	laboratory control sample
MCL	maximum contaminant level
MDE	Maryland Department of the Environment
mg/L	milligrams per liter
mV	millivolts
MS	matrix spike
mS/cm	milliSiemens per centimeter
MSD	matrix spike duplicate
MTBE	metyl-tert-butyl-ether
MW	monitoring well
NTU	nephelometric turbidity unit
ORP	oxygen reduction potential
PARCCS	Precision, Accuracy, Representativeness, Comparability, Completeness, and Sensitivity
PID	photoionization detector
PQL	practical quantitation limits
ppm	parts per million
QA	quality assurance
QC	quality control
R	rejected data value
RI	remedial investigation
RL	reporting limit
ROE	right of entry
RPD	relative percent difference
RSL	Regional Screening Level
SB	soil boring
SC	specific conductivity
SDG	sample delivery groups
SL	screening level
su	standard units

TCE	trichloroethylene
TCL	Target Compound List
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
Weston	Weston Solutions, Inc.
^{o}C	degrees Celsius
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
%R	percent recovered

1.0 INTRODUCTION

The *Remedial Investigation Report Addendum No. 2 for the Waldorf Nike (W-44) Battery, Launch Area* was prepared by ERT, Inc (ERT) in accordance with Contract Number W912DR-06-D-0002, Delivery Order 0003, dated 19 June 2007 contracted by the U.S. Army Corps of Engineers (USACE) – Baltimore District as authorized under the ongoing authorized Defense Environmental Restoration Program – Formerly Used Defense sites (DERP – FUDS) Hazardous, Toxic, and Radioactive Waste project. Activities at the site were conducted under the ongoing DERP-FUDS project and in accordance with the Comprehensive, Environmental Response, Compensation and Liability Act (CERCLA). The intent of remedial investigation (RI) was to conduct additional environmental investigation activities at the former Waldorf Nike (W-44) Battery, Launch Area in Charles County, Maryland, herein referred to as the "site" (**Figure 1-1** and **Figure 1-2**) to further refine the nature extent of a previously identified groundwater plume.

This report represents the second addendum to the RI report. The intent of this investigation was to supplement the previously completed *Remedial Investigation Addendum for the Waldorf Nike (W-44) Site, Launch Area, Charles County, Maryland* (ERT, 2009) and the *Remedial Investigation Report for Nike Battery Launch Area (W-44), Waldorf, Maryland* [Weston Solutions, Inc. (Weston), 2005] by addressing identified data gaps associated with the location of the source area and the extent of the associated groundwater plume. The results of this investigation do not alter the previously recommended further action provided in the original *Remedial Investigation Report for Nike Battery Launch Area (W-44), Waldorf, Maryland* (Weston, 2005) or in the *Focused Feasibility Study for Nike Battery Launch Area (W-44), Formerly Sued Defense Site, Waldorf, Maryland* (Weston, 2011). Rather, the results address previously identified data gaps associated with the location of the source area and further refine the extent of the associated groundwater plume, both of which are necessary prior to developing an adequate environmental management decision. For reference, the *Remedial Investigation Addendum for the Waldorf Nike (W-44) Site, Launch Area, Charles County, Maryland* (ERT, 2009) has been included in this report as Appendix A, and the *Remedial Investigation Report for Nike Battery Launch Area (W-44), Waldorf, Maryland* (Weston, 2005) has been included in this report as Appendix B.

Investigation activities were performed in accordance with the approved *Work Management Plan for Data Gap Investigation at the Former Waldorf Nike (W-44) Site, Launch Area, Charles County, Maryland* (ERT, 2011a). In order to maintain consistency in methodology, analytical reproducibility and representativeness with previous investigation efforts, the Work Management Plan utilized sampling and analytical protocols established in the previously approved planning documents, *Work Management Plan for Four Nike Sites in Maryland* (ERT, 2008a) and *Sampling and Analysis Plan for Four Nike Sites in Maryland* (ERT, 2008b).

1.1 Background Information

Background information has previously been presented in the *Remedial Investigation Report for Nike Battery Launch Area (W-44), Waldorf, Maryland* (Weston, 2005).

1.2 Previous Environmental Investigation

Details of previous environmental investigations since 1986 can be reviewed in the *Remedial Investigation Addendum for the Waldorf Nike (W-44) Site, Launch Area, Charles County, Maryland* (ERT, 2009) and the *Remedial Investigation Report for Nike Battery Launch Area (W-44), Waldorf, Maryland* (Weston, 2005).

Historical investigations identified concentrations of trichloroethylene (TCE) and carbon tetrachloride (CCl_4) in groundwater at the site that exceed their respective United States Environmental Protection Agency (USEPA) Maximum Contaminant Levels (MCLs). The RI completed by Weston in 2005 concluded that there were no impacts to standing water or potential migration routes for standing water inside former missile silos remaining at the site. Groundwater samples collected from monitoring wells (MW) MW-4 and MW-12 immediately adjacent to and downgradient of the former Missile Assembly Building contained the highest concentrations of CCl_4 and TCE. Generally, groundwater flows at the site from south-southeast to north-northwest. Concentrations of CCl_4 decrease at locations downgradient of the former Missile Assembly Building in samples collected from MW-4 and MW-12, and were reported below laboratory detection limits upgradient of the former Missile Assembly Building in samples collected from MW-17. The source of the CCl_4 and TCE detected in groundwater has been assumed to result from a surficial spill or spills of solvents previously used to clean missile parts in the rear of (i.e., to the west of) the former Missile Assembly Building.

Additionally, the 2005 RI concluded that natural attenuation processes appeared to be active, although the primary destructive natural attenuation process, biodegradation, was limited (Weston, 2005). The extent of the groundwater plume appeared to be stable and/or decreasing, based on the low (1 microgram per liter [µg/L]) CCl_4 concentrations detected downgradient in samples collected from MW-11 and the decreasing trend of CCl_4 concentrations detected near the center of the groundwater plume associated with samples collected from MW-4 and MW-12.

An RI Addendum was conducted by ERT in 2009 to assess the current concentrations of TCE and CCl_4 in groundwater. During the 2009 investigation activities, a total of nine groundwater samples were collected from existing monitoring wells and laboratory analyzed for target compound list (TCL) volatile organic compounds (VOCs). The 2009 investigation activities concluded:

- concentrations of TCE and CCl_4 in groundwater decrease radially from MW-4, which is downgradient of the presumed source area; and
- concentrations of CCl_4 in groundwater have historically exhibited wide variability and continue to exceed the USEPA MCLs (USEPA, 2011).

Per USEPA and Maryland Department of Environment (MDE) guidance, indoor air sampling is the most definitive approach for determining if a potential vapor intrusion pathway exists. USACE conducted soil vapor sampling and analysis in 2010 in the basement of a residential property immediately downgradient of the groundwater contaminant plume. Indoor air samples were collected from the basement and first floor of the residential structure situated on Lot 9, adjacent to the site. Additionally, one ambient air sample was collected. Concentrations of TCE and CCl_4 were not detected in any of the air samples that were collected. Based on the indoor air sampling data conducted at the residential structure on Lot 9, it has been confirmed that a vapor intrusion pathway for the residential structure does not exist since concentrations of TCE and CCl_4 were not detected.

1.3 Project Scope and Objectives

The objective of this supplemental investigation was to address two concerns presented by MDE during review of the previously completed *Remedial Investigation Addendum for Nike Missile Launch Area (W-44), Waldorf, Maryland* (ERT, 2009). First, MDE was concerned that the potential exists for residual source material to remain in place adjacent to MW-4 and MW-12, where historic groundwater samples indicate concentrations of TCE and CCl_4 that exceed their

USEPA MCLs. Secondly, MDE was concerned that insufficient groundwater data southwest of the groundwater plume was available to be able to confirm that migration of the contaminants is, in fact, not occurring in that particular direction.

In order to address the concerns expressed by MDE, 17 boreholes were advanced in, and around, the area of concern adjacent to MW-4 and MW-12. From each borehole, a soil sample and screening level groundwater sample were collected and laboratory analyzed for TCL VOCs. Groundwater samples were also collected from nine previously existing permanent MWs and analyzed for TCL VOCs, in order to further refine the current extent of the groundwater plume.

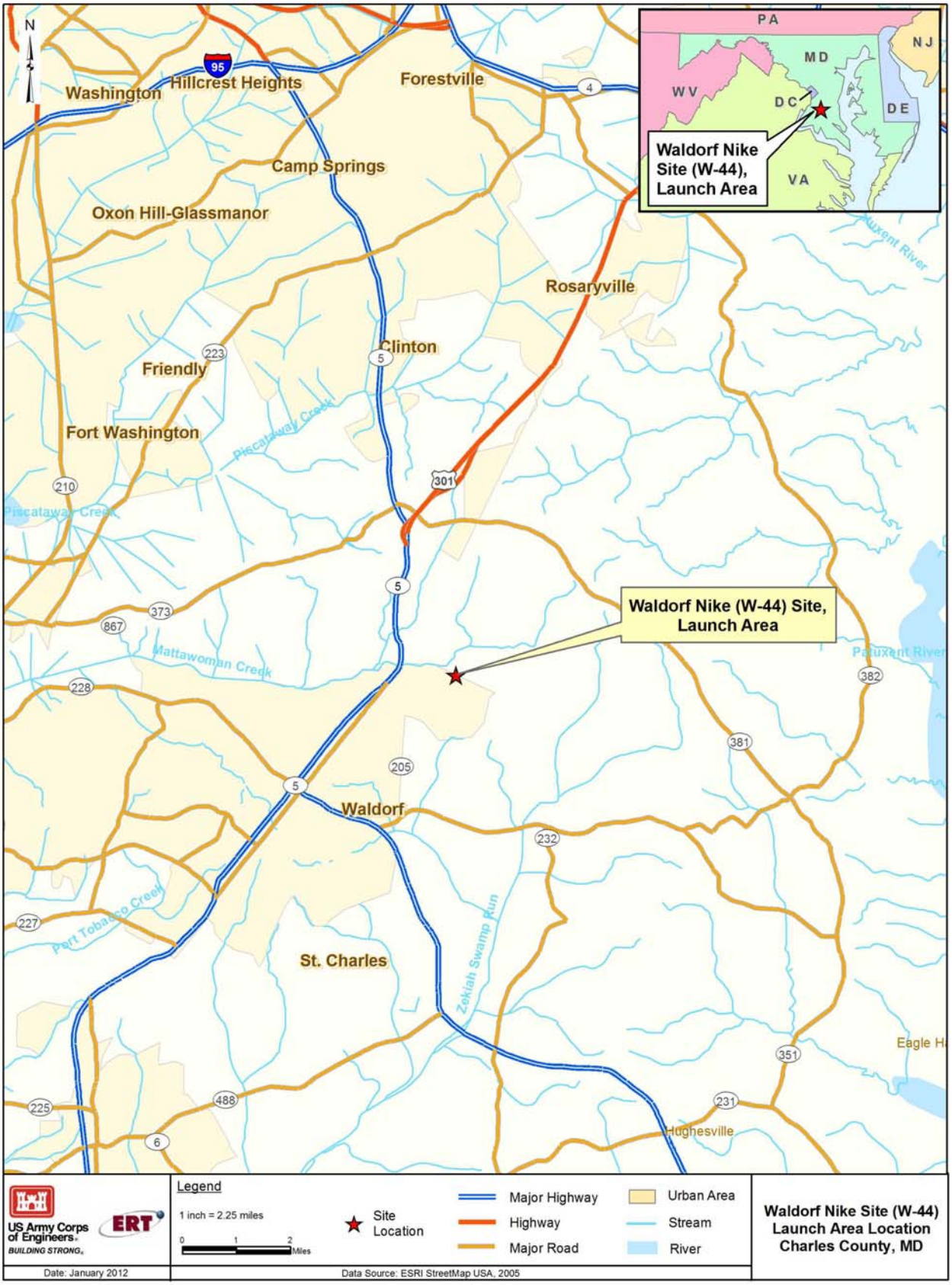

Figure 1-1. Location Map

Figure 1-2. Site Map

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2.0 DATA COMPARISON METHODS

2.1 Screening Criteria

MDE is the lead regulatory agency for this site; however, under DERP-FUDS, USACE performs environmental investigation activities consistent with the CERCLA amended Superfund Amendments and Reauthorization Act (42 U.S.C. §9601 et seq. 1980). As such, the screening criteria used in assessing environmental conditions include USEPA Regional Screening Levels (RSLs) for Residential Soil (USEPA, 2012) and USEPA MCLs for groundwater.

2.1.1 Soil

Reported soil concentrations were screened against the USEPA RSLs for Residential Soil (USEPA, 2012). For the constituents of concern, CCl_4 and TCE, the USEPA RSLs for Residential Soil are 610 µg/kg and 910 µg/kg, respectively.

2.1.2 Groundwater

Reported groundwater concentrations were screened against the USEPA MCLs (USEPA, 2012). For the constituents of concern, CCl_4 and TCE, the USEPA MCL is 5 µg/L.

2.2 Laboratory Data Evaluation

Data were validated by Environmental Data Services, Inc. (EDS) of Williamsburg, Virginia in accordance with the *Contract Laboratory Program National Functional Guidelines for Organic Data Review* (USEPA, 1999) and the reviewer's professional judgment. Laboratory qualifiers, laboratory reports and Quality Assurance/Quality Control (QA/QC) data were qualitatively evaluated in conjunction with the data reduction and reporting process. These data were used to evaluate whether the data objectives for precision, accuracy, representativeness, comparability, completeness and sensitivity (PARCCS) were achieved.

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3.0 SITE DATA GAP INVESTIGATION ACTIVITIES

Investigation activities, as described in the following sections, were performed in order to acquire scientifically defensible data that accomplish the established project objectives. Investigation activities were performed in accordance with the previously approved work plan (ERT, 2011a).

3.1 Rights of Entry

A valid right of entry (ROE) is required for conducting activities on any land not owned by those parties conducting RI field activities. USACE obtained the required ROE for the investigation activities and all requirements of the ROE agreement were adhered to during the completion of investigation field activities. A copy of the ROE is presented in Appendix C.

3.2 Pre-Activity Meetings

A project kickoff meeting and a primary safety meeting were held prior to the start of investigation activities; additional daily "tail gate" activity discussions and daily safety briefings were performed at the commencement of each day's activities focusing specifically on the day's activities and any changes in field conditions that may have resulted in additional risks. Daily site safety forms are presented in Appendix D.

3.3 Vegetation Clearance

Minimal vegetation clearance was required to access portions of the investigation site. Vegetation clearance activities, including the use of a machete to remove low hanging tree branches, were performed in accordance with ERT's health and safety protocols outlined in the *Accident Prevention Plan for Data Gap Investigation, Waldorf Nike (W-44) Site, Launch Area, Charles County, Maryland* (ERT, 2011b).

3.4 Field Screening for Total Organic Compounds

A photoionization detector (PID) was utilized to field screen soil borings and the headspace of each MW during groundwater sampling for the presence of total organic compounds.

Each soil core and sample collected for laboratory analysis was screened using a PID for total organic compounds. PID readings were observed for a minimum of 5 seconds to allow for stabilization, and the highest observed total organic compound reading for each screen was recorded on a sample location-specific field boring log, by the field geologist. Results of soil total organic compound screening are provided in Section 4.1. Soil boring logs are presented in Appendix E.

3.5 Analytical Sampling

Soil boring and temporary MW groundwater sample locations were allocated in a systematic grid to the north, south, and east of MW-4 and MW-12, in order to identify the source area of the groundwater plume. The intent of the proposed systematic sample grid was to identify the presence of potential residual source material adjacent to MW-4 and MW-12, and to collect additional groundwater data, specifically southwest of the groundwater plume (**Figure 3-1**).

Soil and screening level groundwater samples collected from each of the boring locations, and groundwater samples collected from existing conventional groundwater MWs were submitted for laboratory analysis. Collected soil and groundwater samples were shipped to Accutest Laboratories in Dayton, New Jersey for analysis of TCL VOC by USEPA SW846 Method 8260B.

3.5.1 Soil Analytical Sampling

A total of 17 soil samples, one from the advancement of each soil boring, were collected in accordance with the approved *Work Management Plan for Data Gap Investigation at the Former Waldorf Nike (W-44) Site, Launch Area, Charles County, Maryland* (ERT, 2011a).

Soil samples were collected using a direct push technology Geoprobe® with an acetate macrocore liner. Each soil boring was advanced to approximately 20 feet (ft) below ground surface (bgs) and examined for evidence of VOC impacts by visual, olfactory, and PID examination, to determine the appropriate interval for collection of soil samples to be submitted for laboratory analysis. Based on this evaluation, a discrete soil interval was selected from each soil boring for sampling and analysis. Soil samples were collected via deployment of Terracore sampler directly into the soil boring, and immediately transferring sample volume to sample jar containing preservative (to minimize loss of volatiles). If no impacts were identified, the sample was collected from the vadose zone, no greater than 6 inches above the groundwater interface.

Of the 17 soil samples collected, 16 were collected from planned locations on the grid. During the advancement of the proposed soil borings, a 55-gallon drum was encountered approximately 20 ft to the southeast of location SB-3. Upon inspection, the drum was found to be empty, corroded, broken, and tipped on its side in a ditch. An additional boring was advanced (SB-17) due to the presence of the 55-gallon drum, and additional soil and groundwater samples were collected for laboratory analysis. SB-17 was advanced topographically down gradient (to the southwest) of where this drum was found (**Figure 3-1**).

3.5.2 Groundwater Analytical Sampling

A total of 26 environmental groundwater samples were collected from 17 temporary MWs installed at each of the advanced boring locations and nine of the previously existing conventional MWs. Groundwater samples were collected in accordance with the approved *Work Management Plan for Data Gap Investigation at the Former Waldorf Nike (W-44) Site, Launch Area, Charles County, Maryland* (ERT, 2011a) and with *Groundwater Sampling and Monitoring with Direct Push Technologies* (USEPA, 2005).

Temporary MWs were installed and environmental groundwater samples collected from each of the locations where soil borings were advanced. Temporary MWs were installed at depths ranging from 17-19 ft bgs so that the screened interval was at the groundwater interface.

Nine environmental groundwater samples were collected from previously existing conventional MWs: MW-4, MW-7, MW-11, MW-12, MW-14, MW-15, MW-16, MW-17, and MW-18 (**Figure 3-1**). The existing groundwater monitoring wells range in total depth from 14-31 ft bgs.

3.5.3 IDW Management

All investigation derived waste (IDW) was containerized in open head steel 55-gallon drums. IDW consisting of soil cuttings and purge water was segregated, sampled, and analyzed for TCL VOCs for waste characterization per the subcontracted treatment storage and disposal facility requirements.

Figure 3-1. Soil and Groundwater Sampling Locations

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4.0 RESULTS

The following subsections detail the investigation field screening and laboratory analytical results, specifically those exceeding screening criteria that warranted additional evaluation. Analytical summary tables are presented in Appendix F, and complete analytical data packages including data validation packages are presented in Appendix G.

4.1 Phase I Soil Screening PID Results

Field screening for total VOCs in soil samples resulted in non-detect results for the majority of subsurface soil. Results from the PID soil screening identified six soil samples with measureable total organic compounds concentrations, as presented in **Table 4-1**. Total organic compounds concentrations associated with location SB-3 indicate the presence of potential residual impacts in soil. A soil sample was collected from the interval of concern and submitted for laboratory analysis.

Table 4-1. Measurable Volatile Organic Compound Concentrations in Soil Samples

Soil Boring ID	Depth (ft bgs)	Measurement Date	Concentration (ppm)
SB-3	9	6/28/2011	1,084
SB-4	1	6/27/2011	5.3
SB-8	11	6/27/2011	4.0
SB-9	11	6/27/2011	2.9
SB-11	11	6/27/2011	5.5
SB-13	11	6/27/2011	231

Legend
ft bgs *feet below ground surface*
ppm *parts per million*
SB *soil boring*

4.2 Field Groundwater Quality Screening Results

Table 4-2 presents the field screen groundwater quality data recorded immediately prior to the collection of groundwater sample aliquots from MWs during both investigative phases. Available groundwater quality data collected during the entirety of the purge events are provided in Appendix H.

Total organic compound screening results from MW headspace were also collected immediately upon opening each groundwater MW. Results of total VOC screening are also provided within the groundwater purge data sheets presented in Appendix H.

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Table 4-2. Field Screening Groundwater Quality Parameters Data

Location	Date	DO (mg/L)	ORP (mV)	pH (su)	SC (mS/cm)	Turbidity (NTU)	Water Temperature (ºC)
SB-1	06/29/2011	0.00	55	4.64	0.048	336	23.22
SB-2	06/29/2011	0.00	49	4.83	0.058	257	18.61
SB-3	06/29/2011	0.00	91	4.81	0.064	467	22.18
SB-4	06/29/2011	0.00	43	4.97	0.062	339	24.54
SB-5	06/28/2011	0.00	119	3.91	0.047	138	14.03
SB-6	06/28/2011	50.0	190	4.36	0.044	97.0	19.56
SB-7	06/28/2011	0.28	141	4.72	0.039	225	23.73
SB-8	06/28/2011	0.00	36	5.09	0.072	431	24.00
SB-9	06/28/2011	0.00	86	4.28	0.044	404	16.72
SB-10	06/29/2011	1.06	29	5.78	0.111	120	21.29
SB-11	06/28/2011	0.00	46	4.66	0.049	454	21.54
SB-12	06/28/2011	0.00	60	5.44	0.105	539	19.95
SB-13	06/28/2011	0.00	38	4.75	0.051	>800	25.13
SB-14	06/28/2011	0.10	107	4.33	0.037	0.00	23.78
SB-15	06/28/2011	0.00	155	5.03	0.062	312	22.42
SB-16	06/28/2011	4.48	65	5.68	0.073	612	32.98
SB-17	06/29/2011	0.00	113	4.61	0.057	651	20.75
MW-4	12/09/2011	9.51	360	5.21	0.085	0.00	13.30
MW-7	12/09/2011	4.93	362	5.18	0.077	0.00	14.54
MW-11	12/09/2011	0.80	107	5.86	0.172	110	12.52
MW-12	12/09/2011	2.21	-20	6.37	0.119	9.80	12.91
MW-14	12/07/2011	2.57	348	5.10	0.071	0.00	15.94
MW-15	12/07/2011	0.77	-73	6.88	0.253	11.4	16.23
MW-16	12/09/2011	1.09	264	4.75	0.175	8.70	13.68
MW-17	12/07/2011	2.36	195	5.45	0.077	10.3	16.72
MW-18	12/09/2011	10.16	333	5.21	0.104	0.00	16.34

Legend:
ºC degrees Celsius
DO dissolved oxygen
mg/L milligrams per liter
mS/cm milliSiemens per centimeter
mV millivolt
NTU nephelometric turbidity unit
ORP oxidation reduction potential
SC specific conductivity
su standard units

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4.3 Analytical Soil Sample Results

Results from the laboratory analyses of the collected soil samples were screened against the USEPA RSLs for Residential Soil (USEPA, 2012). Analytes were not detected in soil samples at concentrations exceeding these screening criteria; however, 287 micrograms per kilogram (µg/kg) of TCE was detected in the soil sample collected from location SB-3, below the USEPA RSL for Residential Soil of 910 µg/kg. The detected concentration, although below the project screening criteria, was above the USEPA MCL-based Protection of Groundwater Soil Screening Level for TCE of 1.8 µg/kg (USEPA, 2012). The SB-3 sample coincided with the location where elevated concentrations of total organic compounds were identified during field screening.

4.4 Groundwater Sample Results

Results from the laboratory analyses of the 26 groundwater samples collected were screened against the USEPA MCLs (USEPA, 2012).

CCl_4

In 11 of the groundwater samples collected, CCl_4 was detected above the USEPA MCL of 5 µg/L ranging in concentration from 5.4 µg/L to 309 µg/L. These detections occurred in groundwater samples, collected from SB-1 (67.3 µg/L), SB-2 (124 µg/L), SB-3 (27.9 µg/L), SB-6 (7.7 µg/L), SB-7 (10.6 µg/L), SB-8 (85.9 µg/L), SB-10 (27.9 µg/L), SB-11 (5.4 µg/L), MW-4 (192 µg/L), and MW-7 (15.6 µg/L), and MW-12 (14.9 µg/L).

Concentrations of CCl_4 were detected below the USEPA MCL in five groundwater samples, collected from SB-4 (4.5 µg/L), SB-5 (1.6 µg/L), SB-9 (1.2 µg/L), SB-14 (4.6 µg/L), and MW-18 (1.2 µg/L). CCl_4 was not detected in any of the other 10 groundwater samples collected.

TCE

In four of the groundwater samples collected TCE was detected at concentrations above the USEPA MCL of 5 µg/L ranging in concentration from 12.2 µg/L to 37.3 µg/L. These detections occurred in groundwater samples collected from SB-1 (13 µg/L), SB-2 (37.3 µg/L), SB-3 (32.4 µg/L), and MW-4 (12.2 µg/L). The duplicate sample result is presented for MW-4 as it exceeded the result for the environmental sample associated with MW-4.

Concentrations of TCE were detected below the USEPA MCL in 11 groundwater samples collected from SB-4 (4.8 µg/L), SB-5 (1.8 µg/L), SB-6 (3.0 µg/L), SB-7 (1.4 µg/L), SB-8 (3.9 µg/L), SB-9 (2.0 µg/L), SB-10 (1.2 µg/L), SB-11 (0.53J µg/L), SB-17 (1.4 µg/L), MW-12 (1.5 µg/L), and MW-16 (0.82J µg/L). TCE was not detected in any of the other 11 groundwater samples collected.

Locations where CCl_4 and TCE were detected at concentrations exceeding MCL are presented in **Table 4-3**, **Figure 4-1**, **Figure 4-2**, and **Figure 4-3**.

4.5 IDW Sampling Results

Based on soil analytical results and groundwater waste characterization results, containerized IDW was deemed non-hazardous and appropriate for disposal by Environmental Waste Specialists, Inc. Material Profile Sheets, as well as Universal Hazardous Waste Manifests, can be found in Appendix I.

Table 4-3. Groundwater Detections Above the USEPA MCL

Temporary and Permanent Well ID	Sample ID	Sample Date	CCl_4 (µg/L)	TCE (µg/L)
		USEPA MCL	**5**	**5**
SB-1	SB01-GW-11-19	06/29/2011	67.3	13.0
SB-2	SB02-GW-11-17	06/29/2011	124	37.3
SB-3	SB03-GW-11-19	06/29/2011	29.7	32.4
	GW-DUP-2		29.2	31.8
SB-4	GW-DUP-1	06/28/2011	5.4	--
SB-6	SB06-GW-11-19	06/28/2011	7.7	--
SB-7	SB07-GW-11-19	06/29/2011	10.6	--
SB-8	SB08-GW-11-19	06/28/2011	85.9	--
SB-10	SB10-GW-11-19	06/29/2011	27.9	--
SB-11	SB11-GW-11-19	06/28/2011	5.4	--
MW-12	MW12 1211	12/09/2011	14.9	--
MW-4	MW4 1211	12/09/2011	192	7.6
	D1 1211		309	12.2
MW-7	MW7 1211	12/09/2011	15.6	--

Legend:

MCL	*Maximum Contaminant Level (2011)*
CCl_4	*carbon tetrachloride*
TCE	*trichloroethylene*
µg/L	*micrograms per liter*
--	*not detected above project screening criteria*

Figure 4-1. CCl_4 and TCE Detections above Project Screening Criteria

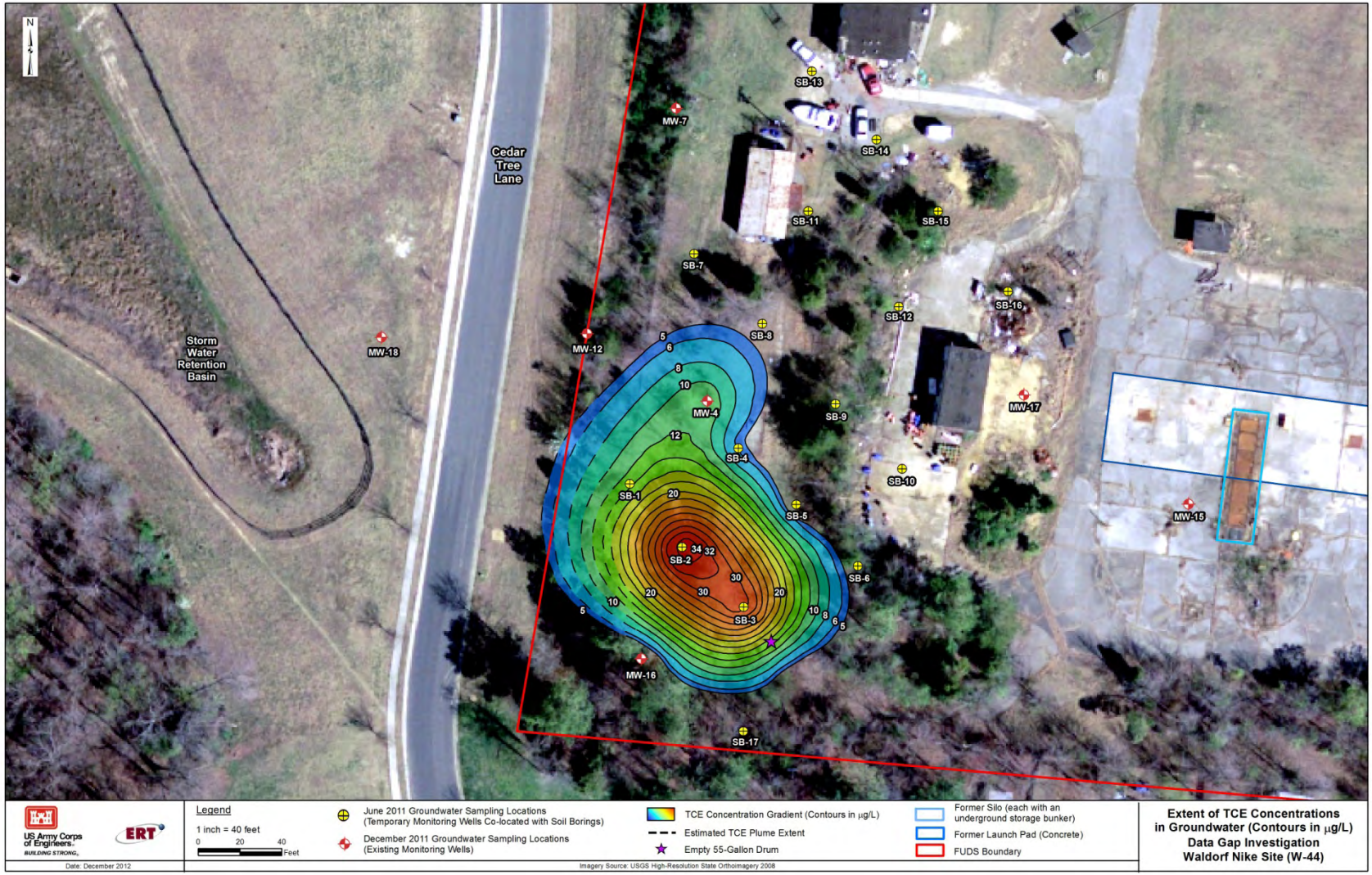

Figure 4-2. Extent of TCE Concentrations in Groundwater

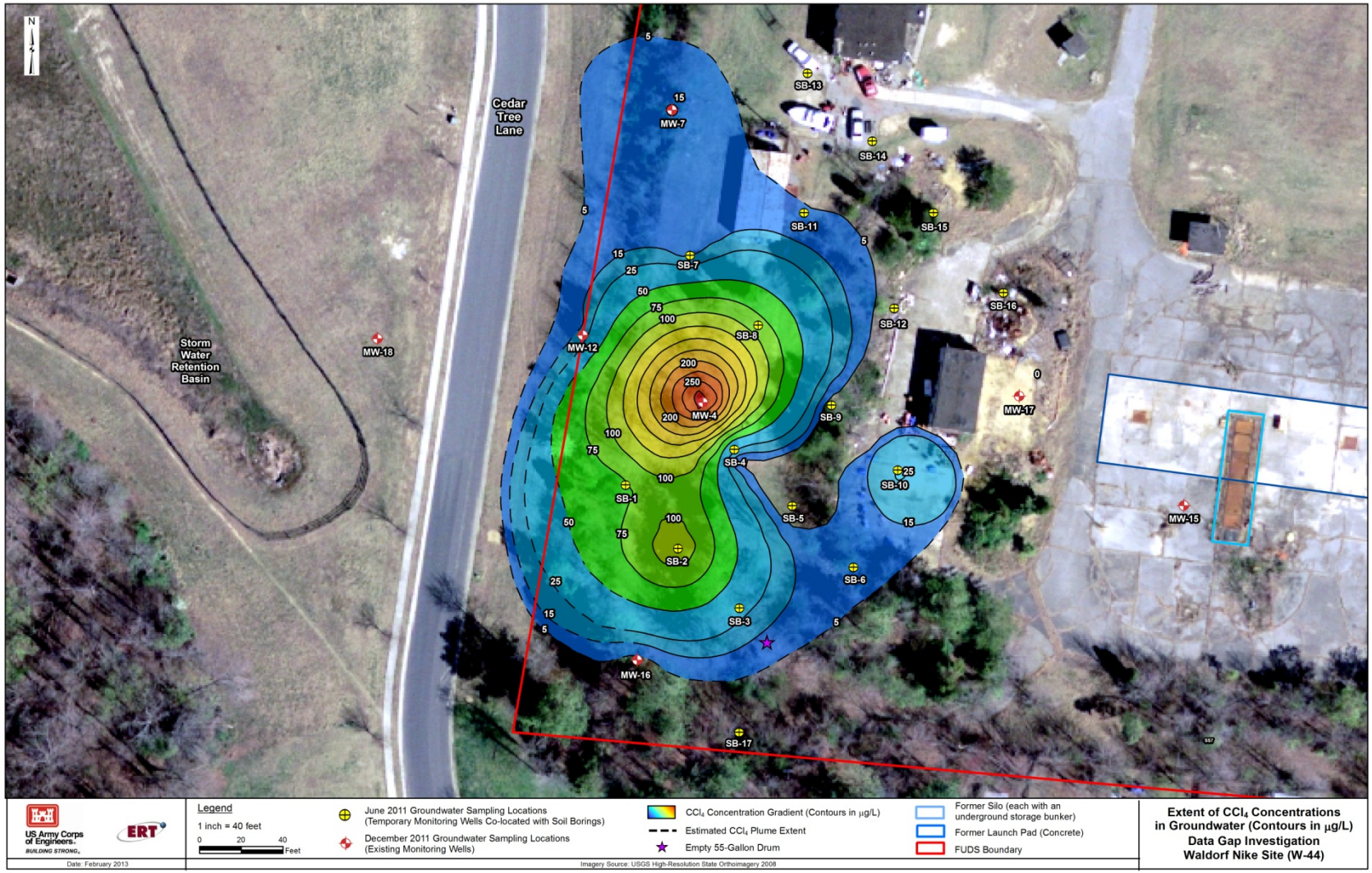

Figure 4-3. Extent of CCl_4 Concentrations in Groundwater

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5.0 DATA QUALITY ASSESSMENT

Data submitted by the ERT field staff and Accutest have been reviewed by the ERT Project Chemist and validated by the independent third party validator, EDS. This data quality assessment (DQA) has been prepared to summarize those findings. Overall, the data was considered of acceptable quality to perform further evaluations.

5.1 Analytical Program

The analytical chemistry data package includes Accutest sample delivery groups (SDGs): JA79541, JA79670, JA79809, and JA94393.

Soil samples were collected from 17 soil borings, and groundwater samples were collected from 17 temporary MWs and 9 permanent MWs. One liquid IDW sample was also collected. The field QC samples for the SDGs include 5 field duplicates, 3 equipment rinsate blanks (ERBs), 3 matrix spike/matrix spike duplicate (MS/MSD) sample pairs, and 4 field trip blanks.

Soil, groundwater, and IDW samples were laboratory analyzed by Accutest for VOCs following USEPA Method 8260B. All samples were collected, shipped, handled, and analyzed in compliance with the approved ERT and Accutest standard operating procedures.

5.2 Data Deliverables

Complete analytical data packages, including raw data and appropriate electronic data deliverables, were submitted by Accutest to ERT. The data packages were provided in an error-free electronic format, consisting of contract laboratory program (CLP) Level IV reports and EZEDDs for EQuIS.

Accutest prepared USEPA CLP Level IV data packages to include a cover sheet, table of contents, case narrative, the analytical results, sample receipt and data management records, internal laboratory QA/QC information, and raw data. The laboratory data packages were organized so that the analytical results were reported on a per batch basis.

Real-time monitoring and management of laboratory analytical performances was achieved through the Accutest web-based Laboratory Information Management System, LabLink®. Secure, formatted data were viewed and downloaded directly from LabLink®, including preliminary analytical reports and electronic data deliverables.

5.3 Review Criteria

The data submitted by Accutest have been reviewed, and the data quality objectives (DQOs) for PARCCS were used to assess the overall quality of the analytical data. These criteria were applied to the laboratory QC analyses conducted during the investigation. The project QC data that fall within the limits of numerical DQOs provide the main point of reference for the investigation.

Following an initial review of sample results, QC results, case narratives, and chain-of-custody forms by the ERT Project Chemist, chemical data were examined for compliance with laboratory derived criteria and methodology presented in the *Contract Laboratory Program National Functional Guidelines for Organic Data Review* (USEPA, 1999) and *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846* (USEPA, 2008) by the EDS Senior Scientist.

5.4 Laboratory Quality Control Summary

5.4.1 Contract Required Holding Times

Holding times are defined as the maximum amount of time allowed to lapse between the date and time of sample collection and the date and time of sample analysis. Analysis of samples that have exceeded the method-recommended holding times may result in the following:

1. Concentrations of compounds that ordinarily would have been detected remain undetected due to chemical transformation, compound volatilization, or biodegradation.
2. Reported concentrations are lower than those originally present, due to the factors previously stated.
3. Reported concentrations are greater than those originally present in the sample, due to external contamination of water samples or changes in soil moisture content.

All samples were analyzed within the recommended method holding time of 14 days.

5.4.2 Precision

Precision is defined as the reproducibility or degree of agreement among replicate measurements of the same compound or element analyzed under identical conditions (USEPA, 2010). Precision is expressed as relative percent difference (RPD) between the two results, and was evaluated based on the analysis of MS/MSD pairs, and field duplicate samples. As with MS/MSDs, the field duplicate data served as indications of the matrix sampled and precision in the analytical system. Based on an evaluation of MS/MSD and field duplicate RPDs, overall precision is considered acceptable. Qualifying issues are presented below.

All MS/MSD RPDs were within laboratory established control limits.

Field duplicate RPDs were within acceptable limits for all analytes, except for methyl-tert-butyl-ether (MTBE) (112 percent) in soil parent-duplicate pair collected from SB-14. MTBE results in the SB-14 parent-duplicate pair were qualified as estimated (J).

5.4.3 Accuracy

Accuracy is defined as the extent of agreement between a measured or calculated value and the true value (USEPA, 2010). Laboratory accuracy was determined using spike percent recovery data from MS and MSD samples, laboratory control samples (LCS), laboratory surrogates, and method blanks. Accuracy is expressed as the proportion of the known amount of each spiked analyte measured by the technique, or percent recovered (%R), and gives an indication of problems that may be associated with a specific sample or sample site (i.e., matrix interferences). Analyses of LCS samples assess overall method performance and are the primary indicators of laboratory performance. Analyses of surrogates involve the addition of a known concentration of a non-target analyte prior to sample preparation and analysis. The surrogate is chemically similar to the target analyte(s) and behaves similarly during extraction and analysis. Surrogate spike recovery measures the efficiency of the steps of the analytical method in recovering the non-target analytes. The laboratory analyzed at least one method blank for each SDG. An aliquot equal in mass to the sample and known to be analyte free was used for method blank analyses. The method blank was taken through the whole analytical process and was analyzed using the same technique as field and other QC samples. Accuracy was also determined using analytical calibration data.

Based on an evaluation of MS and MSD samples, LCS samples, laboratory surrogates, and

method blanks, and per the DQOs, overall accuracy is acceptable. Qualifying issues are presented below. Specified accuracy criteria were achieved except those noted below.

All surrogate recoveries were within the laboratory established control limits, except for 4-bromofluorobenzene in the surrogate analysis associated with soil sample collected from SB-3 (277 percent), and the diluted analysis of soil sample collected from SB-3 (167 percent). The laboratory control limits for 4-bromofluorobenzene (surrogate) is 76-118 %R. All positive results in the soil sample collected from SB-3 analyses were qualified as estimated (J).

No analytes were detected in any laboratory method blank samples.

All LCS recoveries were within the laboratory established control limits, except for dichlorodifluoromethane (143 percent) in the LCS associated with SDG 79670 samples. All associated samples had non-detects of dichlorodifluoromethane, therefore no qualifying action was taken.

Low initial or continuing calibration values were noted for acetone and/or 2-butanone in SDGs 79541, 79670, 79809, and 94393; resulting in rejected (R) data for these analytes in 43 samples, collectively. Unacceptable continuing calibration data were noted for 4-methyl-2-pentatnone in SDG 94393, but no qualifying action was taken since no samples had positive results for this compound.

The data set from the accuracy assessment are considered usable, with exception of 11 acetone results in SDGs 79541 and 79670, and 32 2-butanone results in SDGs 79541, 79670, 79809, and 94393.

5.4.4 Representativeness

Representativeness is defined as the degree to which the data accurately and precisely represent a characteristic of a population, parameter variations at a sampling location, a process condition, or an environmental condition (USEPA, 2010). Sample representativeness was confirmed by collecting sufficient samples of a population medium, properly distributed with respect to location. Representativeness, in part, was accomplished by the consistent use of approved drilling techniques, sample collection methods, equipment, and sample containers for the field work. Representativeness was also ensured by conducting all field measurements, sample collection procedures, and laboratory analyses according to project guidelines and specifications. The data set is considered representative of site conditions for this project.

5.4.5 Comparability

Comparability refers to the confidence with which one data set can be compared to another. To achieve data comparability, the data set was generated by employing standardized analytical methods and standardized data validation procedures (USEPA, 2010). Also, the project planning, including lab selection, incorporated various appropriate USEPA guidance documents to ensure the comparability of the data. Additionally, Accutest participates in the analysis of Performance Evaluation samples for organic and inorganic compounds. The laboratory performance throughout the duration of the project indicates their ability to generate accurate results over time. Based on the overall quality of the laboratory's internal performance evaluation results and the stringent QC requirements set by the standardized methods, the data generated is considered comparable to other data generated through similar processes.

5.4.6 Completeness

Completeness refers to the usable data acquired, which is expressed as a percentage of the

planned valid data (USEPA, 2010). Completeness determinations are made separately for the field collection effort and data obtained from the analytical measurement system. The project completeness goal was 95 percent, and the analytical completeness goal was 95 percent.

All proposed sample borings were advanced and necessary temporary MWs installed and sampled. All QA/QC samples were collected for the project. Completeness for the field effort was 100 percent.

Analytical completeness was calculated as a percentage of valid results. Of the 2,544 constituent results (regular and duplicate samples), 2504 results were valid; therefore, analytical completeness was 98 percent for the project.

5.4.7 Sensitivity

Sensitivity for the project refers to an evaluation of the analytical method quantitation limits to applicable project decision rules, or screening level (SL) benchmarks, where the practical quantitation limits (PQLs) are equivalent to the reporting limits (RLs).

USEPA RSLs for Residential Soil were less than the analytical method RLs for 1,2-dibromo-3-chloropropane in all soil samples. In addition, USEPA RSLs for Residential Soil were less than the analytical method RLs for 1,2-dibromoethane, 1,4-dioxane, and vinyl chloride in the soil sample collected from SB-2. The soil sample from SB-3 was analyzed at the laboratory's medium-level of detection for the method, due to the high concentration of volatile organics observed. Sample dilution was warranted for the soil sample from SB-3 since detections above 1,000 µg/kg for isopropylbenzene and total xylenes were observed. RLs for this sample were elevated accordingly

MDE Cleanup Standards for Type I and Type II Aquifers were less than the analytical method RLs for 1,1,2,2-tetrachloroethane, 1,2-dibromo-3-chloropropane, bromoethane, cis-1,3-dichloropropene, and trans-1,3-dichloropropene in all groundwater samples. USEPA MCLs were less than the analytical method RLs for 1,2-dibromo-3-chloropropane and 1,2-dibromoethane.

For groundwater, 58 of 1,537 (<4 percent) constituent results (regular and duplicate samples) had RLs greater than the respective SLs. For soil, 24 of 1007 (<3 percent) constituent results (regular and duplicate samples) had RLs greater than the respective SLs. Lack of sensitivity, other than the dilution instance noted above for SB-3, is due to the laboratory's inability to achieve PQLs/RLs below low-level SLs, given the methodology used.

5.5 Field Quality Control Summary

Along with field duplicates presented in the precision section above, trip blanks and ERBs were collected and analyzed for the same target compounds or elements and using the same laboratory techniques as those used for the environmental samples. The analytical results obtained from the field QC blanks were considered in assessing the sample collection, handling, and equipment decontamination procedures used in the field.

5.5.1 Trip Blanks

Trip blanks were included in the sampling investigation to monitor for VOC contamination during sample transport and storage. Trip blanks were prepared by Accutest with American Society for Testing and Materials (ASTM) Type II water, stored with the unused sample bottles, and returned to Accutest with each cooler containing VOC samples. No VOC analytes were detected in the four trip blanks associated with this project.

5.5.2 Equipment Blanks

Three ERBs were collected to evaluate the decontamination technique used for manual sampling equipment. ERBs were collected by pouring ASTM Type II reagent water through a recently decontaminated piece of equipment and into a prepared sample container appropriate for the required analysis. ERBs were shipped to Accutest and analyzed for the same analytes as the environmental samples. No VOC analytes were detected in the ERBs analyzed during this project.

5.6 Data Quality Summary

All project DQOs were met. This data quality assessment provides the foundational information to conclude that the investigation data acquired are scientifically sound, legally defensible, and adequate for their intended use.

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6.0 SUMMARY AND CONCLUSIONS

In order to address data gap concerns expressed by MDE, 17 boreholes were advanced in, and around, the area of concern southwest of the existing plume source area, adjacent to MW-4 and MW-12. From each borehole, a soil sample and screening level groundwater sample were collected and laboratory analyzed for TCL VOCs. Additionally, groundwater samples were collected from nine existing conventional MWs and laboratory analyzed for TCL VOCs. A DQA was performed which shows that all project DQOs were met.

From the 17 soil samples collected, TCE was detected in one sample, the sample collected from location SB-3, at a concentration below the USEPA RSL of 910 µg/kg. SB-3 is located south-southeast of MW-4 and MW-12, and approximately 15 ft to the north-northwest of an identified 55-gallon drum. Upon inspection, the identified 55-gallon drum was found to be empty, corroded, broken, and tipped on its side in a ditch. Due to the apparent age and condition of the drum, the location of the drum upgradient of the groundwater plume, and the associated TCE concentrations detected in a soil samples adjacent to the drum, it was determined that the deteriorated drum is the most likely source of contamination causing the groundwater plume.

From the 26 groundwater samples collected at the site, CCl_4 was detected in 11 groundwater samples above the USEPA MCL of 5 µg/L. The highest concentration of CCl_4 was detected in the sample collected from MW-4. In four groundwater samples, TCE was detected at concentrations above the USEPA MCL of 5 µg/L. The highest concentrations of TCE were detected southwest and south-southeast of MW-4, in the groundwater samples collected at locations SB-2 and SB-3.

The additional data collected addresses the concerns raised by MDE. The investigation activities confirmed that a suspected residual source area does exist adjacent to MW-4 and MW-12, the current location of the groundwater plume. The suspected residual source area is likely associated with location SB-3 and a 55-gallon drum identified during the investigation. Due to the proximity of the SB-3 location to MW-4 and MW-12, the residual source area associated with the SB-3 location is suspected to be associated with the observed groundwater plume at the site.

New groundwater data collected from the site has substantiated previous analytical data. During the upcoming preliminary design phase for the remedial action to address the groundwater contaminant plume, USACE has agreed with MDE that additional groundwater sample collection outside of the existing sampling perimeter will be conducted to fully characterize the boundary of the groundwater contaminant plume.

Newly acquired data suggests that TCE concentrations in groundwater may also be contributing risk to human and environmental receptors. The identification and addition of TCE does not alter the previous risk assessment assumptions (Weston, 2005) or alter the remedial alternative evaluation developed as part of the feasibility study (Weston, 2011), as the screening of process options conducted for CCl_4 also are applicable to account for concentrations of TCE that have been detected in groundwater at the site.

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APPENDIX A

Remedial Investigation Addendum for the Waldorf Nike (W-44) Site, Launch Area, Charles County, Maryland

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APPENDIX B

Remedial Investigation Report for Nike Battery Launch Area (W-44), Waldorf, Maryland

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APPENDIX C
Right-of-Entry

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APPENDIX D
Daily Safety Forms

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APPENDIX E
Soil Boring Logs

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APPENDIX F
Analytical Summary Tables

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APPENDIX G
Complete Analytical Data Packages

(Full data packages included on enclosed compact disc)

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APPENDIX H
Groundwater Purge Data Sheets

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APPENDIX I
Investigation Derived Waste Management

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